

A Practical Guide to 'Free-Energy' Devices

Overview

This eBook contains most of what I have learned about this subject after researching it for a number of years. I am not trying to sell you anything, nor am I trying to convince you of anything. When I started looking into this subject, there was very little useful information and any that was around was buried deep in incomprehensible patents and documents. My purpose here is to make it easier for you to locate and understand some of the relevant material now available. What you believe is up to yourself and is none of my business. Let me stress that almost all of the devices discussed in the following pages, are devices which I have not personally built and tested. It would take several lifetimes to do that and it would not be in any way a practical option. Consequently, although I believe everything said is fully accurate and correct, you should treat everything as being "hearsay" or opinion.

The Wright brothers were told that it was impossible for aeroplanes to fly because they were heavier than air. That was a commonly believed view. The Wright brothers watched birds flying and since, without question, birds are considerably heavier than air, it was clear that the commonly held view was plain wrong. Working from that realisation, they developed aeroplanes which flew perfectly well.

The years passed, and the technology started by the Wright brothers and their careful scientific measurements and well-reasoned theory, advanced to become the "science" of aeronautics. This science was used extensively to design and build very successful aircraft and "aeronautics" gained the aura of being a "law".

Unfortunately, somebody applied aeronautic calculations to the flight of bumblebees and discovered that according to aeronautics, bumblebees couldn't possibly fly as their wings could not generate enough lift to get them off the ground. This was a problem, as it was perfectly possible to watch bees flying in a very competent manner. So, the "laws" of aeronautics said that bees can't fly, but bees actually **do** fly.

Does that mean that the laws of aeronautics were no use? Certainly not - those "laws" had been used for years and proved their worth by producing excellent aircraft. What it did show was that the "laws" of aeronautics did not yet cover every case and needed to be extended to cover the way that bees fly, which is through lift generated by turbulent airflow.

It is **very** important to realise that what are described as scientific "laws" are just the best working theories at the present time and it is virtually certain that those "laws" will have to be upgraded and extended as further scientific observations are made and further facts discovered.

Introduction

It should be stressed at this point, that this material is intended to provide you with information and only that. If you should decide, on the basis of what you read here, to build some device or other, you do so solely and entirely at your own risk and on your own responsibility. For example, if you build something in a heavy box and then drop it on your toe, then that is completely your own responsibility (you should learn to be more careful) and nobody other than yourself is in any way liable for your injury, or any loss of income caused while your toe is recovering. Let me amplify that by stating that I do not warrant that any device or system described in this document works as described, or in any other way, nor do I claim that any of the following information is useful in any way or that any device described is useful in any way or for any purpose whatsoever. Also, let me stress that I am not encouraging you to actually construct any device described here, and the fact that very detailed construction details are provided, must not be interpreted as my encouraging you to physically construct any device described in this document. You are welcome to consider this a work of fiction if you choose to do so.

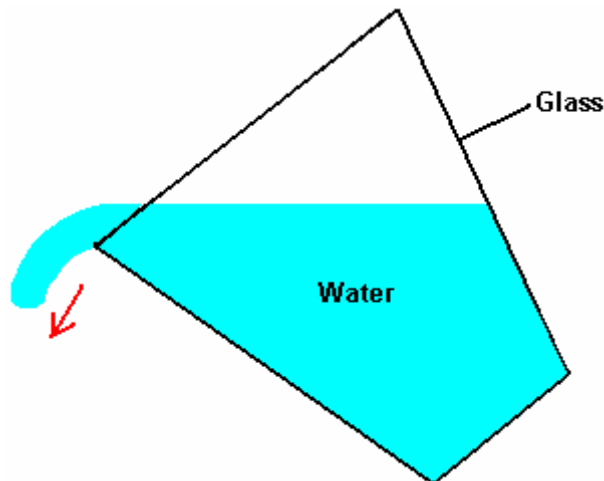
I apologise if this presentation seems very elementary, but the intention is to make each description as simple as possible so that everybody can understand it, including people whose native language is not English. If you are not familiar with the basic principles of electronics, then please read the simple step-by-step electronics tutorial in Chapter 12 which is intended to help complete beginners in the subject.

At this point in time - the early years of the twenty-first century - we have reached the point where we need to realise that some of the "laws" of science do not cover every case, and while they have been very useful in the past, they do need to be extended to cover some cases which have been left out until now.



For example, suppose a bank robber broke into a bank and stole all of the cash there. How much could he take? Answer: “every coin and every note”. The limit is the sum total of all cash in the building. This is what the “Law” of Conservation of Energy is all about. What it says is very simple – you can’t take out any more than there is there in the beginning. That seems pretty straightforward, doesn’t it?

As another example, consider a glass tumbler filled completely with water. Using common sense, tell me, how much water can be poured out of the glass? For the purposes of this illustration, please take it that temperature, pressure, gravity, etc. all remain constant for the duration of the experiment.

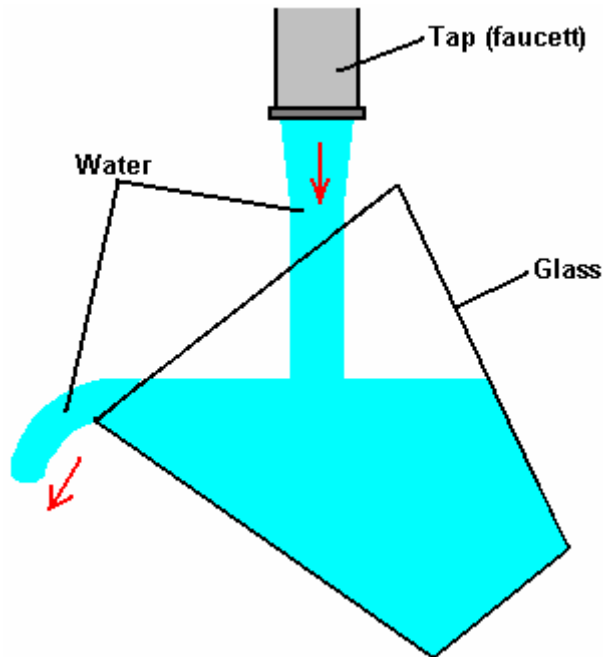


The answer is: “the exact volume contained inside the tumbler”. Agreed. This is what present day science says. To be strictly accurate, you will never be able to pour all of the water out as a small amount will remain, wetting the inside of the glass. Another way of putting this is to say that the “efficiency” of the pouring operation is not 100%. This is typical of life in general, where very few, if any, actions are 100% efficient.

So, are we agreed with current scientific thinking then – the maximum amount of water which can pour out of the tumbler is the total volume inside the tumbler? This seems simple and straightforward, doesn’t it? Science thinks so, and insists that this is the end of the story, and nothing else is possible. This arrangement is called a “closed system” as the only things being considered are the glass, the water and gravity.

Well, unfortunately for current scientific thinking, this is not the only possible situation and “closed systems” are almost unknown in the real world. Mostly, assumptions are made that the effects of anything else around will cancel out and add up to a net zero effect. This is a very convenient theory, but unfortunately it has no basis in reality.

Let’s fill our glass with water again and begin to pour it out again, but this time we position it underneath a source of flowing water:



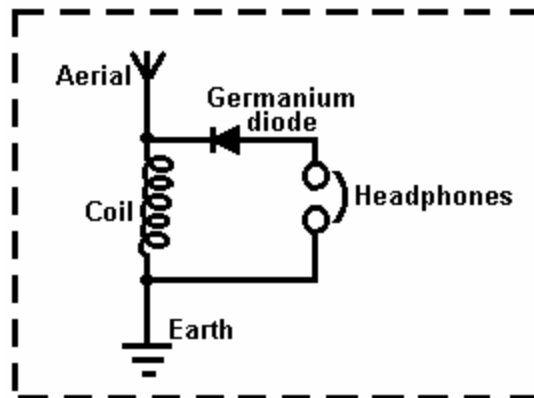
So, now, how much water can be poured out of the tumbler? Answer: “millions of times the volume of the tumbler”. But hang on a moment, haven’t we just said that the absolute limit of water poured from the tumbler has to be the volume inside the tumbler? Yes, that’s exactly what we said, and that is what current science teaching says. The bottom line here is that what current science says does in fact hold true for most of the time, but there are cases where the basic assumption of it being a “closed system” is just not true.

One popular misconception is that you can’t get more energy out of a system than you put into it. That is wrong, because the sentence was worded carefully. Let me say it again and this time, emphasise the key words: “**you** can’t get more energy out of a system than **you** put into it”. If that were true, then it would be impossible to sail a yacht all the way around the world without burning any fuel, and that has been done many times and none of the driving energy came from the crews. If it were true, then a grain mill driven by a waterwheel would not be able to produce flour as the miller certainly does not push the millstones around himself. If that were true, then nobody would build windmills, or construct solar panels, or tidal power stations.

What the statement should say is “more energy can’t be taken out of a system than is put into it or is already in it” and that is a very different statement. When sailing a yacht, the wind provides the driving force which makes the trip possible. Notice that, it is the environment providing the power and not the sailors. The wind arrived without them having to do anything about it, and a lot less than 100% of the wind energy reaching the yacht actually becomes forward thrust, contributing to the voyage. A good deal of the energy arriving at the yacht ends up stretching the rigging, creating a wake, producing noise, pushing the helmsman, etc. etc. This idea of no more energy coming out of a system than goes into it, is called “The Law of Conservation of Energy” and it is perfectly right, in spite of the fact that it gets people confused.

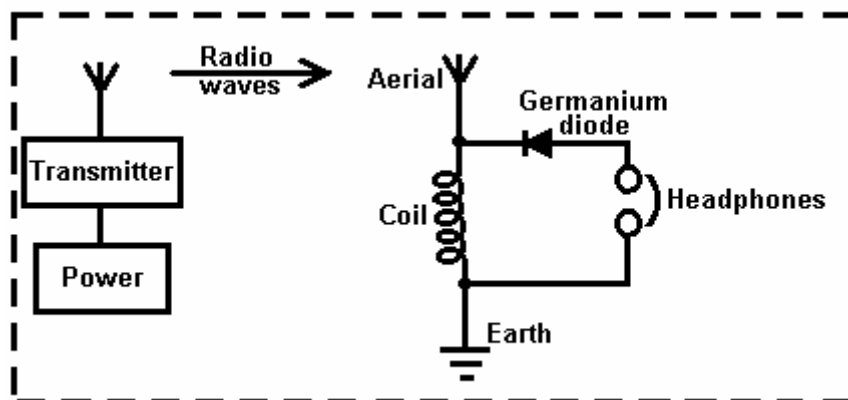
“Free-Energy Devices” or “Zero-Point Energy Devices” are the names applied to systems which appear to produce a higher output power than their input power. There is a strong tendency for people to state that such a system is not possible since it contravenes the Law of Conservation of Energy. It doesn’t. If it did, and any such system was shown to work, then the “Law” would have to be modified to include the newly observed fact. No such change is necessary, it merely depends on your point of view.

For example, consider a crystal set radio receiver:



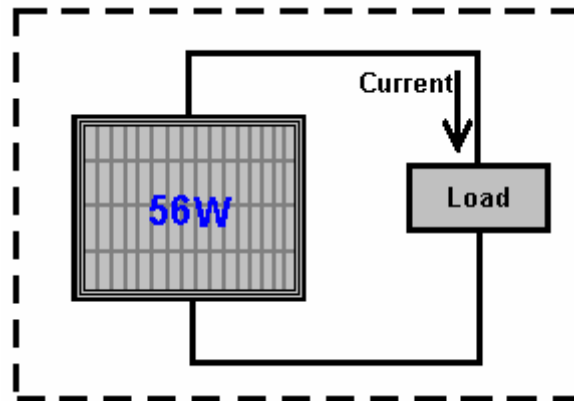
Looking at this in isolation, we appear to have a free-energy system which contradicts the Law of Conservation of Energy. It doesn't, of course, but if you do not view the whole picture, you see a device which has only passive components and yet which (when the coil is of the correct size) causes the headphones to generate vibrations which reproduce recognisable speech and music. This looks like a system which has no energy input and yet which produces an energy output. Considered in isolation, this would be a serious problem for the Law of Conservation of Energy, but when examined from a common sense point of view, it is no problem at all.

The whole picture is:

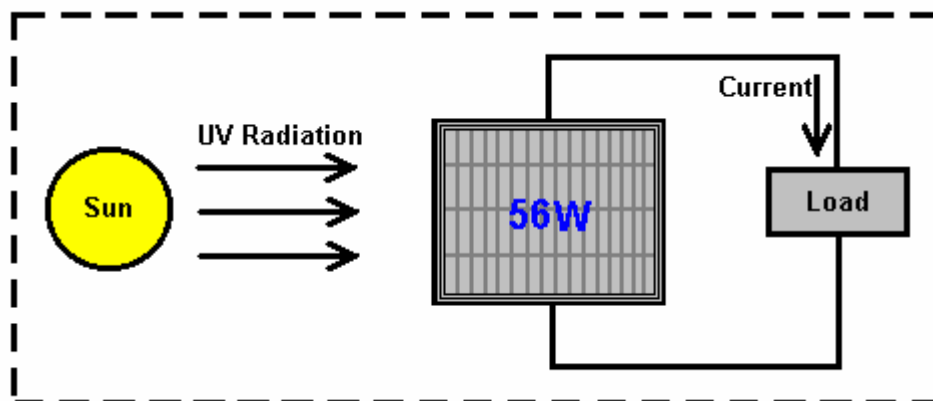


Power is supplied to a nearby transmitter which generates radio waves which in turn, induce a small voltage in the aerial of the crystal set, which in turn, powers the headphones. The power in the headphones is far, far less than the power taken to drive the transmitter. There is most definitely, no conflict with the Law of Conservation of Energy. However, there is a quantity called the “Coefficient Of Performance” or “COP” for short. This is defined as the amount of power coming out of a system, divided by the amount of power that **the operator** has to put into that system to make it work. In the example above, while the **efficiency** of the crystal set radio is well below 100%, the **COP** is greater than 1. This is because the owner of the crystal radio set does not have to supply any power at all to make it work, and yet it outputs power in the form of sound. As the input power from the user, needed to make it work is zero, and the COP value is calculated by dividing the output power by this zero input power, the COP is actually infinity. **Efficiency** and **COP** are two different things. Efficiency can never exceed 100% and almost never gets anywhere near 100% due to the losses suffered by any practical system.

As another example, consider an electrical solar panel:



Again, viewed in isolation, this looks like (and actually **is**) a Free-Energy device if it is set up out of doors in daylight, as current is supplied to the load (radio, battery, fan, pump, or whatever) without the user providing any input power. Again, Power Out with no Power In. Try it in darkness and you find a different result because the whole picture is:



The energy which powers the solar panel comes from the sun.. Only some 17% of the energy reaching the solar panel is converted to electrical current. This is most definitely not a contravention of the Law of Conservation of Energy. This needs to be explained in greater detail. The Law of Conservation of Energy applies to closed systems, and only to closed systems. If there is energy coming in from the environment, then the Law of Conservation of Energy just does not apply, unless you take into account the energy entering the system from outside.

People sometimes speak of "over-unity" when talking about the efficiency of a system. From the point of efficiency, there is no such thing as "over-unity" as that would mean that more power was coming out of the system than the amount of power entering the system. Our trusty bank robber mentioned above would have to take out of the bank vault, more money than was actually in it, and that is a physical impossibility. There are always some losses in all practical systems, so the efficiency is always less than 100% of the power entering the system. In other words, the efficiency of any practical system is always under unity.

However, it is perfectly possible to have a system which has a greater power output than the power input which **we** have to put into it to make it work. Take the solar panel mentioned above. It has a terribly low efficiency of about 17%, **but**, we don't have to supply it with any power to make it work. Consequently, when it is in sunlight, it's Coefficient Of Performance ("COP") is it's output power (say, 50 watts) divided by the input power needed to make it work (zero watts) which is infinity. So, our humble, well-known solar panel has terrible efficiency of 17% but at the same time it has a COP of infinity.

The actual situation is, that we are sitting in a vast field of energy which we can't see. This is the equivalent of the situation for the crystal set shown above, except that the energy field we are in is very, very much more powerful than the radio waves from a radio transmitter. The problem is, how to tap the energy which is freely available all around us, and get it to do useful work for us. It can definitely be done, but it is not easy to do.

Some people think that we will never be able to access this energy. Not very long ago, it was widely believed that nobody could ride a bicycle faster than 15 miles per hour because the wind pressure on the face of the rider would suffocate him. Today, many people cycle much faster than this without suffocating - why? - because the original negative opinion was wrong.

Not very long ago, it was thought that metal aircraft would never be able to fly because metal is so much heavier than air. Today, aircraft weighing hundreds of tons fly on a daily basis. Why? - because the original negative opinion was not correct.

It is probably worth while, at this point, to explain the basics of Zero-Point Energy. Every cubic centimetre of our environment is seething with energy, so much in fact, that if it were converted using Oliver Heaviside's equation (made famous by Albert Einstein) $E = mc^2$ (that is Energy = Mass multiplied by a very big number), then it would produce as much matter as can be seen by the most powerful telescope. You can't actually see energy. All right then, why can't you measure the energy there? Well, two reasons actually, firstly, we have never managed to design an instrument which can measure this energy, and secondly, the energy is changing direction incredibly rapidly, billions and billions and billions of times each second.

There is so much energy there, that particles of matter just pop into existence and then pop back out again. Half of these particles have a positive charge and half of them have a negative charge, and as they are evenly spread out in three-dimensional space, the overall average voltage is zero. So, if the voltage is zero, what use is that as a source of energy? The answer to that is "none" if you leave it in its natural state. However, it is possible to change the random nature of this energy and convert it into a source of unlimited, everlasting power which can be used for all of the things we use mains electricity for today - powering motors, lights, heaters, fans, pumps, ... you name it, the power is there for the taking.

So, how do you alter the natural state of the energy in our environment? Actually, quite easily. All that is needed is a positive charge and a negative charge, reasonably near each other. A battery will do the trick, as will a generator, as will an aerial and earth, as will an electrostatic device like a Wimshurst machine. When you generate a **Plus** and a **Minus**, environmental energy is affected. Now, instead of entirely random plus and minus charged particles appearing everywhere, the **Plus** which you created gets surrounded by a sphere of minus charge particles popping into existence all around it. Also, the **Minus** which you created, gets surrounded by a spherical-shaped cloud of plus-charge particles popping into existence all around it. The technical term for this situation is "**broken symmetry**" which is just a fancy way of saying that the charge distribution of the quantum foam is no longer evenly distributed or "symmetrical". In passing, the fancy technical name for your **Plus** and **Minus** near each other, is a "**dipole**" which is just a techno-babble way of saying "two poles: a plus and a minus" - isn't jargon wonderful?

So, just to get it straight in your mind, when you make a battery, the chemical action inside the battery creates a Plus terminal and a Minus terminal. Those poles actually distort the local environment around your battery, and causes vast streams of energy to radiate out in every direction from each pole of the battery. Why doesn't the battery run down? Because the energy is flowing from the environment and not from the battery. If you were taught basic physics or electrical theory, you will probably have been told that the battery used to power any circuit, supplies a stream of electrons which flows around the circuit. Sorry Chief - it just ain't like that at all. What really happens is that the battery forms a "dipole" which nudges the local environment into an unbalanced state which pours out energy in every direction, and some of that energy from the environment flows around the circuit attached to the battery. The energy does **not** come from the battery.

Well then, why does the battery run down, if no energy is being drawn from it to power the circuit? Ah, that is the really silly thing that we do. We create a closed-loop circuit (because that's what we have always done) where the current flows around the circuit, reaches the other battery terminal and immediately destroys the battery's "dipole". Everything stops dead in its tracks. The environment becomes symmetrical again, the massive amount of readily available free-energy just disappears and you are back to where you started from. **But**, do not despair, our trusty battery immediately creates the Plus and Minus terminals again and the process starts all over again. This happens so rapidly that we don't see the breaks in the operation of the circuit and it is the continual recreation of the dipole which causes the battery to run down and lose its power. Let me say it again, the battery does **not** supply the current that powers the circuit, it never has and it never will - the current flows into the circuit from the surrounding environment.

What we really need, is a method of pulling off the power flowing in from the environment, without continually destroying the dipole which pushes the environment into supplying the power. That is the tricky bit, but it has been done. If you can do that, then you tap into an unlimited stream of inexhaustible energy, with no need to provide any input energy to keep the flow of energy going. In passing, if you want to check out the details of all of this, Lee and Yang were awarded the Nobel Prize for Physics in 1957 for this theory which was proved by

experiment in that same year. This eBook includes circuits and devices which manage to tap this energy successfully.

Today, many people have managed to tap this energy but very few commercial devices are readily available for home use. The reason for this is human rather than technical. More than 10,000 Americans have produced devices or ideas for devices but none have reached commercial production due to opposition from influential people who do not want such devices freely available. One technique is to classify a device as "essential to US National Security". If that is done, then the developer is prevented from speaking to anyone about the device, even if he has a patent. He cannot produce or sell the device even though he invented it. Consequently, you will find many patents for perfectly workable devices if you were to put in the time and effort to locate them, though most of these patents never see the light of day, having been taken for their own use, by the people issuing these bogus "National Security" classifications.

If you feel that this opposition to free-energy and related technology is a figment of my imagination and that the people who state that more than 40,000 free-energy device patents have already been suppressed, then please consider this extract from a 2006 reminder to Patent Office staff in America to single out all patents which have to do with free-energy and any related subjects and take those patent applications to their supervisor to be dealt with differently to all other patent applications:

B. Subject matter of special interest in TC 2800

- 1. Perpetual motion machines; classes 310 and 290**
- 2. Anti-gravity devices**
- 3. Room temperature superconductivity; class 310**
- 4. Free energy – Tachyons, etc.**
- 5. Gain-Assisted Superluminal Light Propagation (faster than the speed of light); class 702, 359**
- 6. Other matters that violate the general laws of physics; classes 73, 290.**
- 7. Applications containing claims to subject matter which, if issued, would generate unfavorable publicity for the USPTO, class 84, 702.**
- 8. Reexamination proceedings involving patents in litigation and:
The court decision/verdict is subject to review by the Supreme Court
The court decision includes high monetary awards
The technology and companies involved would likely generate high publicity**

Here "USPTO" is the United States Patent and Trademark Office, which is a privately owned commercial company run to make money for its owners.

The purpose of this eBook is to present the facts about some of these devices and more importantly, where possible, explain the background details of why and how systems of that type function. As has been said before, it is not the aim of this book to convince you of anything, just to present you with some of the facts which are not that easy to find, so that you can make up your own mind on the subject.

The science taught in schools, colleges and universities at this time, is well out of date and in serious need of being brought up to date. This has not happened for some time now as people who make massive financial profits have made it their business to prevent any significant advance for many years now. However, the internet and free sharing of information through it, is making things very difficult for them. What is it that they don't want you to know? Well, how about the fact that you don't have to burn a fuel to get power? Shocking, isn't it !! Does it sound a bit mad to you? Well, stick around and start doing some thinking.

Suppose you were to cover a boat with lots of solar panels which were used to charge a large bank of batteries inside the boat. And if those batteries were used to operate electric motors turning propellers which drive the boat

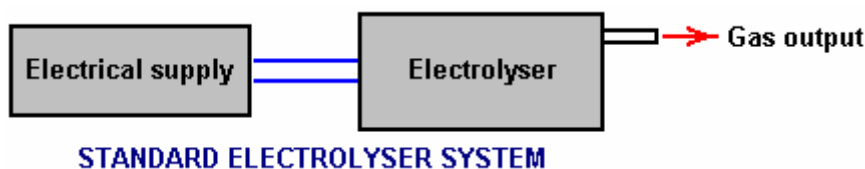
along. If it is sunny weather, how far could you go? As far as the boat can travel while the sun is up and if the battery bank is large, probably most of the night as well. At sun-up on the next day, you can continue your journey. Oceans have been crossed doing this. How much fuel is burned to power the boat? None !! Absolutely none at all. And yet, it is a fixed idea that you have to burn a fuel to get power.

Yes, certainly, you can get power from the chemical reaction of burning a fuel - after all, we pour fuel into the tanks of vehicles "to make them go" and we burn oil in the central heating systems of buildings. But the big question is: "Do we have to?" and the answer is "No". So why do we do it? Because there is no alternative at present. Why is there no alternative at present? Because the people making incredibly large financial profits from selling this fuel, have seen to it that no alternative is available. We have been the suckers in this con trick for decades now, and it is time for us to snap out of it. Let's have a look at some of the basic facts:

Let me start by presenting some of the facts about electrolysis. The electrolysis of water is performed by passing an electric current through the water, causing it to break up into hydrogen gas and oxygen gas. This process was examined in minute detail by Michael Faraday who determined the most energy efficient possible conditions for electrolysis of water. Faraday determined the amount of electric current needed to break the water apart, and his findings are accepted as a scientific standard for the process.

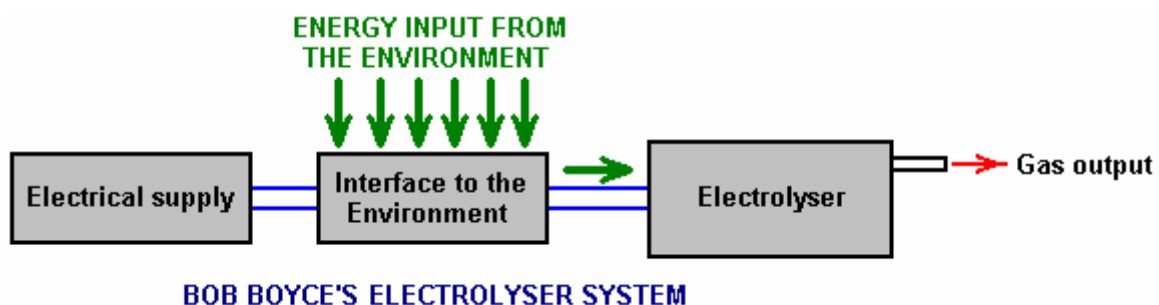
We now bump into a problem which scientists are desperate to ignore or deny, as they have the mistaken idea that it contradicts the Law of Conservation of Energy – which, of course, it doesn't. The problem is an electrolyser design by Bob Boyce of America which appears to have an efficiency twelve times greater than Faraday's maximum possible gas production. This is a terrible heresy in the scientific arena and it gets the average "by the book" scientist very up-tight and flustered. There is no need for this worry. The Law of Conservation of Energy remains intact and Faraday's results are not challenged. However, an explanation is called for.

To start with, let me show the arrangement for a standard electrolyser system:



Here, current is supplied to the electrolyser by the electrical supply. The current flow causes breakdown of the water contained in the electrolyser, resulting in the amount of gas predicted by Faraday (or less if the electrolyser is not well designed and accurately built).

Bob Boyce, who is an exceptionally intelligent, perceptive and able man, has developed a system which performs the electrolysis of water using power drawn from the environment. To a quick glance, Bob's design looks pretty much like a high-grade electrolyser (which it is) but it is a good deal more than that. The practical construction and operational details of Bob's design are shown in <http://www.free-energy-info.tuks.nl/D9.pdf>, but for here, let us just consider the operation of his system in very broad outline:



The very important distinction here is that the power flowing into the electrolyser and causing the water to break down and produce the gas output, is coming almost exclusively from the environment and **not** from the electrical supply. The main function of Bob's electrical supply is to power the device which draws energy in from the environment. Consequently, if you assume that the current supplied by the electrical supply is the whole of the power driving the electrolyser, then you have a real problem, because, when properly built and finely tuned, Bob's electrolyser produces up to 1,200% of Faraday's maximum efficiency production rate.

This is an illusion. Yes, the electrical input is exactly as measured. Yes, the gas output is exactly as measured. Yes, the gas output is twelve times the Faraday maximum. But Faraday's work and the Law of Conservation of Energy are not challenged in any way **because** the electrical current measured is used primarily to power the

interface to the environment and nearly all of the energy used in the electrolysis process flows in from the local environment and is not measured. What we can reasonably deduce is that the energy inflow from the environment is probably about twelve times the amount of power drawn from the electrical supply.

At this point in time, we do not have any equipment which can measure this environmental energy. We are in the same position as people were with electrical current five hundred years ago – there was just no equipment around which could be used to make the measurement. That, of course, does not mean that electrical current did not exist at that time, just that we had not developed any equipment capable of performing measurement of that current. Today, we know that this environmental energy exists because we can see the effects it causes such as running Bob's electrolyser, charging batteries, etc. but we can't measure it directly because it vibrates at right-angles to the direction that electrical current vibrates in. Electrical current is said to vibrate "transversely" while this zero-point energy vibrates "longitudinally", and so has no effect on instruments which respond transversely such as ammeters, voltmeters, etc.

Bob Boyce's 101-plate electrolyser produces anything up to 100 litres of gas per minute, and that rate of production is able to power internal combustion engines of low capacity. The vehicle alternator is perfectly capable of powering Bob's system, so the result is a vehicle which appears to run with water as the only fuel. This is not the case, nor is it correct to say that the engine is powered by the gas produced. Yes, it does utilise that gas when running, but the power running the vehicle is coming directly from the environment as an inexhaustible supply. In the same way, a steam engine does not run on water. Yes, it does utilise water in the process, but the power that runs a steam engine comes from burning the coal and not from the water.

The Basics of "Free-Energy":

This beginner's introduction presumes that you have never heard of free-energy before and would like an outline sketch of what it is all about, so let's begin at the beginning.

We tend to have the impression that people who lived a long time ago were not as clever as we are - after all, we have television, computers, mobile phones, games consoles, aeroplanes, But, and it is a big "but", the reason why they did not have those things is because science had not advanced far enough for those things to become possible. That did **not** mean that the people who lived before us were any less clever than we are.

You have probably heard of the geometry of Pythagoras who lived hundreds of years ago, and that geometry is still used in remote areas to lay out the foundations for new buildings. You have probably heard of Archimedes who worked out why things float. He lived more than two thousand years ago. So, how do those people stack up against you and me? Were they stupid people?

This is quite an important point because it demonstrates that the body of scientific information enables many things which were not thought possible in earlier times. This effect is not restricted to centuries ago. Take the year 1900. My father was a youngster then, so it is not all that long ago. It would be another three years before Orville and Wilbur Wright made their first 'heavier-than-air' flight, so there no aircraft around in 1900. There were no radio stations and most definitely, no television stations, nor would you have found a telephone inside a house. The only serious forms of information were books and periodicals or teaching establishments which relied on the knowledge of the teachers. There were no cars and the fastest form of transport for the average person was on a galloping horse.

Today, it is difficult to grasp what things were like not all that long ago, but come closer in time and look back just fifty years. Then, people researching in scientific fields had to design and build their own instruments before they ever got to experimenting in their chosen fields of knowledge. They were instrument makers, glass-blowers, metal workers, etc. as well as being scientific researchers. Nowadays there are measuring instruments of all kinds for sale ready-made. We have silicon semiconductors which they didn't have, integrated circuits, computers, etc. etc.

The important point here is the fact that advances in scientific theory have made possible many things which would have been considered quite ridiculous notions in my father's time. However, we need to stop thinking as if we already know everything there is to know and that nothing which we think of as "impossible !!" could ever happen. Let me try to illustrate this by remarking on just a few things which as recently as the year 1900 would have marked you out as a "lunatic crank", things which we take for granted today because, and only because, we are now familiar with the science behind each of these things.

Certainties in the year 1900



A metal aeroplane weighing 350 tons couldn't possibly fly - everyone knows that !!



You couldn't possibly watch someone who is a thousand miles away - talk sense !!



No ! Of course you can't speak to somebody who lives in a different country unless you visit them !



The fastest way to travel is on a galloping horse.



A machine could never beat a man at chess - be realistic !

Today, we know that these things are not just possible, but we take them for granted. We have a mobile phone in our pocket and could easily use it to talk to friends in other countries almost anywhere in the world. It would seem very strange if we could not do that any more.

We each have a television and can watch, say, a golf tournament taking place at the other side of the world. We watch in real time, seeing the result of each stroke almost as soon as the golfer does himself. Even suggesting that such a thing was possible might have got you burnt at the stake for witchcraft, not all that long ago, but not having television would seem a very strange situation for us today.

If we see a 350 ton metal Boeing 747 aircraft flying past, we would not think it to be strange in any way, let alone think it was "impossible". It is routine, casual travel at 500 mph, a speed which would have been considered to be a fantasy when my father was young. The fact that the aircraft is so heavy, is of no concern to us as we know that it will fly, and does so, routinely, every day of the year.

We take for granted, a computer which can do a million things in one second. Today, we have lost the understanding of how big "a million" is, and we know that most people are likely to lose a game of chess if they play against a computer, even a cheap chess computer.

What we need to understand is that our present scientific knowledge is far from being comprehensive and there is still a very large amount to be learned, and that things which the average person today would consider "impossible" are quite liable to be casually routine day-to-day things in just a few years time. This is **not** because we are stupid but instead it is because our current science still has a long way to go.

The objective of this website (<http://www.free-energy-info.tuks.nl>) is to explain some of the things which current science is not teaching at the present time. Ideally, we want a device which will power our homes and cars without the need to burn a fuel of any kind. Before you get the idea that this is some new and wild idea, please remember that windmills have been pumping water, milling grain, lifting heavy loads and generating electricity for a very long time now. Water wheels have been doing similar work for a very long time and neither of these devices burn a fuel.

The energy which powers windmills and water wheels comes to us via the Sun which heats air and water, causing wind and rain, feeding power to our devices. The energy flows in from our local environment, costs us nothing and will keep on coming whether we make use of it or not.

Most of the pictures of wind generators and water wheels which you will see, show devices which would take a large amount of money to set up. The title of this eBook is "The Practical Guide to Free-Energy Devices" and the word "practical" is intended to indicate that most of the things spoken about are things which you, personally, have a reasonable chance of constructing for yourself if you decide to do so. However, while in chapter 14 there are instructions for building your own wind-powered electrical generator from scratch, pumping water uphill without using a fuel and utilising wave power at low cost, these things are subject to the weather. So, because of this, the main subject is the next generation of commercial devices, devices which do not need a fuel in order to function and power our homes and vehicles, devices which operate no matter what the weather is doing.

Perhaps I should remark at this point, that the commercial introduction of this new wave of hi-tech devices is being actively opposed by people who will lose a very large stream of revenue when it does eventually happen, as it most certainly will. For example, Shell BP which is a typical oil company, makes about US \$3,000,000 profit per hour, every hour of every day of every year, and there are dozens of oil companies. The government makes even more than that out of the operation, with 85% of the sale price of oil in the UK being government tax. No matter what they say, (and they both do like to talk "green" in order to gain popularity), neither would ever for a single moment, consider allowing the introduction of fuel-less power devices, and they have the financial muscle to oppose this new technology at every possible level.

For example, some years ago Cal-Tech in the USA spent millions proving that on board fuel reformers for vehicles would give us all better fuel economy and cleaner air. They did long-term testing on buses and cars to provide proof. They teamed up with the very large auto-parts supplier Arvin Meritor to put these new devices in production vehicles. Then "One Equity Partners" bought out Arvin Meritor's division that did all the final work to get fuel reformers put into all new vehicles. They created a new company, EMCON Technologies, and that company dropped the fuel reformer from their product line, not because it did not work, but because it **did** work. This is not "conspiracy theory" but a matter of public record.

Some years ago, Stanley Meyer, a very talented man living in America, found a very energy-efficient way of breaking water into a mixture of hydrogen gas and oxygen gas. He pushed on further and found that a vehicle engine could be run on quite a small amount of this "HHO" gas if it was mixed with air, water droplets and some of the exhaust gas coming from the engine. He got funding to allow him to start manufacturing retro-fit kits which would allow any car to run on water alone and not use any fossil fuel at all. You can imagine how popular that

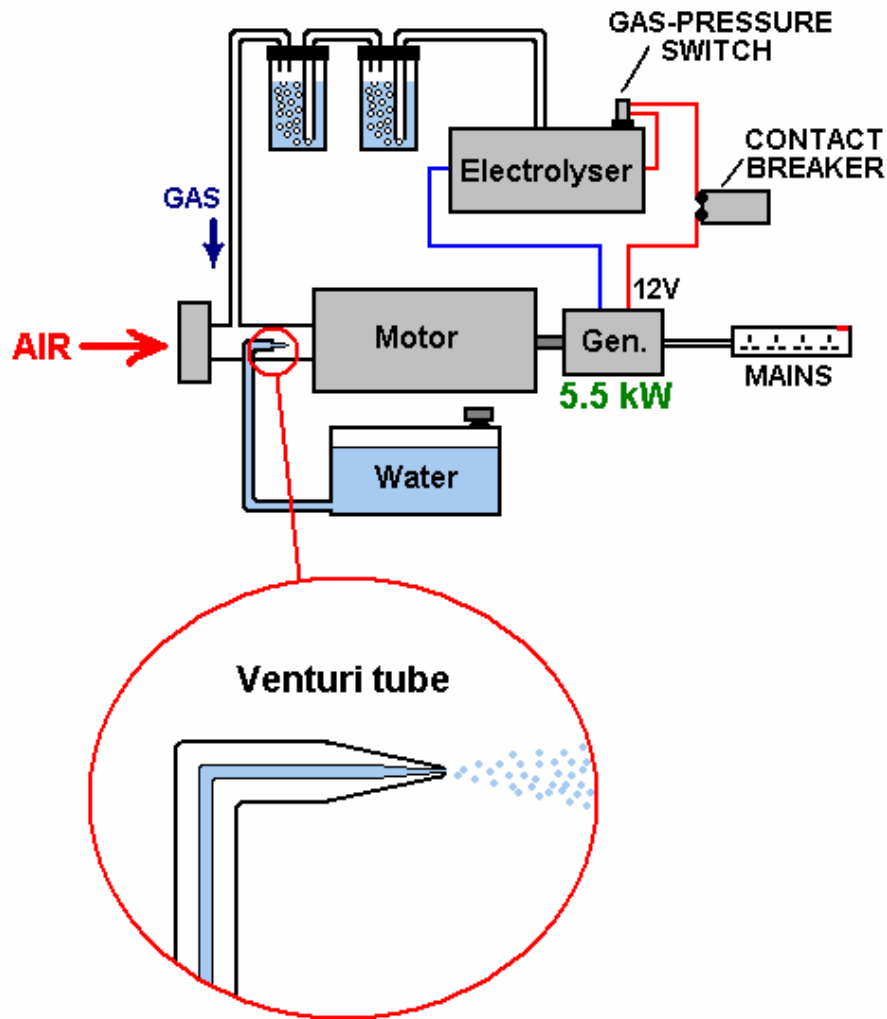
would have been with the oil companies and the government. Just after getting his funding, Stan was eating a meal at a restaurant when he jumped up, said "I've been poisoned !", rushed out into the car park and died on the spot. If Stan was mistaken, and he died of 'natural causes', then it was remarkably convenient timing for the oil companies and the government, and his retro-fit kits were never manufactured.

Even though Stan left behind many patents on the subject, until recently nobody managed to replicate his very low-power electrolyser, then Dave Lawton in Wales achieved the feat and many people have since replicated it by following Dave's instructions. More difficult still is getting an engine to run on no fossil fuel as Stan did, but recently, three men in the UK achieved just that by getting a standard petrol-engined electrical generator to run with water as the only fuel. Interestingly, this is not something which they want to pursue as they have other areas which appeal more to them. Consequently, they have no objections to sharing the practical information on what they did.

In very brief outline, they took a standard 5.5 kilowatt generator and delayed the spark timing, suppressed the 'waste' spark and fed the engine a mix of air, water droplets and just a small amount of HHO gas (which they measured at a flow rate of just three litres per minute). They test-loaded the generator with four kilowatts of electrical equipment to confirm that it worked well under load, and then moved on to a larger engine. This is the general style of generator which they used:



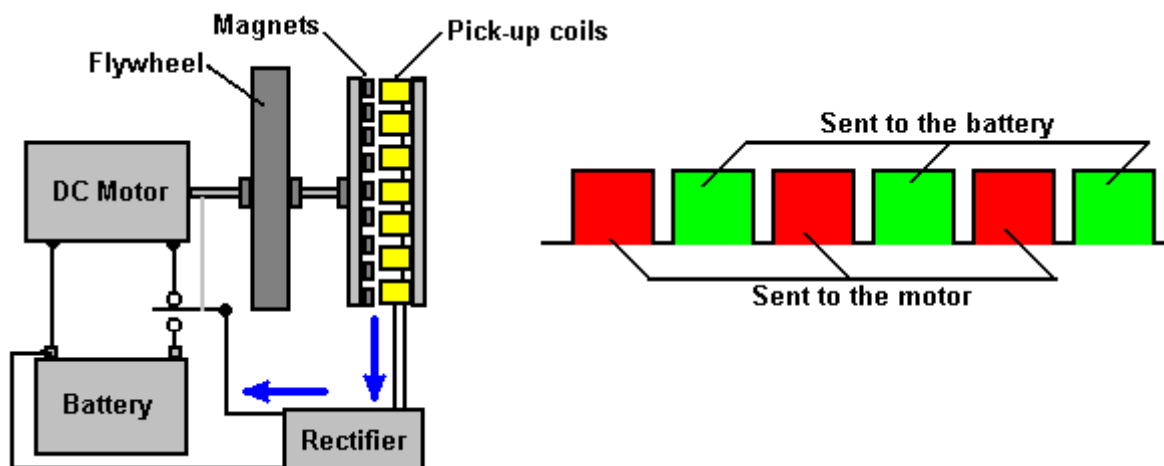
And their arrangement for running it without petrol, is shown in outline here, the full details being in chapter 10, including how to make your own high-performance electrolyser:



Conventional science says that it can prove mathematically that it is quite impossible to do this. However, the calculation is massively flawed in that it is not based on what is actually happening and worse still, it makes initial assumptions which are just plain wrong. Even if we were not aware of these calculations, the fact that it has been done is quite enough to show that the current engineering theory is out of date and needs to be upgraded.

In passing, it might be remarked that an isolated, almost self-sufficient commune in Australia has been supplying their electrical needs by running ordinary electrical generators on water as the only (apparent) fuel for many years now.

However, let us now consider a device built by John Bedini, another talented man in America. He built a battery-powered motor with a flywheel on the shaft of the motor. This, of course, does not sound like startling stuff, but the crunch is that this motor ran in his workshop for more than three years, keeping its battery fully charged during that time - now that **is** startling. The arrangement is like this:

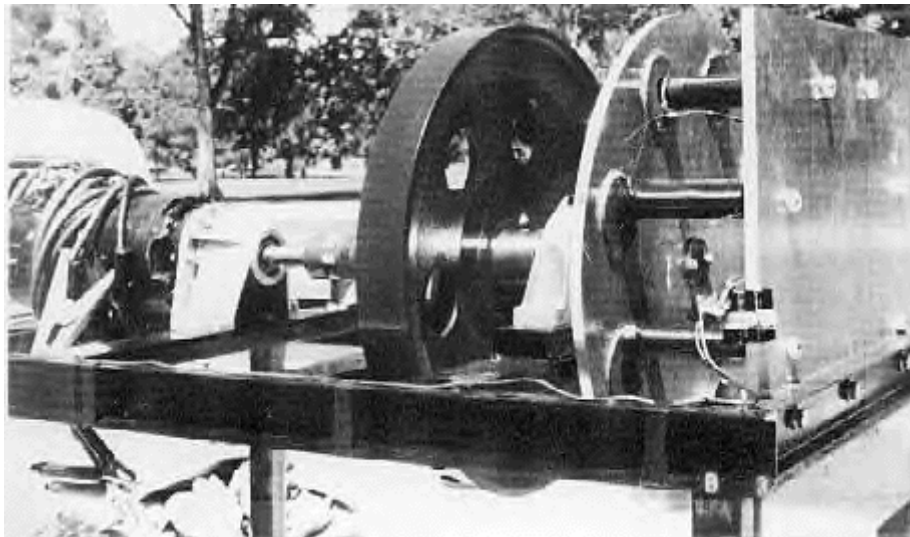


What makes this arrangement different from a standard set-up is that the battery powered motor is not connected directly to the battery but instead is fed with a rapid series of DC pulses. This has two effects. Firstly, that method of driving a motor is very efficient electrically speaking and secondly, when a flywheel is driven with a series of pulses, it picks up additional energy from the local environment.

One other unusual feature is the way that the motor shaft spins a disc with permanent magnets mounted on it. These sweep past a matching set of coils attached to a stationary board, forming an ordinary electrical generator and the resulting electrical power which is generated is converted to DC current and fed back to the driving battery, charging it and maintaining its voltage.

Standard theory says that a system like this has to be less than 100% efficient because the DC motor is less than 100% efficient (true) and the battery is only about 50% efficient (true). Therefore, the conclusion is that the system cannot possibly work (false). What is not understood by conventional science is that the pulsed flywheel draws in additional energy from the local environment, showing that conventional science theory is inadequate and out of date and needs to be upgraded, after all, this is not a 'closed system'.

An American called Jim Watson built a much larger version of John's system, a version which was twenty feet (6 meters) long. Jim's version not only powered itself, but generated 12 kilowatts of excess electrical power. That extra 12 kilowatts of power must be a considerable embarrassment for conventional science and so they will either ignore it, or deny that it ever existed, in spite of the fact that it was demonstrated at a public seminar. This is what Jim's device looked like:



Working quite independently, an Australian called Chas Campbell, discovered the same effect. He found that if he used an AC motor plugged into the mains to drive a flywheel which in turn drove an ordinary generator, that it was possible to get a greater power output from the generator than the amount needed to drive the motor.



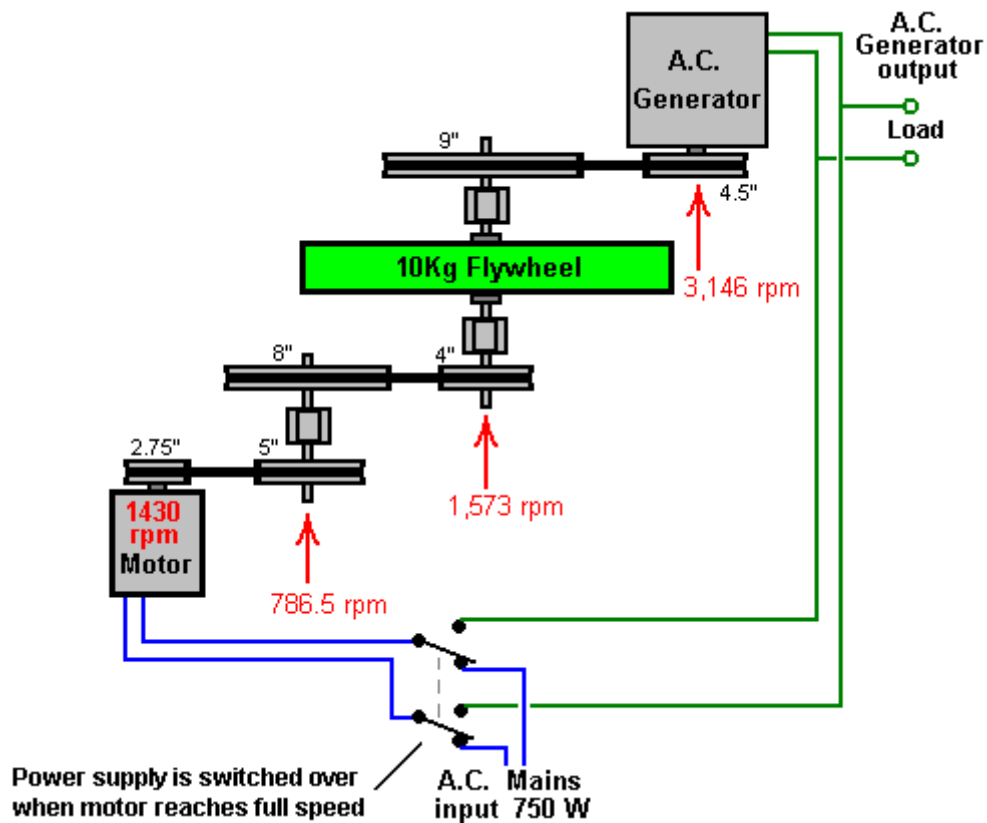
Chas used his motor to drive a series of shafts, one of which has a heavy flywheel mounted on it, like this:



The final shaft drives a standard electrical generator and Chas found that he could power electrical equipment from that generator, electrical mains equipment which required greater current than his mains-driven motor did.

Chas then took it one stage further and when the system was running at full speed, he switched his mains motor over from the wall socket to his own generator. The system continued to run, powering itself and driving other equipment as well.

Conventional science says that this is impossible, which just goes to show that conventional science is out of date and needs to be upgraded to cover systems like this where excess energy is flowing in from the local environment. Here is a diagram of how Chas Campbell's system is set up:



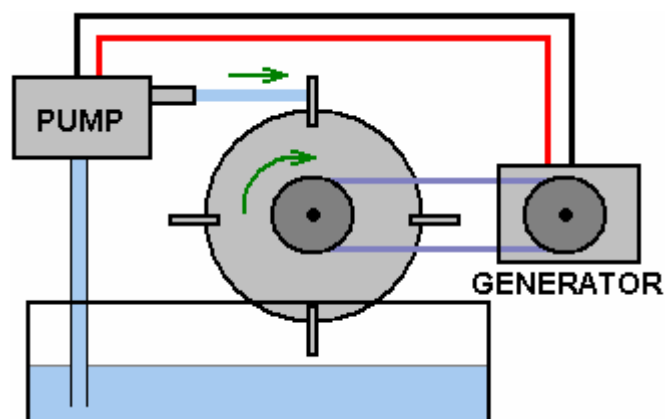
James Hardy has put a video on the web, showing a variation of this same principle. In his case, the flywheel is very light and has simple paddles attached around the rim of the wheel:



He then aims a powerful jet of water from a high-powered water pump, directly at the paddles, driving the wheel round with a rapid series of pulses. The shaft, on which the wheel is mounted, drives a standard electrical generator which lights an ordinary light bulb:



The really interesting part comes next, because he then unplugs the electrical supply to the water pump and switches it over to the generator which the wheel is driving. The result is that the pump powers itself and provides excess electricity which can be used to power other electrical equipment. The arrangement is like this:



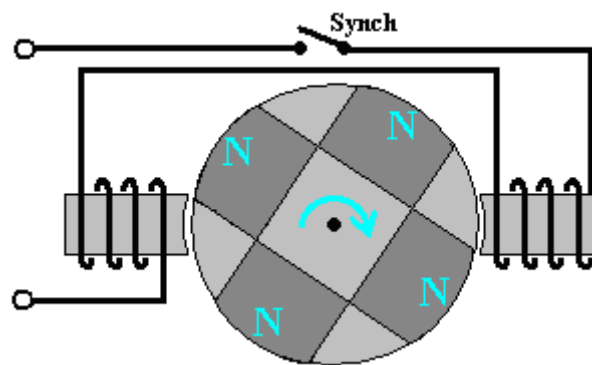
Once again, conventional science says that this is impossible, which in turn, demonstrates that conventional science is out of date and needs to be expanded to include these observed facts.

Permanent Magnets provide continuous power. This is because the poles of the magnet form a dipole, unbalancing the zero-point energy field near the magnet, and causing a continuous flow of energy which we call "lines of magnetic force". This should be obvious as a magnet can support its own weight on the vertical face of a

refrigerator, for years on end. Conventional science says that permanent magnets can't be used as a source of power. However, the reality is that conventional science just doesn't know the techniques necessary for extracting that power. The lines of magnetic flow around any magnet are symmetrical and in order for a magnet to provide a useful directional force, it is necessary to arrange magnets in such a way that their combined magnetic field is no longer symmetrical. Doing that is not easy, but there are many alternative methods. Magnets are attracted to iron and that principle along with several other techniques have been successfully used by the New Zealander, **Robert Adams** who produced a motor which is, typically, at least 800% efficient. This, of course, is impossible according to conventional science. Robert was told that if he shared the information, he would be killed. He decided that at his age of seventy, being killed was not a major thing, so he went ahead and published all the details.

Present day motors driven by electricity are always less than 100% efficient as they are deliberately wound in a symmetrical way in order to make them inefficient. The Adams motor looks like a motor driven by electrical pulses, but it is **not**. The motor power comes from the permanent magnets mounted on the rotor and not from an electrical pulse applied to the electromagnets attached to the stator. The magnets are attracted to the metal cores of the stationary electromagnets. This provides the driving power of the motor. The electromagnets are then powered just enough to overcome the backwards drag of the magnets when they have just passed by the cores of the electromagnets.

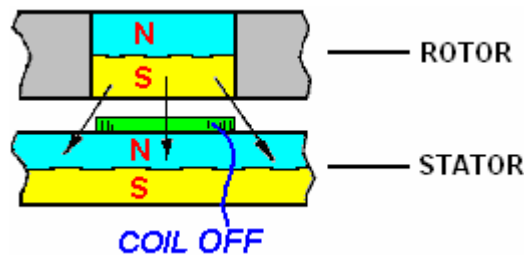
The system works like this:



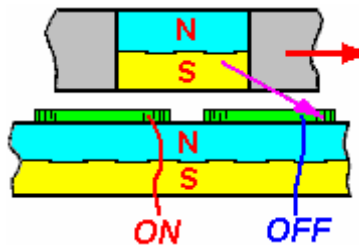
1. The magnets are attracted to the iron cores of the electromagnets, rotating the drive shaft and powering the motor.
2. The moving magnets generate electrical power in the windings of the electromagnets and this power is used to charge the driving battery.
3. When the permanent magnets reach the electromagnets, a small amount of electrical power is fed to the windings of the electromagnets in order to overcome any backward pull hindering the rotation of the drive shaft.
4. When that power supplied to the electromagnets is cut off, the Back EMF pulse is captured and used to charge the driving battery.
5. Although not shown in the diagram above, there are normally additional pick-up coils mounted round the rotor and if they are connected briefly at the right moment, they generate extra current and when they are switched off, their resulting reversed magnetic field also boosts the rotor on its way, and that can raise the Coefficient Of Performance over 1000. One replication using this technique has an electrical input of 27 watts and a 32 kilowatt output.

When operated in this way, the Adams Motor has output power far in excess of the input power needed to make it run. The design confuses conventional science because conventional science refuses to accept the concept of energy flow into the motor, from the local environment. This is all the more strange, considering that windmills, water wheels, hydro-electric schemes, solar panels, wave-power systems, tidal power systems and geothermal energy systems are accepted and considered perfectly normal, in spite of the fact that they all operate on energy flowing in from the local environment. It is difficult to avoid the conclusion that vested interests are working hard to prevent conventional science accepting the fact that free-energy is all around us and there for the taking. Perhaps it is the case that they want us to go on paying for fuel to burn to "make" energy to power our homes and vehicles.

Another example of magnet power being used in the design of a powerful motor comes from **Charles Flynn**. He uses a similar method of electrical screening to prevent magnetic drag hindering the drive shaft rotation. Instead of using electromagnets, Charles uses permanent magnets on both the rotor and the stator, and a flat coil of wire to create the blocking fields:

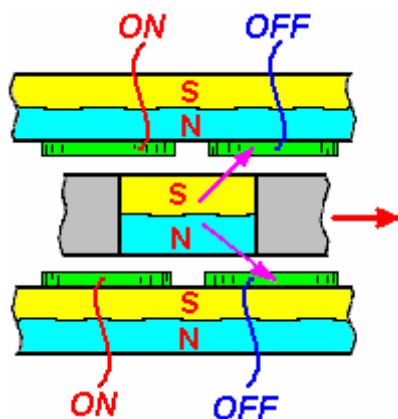


When the coil does not have current flowing through it, it does not produce a magnetic field and the South pole of the rotor magnet is attracted equally forwards and backwards by the North pole of the stator magnet. If there are two coils as shown below, and one is powered and the other is not powered, the backward pull is cancelled out and the forward pull causes the rotor to move forwards:

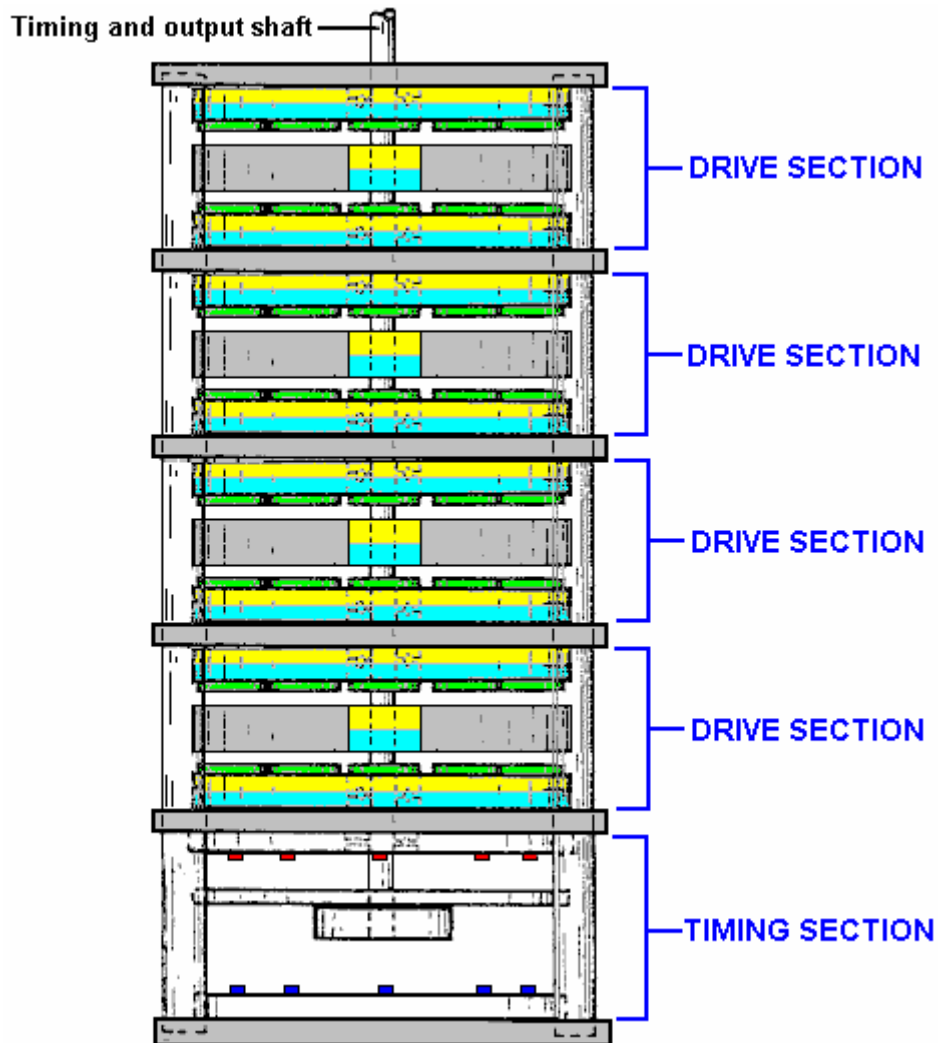


Conventional science takes a quick glance at this arrangement and proclaims that the motor efficiency has to be less than 100% because of the large electrical pulse needed to make the shaft turn. This just demonstrates a complete lack of understanding of how the motor operates. There is no "large electrical pulse" because the motor is **not** driven by electrical pulses, but instead it is driven by the attraction of many pairs of magnets, and only a very small electrical pulse is applied to cancel the backward drag as the magnets move past. To put this in context, the powerful prototype motor built by Charles ran at 20,000 rpm and the power for the coils was supplied by an ordinary 9-volt "dry-cell" battery quite incapable of supplying heavy currents.

The motor is easily made more powerful by using a stator magnet on both side of the rotor magnet, as shown here:



There is no real limit to the power of this motor as layer after layer of magnets can be mounted on a single drive shaft as shown here:

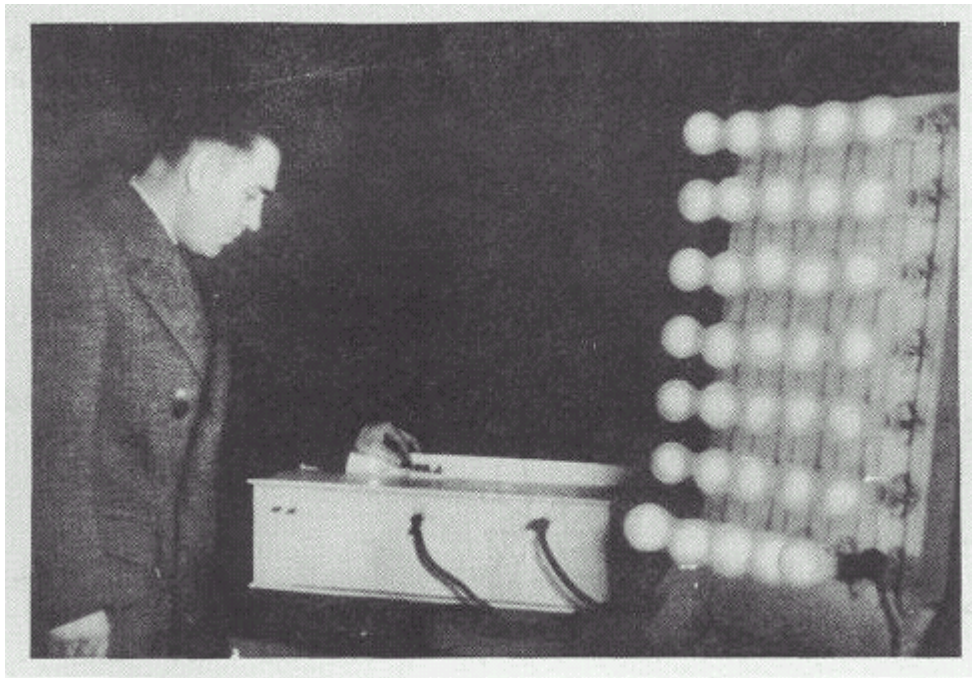


The electrical pulses to the screening coils can be synchronised by the light from Light-Emitting Diodes mounted in the timing section, shining through holes in a timing disc attached to the drive shaft of the motor. The light falling on light-dependant resistors on the other side of the disc, provide the switching for the coil-powering electricity.

Aerial systems. We are surrounded by so much energy that a simple aerial and earth connection can draw in very large amounts of electrical power from the local environment.

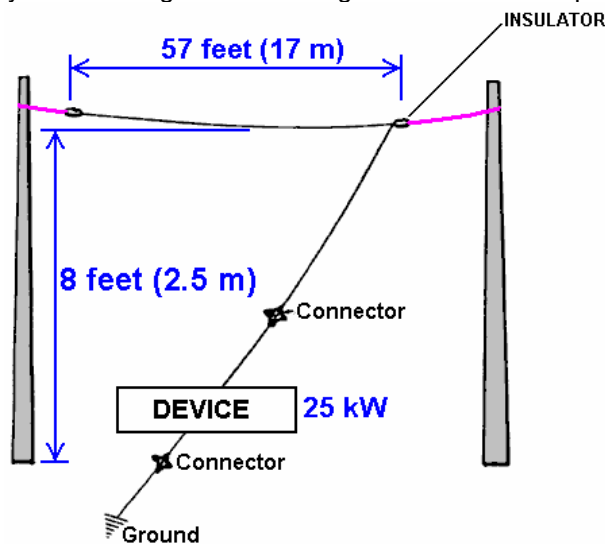


Thomas Henry Moray ran frequent public demonstrations during which he lit banks of light bulbs to show that useful amounts of energy could be drawn from the environment:



Moray's device could produce output powers up to fifty kilowatts and it had no moving parts, just a simple aerial and an earth. In spite of the frequent demonstrations, some people would not believe that this was not a hoax, so Moray invited them to choose a place and he would demonstrate the power available at any location they wanted.

They drove fifty miles out into the countryside and picked a really isolated spot away from all power lines and the very few commercial radio stations in the area. They set up a very simple aerial estimated by one observer to be just fifty seven feet long and only seven or eight feet off the ground at its lowest point:



The earth connection was an eight-foot length of gas pipe which was hammered into the ground. There is no significance in the earth connection being a gas pipe, as that was used just because it was to hand at the time. The bank of lights being powered by Moray's device, grew brighter as the gas pipe was driven further and further into the ground, providing a better and better earth connection. Moray then demonstrated that when the aerial was disconnected, the lights went out. When the aerial was connected again, the lights were lit again. He then disconnected the earth wire and the lights went out and stayed out until the earth wire was connected again. The sceptics were completely convinced by the demonstration (which is most unusual for sceptics as sceptics often refuse to accept anything which contradicts their current beliefs).

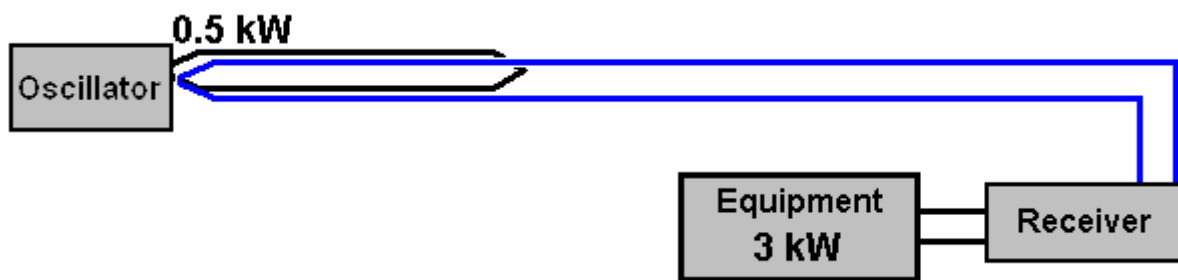
Moray's is one of several excellent and very successful devices which I can't tell you exactly how to replicate (because the details were never revealed and Moray was intimidated into silence) but the important point here is that a 57-foot aerial raised just 8-feet from the ground can provide kilowatts of electrical power at any location, if you know how to do it.

Moray's demonstrations were highly unpopular with some people and he was shot at in his car. He put bullet-proof glass in his car, so they came into his laboratory and shot at him there. They succeeded in intimidating him into stopping his demonstrations or publishing the exact details of how to replicate his aerial power system.

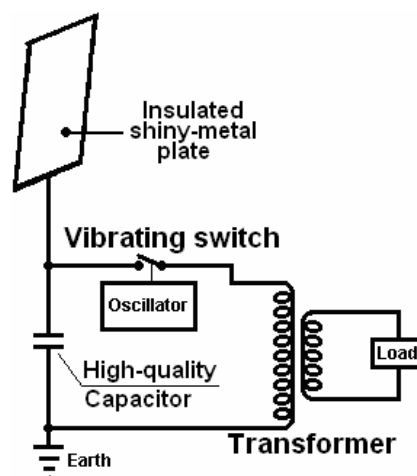
Lawrence Rayburn has developed an aerial system with one part raised thirty feet above the ground. He powers his farm with it and has measured more than 10 kilowatts being drawn from it.

Hermann Plauson has a patent which reads more like a tutorial on how to extract useful power from an aerial. He describes installations where one producing 100 kilowatts of excess power he calls a "small" system as each of his aerals can capture up to a kilowatt and he used many aerals.

Frank Prentice has a patent on an 'aerial' system where he drives a wire loop alongside a long length of wire mounted just seven or eight inches (200 mm) above the ground. His input power is 500 watts and the power drawn from the system is 3,000 watts, giving an excess of 2.5 kilowatts (COP=6):

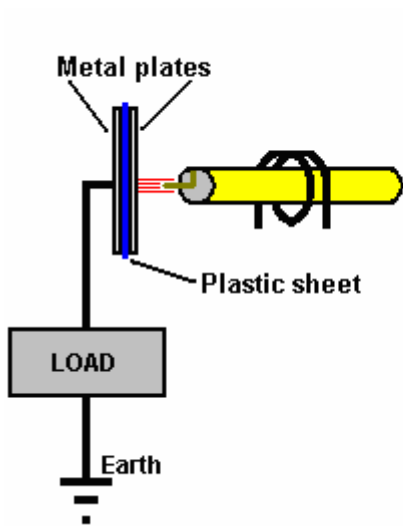


Nikola Tesla, probably the most famous person in the free-energy field, has a patent on an aerial system which uses a shiny metal plate with insulated faces as the main component of his aerial. As is common in this field, a high-quality capacitor is used to store the energy initially and then that power is pulsed through a step-down transformer which lowers the voltage and raises the current available, as shown here:

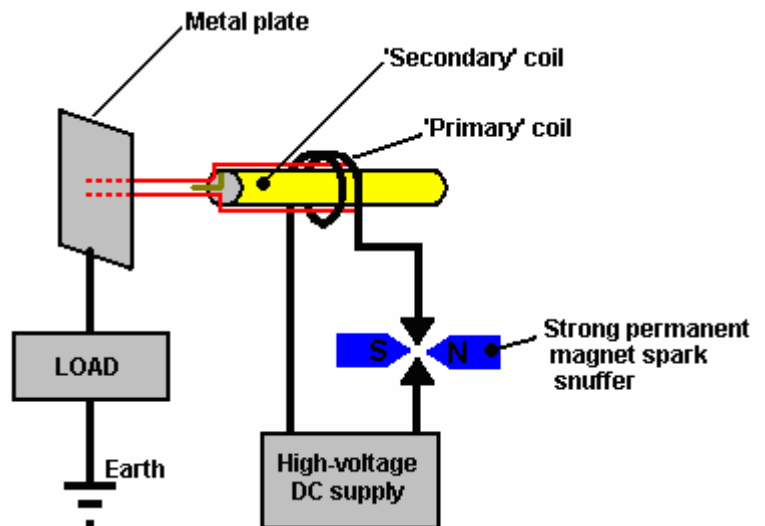


Instead of using an aerial, it is possible to use a **Tesla Coil** which produces very high currents **if** the primary winding is placed in the middle of the secondary winding and not at one end which is the usual configuration. With one method, Tesla directs the output on to a single metal plate and powers a load between the plate and the earth.

Don Smith demonstrates this in a video currently on YouTube. He uses a capacitor made from two metal plates with a sheet of plastic between them, instead of Tesla's insulated single plate. The load is powered between the capacitor and earth. The video shows Don using a 28-watt hand-held Tesla Coil and producing what looks like several kilowatts of power in the earth line.



Don Smith



Nikola Tesla

Don points out that the output power is proportional to the **square** of the voltage and the **square** of the frequency: So if you double the frequency and double the voltage there will be 16 times as much output power.

Tariel Kapanadze demonstrates this in a web video of his interview for Turkish TV. It shows him making an earth connection by burying an old car radiator, and then lighting a row of light bulbs from a fuel-less device. While the commentary is not in English, the video is very informative. You will notice that this is a substantial power output coming from a device built with a very basic style of construction where bare wires are twisted together to form an electrical connection.

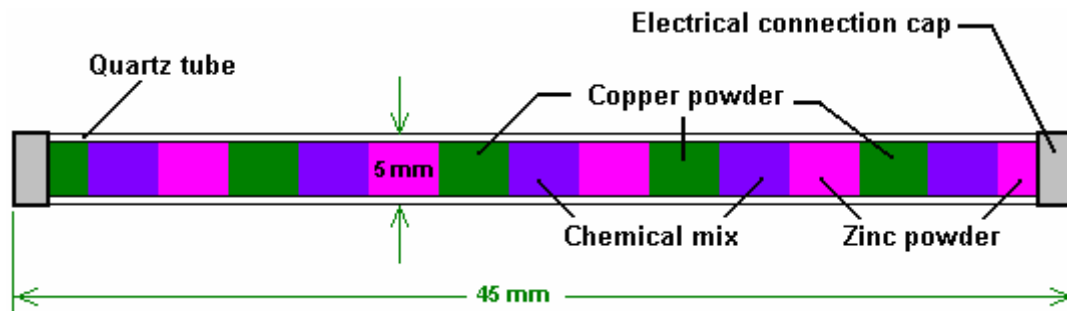
When the starting battery is removed, the equipment is held in the air to show that it is self-contained and self-powered. This is another confirmation that free-energy is all around us and ready to be taken by anyone who knows how. Tariel is seen here lighting a row of five light bulbs hanging from a broom handle placed across the backs of two chairs - not exactly a high-tech, high-cost form of construction this!



This is a picture of his circuit housing, spark gap and output transformer:

However, I can't provide you with the exact details as Tariel has never revealed how he does it and there is every indication that he never will. He says that if he told how it worked, then "you would laugh as it is so simple".

The **Colman / Seddon-Gillespie** 70-year battery. A quite different approach to getting fuel-less power was taken by Colman and Seddon-Gillespie who developed a tiny tube of harmless chemicals - copper, zinc and cadmium:

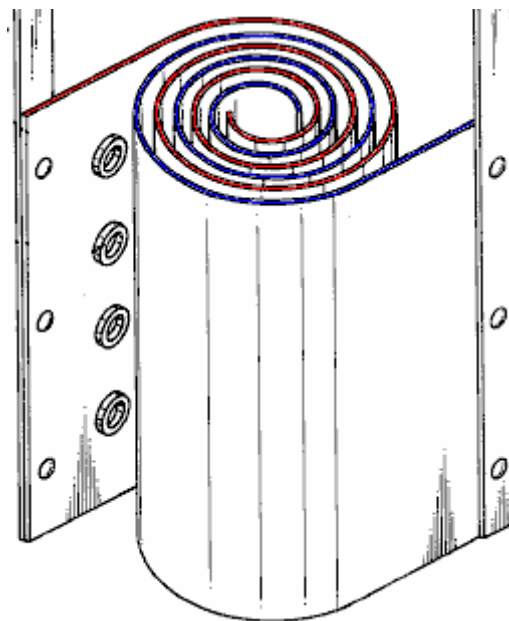


They found that if this tube was subjected to a few seconds of high-frequency electromagnetic radiation, then it became radioactive for about one hour. During that time, a kilowatt of electrical power could be drawn continuously from this tiny tube. Near the end of the hour, another burst of electromagnetic waves keeps the tube radioactive and maintains the output current. Lead shielding is used to make this a safe device to use. They have a patent on this device. The expected working life of one of these tubes is estimated as being seventy years.

Electrolysis. Michael Faraday did a really excellent job of investigating how much energy was required to change water from its liquid state into a mixture of hydrogen gas and oxygen gas. Conventional science has latched on to this information and refuses to believe that it is not the last possible word on electrolysis.

This is akin to saying that the fastest a man can propel himself over the ground is by running, and refusing to accept the fact that there might be a later invention of a bicycle which would allow a much faster human-powered speed over the ground.

This is maintained in spite of the fact that a patent has been awarded to **Shigeta Hasebe** for a different style of electrolysis, using magnets and spiral electrodes like this:



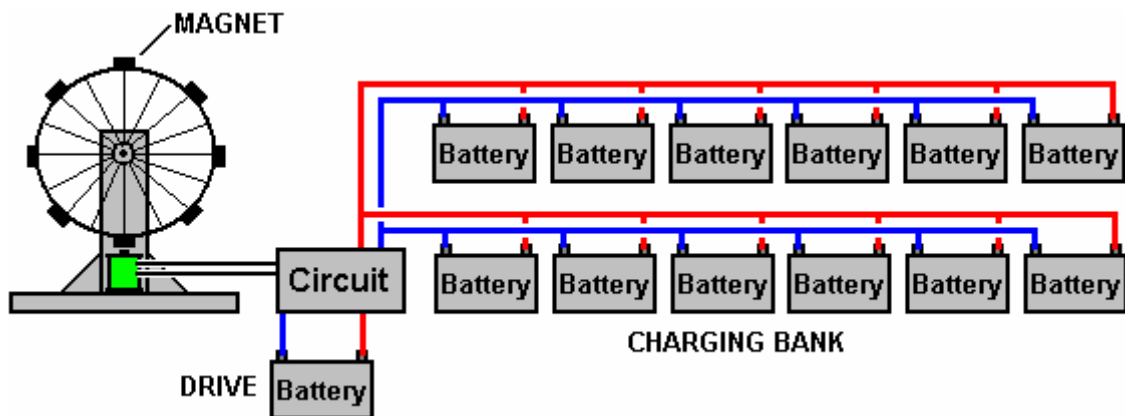
In his patent, Shigeta indicates his disappointment that his laboratory tests only showed an efficiency of ten times greater than that of Faraday while his calculations showed that he could be getting twenty times the Faraday result. The different method, along with the use of powerful magnets at the top and bottom of his electrode pairs, bypassed the limits which Faraday had established by changing the working conditions.

Stanley Meyer of the USA discovered a method of splitting water into its gas form, using very little power. Stan's work has been replicated by Dave Lawton and many other people. For example, Dr Scott Cramton has produced the "HHO" gas mix produced by the electrolysis of water, at a rate of 6 litres per minute with a power input of just 36 watts (12 volts at 3 amps). This is dramatically better than Faraday thought was possible and it allows power production through recombining that HHO gas to give water again, as the power produced is well above the amount of power needed to split the water in the first place. It should be remarked in passing, that most of the power produced when HHO is recombined into water, does not come from the hydrogen (even though in its HHO form it is typically four times more energetic than hydrogen gas), but from charged water clusters which are generated during the electrolysis process.

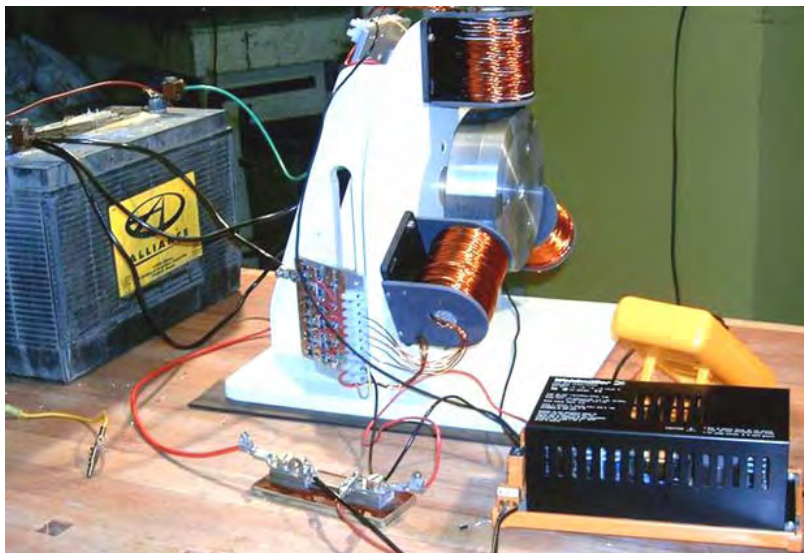
John Bedini of the USA has patented a system for the rapid charging of batteries with a pulsed waveform. Using banks of batteries tends to be very expensive and very space-consuming.

John Bedini's spike-generating system can charge several batteries at the same time. The snag is if you use batteries to power equipment while they are being charged, they don't recharge nearly as well. The system is easy to make and use. The best performance that I have come across is where there is thirteen times more power output than the power input.

There are several variations on John's pulser. The most common is a bicycle wheel with ferrite permanent magnets attached to the rim:



As the wheel spins, the approaching magnet generates a voltage in one winding of an electromagnet. This triggers a circuit which powers a second winding of the electromagnet. This pulse pushes the magnet away, keeping the wheel spinning. When the power to the coil is cut off, the resulting "Back EMF" voltage spike is fed to the batteries being charged. If the spike is sharp enough, it can cause an inflow of additional energy from the local environment. Interestingly, the rate at which the wheel rotates is directly proportional to the amount of charge in the batteries being charged. Here is a picture of **Ron Pugh's** high-quality construction of a Bedini pulse charger:



Conclusion:

The term "Free-Energy" generally means a method of drawing power from the local environment, without the need to burn a fuel. There are many different successful methods for doing this and these methods span many countries and many years.

The amount of power which can be collected can be very high and the few kilowatts needed to power a household is most definitely within the reach of most of the devices mentioned.

In this brief introduction, not much detail has been given about the devices mentioned and only a small selection of devices has been covered. Much more detail is available in the various chapters of this eBook

The 'bottom line' is that energy can definitely be drawn from the local environment in sufficient quantities to supply all of our needs. For whatever reason, conventional science appears determined not to accept this basic fact and denies it at every opportunity. It seems likely that vested financial interests are the root cause of this refusal to accept the facts. The true scientific method is to upgrade scientific theory in the light of observed fact and new discoveries, but the true scientific method is not being followed at the present time. To conclude this introduction, let us consider some of the many ways which can be used to gather energy from the zero-point energy field in readiness for use in our daily tasks. Here are some of those methods:

Method	Examples
1. Using an aerial	Alexkor's aerial 100 watts, chapter 7 Herman Plauson patent 1 kilowatt from each aerial, chapter 7 Lawrence Rayburn's TREC aerial 10 kilowatts, chapter 7 Thomas Henry Moray demonstrations up to 50 kilowatts, chapter 7
2. Gravity	William Skinner – powered his workshop in 1939, chapter 4 James Kwok 250 to 1000 kilowatts, chapter 4 Mikhail Dmitriev's pushed weights, 100 watts, chapter 4
3. A spinning rotor	Teruo Kawai self-powered electric motor cycle, chapter 2 Lawrence Tseung's wheel 100 watts, chapter 2
4. Motionless circuit	Carlos Benitez 2 kilowatts, chapter 5 Lawrence Tseung's magnetic frame 10 watts, chapter 3 Valeri Ivanov's magnetic frame 10 watts, chapter 3 Rosemary Ainslie's heater 100 watts, chapter 5
5. Efficient magnetic transfer	Thane Heins' 1 kilowatt, chapter 3 Tewari Paramahansa's 3 kilowatts, chapter 2 Clemente Figuera's 20 kilowatt transformer, chapter 3
6. Efficient electrolysis for	Dave Lawton, chapter 10

heating and powering generators	Dr Scott Cramton, chapter 10 Bob Boyce, chapter 10 Selwyn Harris, chapter 10 David Quirey unmodified generator, chapter 10
7. Effective battery charging	Motionless: Lawrence Tseung's FLEET, chapter 5 Alexkor's many systems, chapter 6 Moving: John Bedini / Ron Pugh, chapter 6
8. Permanent magnets only	Muammer Yildiz's motor, 300-watts, chapter 1 Dietmar Hohl's motor, 20 watts, chapter 1 ShenHe Wang's generators, 1 to 100 kilowatts, chapter 1 Mini Romag / J L Naudin generator, 35 watts, chapter 13
9. Permanent magnets with electricity	Robert Adams' generator, multi kilowatt, chapter 2 Charles Flynn's motor, unlimited, chapter 1 Steven Kundel's motor, 100 watts, chapter 1 Donald Kelly's motor, 100 watts, chapter 1
10. Passive devices	Dr Oleg Gritschewitch's Toroid 1500 kilowatts, chapter 5 Bill Williams/Joe Nobel's Joe Cell, unlimited, chapter 9
11. Inertia	John Bedini's pulsed flywheel, chapter 4 James Hardy's water-jet generator, chapter 2 Chas Campbell's self-powered flywheel, chapter 4
12. Ground energy	Barbosa and Leal 169 kilowatts, COP=102.4, chapter 3 Frank Prentice 3 kilowatts, COP=6, chapter 5 Michael Emme's Earth Battery, 3 kilowatts, chapter 6
13. Radioactive	Colman / Seddon-Gillespie's 1 kilowatt, 70-year battery, chapter 3 Tesla's generator (spark gap alternative), unlimited, chapter 11
14. Isotope exchange	Meyer and Mace using isotopes of iron, 1 kilowatt, chapter 3
15. Splitting the Positive	Clemente Figuera's 5 kilowatt generator (avoids back-EMF), chapter 3
16. Magnetic Coupling	Raoul Hatem's multi-generator system, unlimited, chapter 2
17. Inert-gas motors	Josef Papp (Volvo 90 HP engine @300 HP 40 min. demo), chapter 8 Robert Britt, unlimited, chapter 8.
18. Optical amplification	Pavel Imris' optical amplifier, multiplier of 9 times, unlimited, chapter 3
19. Friction	Paul Baumann's Thestatika (Wimshurst machine), 3 kilowatts, chapter 13
20. Piezo electricity	Michael Ognyanov's semiconductor battery, 10 watts, appendix

Not included in this list:

Andrea Rossi's Cold fusion, 1 kilowatt modules,
Floyd Sweet's motionless magnetic system (COP=1.612 million at 500 watts),
Steven Mark's self-powered toroid, hundreds of watts,
Tariel Kapanadze's 1 kilowatt to 100 kilowatt generators,
Don Smith's high kilowatt designs,
Alfred Hubbard's 35 HP engine,
Richard Clem's 300 HP self-powered engine,
Dan Cook's self-powered motionless generator,
Joseph Newman's motor
and many others.

As many people are not aware of the cost of running existing mains equipment, here is some indication of the current draw from the mains and from a 90% efficient 12-volt inverter running from a battery. There is a continuous current draw when an inverter is switched on, whether the inverter is powering equipment or not.

Load	220V mains	110V mains	12V inverter
100 watts	0.46 Amps	0.909 Amps	9.26 Amps
500 watts	2.27 Amps	4.55 Amps	46.3 Amps
1 kilowatt	4.55 Amps	9.09 Amps	92.6 Amps

2 kilowatts	9.09 Amps	13.64 Amps	185 Amps
3 kilowatts	13.64 Amps	18.18 Amps	278 Amps
4 kilowatts	18.18 Amps	22.73 Amps	370 Amps
5 kilowatts	22.73 Amps	45.45 Amps	463 Amps
10 kilowatts	45.45 Amps	90.91 Amps	926 Amps

People looking for free-energy generators generally have no idea what is involved. In the UK, household mains appliances have a 13-Amp fuse, limiting them to 3 kilowatts of power before the fuse burns out. House wiring is run in a ring which allows each power socket to be fed by two lengths of mains wiring, so that the current is supplied from two directions, doubling the current available at each socket. Ten kilowatts from a battery inverter would need to carry a massive 926 Amps which is far more than the starter motor current in a vehicle and that 926 Amps is more than 70 times the UK household fuse rating.

To determine how much electricity you use in a day, you list everything electrical that you use and how long you have each item on for during the day. For example, a 100-watt bulb which is on for 8 hours, uses 0.1 kilowatts multiplied by 8 hours which is a total of 0.8 kilowatt-hours (which is the 'Unit' used by power companies to charge their customers). So, if you are charged 15 pence per Unit, then that bulb being on for eight hours will cost you $0.8 \times 15 = 12$ pence during that one day.

The power rating of each item of equipment is normally shown on a plate or sticker on the back of the unit. To give you a general idea of typical power ratings, here is a list:

Light bulb: 100 watts, Kettle: 1.7 to 2.5 kilowatts, Cooker: 7 kilowatts, Hot plate: 1.2 kilowatts, Dishwasher: 2 kilowatts, Washing machine: 2.25 kilowatts maximum but during most of the cycle it is much less than that, Tumble dryer: 2 to 2.5 kilowatts, TV set : 50 to 100 watts, Radio: 10 watts, DVD player: 50 watts, Computer: 150 watts, Music system: 100 watts, Fridge/freezer: 500 watts maximum, but very little during a day as it is off most of the time, Air conditioning: anything from 1 kilowatt to perhaps 4 kilowatts, depending very much on the actual A/C unit, Fan: 50 watts.

A very effective way to determine the actual power draw of any item of household equipment is to use a cheap, mains watt-meter such as the one shown here. Equipment can be plugged into it and the watt-meter plugged into the mains. It will then tell you the actual power draw and the cumulative power 'consumption' for any item of equipment. Using it on a fridge or fridge-freezer is very informative as the cumulative reading shows the actual amount of current draw over a day, and at night, with the lower temperatures and nearly zero opening of the door, the current draw is very much lower than the peak current draw. A domestic watt-meter is low-cost as they are made in large volumes. The one shown below is a fairly typical unit.



If you manage to buy a free-energy generator, it is likely to be expensive. However, if you examine what items of household equipment are costing you the most to run, it is quite possible that a fairly small generator could make a major difference to your electricity costs.

Already on sale:

Even though the people who have been denying that free-energy is possible and suppressing inventors and inventions for more than a hundred years now, they do slip up on some things, possibly thinking that the general public are just not smart enough to see the facts. For example, portable air conditioning units are on sale and some provide heating as well as cooling. In the sales literature, the sellers state quite clearly that the heat output is substantially greater than the electrical input, typically 2.6 to 3.0 times greater. They point out very clearly that if you heat with electricity, then you can reducing your heating bills to one third by using their equipment. Here are three typical examples of this:



This is the ElectriQ “Air Cube” AC9000E with 7000 BTU capacity and in 2015 retails for £220 from www.appliancesdirect.co.uk. Intended for rooms of up to 18 square metres floor space, it uses 900 watts maximum input for cooling and 750 watts maximum input for 2 kilowatts of heating. That is three quarters of a kilowatt input for 2 kilowatts of output, so the Coefficient Of Performance which is output divided by the user’s input is 2.67 or heating bills would drop to 37.5% of what they were. This is very interesting as we are repeatedly told that COP greater than 1 is impossible and “there is no such thing as a free meal”. Fortunately, the ElectriQ company disagrees.



This is the Climachill Ltd. PAC12H (KYD32) 12000 BTU air conditioner, in 2015 retailing at £312 and when heating it has a COP of about 3.0 with a 3.5 kilowatt performance with an input just over 1 kilowatt. Climachill Ltd. Also fails to understand that “there is no such thing as a free meal” and that it is impossible to have a greater output than the input.



This is the Electrolux EXP09HN1WI retailing in 2015 at £336 and providing cooling and 2.32 kilowatt heating with a $COP=2.82$ meaning that for an output of 2.32 kilowatts, the required input is 823 watts. Supplied by many different retailers.

There are many other portable air conditioning units including much larger versions. What they all have in common is an output which is much larger than the input. The average refrigerator also has a performance nearly three times greater than the power needed to operate it.

You may disagree, but it is clear to me that if I can get 3 kilowatts of heating for 1 kilowatt of input power, then I am receiving 2 kilowatts of free-energy.

I hope that you can see from the long list of methods presented in this introduction, that there is nothing actually strange or weird about the concept of using free-energy or self-powered generators. Therefore, I invite you to examine the facts, read the information in this eBook and the additional information on the website <http://www.free-energy-info.tuks.nl/> and make up your own mind on the subject. Please note that this is not a fixed body of information and this eBook normally gets a significant upgrade on a regular basis. Consequently, I suggest that you download a new copy say, once per month in order to stay up to date with what is happening. Good luck with your research.

The “Scientists”

People who are not familiar with free-energy, sometimes wonder why free-energy generators are not on sale in the local shops and why ‘scientists’ claim that these things are not possible. There are a number of reasons. One reason is that they have been taught to consider all physical things as part of a “closed system” where all outside influences have been excluded. That is a nice idea for performing analysis but it must not be thought to have anything much to do with real systems in the real world because there is no such thing as a closed system. If you think you can make a closed system, then I would be delighted if you would tell me how. Your system would have to exclude gravity, cosmic particles, heat, light, all electromagnetic influences, magnetic effects, longitudinal waves, the zero-point energy field and everything else you can think of. So far as I am aware, nobody has ever managed to construct a closed system and some experiments are carried out in deep mines in an attempt to lower some of the effects which we just cannot block. So, while a “closed system” is a nice idea, you will never encounter one.

Another reason is that scientists not only are not aware of current technology, but they are not even aware that they don't know the relevant facts. It seems to be a strange feature of people who have received a university degree, that they think that they are smarter than other people, when in fact, all that the degree shows is that they have sat through long periods listening to what the professors have to say, and as those professors are frequently wrong and the graduates have been misled (and that is not a case of 'sour grapes' as I have more letters after my name than are in my name, and I assure you that university graduates can be lacking a great deal of factual information). For example, 'scientific experts' have performed calculations and say that the laws of physics shows that an electrical generator cannot be run on the gas mix which is produced from water when electricity is passed through it. This is a typical conclusion which is totally wrong considering that people in isolated areas have been getting their daily electricity from generators whose only fuel appears to be water. Let's examine their approach.

1. They say that water consists of two molecules of Hydrogen and one molecule of Oxygen. That is nearly right, and fish should be very thankful that they are not completely right. They then say that the amount of current needed for splitting water into a gas mix is shown by Faraday's experiments. What they are not aware of is that Bob Boyce, Stan Meyer and Shigeta Hasebe have each produced ten times the Faraday results and each using completely different methods. A factor of 10 in a calculation makes a major difference.

2. They then calculate the energy produced when hydrogen is burnt. That is a major mistake as the gas produced by electrolysis of water is not hydrogen but instead is a mixture of highly charged single hydrogen atoms and highly charged single oxygen atoms. That mix is generally called "HHO" and has a recombination energy which is usually four or five times greater than hydrogen gas. HHO is so active and energetic that compressing it to a pressure over 15 pounds per square inch ("15 psi") causes it to ignite spontaneously. This means that the 'scientific' calculations are already low by a factor of at least 40.

3. They are not aware that if a fine spray of cold water droplets or 'mist' is added to the incoming air, that the water converts to flash-steam on ignition of the HHO, producing high pressure inside the cylinder of the generator and causing the generator to act as an internal combustion steam engine.

As a result of these details, the 'scientific' calculations which show that a generator cannot be self-powered are completely wrong, as are many of the 'scientific' pronouncements made by ignorant 'scientists'.

However, moving on, probably the most important reason for the rubbish spouted by scientists and university researchers is a human problem. Universities have to maintain their standing and prestige by constantly publishing research papers. Those research papers are produced as the result of research work done by graduates under the guidance of a professor. That work costs money which is provided by rich people as 'grants'. The rich people are normally rich because they have a lucrative business, and they can bring pressure to bear on the Professor, not to allow any research which would compete with their existing business profits. That way, the output from the main universities is controlled and if any honest researcher is not willing to go along with what is being said, then that researcher is blacklisted and even ridiculed by his former colleagues, and he finds it impossible to get any further research position anywhere. Scientific information has been suppressed for more than a hundred years now.

So, the result of these things is that the straightforward reality of free-energy devices is denied (tongue in cheek generally) by scientists who don't want to be blacklisted and who are fully aware that what they are stating is actually lies. The internet is making things difficult for them, but they are still doing a fine job of fooling most of the people for most of the time, banking on a general lack of knowledge by the public.

Patrick Kelly

<http://www.free-energy-info.com>

<http://www.free-energy-info.co.uk>

<http://www.free-energy-devices.com>

<http://www.free-energy-info.tuks.nl>

Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Free energy devices have been around for a very long time now. I have stood beside a water mill and it's power is scary as it could crush you in moments and never even notice. That mill is on a quietly flowing small river and it can operate at any time day or night without having to pay anything for the power which it uses. It will have cost quite a bit to build the mill in the first place, but after that, it produces major power year after year. Most free-energy devices are just like that as it costs to build them in the first place, but after that they run for free.

This presentation is mainly for people who have never come across free-energy and know nothing about it. So, each chapter deals with just one device and tries to explain it clearly.

Chapter 1: A solar-powered light

The objective is to build a simple battery-operated light which is charged by the sun and is available for use every night. Solar panels can be very useful items in spite of their very low efficiency and high cost. When thinking about solar panels people generally imagine a set of many large solar panels mounted on the roof of a house. The cost of doing that is far too great for most people to consider it. However, at this time, there are a very large number of people in the world who do not have any electricity at all. It appears that a useful electricity feature for them would be electric lighting at night. With the components which have become available recently, providing good lighting at realistic cost is now possible.

Small solar panels offered for sale as “10 watt, 12 volt” capacity can now be bought reasonably cheaply. Made in China, these panels can provide a current of just over half an amp. These panels which have an aluminium frame are typically 337 x 205 x 18 mm in size and look like this:

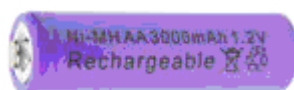


Tests which I have run show that a 1000 lux very realistic level of lighting can be provided with a total of just 1.5 watts of electrical power. The best lighting source that I have found is the “G4” style, LED (Light Emitting Diode) arrays made in China using the “5050” chip technology. These are cheap and have a very heavily non-linear light output for current draw, which is a fact which we can use to our advantage. These LED arrays come in “white” or “warm white” versions (my preference is the warm white variety) and they look like this:



With a diameter of 30 mm and pins which are easy to connect to, these are very convenient devices which have an excellent lighting angle of 160 degrees and a light output of 165 lumens for a 1.2 watt electrical input.

One of the problems with such a unit is the selection of a suitable battery. Lithium batteries are excellent but the cost of a suitable lithium battery is ten times greater than the cost envisaged for the whole unit, effectively excluding lithium batteries. Lead-acid batteries are far too large, too heavy and too expensive for this application. Surprisingly, what appears to be the best choice is the very popular AA size Nickel-Manganese rechargeable battery which is 50 mm long and 14 mm in diameter:



Rated at up to 3 Amp-Hour capacity, they are very low cost, are lightweight and can be placed in a battery box like this:



The battery box can be adapted to hold seven batteries rather than the intended eight batteries, producing a nine volt battery pack with 1.2V batteries. If three of these battery packs are used with the solar panel, then there is no need for over-charging protection as NiMh batteries can deal with overcharging current if it does not exceed 10% of the battery's milliamp-hour rating, and that simplifies the design very considerably.

However, some of these small NiMh batteries do not live up to the maker's claims and so you need to run a load test on any particular make of battery which you may consider using. For example, here are

six different types of these batteries which I tested in groups of four, with a load of about 50 milliamps at five volts. The same load was used to test each of these batteries:



Fusiomax 800



Digimax 2850



Duracell 2400



SDNMY 3800

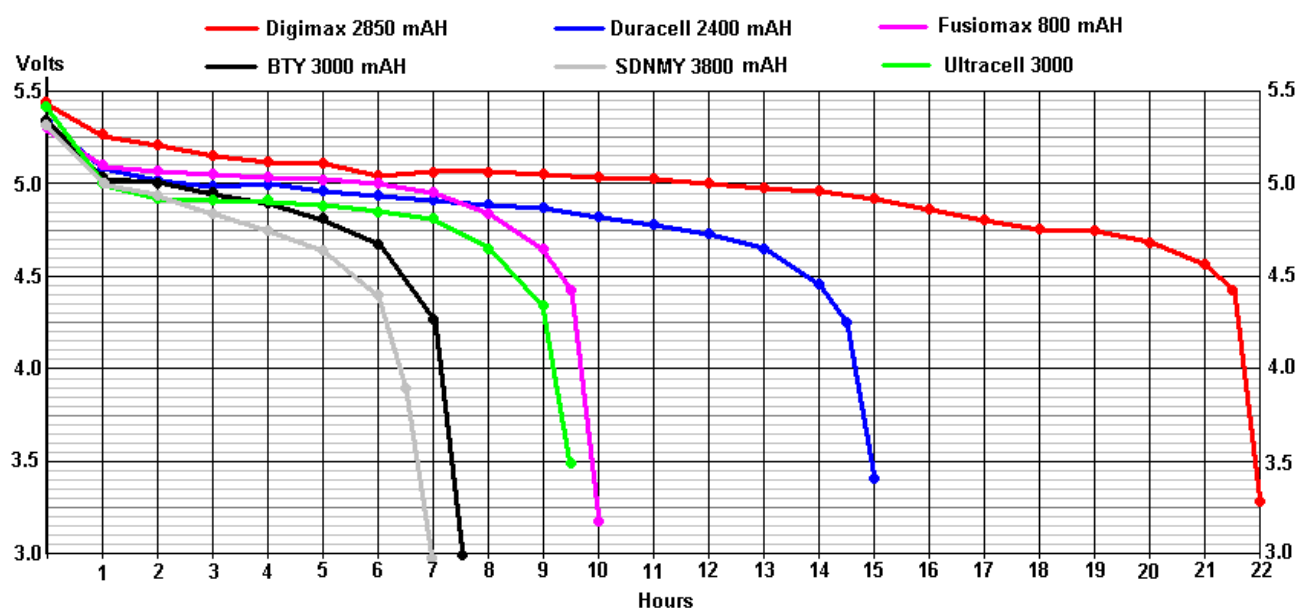


BTY 3000



Ultracell 3000

The results were most revealing:



The BTY 3000 batteries do not actually claim on the battery to be 3000 mAhr (although the sellers do) and so, the “3000” could just be a trading name. The tests results for the BTY 3000 were so

staggeringly poor that the test was repeated three times with longer recharging time for each test, and the one shown above is the 'best' result. You will notice how far short it falls when compared to the low-cost Fusiomax 800 mAh batteries. The terrible performance of the BTY 3000 batteries is only exceeded by the incredible "SDNMY 3800 mAh" batteries which show almost negligible capacity in spite of their amazing claims of 3800 mAh.

NiMh batteries are 66% efficient. You should only ever charge a 3000 milliamp-hour NiMh battery at 300 milliamps or less and so with a 10-watt solar panel, overcharging is not a problem.

Light meter tests provide some very interesting results for the LED arrays. When using two LED arrays side by side in a light box, the figures for voltage / current draw / light produced using 1.2-volt NiMh batteries were:

9 batteries 11.7V 206 mA 1133 lux: 2.41 watts 470 lux per watt (the manufacturer's intended performance)

8 batteries 10.4V 124 mA 725 lux 1.29 watts 562 lux per watt

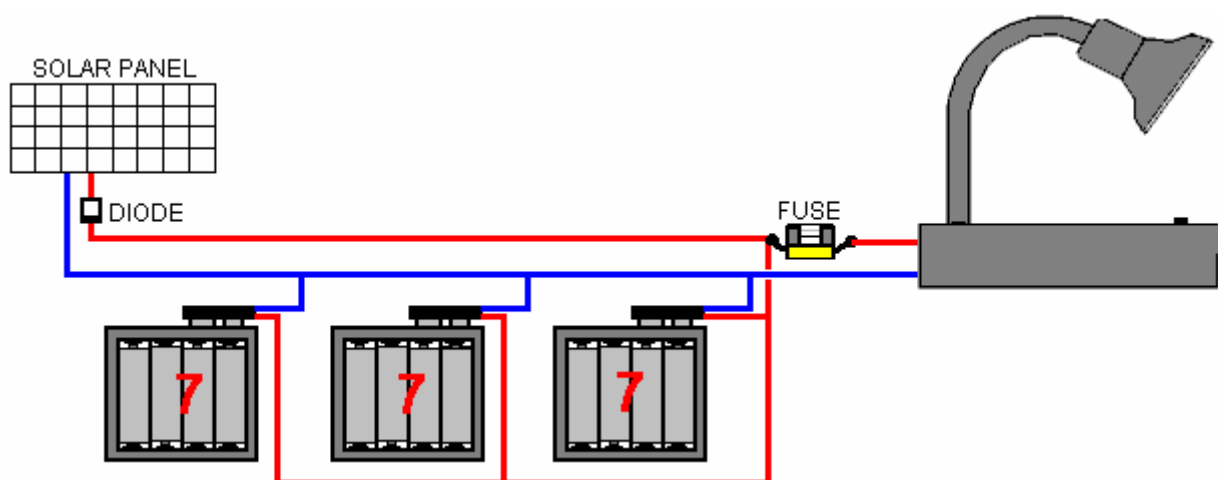
7 batteries 9.1V 66 mA 419 lux 0.60 watts **697** lux per watt (a very realistic performance level)

6 batteries 7.8V 6 mA 43 lux 0.0468 watts 918 lux per watt

This is very revealing information, showing that one of these LED arrays fed with just 33 milliamps can produce very impressive 210 lux lighting at a wide angle of illumination. To put that another way, feeding five LED arrays with 9 volts, generates a very acceptable 1000-lux lighting level for just 165 milliamps which is only 1.5 watts. That is spectacular performance.

Equally impressive is what happens when the battery voltage drops when the battery is nearly fully discharged. The LED performance rises to combat the loss of voltage and even at a ridiculously small 3 milliamps fed into each LED, there is a 21 lux light output from each LED array. The effect is that while the lighting does dim slightly, it does so very gradually in a barely noticeable way. With three sets of genuine high-capacity AA NiMh batteries, we can expect a minimum of eight hours of continuous 1000-lux lighting from a desk lamp. That is a total of twelve watt-hours, and the solar panel feeding 66% efficient batteries at nine volts, is capable of replacing one of those usable watt-hours in twenty minutes. In other words, just two hours forty minutes of good daytime lighting can provide eight hours of 1000-lux lighting every night.

The only moving component in this system is the On/Off switch and the circuit could not be any more simple than this:



All solar panels have a diode to prevent the panel drawing current from the batteries during the hours of darkness and it is not unusual for the panel to be supplied with a diode already connected in place.

Personally, I would consider a fuse to be unnecessary but it is standard practice to fit one. The batteries are installed in a base box which supports the solar panel and gives sufficient weight to produce a very stable lamp. The five LED arrays are connected in parallel and fitted into a suitable lamp housing such as this one:



Only the flexible stem, 120 mm diameter lampshade and On/Off switch are used.

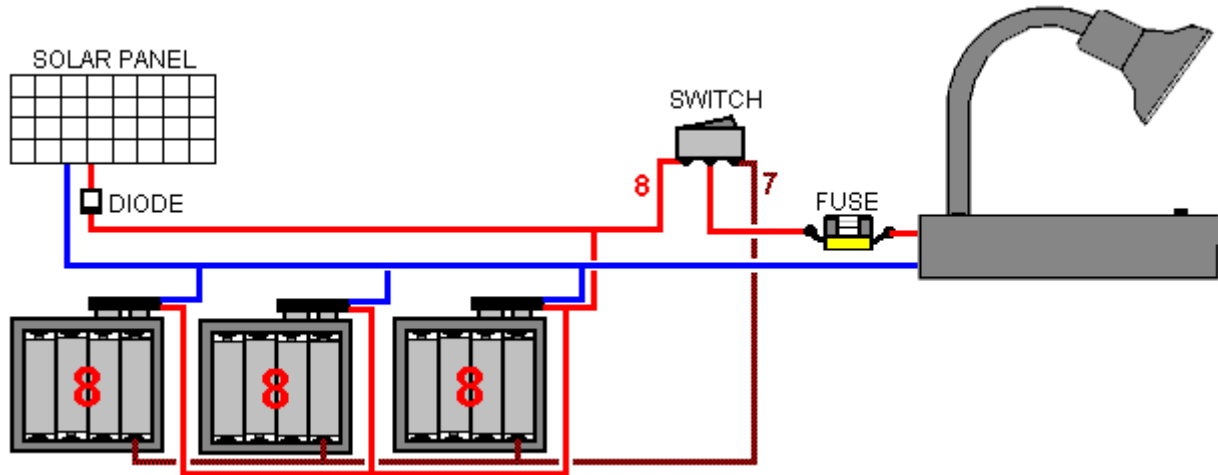
While this is an exceptionally simple and robust design, it is actually an affordable and very desirable unit which can provide years of cost-free lighting at a very satisfactory level. The prototype looks like this:



This is, of course, a perfectly ordinary and quite standard type of a solar-powered light. The difference here is that it is a very effective light suited to lighting a desk to a high level all night long. It is mobile and has a wide angle of lighting.

It is also possible to extend the design very slightly, to provide an even longer period of lighting or if preferred, a period of even brighter lighting. This can be done by using eight batteries in each battery holder – which has the advantage that standard battery holders can be used without any need to adapt them to hold just seven batteries.

This has the slight disadvantage that we do not want to supply the extra voltage to the LED arrays because doing that would cause a greater current draw than we want. We can overcome this by using an extra change-over switch and having two connections to each battery holder. The circuit could then become:



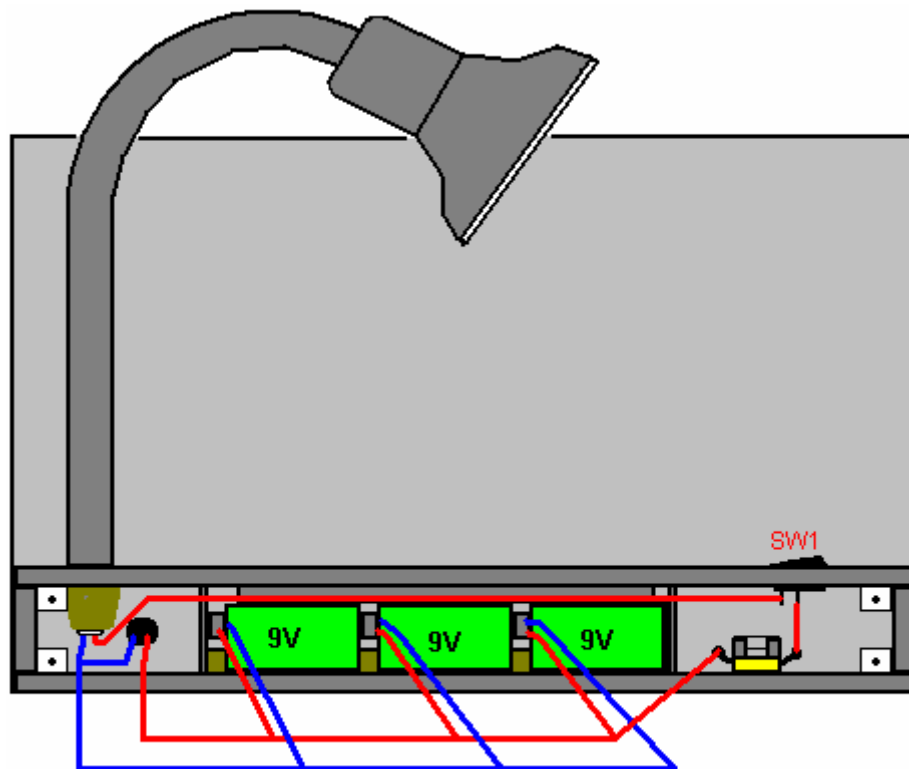
With this arrangement, the lighting unit is fed by either eight batteries or by seven batteries, depending on the position of the change-over switch. When the solar panel is charging the batteries, all eight batteries per holder get charged no matter what position the extra switch is in.

This has the advantage that when the battery voltage starts to drop after a few hours of powering the light, then the switch can be operated, raising the voltage reaching the lamp by the voltage of the extra battery, possibly producing a brightness exceeding the maximum when using just seven batteries in each battery holder. This arrangement has the slight disadvantage that the user could switch in all eight batteries from the beginning, producing a much higher current drain and while that would give a higher lighting level, the overall time is likely to be reduced. Mind you, it is possible that this might suit the user

If this style of operation is chosen, then I suggest that the extra switch is located well away from the On/Off switch so that the user does not get confused as to which switch does which job. Perhaps the second switch might be located near the stem of the lamp support, like this:

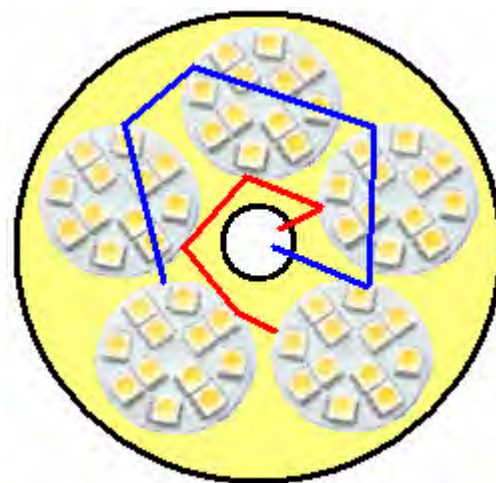


The physical layout of the components could be like this:



Here, the weight of the solar panel and the three battery packs give the unit stability if the lamp is bent in any direction. With four LED arrays, an excellent level of lighting results, however, I would suggest using five LED arrays as that gives an even wider range of lighting.

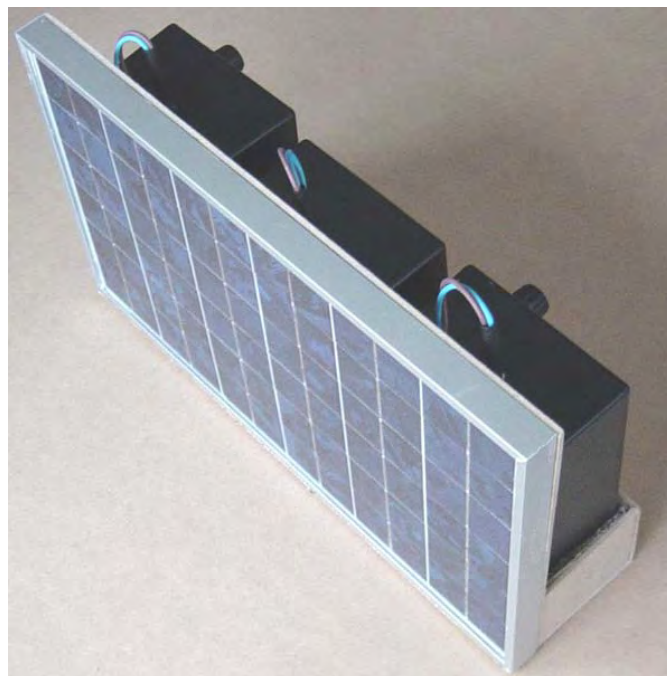
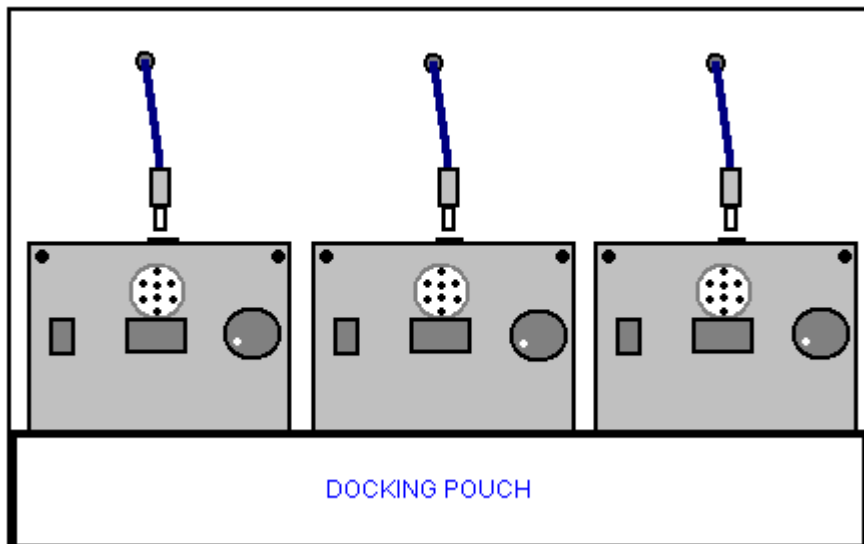
If a commercial lamp is being used, then it needs to be taken apart now and prepared for this project. The base is removed, the bulb holder is removed and two wires are fed through the remaining shaft so that the LED arrays can be fitted. A circular disc of any kind of rigid material is cut, the diameter being slightly less than the diameter of the mouth of the lamp. Four or five LED arrays (depending on your choice of numbers) are glued to the disc and wired up in parallel with all of the plus wires connected together and to one of the wires feeding through the shaft of the lamp, and all of the minus wires connected together and attached to the other wire passing through the column of the lamp:



This disc is then eased through the mouth of the lamp shade where it sits about 10 mm below the rim of the shade due to the taper of the shade. Position the disc so that it is square on to the rim of the shade

and glue it in position. If frosted plastic is to be used, then mark the sheet around the rim of the shade and cut out the resulting circle, drill some ventilation holes in it although the LED arrays always run cold, and glue the frosted plastic disc to the rim of the shade.

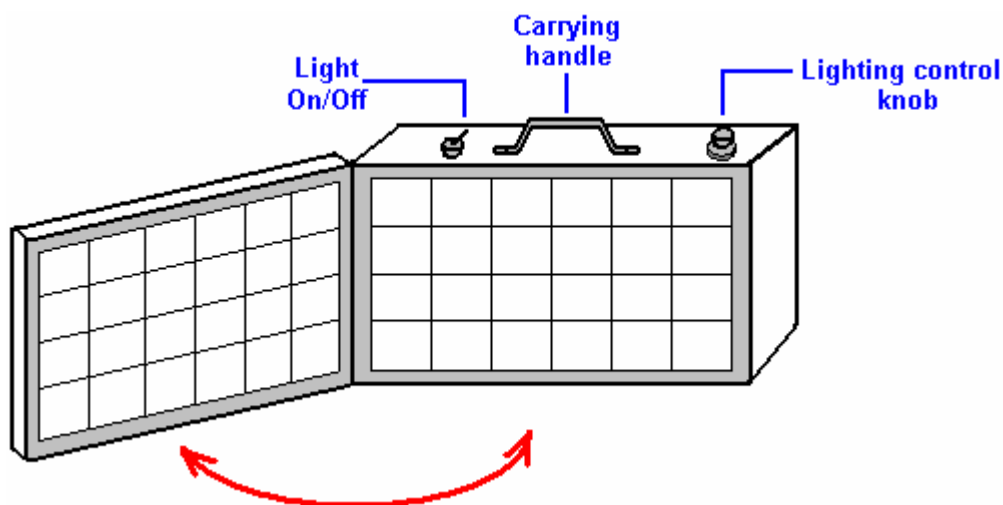
Some people might prefer to have general room lighting rather than a desk lamp. That is perfectly possible and three separate lighting units can be used instead:



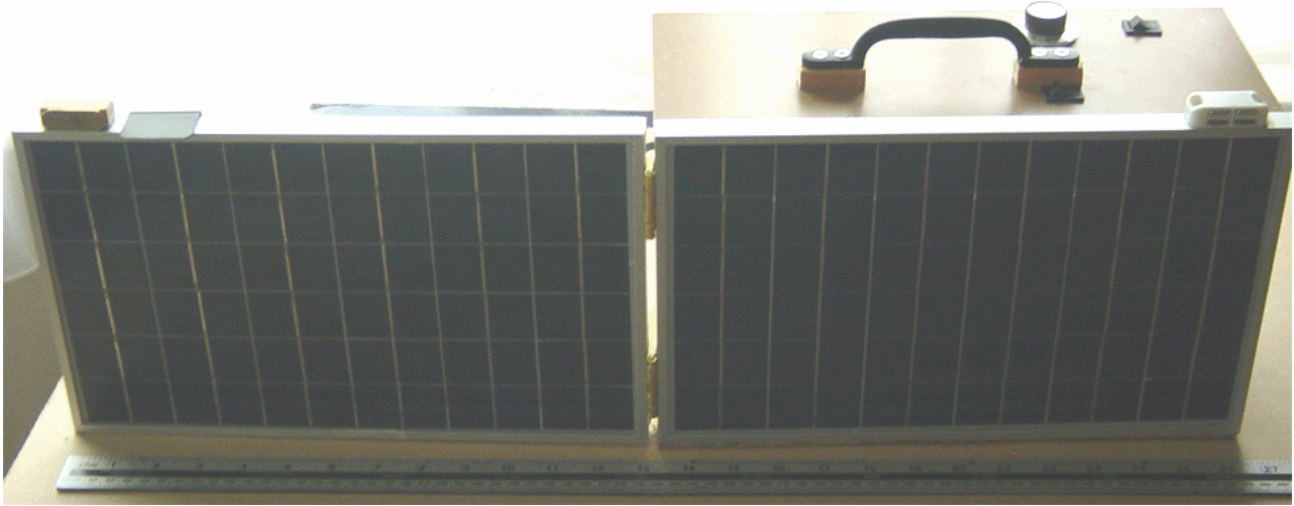


These units are particularly useful as they can be used at different points in a room to give really good lighting, or they can be used in different rooms, or they can be switched on at different times during the night.

An alternative is to use many LED arrays in one unit: If a very powerful single source of lighting is needed, it is possible to use a larger solar panel, or for a more compact unit, two of the 12-volt 10-watt panels shown above. The arrangement can use the same simple manual control of lighting level and the same booster switch for even greater lighting for a few minutes. The arrangement can be like this:

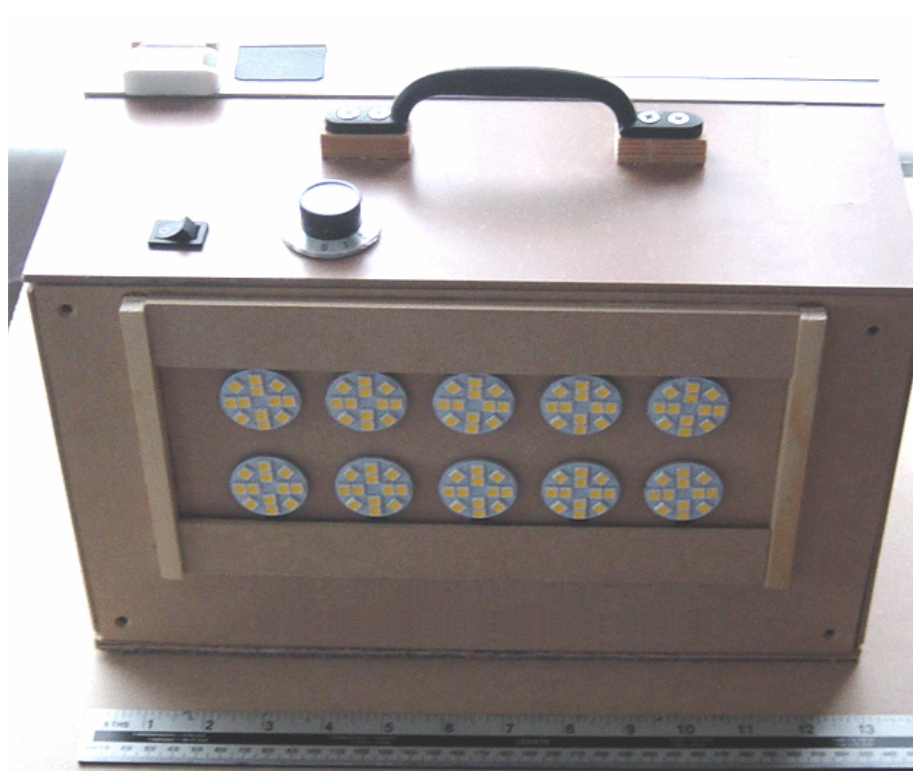


When closed over, the face of solar panel P1 faces that of solar panel P2, protecting both when the unit is being carried. An early prototype of this style of construction with the panels open, looks like this:



A magnetic catch is used to hold the hinged panel securely closed when the unit is being carried and a small flap is attached beside the magnetic catch to overcome the slightly excessive looseness of the hinges. The unit does not need to be as deep as this experimental model was made.

The front view of the unit, ready to receive the frosted plastic cover for the LED arrays, looks like this:

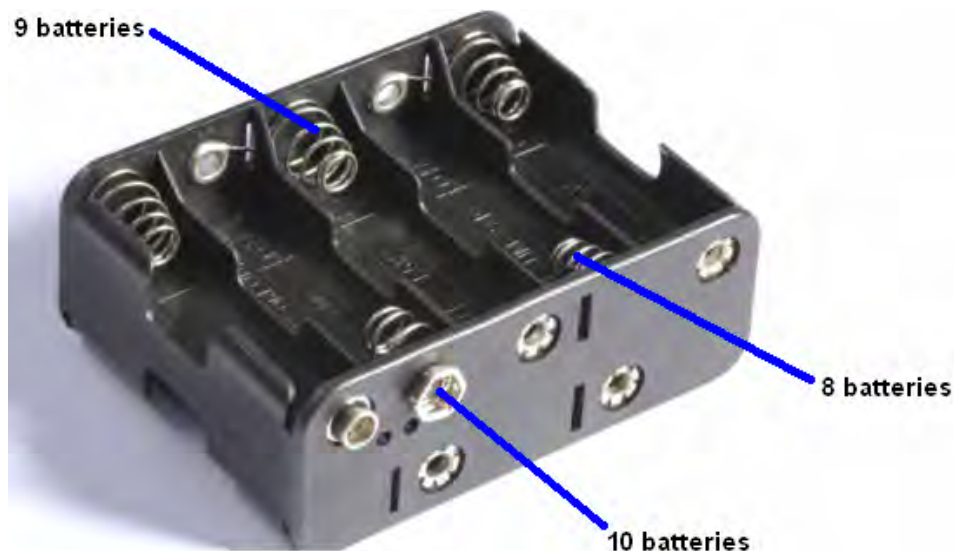


The underside of the unit is covered with a soft protective layer to ensure that it does not scratch any surface on which it is placed. In order to avoid the need for overcharging circuitry, this unit has six battery packs and so, having ten LED arrays, the duration of lighting is about the same as that of the desk lamp, although obviously, the light output can be much greater. With the greater lit area of ten LED arrays, a lower actual current can be used while still providing a good level of lighting.

With fully charged batteries switched to the 'boost' setting, this unit puts out more light than a 100-watt incandescent bulb powered by the mains. Tested in daylight, that looks like this:



Let me stress again, that these units are not difficult to build. The battery boxes can be adapted quite easily by choosing where to connect to the battery pack:



360 Degree Lighting for Africa

The desktop lighting unit described above is very effective for lighting in cold areas where houses have windows with glass in them and where the roof does not project much beyond the house wall. However, housing style is very different in places like Africa where strong sunlight is experienced all year round and so a house roof is likely to project well beyond the wall in order to give improved shade for outside seating.

Anna Brüderle's "*Solar Lamps – Africa*" marketing research published by GIZ GmbH Uganda, has raised many previously unknown facts which should result in physical design changes. I have produced three solar prototype lighting units, but these have been based on recharging using light coming through a glass window. That is not really possible in the African environment surveyed, as it shows:

1. Using a solar panel indoors is not possible due to lack of windows and major roof overhang.
2. Using a solar panel light being recharged outdoors is liable to have it stolen.
3. Using an outside solar panel connected by a wire is liable to damage and/or child injury when at play.

The survey-area lifestyle has the following characteristics:

1. Seven people living in one building is not unusual and so 360-degree lighting is preferred.

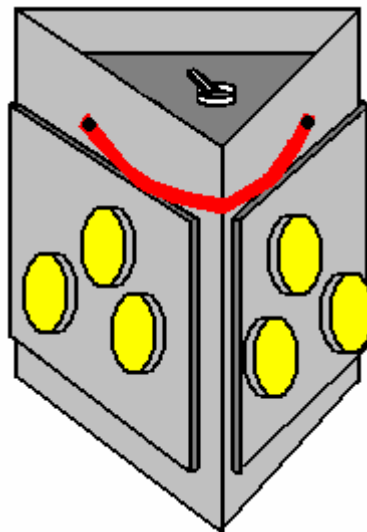
2. The kitchen is normally separate and has no windows and yet needs meal-preparation lighting.
3. Burning a fuel for lighting is liable to cause poor health from the fumes produced.
4. Child education is hindered by lack of lighting.
5. Light usage is usually 3 or 4 hours at night plus 2 hours in the morning.
6. Tests with 100 lumen lighting level have been considered to be satisfactory.
7. Lamps are normally placed on the dining table during meals and hung from the ceiling at other times.
8. When carried outside, a narrow forward lighting arc of say, 90-degrees is preferred for safety.
9. Units with variable lighting levels are preferred but why is not specified – probably light duration.

In these houses, there can be internal walls which do not reach the ceiling so that light in the central room spills over into the additional rooms.

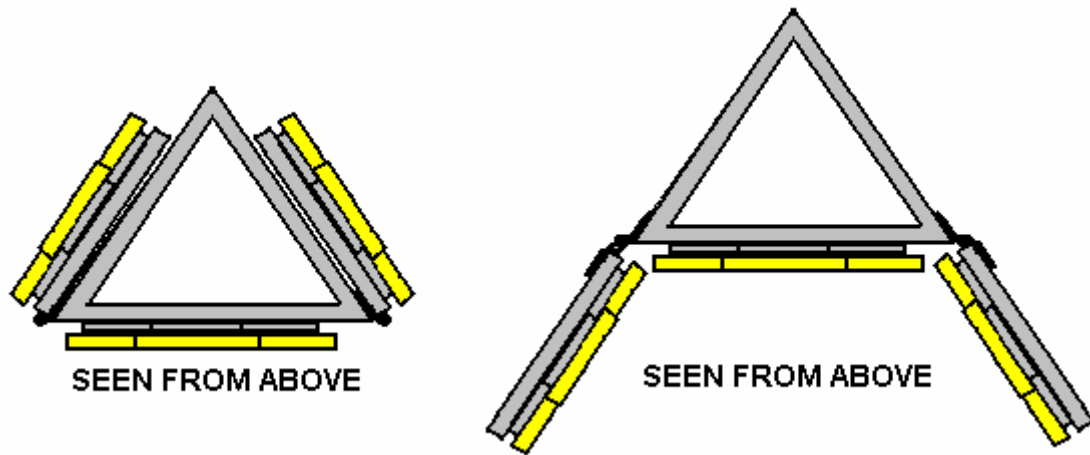
These features call for a lighting unit which is:

1. Able to provide 360-degree illumination.
2. Able to give a restricted 90-degree lighting arc when used outside.
3. Stable when standing on a horizontal surface.
4. Able to be carried comfortably.
5. Able to be suspended from a ceiling.
6. Able to provide considerably more than 100 lumens for the lighting periods used.
7. Is cheap enough to be bought.
8. Is very robust.
9. Is free of any glass components as hurricane lamp accidents are mainly cuts from broken glass.

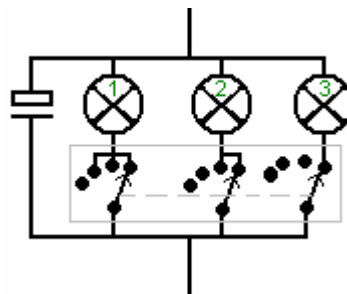
It is possible to design a lamp which meets all of these requirements although low cost is the most challenging requirement. To meet the user's needs, it might be possible to use a housing like this:



The triangular shape makes for easy construction and is very robust from an engineering point of view. It also cuts down the number of faces needed for 360-degree lighting to just three. The versatility is increased greatly if two faces are hinged:

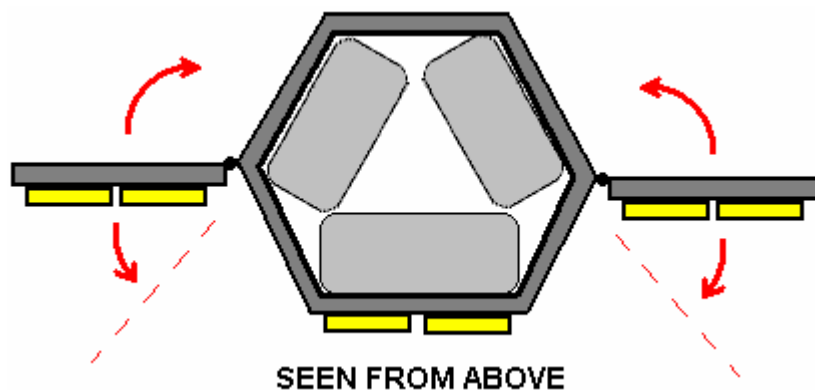


This arrangement allows two faces to be aligned with the fixed front face, giving all horizontal lighting in one direction which is a very, very bright arrangement. The two faces can be moved further around to give the wanted narrow forward beam for walking outdoors. If desired, the lighting level can be controlled by making the On/Off switch a three-pole four-way rotary switch:

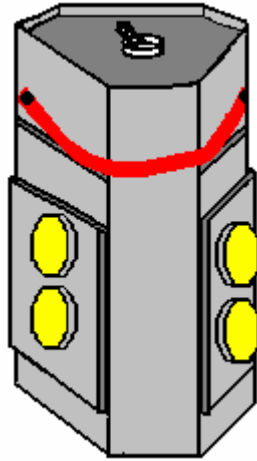


This arrangement gives Off, One panel, Two panels and Three panels of illumination, but it could also be that instead of switching off an entire panel that the switching illuminates one LED array per panel, two LED arrays per panel and three LED arrays per panel.

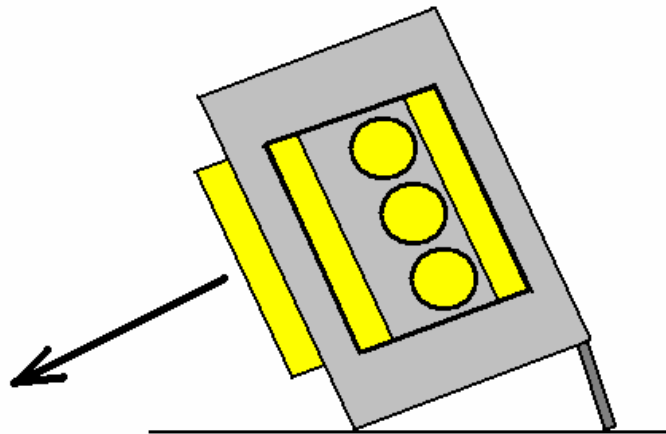
If ordinary 10-battery holders are used, then the lamp housing can be made more compact as the corners of the triangle are not needed. The battery packs fit in like this:



Giving a compact hexagonal shape which is strong and has the same lighting capability. The sides extend above the top and below the base so that the unit can stand on a flat surface either way up. The hinges need to be stiff so that they hold their position when set to the desired angle.



The addition of a simple hinged flap to the base allows a tilted option which imitates the downward lighting style of a desk lamp:



This unit is recharged by plugging it in to a small solar panel as before. This unit was never manufactured as the person who asked me to design it for him decided that it was too expensive as it would cost him £25 to make one.

Simple Free-Energy Devices

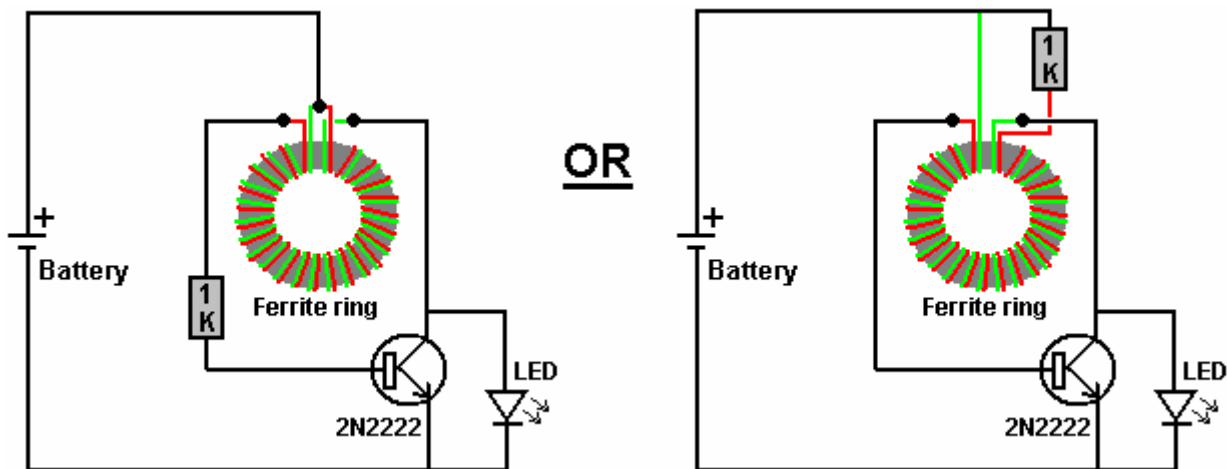
This presentation is mainly for people who have never come across free-energy and know nothing about it. So, each chapter deals with just one device and tries to explain it clearly.

Chapter 2: The “Joule Thief”

There is nothing magical about free energy. I consider that a “free-energy” device is one which outputs energy without the need for having to buy fuel to power the device. We live in a vast energy field and there are many different ways to access that energy and make it into a form which is useful to us – typically electricity. One of those ways is to pass current through a coil of wire and then suddenly switch off the current. When you do that, the coil produces a sudden, very large voltage spike which causes energy to flow into the coil from the outside environment.

For this inflow of energy to be useful, we need it to happen many times per second, and that required an electronic circuit. Electronic circuits are not difficult to understand, nor are they hard to construct, and I will explain as we go along.

Mr. Z. Kaparnik, in the "Ingenuity Unlimited" section of the November 1999 edition of the magazine "Everyday Practical Electronics" showed his clever design which he called the “Joule Thief”. His circuit allows a discharged 1.5-volt dry battery to power a 3-volt LED (“Light Emitting Diode”). His circuit is very simple and very clever and has become enormously popular. This is his circuit:



The battery looks like this:



The 1K resistor looks like this:



The 2N2222 transistor looks like this:

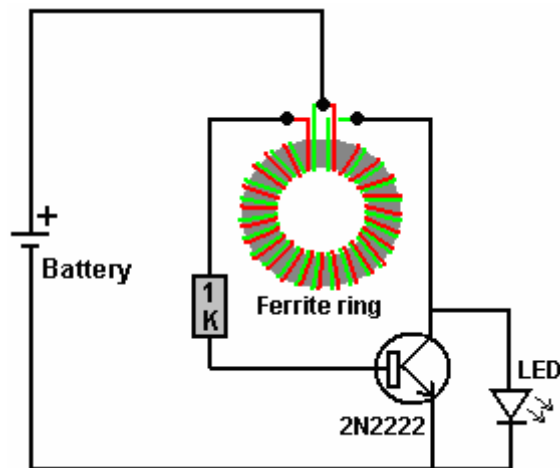
The LED looks like this:



The Ferrite ring looks like this:



The circuit is very simple:

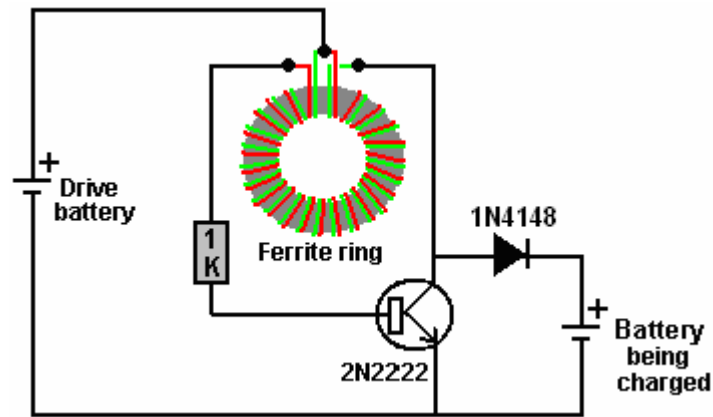


Two short lengths of thin wire (enamelled solid copper wire) are used to wind a few turns around the toroid. This makes two separate coils wound side by side. When the battery is connected, current flows through the red coil, is limited by the 1000 ohm resistor and flows through the transistor back to the battery. This turns the transistor on which drives a pulse of current through the green coil, and that causes a corresponding pulse in the red coil. That process repeats itself, perhaps 200,000 times per second.

Because of the characteristics of any coil, the voltage produced in the green coil when the transistor switches off is very much higher than the voltage of the battery, and well in excess of the 3-volts needed to light the LED. If the battery is only half a volt (and unable to run the original TV remote or whatever) it can still light the 3-volt LED. So, a tiny torch with just one LED as the light source can be powered by a battery which was considered "dead". This is interesting and instructional. You connect the battery and the LED lights up. You disconnect the battery and the LED goes out.

This looks as if the battery is lighting the LED, but in fact, it isn't. What is actually happening is that the battery powers the circuit, causing the green coil to produce high voltage spikes, and those spikes cause energy to flow into the circuit from outside, lighting the LED (which the battery just can't do).

This very simple circuit is causing the environment to supply free power to you and that is very impressive! The circuit can be constructed using an ordinary strip of screw blocks. However, we can use that incoming energy for other things. For example, we could use it to recharge a rechargeable battery:

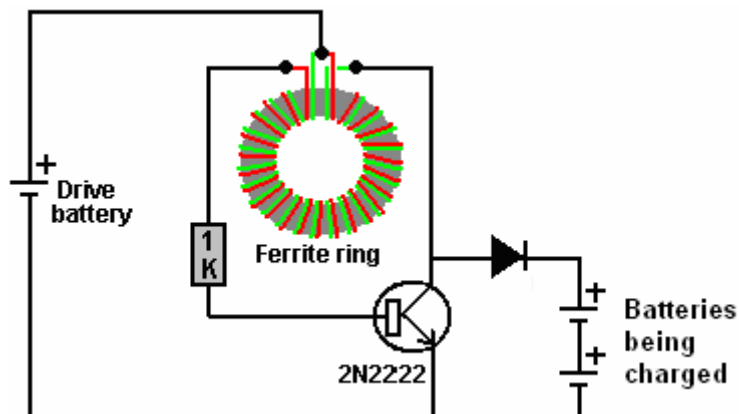


In this arrangement the LED is replaced by an ordinary diode (almost any diode will do) and the incoming power fed into a rechargeable battery. I have used this circuit to recharge a 2285 milliamp-hour AA size battery from 0.6 volts to 1.41 volts in one hour without running the drive battery down by any significant amount.

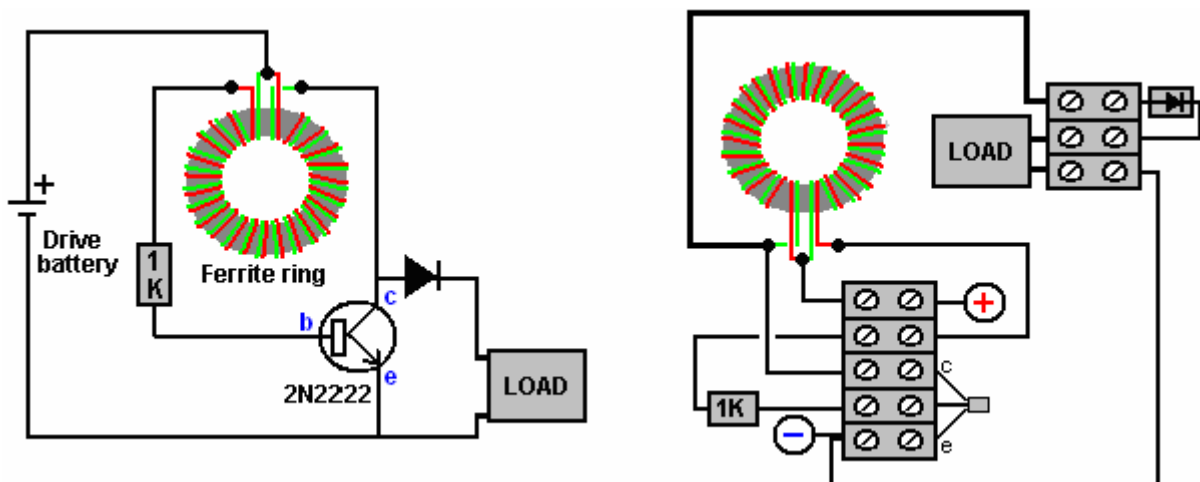


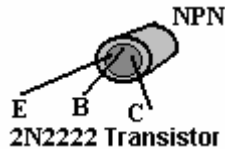
A 1N4148 diode looks like this:

However, the big gains are when two or more batteries are charged at the same time:



Two NiMh rechargeable batteries have less voltage than a 3-volt LED, so obviously, if the circuit can light a 3V LED it can definitely recharge two NiMh batteries.





The transistor connections are like this:

Mr Kaparnik used a tiny ferrite ring out of an old Mains LED light bulb, but it is not necessary to have a ring at all. I have used a cylinder of paper instead and it works very well. The coil can be wound quite easily. A pencil makes a good former for a coil, so cut a strip of paper 150 millimeters wide and wrap it around the pencil to form a paper cylinder several layers thick and 150 millimeters wide and seal it with Selotape:



Make sure that when you pull the paper cylinder together with the Selotape, that you don't stick the paper to the pencil as we will want to slide the completed cylinder off the pencil after we wind the coil on it. The coil can now be wound on the paper cylinder, and for this, it is convenient to use two fifty gram reels of enamelled copper wire. The wire which I used is 0.375 millimeters in diameter. There are many different ways to wind a coil. The method I use is to leave at least 150mm of spare wire at the beginning so that the coil can be connected when wound, then make three or four turns like this:



Then hold those turns in place with Selotape before winding the rest of the coil. Finally, the right hand end of the coil is secured with Selotape and then both ends are covered with electrical tape as Selotape deteriorates with time. While this coil has been wound with only one layer, if you want, an extra single covering of paper can be used to cover the first layer and a second layer wound on top of it before being taped and slid off the pencil.

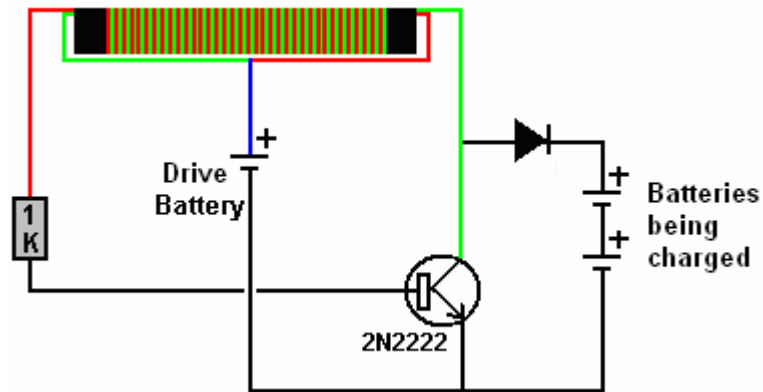
While the diagrams above show the strands of wire in two colours, the reality is that both wires will be the same colour and so you end up with a coil which has two identical looking wires coming out of each end. You make the wires at each end more than the length of the coil so that you have enough connecting wire to make the final connections. Use a multimeter (or battery and LED) to identify a wire at each end which connects all the way through the coil and then connect one end of that wire to the other wire at the other end. That makes the central tap of the coil "B":



The coil needs to be checked carefully before use. Ideally, the joint is soldered and if the enamelled copper wire used is the "solderable" type (which is the most common type) then the soldering iron heat will burn the enamel away after a few seconds, making a good joint on what used to be fully enamelled

wires. A resistance test needs to be carried out to check the quality of the coil. First, check the DC resistance between points “A” and “B”. The result should be less than 2 ohms. Then check the resistance between points “B” and “C” and that should be an exactly matching resistance value. Finally, check the resistance between points “A” and “C” and that value will be more than the “A” to “B” resistance but never seems to be twice. If it isn’t more, then the joint is not properly made and needs to be heated up with the soldering iron and possibly more solder used on it and the resistance measurements made again.

The simple circuit as shown can charge four AA batteries in series when the circuit is driven by just one AA battery.



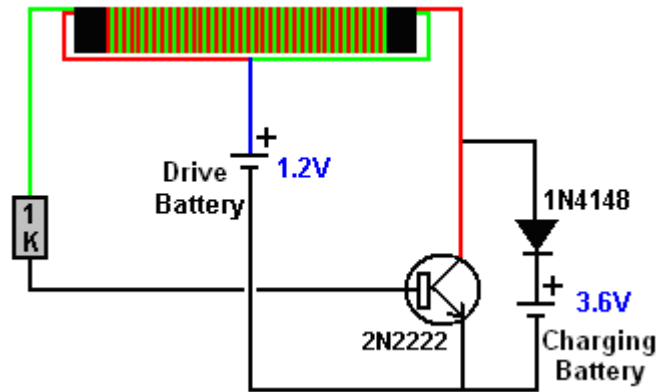
I have used a 1N4148 diode which is a silicon diode with a voltage drop across it of 0.65 or 0.7 volts and it has worked well. However, a germanium diode with its much lower 0.25 to 0.3 voltage drop is generally recommended, perhaps a 1N34A diode. It is also suggested that using two or three diodes in parallel is helpful.

This simple Joule Thief circuit can be used with a little ingenuity, to power the lamps of chapter 1 without the need for a solar panel, but that is for a later chapter.

There are various circuits which I have shown which use the well-known “Joule Thief” circuit as part of the design. These devices have worked well for me. However, in 2014, Suchahyo stated that some people found that pulse-charging batteries for a few times, caused those batteries to then have “surface charge” where the battery voltage rose without there being a corresponding genuine charge inside the battery. That is something which I have never experienced myself but that might be because I didn’t discharge and recharge batteries a sufficient number of times for me to experience the effect.

My preferred form of Joule thief uses a bi-filar coil of 0.335 mm diameter wire wound on a paper cylinder formed around a pencil and only 100 mm (4 inches) long, as that produces a very cheap and lightweight circuit. As I understand it, the Joule Thief produces a rapid stream of high voltage spikes of very short duration. Those spikes cause the local environment to feed static energy into both the circuit and the circuit’s load device (typically an LED or a battery).

While I have never experienced surface charge from a Joule Thief circuit, I tested some old Digimax 2850 mAHr test batteries which had been sitting unused for more than a year. These did indeed show a surface charge effect when load tested. The first test used one battery to drive the circuit and charged three batteries in series using this circuit:



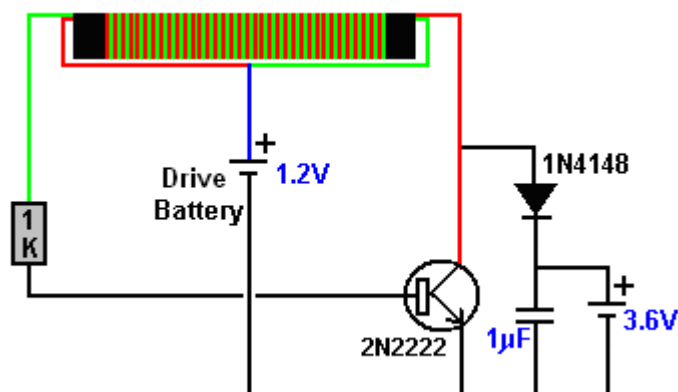
But no matter how long the circuit operated, it would not charge the output battery above 4.0 volts which is 1.33 volts per battery. The load test results were terrible with the voltages at one hourly intervals being 3.93V, 3.89V, 3.84V, 3.82V and 3.79V after only five hours of powering the load. That is ridiculous performance as those batteries managed 22 hours of load powering with the solar panel design.

Perhaps the batteries were damaged. So I overcharged them with a main operated charger, reaching 4.26 volts which is 1.42 volts per battery and the hourly load testing results were 4.21, 4.18, 4.16, 4.15, 4.13, 4.12, 4.10, 4.08, 4.07, 4.07, 4.06, 4.05, 4.03, 4.03, 4.02, 4.01, 4.00 (after 17 hours), 3.99, 3.99, 3.98, 3.97, 3.97, 3.96, 3.96, 3.95 after 25 hours and 3.90 after 33 hours. Clearly, there is nothing wrong with the batteries so the effect must be a factor of the charging.

Feeding static electricity into a capacitor converts it into normal “hot” electricity, but we want a very simple circuit, so the next step was to add in a 100 volt 1 microfarad capacitor which looks like this:

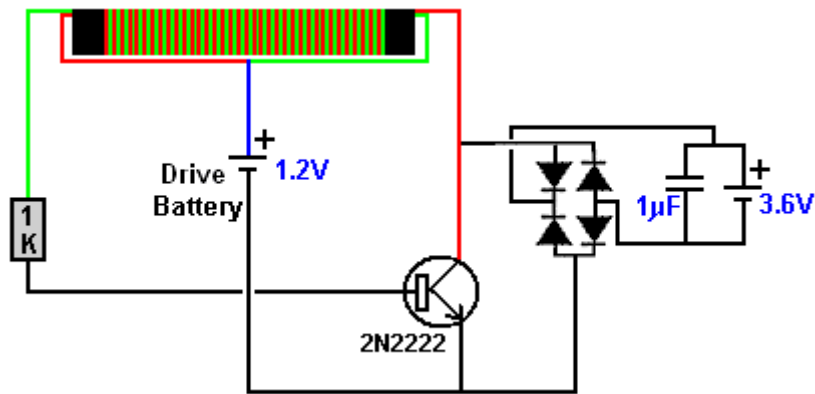


making the circuit:



With the battery on charge removed, the voltage on the capacitor reaches 22 volts. Charging the same batteries with this circuit reached 4.14 volts and produced load results of 4.09, 4.05, 4.01, 3.98, 3.96, 3.93, 3.90, 3.88, 3.85, 3.83, 3.81 and 3.79 volts after 12 hours which is much better than the 5-hour total previously experienced. However, obviously, something better is needed.

The next step is to use a diode bridge of 1N4148 diodes instead of the single diode, giving this circuit:



Without the charging battery connected, this circuit gives 28 volts on the capacitor and the battery charging is good, giving load testing results of 4.18, 4.16, 4.15, 4.13, 4.11, 4.10, 4.08, 4.08, 4.06, 4.05, 4.04, 4.03, 4.02, 4.00, 3.99, 3.98, 3.97, 3.96, 3.95, 3.95, 3.94, 3.94, 3.93, 3.93, and 3.93 volts after powering the load for 24 hours. This seems to be a very satisfactory result for such a minor alteration.

If two 1.2V batteries are used to drive the circuit, without a battery on charge, then the voltage on the capacitor reaches 67 volts, but that is not necessary for charging a 12-volt battery. Although the change is slight, the circuit operation is changed considerably. The capacitor does not discharge instantly and so, for some of the time between the sharp Joule Thief pulses, the capacitor supplies extra charging current to the battery on charge. This does not mean that the battery being charged is charged much faster and you can expect that full charging will take several hours.

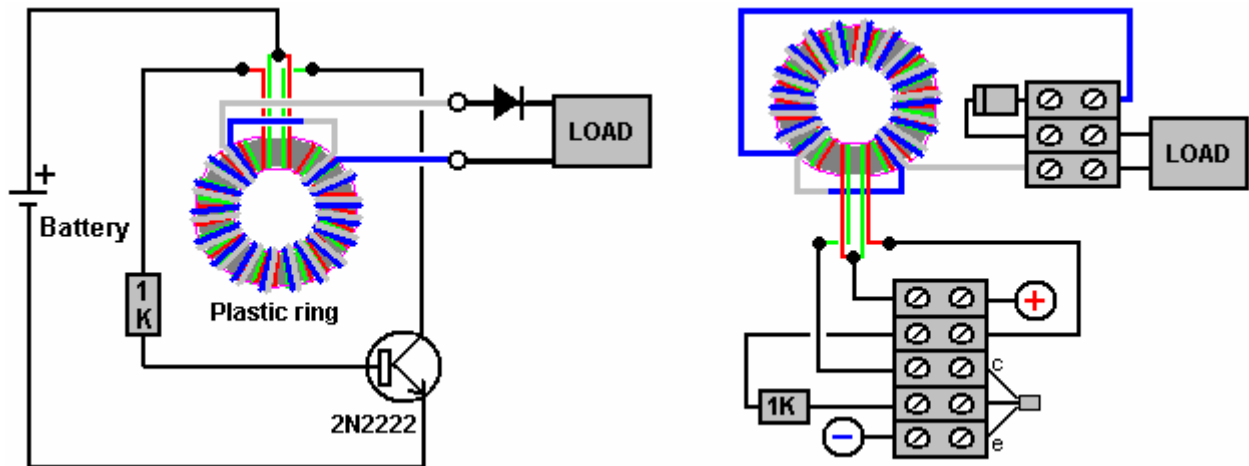
Patrick J Kelly
www.free-energy-info.com

Simple Free-Energy Devices

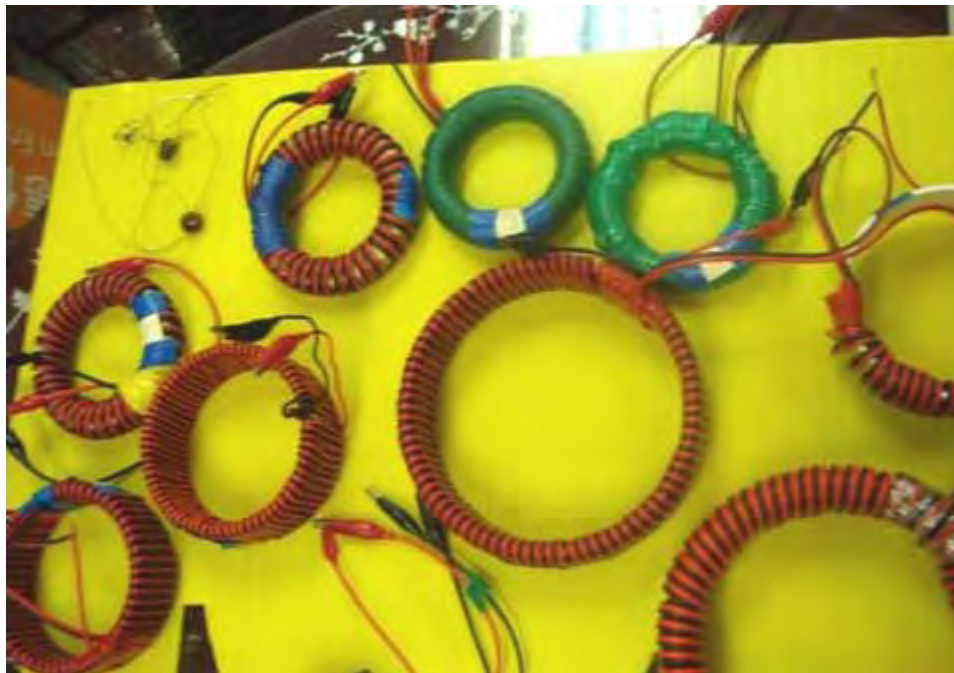
There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 3: The FLEET Circuit

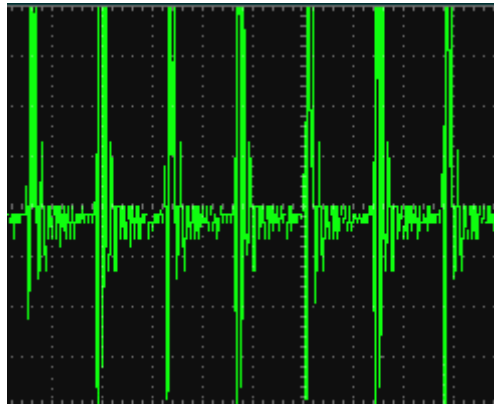
Lawrence Tseung modified the Joule Thief circuit of chapter 2 by adding an additional winding to it. This extra winding is made with two strands of wire laid side by side. Also, the ferrite ring of the Joule Thief is replaced with a much larger plastic ring, and the wire used to wind the coils is increased to normal household size. The modified circuit looks like this:



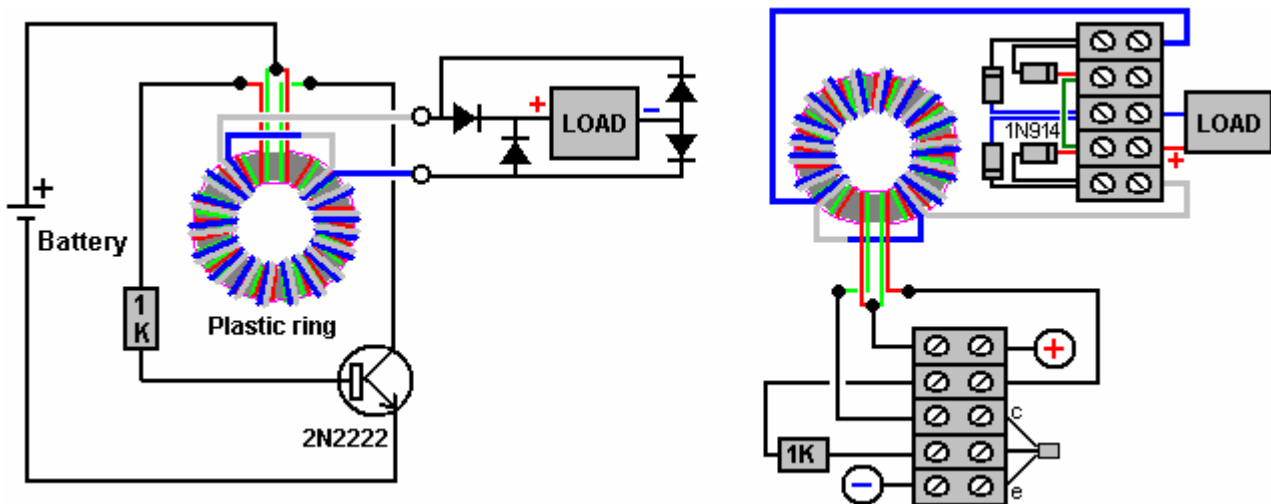
Lawrence calls this circuit the “FLEET” circuit and he has tried it with many different coils:



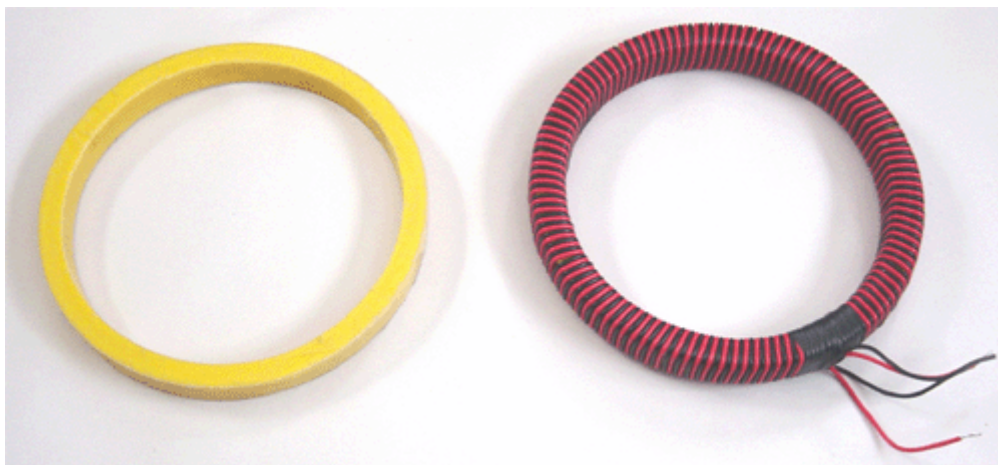
This circuit oscillates at about 280,000 times per second and the waveform is like this:



Some years ago there was some heated discussion about whether or not free-energy actually existed. There was no doubt in my mind, but in spite of that I wound a plastic ring of about 200 mm in diameter and set up a FLEET circuit in one evening. I ran the circuit with two identical small, 12V lead-acid batteries, one to power the circuit and one to be charged by the circuit. I used a diode bridge of four diodes rather than just a single diode. This is the circuit:



And this is the coil which I used:



The objective was to have no outside source of power. I may have used a higher value base resistor but I do not recall if I did. The results were most revealing. I ran the circuit for some hours, swapped the batteries over and repeated the charging. Then the batteries were swapped over again and a third charging period was performed. At the end of those tests, both batteries had greater, real, usable

power than when the test was started. That certainly convinced me that power was flowing into the circuit from outside.

There is also the fact that lead-acid batteries are only 50% efficient, that is, they lose half of the current which you feed into them. The fact that both batteries gained power shows clearly that the FLEET circuit performed for me by outputting more than twice the power needed to make it run.

Patrick J Kelly

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There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

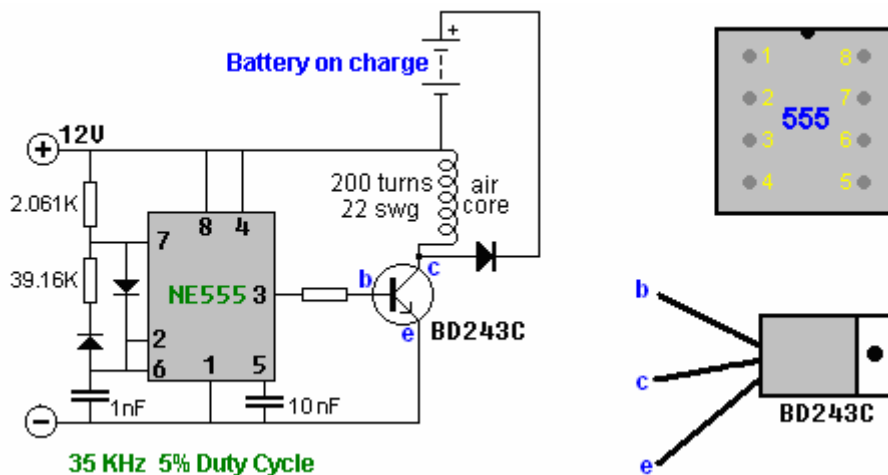
Chapter 4: The “Alexkor” Circuits

There is a Russian developer whose web ID is “Alexkor”. He has been developing battery charging circuits for some years now and is very adept at it. First, let me explain that we live in a very strong energy field and if you know how, you can tap into that energy field and extract useful energy from it. It is popular to extract electricity from our universal energy field (also called “our local environment”). Alexkor has chosen to extract electricity and use it to recharge batteries of all types. Lead-acid batteries are popular in spite of their great weight and cost, because with the aid of a DC/AC inverter they can replace mains electricity.

A problem with lead-acid batteries is that they have a limited life of about four years **IF** they are charged using a conventional battery charger or a solar panel. However, if they are charged by DC pulses, those same batteries can last at least fifteen years. In passing, it is possible to convert an old lead-acid battery to Alum by replacing the battery acid with Alum, but leaving that aside for now, let’s look at the Alexkor style of pulsing.

As is well known, if you pass a current through a coil of wire and suddenly cut that current off, the coil generates a high voltage across its ends. For example, a 12-volt battery powering a coil can develop voltages as high as 600-volts. The voltage reached depends on the characteristics of the coil and the quality of the switching. A fast switch off is essential and a fast switch on is important but to a somewhat lesser degree.

The high voltage produced can be used for various things and one popular use is to recharge a battery. For this, the current through the coil is switched on and off thousands of times per second. Alexkor’s first circuit is shown here:

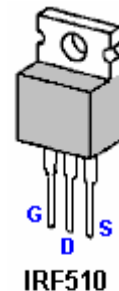
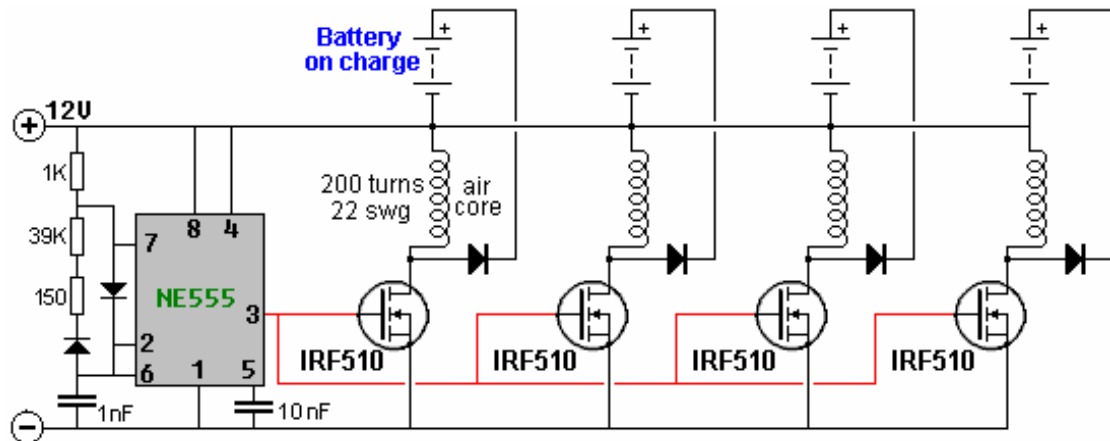


This simple circuit oscillates 35,000 times per second and it is off for 95% of the time. The coil is very simple and is just 200 turns of 0.71 mm diameter enamelled, single core solid copper wire.

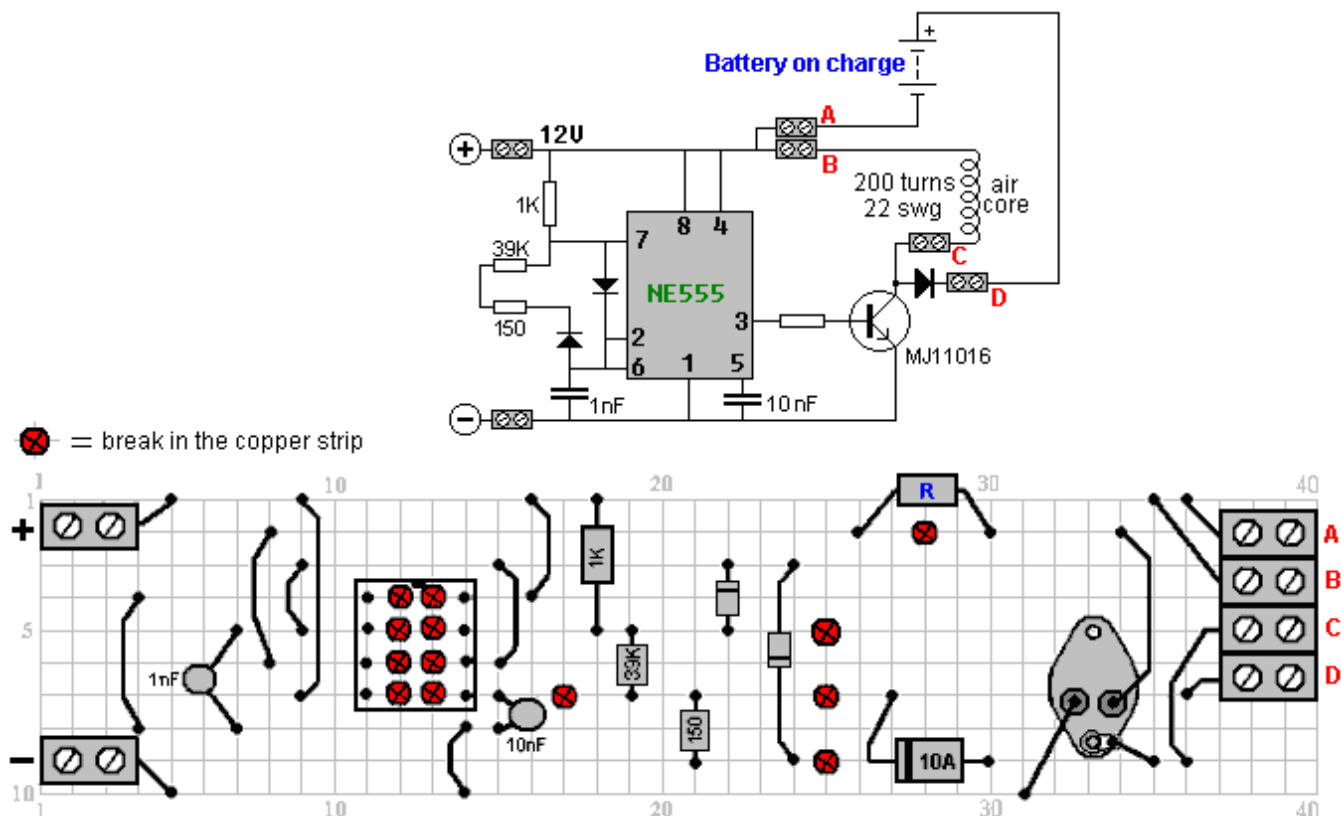
It is possible to set this circuit up on a plug-in development board and one way to do that could be:

Alexkor uses preset resistors to adjust the base resistors to their optimum values. The simplicity of this circuit makes it very attractive as a construction project and using more than one coil should make for impressive performance figures. Alex says that the best results are achieved with just the one (1000V 10A) diode per transistor and not a diode bridge. Multiple transistor chargers like the one above, work best when there is a separate wire from each coil to the battery being charged.

Further development by Alex shows better performance when using the IRF510 FET instead of the BD243C transistor. He also has found it very effective charging four separate batteries and he has revived an old NiCad drill battery using this circuit:

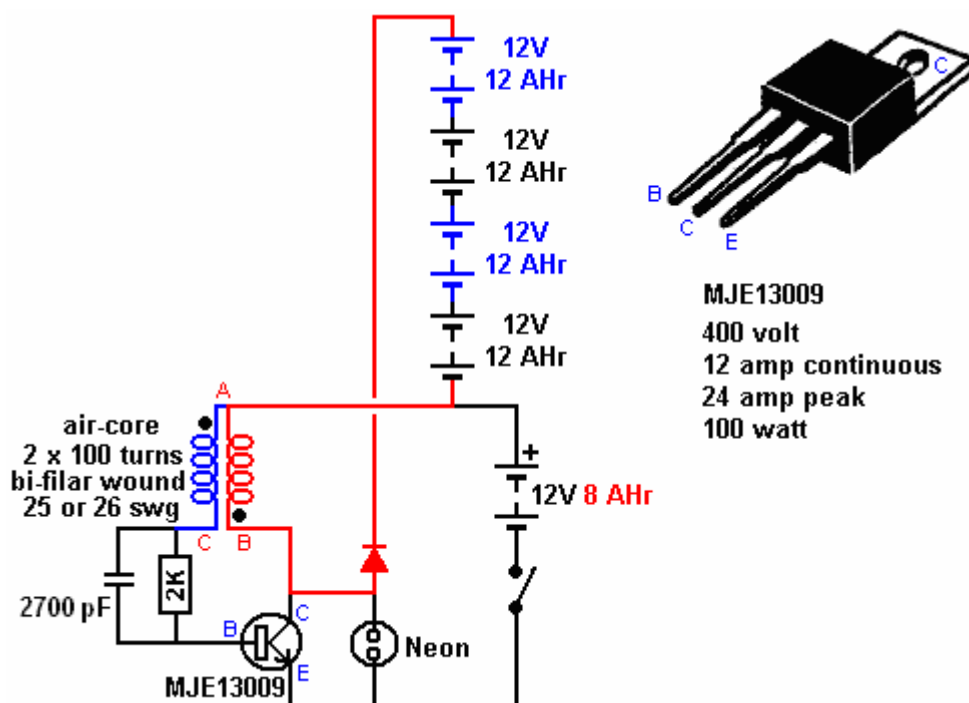


It is possible to use various different high-voltage transistors with these circuits. As some people have difficulty in working out a suitable physical construction for a circuit, here is a suggestion for a possible layout using an MJ11016 high-power high-gain transistor on stripboard.

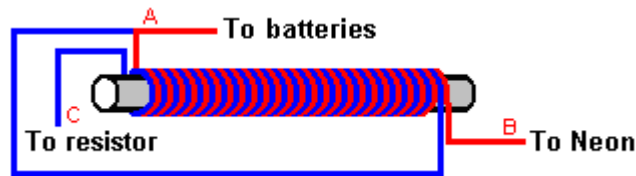


Alexkor's Self-Charging Circuit.

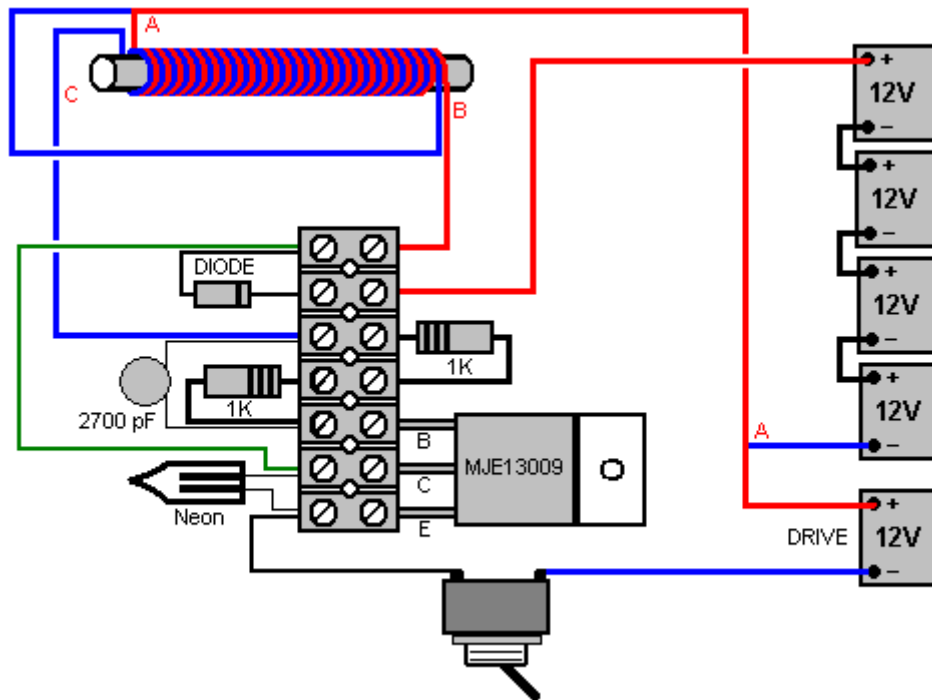
This is a particularly simple circuit which allows a 12V, 8 amp-hour battery charge a 48V, 12 amp-hour battery with radiant energy, in 20 hours using twelve times less current than a conventional charger would. The circuit can charge lithium, NiCad or lead-acid batteries. The circuit used is:



The coil is wound on a hollow former, using two separate strands of wire of 0.5 mm diameter, giving a resistance of just 2 ohms. The strands of wire are placed side by side in a single layer like this:



A possible physical layout using a small standard electrical connector strip might be:

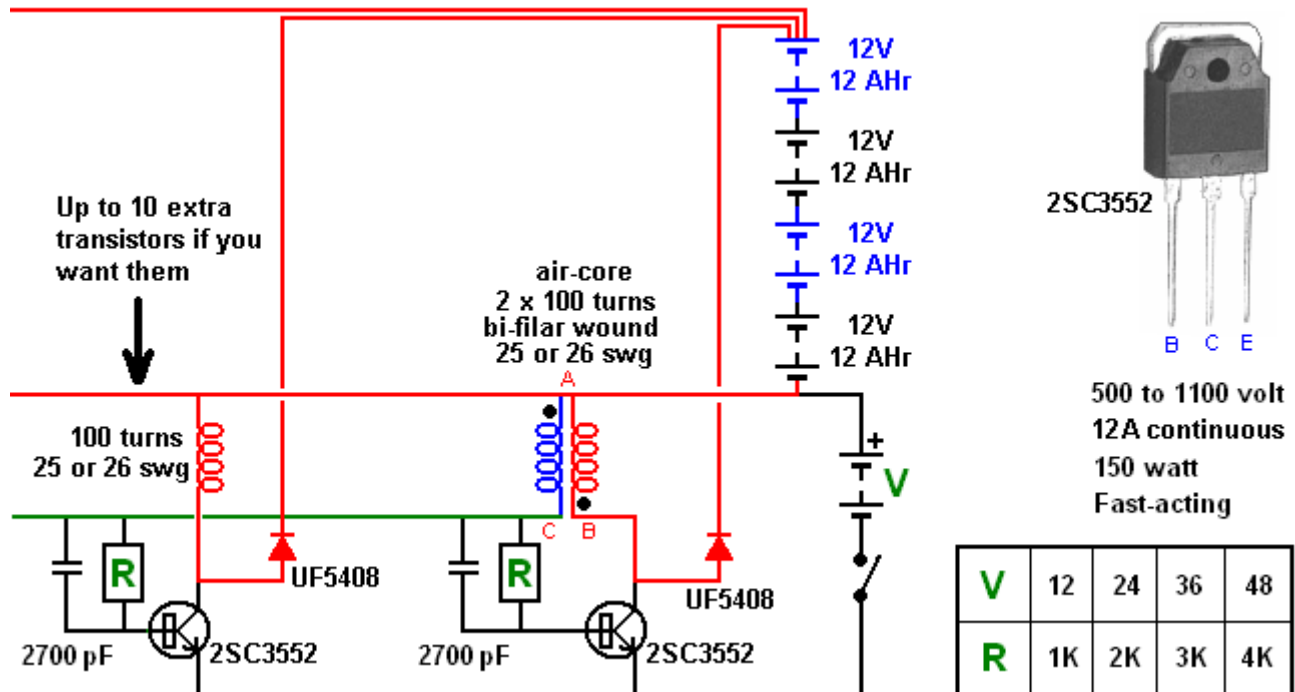


If the coil is wound on say, a 1.25-inch or 32 mm diameter plastic pipe, then the outside pipe diameter is 36 mm due to the wall thickness of the plastic pipe, and each turn takes about 118 mm, so around 24 metres of wire will be needed for the 200 turns (100 turns of two wires lying side by side). If 13 metres (14 yards) of wire is measured off the spool and the wire folded back on itself in a sharp U-turn, then the coil can be wound tightly and neatly with close side-by-side turns. A small hole drilled at the end of the pipe allows the folded wire to be secured with two turns through the hole, and the 200 turns will take up a length of about 100 mm (4-inches) and the two loose ends secured using another small hole drilled in the pipe. The starting ends are cut apart and the ends of each coil determined using a continuity test.

Lead-acid batteries such as the type used in cars, have a fairly limited life if charged with an ordinary mains powered charger. However, this pulsing circuit charges the batteries in a much better way which gives each battery a very long life and if used daily, after a time each battery holds more power than when it left the factory.

You will notice that the circuit does not use a solar panel nor does it have any kind of mains connection. It operates day and night and can charge four batteries, one of which can be used to power the next charging session. That leaves three fully charged batteries which can be used to power ordinary mains equipment through a standard DC-to-AC mains inverter, which might look like this:

The transistor drive to the battery bank can be replicated for additional drive and up to an additional ten transistors could be used like this:



The 2700 pF capacitor is recommended for each additional transistor, but it is not an essential item and the circuit will operate ok with just the one on the bi-filar coil drive section.

These Alexkor circuits are simple and direct and they are not difficult to construct. They are as useful as solar panels but very much cheaper as well as being protected from damage by hailstones which can destroy many expensive solar panels in just a few minutes. Again, let me stress the fact that the energy which these circuits channel into the batteries comes directly from the massive energy field in which we live. This is not magic but instead is just sensible engineering which uses our surrounding environment.

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Simple Free-Energy Devices

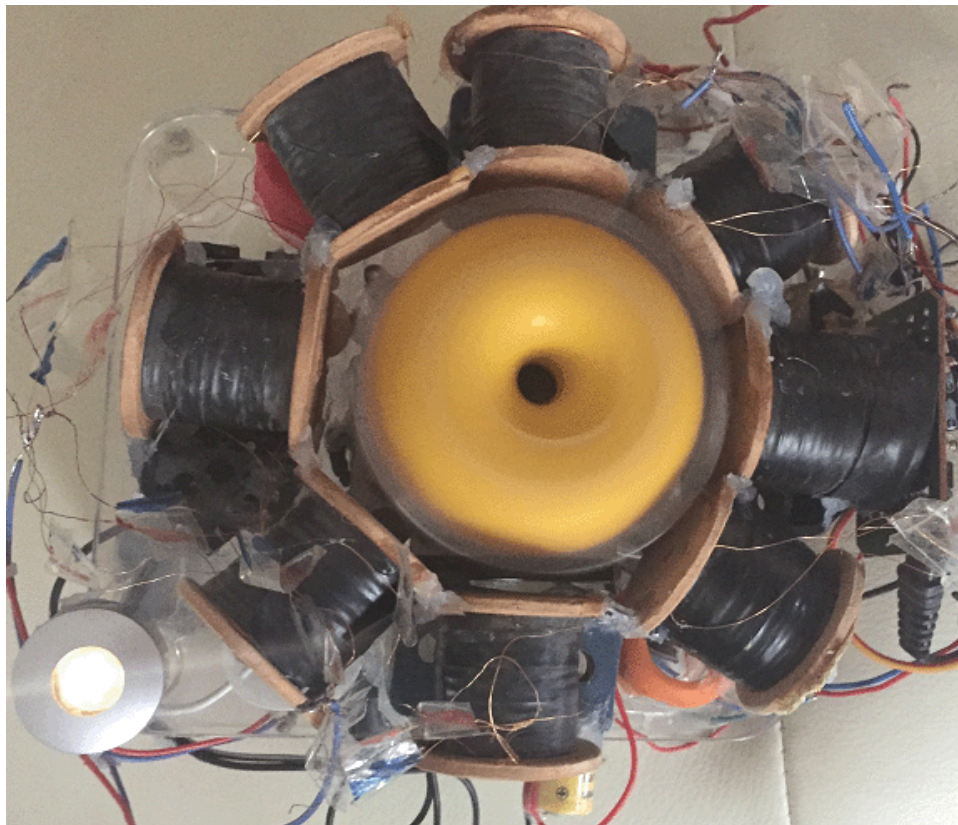
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Chapter 5: The Denis Sabourin Generator

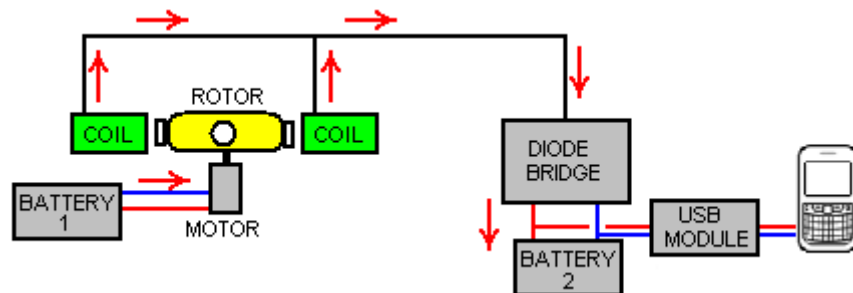
Denis Sabourin has built a generator which operates well in that it runs indefinitely, self-powered while charging a cell phone overnight. The construction is very simple. The heart of the generator is a small motor with a yellow plastic float from a fishing net glued to it to make a lightweight rotor which has four magnets attached to the float:



The rotor can, of course, be constructed from lightweight materials if it is difficult to get a float from a professional fishing net. The magnets are N52-grade 20 mm diameter neodymium magnets 5 mm thick. The motor is powered by a 3.7V Lithium ion battery and there are eight output coils positioned around the rotor. The coils are connected in pairs with the four pairs powering the system.

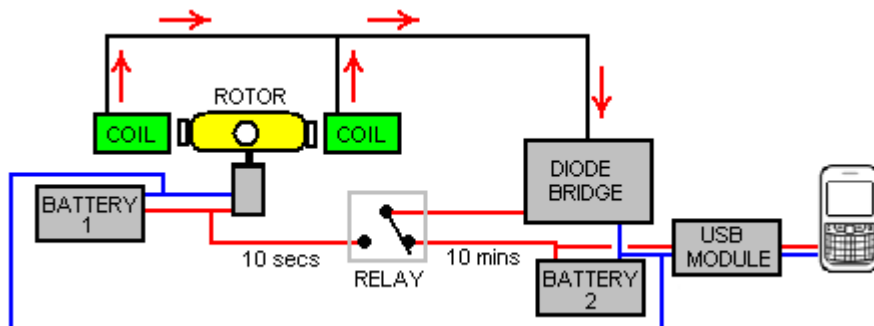


Each coil is wound with two strands of 0.19 mm diameter enamelled copper wire, which is swg 36 or could be AWG #32. Each strand weighs 50 grams and both strands are wound at the same time. That arrangement allows the coils to be connected as bi-filar coils if that is desired. The central core of each coil is made of plastic and is 8 mm in diameter with a 6 mm diameter hole in the centre, and the completed winding is 30 mm diameter on a coil which has 33 mm of winding space between the ends. When the winding is completed, each coil is given a layer of electrical insulating tape to protect the wires rather than to provide any additional insulation. So, the overall arrangement is:

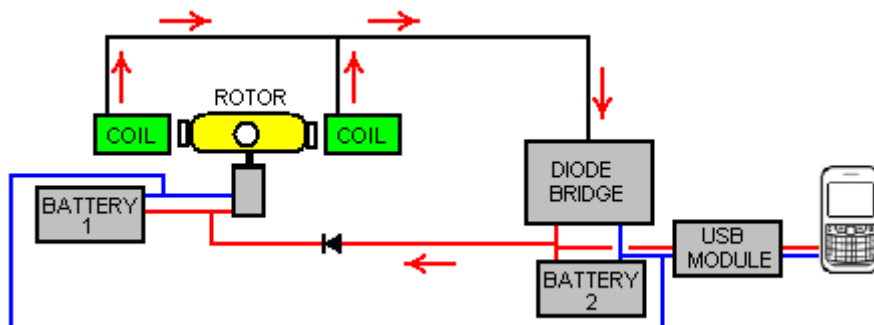


Here, Battery 1 powers the motor which spins the rotor. The powerful rotor magnets passing close by the set of eight coils generates an alternating voltage which is rectified by the diode bridge and used to charge the mobile phone battery through a 5-Volt USB module. Only two of the eight output coils are shown in the diagram above.

This system works well, charging Battery 2, but the Battery 1 gradually runs down as it is powering the motor but is not being recharged. To deal with this situation, Denis uses a switching box which powers a relay for ten seconds once every ten minutes. The relay contacts are used to disconnect the charging current from Battery 2 and pass it instead to Battery 1:

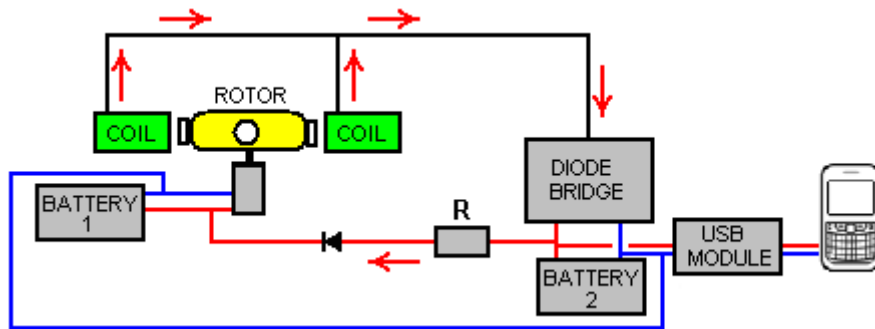


The objective is to keep Battery 1 charged while the circuit is running. If no switching is used, then Battery 1 has to be connected to the charging circuit at all times. But if a fully discharged phone is connected to the system then Battery 1 might have a much higher voltage than Battery 2 and so we need to prevent Battery 1 from pouring its current into the Battery 2. That can be done by using a diode which allows charging current to flow into Battery 1 but no current flowing from Battery 1 to Battery 2:

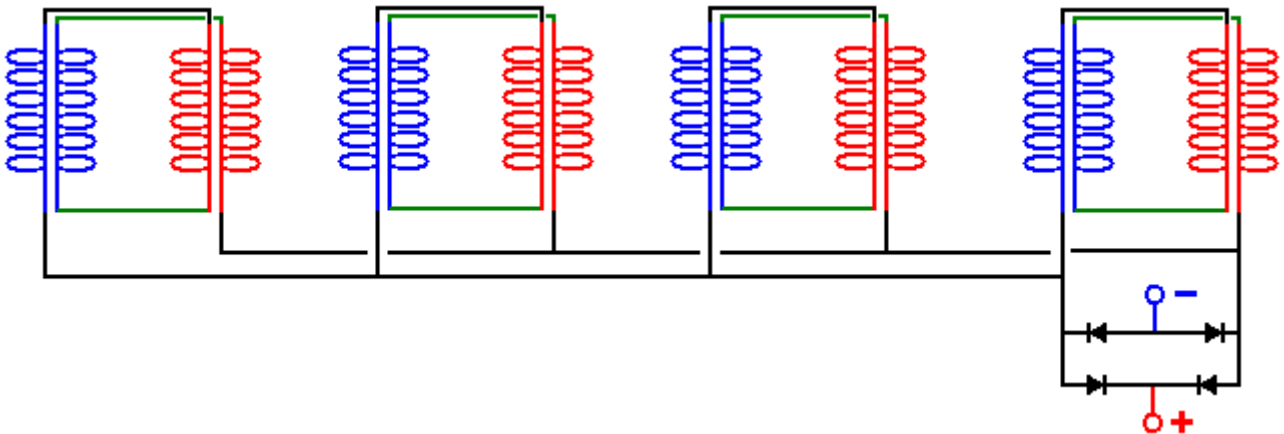


With this arrangement, Battery 2 gets most of the charging current, especially since Battery 1 always has a good level of charge on it and there is a small voltage drop across the diode, so most of the charging current will flow into Battery 2.

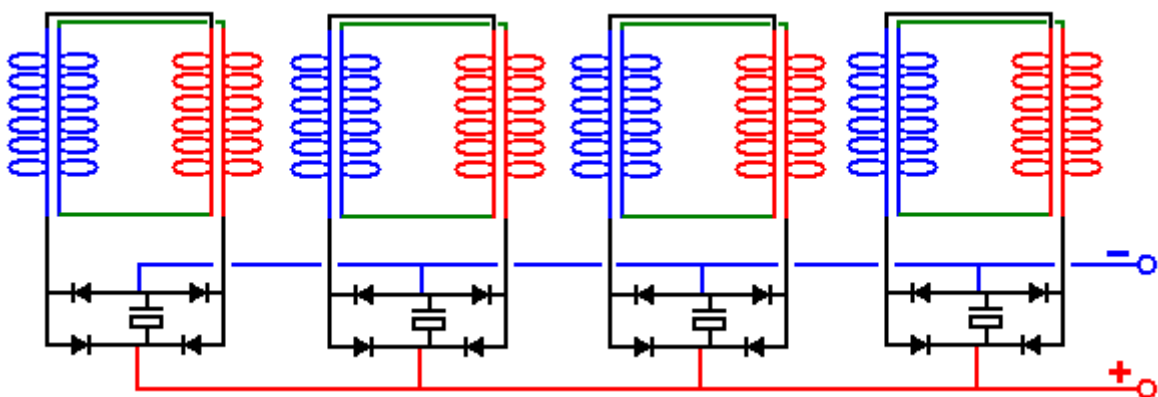
If you wish to limit the Battery 1 charging current further, then a resistor “R” can be placed in the line like this:



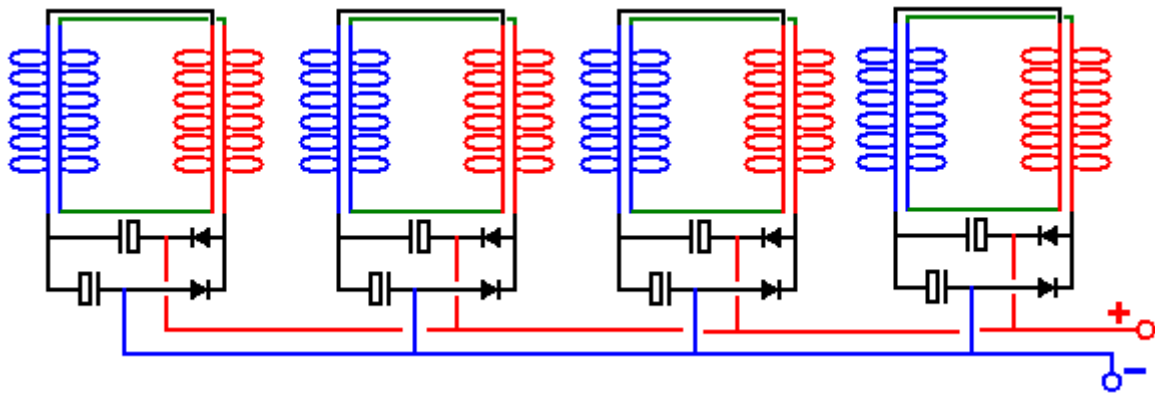
The value of the resistor “R” has to be found by experimentation with your own physical implementation, but I would expect the value to be low, perhaps 47 ohms or so. If the light is not required, then all eight output coils can be used for charging. The coils are connected in pairs and Denis has an unusual method of connecting them:



This is not the bi-filar connections which you would expect, but this wiring arrangement has proved to be very effective in practice. A variation on this which I would prefer due to its increased flexibility and the possibility of creating increased output voltage through different connections, is:



Here, each pair of coils has its own rectification and smoothing capacitor and as such, each pair acts as a small everlasting battery. An alternative to that is to use a voltage-doubler circuit for the rectification to nearly double the output voltage when powering a load:



The batteries used in the prototype are lithium ion types with a voltage of 3.7 volts and a capacity of 1200 mAHr. These batteries have worked very well, but lithium ion batteries are not the easiest batteries to work with as they have a strong tendency to catch fire if mistreated, and they are rather expensive as can be seen here:



2x M J K AA 3.7V 1200mAh TR 14500 AA Li-ion
Lithium Rechargeable Battery *****

£4.99

Buy it Now

+ £1.00 postage

An alternative which might be considered is using Nickel-Manganese batteries which are the same size but only 1.2 volts each, so we would use three NiMH batteries instead of one lithium ion battery. However, the NiMH batteries can have a much greater capacity of 2850 mAHr and they are fully stable although when fully charged they should not be over-charged at more than 10% of the mAHr rated value as the battery life will be reduced if that is done.

However, some of these small NiMH batteries do not live up to the maker's claims and so you need to run a load test on any particular make of battery which you may consider using. I recommend these batteries due to their exceptional performance when tested:



Digimax 2850

Consequently, I would suggest replacing one 3.7V lithium-ion battery with three Digimax 2850 batteries using a box like this:



A battery pack like this will charge up to 4 volts and so would be a good substitute for lithium-ion batteries as one of those is required to drive the USB board which is used to charge a mobile phone. The connector clips are very cheap:



5 x PP3 9V Battery Leather Snap-on Connector Clip Tinned Wire Leads 150mm TYPE-B

BUY ANY 3 items/packs - get it with 1st CLASS MAIL FREE

£1.58

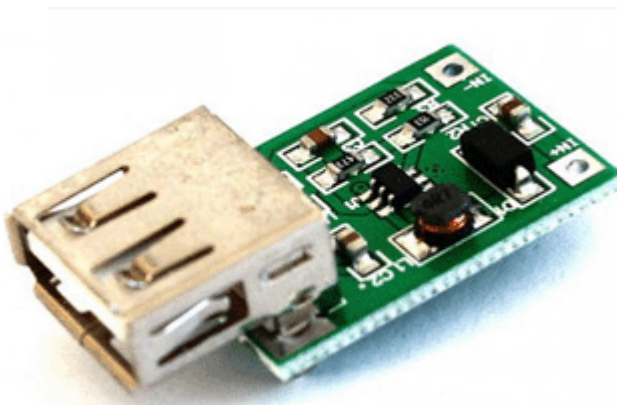
Buy it Now

Free Postage

1172 sold

eBay Premium Service

The USB board is small and low cost as can be seen here:



0.9-5V to 5V 600mA DC-DC Step Up Boost Voltage Converter Module with USB Output

BUY ANY 3 items/packs - get it with 1st CLASS MAIL FREE

★★★★★ 1 product rating

Condition: **New**

Quantity:

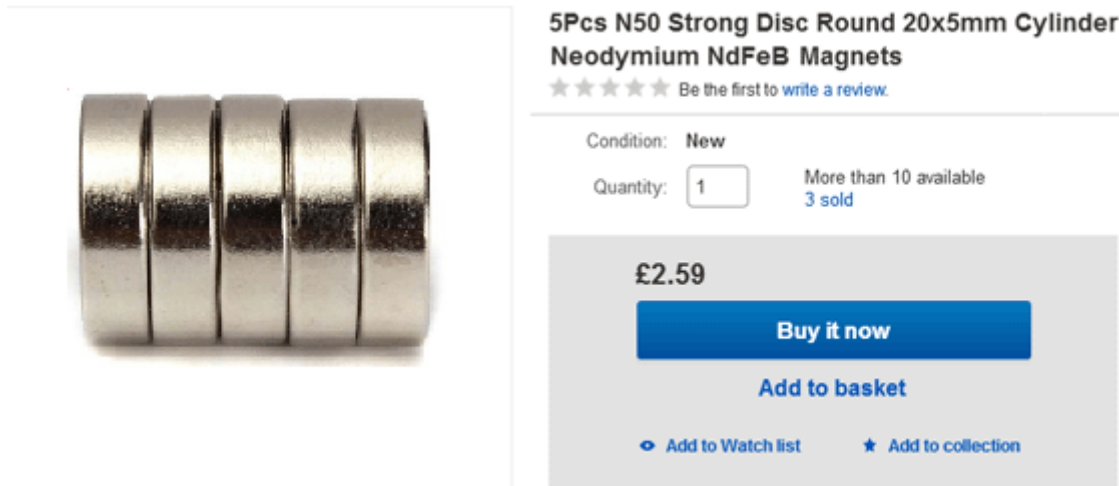
More than 10 available
626 sold

£1.88

Buy it now

The input to this DC-DC converter board is supposed to be in the range 0.9 volts to 5.0 volts, so the 4 volts of the NiMh battery pack should be very suitable.

Suitable magnets are available on eBay:

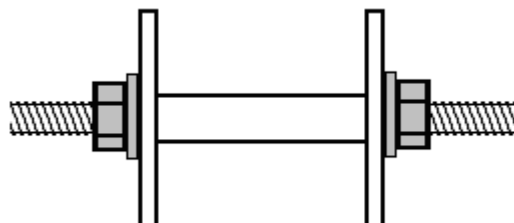


The coils can be wound easily by hand as enamelled copper wire is supplied in 50 gram reels and that makes it easy to wind one coil from two of those reels placed side by side on a fixed bar. We can make up coil spools quite easily if we use a power drill and a hole saw set like this:

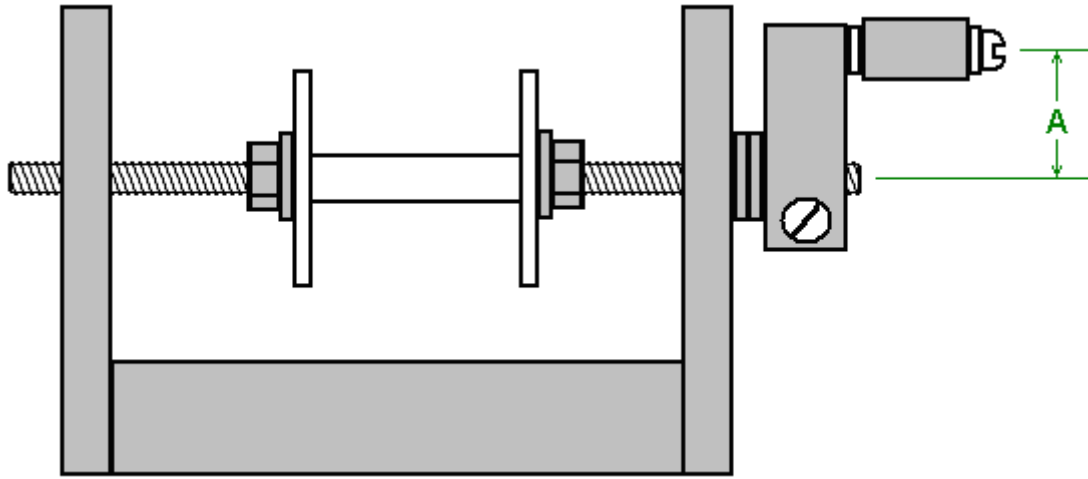


These saw sets normally have a saw which has an inner diameter of 35 mm. A small sheet of 3 mm thick Medium Density Fibreboard ("MDF") can easily be drilled using the hole saw, and each drilling produces one perfectly round disc with an exactly centred hole in the middle. Two of those can be glued (at exact right angles to the central shaft) on to a tube to form a spool of the size wanted. If it is available, plastic sheet could be used instead of the MDF. Plastic tube of 8 mm diameter and an inner diameter of 6 mm is often available on eBay, but failing that, it is actually quite easy to drill a 6 mm hole through a short length, say, a 30 mm length of 8 mm diameter dowel rod. The piece of dowel is held in a vise and because it is easy to see, drilling a reasonable hole down the length of dowel is not actually that difficult.

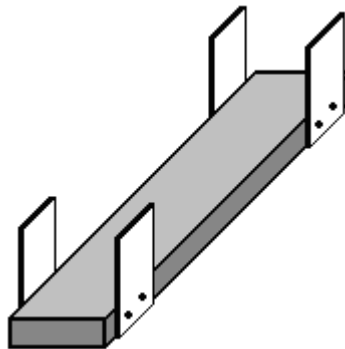
The spool can be clamped on to a standard 6 mm diameter threaded rod using two washers and two nuts or wing nuts:



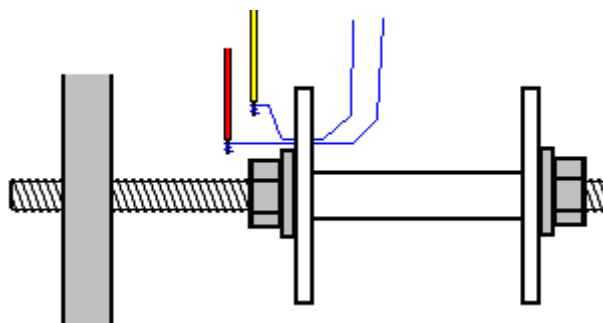
Then the threaded rod can be clamped at one end with a simple crank handle formed out of a small piece of timber, a clamping screw to grip the rod and a 20 mm length of drilled dowel on a screw to form the rotating winding handle:



A simple drilled hole in the vertical sides works perfectly well as a bearing, but keep the length “A” short as that needs less wrist movement and with it short, it is quite easy to turn the handle four times per second. A plank around 600 mm long makes a good base for the winder:



The winding handle part is at the near end and the two 50 gram spools of wire are placed side by side on a rod or dowel at the far end. The longer the plank, the easier it is to draw wire from the supplying spools as the angle between those spools and the spool being wound is smaller. The supplying spools are each just mounted on a dowel pushed through holes in the side pieces. Be sure to make those dowels horizontal so that the spools don't keep moving to one side or the other.



To start winding a coil, drill a very small hole in the left hand flange, just outside the washer. Thread the two wires through the hole and wind each a few times around the bared end of a short length of plastic covered wire, and join each wire to the copper winding wire by soldering it. This only takes a moment and if you have never soldered, it is very easy to learn and easy to do. Next, use a piece of duct tape to attach the thin wires firmly against the outer face of the flange of the coil spool and wrap the spare plastic covered wires around the threaded rod a few times so that they won't catch on anything when being whirled around. Trim the duct tape so that it is all on the outside of the flange and so will not get in the way of the wire which is being wound on to the coil spool.

The coil is wound by gathering the two strands in your left hand and turning the crank handle with your right hand. If you wish, you can clamp the winder to the table or workbench which you are using. The

preferred way of winding is to turn the crank handle so the that wire entering the coil spool feeds on to the underside of the spool. That method of winding is called "Counter-Clockwise". If you want a clockwise wound coil, you just turn the crank handle in the opposite direction so that the wire enters the spool at the top. Counter-Clockwise is considered to be the better way to wind these coils.

When starting to wind, guide the wires close to the drilled flange. This is to keep the starting wire taught, flat and out of the way of the following turns. As winding continues, the wires are directed very slowly to the right until the spool shaft is fully covered. Then the wires are directed very slowly to the left for the next layer, and that is continued, right, left, right, left until the coil is completed. Then the two wires are duct taped to the plank so that they are kept controlled while you are busy with other things. Then the wires are cut, a few turns taken around the stripped end of a short length of thicker wire and soldered to make an electrical and mechanical join between the thick wire and the thin wire. The body of the coil is now wound with electrical tape so that none of the wire is visible, and then the duct tape is removed from the spool and the two starting soldered joints are epoxied to the flange.

There is no need to mark the wires as the start of the wires are the ends coming through the drilled hole and the ends of the wires just stick out from under the electrical tape, and a meter will tell you which start and which finish are the same wire. You need to check that anyway to ensure that the wire connections are good and that the resistance of each of the two wires in the coil is exactly the same.

It is not at all difficult to wind these coils, but it will take a few days. For people living in the UK, the best supplier is the Scientific Wire Company who manufactures the wire. In June 2017 they sell 50 gram reels of SWG 36 wire (their Ref: SX0190-050) for £3.10 including tax at http://wires.co.uk/acatalog/SX_0190_0280.html and that is 'solderable' enamel which just burns away when you solder to it, which is enormously helpful, especially with very thin wire. An alternative supplier is https://www.esr.co.uk/electronics/products/frame_cable.htm which also offers 50 gram reels of 36 swg wire. The big advantage of these small reels is that you can just wind the entire contents of two reels of the wire to make the needed bi-filar coil without having to count the turns, and that is very convenient.

The motor is a 5V fan with the fan blades glued to the yellow float and positioned very carefully to get it exactly centred over the shaft of the fan. The maximum current draw for the motor is 360 milliamps but as Denis is running it on 3.7 volts or less, the actual current draw is very small indeed. The underside of the fan looks like this:



This particular fan is available on eBay:



Tested For ASUS A8H A8He A8J A8Ja A8Jc Series
CPU Cooling Fan KFB0505HHA

£7.34

Buy it Now

Free Postage

[See more like this](#)

Denis invites you to build this generator circuit yourself.

Patrick J Kelly
www.free-energy-info.com

Simple Free-Energy Devices

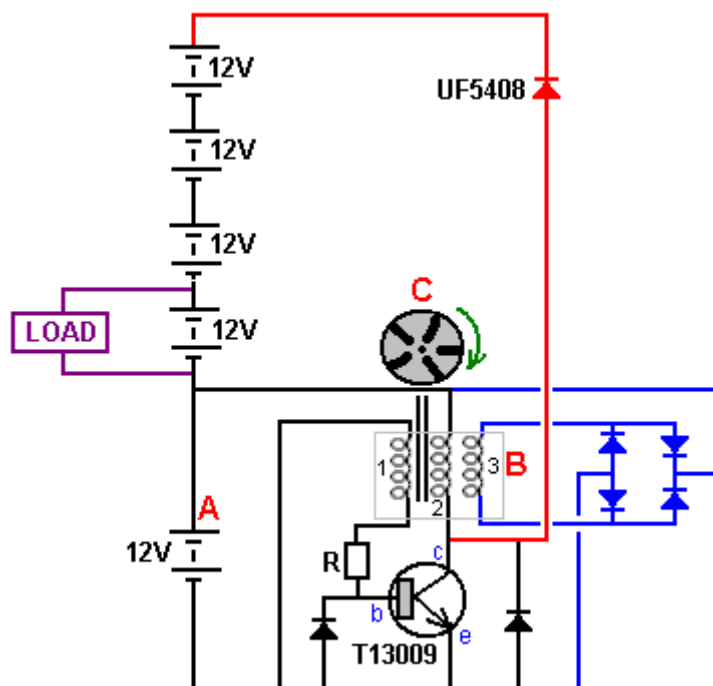
There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 6: The South African Generator

A free-energy developer working in South Africa where it is difficult to find electronic components, has very kindly shared the details of his compact self-powered generator so that you can build one if you choose to do so. Using a small inverter, the output of the prototype is 40 watts at mains voltage and frequency and the generator is a small table-top unit which is not difficult to build. The generator uses five small 12-volt 7 Amp-Hour lead-acid batteries like this:



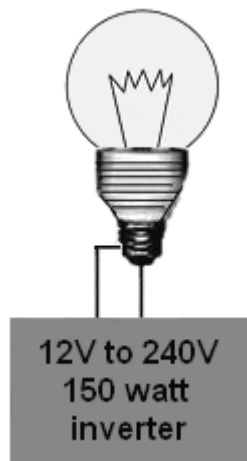
While this sounds like a lot of batteries, bear in mind that this is a generator which has a continuous electrical output, day and night and the batteries never have to be charged – a bit like a solar panel which works at night as well as during the day. Even if you are not familiar with electronics circuit diagrams (chapter 12 can fix that for you if you want), please try to follow along as we run through the circuit diagram and explain how the generator works. This is the circuit diagram:



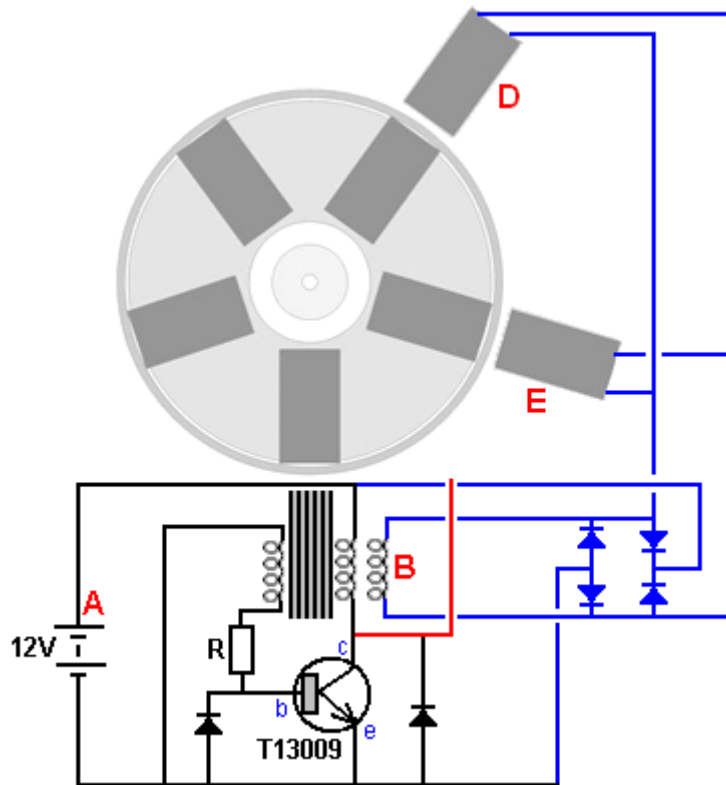
The battery marked "A" powers the circuit. A rotor "C", containing five magnets is moved so that one of the magnets passes near the coils. The coils set "B" has three specially-wound coils and the magnet moving past those three coils generates a small current in coil number "1" which then flows through the resistor "R" and into the base of the transistor, causing it to switch on. The power flowing through the transistor coil "2" causes it to become a magnet and that pushes the rotor disc "C" on its way, keeping the rotor spinning. It also induces a current in the winding "3" and that current is rectified by the blue diodes and passed back to charge battery "A", replacing the current drawn from that battery.

When the magnet in rotor "C" passes away from the coils, the transistor switches off, moving its collector voltage very quickly up to the +12 Volt line, starving coil "2" of current. Because of the way that coils are, the coil drags the collector voltage on up and it would reach 200 volts or more if it were not connected through the red diode to all five batteries which are connected in one long chain. The batteries will have a combined voltage of just over 60 volts (which is why a powerful, fast-switching, high-voltage T13009 transistor is being used. As the collector voltage passes the voltage of the battery chain the red diode starts conducting, passing the available energy in the coil into the battery chain. That current pulse passes through all five batteries, charging all of them. The higher voltage caused by so many batteries means that higher power is fed into all the batteries from coil "2". Loosely speaking, that is the generator design.

In the prototype, the load for long-term testing was a twelve volt 150-watt inverter powering a 40-watt mains light bulb:

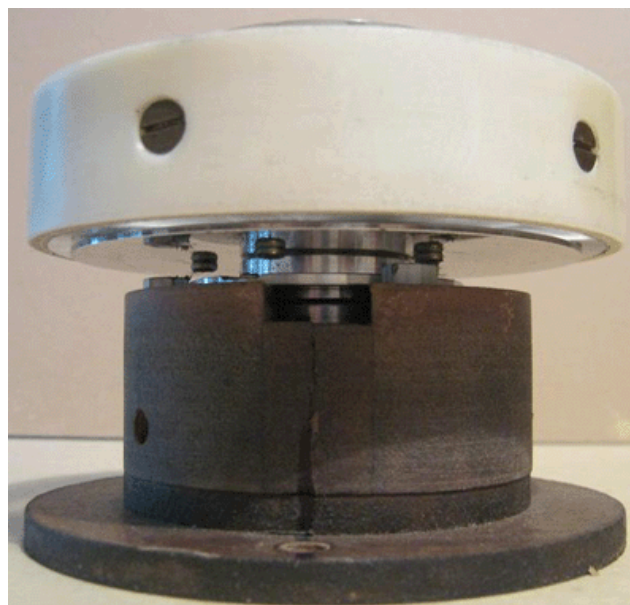


The basic design shown above was then modified by the addition of two additional pick-up coils:



Coils “B”, “D” and “E” are all triggered at the same time by three different magnets. The electrical energy produced in all three coils is passed to the four blue diodes to produce a DC power supply which is used to charge battery “A” which powers the circuit. That additional input to the drive battery and the addition of two more drive coils to the stator, makes the system operate securely as self-powered, maintaining the voltage of battery “A” indefinitely.

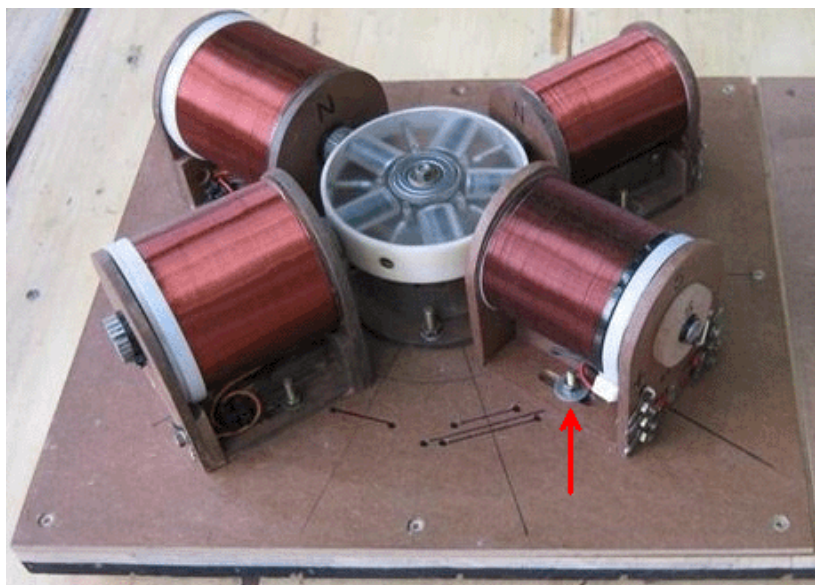
The only moving part of this system is the rotor which is 110 mm in diameter and is a 25 mm thick acrylic disc mounted on a bearing taken from an old computer hard disc drive. The arrangement looks like this:





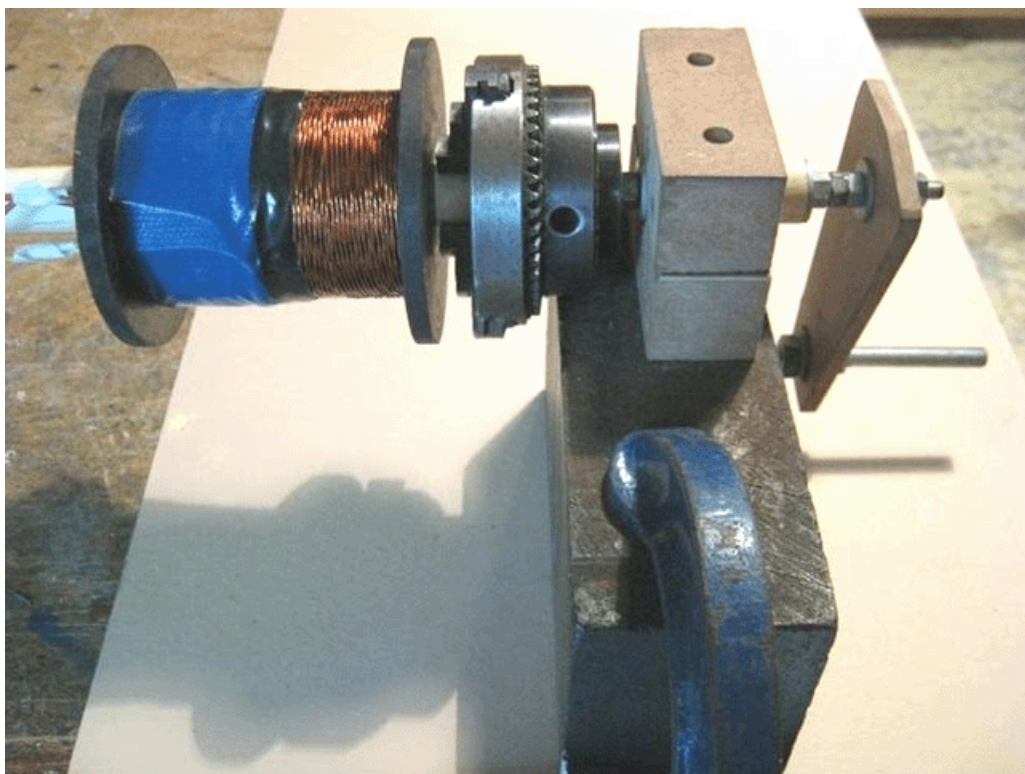
In the pictures, the disc looks to be hollow but in actual fact it is solid, very clear plastic. The disc has been drilled at five evenly spaced points around the circumference, that is, at 72 degree intervals. The five main holes drilled in the disc are to take the magnets which are sets of nine circular ferrite magnets, each 20 mm in diameter and 3 mm thick, making each stack of magnets 27 mm long and 20 mm in diameter. The magnet stacks are positioned so that their North poles face outwards. When the magnets have been installed, the rotor is placed inside a strip of plastic pipe which prevents the magnets escaping when the disc is spun rapidly. The plastic pipe is secured to the rotor using five bolts with countersunk heads.

The gap between the rotor and the coils can be set as anything from 1 mm to 10 mm as the coils have slotted mounts as can be seen from this picture of an earlier version of the generator:



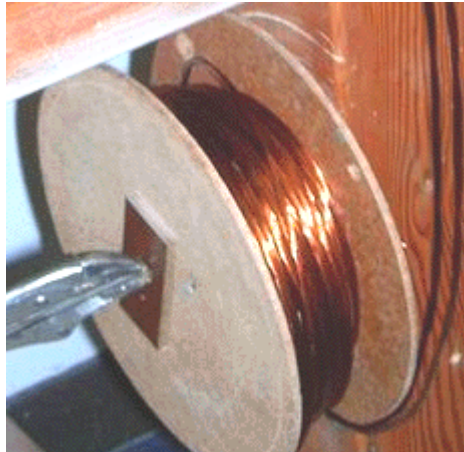
Notice the way that the coil mounts allow the distance between the coils and the rotor to be changed. The working gap between the rotor and the coils can be adjusted so that the performance can be maximised by finding the most effective gap.

The spools of the coils are 80 mm long and the ends are 72 mm in diameter. The centre shaft of each coil is made of a length of plastic pipe with a 20 mm outer diameter and an inner diameter of 16 mm, giving a wall thickness of 2 mm. After being wound, that inner diameter is filled with a series of welding rods with their welding coating removed, and which are then encased in polyester resin although a solid bar of soft iron is a good alternative:



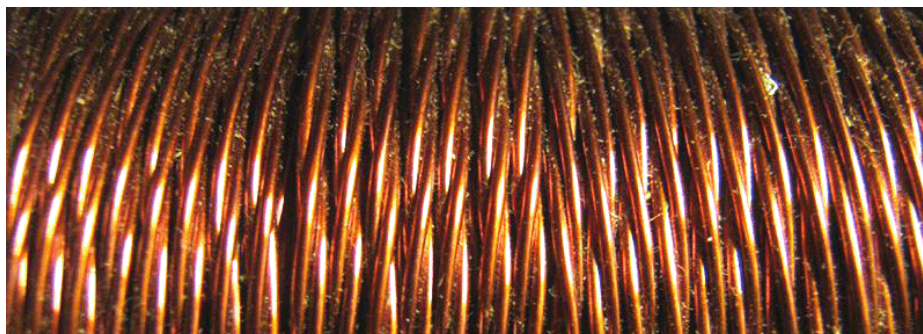
The three strands of wire which form coils “1”, “2” and “3” are 0.7 mm diameter wire and they are twisted together to become a “Litz” wire before being wound into the coil “B”. This produces a much thicker composite wire strand which is easy to wind accurately on to the spool. The winder shown above uses a chuck to grip the coil core for winding, but any simple winder will work well.

The developer does the Litzing by stretching out three strands of wire, each coming from a separate 500 gram reel of wire. The three strands are clamped at each end with the wires touching each other at each end and with three metres between the clamps. Then, the wires are clamped in the middle and 80 turns applied to the middle. That gives 80 turns for each of the two 1.5 metre lengths held between the clamps. The twisted wire is wound on to a makeshift reel to keep it tidy as this twisting has to be repeated 46 more times as the entire contents of the reels of wire will be needed for this one composite coil:



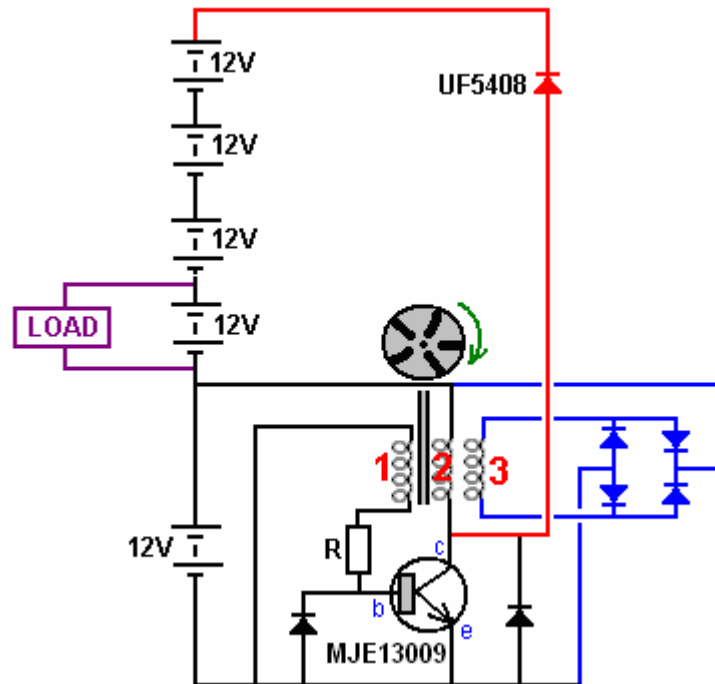
The next 3 metres of the three wires is now clamped and 80 turns applied to the central point, but this time the turns are applied in the opposite direction. Still the same 80 turns, but if the last length was ‘clockwise’ then this stretch of wire will be turned ‘counter-clockwise’. This alternation of direction gives a finished set of twisted wires where the direction of twist reverses every 1.5 metres along the length. That is the way that commercially produced Litz wire is made, but I seriously doubt that the resulting performance is any better than if the direction of wind was never changed and the twisted wire had the same direction of twist along its whole length.

This very nice twisted group of wires is now used to wind the coil. A hole is drilled in one spool flange, right beside the central tube and core, and the start of the wire fed through it. The wire is then bent sharply at 90 degrees and fed around the shaft of the spool to start the winding of the coil. The wire bundle is wound carefully side by side along the length of the spool shaft and there will be 51 turns in each layer and the next layer is wound directly on top of the first layer, moving back towards the start. Make sure that the turns of this second layer sit exactly on top of the turns beneath them. This is easy to do as the wire bundle is thick enough to make positioning very easy. If you prefer, a single thickness of white paper can be placed around the first layer, to make it easier to see the second layer as it is wound. There will be 18 of these layers to complete the coil, which will then weigh 1.5 kilograms and in 2016 prices in the UK, the wire in this coil will cost £45 and the winding looks like this:

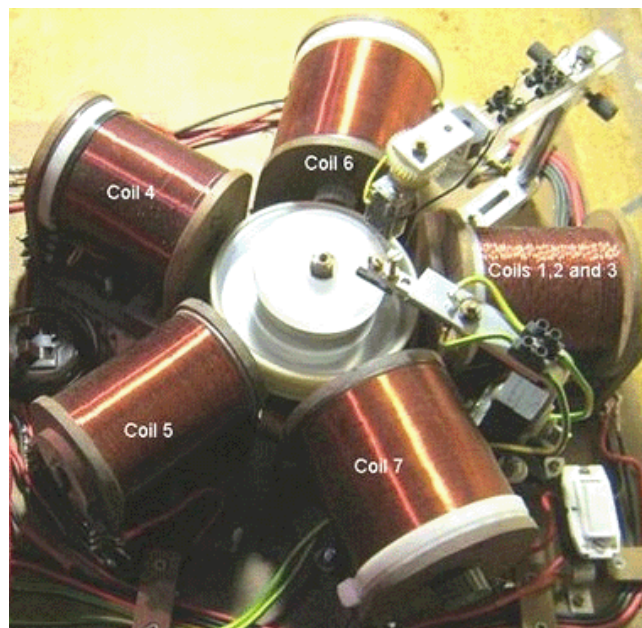


This completed coil now contains three separate coils in very close proximity to each other and that arrangement is excellent when one coil is powered up, for inducing energy in the other two coils. This winding now contains coils 1,2 and 3 of the circuit diagram. There is no need to concern yourself with marking the ends of each strand of wire as a simple ohmmeter will tell you which two ends have a winding between them.

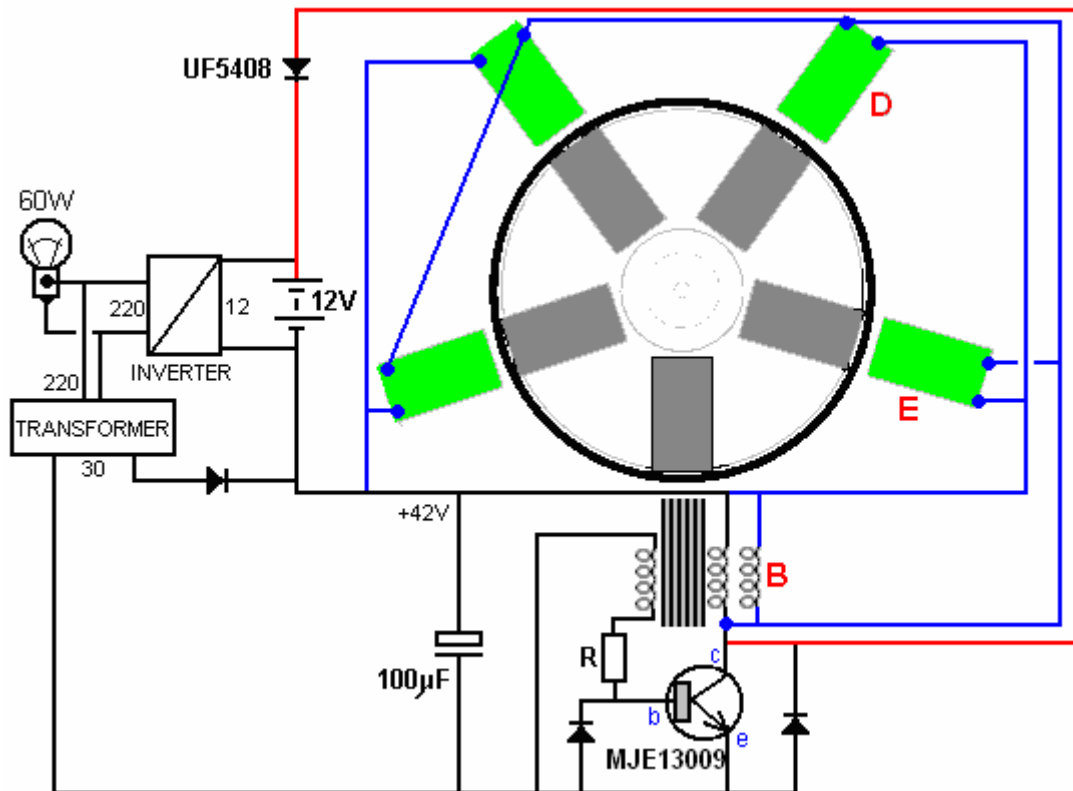
Coil 1 is used as the trigger coil which switches the transistor on at the right instant. Coil 2 is the drive coil which is powered by the transistor, and Coil 3 is the first of the output coils:



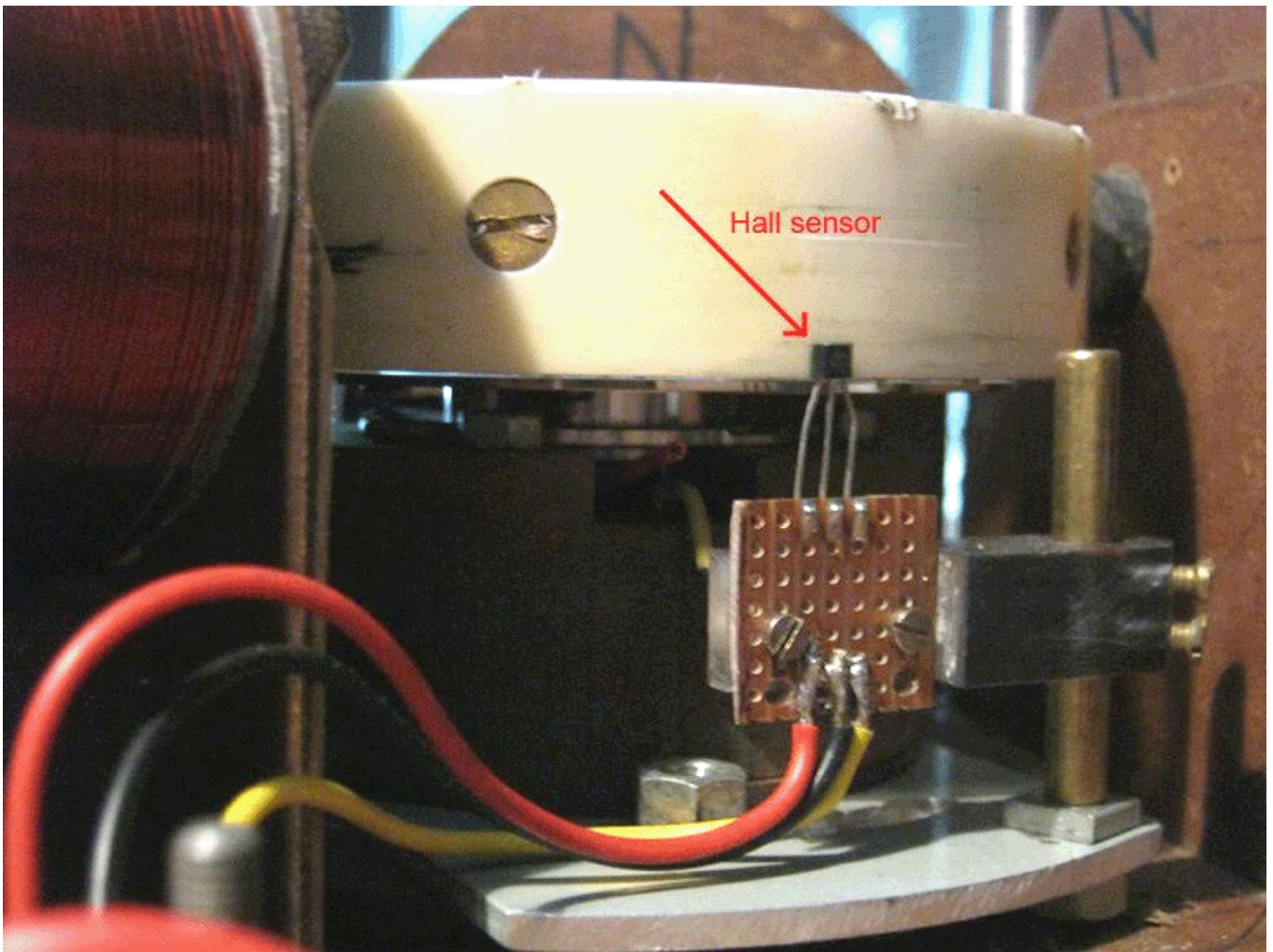
Because of the coils which were already to hand during the development of this highly successful system, coils 4 and 5 are simple helical-wound coils which are wired in parallel with drive coil 2. They boost the drive and they are necessary. Coil 4 has a DC resistance of 19 ohms and coil 5 a resistance of 13 ohms. However, investigation is underway at present to determine the best coil combination for this generator and it is probable that the additional coils will be the same as the first coil, coil "B" and that all three coils are connected in the same way and the driving winding in each coil driven by the one powerful, fast transistor. The present arrangement looks like this:



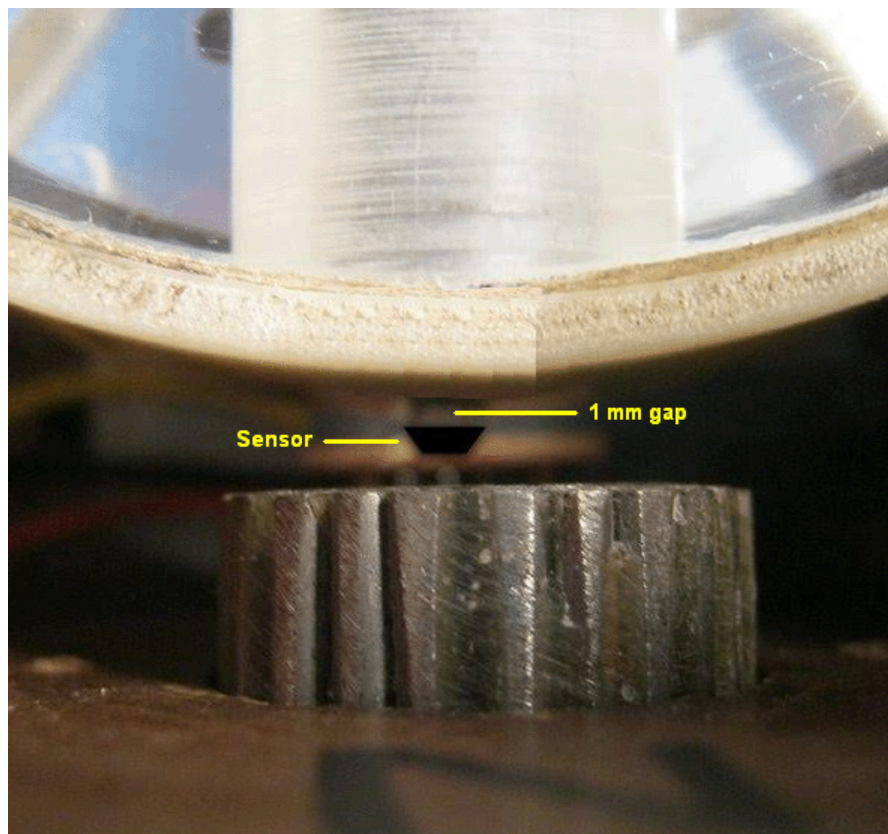
The two gantries can be ignored as they were only for investigating alternative ways of triggering the transistor and they are no longer used.

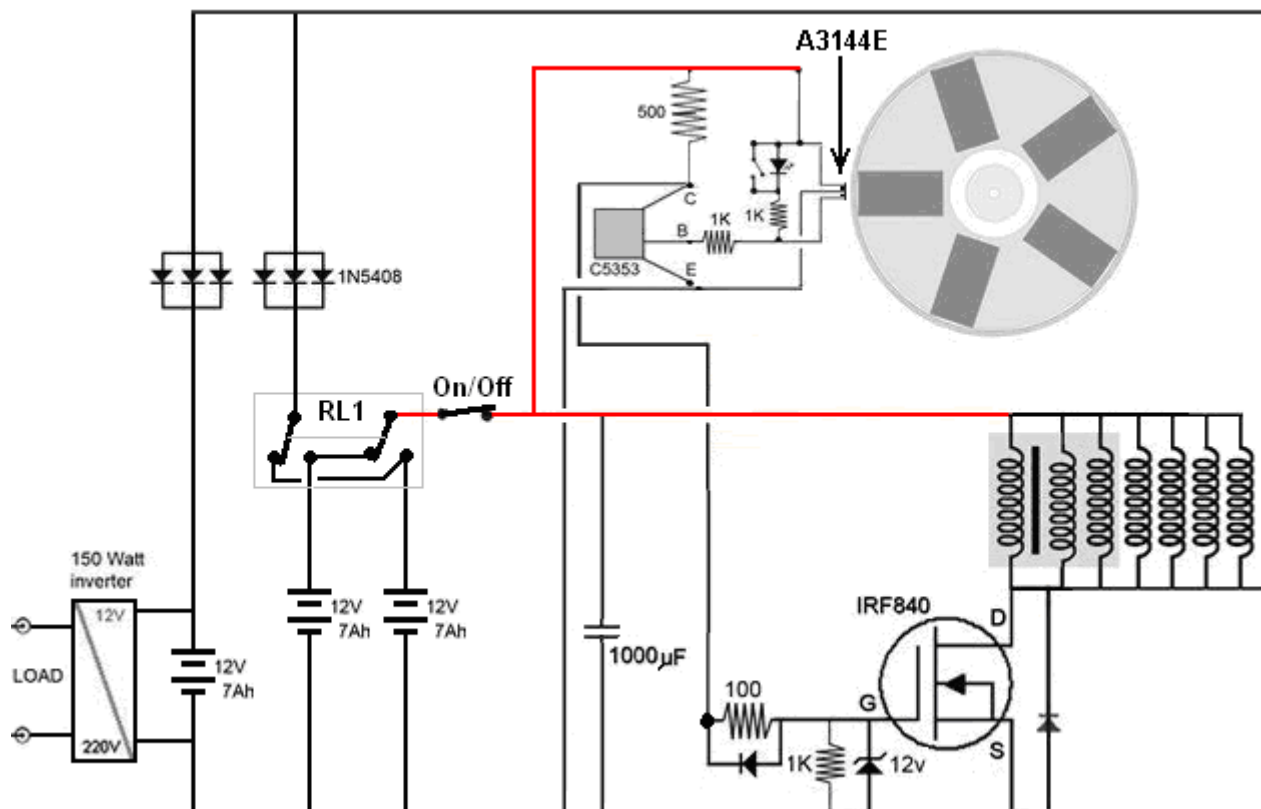


In this arrangement, coil “B” is also pulsed by the transistor and the output from the coils around the rotor is now directed to the output inverter. The drive battery has been eliminated and a low-power 30V transformer and diode run from the inverter output replaces it. Spinning the rotor generates sufficient charge on the capacitor to get the system running without a battery. The output power has now risen to 60 watts which is a 50% improvement. The three 12-volt batteries have also been eliminated, and the circuit can run with just one battery. Continuous power output from a single battery which never needs to be recharged is a very satisfactory situation.



Or when the coil is in position, the view from above is like this:



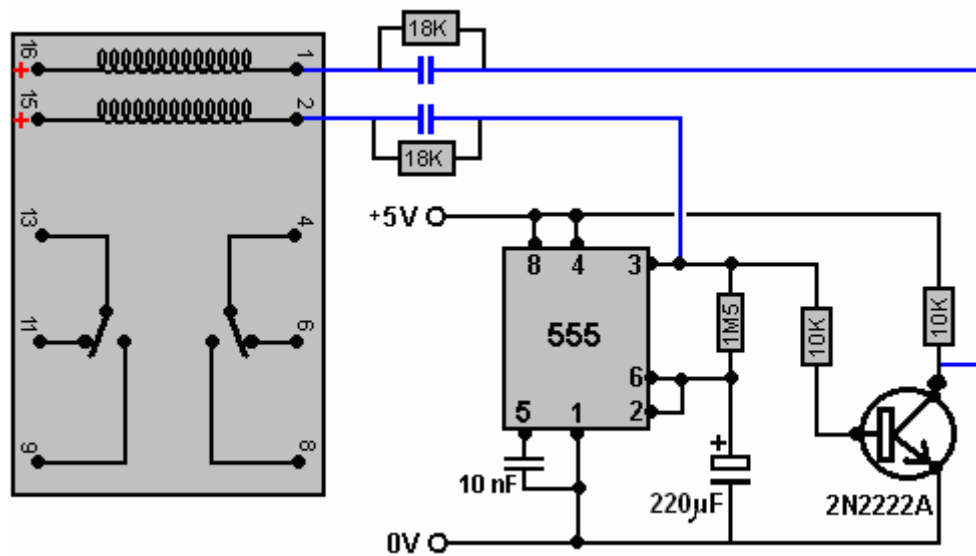


This circuit has a 150 watt continuous output and it uses three 12-volt batteries. The first two batteries are used, one to power the circuit while the second one is being recharged through three diodes wired in parallel to improve the recharging current flow. The two-pole two-way changeover switch “RL1” swaps the batteries over every few minutes using the circuit shown below. This technique keeps both batteries fully charged.

The recharging current also flows through a second set of three diodes wired in parallel, recharging the third 12-volt battery which powers the inverter which supplies the load. The test load was a 100-watt bulb and a 50-watt fan.

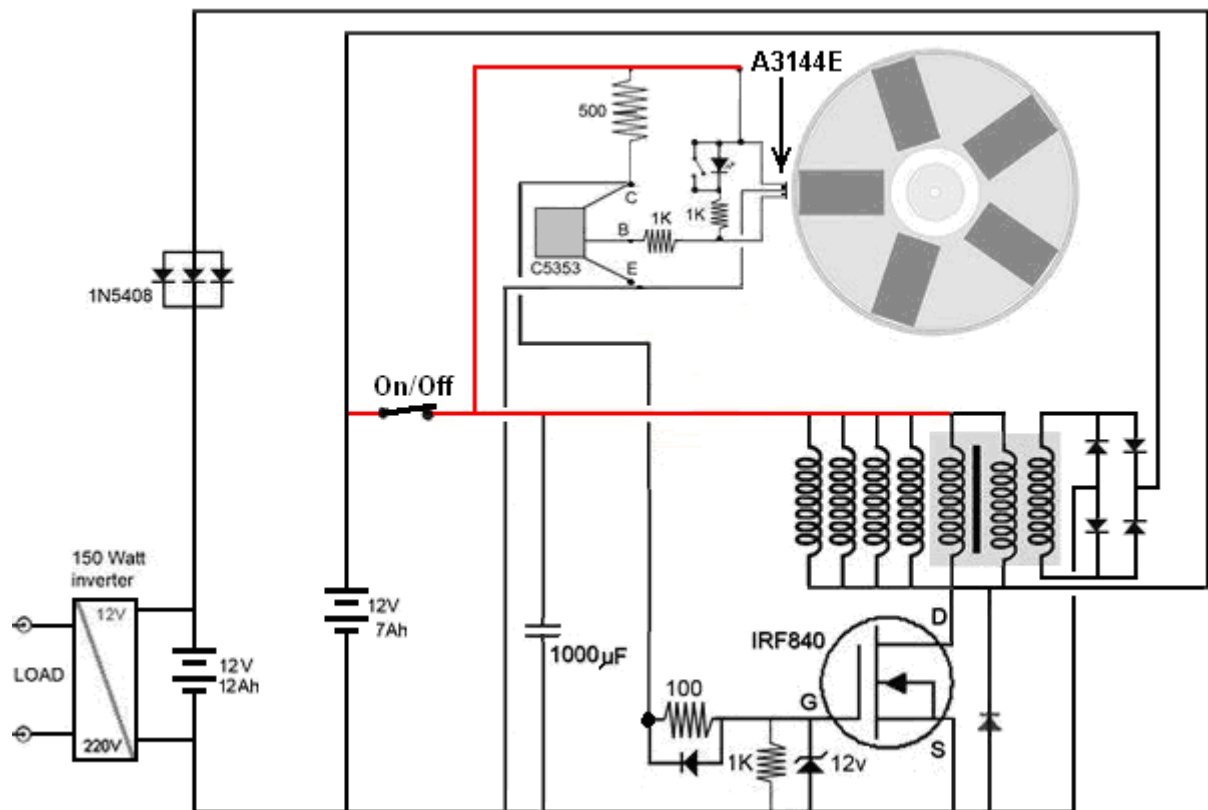
The Hall-effect sensor drives a C5353 transistor but any fast-switching transistor such as a BC109 or a 2N2222 transistor can be used. You will notice that all of the coils are now being driven by the IRF840 FET. The relay used for the switching is a latching type such as this one:





The capacitors shown in blue are chosen to operate the actual physical relay which is used in the circuit. They give the relay a brief switching pulse every five minutes or so. The 18K resistors across the capacitors are to bleed off the capacitor charge during the five minutes when the timer is in it alternative state.

However, if you wish to avoid switching between batteries, the circuit can be arranged this way:



Here, the battery which powers the inverter which supplies the load is increased in capacity and while the developer used two of his 7 Amp-Hour batteries, you can use a standard 12-volt 12 Amp-Hour

The 1N5408 diode is a 1000-volt 3-amp component. The diodes which are not shown with a type number against them can be any diode in the 1Nxxx range of diodes.

Update in April 2018:

The circuit diagram illustrates a motor speed control system. It features two 12V 7Ah batteries connected in series to provide power. A 1N5408 diode is used for rectification. The control section includes a 555 timer configured as an astable multivibrator, with components like a 75Ω resistor, 200KΩ potentiometer, 220μF capacitor, 10nF capacitor, and a 1000μF electrolytic capacitor. The timer's output drives a C5353 transistor through a 500Ω resistor. This transistor controls a relay (RL1) via its common terminal. The relay's normally open contact connects the motor to a 150Watt inverter, which provides 220V AC to the motor. The motor is a three-phase unit with 6 poles. A feedback loop uses an A3144E optocoupler to sense the motor's position (via a rotor with 11cm diameter) and provide feedback to the 555 timer. The motor's ground connection is also tied to the negative terminal of the battery stack.

However, the South African developer would very much like to omit the mains inverter, and so he prefers the following arrangement. This version powers the drive circuitry through an ordinary DC-to-DC inverter which provides additional voltage to the IRF840 transistor and the circuit works very well with this configuration:

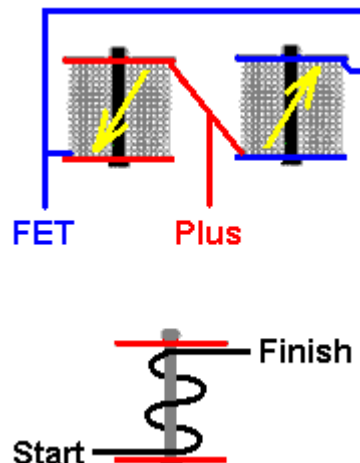
This 3D-printed rotor is made in two halves which are then bolted together.

The developer has continued advancing his design. One of the things which he didn't like was the fact that the five coils being used required a total of some 1640 metres of wire, so smaller coils were constructed. This new arrangement works spectacularly well and each new coil has a total wire length of just 22 metres, which is less than one twelfth of the previous wire length. The wire size remains 0.711 mm diameter wire (swg 22 or AWG #21) and each new coil is wound on a 6 mm diameter iron bolt core and the windings cover a length of 24 mm along the bolt which has two 30 mm diameter flanges mounted on it giving an overall length of 30 mm and the completed winding is 27 mm in diameter. There are twelve layers of the 0.71 mm diameter wire on each coil.

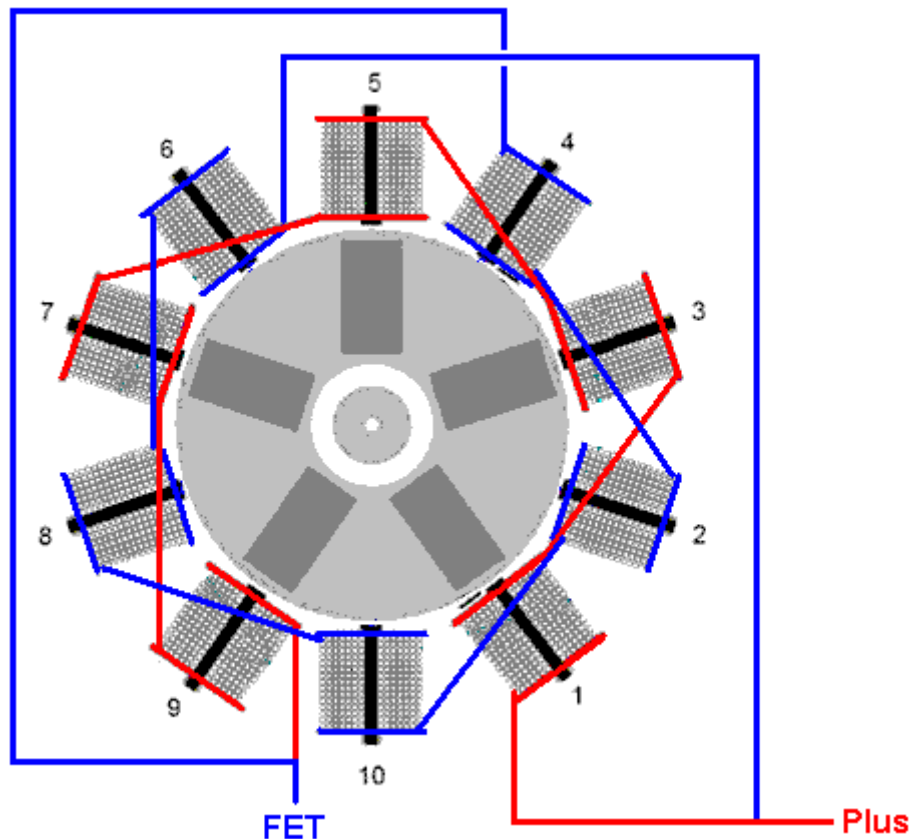
These new coils are connected in two groups of five in series, giving a DC resistance of about 4 ohms for each chain of five coils. The voltage spikes generated when a set of five coils is switched off is more than 500 volts. The wire in each coil weighs 70 grams. The coils look like this:



And they are drawn like this:



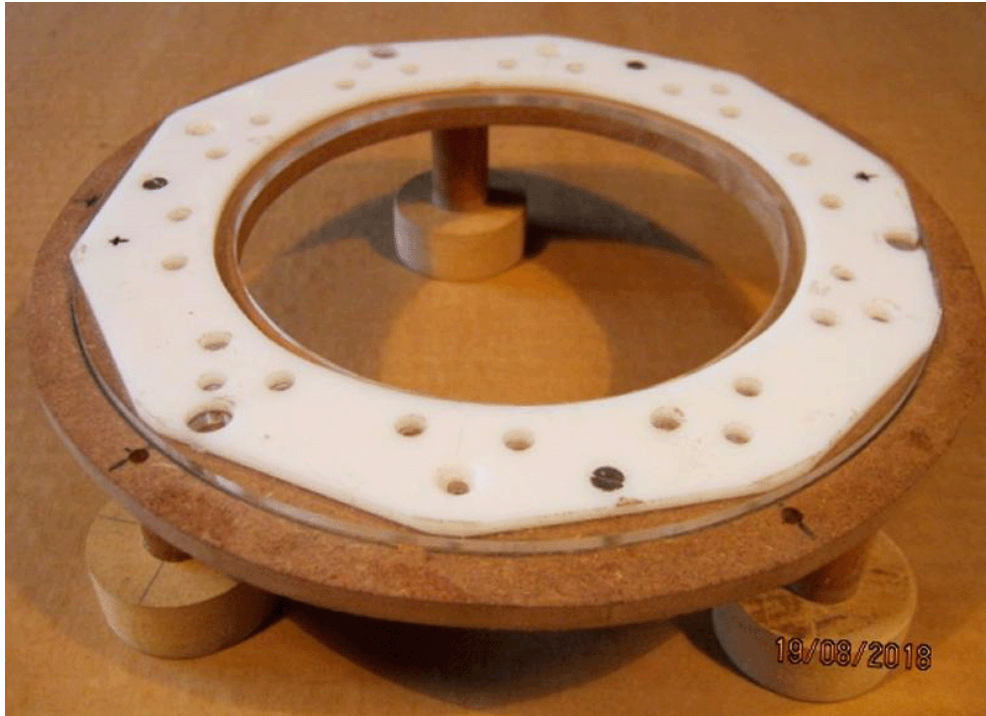
The two sets of five coils in series are connected in opposite directions as shown above. The Start of the set of coils shown in blue and the Finish of the set of coils shown in red are connected to the Plus of the battery. This causes current to flow in opposite directions in each set of five coils and if one set has a North pole facing the rotor, then the other set will have a South pole facing the rotor. The coils are alternated around the rotor like this:



All ten coils are pulsed at the same instant and that instant is arranged to happen when a rotor magnet is between the two opposing coils. One coil pushes the magnet away and the other coil pulls that same magnet towards itself. This is very effective with the rotor spinning so fast that the developer describes it as being “scary” and he has to clamp it to the workbench because of the power being generated.

Another reason why there is such a great increase in power is that now the design uses two Hall-effect sensors (at coil 1 and coil 4 in the above diagram) and that gives ten pulses per rotation as opposed to the earlier five pulses per rotation. The drive circuit is very simple indeed.

The developer now uses a different method of mounting the ten coils so that there is more space to access the Hall-effect sensors for adjustment. The whole top wood and acrylic mounting ring is easily removed by loosening just four screws:

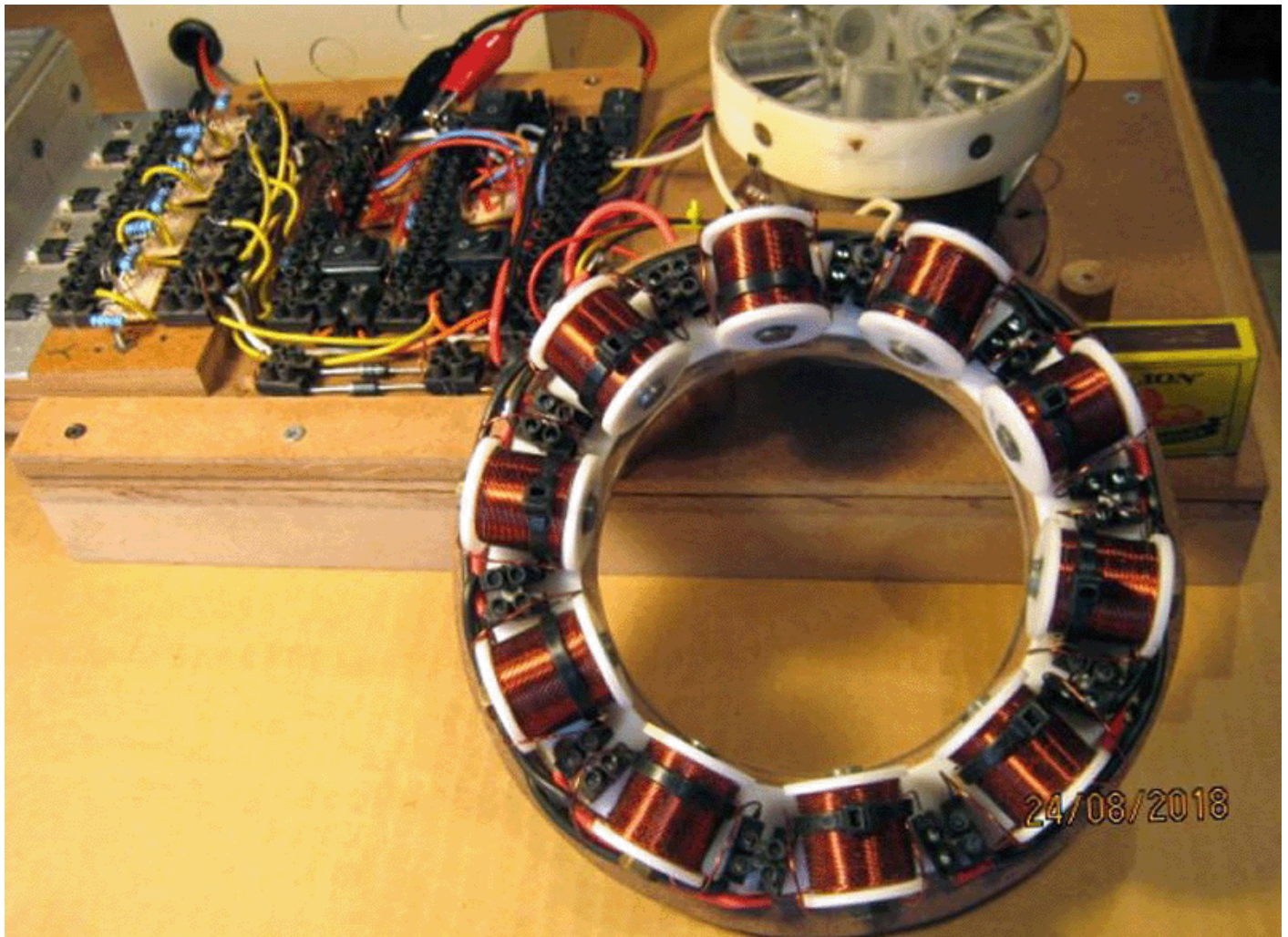


The small coils are held in place with cable ties and are easy to remove. Each coil has a resistance of 0.8 ohms and the cores are standard 6 mm diameter galvanised iron bolts which do not retain magnetism, that is, they do not become permanent magnets no matter how often they are stroked repeatedly with a strong permanent magnet. The set of ten coils mounted around the rotor look like this:

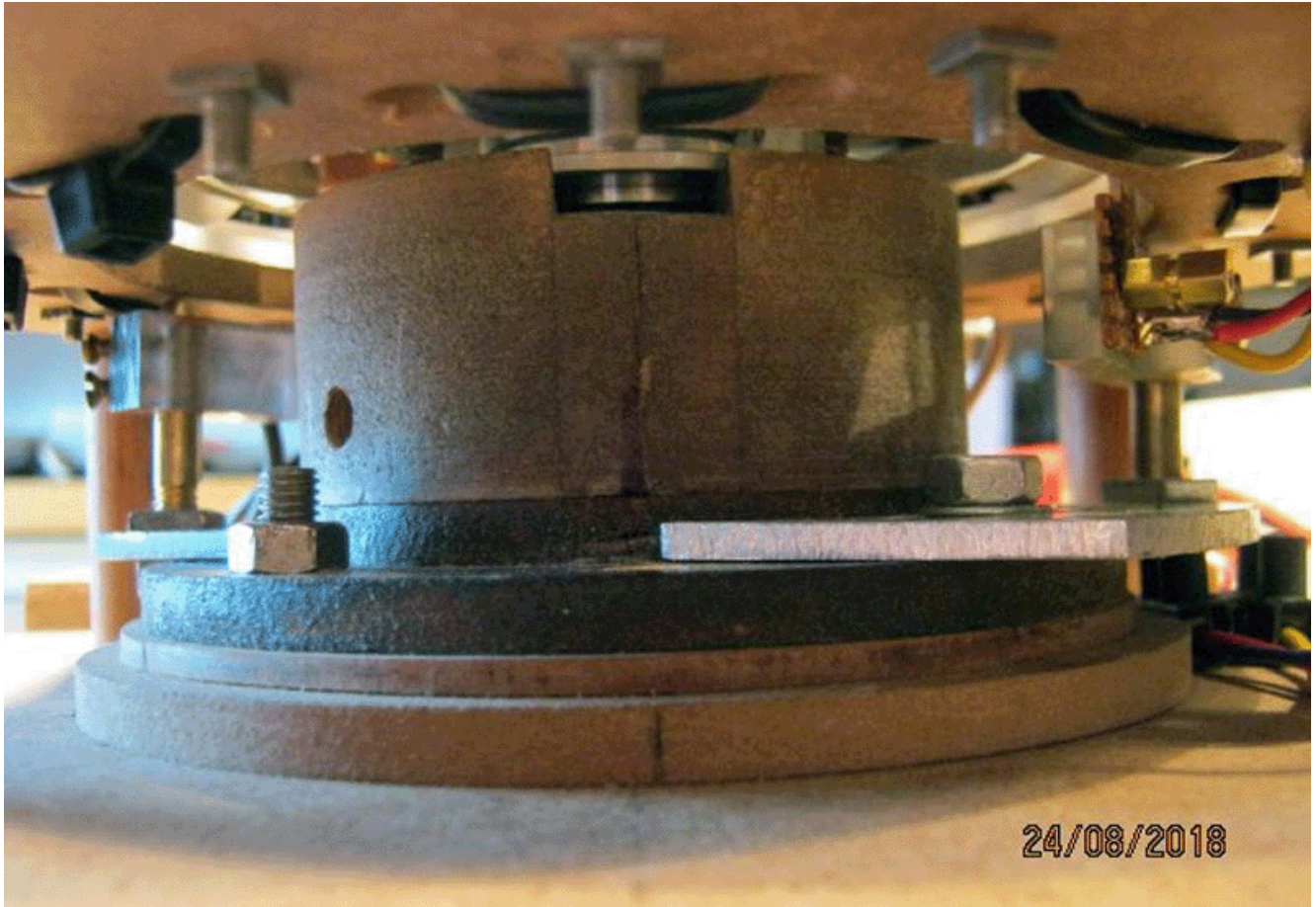


Remember that the coils are mounted on their own support ring and so can be handled as a single unit. This is very convenient.

In the following picture, the matchbox at the right hand side of the picture is there to give you a good visual idea of the size of the unit:

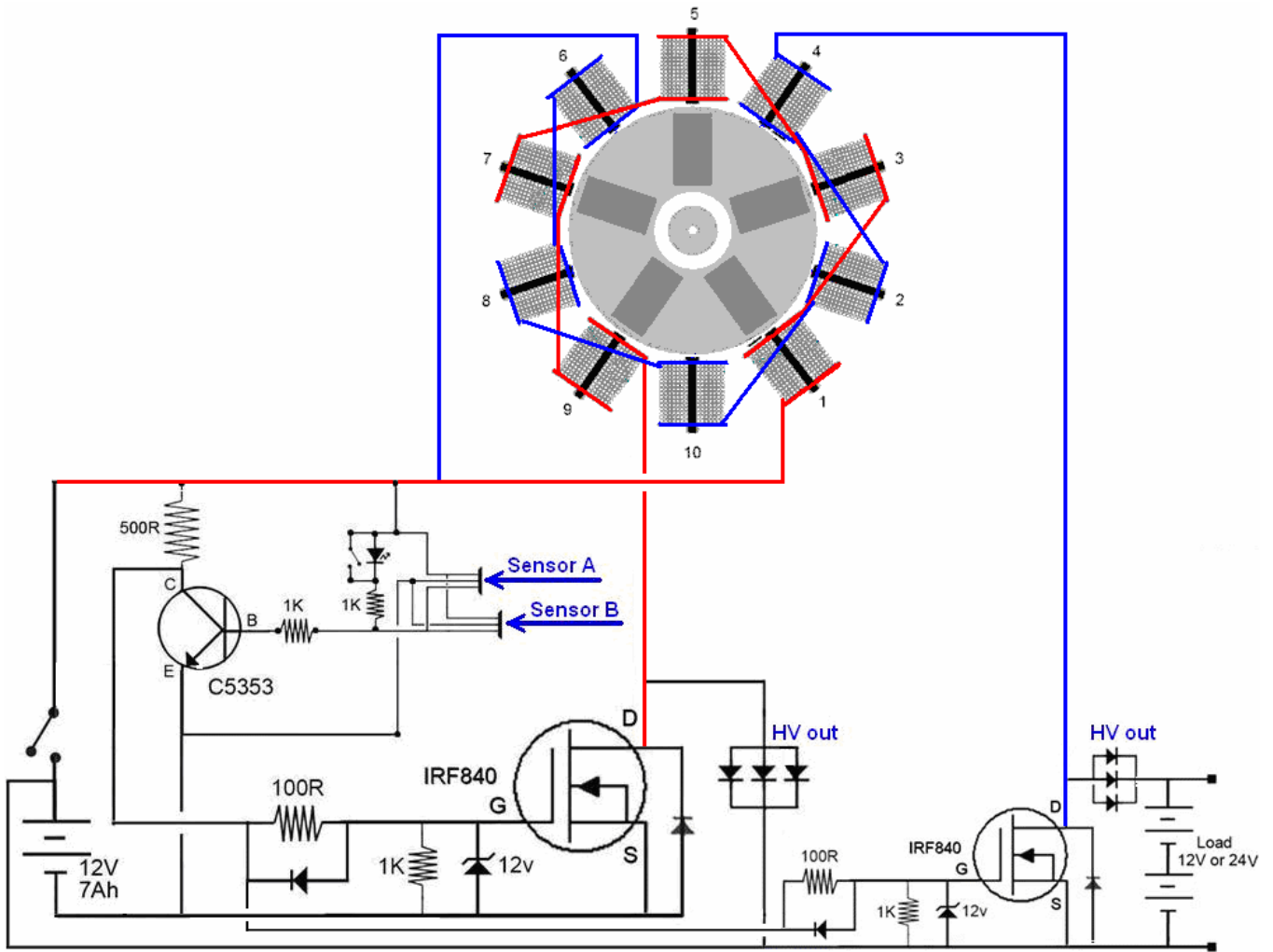


The working space left free around the underside of the rotor is much greater than was available in the earlier designs:

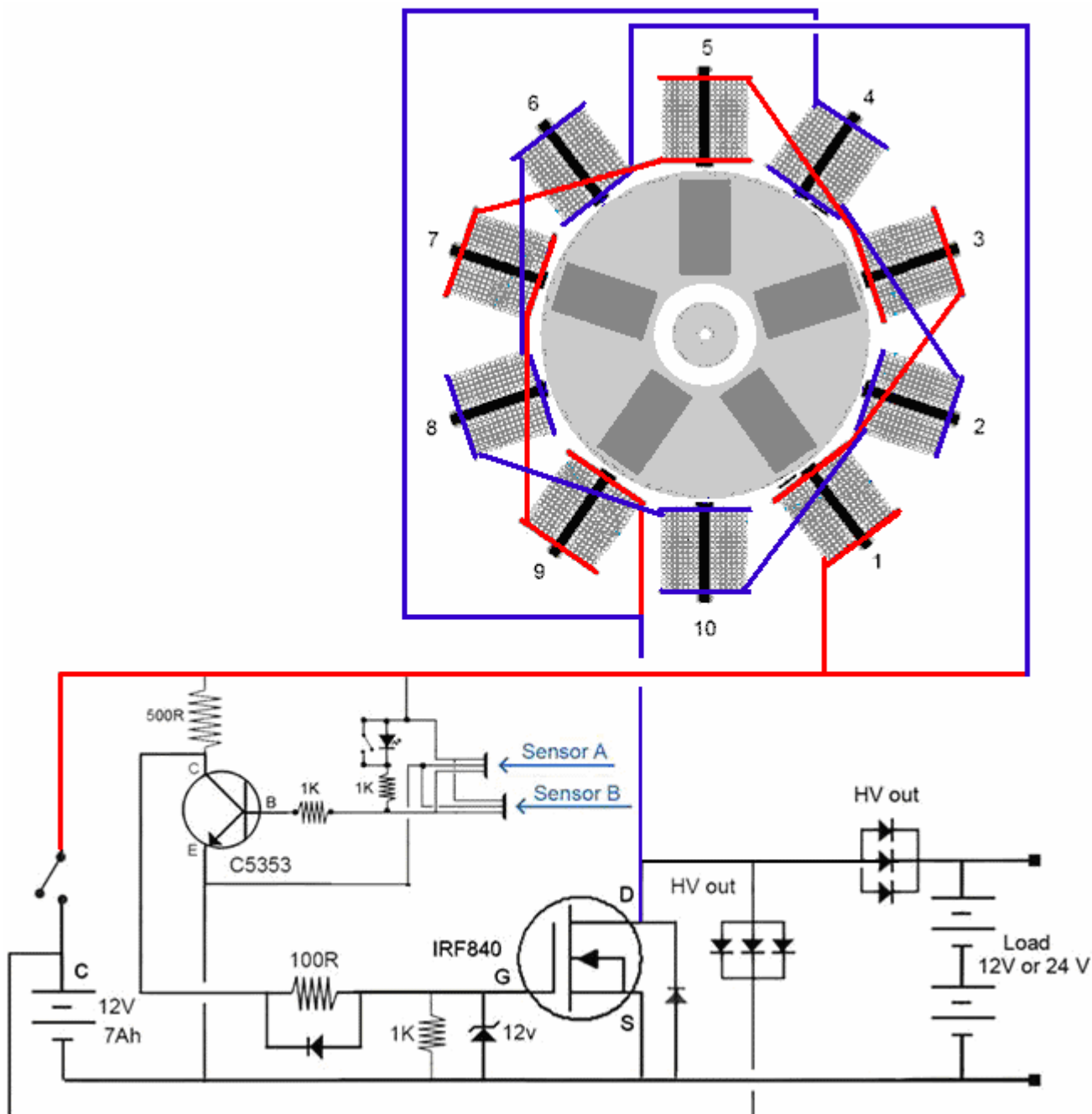


It is important to understand that while the 110 mm diameter rotor has five magnets located at even intervals around its circumference, there are now ten coils on the surrounding stator, and there are now ten pulses per revolution. These pulses are powerful and when the current is cut off, each chain of five coils generates 600 volt spikes (although that can reach 900 volts on occasions).

In this latest design, every second coil is wired in reverse so that it presents a South pole to the rotor magnet, and there are now two Hall-effect sensors, one just before the rotor magnet and one just after the rotor magnet. This allows a simplified circuit with just one drive transistor like this:



As it stands, this circuit can charge 12V or 24V batteries or power a 12V inverter connected across a 12V battery, or 24V inverter connected across a 24V battery. A version of this circuit with fewer components which works very well indeed is this:



The 150-watt Generator Goes Solid State

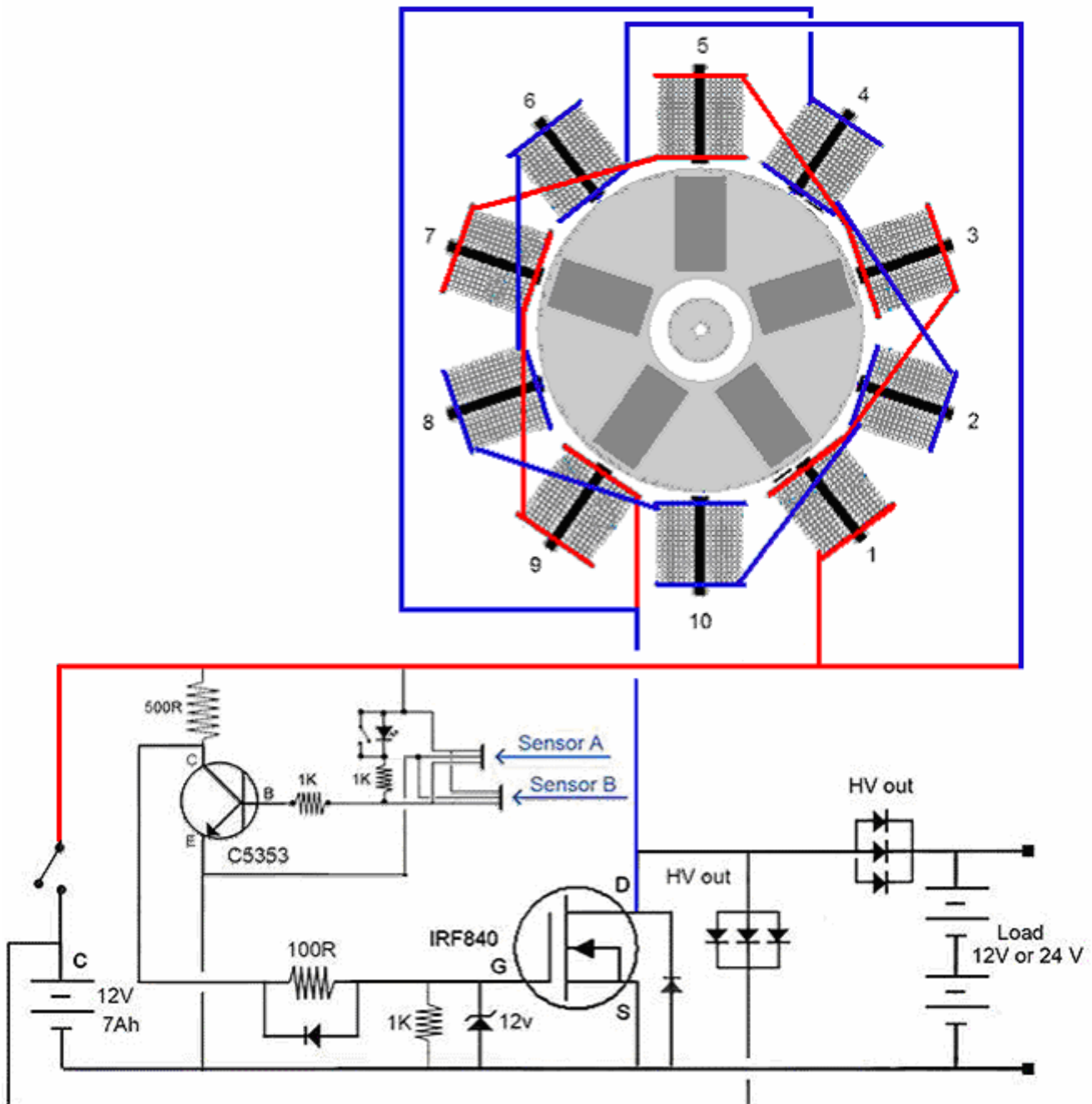
A free-energy developer who lives in South Africa and who prefers to remain anonymous, has very kindly shared the details of his compact self-powered generator so that you can build one if you choose to do so. His design has developed through several stages and reached 150 watts of self-powered output. He used an accurately made rotor with five magnets, spinning inside a ring of ten coils:



His designs are fine for people with good constructional skills and access to suitable equipment. However, it has always been desirable to have a motionless, solid-state version which generates excess power without moving parts or the constructor needing to have good skills and equipment.

This next step comes by applying common sense to the earlier designs which have proved to have very satisfactory operation and output. If the latest rotor version produces ten pulses per revolution and rotates at say, 2500 revolutions per minute, then the circuit generates about $2500 \times 10 / 60 = 417$ pulses per second. That is normally written as 417 Hz which is a low rate for an electronic circuit although it is a major rate of mechanical rotation

The circuit generates its excess power by applying these 417 pulses per second of 12-volts to two chains of five small coils in each chain. The circuit uses two separate Hall-effect sensors and it is like this:



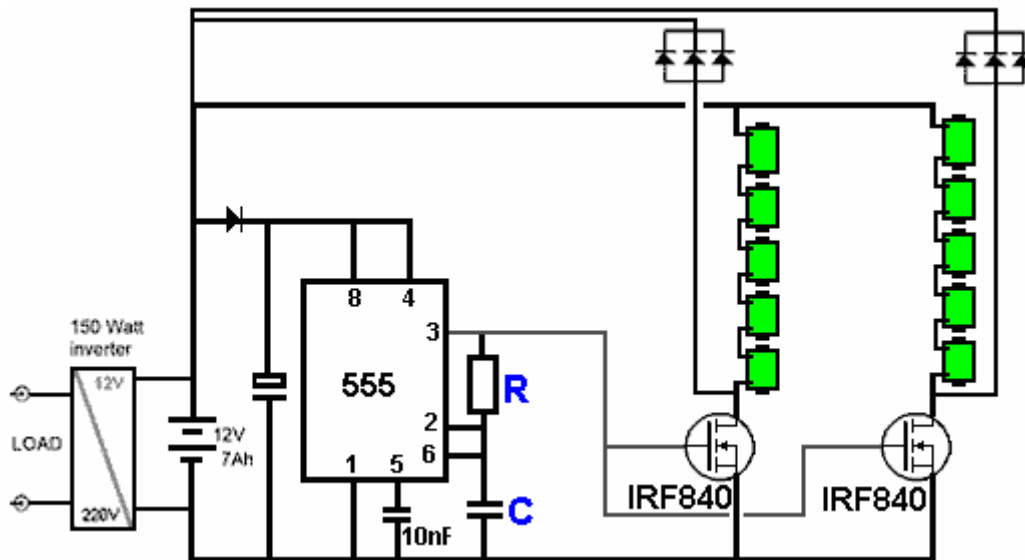
If we want to reproduce this performance without the rotor and its magnets, then we need to apply 12-volt pulses to those two chains of coils 417 times every second. That may sound difficult if you are not familiar with electronics, but in actual fact, it is a very simple task and 417 Hz is very slow operation for an electronic circuit as they could easily generate 3,000,000 pulses per second.

Because we live in an intense energy field, when each of those 12-volt pulses is cut off, the voltage across the coil chain rises very rapidly to more than 600-volts and that causes an inflow of energy into the circuit from our local environment. That inflow of energy is much greater than the original 12-volt pulse, and that is what we call "free energy".

The latest coils used with the rotor system are wound twelve layers deep and 27 mm long, on galvanised iron 6 mm diameter bolts. There is a common conception that iron can't change its direction of magnetism very fast. Personally, I'm not at all sure that that is actually correct, but initially, let us presume that we need to keep the pulsing down to say, 800 Hz or less. Of course, if we are winding coils for this solid state project, then we could wind them on a ferrite rod as the core as that should allow a much higher pulsing rate, and it is reasonable to presume that the greater the number of pulses per second, the greater the average excess output power will be.

Initial tests have been carried out using the existing ten coils which were used with the rotor circuit. The output proved to be satisfactory and pretty much equivalent to the rotor circuit output if the driving signal was 40% On and 60% Off:

Just initially, we will stay with low frequency (due to assumed iron core coil limitations) and run the testing using a circuit of this type:



The resistor "R" and the capacitor "C" control the frequency of the pulsing and the result is very good. However, as the developer has powered both coil chains of his rotor circuit from a single transistor (although they generate at least 600V feedback pulses), he used just one transistor for his tests. He also likes to use his circuit which swaps over two drive batteries, one to provide current while the other one is recharging, but that is a minor matter.

Now that there is no need to construct a precision rotor with magnets, the only significant task is to wind the coils which generate the excess power. It is perfectly possible to wind perfect coils without any equipment at all. First, you need to choose the wire diameter and buy in the wire needed. Wire of 0.71 mm diameter is popular (swg 22 or AWG 21) and is easy to work with. Then you need to choose the core material – iron (not steel) or ferrite and create a spool with that core by attaching stiff flange discs of about 30 mm diameter at the ends of the core for iron. The coils shown here are wound on 8 mm iron bolts with windings 75 mm long, eight layers of wire and 40 mm diameter flanges (which could be much smaller):



Three of these coils can be wound from a single 500 gram reel of 0.71 mm wire and the iron cores can certainly operate at more than 6000 Hz. Each of these coils has about 315 turns and a DC resistance of 1.6 ohms. However, ferrite is generally considered to be a better core for high frequency operation

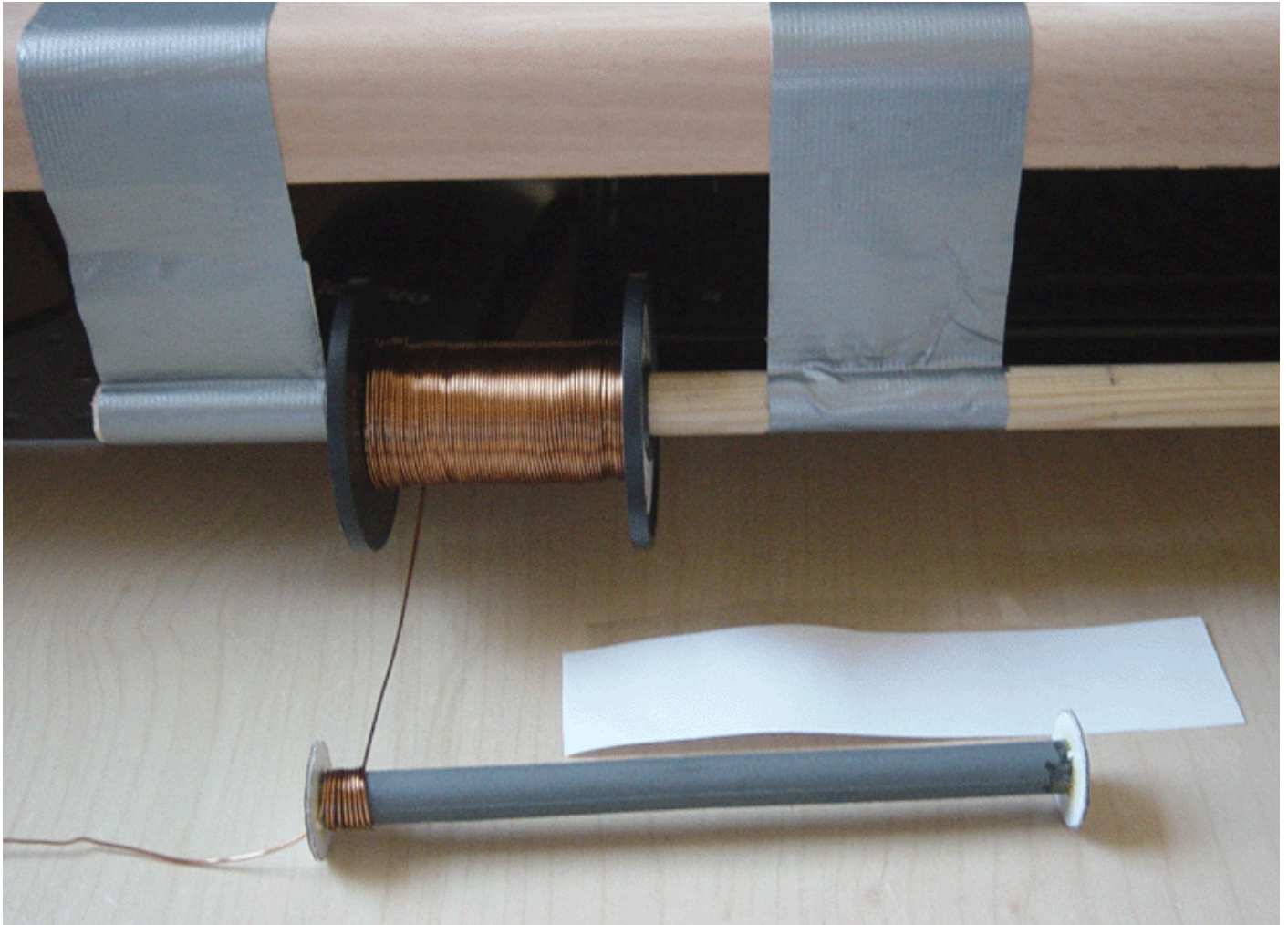
and these can be wound quite easily. Using the same 0.71 mm diameter wire (swg 22 or AWG #21), a 140 mm long ferrite rod of 10 mm diameter can be wound quite easily without any equipment, and six coils with three layers each can be wound from a single 500 gram reel of wire, and each coil has about 590 turns and a DC resistance of one ohm.

The basic ferrite rod has a 20 mm diameter disc of stiff cardboard glued to each end. It looks like this:



Cut a 140 mm wide piece of paper 32 mm long. This width matches the gap between the spool flanges. Attach a strip of Selotape to the paper so that it overlaps by half its width all along the paper strip and set it aside until the first layer of wire has been wound.

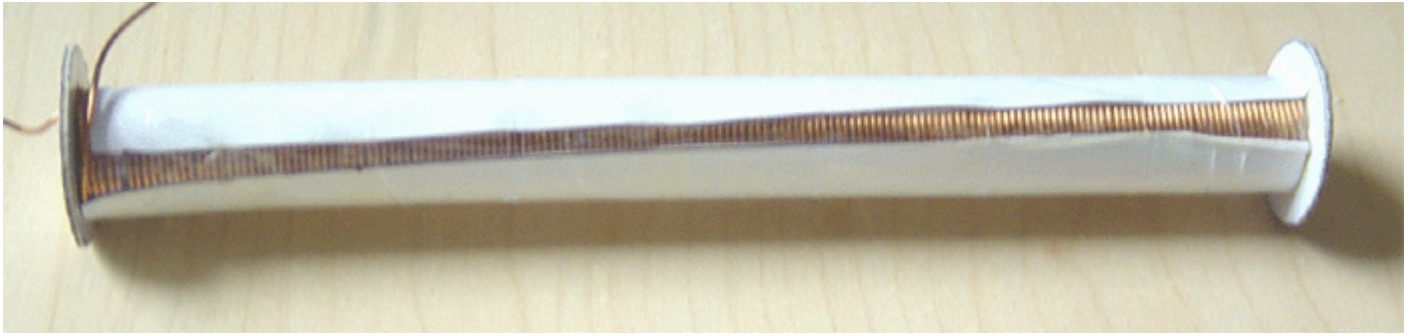
You can hang the full spool of wire on a rod hung from the edge of a table or desk. Push the first few inches of wire through a hole through the flange near the core and start winding by turning the spool in your hand. The winding needs to be done carefully so that the turns lie cleanly side by side with no gaps between them and no turns overlapping any other turn:



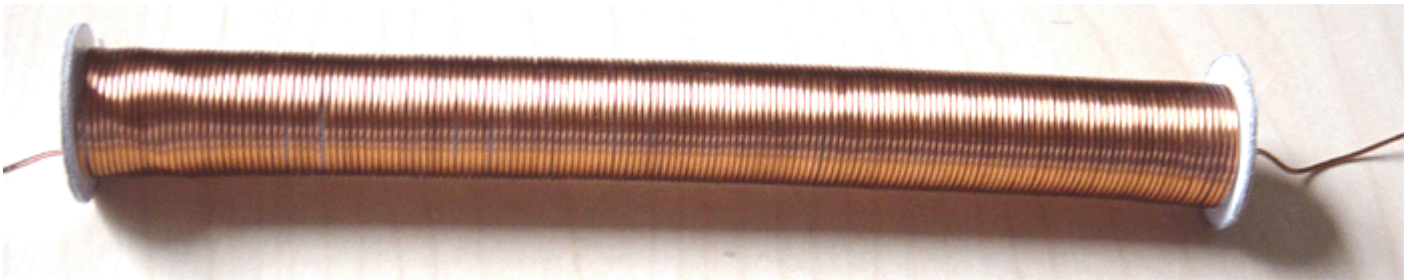
When the far end of the spool is reached, stick the piece of paper to the layer of turns using the Selotape already on the paper, bend the paper round the layer of winds and pull it tight using other strips of Selotape to hold it in place as you move progressively along the length of the spool. The paper will not be long enough to go all the way around the layer as the core now has the wire thickness making the core larger, but that is quite intentional as you don't want more than a single layer of paper. You will need the paper layer to allow you to see the next layer of wire clearly as you wind it. If you don't have that paper layer it is enormously difficult to see the next layer well enough to detect winding errors as the wire is exactly the same colour as the first layer.



You now have a perfectly wound first layer. Before starting the second layer, cut the next strip of paper, measuring 40 mm wide. Stick a strip of Selotape along the length of the paper, again, with half of the width of the Selotape overlapping the paper and set it aside. Wind the next layer in exactly the same way, finishing by sticking and securing the paper around the core with its two layers of wire.



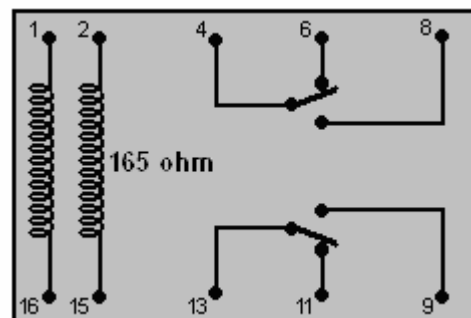
That process is repeated until all of the desired layers have been wound. Finally, the wire is cut with a few inches left for connecting the coil in the circuit, and the wire is passed through a second hole in one of the flanges:



This generator can be built in thousands of variations, the main difference being the coils being used – the core material, the core length, the wire diameter, and the number of layers wound. Each coil should have a resistance of four ohms or more, even if that takes more layers of wire.

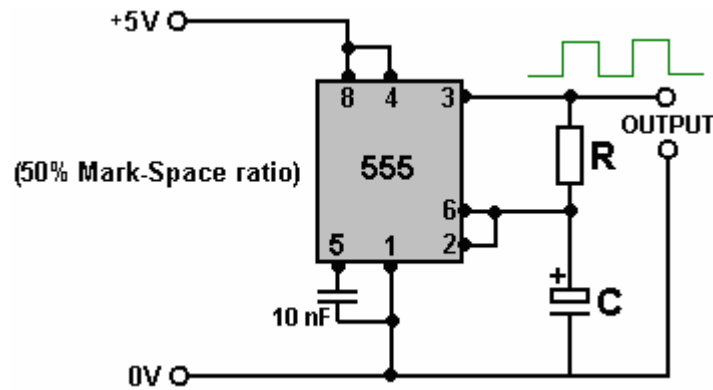
The way that coils perform is not at all obvious. It is generally agreed that the larger the number of turns, the greater the voltage produced when the coil is pulsed. BUT, other factors are also important. The impedance of the coil (it's AC resistance) makes a very big difference when the coil is being pulsed. That is affected by the core material, the wire diameter, the wire material, the number of turns, the quality of the winding, how spread out the turns are, the number of layers, etc. Generally speaking, it is probably best to wind a series of coils and test them to see which works best for you, and then wind the remaining coils to match your best result.

If you wish to use two separate drive batteries, one to power the circuit while the other is recharging, then that is perfectly possible. Batteries which are providing power to a load don't charge nearly as well as unloaded batteries being charged. However, the mechanism which switches between the two sets of batteries needs to have extremely low current draw in order not to waste current. One possibility for that would be to use a latching relay like this:



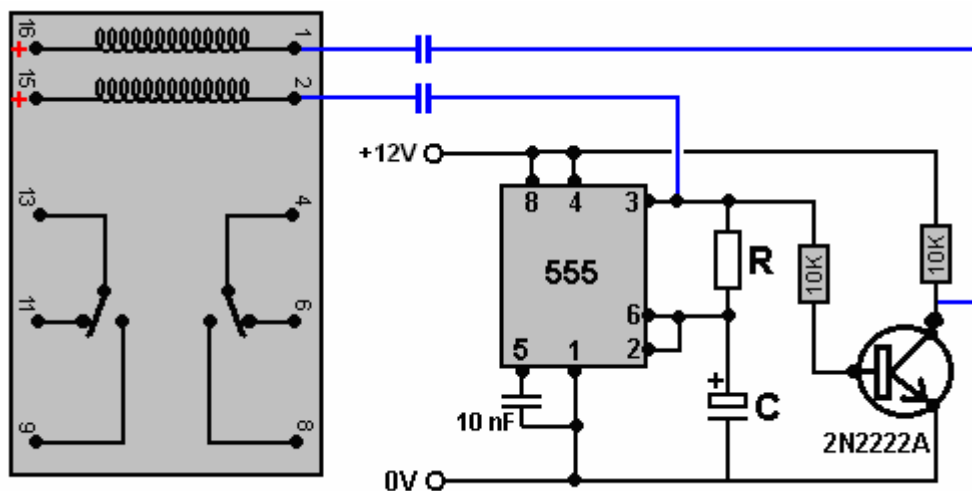
This is the electronic version of a mechanical two-pole switch. A brief pulse of current between pins 1 and 16 locks the switch in one position and later, a pulse of current between pins 2 and 15 locks it in the other position. The current drain on the circuit would be almost zero.

While standard NE555 integrated circuits can operate with a supply voltage down to 4.5 volts (and in practice, most will operate well at much lower supply voltages), there are several much more expensive 555 ICs which are designed to work at much lower supply voltages. One of these is the TLC555 which has a supply voltage range from just 2 volts right up to 15 volts, which is a very impressive range. Another version is ILC555N with a voltage range of 2 to 18 volts. Combining one of those chips with a latching relay produces a very simple circuit as the 555 timer circuit is exceptionally simple:



The capacitor used has to be high quality with very low leakage in order to get this waveform which is On for exactly the same length of time as it is Off. This is important if we want the two batteries to receive the same length of time powering the load as the time they receive being recharged.

A weakness of the 555 chip timer from our point of view is that it has only one output while we need two outputs, one falling when the other rises. That can be arranged by adding a transistor and a couple of resistors like this:

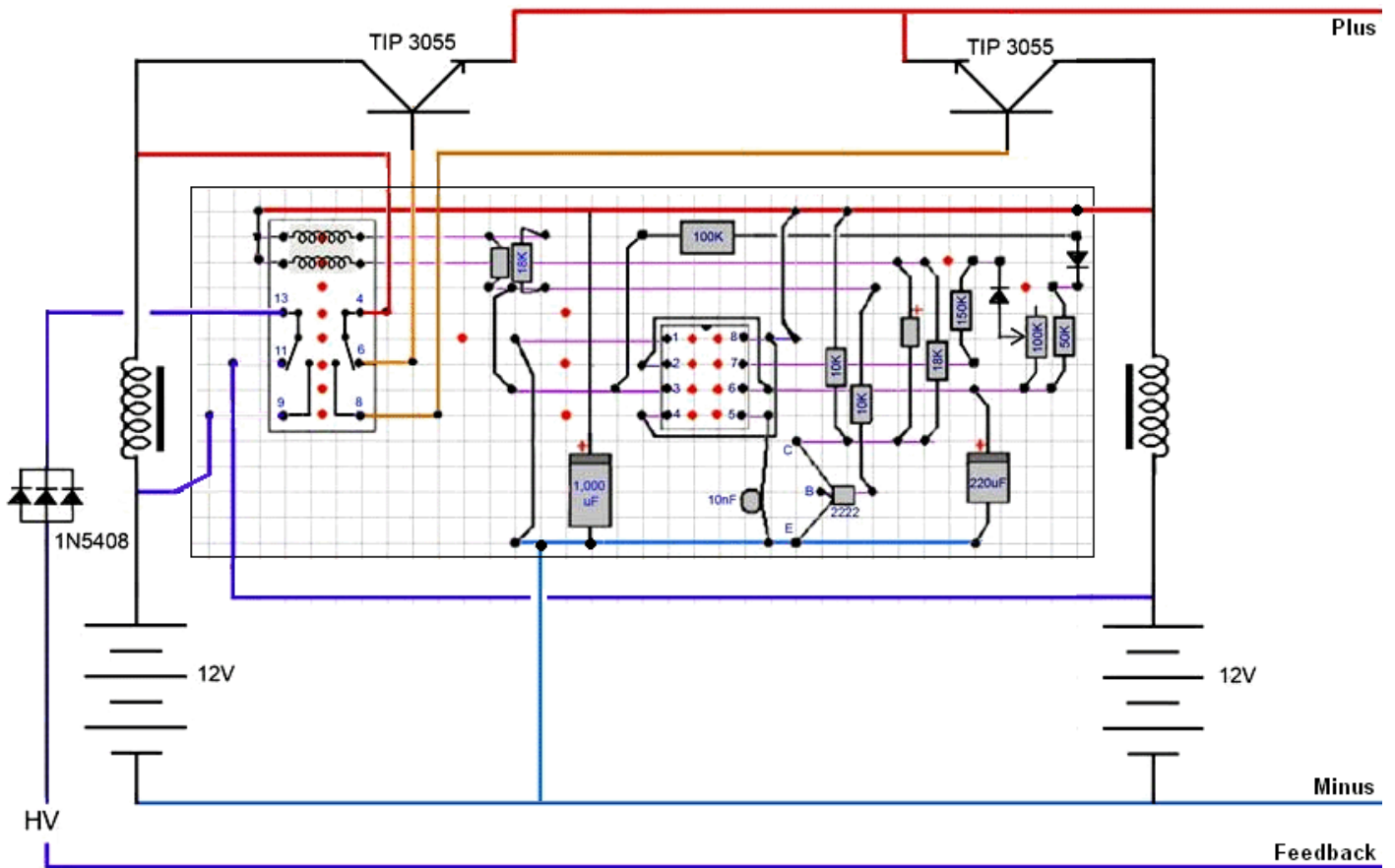


With this circuit, when pin 3 of the 555 chip goes low, the capacitor connecting it to pin 2 of the relay pulls that pin 2 voltage low and causes the relay to change state as the relay pin 15 is connected to +12V, causing a current surge through the coil as the capacitor charges. A few moments later, when the capacitor has charged up, the current drops away to zero. Five minutes later pin 3 goes high again and that switches the transistor on causing its collector voltage to drop rapidly to near zero. That pulls pin 1 of the relay down low causing it to change state before the capacitor has a chance to charge up.

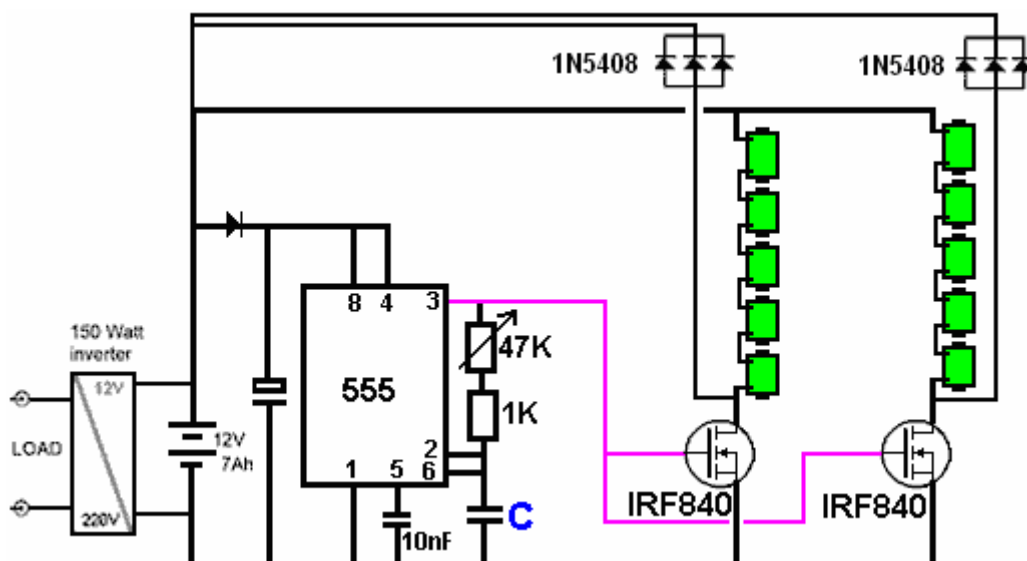
This is fine if the capacitors shown in blue are poor quality and their charge bleeds away in a period of five minutes. Nowadays, even cheap capacitors are generally much too good quality to allow that to happen and so we need to connect a resistor across the capacitor to create that drop in charge. But that additional resistor is connected continuously and so it needs to be of a high enough value not to

waste any significant current – perhaps 18K would be a reasonable choice. An 18K resistor with twelve volts across it draws only 0.667 of a milliamp of current.

So, if we prefer, we could use this circuit, perhaps laid out like this:



The TIP3055 transistors are there only to raise the current carrying capacity of the tiny latching relay. Let's decide to build a very simple version of the circuit but allowing for later expansion for greater output power. Let's try this circuit arrangement:



This arrangement allows for considerable alteration of the operating frequency by merely turning a knob. Experienced constructors will have their own preferred methods of construction, but we might choose to use a layout on an open board in order to make it easy to see what is happening and to give good cooling during the development stage.

This arrangement keeps soldering to a minimum and allows for easy alterations as the circuit is extended for higher output power. The timer board can be swapped out later on if you decide to use a Divide-by-N style of operation.

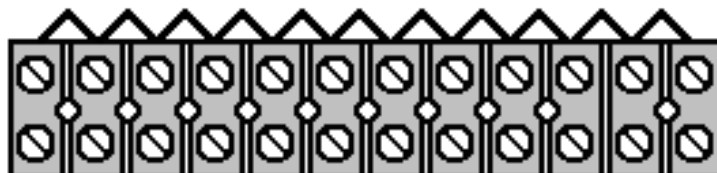
Two types of screw connectors are used. One type has all of the connectors connected so that many wires can be connected to a single point. They look like this:



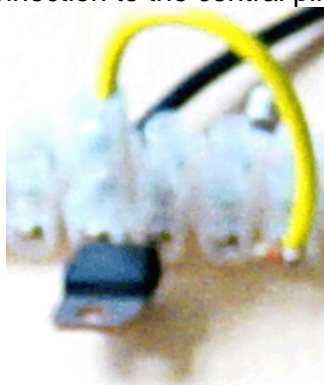
Unfortunately, these connectors cost about £5 each which is several times more expensive than the standard connector which has each connector insulated from all of the other connectors in the block:



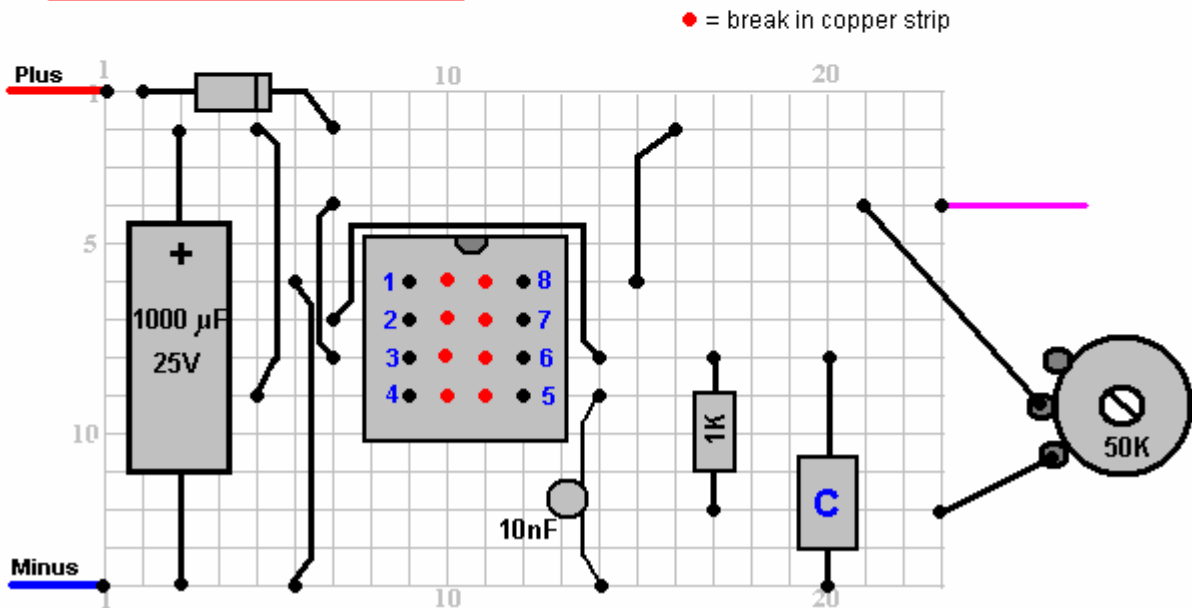
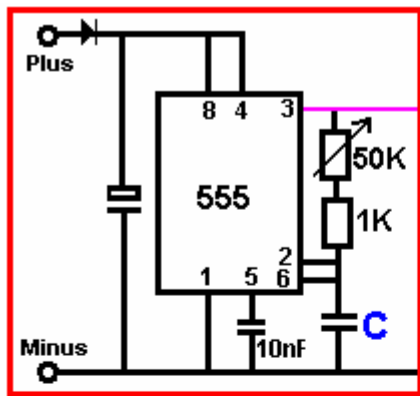
If cost is a major factor, then a standard connector strip can be converted to a single multiple output strip by wiring one side with a thick piece of wire like this:



We have a problem with connecting the FET transistors because their pins are so close together that they don't fit conveniently into a screw connector block. We can get around that problem by cutting one connector off the block, bending the central pin of the FET upwards into a vertical position and using the single cut off connector to make the connection to the central pin of the FET:



The layout of the timer is not at all critical and a layout like this might be used:



The capacitor "C" will be about 10 nF and the variable resistor can be 47K or 50K linear or a higher value could be used.

So, if you were going to build this generator, how might you go about it? Well, you might start by building the timer board shown here, either as shown or to your own layout. I strongly recommend using a socket for the 555 timer chip as transistors, Integrated Circuits and diodes can easily be damaged by heat if they are not soldered quickly. As the generator is for your own use, you can avoid the horrible lead-free solder which is so difficult to work with and I suggest that 0.8 mm diameter multicore solder is the right size for this work. So, to construct the timer board you will need:

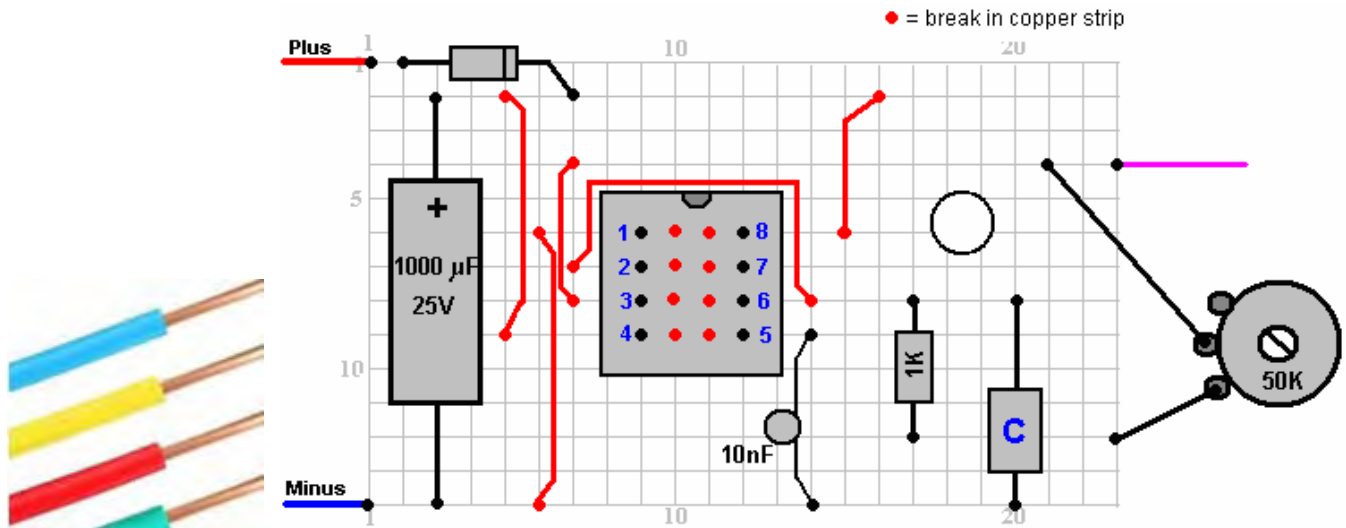
1. A soldering iron of about 40 watts, and 0.8 mm cored solder.
2. Stripboard ("Veroboard") with 14 strips each with 23 holes.
3. A drill bit or a knife to break the copper strips which run between the pins of the 555 chip.
4. One 8-pin Dual-In-Line socket for the 555 chip.
5. Some solid-core plastic covered wire to form the jumpers on the board.
6. The components: One 555 chip, one 8-pin socket, one 1000 microfarad 25V capacitor, two 10 nanofarad ceramic capacitors, one 1K resistor, one 50K or 47K or higher linear variable resistor, one diode which could be 1N4007, or 1N4148, or almost any other diode.
7. A magnifying glass of some description. A cheap plastic one can be quite sufficient. This helps greatly when examining the underside of the board to make sure that solder joints are well made and that there is no solder bridging between adjacent copper strips.
8. A cheap digital multimeter for measuring voltages and resistance.

Not essential but very, very convenient is one of those angled arm clamping devices which are usually supplied with a magnifying glass. If you discard the magnifying glass, the angled arms can hold the board and component in place, leaving both hands free to do the soldering. A cloth wet with cold water

is very good for cooling down soldered joints rapidly to prevent heat damage.



Start by breaking the copper strip in columns 10 and 11 on rows 6 to 9. This is needed in order to prevent the strips short-circuiting the pins of the 555 chip. Mount and solder the 555 socket in place (if you bend the legs outwards along their strips it holds the socket in place and makes for a good solder joint). Then, cut solid core insulated copper wire to the correct lengths and solder the five wire jumpers on the board:



Then work from left to right, mounting the remaining components. The capacitor “C” has got a lot of spare space around it so that it can be altered at a later date if you decide that you should.

Finally, connect the variable resistor (which many people mistakenly call a “pot”) and the positive and negative connecting wires using multi-strand copper wire as that is much more flexible, and lastly, the connecting wire from pin 3 out to the distribution block which connects to the FET gates. Check that the circuit has been connected correctly and that there are no soldering errors on the underside of the board – this is much easier with a magnifying glass as the gaps are very small.

Set the variable resistor shaft to about its mid position, connect the board to a 12-volt source of power and measure the voltage coming from pin 3 of the 555 chip. The voltage should be about half of the supply voltage and should not change much when you adjust the variable resistor.

Please understand that this presentation is for information purposes only and it is not an encouragement for you or anyone else to actually build one. Also, no representations are made that this design will produce any particular level of output power.

Patrick Kelly

www.free-energy-info.com

www.free-energy-info.tuks.nl

Video: www.youtube.com/user/TheEngpjk/videos

Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 7: Using a Pyramid

Using a pyramid is generally thought to be a “wacky new-age nonsense” thing but that notion is just a demonstration of ignorance on the part of the general public. We live in an intense energy field and we can manipulate that energy field with high voltage spikes to get an inflow of energy which we can use as electricity.

If we align the molecules of a suitable material we can create a permanent magnet. That can be done in a tiny fraction of a second, but the magnet produced by that very short pulse can support its own weight against gravity for years on end if you place it on a metal fridge. The magnet has no power but it is configured in such a way that the energy field flows through it creating the force which we call magnetism.

However, if we don't manipulate the energy field and just let it flow naturally, we find that it is affected by various shapes. Do you seriously think that the people who built the great pyramid of Giza just used that shape because they thought it was “pretty”? Not at all, it is that shape because of the effect that shape has on the energy field (provided that it is aligned correctly with magnetic North).

This chapter is about using free-energy indirectly. Our massive universal energy field carries life force and so, if we concentrate it with a suitably shaped structure we can get serious gains. For example if you grow tomatoes without using a pyramid, then you can get 10 to 14 pounds weight of tomatoes per plant. However if you grow the same plant inside a pyramid the yield can be 40 to 50 pounds of tomatoes from the plant. That is an increase of at least three times for no extra physical effort other than picking the extra weight of fruit.

It has been found that an old pet in poor health can be revived and have dramatically improved health by getting them to sleep under a pyramid shape. There are reports of instances where dogs suffering from old age, lameness and hair loss have been cured and rejuvenated in about six weeks by the use of a pyramid. Pests can be discouraged by using a pyramid. If food is placed unwrapped underneath an outdoor pyramid, ants head for the food but veer off before reaching it and exit the pyramid without ever reaching the food.

A pyramid has a major effect on land in that it alters the water table, drawing up water through the ground so that plants get just enough water for good growth and yet never get flooded with excess water.

One feature of a pyramid which does not appear to be widely known is the fact that it can return Genetically Modified seed to it's original condition. That is, if Monsanto modifies seed so that it no longer produces seed for the next generation of crop, then storing that seed in a pyramid can return the seed to its original state where it now produces crops which have healthy seed as was originally the case.

I am not familiar enough with the technology of the flow of our universal energy field in order to be able to explain it adequately, so the best I can do is to tell you of the experiences of Les Brown of Canada who has used a pyramid for some years. In spite of the harsh Canadian winters, Les gets six crops per year and each crop is three or four times larger than he would get without a pyramid. He estimates that he gets 36 times more crop yield with a pyramid than without one.



The best shape is that which matches the dimensions of the Great Pyramid, whose faces slope at an angle of 51 degrees, 51 minutes and 10 seconds. Pyramids with other slopes will work, but not quite as well.

Les Brown says: My test pyramid is 30 feet (9144 mm) high at the peak. The sides from base corner to peak are 44 feet 4.5 inches (13536 mm) and the base sides 46 feet 10.5 inches (14288 mm). It contains two additional floors above the ground level. The floor area of those floors equals the area of the ground level, virtually doubling the growing area.

My first floor is 12 feet above the ground and there is a reason for this. I calculated that when the sun was at its highest point, the first floor would have to be 12 feet high to allow the sun to shine on to the back North edge of the ground floor. The 12-foot height was perfect but not absolutely necessary as there are as many plants which grow well in shade as those that prefer the sun. In future, my pyramid floors will all be 8-feet apart and I will put my sun-loving plants in the southern half and my shade-loving plants in the back northern half.

By placing the floors at 8-foot intervals there is much more growing area. With floors inside a pyramid, the higher up the floor is, the higher the temperature there. For example, if the ground floor is at 75°F, then the second floor would be at 90°F and the third floor would be about 105°F to 115°F. Each of the higher floors also have higher humidity. The ground floor is perfect for such crops as radishes, lettuce, carrots, beets, tomatoes, etc. The second floor is ideal for cucumbers, squash, peppers and plants which like it hotter and more humid than the ground floor. The top floor can be used for lemons, oranges, (in Canada!!), figs and especially orchids.

The pyramid draws in its own water on the ground floor; I have never had to water that level which is built directly on the ground. It never draws too little or too much, always just the right amount for growth. Naturally, I have to pump water to the upper floors, but because the ground floor provides its own water supply, at least half of my pyramid is watered automatically for no cost. I grow right in the ground on which the pyramid stands, but upstairs I have placed wooden planting troughs all around the floors, leaving room to walk, and I grow plants in these. It is a major job getting soil to the upper floors initially, but that is only a one-time task. The troughs are 14 inches wide, 16 inches deep and have a bottom.

Space in the pyramid is used to the utmost. At the perimeter of the low areas I plant the kind of plants which need little headroom, and then plant the bigger crops towards the middle. This is a matter of common sense, but using vine type tomatoes and stringing them up, one can work better between the rows, and if the lower leaves are removed, there is sufficient space to grow lettuce, cabbage or any low-lying crop in between the tomato plants. The trusses may be left

on the tomatoes as they will not shade the low-lying plants. To ensure a steady supply of food, it is wise to plant only a few plants of each variety at intervals, which means that in the beginning it will take several weeks to reap a full harvest, but after that there will be a continuous yield. By planting in such a manner, the grower will reap about six full crops each year. This method only applies to an enclosed pyramid, which would also need heating in the winter. The means of heating is up to the individual. Personally, I use a wood-burning stove because I have my own supply of wood. However, a wood and oil combination is best because it allows one to be away for a couple of days when necessary and then if the wood fire gets low, then the oil burner takes over.

In addition to food growth, the pyramid also has application in food preservation. I have read that 40% of all food grown in my home country of Canada is lost to putrefaction. This state of affairs can be remedied. The energy of the pyramid which grows plants so amazingly well, can also be used for the mummification of food which can be dried and kept in storage for an indefinite period without losing any of its taste or nutritional properties. There are absolutely no ill effects on any food stored in a pyramid. In fact, in many instances it is far better when reconstituted than it was in the first place. It has the water taken out of it, but it also repels bacteria and as a result, nothing will rot in a pyramid. For instance, I cannot make a compost heap inside my pyramid; I have to do it outside, otherwise the ingredients in the compost all remain in good shape and will not break down. The grain grown in Manitoba today is a direct descendant of the grain found in the Great Pyramid, grain that had been there for centuries and which had kept perfectly.

My pyramid is made from rough-sawn timber, cut on and near my property and milled by a neighbour. But it is not necessary for pyramids to be made of wood. They can be made of any rigid material which will support permanent glazing: cardboard, strong wire, sheet steel or other metal, angle irons, logs – anything which will not curve and which can be measured precisely and fitted.

Pyramids do not have to have solid faces. For many uses, open-sided shapes will do, so long as all the corners are joined and the angles are correct. My present pyramid is made of timber and covered with heavy-gauge plastic sheet. Future ones will be made sheathed in fibreglass, acrylic or glass. They will be closed pyramids solely because I propose to grow food during the depths of Canada's frigid winters. My pyramid frame is built mainly of wood measuring two inches by four inches and two inches by eight inches rough sawn. Pyramids can be built any size as long as the proportions are correct.

Cucumbers grown outside each average one pound in weight while those grown inside the pyramid average four pounds each. Tomato plants average 10 to 14 pounds per plant outside while 50 to 60 pounds per plant inside. Cabbages grown outside weigh 3 pounds while inside they are 12 to 13 pounds each. Inside, radishes grow to 4-inch diameter, lettuces are two to three times larger, beans grow to 25 inches long and 1.25 inches wide.

Growing times are the same but the pyramid draws water up out of the ground as needed, gets rid of pests and prevents decay of any type

It is very important that a pyramid has one of its base sides aligned exactly North-South, and a compass is needed to align the pyramid exactly.

Patrick J Kelly
www.free-energy-info.com

Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 8: The Donnie Watts Generator

Donnie Watts has designed a simple generator which is capable of providing enough electrical power to meet the needs of a typical household.

The design is based on well known principles and this engine runs cold and is simple enough for many people to be able to build one. The output power increases with rotor diameter and with rate of spin and so in order to stop the device accelerating until it destroys itself, an inflow valve to limit the water entering the rotating cylinder, or other effective means of speed control is an important requirement.

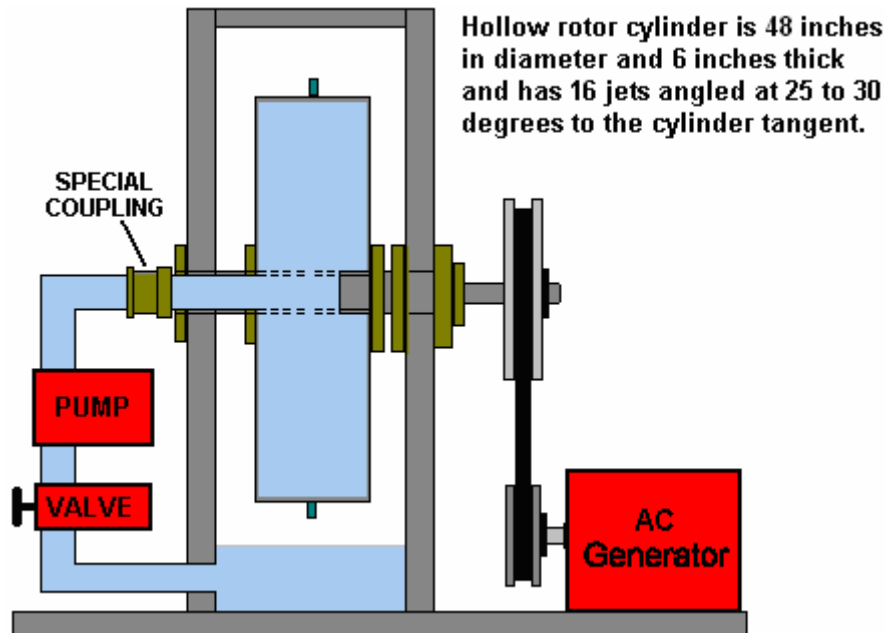
What needs to be understood very clearly is that this is an **exponential** power engine. The output power is proportional to the **square** of the rotation speed, so double the revolution speed and you quadruple the output power. Also, the output power is proportional to the **square** of the rotor diameter, so double the diameter and that quadruples the output power. So, if you double the rotor cylinder diameter and you double the rotation speed, the output power goes up by a factor of sixteen times. The basic Coefficient Of Performance for the design is four. That means that the output power is always at least four times greater than the input power.

This information comes from two separate patents. The first was in 1989 and shows a generator which could be built by most people. The second was three years later and is much more complicated, suggesting mechanical methods of controlling the rotor speed. I suspect that few people would be able to build the later design. Both patents are shown at the end of this document. However, I will concentrate on the simple version so that you have a chance of building it yourself.

Donnie Watts says that initially, it is necessary to start the device with a water pump, but when the rotation reaches 60 rpm the device no longer needs the water pump although it can be left running if desired. At 60 rpm, the pressure inside the rotor drum reaches the point where the suction caused by the water passing through the rotor jets creates sufficient suction to maintain the operation. **But**, remember that this is a positive feedback system, with an increase in speed causing an increase in power, an increase in water flow, an increase in speed of rotation, and consequently, the engine will runaway self-powered and if you are not ready for that with a throttle on the rate of water flow into the cylinder, then the engine is perfectly liable to accelerate to the point where internal pressure damages the engine, probably causing the rotor drum to leak.

However, it occurs to me that an alternative way of starting the generator would be to spin the rotor with an electric motor temporarily attached to the output shaft of the device, or possibly even with a manual starting handle like early cars used.

Anyway, in broad outline, Donnie originally showed the design is like this:

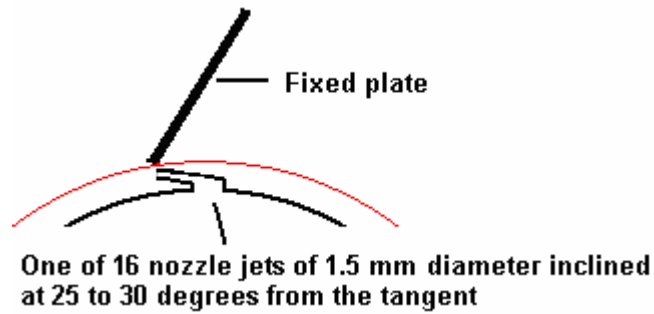


The circular rotor has water (or whatever fluid you decide to use) pumped into it by the pump. The “special coupling” has one side stationary and the other side able to rotate. The water entering the drum squirts out through angled jets on the circumference, causing the drum to rotate. Once the drum gets past one revolution per second, the water squirting out of the jets draws in more water and the system becomes self-powering. The water from the jets collects in the bottom of the sump housing which supports the axle and is then ready to be fed back into the drum again.

Most generators require to be spun at 3000 rpm or slightly faster. That speed can be achieved by the belt gearing between the output shaft and the generator’s input shaft. A generator of that general type could look like this 5 kilowatt alternator costing £325 in 2018:



However, the output power of this design is said to be further increased by the inclusion of thrust baffles on the inside of the housing. The idea is to have the jets of water strike a fixed surface at right angles to the jet and as close to the jet nozzle as possible:



However, the later patent points out that while the jets always apply their thrust to the rotor drum no matter what speed it is rotating at, once the drum gets up to speed, the fluid coming out of the jets is nearly stationary relative to the sump and so these baffle plates would only be helpful when starting from stationary.

Let me stress that this device is effectively a fuel-less engine with a substantial power output. It can be built in various different configurations.



The 1992 patent is shown at the end of this document, but due to the difficulty of constructing that version, I will stay with the original construction which has the axle shaft horizontal and so the axle and drum weight do not apply a sideways load on the bearings.

Donnie Watts shows a 48-inch (1220 mm) diameter rotor drum. Inexperienced constructors almost always decide that instead of constructing what is shown, that they will "improve" the working design by changing it to their own ideas. That almost never works, and what they are testing is their own design and not the design which they are trying to replicate.

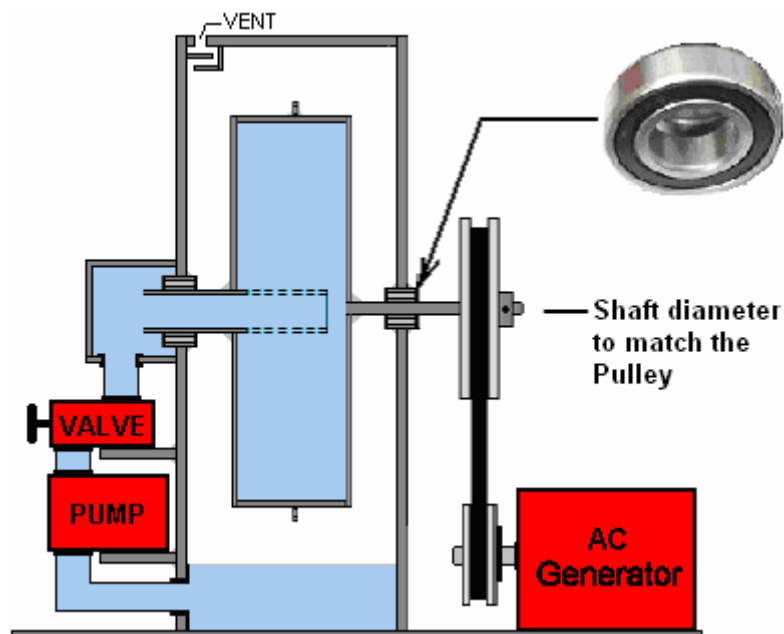
For example, the pipe feeding water to the drum is specified as being 3-inch (75 mm) diameter. An inexperienced constructor chooses to build a smaller diameter drum and so decides to reduce the supply pipe diameter to 1-inch (25 mm). No, no, no! This is a very, very important component which must NOT be changed. Just because you decide to use a smaller drum does not also scale down friction nor the difficulty in pushing water through a pipe.

A 75 mm diameter pipe has a cross-sectional area of 4417 square millimetres. While a 25 mm diameter pipe has a cross sectional area of 490 square millimetres, which is only 11% of the 75 mm diameter pipe. In other words, to match the 75 mm diameter pipe's capability, you would need **ten** 25 mm diameter pipes to carry the same flow. Donnie also stresses that the inlet pipe **MUST** have nearly twice the cross-sectional area that all of the jets have combined. The later patent appears to raise that factor to 8 times the sum of the jet openings.

If you find this hard to believe, then take a one-meter length of ordinary garden hosepipe and try to blow air through it. Although the pipe has a diameter of 12 mm or so, you will see how hard it is to blow air through it. If you build the generator with a 1-inch diameter pipe between the pump and the drum, then you probably will not get the rotor over 300 rpm as that is the equivalent of throttling the pump down to 10% of its input capability.

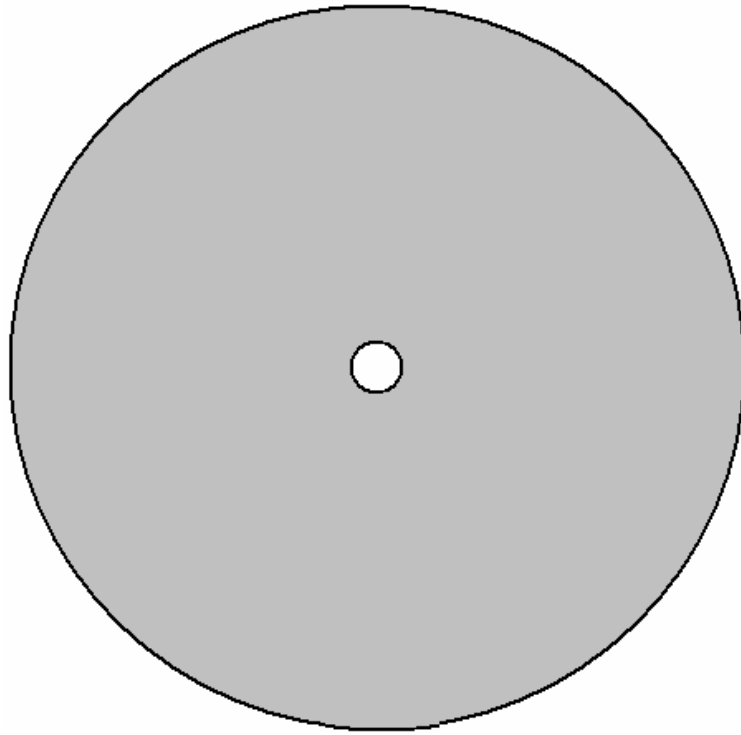
The smaller you make a Donnie Watts generator, the more accurate your construction has to be. For that reason, I strongly recommend that to make the drum at least 1 metre in diameter.

An American developer Rick Evans has come up with a way to avoid the need for a special supply hose coupling and his method looks like this:

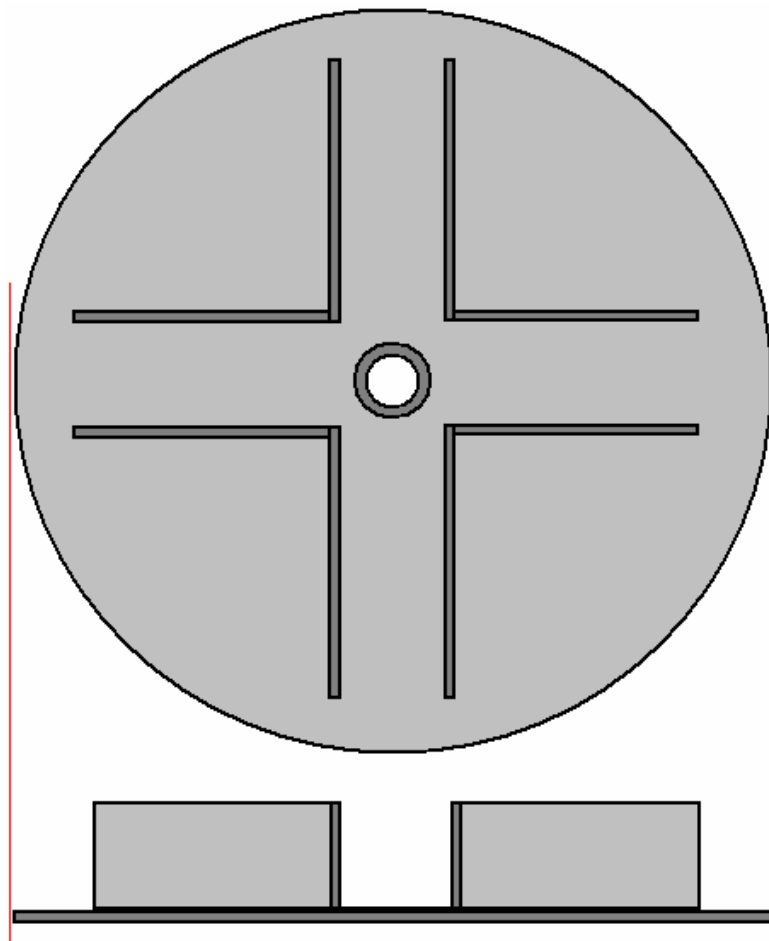


This is a very clever solution with the 3-inch diameter pipe being supported by an ordinary ball or roller bearing. If any liquid were to leak through the bearing, then it ends up in the sump, ready for circulating again.

There are many different ways to construct a Donnie Watts generator. The method shown here is merely a convenient method of construction using 3 mm (1/8 inch) thick mild steel and a welder. The diameter of the rotating drum can be whatever you choose but the output power increases with the square of the diameter, so if you double the diameter the output power becomes four times greater. This example will be based on a 1-metre diameter. You start by cutting out two discs, one with a 3-inch diameter central hole and one with a central hole of the size needed for the axle of your pulley wheel:

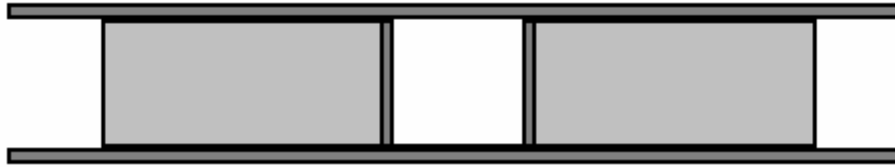


Then you weld on eight rectangles of steel 144 mm wide to the disc which has the smaller hole:



These strips are to channel the water (or other fluid such as transmission fluid) as it passes through the drum when the generator is operating. There must be at least 50 mm (two inches) clear between these plates and the edge of the disc to allow easy flow of water past the plates.

The 144 mm depth of the plates allows clearance for the second disc to be welded in place to form a drum. Seen from the side, it looks like this:



And then the outer rim of the drum is welded in place:



If you have never built anything in steel, let me assure you that it is not a difficult thing to do, and yes, I have built in steel, starting as a total beginner. However, while mild steel is easy to work and weld, stainless steel is much, much more difficult, so avoid stainless steel. Steel pieces are cut and shaped using an angle grinder like this:



And while the picture shows a handle sticking out of the side of the grinder so that you can use two hands, it is generally more convenient to remove the handle and just hold the grinder in just one hand as it is not heavy. When working steel, wear a pair of “rigger” gloves which are strong, reinforced gloves which will protect your hands from sharp steel edges and always wear eye protection.

If you are going to be drilling steel, then a mains powered drill is needed as battery-powered drills are just not up to the job unless it is just a single hole. When drilling steel it is helpful to have an additional hand grip.



With the drill shown above, the hand grip clamps on to the ring just behind the chuck and can be set at any angle. Steel pieces are joined together by welding. Some welders are quite cheap. Most types can be hired for a day or half a day. It is also possible to shape the pieces and have a local steel fabrication workshop weld them together for you and making a good welded joint takes only a second or two. The really vital thing is never look at a weld being made unless you are wearing a welding visor or welding goggles, as you can damage your eyesight looking at a welding arc without protection.

If you decide to buy a welder, then be sure to get one which will run on your house mains supply, otherwise you have to upgrade your house wiring to carry the higher current. This welder would be suitable, and at the start of 2016 it costs only £60 including tax which is about 82 euros or US \$90.



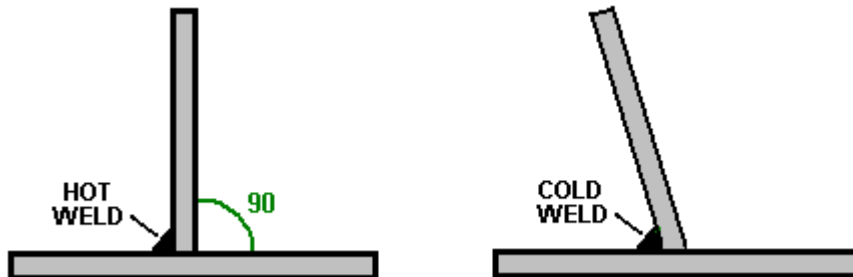
With this “stick welder” the silver clamp on the right is attached to the metal to be welded and a 2.3 mm diameter coated welding rod placed in the black clamp on the left. The stick is then applied to the welding area and the coating on the welding rod becomes a gas cloud, shielding the hot metal from the oxygen in the air. When the weld has cooled down, there may be a layer of oxide on the outside of the joint and so the back of the wire brush is used as a hammer to break up the layer and the wire brush used to scrub the joint clean.

However, the most important item of equipment for anyone doing welding work is a protective helmet. There are many different designs and widely varying costs. Many professional welders choose one of the cheapest types which look like this:

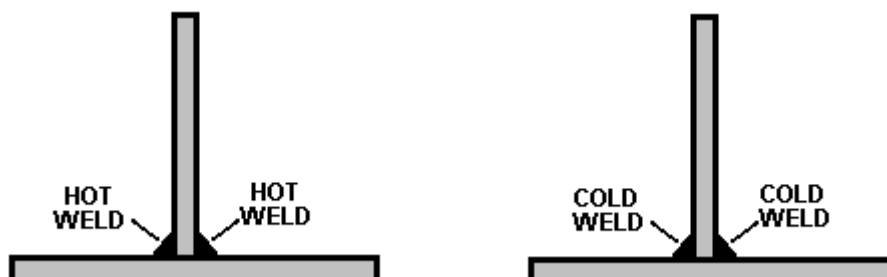


This type has a clear glass screen and a hinged safety filter to allow safe welding. Professionals adjust the hinge tension so that the filter can only just stay in its raised position. The welder then positions the joint pieces in their exactly correct position while looking through the plain glass, and when ready to start the weld he just nods his head which makes the filter drop into place and the weld is started. Never, ever, try welding without proper eye protection.

Welding is easy to learn and it is a brilliant method of construction ... but it has one major problem. When a joint is made the two pieces of steel melt and merge together. This can happen in a tenth of a second. Don't put your finger on the joint to see if it is still hot, if it is, then you will get a painful burn and that should remind you not to do that again. That heat is the problem, because when steel gets hot it expands, and when it cools down it contracts. That means that if you were to set up a piece of steel at exactly a right angles and weld the pieces together then as the joint cools down it contracts and pulls the joint out of alignment:



Please don't imagine that you can just push the vertical piece back into position as that isn't going to happen because the joint is instantly very, very strong. Instead, you use two quick welds of equal size, with the second one being 180 degrees opposite the first one:



Then, as the welds cool down, they pull in opposing directions and while it produces stresses in the metal, the vertical piece stays vertical. Let the welds cool down in their own good time, taking perhaps ten minutes to cool properly. Do **not** apply water to the welds to speed up the cooling as that actually alters the structure of the steel and you really don't want to do that.

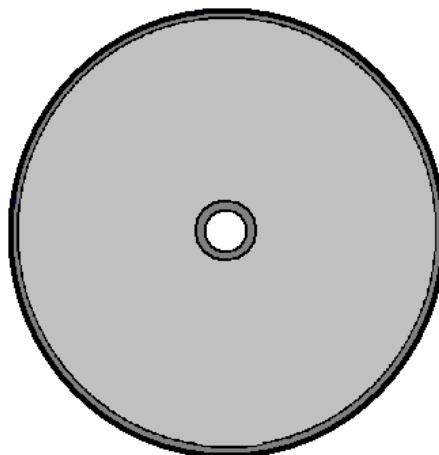
Metal can be cut quite readily using a cutting blade in your angle grinder but be sure to install the blade so that it rotates in the direction shown on the blade. The blade is likely to look something like this:



When cutting or grinding **always** wear protective goggles to make sure that you don't get a metal fragment in your eye – eyes are not readily replaceable !! If you do get a small steel fragment in your eye, remember that steel is highly magnetic and so a magnet may help in getting the fragment out with the minimum of damage, however, it is much, much easier to wear goggles and not have the problem in the first place.

The Donnie Watts drum spins on an axle and so needs a bearing on the axle pipe which supports it. The flow of liquid through the drum will be substantial and so Donnie recommends a 75 mm (3 inch) diameter pipe as the axle. That may sound excessive, but the reality is that it is quite difficult to force liquid through a pipe as there is much greater back-pressure than you would expect. So use a 75 mm pipe.

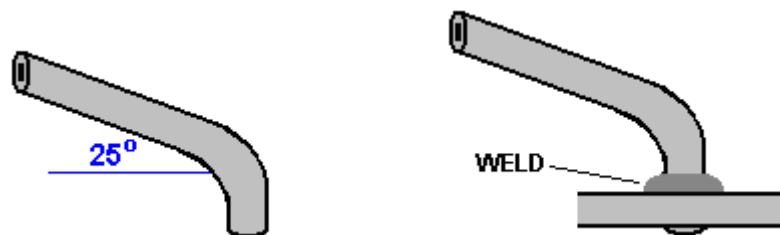
The next step is to attach the outside strip to complete the basic drum. If you are great at bending 3 mm thick steel then do that but most constructors will find it much easier to weld, say, 32 strips 150 mm tall, around the outside of the drum (that actually makes it easier to attach the nozzles to complete the drum at a later stage. Here, we will assume that the drum is being built by a professional steel fabrication shop which can bend 3 mm thick steel to the required curvature, that is, to the diameter of the drum:



The outer edge of the drum is welded all along its length. The weld needs to be airtight but please understand that due to heat stress, long welds need to be done in short lengths of say, 25 mm in length or less and allowed to cool before the next weld is made. The technique is to make this series of short welds spread out along the length of the long weld and when those welds have cooled down, then they are each extended for another 25 mm. Slow and careful construction is easily the best method.

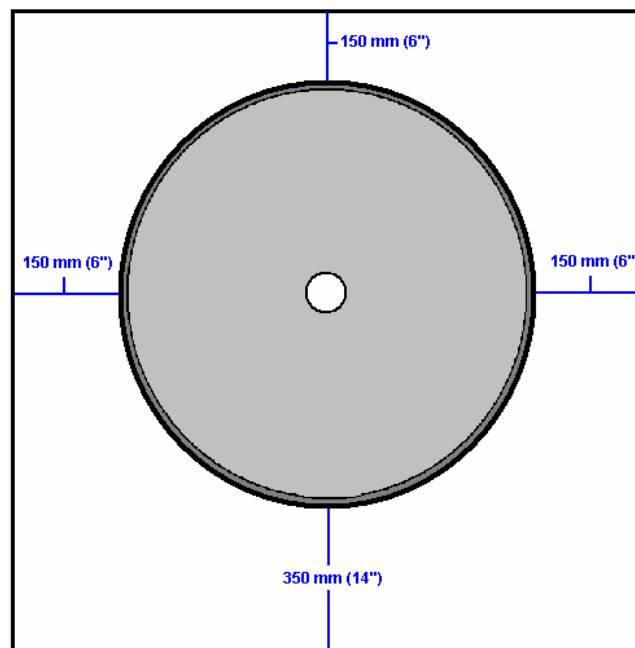
We now need to attach nozzles through the outer wall of the drum. A hole needs to be drilled through the outer wall for each nozzle. As with all holes drilled through steel, the hole is drilled at right angles to the steel, that is perpendicular. I'm not saying that you can't drill a hole at an angle, but it is very, very difficult to do without breaking the drill bit and it is very difficult to hold the drill steady enough to get the hole started.

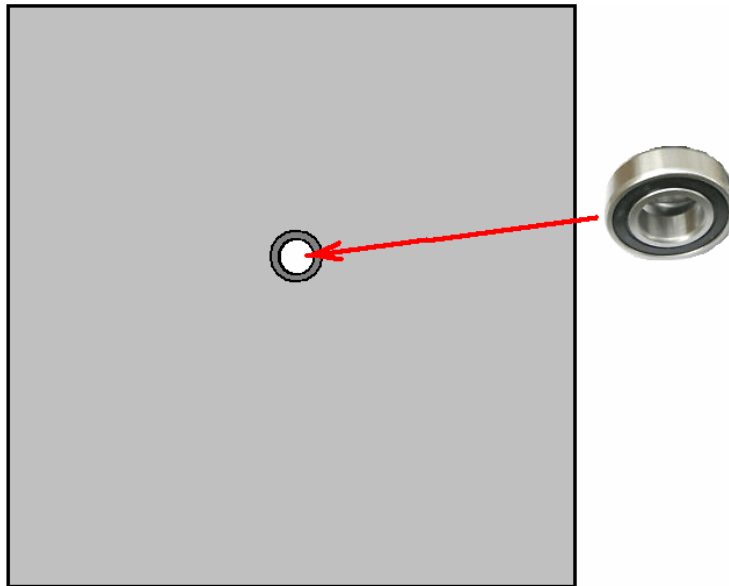
We want to have the jet of liquid leave the nozzle at 25 degrees to the face of the steel. We also want the jet orifice to be 1.5 mm in diameter. So we need to construct jets from steel pipe with that internal diameter, insert them through the outer wall of the drum and weld them in place:



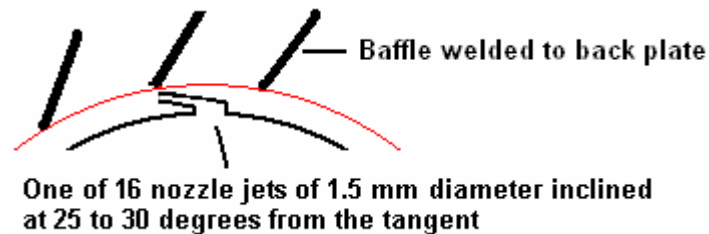
How many jets? I would suggest sixteen, but the number is not critical. It is said that the jets of water are more effective if they strike a nearby surface, so we may choose to attach a series of baffle plates to the outer housing. How many baffle plates? I would suggest sixteen. BUT these baffle plates are only effective when starting a stationary rotor and so can be omitted if you prefer.

The diagram of the sump enclosure drawn by Donnie shows angled top edges, but it is probably easier just to use square plates as there is less cutting and welding if you do that. Donnie suggests that the housing plates need to be 300 mm wider than your drum and have 150 mm clear above it and $150 + 200 = 350$ mm clear below it as the bottom of the housing acts as a sump for the liquid which passes through the jets:

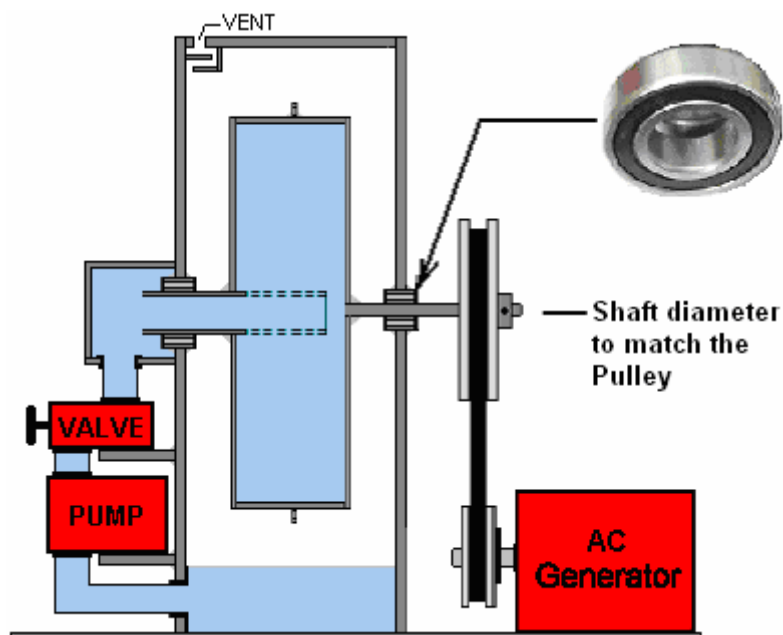




If you want to use baffles then they are welded to the back plate of the sump enclosure which will house the drum, but be sure that they clear all of the nozzles welded to the drum:



There is no need for additional housing. There is a pump needed to get the system started, and that can be mounted on the outside of the drum housing, as can the generator. The slide valve which controls the amount of liquid allowed into the drum is also mounted on the outside of the drum housing. The supporting axle pipe spins with the drum, driving the alternator generator which provides the required mains voltage AC output, and it will be mounted on the outside of the housing. This overall arrangement produces a device which is much taller than it is wide, so a stability plate is welded to the base in order to provide that missing stability. The overall arrangement could be like this:



While the axle shaft can be made of two parts welded together and welded to the drum, I suggest that it is more practical to weld the incoming three-inch diameter pipe to the drum and then, choosing a bar diameter which matches the size needed for your chosen pulley wheel, that bar is welded to the other side of the drum as shown above. The part of the axle on the right of the drum is solid and provides the drive to the generator:

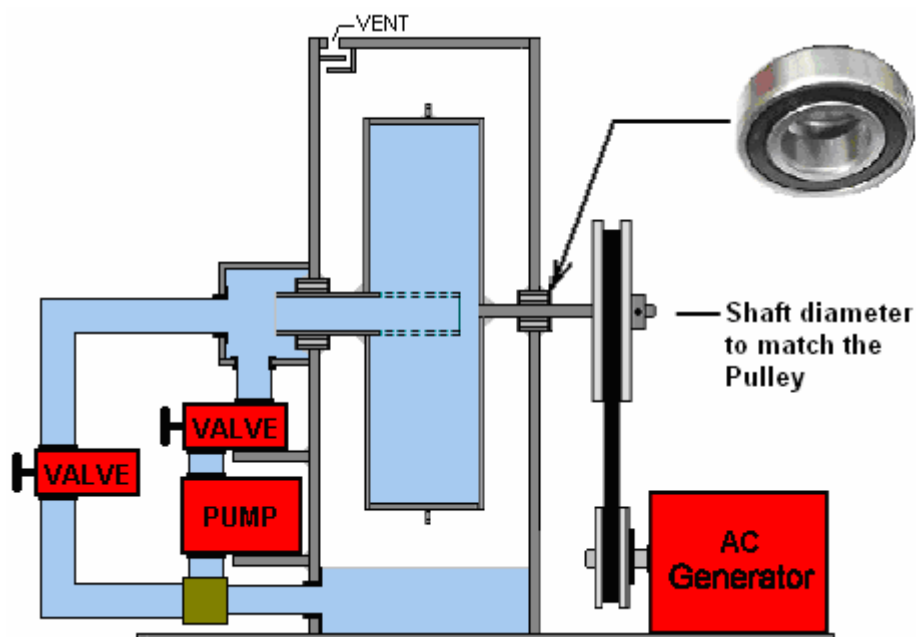


To get the generator operating requires the pump to be operated and so, either access to mains or alternatively access to a battery and inverter is essential. Once the generator is running, the pump can be powered by the generator. It is stated that when the speed of rotation passes one drum revolution per second, that the liquid passing through the jets causes enough vacuum inside the drum that the pump can be powered down, but it is also possible to leave the pump running all the time.

People sometimes have difficulty in understanding the pressures involved. The drum which revolves is the only place that there is pressure when the generator is operating. The outer case has only two main functions, namely to support the drum axle and to act as a sump to return the liquid to the pump which feeds the liquid back to the drum to be used again.

That is, the inside of the sump housing is at atmospheric pressure and if you were to install baffle plates to catch any stray liquid, then it could be open at the top of the case. If the drum is large enough and the drum intake pipe large enough, then the Donnie Watts generator becomes self-sustaining at about one revolution per second, and the liquid exiting through the jets starts sucking liquid in through the intake pipe.

Concerns have been expressed that the pump undergoes unnecessary wear when the generator is running and the pump is no longer needed. So, if desired, the pump can have a bypass which is valve controlled like this:



While this does require some additional piping, a valve and a T-junction for the pipe bypass, it results in a pump which can be switched off when not needed and the new valve used as the drum speed control.

Let me stress again that this is an exponential positive-feedback design which will keep accelerating until the bearings fail or the pressure inside the drum causes some form of rupture which will starve the jets of liquid, or the generator might fail due to excessive speed. While this may seem like irrelevant theory, I assure you that it isn't. You have this generator running and powering your house and the weather is hot. You have an air-conditioning unit keeping your house cool. It draws a lot of current, but then the thermostat switches it off because your house is cool enough. This is a problem. The current draw from the generator goes down by a major amount. This makes the generator shaft much easier to spin, but the drive power from the Donnie Watts unit is now much higher than is needed. This is not helpful, and the system is now unbalanced and the drum will speed up, spinning the generator shaft faster than it should. If you are standing there and adjust the control valve accordingly, then everything goes back to normal. But the point is that a generator of this type is fine for a fixed load, but you need to pay attention to what the electrical load is if it changes. You could build an automatic valve adjustment to make an automatic speed control or install one or more pressure relief valves. The later patent is mainly about automatic speed control of the drum.

As some people find this generator hard to understand, let me explain it in broad outline. The device is essentially a motor. It is a motor which is a spinning drum inside a support housing which acts as a sump. This is a self-powering motor and the faster it goes, the higher the power level which it generates. As that is a positive feedback system, the motor will keep accelerating and gaining power until it exceeds the strength of the materials use to construct it and so it breaks the drum open.

In order to prevent that happening, an adjustable valve (which is the equivalent to a large tap or fire hydrant valve) can be placed in the pipe which feeds the liquid to the spinning drum. That valve acts as a manual speed control for the motor.

In order to produce useful work, this motor design is used to power a separate electricity generator, using two pulley wheels and an AC generator or "alternator", making the design a Motor/Generator. It is not easy to spin the alternator when it is supplying substantial amounts of electricity to washing machines, tumble dryers, air conditioners, heaters, stoves, TVs etc. and so the alternator acts as a brake, slowing the motor down. That doesn't matter as the speed control valve can be opened a bit to get the speed back up to what it should be.

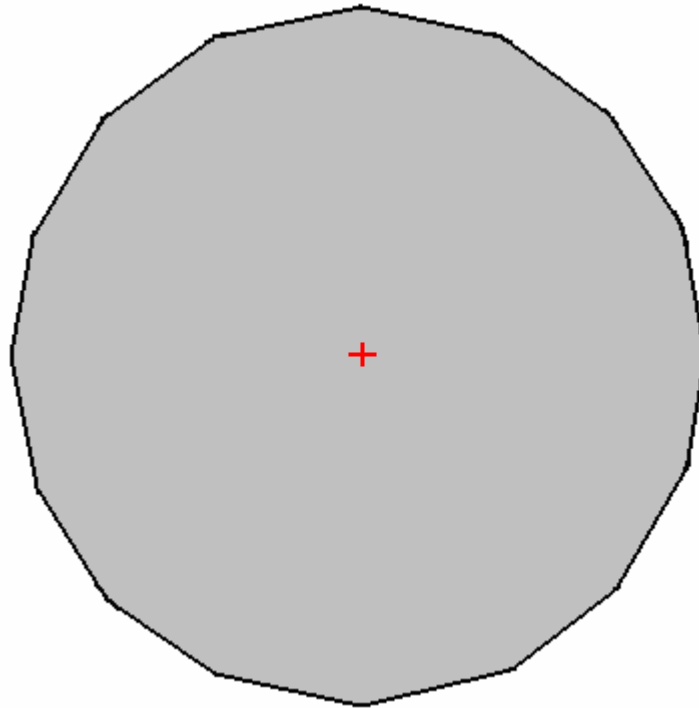
It is important to spin the shaft of the alternator at the speed it is designed for. Spin it too slowly and it will produce a voltage which is less than mains voltage and a frequency which is less than that of the mains. Spin it too fast and the generator will produce a voltage which is higher than mains voltage and a frequency which is greater than the mains frequency.

Typical design speeds for spinning the shaft of an alternator range from 1800 rpm (30 times per second) and 3000 rpm (50 times per second). Alternators are designed to produce either 110 volts at 60 cycles per second for American equipment, or 220 volts at 50 cycles per second for everybody else.

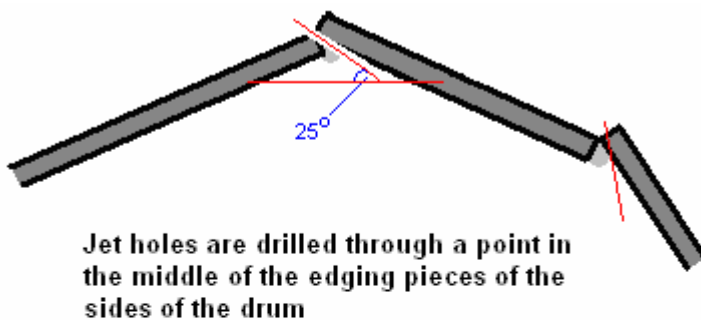
This is fine IF the electrical load is constant and the speed valve is adjusted correctly. BUT we have a problem if the electrical load drops suddenly. Because the electrical current draw has dropped, the shaft of the alternator becomes much easier to spin and so it acts as far less of a brake and because the valve setting is unchanged, the motor speeds up. This is not a problem IF there is a human standing beside the generator ready to adjust the valve setting accordingly. Unfortunately, that is not convenient and worse still, many electrical appliances switch themselves on and off on a very regular basis and the basic Donnie Watts design is not able to cope with that.

So, it would be very convenient if we were to make the Donnie Watts motor adjust it's own control valve when necessary. Let's see if we can come up with a simple system for doing that. Commercial valves are generally not suitable for this as they are either fully ON or fully OFF and are not electrically adjustable to give any intermediate setting. Also, they tend to be far too small a diameter to interest us but we can indeed use them if we wish, but more on that later.

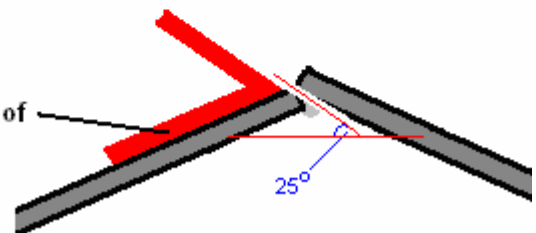
For home builders, it would probably be easier to use a 16-sided shape rather than a circular disc:



Apart from being all straight-side cuts, there is the advantage that the plates which form the circumference of the drum can become drilling points for a system which is more simple than using pipe nozzles:



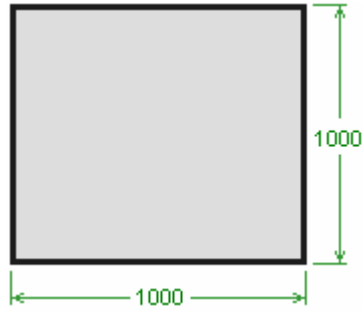
Drill template clamped to one of the two side pieces.



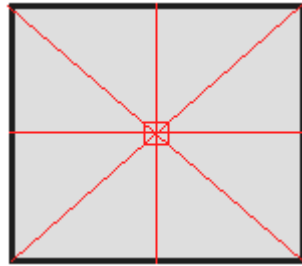
The single drill hole in the middle of the circumference wall of the drum then acts as a jet and using the template to get the drill bit angle the same every time, produces correctly angled water jets.

Some people feel that they would prefer to have some more detailed information, so the following are some very basic details for constructing a generator with a 1000 mm (39 inch) diameter drum using straight edges.

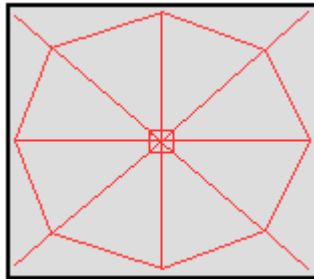
To make the first drum side we start with a square piece of 3 mm thick mild steel 1000 mm x 1000 mm.



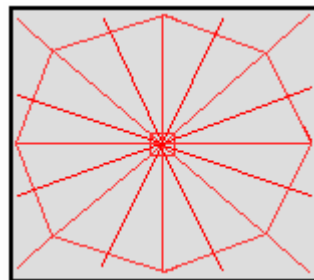
Draw diagonals from the corners to establish where the centre of the square is, then draw vertical and horizontal lines, like this:



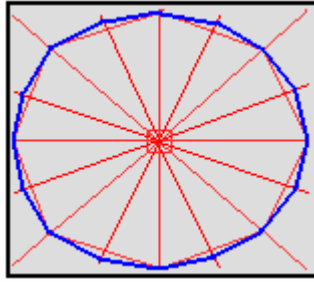
Measure 500 mm from the centre point, out along each diagonal and mark each of those points. Then, connect those points to make an even octagon:



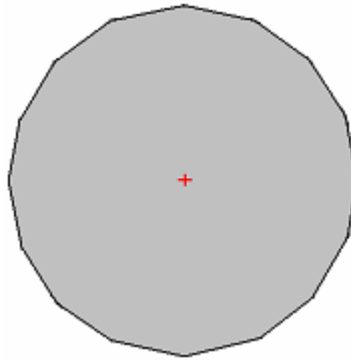
Next, mark the central point of each of the eight sloping lines and draw a line from the central point through each of these new points:



Mark 500 mm from the central point out along each of these new lines and then connect these points to form the 1000 mm diameter 16-sided drum side:



Then cut along these outside lines to form the first side of the drum:



Clamp this side to another piece of 3 mm thick mild steel and mark carefully around it to get the shape and size of the second side of the drum. Cut around this new side and draw some diagonals to establish the centre point.

One of these two drum plates needs to have the 3-inch (75 mm) intake pipe installed as an axle. You could get a local steel fabrication shop to drill the hole for you. Alternatively, you could mark the exact position and size and drill a ring of small holes around the circumference and with a small cutting blade in the angle grinder, cut between the holes and then using a grinding disc in a power drill, smooth out the unevenness between the holes to give a reasonable quality hole accurately positioned. Remember to use goggles for both cutting and smoothing. Another way would be to rent a plasma cutter and air compressor for a morning and use that to cut an exact hole.

Having got the exactly positioned hole in the drum side plate, it needs to be welded in place. For that, these magnetic angles are enormously helpful:



This is because they are low cost, grip the plate and pipe very strongly and make a perfect 90-degree angle. Using four of these magnetic clamps holds the pipe securely and accurately.

Remember that the moment a weld is made on one side of the drum plate, the other side of the drum plate needs to be welded immediately and both allowed to cool as slowly as possible to avoid heat shrinkage pulling the pipe out of its alignment with the drum plate. Remember that the drum plate will

be hot enough to burn you even if the weld only took a split second to make, so take care. In other words, if the pipe is vertical, then almost simultaneous welds need to be made on the top of the drum plate and on the underside of the drum plate. The thicker the steel, the easier it is to weld without problems and so welding the pipe is straightforward. It takes a great deal of skill to weld steel sheet of 1 mm thickness without tearing a hole in the sheet, but thankfully, that is not something which you need to do with this design.

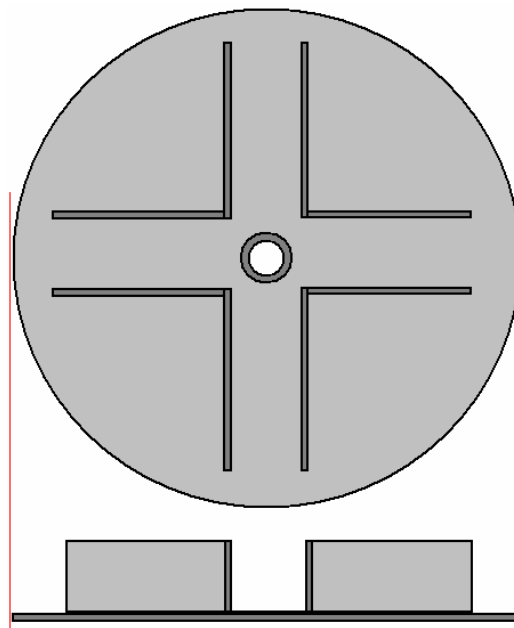
Having tack-welded the pipe carefully and quickly on both sides, using welds only 6 mm or so long, and having waited for those welds to cool down fully, make two additional tack welds at 180 degrees away from the first two, and then two more pairs so as to have a weld every 90 degrees around the pipe. Then the welding all around the pipe is completed welding only very short lengths in opposing pairs and letting the welds to cool before making the next weld.

A cheap workmate like this:



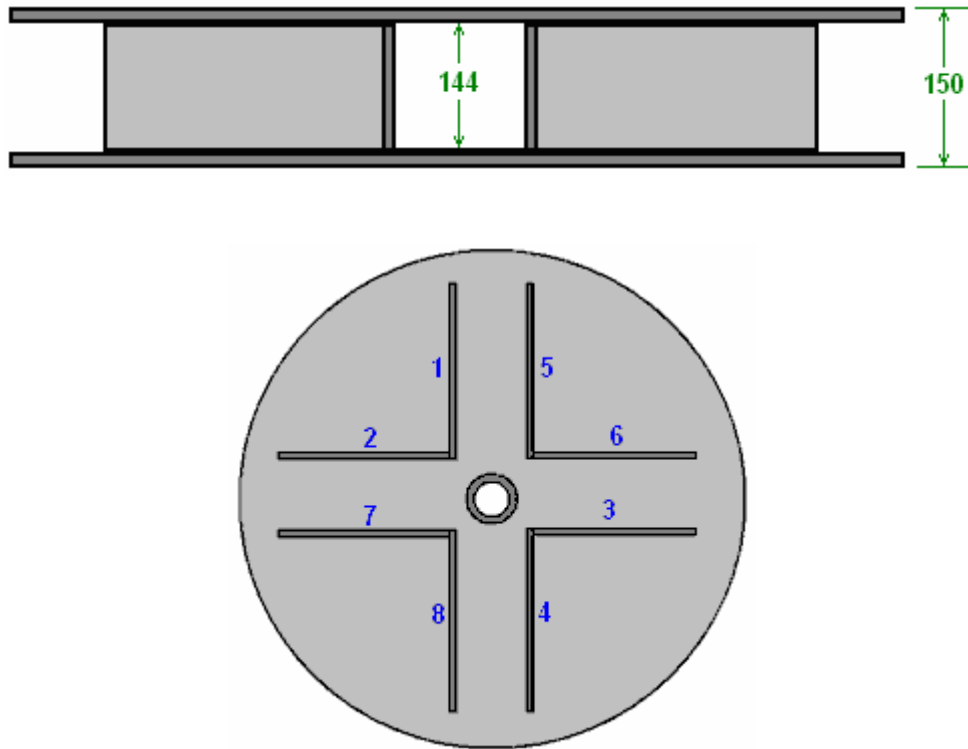
makes a good support for this work and it allows the pipe to be gripped securely while the drum plate is resting horizontally on the bench. If you feel that an open 3-inch (75 mm) diameter pipe is not sufficient to get the liquid into the drum, then make as many openings (drill holes or angle grinder slits) as you consider necessary.

Mild steel 3 mm thick can be supplied in 150 mm wide strips. One of those would reduce the amount of steel cutting needed to complete the drum as it is needed for the internal channels and for the circumference wall of the drum:

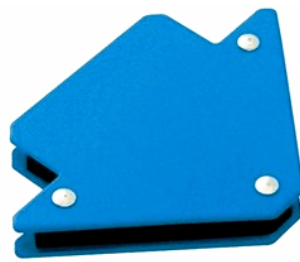


As the drum diameter is 1000 mm and 150 mm is left around the centre and 50 mm is left at each side, the eight internal walls need to be only $500 - 75 - 50 = 375$ mm (14.76 inches) long. The 150 mm clearance in the centre of the disc does not need to be exact, and so cutting 370 mm from the 150 mm strip will do nicely for all eight walls.

As we want to use the width of the 150 mm strip to make the sixteen circumference strips, measure the exact width of the strip supplied to confirm that it is 150 mm wide. I have never been supplied a strip which was not accurately 150 mm wide, but check carefully to make sure that your strip is exactly 150 mm wide and adjust the measurements slightly if it isn't. Ideally, the strip is exactly 150 mm wide and so the inner walls need to be 144 mm wide and 370 mm long, so 6 mm needs to be removed from each of those eight walls unless you choose to cut them directly from sheet:



Use the magnetic clamps to hold each plate vertical when positioning and tack welding it:

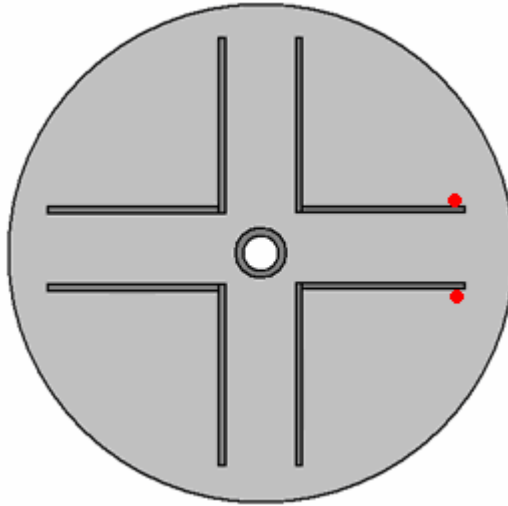


Complete the welding of these eight plates, remembering to take it slowly, remembering to always use simultaneously opposing welds and allowing each weld to cool naturally.

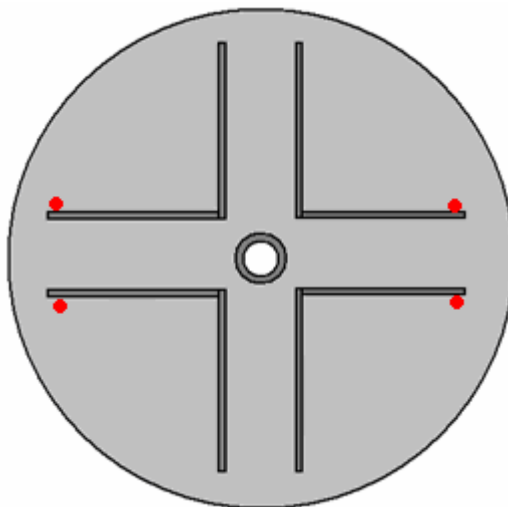
The next step is to attach the second side of the drum. The really important thing here is to align the second side exactly and the magnetic angles are helpful here as well. Measure the straight edges which form the circumference to your drum and cut two 150 mm strips to that exact length. Place the first drum side with its welded partitions, horizontally on the workmate and attach one magnetic brace to it, positioning the magnet exactly at the edge of the disc, half way along one straight edge. Do that 90-degrees away with a second magnet. Attach one of your edging strips to each magnet, standing them straight up vertically, then slide the second side on top, aligning a straight edge with a straight edge on the lower drum side. Use additional magnetic braces to attach the upper drum side to each of the two edging pieces attached to the lower drum side. Make sure that all four magnets are fully touching the drum sides and the edging pieces.

Go around the whole drum, using a setsquare to confirm that the two drum sides match exactly and be very sure that the flat edges match exactly. Remember that once you make the first tack weld on the second drum side, that is it, and you have no realistic chance to change the positioning.

Once you are satisfied that the second drum side is positioned exactly right, make two opposing tack welds on the second (upper) drum side like this:



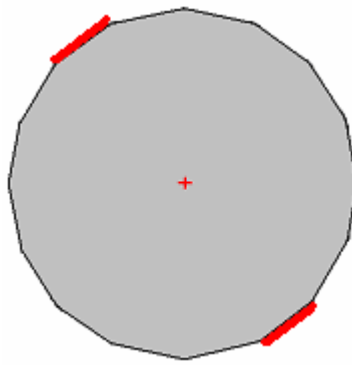
These welds are made upwards, so be sure you are wearing good strong gloves as getting molten metal on bare skin is not a pleasant experience! Then make two more opposing tack welds like this:



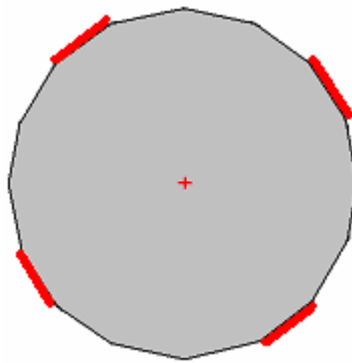
You can then turn the drum over so that all following welding is downwards and you are not liable to get hot metal coming at your hands. There is room to weld inside the drum as the pieces forming the channel walls are only 370 mm long and there is 144 mm of clearance between the drum sides.

These eight short pieces hold the drum sides securely and give the drum major strength. (Strictly speaking, the above diagrams should show 16-sided sides rather than circles). We come now to attaching strips to the sides of the drum to form the outer drum wall. Remove the magnets and alignment side strips and turn the drum sideways and clamp it in the workmate so that the drum edge is facing upwards and so is easy to work with.

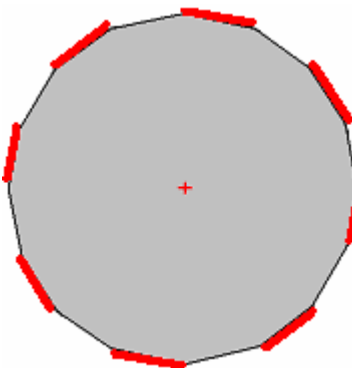
The vertical outer wall of the drum is made up of sixteen strips of steel, each 150 mm wide. Each strip will be about 196 mm long but that length is marked on the strip directly against the straight side of the drum disc. You start by welding these narrower strips as the vertical walls. Take two edging pieces already cut, and weld them to the drum in opposite positions around the drum:



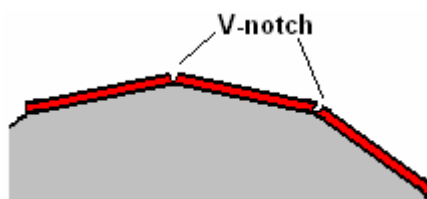
The welds can be made inside the drum if you wish. Two more circumference pieces are then measured carefully, cut and welded like this:



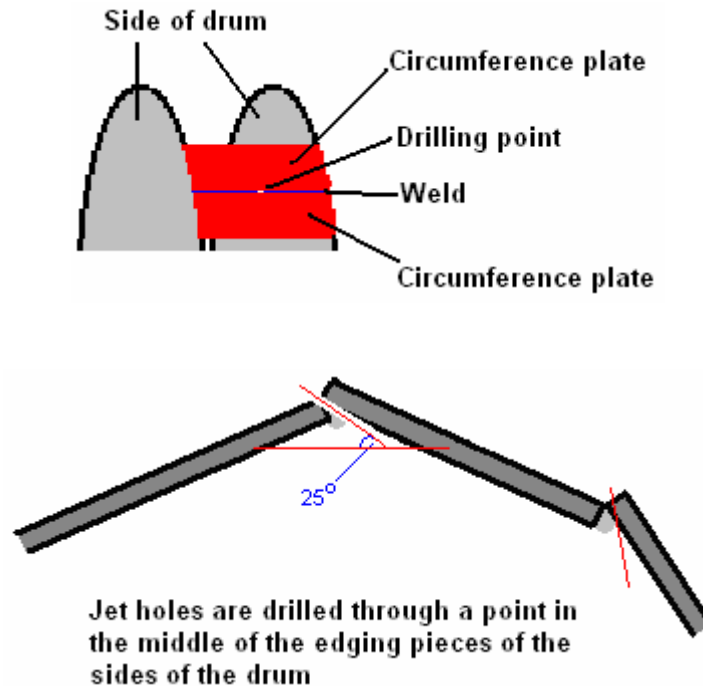
Then four more like this:



This is where it becomes interesting. The final plates need to be measured very accurately and they will be welded in place like this:



The V-notch between the plates is very important as it is where the nozzle jets will be drilled:



It may be necessary to lower the next circumference plate just opposite the jet exit using a grinding tool so that it does not interfere with the jet of liquid leaving the drum:



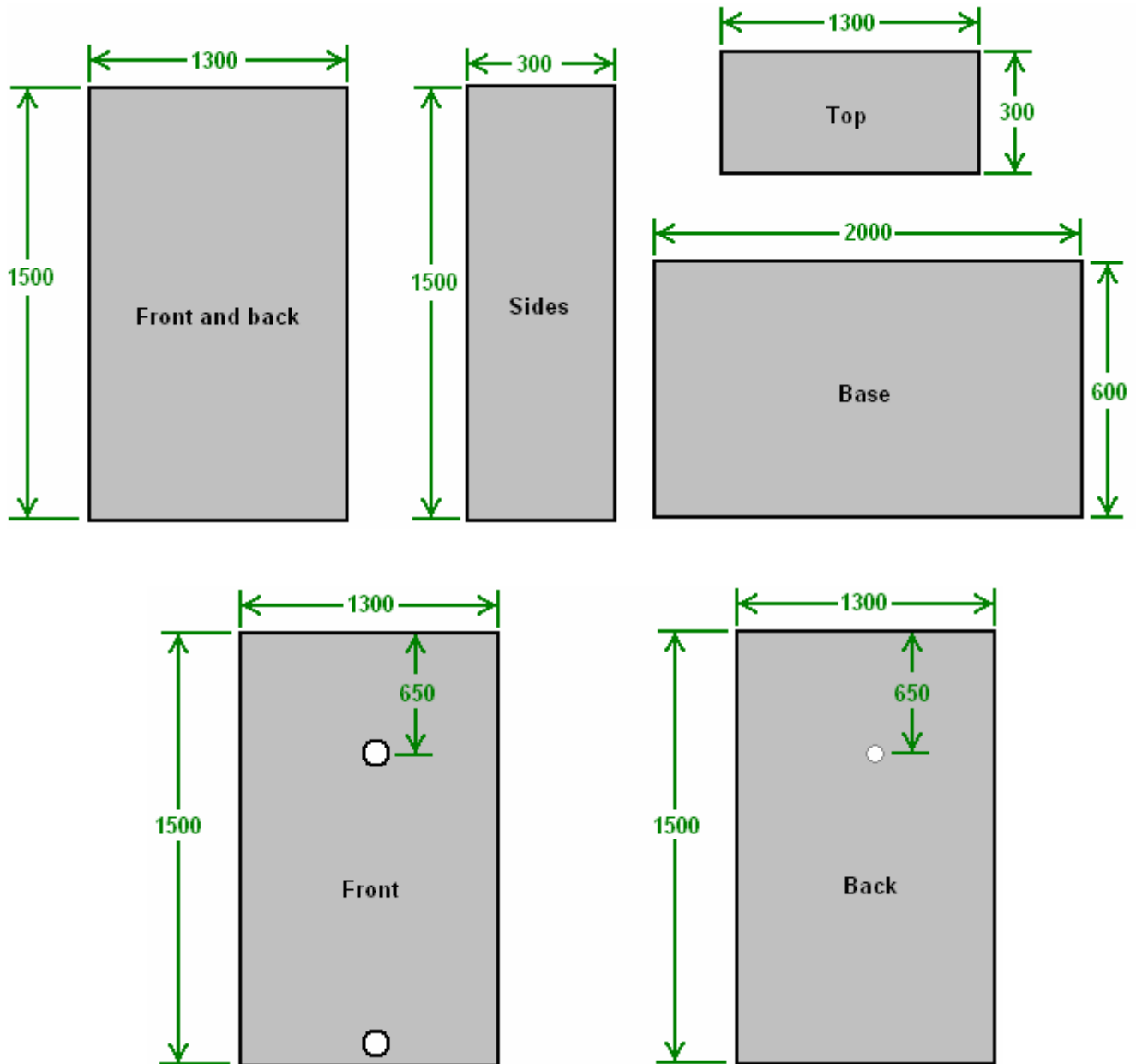
So, after all that effort, you now have a strong and secure drum, but it only has the 3-inch diameter inlet pipe attached and we need the axle support bar on the other side of the drum. What diameter should it be? I don't know, because it needs to have a pulley mounted on it. I would expect it to be about 25 mm (1-inch) in diameter but you need to search suppliers for pulleys and buy two, one for the drum and one to match the drive shaft diameter of your alternator. Obviously, the two pulleys need to work with the same drive belt. Ideally, the drum pulley should be two or three times the diameter of the alternator pulley. In fact, any ratio up to say, five times would be good as the working output of the alternator will be reached at lower drum revolutions and that would give smoother running if the drum construction is not perfect.

So, we have identified what shaft diameter is needed for the drum output and we have purchased a mild steel bar of that diameter. The centre point of the second drum side is marked. If you have cleverly welded it on the inside of the drum, then mark the diagonals to get the centre point. Check it by clamping the 3-inch pipe bearing in the workmate, placing the drum inlet pipe in it and spinning the drum. The centre point should appear stationary when the drum spins. Holding a felt-tipped pen stationary, mark a small circle by touching the drum close to the centre – say about 30 mm in diameter.

That is where the pulley bar needs to be welded. Use the four magnetic clamps to position the bar in the middle of the circle with the clamps at 90-degree angles to each other. Spin the drum again to make sure that the bar does not appear to move. If it does, then correct the position until the bar seems motionless. Then tack weld between the magnets. Unfortunately, heat destroys magnets and so welding so close to the magnets is liable to destroy them – thankfully, they are cheap to replace.

Now that we have completed the drum, we need to make the support housing which also acts as a sump for the liquid which has passed through the drum. In passing, while the Clem engine used cooking oil as the liquid because the Clem engine generates a good deal of heat, some people suggest using transmission fluid in the Donnie Watts design, primarily so that it lubricates everything which it passes through.

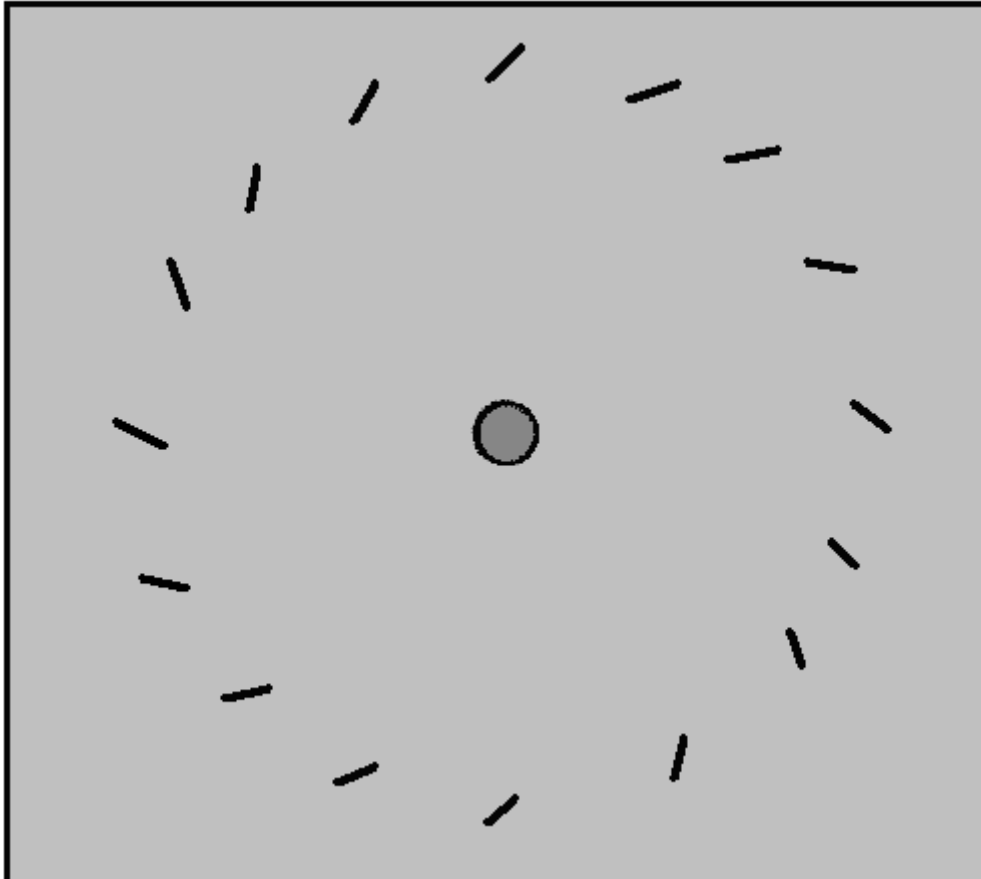
The container which acts as a sump can just be a rectangular box. It is specified that there should be 150 mm clearance on both side of the drum which is $1000\text{ mm} + 150\text{ mm} + 150\text{ mm} = 1300\text{ mm}$ wide. The sump is to have an additional 200 mm depth and with the 150 mm at the top and the 1000 mm diameter of the drum, makes a front and back panel size of $1500 \times 1300\text{ mm}$. The sides would need to be about 300 mm wide:



The next step is to construct the baffle plates to catch the jets of liquid coming out of the nozzles of the drum. First, a hole is created in the front panel and the bearing attached. The bearing will be the best 75 mm diameter bearing which will fit your intake pipe and mount securely to the front panel:



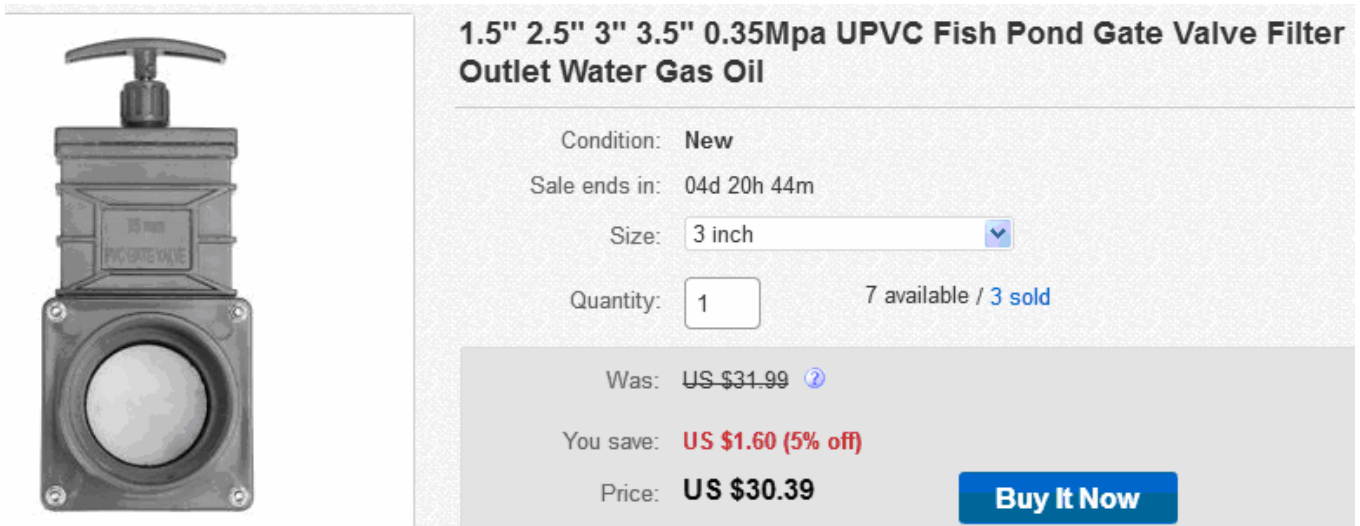
With the bearing fitted, place the front panel on the workmate and feed the drum's intake pipe into the bearing. This gives you a flat, horizontal surface with the drum in it's exact position. Clamp the drum in place so that it can't move. If you want to use baffle plates then use one of the magnet clamps to position, and mark the position of the first baffle. With the drum fixed in place, mark the position of the matching fifteen other baffle plates. Unclamp and remove the drum so that there is a clear unencumbered work area. Using just one magnetic clamp, position each baffle plate and tack weld it in position with a tack weld on the drum side and an immediate matching tack weld on the side away from the drum – remember that we need matching welds to stop the cooling weld pulling the baffle plate away from the vertical.



Next, put the drum back again and give it a spin to make quite sure that the drum clears all of the baffle plates. I seriously doubt the spacing specified for the housing. The liquid squirts through the drum "nozzles" and hits the baffle plates. But then, where does it go? It has lost it's momentum and will just fall under gravity. Some will fall on to the drum which will hurl it off on to the wall where it will fall down into the sump. Part will fall clear of the drum and will fall down the side of the housing. So, why the gap? 75 mm should be easily enough to allow that to happen no matter what the drum diameter is. Five millimeters of space outside the baffles should actually be quite enough.

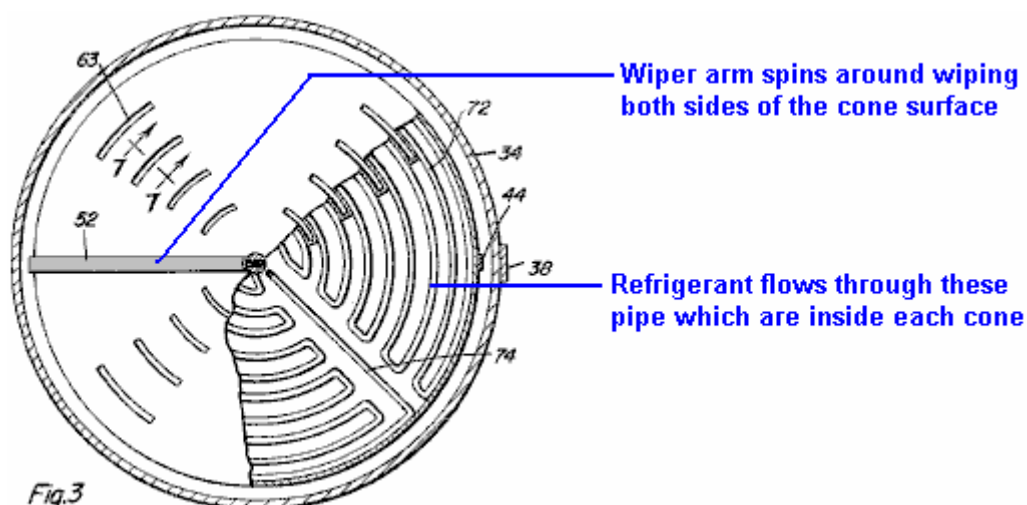
The physical size and shape of the pump is not important as it is located outside the sump housing. I have been asked what is the minimum pump size, but I don't know, the most I can say is that Donnie Watts specified a 500 watt pump for his four-foot diameter drum, but I feel that a more powerful pump would be helpful. Please understand that I have never built or even seen a Donnie Watts generator. I believe that it will work exactly as specified (especially since the very similar Clem Motor worked well) but I can't guarantee that it will. In passing, if the arrangement where there is a pump bypass pipe and valve, then one pump could be used to start a whole row of Donnie Watts generators by disconnecting the pump from each as soon as it is running properly. Of course, in that case, the pump valve needs to be between the drum and the pump to enclose the sump when the pump is removed.

Purely On and Off valves are not expensive, even in 3-inch diameter:

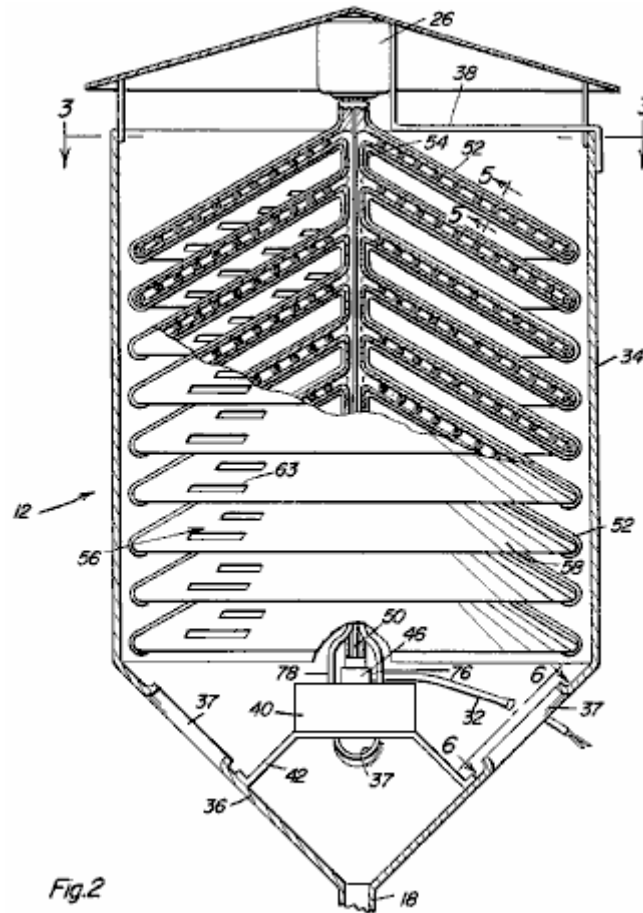


It appears that this valve is either fully On or fully Off. There are valves which claim to be fully adjustable under electronic control but nothing suitable has been found. So, for the moment, assume that the generator will be run under constant load and just construct the box surrounding the drum intake pipe as 300 x 300 x 150 mm in size and with a removable 300 x 300 mm side, sealed with a plastic or rubber gasket.

If you feel that a generator which is restricted to a fixed load output is really not all that useful, then think again. Consider using it to power an Elmer Grimes water supply system. The US patent 2,996,897 (22 Aug 1961) is more than fifty years old and it describes a system which can produce drinking quality pure water. It is effectively an outdoor refrigerator. A series of cone-shaped metal panels are stacked together vertically to save space. Each cone has pipes inside it which pass the cooling fluid through the cones, ensuring that they are always at low temperature. In the same way that a cold drink gets water droplets on the outside of the glass, the cones get water droplets forming on them all the time. A wiper arm like a windscreen wiper on a car then brushes those droplets off, with the wiper arm rotating around the cones continuously, rather than backwards and forwards as a car wiper blade does. This produces a continuous stream of fresh water coming off the cones. Unless there is some good reason why not to, the cones are mounted in a raised position so that gravity can be used to direct the water flow to where it needs to end up. Cones are used as they have a greater surface area than a flat plate of the same diameter would have, and the downward slope of the cone helps the water droplets flow off the cone surfaces. Top view:



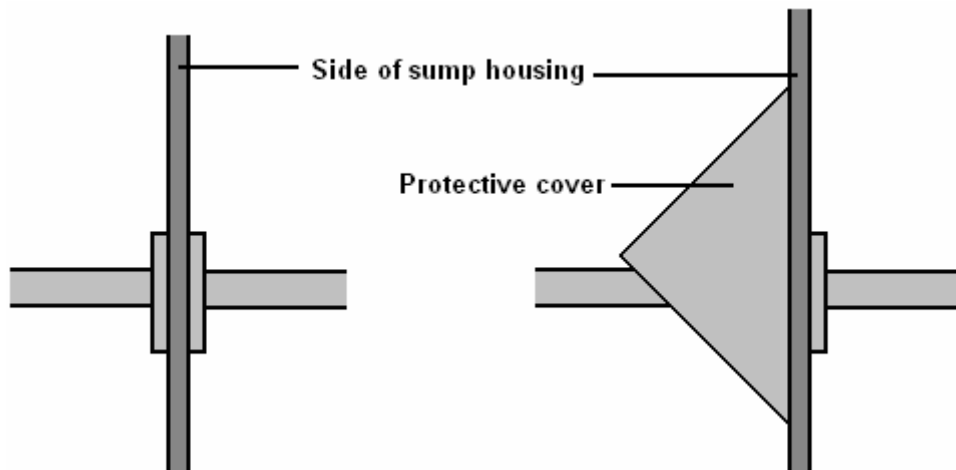
Side view:



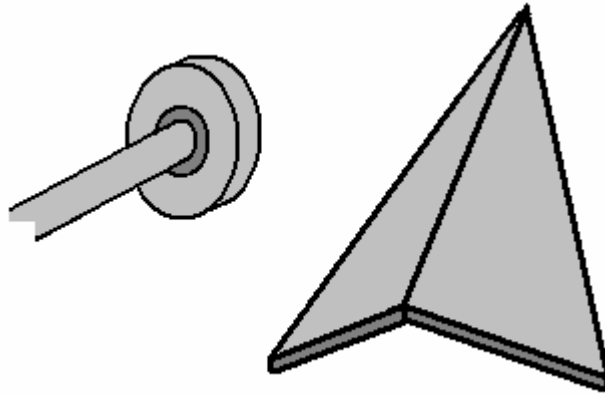
One of these Grimes systems produces enough water to support a ranch in Texas during a drought, and it could be powered indefinitely by a Donnie Watts generator. Think of the effect one would have on a village which has only access to polluted water (especially if you don't know the technology of colloidal silver).

As it is probably not necessary to produce drinking water all the time, the generator could power electrical cooking in area where firewood is getting scarce, charge mobile phones, power TVs, power fans, refrigerators, etc.

The inside of the sump housing is an unpressurised and very wet area. We don't want any oil leaking out through the drive shaft bearing, so providing a steel umbrella would be a good idea:



For this, two triangles of steel are cut and then welded so that most of the oil landing on them will run off without reaching the bearing:

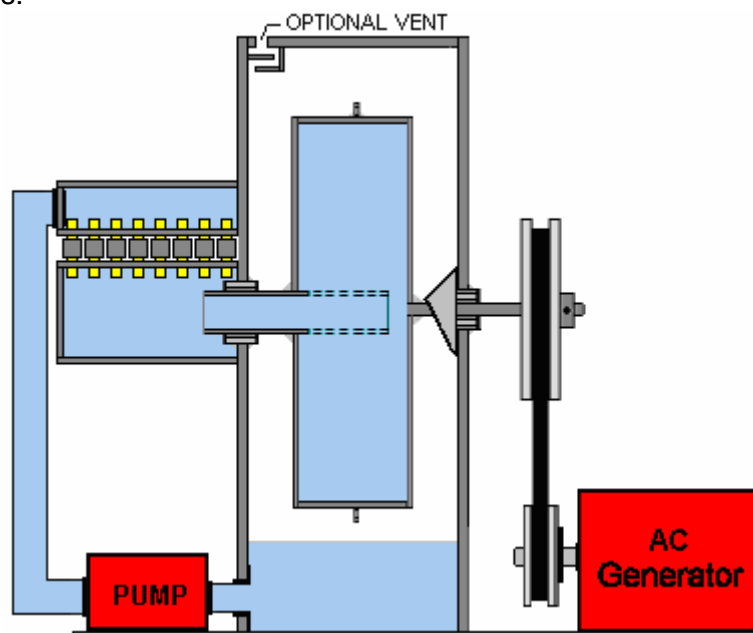


Some people may prefer to use commercially constructed components instead of constructing an adjustable flap for the 3-inch diameter rotating intake pipe to the drum. Well, let's see if we can come up with a different method of low-cost automatic flow control. For the system to be automatic I suggest that we could use electrically operated valves which can then be governed by a control circuit. The vast majority of such low-cost valves are only half-inch diameter made for central heating systems, and they are closed unless fed with power to open them. I would suggest the following valve:

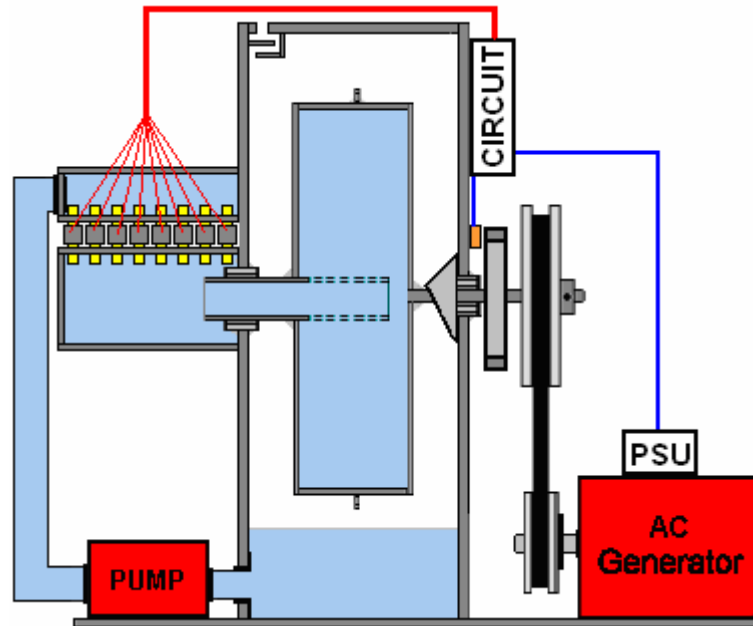
This plastic one-inch diameter valve costs about £8:



We can get variable control by using a row of these valves to restrict flow. For this, we use a second liquid filled box like this:



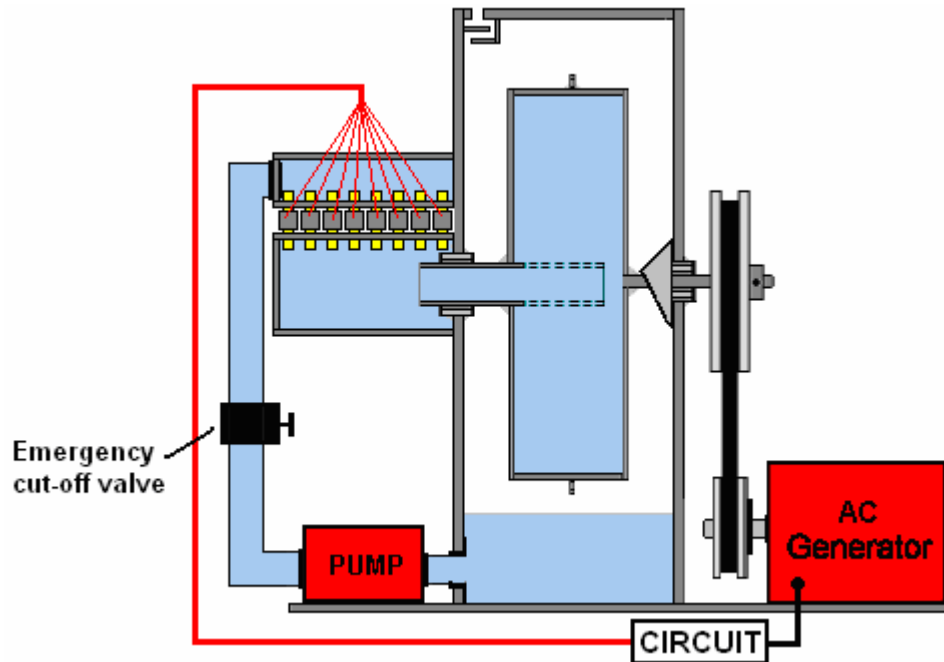
This row of ten valves allows ten different flow settings when the valves are switched on or off by the control circuit and there is the added advantage that if the control circuit is powered via the alternator output and there is a major problem where the drive belt snaps or there is any other major fault which removes the alternator drag from the output shaft, then all valves will automatically shut down and block the flow due to lack of voltage to keep them open. The arrangement could be like this:



The most direct way of determining the speed of the output shaft is to connect a disc to the shaft and use a sensor to detect how often a magnet in the disc passes by. A rev counter circuit then monitors the shaft speed and switches off valves progressively if the shaft starts to rotate too fast.

While the diagram above shows the most secure way to assess the speed of rotation of the generator, for most people it is more convenient to skip as much construction work as possible. So, a way which skips the need for an additional rotor disc and sensor is attractive. For that we can measure the output of the alternator rather than the direct speed of the generator axle.

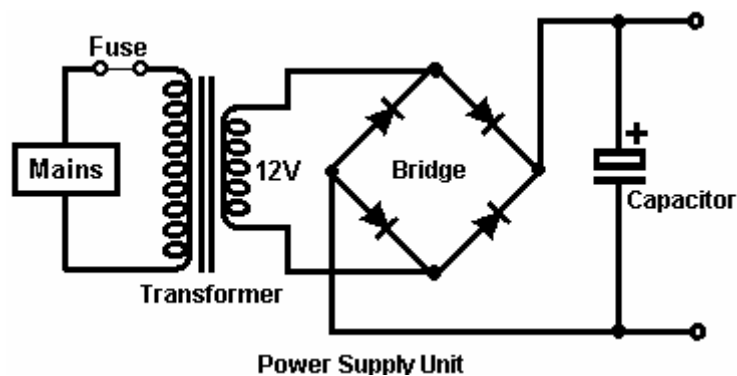
The alternator is an alternating current generator. If you spin the drive shaft of the alternator at it's design speed then mains voltage is produced. If the shaft is spun faster than it is supposed to be, then a higher voltage is produced. If the shaft is spun slower than it's design speed, then the output voltage is less than the mains voltage. We can therefore use the voltage of the generator's output to control the switching of the row of valves, and the design then becomes this:



With this arrangement, if the drive belt were to break or the alternator were to develop a serious fault, then the circuit voltage would drop off and as a result, the circuit would no longer supply current to the open valves and they all would close, shutting off the generator which is exactly what is needed.

Now, all that is needed is a simple circuit to control the valves. Please understand clearly that I have never been trained in electronics and so I am only self-taught, so feel completely free to consult an expert to provide you with a better circuit.

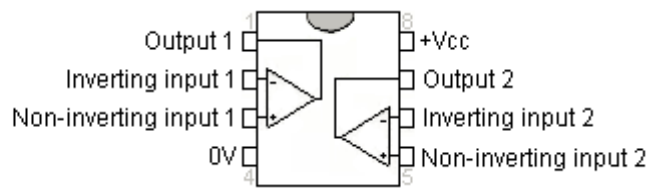
The valve opens if fed 300 milliamps of current at 12 volts. That is 3.6 watts of power for each valve or just 36 watts for all ten valves. The alternator produces mains voltage so we will drop that down to around 12 volts both for safety sake and to make the circuit components cheaper. To drop the voltage down we use a simple power supply comprising of a 3-amp mains transformer to lower the voltage, a diode bridge to convert the output into pulsing DC and a capacitor to smooth out the pulsing:



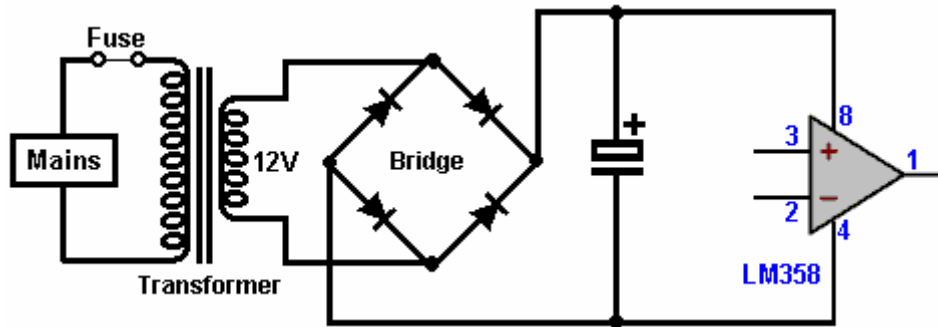
As with all circuits, and especially mains circuits, we install a fuse or circuit breaker as the first component, and we insulate all metal components to make sure that we don't accidentally touch them and get a nasty shock. Once the voltage is down to 12 volts the circuit is no more dangerous than a 12 volt car battery and it is not necessary to insulate everything. The fuse is a 3-amp fuse.

This circuit is deliberately not self-adjusting as we want to use it to detect voltage differences coming in from the alternator which is marked "Mains" in the diagrams. The most important thing is to detect a rise in voltage as that indicates that the generator is starting to rotate too fast and so we want to switch off one or more valves. The circuit for each valve is the same as for all of the others although the adjustment of each circuit is slightly different so that the valves switch off at slightly different voltages.

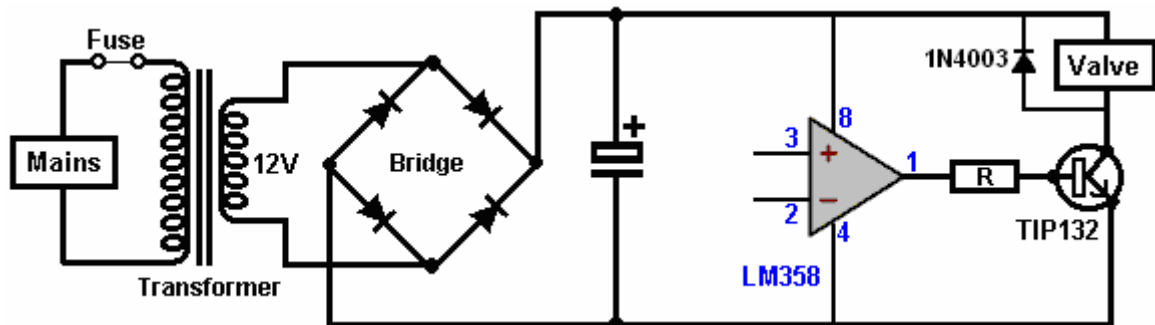
The switching circuit which we will use is called an “operational amplifier” and thankfully that whole circuit comes ready made in a standard chip. For example, the very cheap LM358 chip has two separate “op-amp” circuits in it:



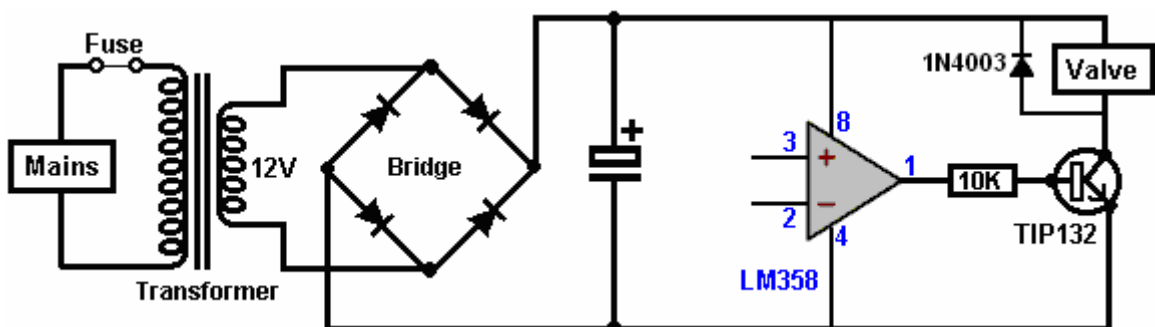
If we connect an LM358 into the circuit we get this:



If the voltage at pin 3 exceeds the voltage at pin 2 then the output on pin 1 will be high (about 10 volts) otherwise the voltage on pin 1 will be low. We will use the high voltage on pin 1 to switch on one of the valves and we will use a high-power high-gain transistor like the TIP132 to do this:



The TIP132 can handle 100 volts, 8 amps and has a gain of 1000, so if it is passing 330 milliamps through the valve winding, then it will need a base current of 0.3 milliamps. That current flows through the resistor “R” which has about 10 volts across it. Resistance = Volts / Amps or $10 / 0.0003$ amps which is 33,333 ohms or 33K. However, we will increase the base current by a factor of 3 and use a 10K resistor:



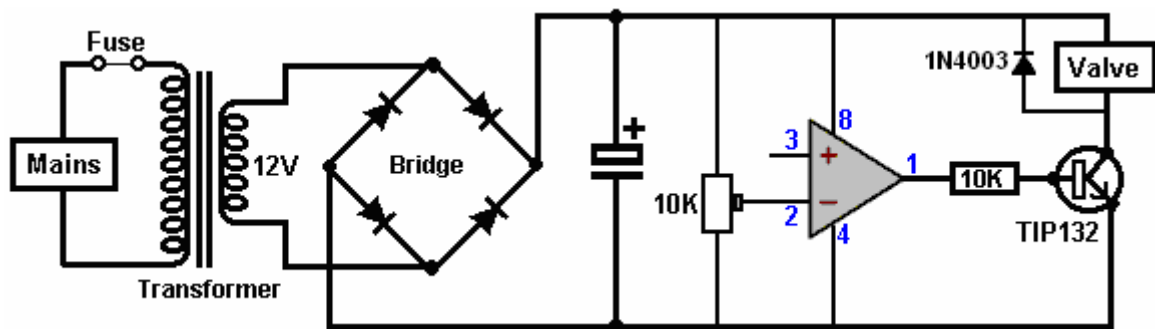
Now we need to get the LM358 to switch off, causing the voltage on pin 1 to drop low, starving the TIP132 of base current and cutting the power to the coil of the valve. For that, we need the voltage on pin 2 to rise above the voltage on pin 3 and we want that to happen if the power supply voltage rises.

So, if we connect a multi-turn 10K preset resistor across the power supply and feed it to pin 2, then we can set it so that the op-amp triggers with a rise in voltage. A resistor of that type looks like this:

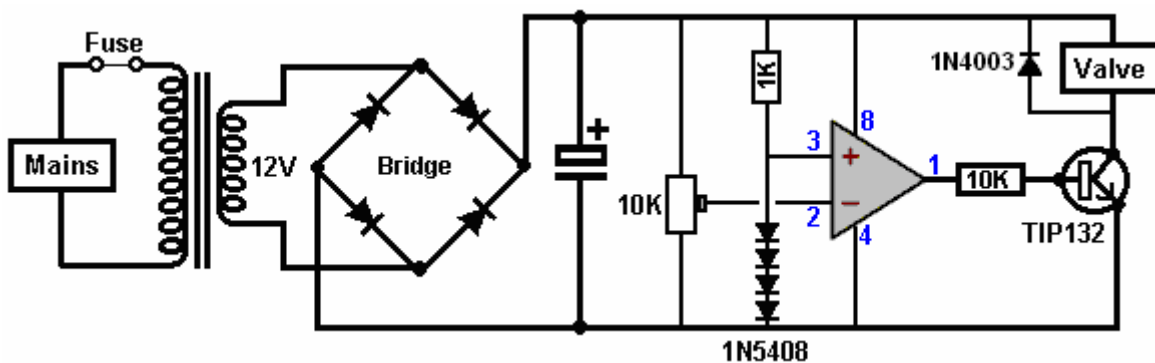


or

And the circuit becomes:



Now the last step is to provide a reference voltage which does not change if the power supply voltage increases. The approved way is to use a zener diode with a resistor in series with it and in theory, the voltage drop across the zener diode is a reliable reference voltage. I have not found that arrangement to work at all well, so I suggest using ordinary diodes such as the 1N5408 instead, like this:



This arrangement gives about 10 milliamps flowing through the diode chain and some 2.75 volts are generated across the diodes. That voltage does not alter appreciably if the power supply voltage increases.

The second op-amp in the LM5408 chip can be used to control the next valve. Pins 4 and 8 are already connected to the power lines, but what was pin 1 is now pin 7, what was pin 2 is now pin 6 and what was pin 3 is now pin 5.

The circuit is set up using a bench power supply. Measure the voltage of the power supply powered by the Donnie Watts alternator and then disconnect it. Connect the bench supply in place of the alternator supply and set the voltage to exactly the same value. All op-amps are connected to the four diode reference voltage point.

Let's say that we want the valves to drop out at every 5-volt increase of the mains voltage. If it is a 240 volt mains supply, then the transformer drops that down to 12 volts which makes the change 20 times smaller, so the power supply voltage will go up by only $5 / 20$ volts which is only one quarter of one volt. So you adjust the bench power supply up by a quarter of a volt and adjust the first variable resistor so that the first valve shuts off. Lowering the bench supply voltage by that quarter of a volt should have the valve clicking open again.

This is repeated with all of the valves so that the second valve drops shut at half a volt higher voltage. The third valve drops closed at three quarters of a volt increase over the original voltage, and so on.

When starting the Donnie Watts generator you need the valves open and so a 12V source has to be applied to the valves. Make sure you do that through a press button switch and not a toggle switch because you could easily forget to switch the toggle switch off after the system gets up to speed.

The two patents:

The 25th September 1989 patent application by Donnie C. Watts describes the operation of the device:

DESCRIPTION AND WORKING DETAILS OF THE CENTRIFUGAL ENERGY AMPLIFICATION AND CONVERSION UNIT

Description of Unit

The unit consists of two circular steel plates one eighth of an inch thick and four feet or larger in diameter, forming the exterior of a wheel. These plates are placed six inches apart on a hollow axle three inches in diameter. Between these two plates are four V-shaped pieces of sheet metal spaced precisely to form six-inch spokes which will direct water from holes in the central axle to the outer rim, while the inside of the V will form air pockets between the spokes. The ends of the V must not be closer than two inches to the outer rim of the wheel. All four V-shaped units must be precisely placed in balance with each other and securely welded to keep the air pockets and the water pockets separated. The outer rim of the wheel is made of a piece of one eighth inch thick sheet metal six inches wide, formed in a perfect circle and welded securely to the edge of the circular plates so that the area inside is completely enclosed. On this outer rim, directly in the centre, are placed between four and fifty water jets about the size of a football needle, slanted sharply to one side to give the wheel a turning motion. (The optimum number of water jets on the outer rim depends on the application, but the volume of water being expelled through the jets must not exceed sixty-six percent of the volume of water which can pass through the openings at the centre axle. The reasons for this are:

1. The water going out of the jets would be going out faster than the water entering the wheel which would result in no pressure near the outer rim, pressure which is essential for the running of the motor.
2. The water entering the wheel must go immediately into a puddle of water. The longer it remains a stream of water instead of a puddle of water, the more energy is wasted.

Because the water being ejected through the exterior jets is always less than the amount of water available to the jets, a pressure build-up will occur near the outer rim. A spring-loaded pressure release jet (not shown) must be built into the exterior rim along with the other jets, but facing in the opposite direction to keep the wheel from over-spinning if the load (generator) is dropped or does not take enough power off to keep the wheel speed constant. There are several other ways to control the speed.

The central axle is designed to have water going into one end of it, and an electrical generator attached to the other end of it. Between the water entry and the generator, very close to the wheel itself, would be very sturdy roller or ball bearings resting on, and attached securely to, a framework which will hold the wheel one foot off the floor. Water is forced into the axle via a high-volume low-power centrifugal force pump, approximately one half horsepower motor, at approximately 20 (US) gallons per minute depending on speed and power requirements. This motor and water pump is primarily to start the wheel and since the power from this is all added to the power output of the big wheel, I prefer to leave the pump running during operation.

The entire unit (depending on application) can be put into a containment shell which can be pressurised or evacuated of air. If the unit is to be operated in an open field, the outer shell can be pressurised and the starting pump removed or turned off once the motor is running by itself. If the unit is to be operated in a garage or near a house, it would be operated at atmospheric pressure or in a vacuum, in which case it is necessary to leave the pump attached and running so that air bubbles do not form near the central axle.

Also, the containment shell must be able to collect about ten inches of fluid in the bottom, waiting to be recycled through the wheel.

Important Notes Regarding this engine:

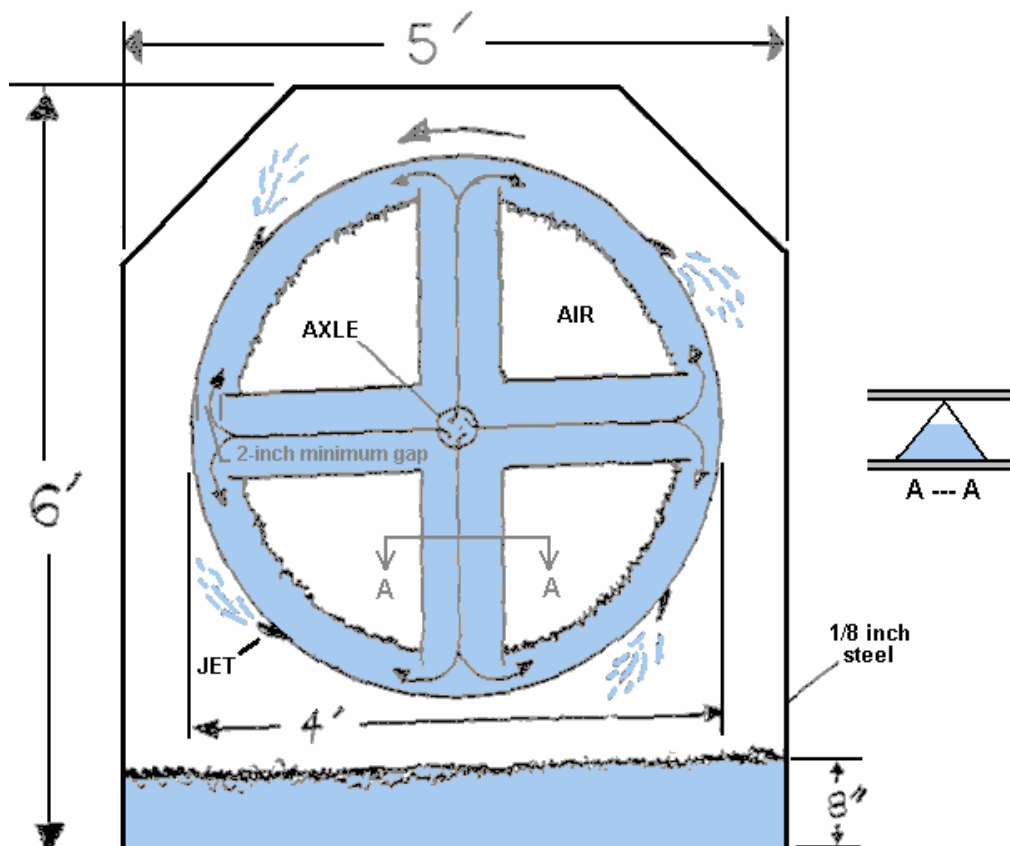
1. The speed and horsepower curve of a self-energised motor is exactly the opposite of that of a normal motor. A normal motor reaches a power peak and then starts downwards. The power curve starts with a slow upward climb and then accelerates rapidly until the power line curve is almost vertical (just prior to disintegration if speed control is not being used).

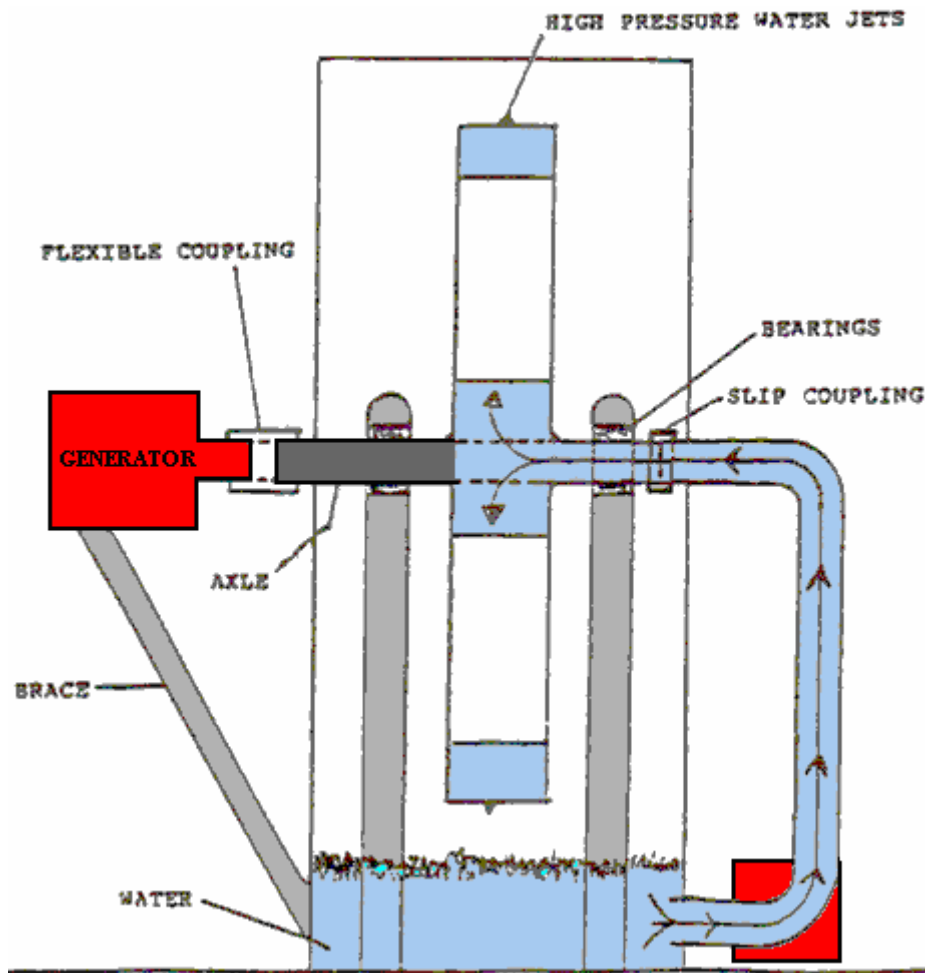
The motor will not generate more energy than is put into it before it reaches 60 to 100 rpm, depending on design and size.

2. As speed increases, air bubbles which occur in the working fluid will accumulate in the air pockets. The air pockets serve only to hold the pressure steady and give a gentle persuasive pressure that is multi-directional instead of just centrifugal, resulting in a steady pressure to the jets. It is not just possible or probable that the unit would blow itself apart by its own power (if the pressure were not released at some point or power taken off); it happens to be a fact. Air pressure will accumulate in the air pockets inside the wheel only after the wheel is going 60 rpm or faster.
3. The pressurised air in the outer rim of the wheel is essential because it pushes in all directions at once, while the water pushes in only one direction. In other words, centrifugally forced water is not interested in finding its way through the jets, it is only interested in pressing directly against the outer rim. The water holds the air in place at the same time that the air is forcing the water through the jets, and the water coming down from the axle keeps replacing the expelled water. This is why I keep saying over and over again, "Make it big enough, make it big enough". Otherwise it would be no more workable than a small dam.
4. In order for this motor to work properly, the water coming down the spokes must not be restricted in any way until it reaches the outer rim. This is why we have six-inch spokes. The water resting against the outer rim cannot be moving about rapidly; we want the water sitting as still as possible under as much pressure as possible.
5. There are two primary factors which must not be altered in the design of this wheel, otherwise it will not work:
 1. The spokes must be very large and free of restrictions, because liquid in general tends to cling to anything it gets near.
 2. The speed of the wheel turning is essential to the centrifugal force required to build up the pressure near the outer rim, and for this reason the jets in the outer rim must be small in diameter and in large numbers so that the concentration is on speed instead of on volume (but not to exceed 66% of the water which can enter at the central axle).

6. Regarding the working fluid: Although it has been referred to here as “water”, the working fluid can be any kind of transmission fluid, oil, hydraulic fluid, etc., keeping in mind that the working fluid must also act as a lubricant for the bearings which are expected to last for ten to twenty years. I recommend regular off-the-shelf transmission fluid, which I have seen used alone in a car engine with lubrication results quite comparable to oil.

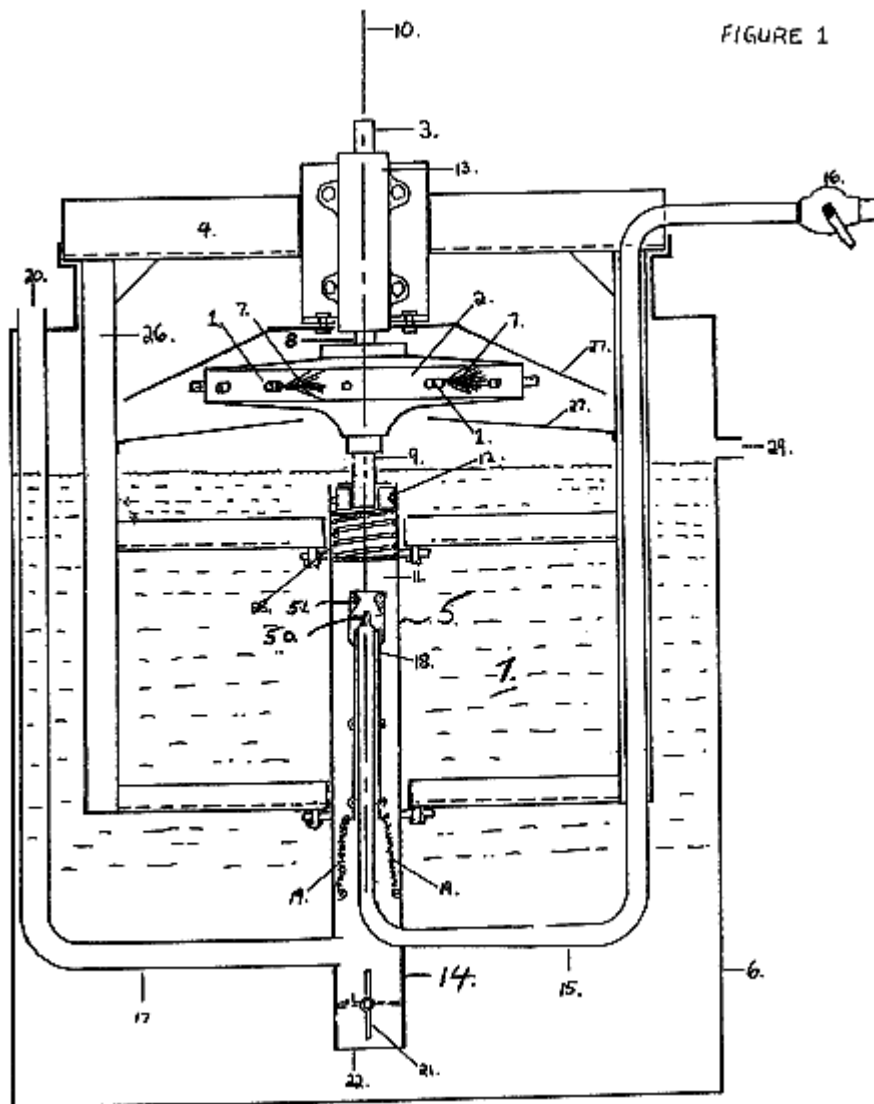
The primary functional differences between this motor and damming up a river are: We create our own “gravity” and pre-determine the amount of that gravity by two methods instead of just one. The gravity in a dam can only be increased by building the dam larger; the motor can also increase the working “gravity” by increasing the rpm. This is done by adding more jets, right up to the point where 66% of the incoming water is being ejected. To use more of the available water than this would cause too much turbulence of the water inside the wheel. But keep in mind that there is always plenty of pressure inside the wheel to do the work it is designed for, providing that it is let run at a high enough speed to keep the pressure in the outer rim very high – in exactly the same sense that you don’t try to take off in your car until the engine is going at high enough rpm to handle the load application.





The two drawings above were produced by Donnie Watts and in them 4' means four feet and 8" means eight inches.

This design from Donnie Watts could be built by most people, but on 13th March 1992, Donnie Watts and T. Edwin Orton obtained Canadian patent 2025601 for a much more complicated version of the motor. It looks like this:



This is a much more complicated device with the rotor bearing having to support the full rotor weight as an axial drag, and there is the addition of an extra air intake, an extra valve, springs and a valve seal among other things.

The Canadian 2025601 Patent

ROTOR POWER CONVERSION APPARATUS AND METHOD

Field of the Invention

This invention relates to the field of mechanical power converters and in particular to the field of mechanical power conversion apparatus which convert the flow of the fluid to rotational mechanical power at high efficiency.

Background of the Invention

In prior art there are many devices in which rotational mechanical power has been extracted from the kinetic or potential energy of moving fluid. Devices have included the water wheel, the water turbine and "Pelton wheel" and various turbines in which fluid under the influence of external pressure, flows radially outwardly or inwardly past curved vanes to impart its force to the vanes and create torque. The present invention falls into the latter category but the method of power conversion is significantly different from the prior art in order to achieve higher efficiencies.

In conventional power conversion apparatus, moving fluid under the influence of gravity or pressure from an outside source is directed tangentially against vanes or paddles as in the case of the water wheel, "Pelton wheel" or water turbine; or it is directed radially outwardly or inwardly to impact against and escape freely past curved vanes as in the case of various water, air and exhaust turbines. The fluid transfers its energy to the paddles or vanes by impacting against them and, as the paddles or vanes move at increasing velocity away from the point of impact, the force of impact, the force of impact of fluid against them decreases. Thus, as the tangential velocity of the rim of the wheel or rotor increases, the torque on the wheel or rotor decreases as a function of the geometry and angular velocity of the turbine. The moving fluid transfers some of its kinetic energy to the vanes or paddles, losing some of its velocity in the transfer, but escapes past the vanes or paddles, still retaining a considerable proportion of its velocity and kinetic energy. In the present invention, this escaping energy is reduced as will be further described. In the present invention, the torque on the rotor is caused by jet thrust reaction originating at and acting tangentially to the arc described by the outer periphery of the rotor. Because jet thrust reaction is always relative to its point of origin and undiminished regardless of the movement of that point or origin, being dependent only upon the efficiency of the jet and the pressure which feeds it, the torque on the rotor does not decrease as the rotational speed of the rotor increases.

Secondly, whereas the movement and/or pressure of fluid in conventional devices is supplied from an outside source such as external pressure or gravity, the working pressure of the fluid in the present invention is increased within the hollow rotor itself by the centrifugal force acting upon the fluid like a greatly enhanced artificial gravity acting radially outward as the fluid rotates with the rotor. To accomplish this, the working fluid is freely admitted to the centre of the hollow rotor but allowed only restricted escape at the diametral periphery of the rotor through jets much smaller in aggregate cross-sectional area than the aggregate cross-sectional area of the passages by which fluid enters and travel outward from the centre to the periphery within the rotor. At the same time the fluid is forced to rotate with the rotor by being conducted radially outward in discrete passages as it gradually moves outwardly from the centre to the periphery of the rotor to replace fluid which is expelled from the thrust-jets by the centrifugally-induced pressure.

The jets eject a relatively small volume of fluid compared to that which can freely flow radially outward from the hub, while being forced to rotate with the rotor, so as not to disturb the predominately static (relative to the rotor) pressure head inside the rotor.

By these means, the velocity and kinetic energy of the fluid is first converted to a substantially static pressure head of fluid within the periphery of the rotor and thence to a jet thrust originating at and acting tangentially to the arc described by the periphery of the rotating rotor, such thrust always being always relative to its point of origin and not diminished by the movement of that point of origin. This thrust produces torque on the rotor, relative to a fixed frame of reference, which is extracted as rotational power at the axis in a conventional manner.

An explanation of the mathematical relationships involved will aid in understanding the working principles of this invention. For simplicity, the diametral periphery of the rotor will be called the rim and the hub where the fluid enters will be called the centre. The jets are at the rim and thrust tangentially to it. The fluid enters at the centre and is forced, by radial passages or partitions, to rotate with the rotor as the fluid moves gradually toward the rim where it is constrained except for a portion which can escape via the thrust-jets. Such portion is a small amount in proportion to that which the passages can transfer with minimal friction losses. The fluid within the rotor acts much like a fluid flywheel exerting centrifugally-induced pressure outwardly from the centre toward the rim of the rotor.

Mathematically, excluding friction losses, the pressure of the fluid inside the rim due to the centrifugal force acting on the column of fluid radially disposed between the centre and the rim, is always proportional to the tangential velocity of the rim regardless of the diameter of the rotor; i.e. a 1 foot diameter rotor at 20 revs per second gives the same pressure as a 2 foot diameter rotor at 10 revs per second. Quantitatively, by conventional centrifugal pump design formula, it is shown that the centrifugally-induced pressure within the rim of the rotor is sufficient to eject fluid from the jets at the same velocity, relative to the jet, as the tangential velocity of the jet and rim, relative to a fixed frame of reference. The acceleration of fluid from the jets tangential to the rim of the rotor, causes an equal and opposite reaction thrust to be imposed on the rim of the rotor, such thrust being relative to the jet and

not diminished by the tangential rotational movement and velocity of the jet fixture in the opposite direction. The ejected fluid has very little velocity remaining relative to a fixed frame of reference; having given up almost all of its kinetic energy to the rotor as tangential reaction thrust.

Experimental jet thrust velocities of 0.95 in relation to theoretical values are readily achieved with correct jet design as set forth in various manuals, (Ref.1) as are net thrust values of 0.9 of theoretical values in relation to pressure.

$$\text{Theoretical pressure head } H = V^2 / 2g$$

Where V = rim velocity and
 g = acceleration due to gravity

$$\text{Velocity of fluid from jet } V = \text{the square root of } 2gH$$

After allowing for friction losses and inefficiencies just as in conventional machines, a high ratio of output power to input kinetic or potential energy is nevertheless achieved.

Summary of the Invention

An apparatus for converting fluid pressure into rotational mechanical power has the object of providing a more efficient means for converting input power into output power than is conventionally obtainable.

In its broadest form, the invention provides an apparatus for converting the power of a fluid flow into a mechanical power output, the apparatus comprising a hollow rotor mounted for rotation about a central axis relative to a fixed frame of reference and provided with a thrust-supplying jet on the circumference of the rotor, and fluid supply means for supplying the fluid flow to the interior of the rotor at a point on the axis of the rotor. The apparatus is adapted to provide enforced rotation of the fluid in the interior of the rotor together with the rotor, and constraint of the fluid within a diametral periphery of the rotor, other than fluid flow through the jet. The fluid pressure is therefore converted into a tangential rotational reaction thrust acting at a point at or near the diametral periphery of the rotor, the magnitude of the thrust acting at the point being dependent only on the fluid pressure within the rotor.

According to one aspect of the invention, the apparatus converts input power to output power at high efficiency by a sustainable rotational reaction thrust originating on a rotor, where the thrust, being relative to the rotor, propels the rotor at high rotational velocity relative to a fixed frame of reference. The apparatus has thrust-jets, a pressure-tight hollow rotor radially disposed around a hollow hub with fluid entrance at one or both sides of the hollow hub and thrust-jets tangentially oriented around the diametral periphery. The hollow rotor has discrete radially-oriented internal passages or partitions extending from the hub to, or nearly to, the internal diametral periphery of the rotor to freely conduct fluid radially outward from the hub while enforcing its rotation together with the rotor. The apparatus has a rotor support shaft and low-friction bearing means, a bearing support, a power take-off and a fluid supply. The thrust-jets extend from the rotor and impart rotational thrust to the rotor by ejecting a pressurised stream of fluid in a direction approximately tangential to the arc described by the rotor's rotational motion, while at the same time, the rotor's rotational motion causes a centrifugally induced increase in the pressure of the fluid which feeds the thrust-jets from within the rotor; the pressure thus generated being additive to external input pressure to the hub of the rotor. The rotor has a rigid axle or axles as hollow intake pipe or pipes attached to the rotor along the axis of rotation, the axle(s) being supported by the bearing means to rotate freely therein. Fluid is admitted to the hollow intake pipe(s) which may also serve as axle(s) and thence through the hollow hub to the radial feed arms or channels within the rotor. The radial feed arms or channels feed fluid through **at least an 8:1 contraction ratio** to the thrust-jets. In the case of liquid being used as the working fluid, fluid is admitted to the intake pipe(s) through a rotating seal in order to exclude air. The axle(s) extend through low-friction bearings on the rotor support to provide a power take-off whereby mechanical power may be transmitted by gears, pulleys and the like. A starting mechanism, rotor speed governors, air purging mechanism in the case of liquid operated units, and shut-off mechanisms are provided.

Brief description of the drawings

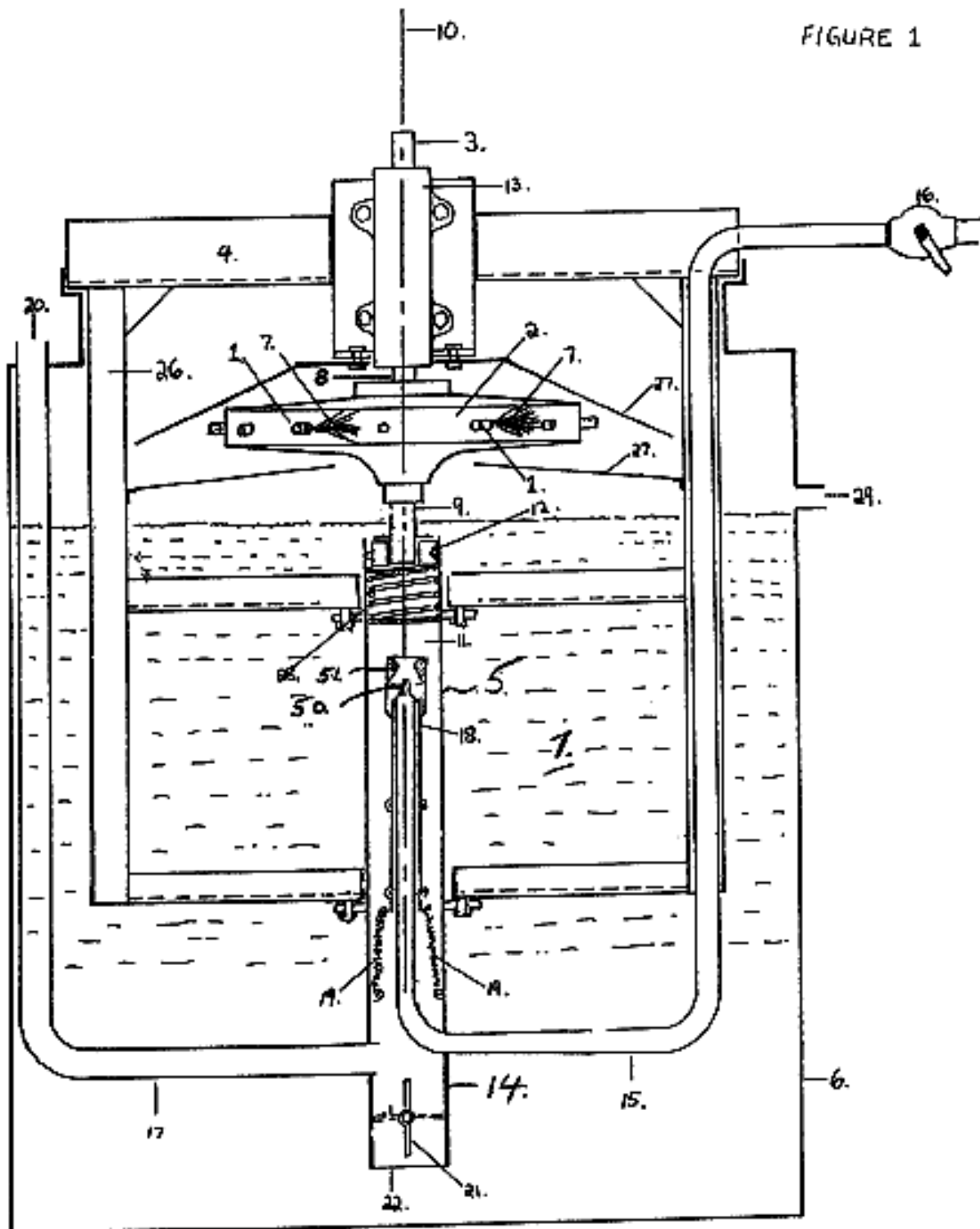


Fig.1 is a front elevation view, partially in cross-section of one embodiment of the apparatus showing the retractable jet-siphon pressure injection nozzle in it's retracted position.

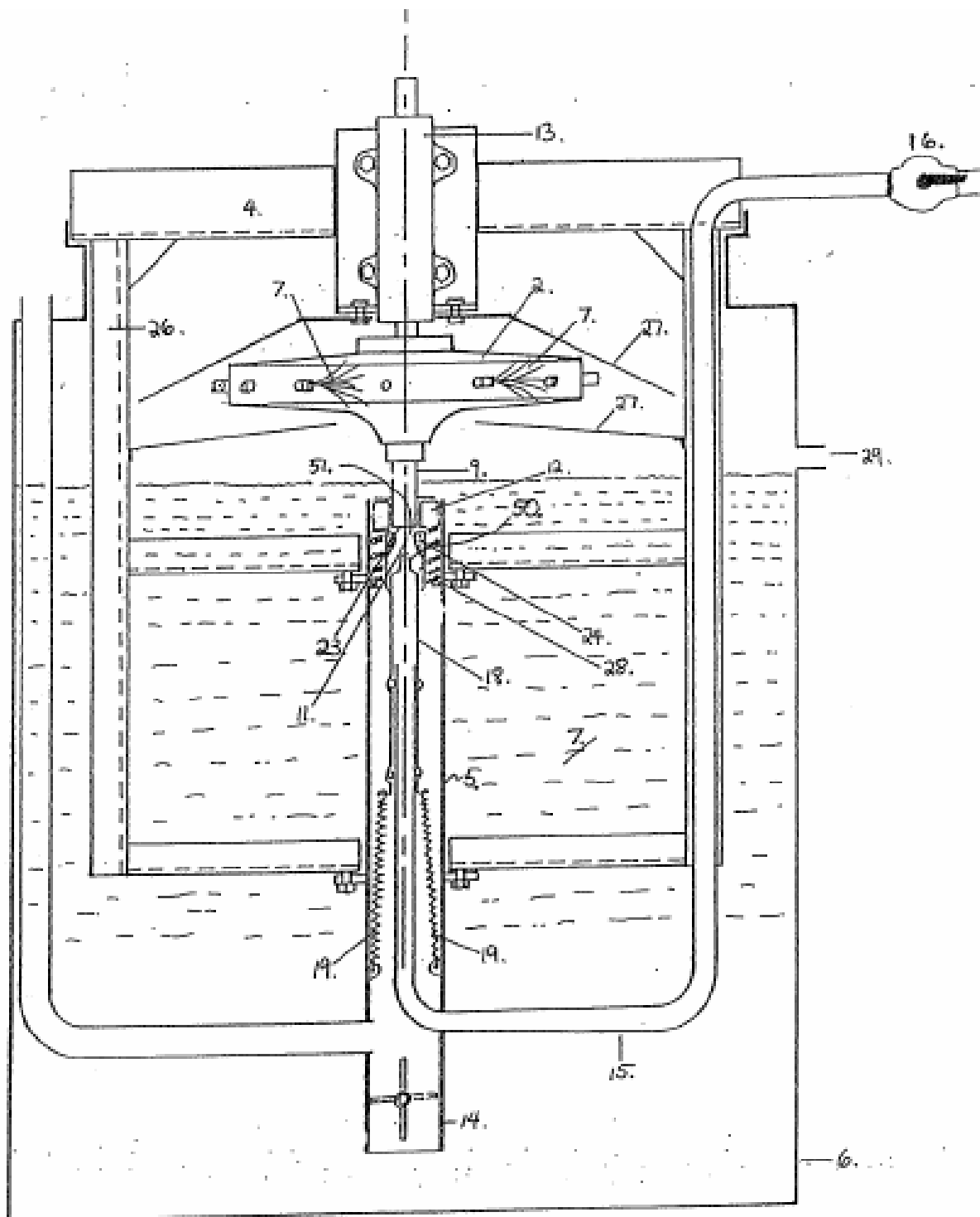


Fig.2 is a front elevation view, partially in cross-section, of one embodiment of the apparatus, showing the retractable, jet-siphon pressure injection nozzle in its pressure injection engaging position.

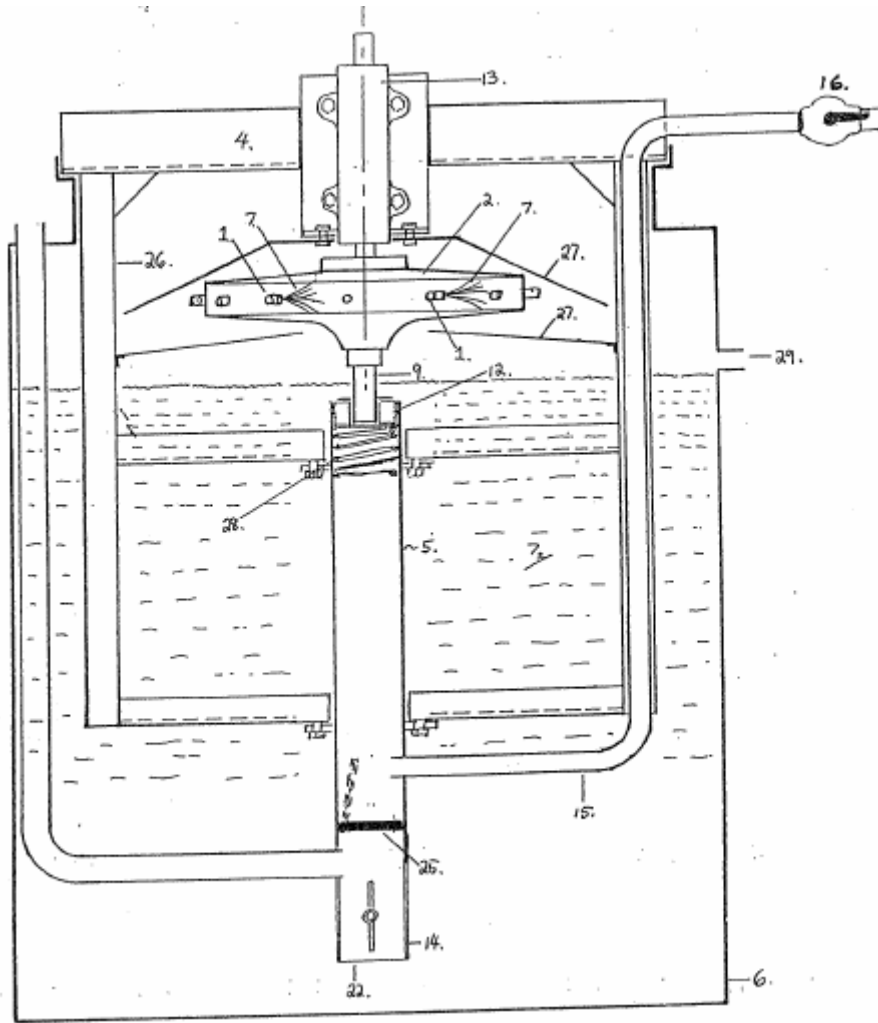


Fig.3 is a front elevation view, partially in cross-section, of a second embodiment of the apparatus showing the one-way valve in the open position.

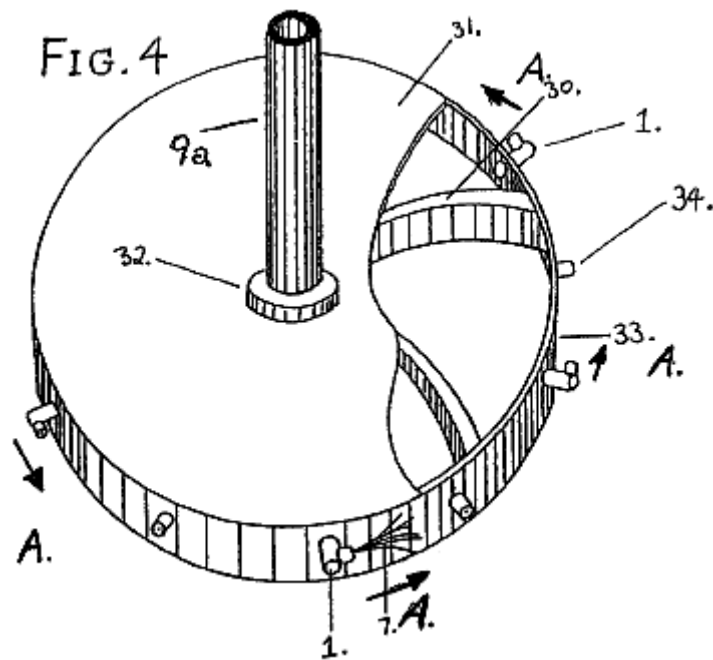


FIG. 4 is a top oblique view, partially cut away, of one embodiment of the rotor of the invention.

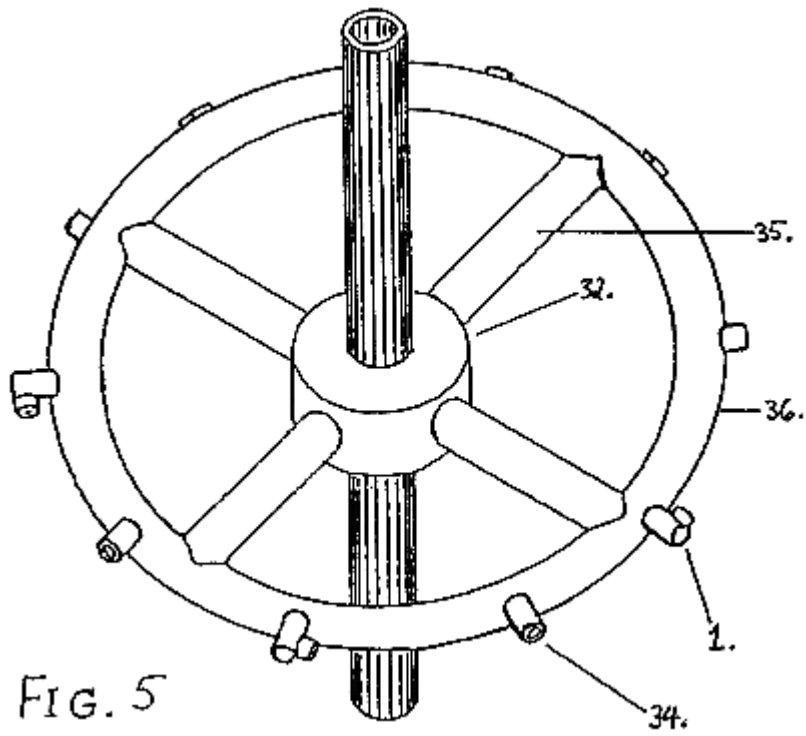


Fig.5 is a top oblique view, partially cut away, of a second embodiment of the rotor of the invention.

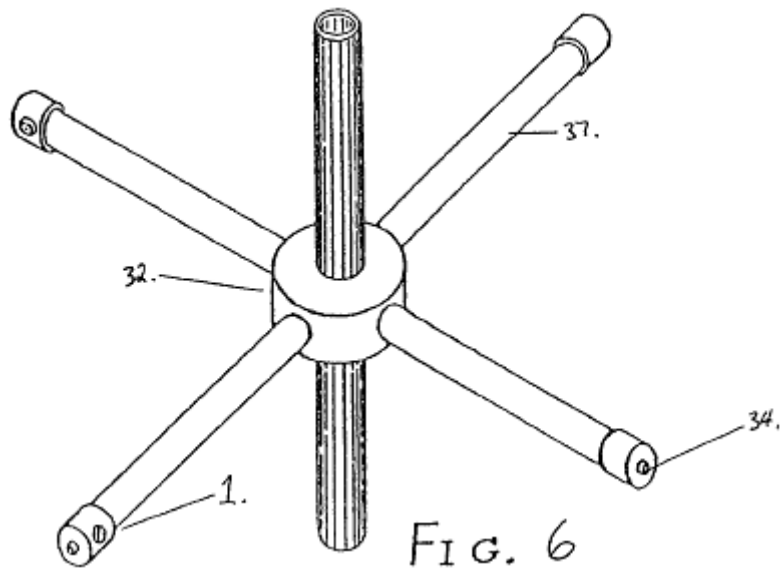


Fig.6 is a top oblique view, partially cut away, of a third embodiment of the rotor of the invention.

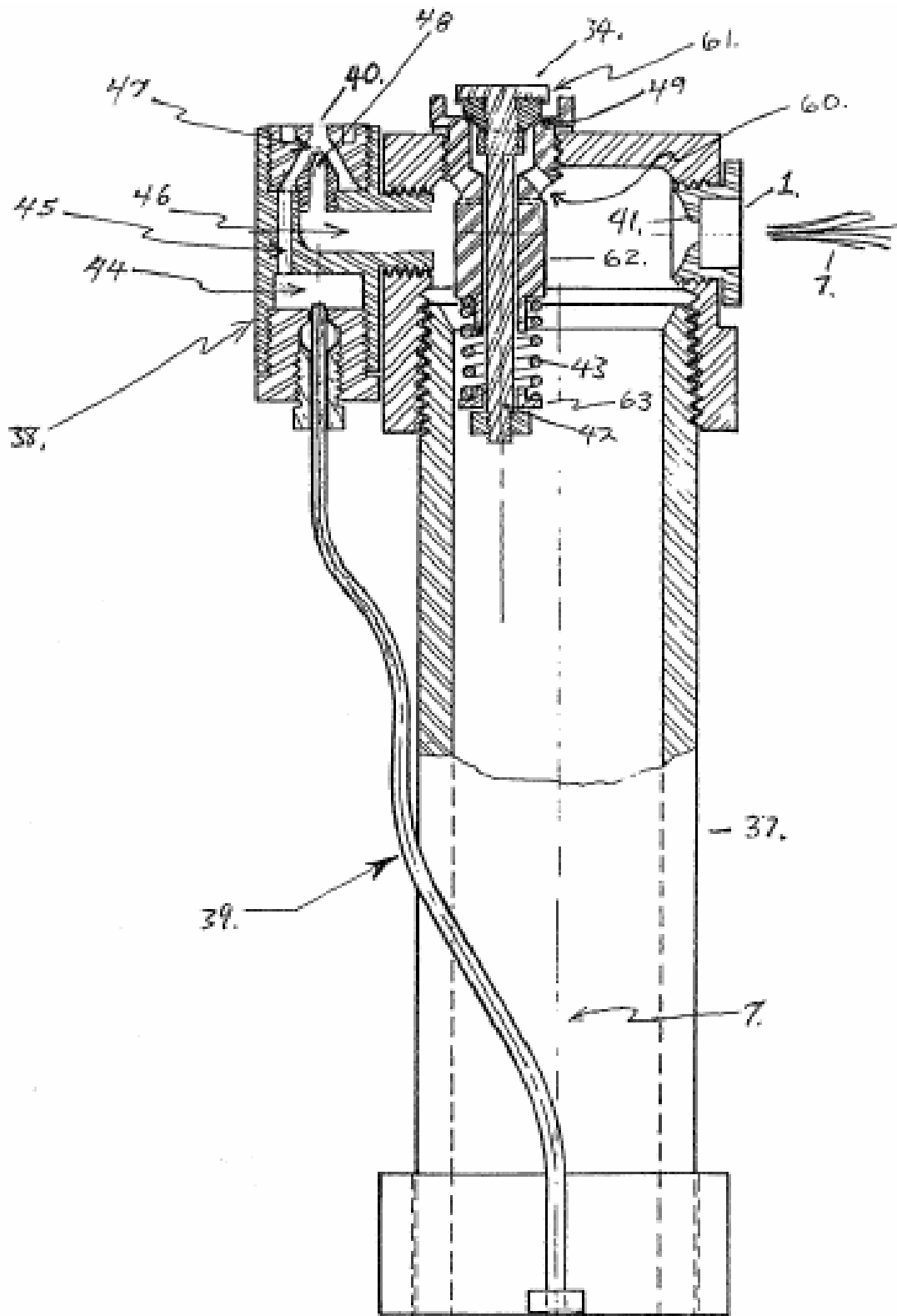


Fig.7 is a top elevation view, partially cut away, of greater detail of the outer end of a radial feed arm of the third embodiment of the rotor of the invention, showing a centrifugal-force operated, poppet type governor release valve, a pressure operated jet-siphon air purging mechanism and a correctly shaped thrust-jet.

Detailed Description of the Preferred Embodiment

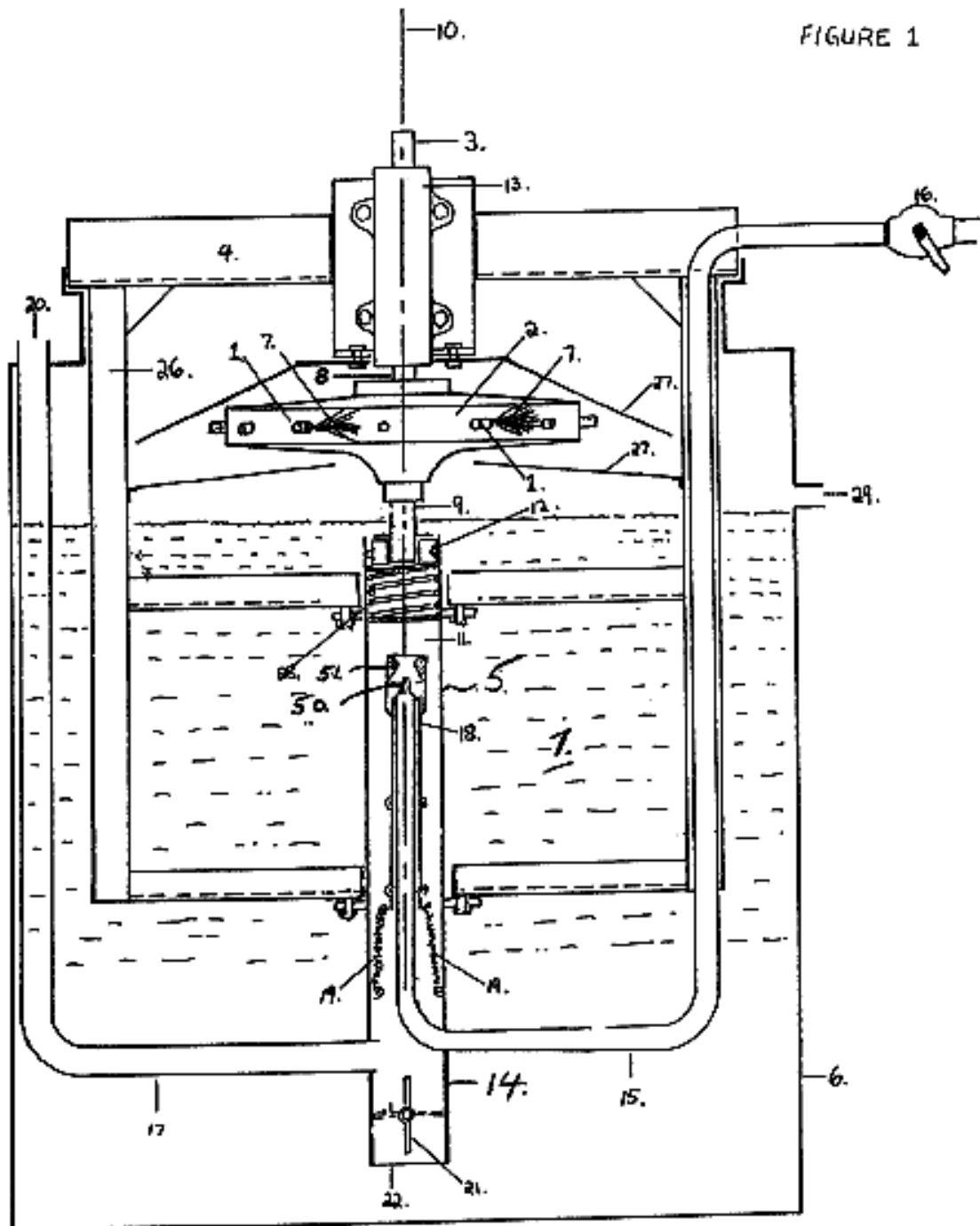


Figure 1 illustrates the invention having thrust-jets 1, rotor 2, power take-off 3, rotor support 4, fluid supply 5, and fluid reservoir 6. Thrust-jets 1 extend from rotor 2 and impart rotational thrust to rotor 2 by ejecting a stream of fluid 7 in a direction indicated by arrow "A" in Figure 4, approximately tangential to the arc described by the rotor's rotational motion.

Fluid 7 (such as water) is supplied to the fluid supply line 5 through the open bottom 22 in order to exclude entrained air bubbles. Rotor 2 has rigid upper axle 8 and rigid lower intake pipe 9 attached to the rotor 2 along the rotor's axis of rotation 10. Rotor 2 is suspended over fluid reservoir 6 on axle 8 by rotor support 4.

Fluid supply line 5 is supported in fluid reservoir 6 on axle 8 by rotor support 4. Fluid supply line 5 is supported in fluid reservoir 6 centrally aligned beneath rotor 2. Intake pipe 9 is hollow and communicates with fluid supply line 5 to channel fluid 11 from fluid supply line 5 to rotor 2. Fluid 7 is

channelled from intake pipe **9** through rotor **2** in one of the manners further illustrated below. Intake pipe **9** is seated in seals **12** mounted in the upper end of supply line **5**, where such seals may be of a conventional ceramic, composite or carbon-graphite wear-ring type. Axle **8** extends through low friction bearings (not shown) in upper bearing housing **13** on rotor support **4** and connects to power take-off **3**. Axle **8** is solid or sealed from rotor **2** and intake pipe **9** such that fluid **7** in rotor **2** and intake pipe **9** is prevented from entering axle **8**. Mechanical power is transmitted from power take-off **3** by attaching suitable gears, pulleys or the like.

Fluid supply line **15** is supplied with fluid under pressure from an outside source through fluid supply line **5** through leak proof connections or welding and its inner end is attached centrally below and in line with intake pipe **9**. Retractable jet-siphon assembly **18** telescopes on to the inward vertical end of fluid supply line **15** and is provided with one or more O-ring seals along its interior diameter to provide a sliding (telescoping) fluid-tight joint. Unless forced upward by internal pressure from the fluid supply line, the jet-siphon assembly is held in the retracted position shown in Figure 1 by retraction springs **19** attached to fluid supply line **5**.

Ventilator pipe **17** communicates with fluid supply line **5** at its lower end with open air at its upper end **20**. Ventilator **17** is provided so that ambient air may be introduced into fluid supply line **5** to interrupt the supply of fluid **7** into rotor **2** from reservoir **6**. While retractable jet-siphon assembly **18** is retracted under the spring force of springs **19**, introduction of ambient air from ventilator **17** into fluid supply line **5** will, if rotor **2** is spinning, cause rotor **2** to decelerate as air is drawn up through the intake pipe **9** and into rotor **2** to replace fluid exhausting through jets **1**.

Ventilator **17** has air intake **20** and communicates with fluid supply line **5** near its lower end but above butterfly valve **21** which is positioned in fluid supply line extension **14** near opening **22** and may be rotated from an open position (shown in solid lines), in which position fluid from reservoir **6** is free to enter fluid supply line **5** through opening **22**; to a closed position (shown in broken lines), in which position, fluid from reservoir **6** is prevented from entering supply line **5** and ambient air from ventilator **17** may be entrained into fluid supply line **5**. Ambient air from ventilator **17** is entrained into fluid supply line **5** if static fluid pressure in fluid supply line **5** is lower than the ambient atmospheric static pressure. A lower than ambient pressure in supply line **5** will exist if valve **21** is closed and rotor **2** is spinning.

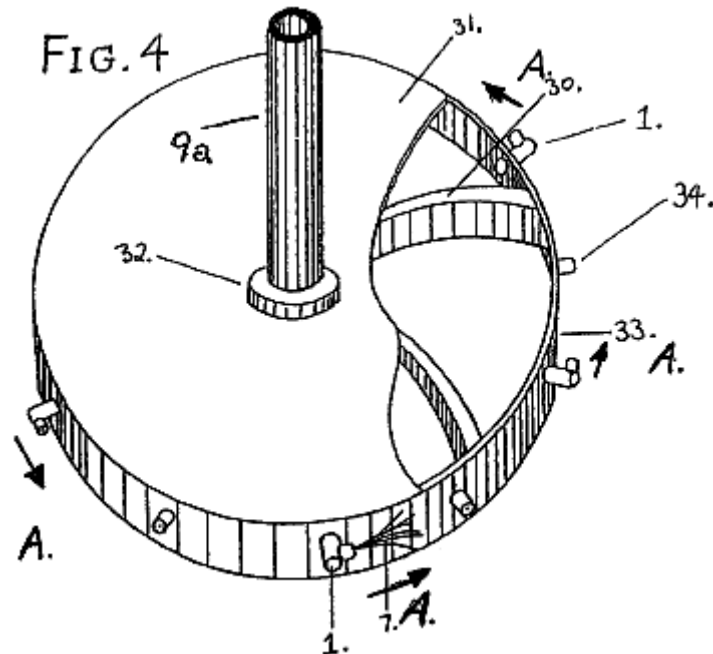
As illustrated in Figure 2, retractable jet-siphon assembly is mounted on the end of supply line **15** supported concentrically within fluid supply line **5**. Retractable jet-siphon assembly **18** has restricted inner nozzle **50** with outer venturi **51** affixed in cooperative relationship to it, forming a jet-siphon. Nozzle **50** has a diameter significantly less than the diameter of pipe **15**. As the force acting to advance retractable jet-siphon assembly **18** increases due to increased fluid pressure from fluid supply line **15** acting on the interior of the retractable assembly **18**, retractable jet-siphon assembly **18** advances toward opening **23** in rotor intake pipe **9**. Conversely, as fluid static pressure from fluid supply line **15** is decreased, assembly **18** retracts away from rotor intake pipe **9** under the force of retraction springs **19**.

When jet-siphon assembly **18** is fully advanced, upper side of venturi ring **24** seals against the underside of seal **12** so that jet-siphon **18** injects fluid from fluid supply **7**, mixed with and assisted by fluid under high pressure from fluid supply line **15**, directly into intake pipe opening **23**. By these means, a high pressure, low volume fluid supply from fluid supply line **15**, is used to provide a higher volume of fluid to the rotor at somewhat lower pressure. Conversely, as fluid static pressure from fluid supply line **15** is decreased, nozzle **18** retracts away from lower rotor axle **9** under the force of retraction springs **19**. Retraction springs **19** are secured to supply line **5**.

Figure 3 illustrates a second embodiment of the invention. A one-way valve **25** is provided in the supply line **5** instead of retractable jet-siphon assembly **18**. One-way valve **25** is biased from a closed position, in which fluid from reservoir **6** is prevented from entering through opening **22**, to an open position (shown in broken lines) in which fluid from fluid reservoir **6** flows into supply line **5** when static fluid pressure in supply line **5** is lower than ambient atmospheric static pressure. Static fluid pressure in supply line **5** is lower than ambient atmospheric static pressure when fluid supply valve **16** is closed and rotor **2** is spinning. Rotor **2** in this embodiment is supplied with fluid under pressure from an outside source by pressurising fluid in supply line **5** from fluid supply line **15**. This pressurisation closes one-way valve **25** and forces pressurised fluid from fluid supply line **15** into rotor **2** and on out through jets **1**

as fluid 7. In this embodiment, fluid supply line 15 enters supply line 5 between intake pipe 9 and one-way valve 25.

As illustrated in Figures 1, 2 and 3, support frame 26 descends from rotor support 7 into fluid reservoir 6. Support frame 26 and bearing housing 13 support fluid deflectors 27 which deflect and diffuse fluid streams from 1 into reservoir 6. Rotor housing 26 extends below rotor 2 into reservoir 6 to rigidly support fluid supply line 5. Coil spring 28 is supported at its lower end in the inner surface of supply line 5 and resiliently supports seals 12 within supply line 5. Reservoir 6 has overflow port 29.



Figures 4, 5 and 6 illustrate three embodiments of rotor 2. Rotor 2 in Figure 4 has straight or curved radially oriented guide partitions 30 within rotor casing 31 and extending from the fluid entrance in hub 32 to, or almost to the inner rim 33 of rotor 2. On the initial acceleration of rotor 2 from rest, pressurised fluid from intake pipe 9a and/or intake pipe 9 (not shown) is forced away from rotor hub 32 between partitions 30 to rotor rim 33 where the pressurised fluid is forced from jets 1 to accelerate rotor 2. Centrifugal force due to the rotational motion of rotor 2 further pressurises the fluid constrained within rotor casing 31 against rotor rim 33. Fluid from open inner end of intake pipe(s) 9 and/or 9a enters casing 31 and is accelerated rotatively as it is impelled, by centrifugal force, radially outward from rotor hub 32, between partitions 30 to rotor rim 33 where it continuously replaces the fluid forced from jets 1 or from governor pressure release valves 34. The rotational velocity of the fluid is great compared to its radial velocity in order to ensure maximum pressure build-up due to centrifugal force, and minimum turbulence and static pressure head loss due to fluid friction within the rotor 2. Governor pressure release valves 34 regulate rotational speed of the rotor 2 by releasing fluid radially from rotor 2 when centrifugal force, plus static fluid pressure head within rotor 2 exceeds a predetermined level exerted against governor pressure release valves 34 limits rotational speed of rotor 2 by increasing the flow of fluid through rotor 2 and thereby increasing the amount of power used to rotationally accelerate fluid without increasing the tangential jet thrust imposed on rotor 2.

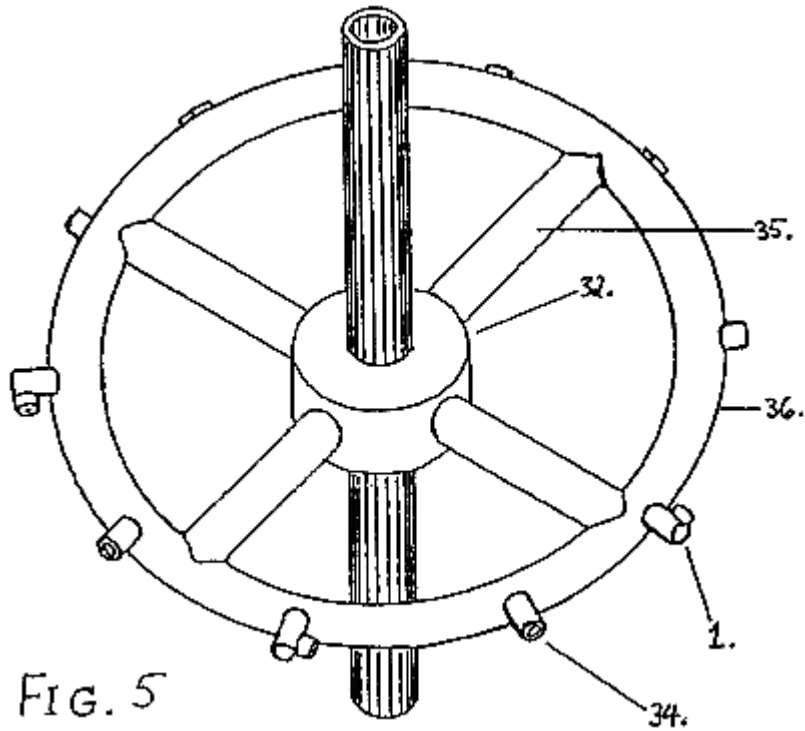


Figure 5 illustrates an embodiment of rotor 2 where hollow spokes 35 and hollow tubular rim 36 are substituted for radial partitions 30 and rotor casing 31.

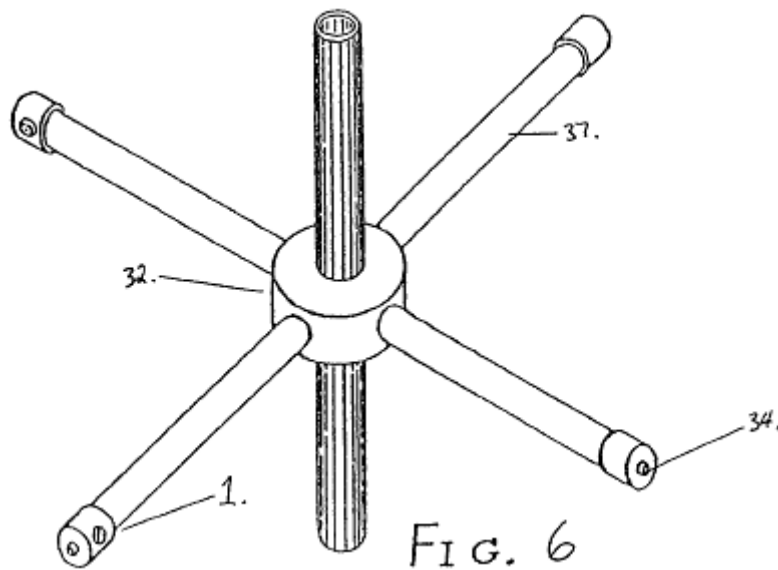


Figure 6 illustrates an embodiment of rotor 2 where hollow arms 37 are substituted for radial partitions 30 and rotor casing 31.

In embodiments illustrated in Figures 4, 5 and 6, **the combined cross-sectional area of intake pipes 9 and/or 9a and the combined cross-sectional areas of spokes 35 and of arms 37, are at least 8 times greater than the combined cross-sectional areas of the nozzle openings in jets 1 in order to reduce pressure losses in rotor 2.**

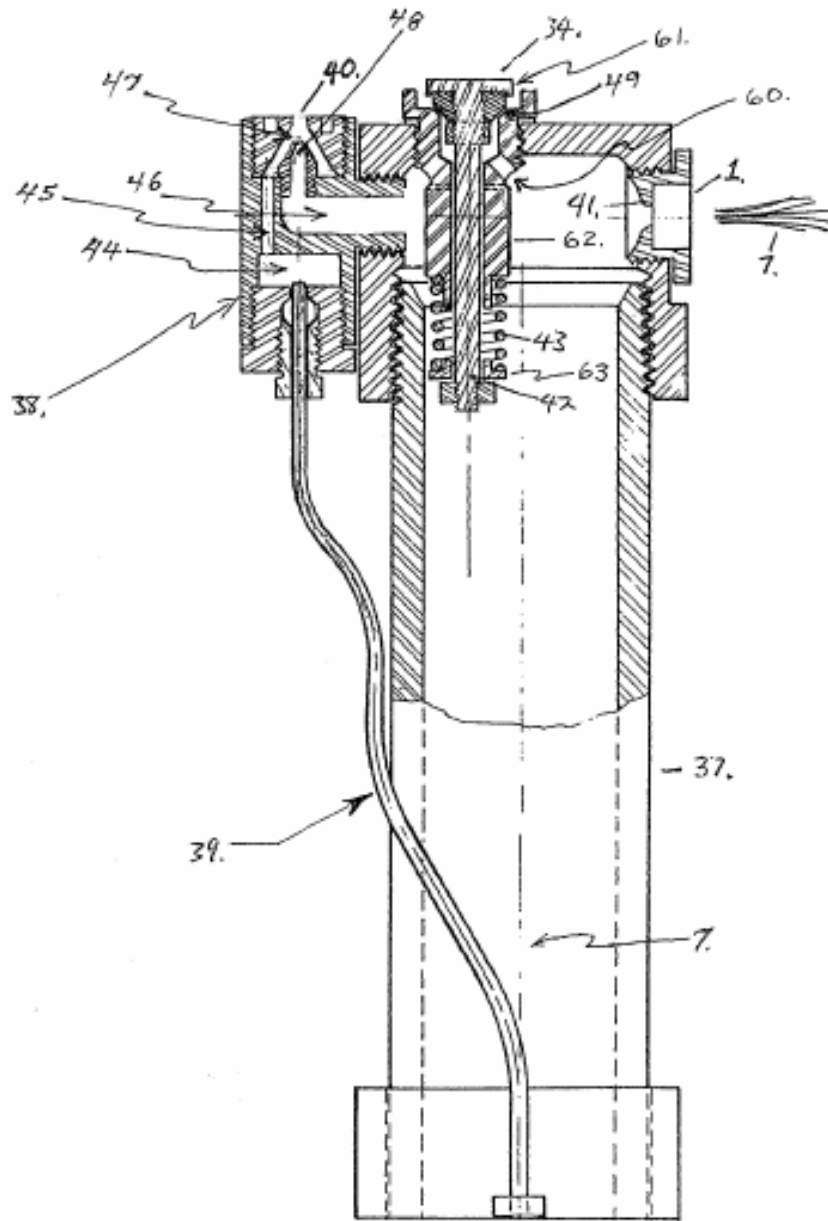


Figure 7 illustrates an embodiment in greater detail of spoke **37** incorporating a jet-siphon air purging mechanism **38** for machines using liquid operating fluid **7**. Air line **39** connects the central interior cavity of rotor hub **32** to intake area **44** of air purging mechanism **38**. When rotor **2** is spinning, a small amount of air inevitably entrained in fluid **7** is centrifuged out of fluid **7** and would otherwise collect in the centre of rotor **2**, thus reducing centrifugally induced pressure build-up in the working fluid **7** within the rotor **2**. Jet-siphon purging mechanism **38** uses a small amount of fluid **7** under high pressure from within rotor **2** and conducts it via passage **46** to high-pressure siphon-jet **48**. The fluid **7** is ejected at high velocity through venturi area **47** and draws air along connecting passages **45**, through intake area **44** and through air line **39**, from the hub **32** of rotor **2**. The air entrained with working fluid **7** in venturi **47**, is exhausted from purging mechanism outlet **40**, either radially or tangentially-assisting jet thrust from thrust-jets **1**.

In a further embodiment, rotor **2** may have air purging means (not shown) consisting of a small diameter tube centrally affixed within feed pipe **5** and extending upward through the centre of intake pipe **9** into the central interior cavity of rotor **2**; the lower end of said tube extending through fluid-tight connectors through the wall of feed pipe **5** and through the outer wall of reservoir **6** to communicate with outside air or with the intake of an external vacuum pump, whereby air may be purged from the central cavity of rotor **2** by incoming fluid pressure into rotor **2** forcing air out of the small diameter purge tube, or air may be drawn out of the purge tube by the vacuum pump and expelled to the outside air.

Figure 7 also illustrates a cross-section, governor pressure release valve assembly **38**. As rotational speed of rotor **2** increases beyond a pre-determined limit, increasing centrifugal force and fluid pressure within arm **37** of rotor **2** presses outward against valve stem **42** and valve head **61**. Valve stem **42** with retainer **63**, is forced against coil spring **43**, allowing valve head **61** to move away from valve seat **49** in valve body **62**.

Pressurised fluid **7** from within arm **37** of rotor **2** is thus allowed to escape through passages **60** in valve body **62** and thence out between valve seat **49** and valve head **61**; then being exhausted radially from arm **37** of rotor **2**.

As previously stated, the release of fluid from governor pressure release valve **34** increases the outward radial movement of fluid **7** within arm **37** of rotor **2** without a corresponding increase in tangential jet thrust; and more fluid per unit of time is caused to be accelerated from its curvilinear velocity at the hub **32** of rotor **2** to its curvilinear velocity at the outer end of arm **37** of rotor **2**, as it moves radially outward within arm **37** of rotor **2**, than that which is ejected to produce jet thrust at the jets **1**. The increased fluid-acceleration demand imposes a drag force upon the rotational movement of rotor **2** without a corresponding increase in propulsive from the jets **1**, thus preventing the rotor from overspeeding. Conversely, when transmission of power from power take-off **3** (in Figure 1) holds the rotational speed of rotor **2** within the predetermined limit, valve spring **43**, reacting against valve spring retainer **63** on valve stem **42**, pulls valve head **61** firmly against valve seat **49**; thus preventing the escape of fluid **7** through governor pressure release valve **34** and allowing rotor **2** to operate at full efficiency. Figure 7 also illustrates a correctly configured thrust-jet **1** having very short, constant diameter jet tube and smoothly rounded approach **41** so as to produce fluid stream **7** from jets **1** with low pressure loss in the nozzle and maximum velocity.

In a further embodiment, rotor **2** may have governor jets (not shown). Whereas jets **1** provide an acceleration thrust to rotor **2**, governor jets act in a direction generally opposite to that of jets **1** to provide a decelerating thrust to rotor **2**. Governor jets are activated when static fluid pressure in rotor **2** exceeds a predetermined level exerted on governor jets. The governor jets may be interspersed between thrust-jets **1**.

Also, in a further embodiment (not shown), rotor **2** may have governor means to limit rotational speed of the rotor by deployment of deflectors against the stream of fluid issuing from the jets, or by rotation of the jets in their mountings.

Referring to Figures 1 and 2, in operation. Rotor **2** is accelerated from rest by opening fluid supply valve **16** and advancing the retractable jet-siphon assembly **18** so that the upper side of venturi ring **24** seals against the underside of seal **12** which communicates with intake pipe **9** of rotor **2**:

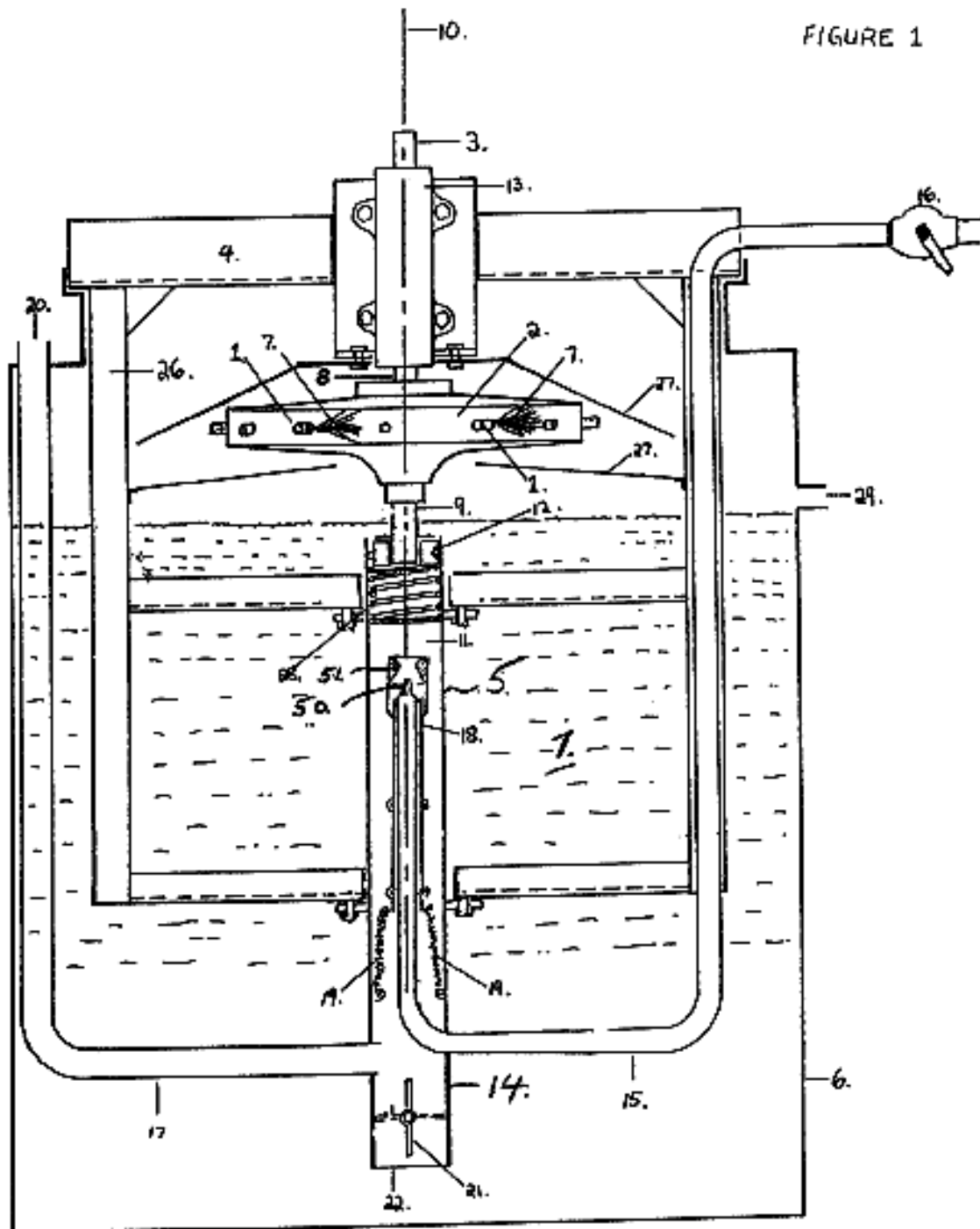


FIGURE 1

Pressurised fluid is injected into rotor 2 via intake pipe 9. Rotor 2 fills with pressurised fluid 7 which is forced through jets 1 and the reaction thrust acting tangentially, accelerates the rotor from stationary. Centrifugal force increases as the square of the rotational speed. Once the rotor has been accelerated to its desired operating speed, mechanical power may be transmitted from take-off 3 in accordance with the design capacity of the apparatus. It is necessary that the rotational speed of the rotor be automatically and quickly governed in order to prevent the rotor from overspeeding and quickly destroying itself.

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Simple Free-Energy Devices

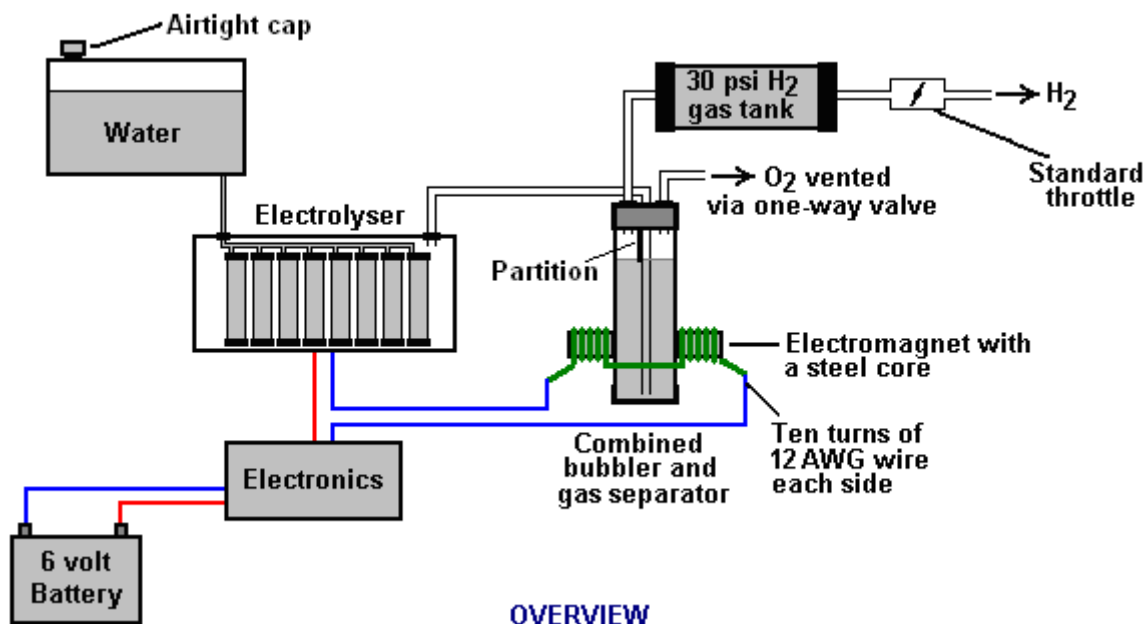
There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 9: Zach West's Water-powered Motorcycle

Zach West of the USA can run his 250 cc motorcycle on water. Strictly speaking, he converts the water into gas before feeding it to the engine. All of the components which Zach uses he made himself and none of them are difficult to make. The device used to turn water into gas is called an electrolyser and it operates by passing an electric current through the water. Personally, I suspect that the electric system of a motorcycle is not able to keep the motorcycle battery fully charged while converting water into a suitable fuel, but using a 12-volt system should overcome that difficulty.

The method which Zach uses is somewhat unusual as he manages to bleed off and discard most of the oxygen produced when water is converted to gas. This means that the remaining gas is mainly hydrogen which is far less reactive than HHO which is already in the perfect proportions for combination back into water and so is highly reactive. Instead, the resulting gas can be compressed reasonably well, and Zach compresses it to 30 psi (pounds per square inch) in a storage container. This helps with acceleration from stationary at traffic lights.

Zach uses a simple, modular style of construction where a series of coiled electrode pairs are each placed inside an individual length of plastic pipe. This is a design which is neither difficult nor particularly expensive to build. In overall broad outline, Zach's electrolyser is fed water from a water tank to keep it topped up. The electrolyser box contains several pairs of electrodes which split the water into hydrogen and oxygen when fed with pulsed electrical current generated by the electronics, which is powered by the electrical system of the motorcycle. The gas produced by the electrolyser is fed to a bubbler, which prevents any accidental igniting of the gases travelling back to the electrolyser and in addition, removes most of the oxygen from the gas by acting as a gas “separator”. The arrangement is like this:

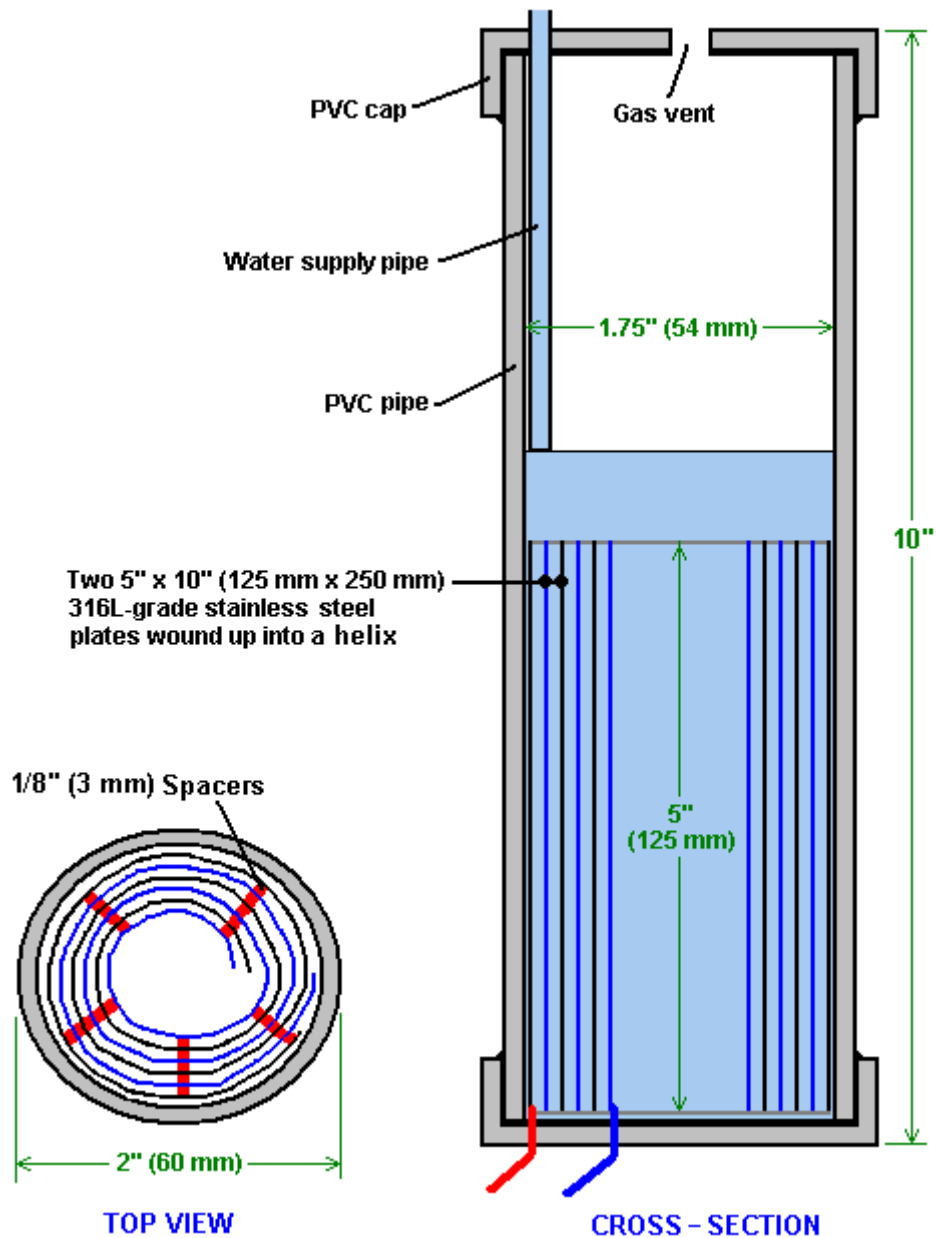


The hydrogen gas output from the electrolyser is not fed directly to the engine but instead it goes to a pressure tank which is allowed to build up to thirty pounds per square inch pressure before the engine is started. The majority of the oxygen produced by the electrolysis is vented away through a 30 psi one-way valve which is included to keep the pressure inside the bubbler (and the electrolyser) at the 30 psi level. That pressure would be excessive for a high-performance electrolyser which produces HHO which is highly charged electrically and so will ignite spontaneously when compressed, due to its own electrical charge. However, in this simple DC electrolyser, the HHO gas is mixed with quite an amount of water vapour which dilutes it and with the reduced oxygen level, that allows compression to thirty pounds per square inch.

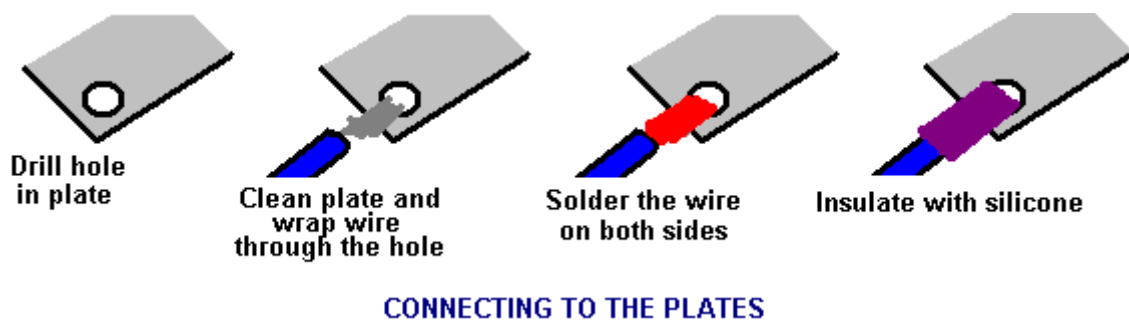
The water supply system operates by having an air-tight supply tank positioned at a higher level than the electrolyser. A small diameter (1/4" or 6 mm) plastic tube coming from the supply tank feeds through the top of the electrolyser and straight down, terminating at exactly the electrolyte surface level wanted in each of the electrolyser tubes. When the electrolysis lowers the electrolyte level below the bottom of the pipe, bubbles of gas pass up the tube allowing some water to flow from the tank to raise the electrolyte surface level back to its wanted position. This is a very neat passive system needing no moving parts, electrical supply or electronics but yet one which accurately controls the electrolyte level. One essential point to understand is that the water tank needs to be rigid so that it will not flex and the filler cap needs to be air-tight to prevent the entire water supply discharging into the electrolyser. Another point to remember when topping up the water tank is that the tank contains HHO gas above the water surface and not just plain air, and that gas mix is at 30 psi pressure.

Now, to cover the design in more detail. This 6-volt electrolyser contains eight pairs of electrodes. These electrode pairs are coiled around in "Swiss-roll" style and inserted into a length of 2 inch (50 mm) diameter plastic pipe, ten inches (250 mm) tall. The electrodes are each made from a 10 inch (250 mm) by 5 inch (125 mm) length of 316L-grade stainless steel shimstock which is easy to cut and work. Shimstock is available from a local steel supplier or metal fabrication company and is just a sheet of very thin metal.

Each electrode is cleaned carefully, and wearing rubber gloves, cross-scored using coarse sandpaper in order to produce a very large number of microscopic mountain peaks on the surface of the metal. This increases the surface area and provides a surface which makes it easier for gas bubbles to break away from and rise to the surface of the electrolyte. The electrodes are rinsed off with clean water and then coiled round, using spacers to maintain the necessary inter-plate gap, to form the required shape which is then inserted into a length of plastic pipe as shown here:



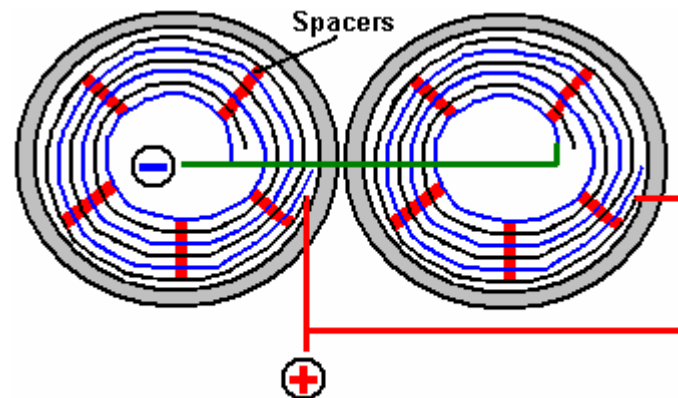
As the springy metal pushes outwards in an attempt to straighten up again, spacers are used to keep the electrodes evenly separated along their whole length by inserting 1/8 inch (3 mm) thick vertical spacer strips. The connections to the plates are made by drilling a hole in the corner of the plate and inserting the wire several times through the hole, twisting it back around itself and making a wire-to-wire solder joint on both sides of the steel. The joint is then insulated with silicone or any other suitable material. It is, of course, essential that the joint does not short-circuit to the other electrode even though that electrode is very close by.



It is always difficult to make a good electrical connection to stainless steel plates if space is restricted as it is here. In this instance, the electrical wire is wrapped tightly through a drilled hole and then soldered and insulated. The soldering is only on the wire as solder will not attach to stainless steel.

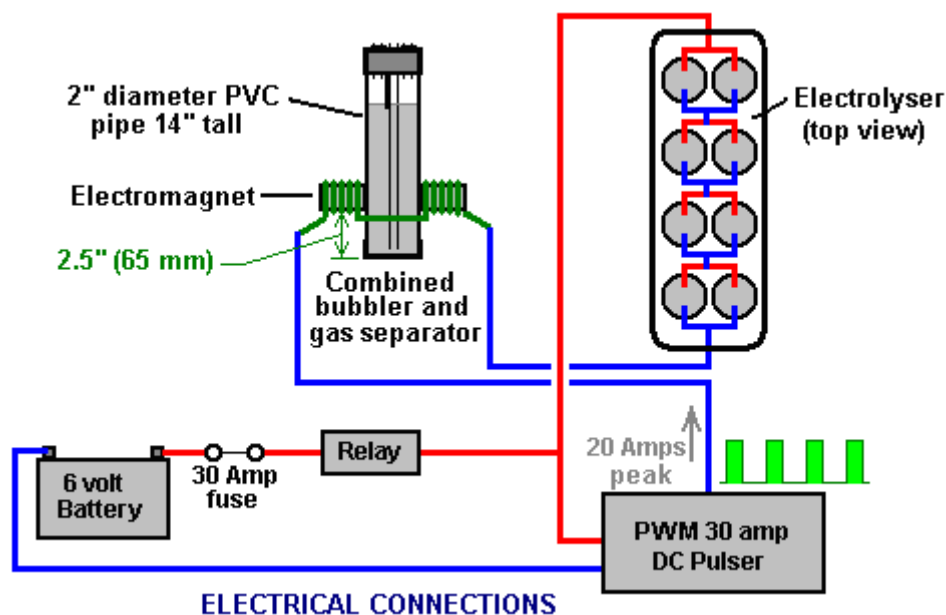
An unusual feature of this design is that each of the electrode pairs is effectively a separate electrolyser in its own right as it is capped top and bottom, and effectively physically isolated from the other electrodes. The water feed comes through the top cap which has a hole drilled in it to allow the gas to escape. The electrical wires (#12 AWG or swg 14) are fed through the base and sealed against leakage of electrolyte. Each of these units has some electrolyte stored above it, so there is no chance of any part of the electrode surface not being able to generate gas. There is also a large amount of freeboard to contain splashes and sloshing without any electrolyte being able to escape from the container. The end caps are standard PVC caps available from the supplier of the PVC piping, as is the PVC glue used to seal them to the pipe.

Eight of these electrodes are placed in a simple electrolyser case and connected together in pairs as shown here:



CELLS ARE WIRED IN PAIRS (Top View)

Pairs of pipe-enclosed electrode spirals are then connected in a chain inside the electrolyser as shown here:

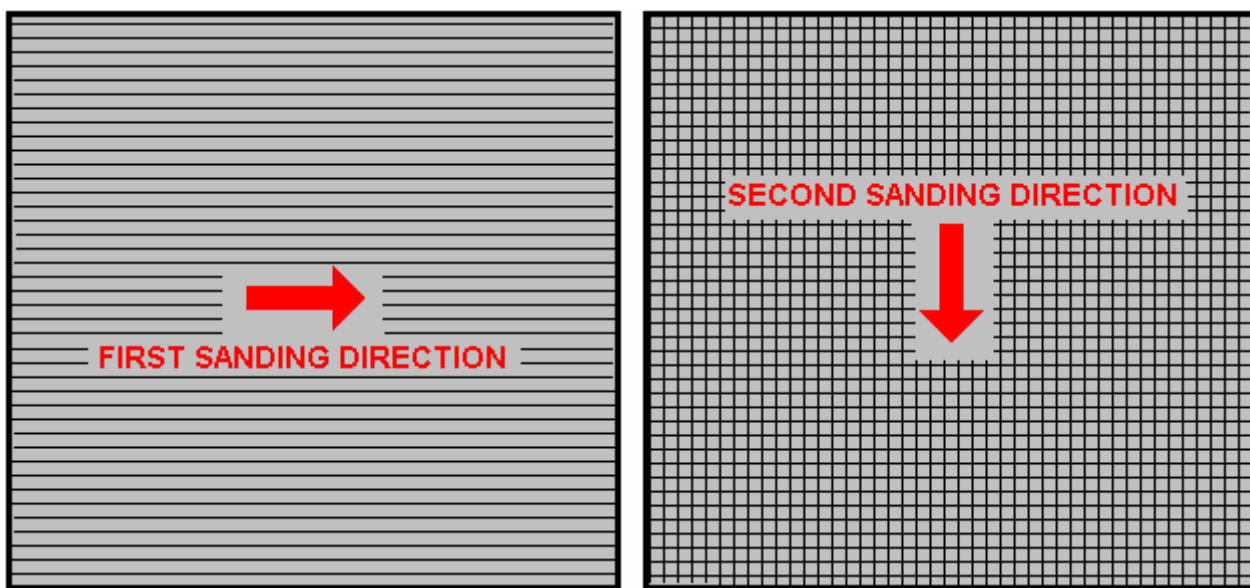


Many years of experimentation and testing have shown that 316L-grade stainless steel is the most suitable material for electrodes, but surprisingly, stainless steel is not highly electrically conductive as you would expect. Each electrode causes a voltage drop of nearly half a volt, and so careful surface

preparation, cleansing and conditioning are needed to get top performance from the electrodes. This process is described in detail by the very experienced Bob Boyce who says:

The preparation of the plates is one of the most important steps in producing an electrolyser which works well. This is a long task, but it is vital that it is not skimped or hurried in any way. Surprisingly, brand new shiny stainless steel is not particularly suitable for use in an electrolyser and it needs to receive careful treatment and preparation before it will produce the expected level of gas output.

The first step is to treat both surfaces of every plate to encourage gas bubbles to break away from the surface of the plate. This could be done by grit blasting, but if that method is chosen, great care must be taken that the grit used does not contaminate the plates. Stainless steel is not cheap and if you get grit blasting wrong, then the plates will be useless as far as electrolysis is concerned. A safe method is to score the plate surface with coarse sandpaper. This is done in two different directions to produce a cross-hatch pattern. This produces microscopic sharp peaks and valleys on the surface of the plate and those sharp points and ridges are ideal for helping bubbles to form and break free of the plate.



When doing hand sanding the sandpaper is drawn across the plates in **one** direction only and not backwards and forwards, as the backwards stroke always destroys the perfectly good ridges created on the forward stroke. Also, you only need two strokes in one direction before turning the plate through ninety degrees and completing the sanding of that face of the plate with just two more strokes (again, with **no backstroke**).

Always wear rubber gloves when handling the plates to avoid getting finger marks on the plates. Wearing these gloves is very important as the plates must be kept as clean and as grease-free as possible, ready for the next stages of their preparation. Any particles created by the sanding process should now be washed off the plates. This can be done with clean tap water (not city water though, due to all the chlorine and other chemicals added), but only use distilled water for the final rinse.

While Potassium hydroxide (KOH) and Sodium hydroxide (NaOH) are the very best electrolytes, they need to be treated with care. The handling for each is the same:

Always store it in a sturdy air-tight container which is clearly labelled "DANGER! - Potassium Hydroxide". Keep the container in a safe place, where it can't be reached by children, pets or people who won't take any notice of the label. If your supply of KOH is delivered in a strong plastic bag, then once you open the bag, you should transfer all its contents to sturdy, air-tight, plastic storage containers, which you can open and close without risking spilling the contents. Hardware stores sell large plastic buckets with air tight lids that can be used for this purpose.

When working with dry KOH flakes or granules, wear safety goggles, rubber gloves, a long sleeved shirt, socks and long trousers. Also, don't wear your favourite clothes when handling KOH solution as it is not the best thing to get on clothes. It is also no harm to wear a face mask which covers your mouth and nose. If you are mixing solid KOH with water, always add the KOH to the water, and not the other way round, and use a plastic container for the mixing, preferably one which has double the capacity of the finished mixture. The mixing should be done in a well-ventilated area which is not draughty as air currents can blow the dry KOH around.

When mixing the electrolyte, **never** use warm water. The water should be cool because the chemical reaction between the water and the KOH generates a good deal of heat. If possible, place the mixing container in a larger container filled with cold water, as that will help to keep the temperature down, and if your mixture should "boil over" it will contain the spillage. Add only a small amount of KOH at a time, stirring continuously, and if you stop stirring for any reason, put the lids back on all containers.

If, in spite of all precautions, you get some KOH solution on your skin, wash it off with plenty of running cold water and apply some vinegar to the skin. Vinegar is acidic, and will help balance out the alkalinity of the KOH. You can use lemon juice if you don't have vinegar to hand - but it is always recommended to keep a bottle of vinegar handy.

Plate cleansing is **always** done with NaOH. Prepare a 5% to 10% (by weight) NaOH solution and let it cool down. A 5% solution 'by weight' is 50 grams of NaOH in 950 cc of water. A 10% solution 'by weight' is 100 grams of NaOH in 900 cc of water. As mentioned before, never handle the plates with your bare hands, but always use clean rubber gloves.

A voltage is now applied across the whole set of plates by attaching the leads to the outermost two plates. This voltage should be at least 2 volts per cell, but it should not exceed 2.5 volts per cell. Maintain this voltage across the set of plates for several hours at a time. The current is likely to be 4 amps or more. As this process continues, the boiling action will loosen particles from the pores and surfaces of the metal. This process produces HHO gas, so it is very important that the gas is not allowed to collect anywhere indoors (such as on ceilings).

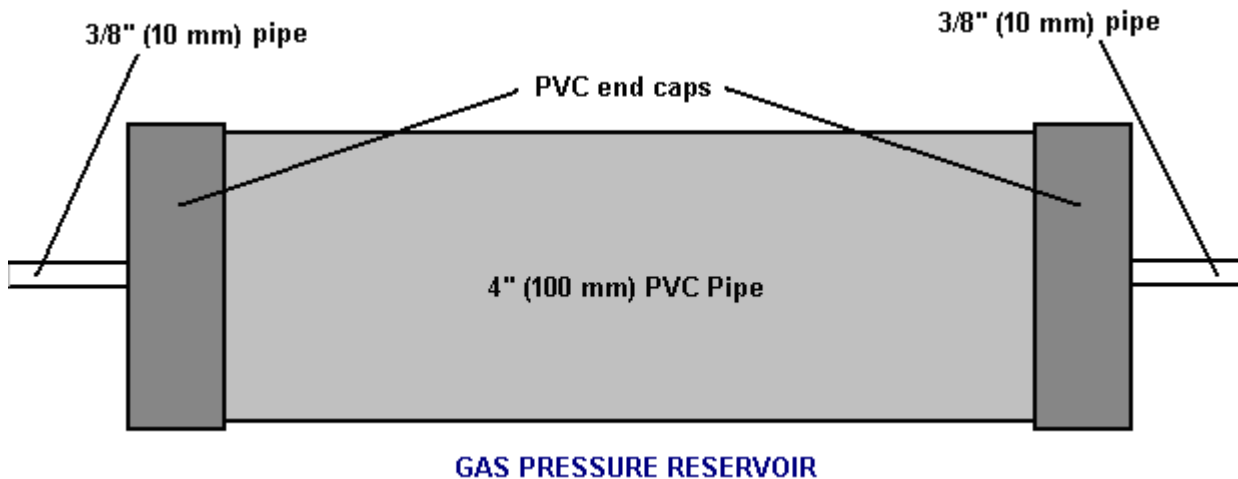
After several hours, disconnect the electrical supply and pour the electrolyte solution into a container. Rinse out the cells thoroughly with distilled water. Filter the dilute NaOH solution through paper towels or coffee filters to remove the particles. Pour the dilute solution back into the cells and repeat this cleaning process. You may have to repeat the electrolysis and rinsing process many times before the plates stop putting out particles into the solution. If you wish, you can use a new NaOH solution each time you cleanse, but please understand that you can go through a lot of solution just in this cleaning stage if you choose to do it that way. When cleansing is finished (typically 3 days of cleansing), do a final rinse with clean distilled water. It is very important that during cleansing, during conditioning and during use, that the polarity of the electrical power is always the same. In other words, don't swap the battery connections over as that destroys all the preparation work and requires the cleansing and conditioning processes to be carried out all over again.

Using the same concentration of solution as in cleansing, fill the cells with dilute solution. Apply about 2 volts per cell and allow the unit to run. Remember that very good ventilation is essential during this process. As water is consumed, the levels will drop. Once the cells stabilise, monitor the current draw. If the current draw is fairly stable, continue with this conditioning phase continuously for two to three days, adding just enough distilled water to replace what is consumed. If the solution changes colour or develops a layer of crud on the surface of the electrolyte, then the electrodes need more cleansing stages. After two to three days of run time, pour out the dilute KOH solution and rinse out the cells thoroughly with distilled water.

The construction which Zach has used is very sensible, utilising readily available, low-cost PVC piping. The spiral electrodes are inside 2" diameter pipe and Zach says that the bubbler is also 2" diameter PVC pipe. I seriously doubt that a two-inch diameter bubbler could handle a flow as high as 17 lpm which is a substantial amount. Also. You want the bubbles in the bubbler to be small in order that the gas comes into good contact with the water. Consequently, using more than one bubbler where the diagram shows just one, would be sensible.

The bubbler is located between the storage tank and the engine and positioned as close to the engine as possible. The bubbler does two things, most importantly, it prevents the gas in the storage tank being ignited by a backfire caused by an engine valve sticking slightly open and secondly, it removes every last trace of potassium hydroxide fumes from the gas, protecting the life of the engine. This is a big gain for such a simple addition.

The gas storage tank is also made from PVC pipe, this time, 4 inch (100 mm) diameter, 14 inches (350 mm) long with standard end caps fixed in place with PVC glue as shown below. This is a compact and effective arrangement well suited for use on a motorcycle. The majority of this extra equipment can be mounted in bike panniers, which is a neat arrangement.



The electric drive to the electrolyser is from a Pulse Width Modulator (also known as a "DC Motor-speed controller") which was bought from the Hydrogen Garage in America. That particular PWM board is no longer available, so especially for those people in Europe the choice might be rmcybernetics.com, although there are many suppliers and the module should not be expensive.



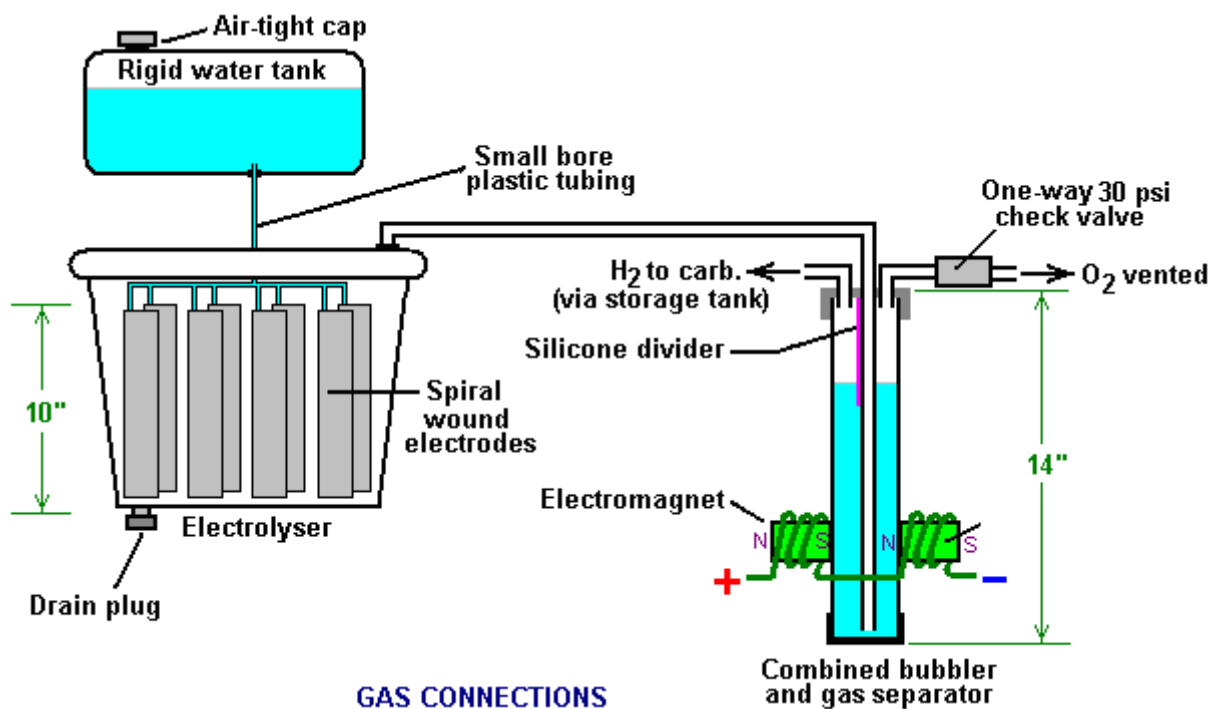
As this unit was rated at just 15 Amps maximum, Zach added another 15 Amp rated FET transistor in parallel to the output stage to raise the current capacity to 30 Amps. A fuse protects against accidental short circuits and a relay is used to control when the electrolyser is to be producing gas. The connecting wire is #12 AWG (swg 14) which has a maximum continuous current capacity of just under

ten amps, so although the current peaks may be twenty amps, the average current is much lower than that.

Two electromagnets outside the bubbler, positioned 2.5 inches (65 mm) above the base, are connected as part of the electrical supply to the electrolyser, and these cause most of the oxygen and hydrogen bubbles to separate and exit the bubbler through different pipes. There is a divider across the bubbler to assist in keeping the gases from mixing again above the water surface. The bubbler also washes most of the potassium hydroxide fumes out of the gas as the bubbles rise to the surface, protecting the engine as these fumes have a very destructive effect on engines.

The objective with any HHO system is to have the minimum amount of gas between the bubbler and the engine in order to block the ignition of the gas in the unlikely event of a backfire. In this system, the gas storage tank contains a very large amount of gas, though admittedly it is not full HHO gas thanks to the electromagnet separation system, but nevertheless, it would be most advisable to have a second bubbler between the gas storage tank and the engine, positioned as close to the engine as possible. HHO gas produces a very high-speed shock-wave when it is ignited so the bubbler needs to be of strong construction to withstand this. No pop-off bubbler cap or blow-out device acts fast enough to contain a HHO shock-wave, so make the bubbler housing strong enough to withstand the pressure wave.

Zach's electrolyser arrangement is like this:



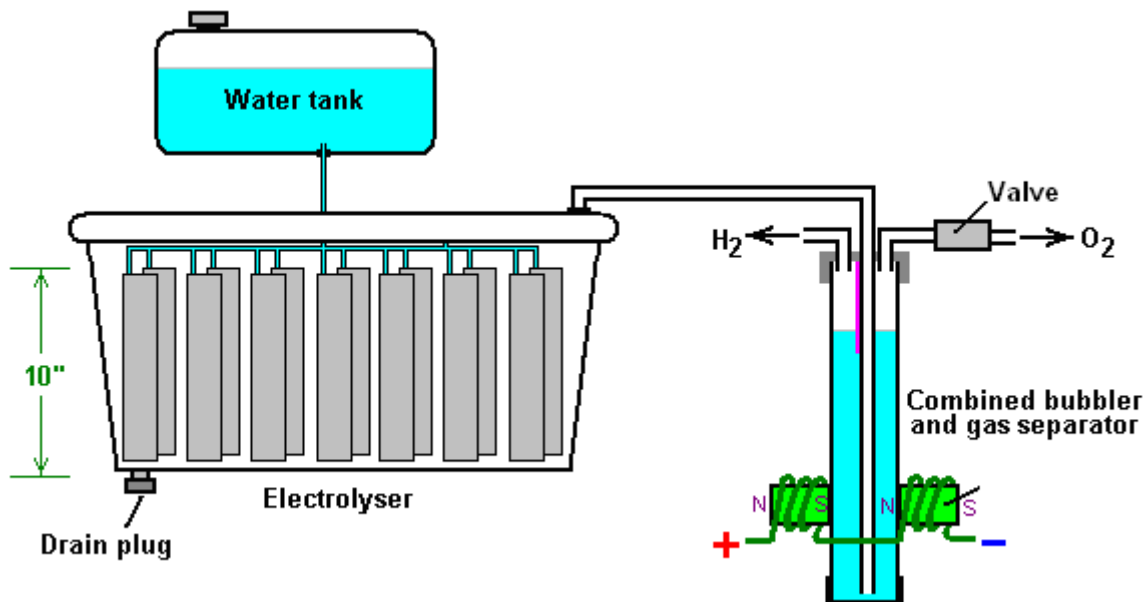
It must be realised that the water tank, electrolyser, bubbler/separator and hydrogen holding tank, all operate at thirty pounds per square inch. This means that each of these containers must be robust enough to withstand that pressure quite easily. It also means that the 30 psi one-way check valve on the oxygen venting pipe is an essential part of the design as well as being a safety feature. As a bubble of gas from the electrolyser escapes into the water tank every time a drop of water feeds to the electrolyser, the contents of the water tank above the water surface becomes a stronger and stronger mix of air and HHO gas. Consequently, it soon becomes an energetic mixture. It is common for static electricity to build up on a tank of this nature, so it will be very important to earth both the tank and it's cap before removing the cap to top up the tank with more water.

The electrolyser has a potassium hydroxide (KOH) solution in it. The electrolysis process produces a mixture of hydrogen, oxygen, dissolved gases (air) and potassium hydroxide fumes. When the system is being used, the water in the bubbler washes out most of the potassium hydroxide fumes, and in doing

so, it gradually becomes a dilute electrolyte itself. Potassium hydroxide is a true catalyst and while it promotes the electrolysis process, it does not get used up during electrolysis. The only loss is to the bubbler. Standard practice is to pour the contents of the bubbler into the electrolyser from time to time, filling the bubbler again with fresh water. Potassium hydroxide has been found to be the most effective catalyst for electrolysis but it has a very bad effect on the engine if it is allowed to enter it. The first bubbler is very effective in removing the potassium hydroxide fumes, but many people prefer to take the scrubbing process a step further by placing a second bubbler in the line, in this instance, between the hydrogen pressure tank and the engine. With two bubblers, absolutely no potassium hydroxide fumes reach the engine.

When running with HHO gas as the only fuel, it is essential to adjust the timing of the spark so that it occurs after Top Dead Centre. The timing on this bike is now set at 8 degrees after TDC. However, if David Quirey's style of bubbling the HHO through a liquid such as acetone, then no timing alterations would be needed.

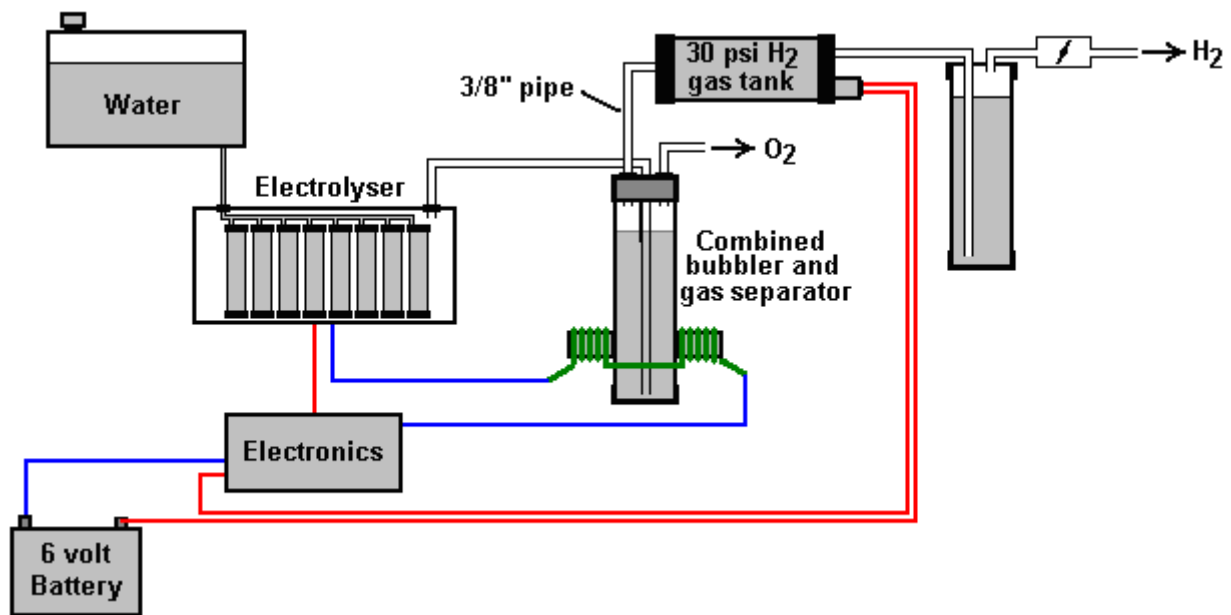
This electrolyser is designed to run off the nominal six volts of a motorcycle electrics (about 7.3 volts with the engine running), but increasing the number of tubes, each containing electrode coils, would convert the design to a 12V system and then the electrolyser housing would probably be like this:



It is possible that seven sets of three or four spirals wired in parallel would be used for larger engines with their 13.8 volt electric systems. Zach uses the very simple method of allowing excess gas to be vented via the oxygen valve if gas production exceeds the requirements of the engine. When operating on a twelve volt system it might be more convenient to use a standard pressure switch which opens an electrical connection when the gas pressure rises above the value for that switch:

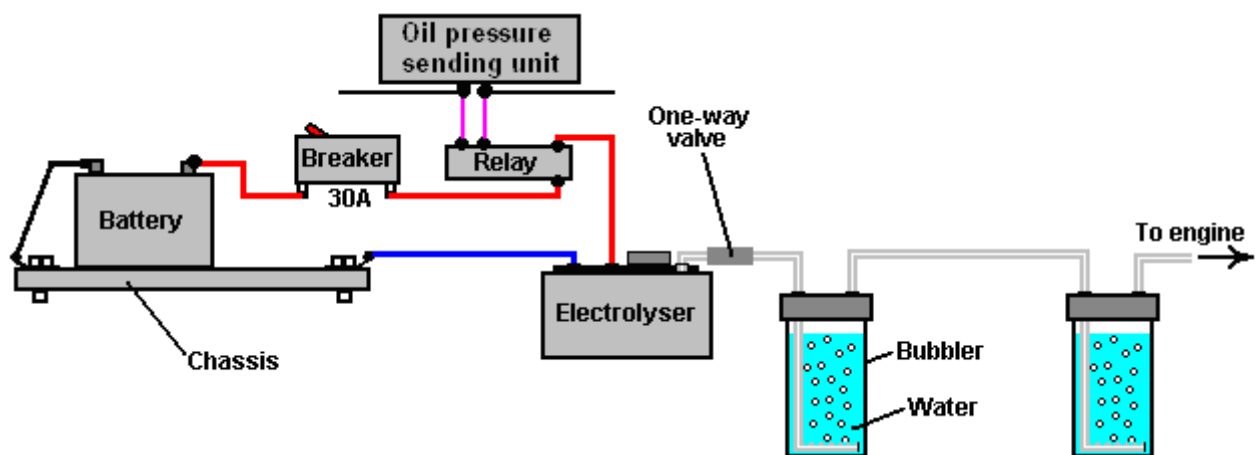


The pressure switch just mounts on one of the end caps of the pressure tank and the switch electrical connection is placed between the relay and the electrolyser. If the gas pressure reaches it's maximum value of 30 psi. then the switch opens, stopping electrolysis until the pressure drops again:



Caution: This electrolyser is not a toy. If you make and use one of these, you do so entirely at your own risk. Neither the designer of the electrolyser, the author of this document or the provider of the internet display are in any way liable should you suffer any loss or damage through your own actions. While it is believed to be entirely safe to make and use an electrolyser of this design, provided that the safety instructions shown below are followed, it is stressed that the responsibility is yours and yours alone.

An electrolyser should not be considered as an isolated device. You need to remember that both electrical and gas safety devices are an essential part of any such installation. The electrical safety devices are a circuit-breaker (as used by any electrician when wiring a house) to protect against accidental short-circuits, and a relay to make sure that the booster does not operate when the engine is not running:



However, the system designed by Zach West is almost certainly not self-sustaining and if that is correct, then the battery powering the electrolyser will need to be charged between trips. That does not have to be the situation as high-efficiency electrolyzers are available. First, the Shigeta Hasebe spiral plate electrolyser has produced 7 lpm of HHO gas mix for an input of just 84 watts and while that 84 watts is an inconvenient 2.8V at 30 amps, it should be possible to raise the voltage and lower the current without losing too much of the performance. In my opinion, the electrics of a motorcycle should be able to output 84 watts and so the motorcycle could become self-powered.

Motorcycles can definitely become self-powered as can be seen from the electric motorcycle system of Teruo Kawai's COP>3 design. Teruo went to America and was in a meeting aimed at getting his design manufactured and sold in America when the meeting was interrupted and Teruo intimidated into abandoning his venture.

You must also remember that Steve Ryan of New Zealand demonstrated running his motorcycle on treated water. I suspect that the treated water was water which had been infused by charged water clusters as described by Suratt and Gourley. Their electrolyser has an efficiency of 0.00028 kilowatt-hour or less to generate one litre of gas. Those inconvenient units mean that to produce 1 lpm needs 16.8 watts or 7 lpm needs 118 watts. If cold water mist is added to the air entering the motorcycle engine, then it seems likely that a good deal less than 7 lpm would be needed. If you have a good enough tank which is made of a material capable of containing the very small molecules of this gas, then the gas can be compressed to 1000 psi and that should allow a motorcycle to run for some time on the gas cylinder.

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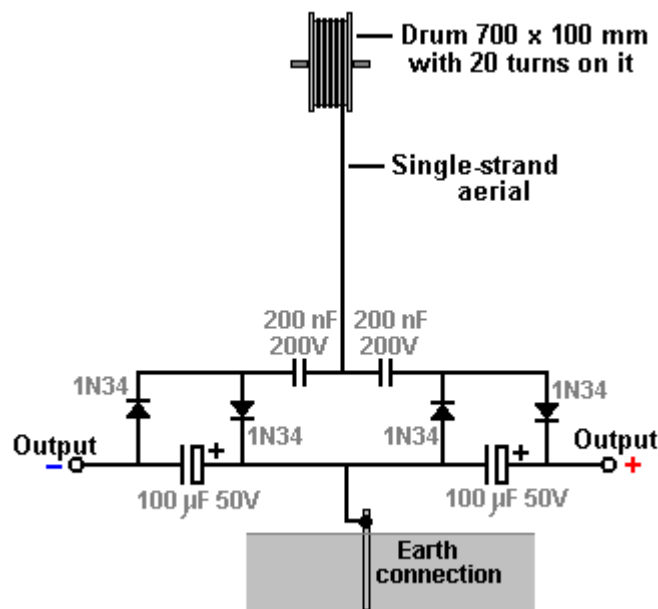
Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 10: Power from an Aerial

We come now to the practical and useful aerals used by Jes Ascanius, a Danish developer, to whom thanks is due for sharing his design. Initially, he set up a system to charge his mobile phone battery overnight from an aerial. Let’s start with the very simple system and progress from that to more powerful arrangements.

The initial circuit uses one strand of solid wire which rises vertically to a 700 mm diameter drum where there are some twenty turns. The arrangement is like this:

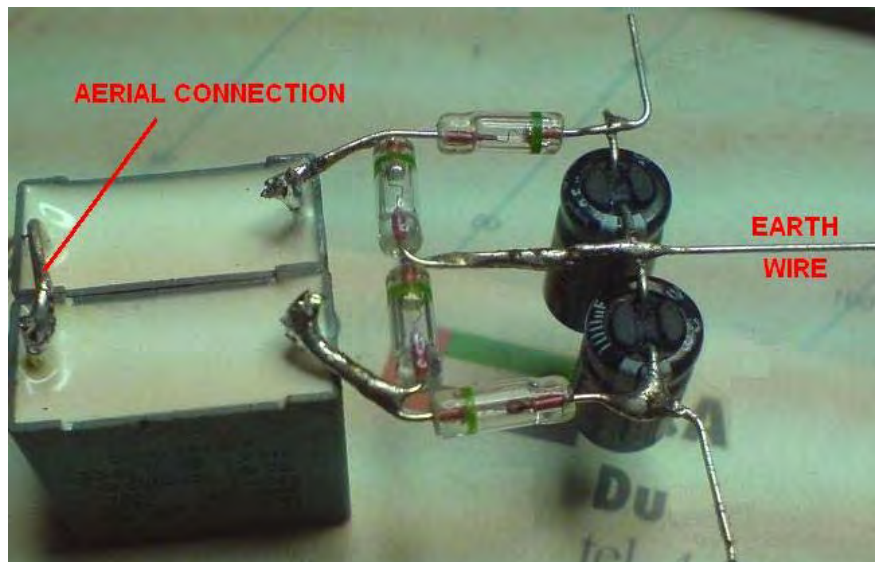


The aerial wire is several metres long, and in the prototype, was supported by (and insulated from) the eaves of a house. The aerial should be vertical or near vertical and a proper earth connection provided by driving a metal rod into the ground or connecting a wire to a metal plate and burying the plate in the ground as a good electrical connection is needed here. The earth connection used here is a 12 mm copper pipe 3 metres long, driven into the ground and the ground around it saturated with water:

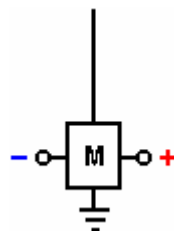


The wire used to connect with the earthing rod is very important and should not be less than 8 swg copper wire, that is, 4 mm diameter and 13 sq. mm. cross-sectional area. With this free-energy device, this is an important detail as are the diodes used which are germanium 1N34 or 1N34a which are particularly suited to this application due to their very low voltage drop. For the 200 nF capacitors,

ceramic disc types are recommended. The prototype build used two large scavenged capacitors and it looks like this:



Now, consider this circuit as described, to be one modular building block which can lead to serious power being drawn from an aerial. I will represent the circuit shown above as a rectangle, showing the above circuit as:



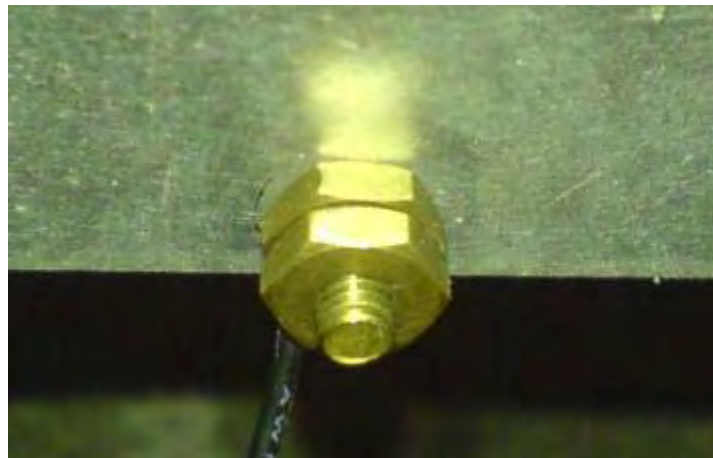
While it is possible to use more than one module with the aerial to get more power, the Danish developer then switched to a more advanced arrangement by attaching a 600 x 800 x 2 mm aluminium plate inside the sloping roof of his house:



The plate being suspended using nylon cord to prevent it touching the roof or anything else:



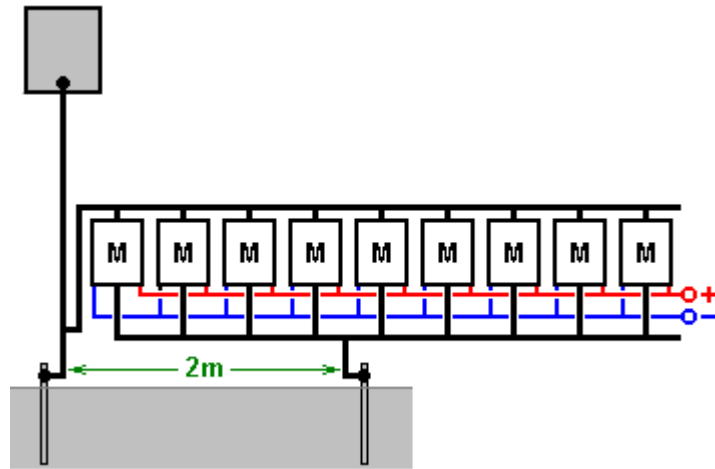
The plate is positioned between 3 and 3.5 metres (10 to 12 feet) above the ground and the attachment to the plate is also heavy-duty 8 swg cable:



The cable is connected to the aluminium plate using a brass bolt and nuts which the builder thinks may be significant, quite apart from avoiding any galvanitic connection to the circuit. The cable is then run vertically downwards to the circuit. For this arrangement a second earthing point is also used. This is a galvanised iron pipe 3 metres long, driven vertically into the ground which is saturated with water. The second earth is 2 metres away from the first earth and there is no known significance in the use of an iron pipe as it was used because it was to hand at the time..

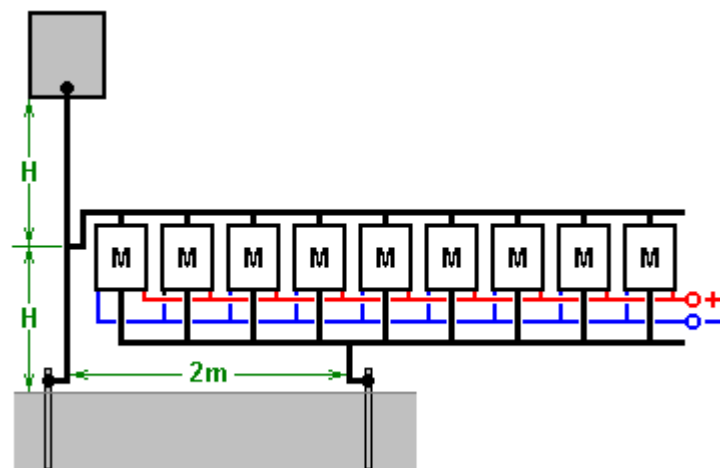
This arrangement provides serious power, enough to cause injury to, or kill a careless human. With two modules, it will light an LED very brightly, driving it to 2.6 volts. If the LED is removed, then the voltage climbs to about twenty volts and is easily sufficient to charge a 12V battery or battery bank although that

takes time. With twenty modules a 12V battery can be charged over night. It is estimated that with two hundred modules, the power would be sufficient to power a household although that has not yet been done. It should be borne in mind that each module is easy and cheap to make, so arranging for a stack of them where additional modules can be added at a later date for more power, is an ideal arrangement. The circuit is like this:



This circuit looks completely mad as the aerial input to the circuit appears to be directly short-circuited by the first earth connection. In spite of this, the circuit works very well when connected this way. Additional modules can be added without any known limit. Increased power can be had by either raising the aluminium plate higher above the ground, to say, 10 metres (33 feet), or by adding one or more additional aerial plates. As you have a good aerial connected through to a very good earth, there has to be the possibility of the equipment being hit by lightning, and so it is recommended that a protective spark-gap is installed between the aerial and the earth, close to the circuit, so that if high-voltage is suddenly applied to the aerial, the spark gap will fire and shunt the excess power through to the earth. Alternatively, possibly a better solution is to install a standard lightning rod system a few metres away from the aerial and a metre or two higher up, so that it forms a more attractive point for a lightning strike.

Further experimentation has shown that altering the connection point for the aerial has a significant effect on the results. If the connection is made at the mid point between the aerial plate and the earth connection, it produces a greater output:



With this arrangement a single module produces around 30 volts while the original method of connecting near the earth was giving about 26 volts with two modules. Jes Ascanius has carried out further experimentation and he states that diodes with response times under 30 milliseconds produce a greater output and he recommends the use of BYV27 diodes which have a 200-volt 25nS rating as he gets three times the output from them. He also recommends using them in Joule Thief circuits.

Dragan Kljajic has been experimenting with this circuit and has started by building many of these modules on a printed circuit board like this:



Using two of these boards, Dragan is pulling 96 watts continuously from his aerial plate. He intends to extend this arrangement much further, but that is for a later date.

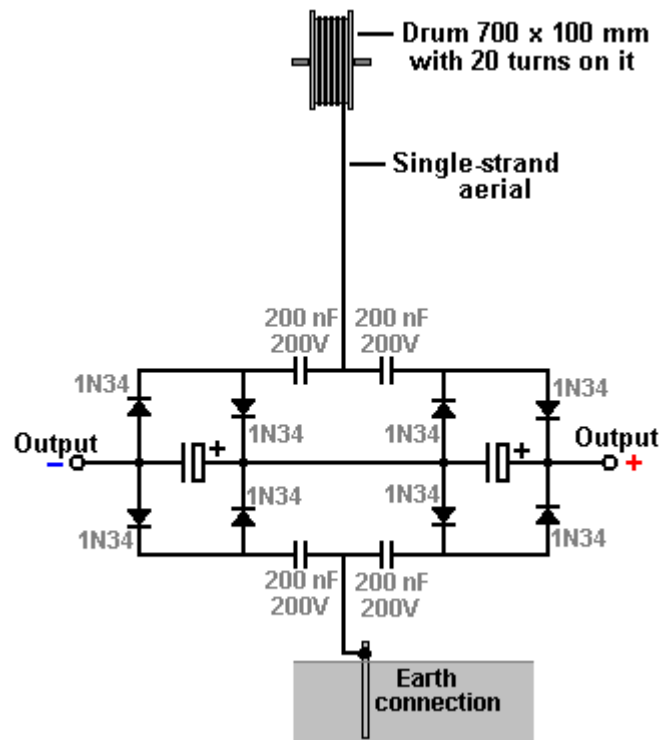
Here is a forum: <http://www.energeticforum.com/renewable-energy/10947-jes-ascanius-radiant-collector.html> where some builders of this system share comments. One comment is that there is an increased risk of a lightning strike where you have an earthed aerial, and so it is advisable not to place the aerial plate inside a house, but perhaps suspended between two trees. Also, using a car spark plug connected across the module set can protect against lightning strikes damaging the circuitry.

As a result of queries, Jes stresses the following points:

1. The plate **must** be high off the ground.
2. The plate **must** be polished and insulated.
3. The wire **must** be single-strand solid wire.
4. There **must not** be any part of the wire above the circuit, which is not insulated.

He further comments saying: **you can use aluminium foil and cling film to make many collector plates 0.4 m x 5 m and connect them close together to feed the aerial wire. Remember, no uninsulated wire anywhere. Any queries should be asked on the forum shown above.**

A modification of this circuit of Jes Ascanius' by a developer who prefers to remain anonymous, doubles the output of each module by adding a mirror image of the circuit like this:



As can be seen, the addition is of four diodes and two capacitors. Presumably, using BYV27 diodes rather than 1N34 diodes would create a further enhanced output.

Patrick J Kelly
www.free-energy-info.co.uk

Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 11: Gravity Power Generator

In 1939, William Skinner of Miami in Florida, demonstrated his fifth generation generator powered by spinning weights. His demonstration is at <http://www.britishpathe.com/video/gravity-power> at time of writing. He shows his design powering a twelve-foot lathe, a drill press and a power hacksaw, all simultaneously. The newsreel commentator states that the output power was “1200% of the input power” which is $COP=12$ but it is highly likely that he should have said “1200 times” rather than “1200%” because he continues to state that using the design would allow a one-horsepower (746 watts) input power to power 3,500 homes. If it were $COP=12$ then each of those 3,500 homes would receive less than 2.6 watts, which is clearly wrong. At the much more likely $COP=1200$, each household would receive on average, 255 watts, which might be just possible in 1939 when few appliances were electric. Anyway, Skinner’s impressive equipment could be driven by a single cotton thread drive band while powering his whole workshop. It looked like this:



This design has four nearly vertical shafts, each braced to give additional rigidity. These rotating shafts pass their rotating power to the mechanical output drive belt seen on the left. Each of these rotating shafts has a heavy weight in the form of a thick, short cylinder mounted high up near the top of the shaft and what is probably an even heavier weight in the form of a long narrower cylinder attached near the bottom of the shaft as seen just to the right of the output drive belt. These four identical sets of shafts with their pairs of weights spin two or three times per second and produce the whole of the output power.

As far as I am aware, Skinner never patented his design or disclosed how it worked. However, the operating principle is very simple indeed although it may take you a while to grasp how it works. You can check this out quite easily for yourself if you have access to an old-fashioned chair with four rigid legs like this:



Tilt the chair over so that it is balanced on one leg. You will notice that almost no effort is involved in keeping it in that position as all of the weight is supported by the floor through just one of the legs. Now, move the top of the chair by a very small amount and keep the top of the chair in that position. You will notice two things: first, very little effort was needed to move the top of the chair and second, the chair now swings around and becomes stationary on the same side that the top of the chair was moved.

Notice two other things: the chair swung around because of your moving the top slightly and **you** did not swing it around, and if the chair is heavy, the amount of energy in the swinging chair is very much greater than the amount of energy which you applied to the top of the chair.

If you were to keep moving the top of the chair in a tiny circle, then the chair will spin around continuously for however long that you choose to wobble the top of the chair. The amount of energy in the spinning chair is very much greater than the energy which you are expending to make the chair spin. So from where is that extra energy coming?

What is happening is that the chair swings round under gravity to reach the lowest possible point for it with the new position of the top of the chair. But, before it can get there, you move the top of the chair further around and so the chair has to swing further in order to reach the lowest point. But before it can get there, you move the top again The chair keeps swinging round and round, pulled by gravity, for as long as you choose to keep moving the top. But, no matter how heavy the chair, very little effort is needed from you to cause the spinning.

Skinner had a mechanism at the top of each vertical drive shaft, and that mechanism kept moving the top of the shaft in a small circle while allowing the shaft to rotate freely at all times. That caused the very heavy weights attached to the shaft to keep spinning around, and he used that power of the heavy spinning weights to power his whole workshop. Moving the top of the shafts required so little power that he used a 93-watt electric motor and to show that he was not even using all the power of that small motor, he used a single cotton thread as a drive band to move the tops of the four power output shafts.

His mechanism looks complicated. This is partly due to the fact that there are four identical power shafts with their weights, mounted in the one compact frame and that makes the device look more complicated than it really is. It is also due to the fact that the system shown in the newsreel is William's fifth version of the device. It is likely that his earlier, much more simple versions worked well and encouraged him to build even fancier versions.

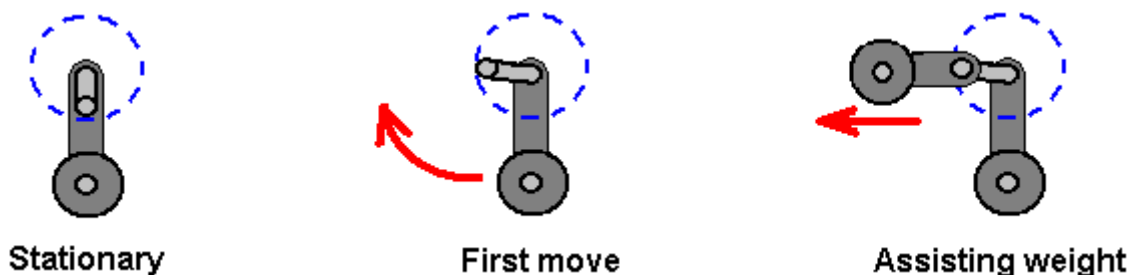
There are two forums where members of those forums are trying to work out exactly how his final version machine worked and then replicate the design for current day use as it is a neat system for accessing additional usable power. Those forums are at:

<http://www.overunity.com/14655/1939-gravity-power-multiply-power-by-1200/#.U5y0gXaqmJA> and

It needs to be remembered however, that it is not actually necessary to replicate William's fifth version, but instead it would be quite enough to use the principle of the spinning chair to produce a simple mechanism where the input power is far less than the output power.

If we consider what is happening, then perhaps we can understand Skinner's complicated-looking arrangement. We can consider just one of the four axle shafts. The large weight is spinning around in a circle and that motion is then used to power the output shaft. In order to reduce the effort needed to spin the weight, the axle shaft has been made thinner and four bracing rods have been used to brace the shaft in exactly the same way that sailing yacht masts are usually braced with "spreaders" to hold the bracing out from the mast and so give greater overall stiffness. So we can ignore those bracing bars as they have nothing to do with the actual operation of his design, but are merely his choice out of many different construction options.

Remember the spinning chair and consider what has to be done to spin Skinner's heavy weight. The top of the shaft has to be moved in a small circle. Looking down from the top the situation is like this:



When the system is switched off, the weight attached to the bottom of the shaft comes to rest directly underneath the top of the shaft. When the system is started again, the first move is to shift the top of the axle shaft ninety degrees around. This is the start of the rotary movement and initially, the movement is slow as it takes the heavy weight some time to get moving. To reduce the effort of moving the top of the shaft ninety degrees ahead of the big lower weight, Skinner has added a weight at the top to assist the movement in that direction.



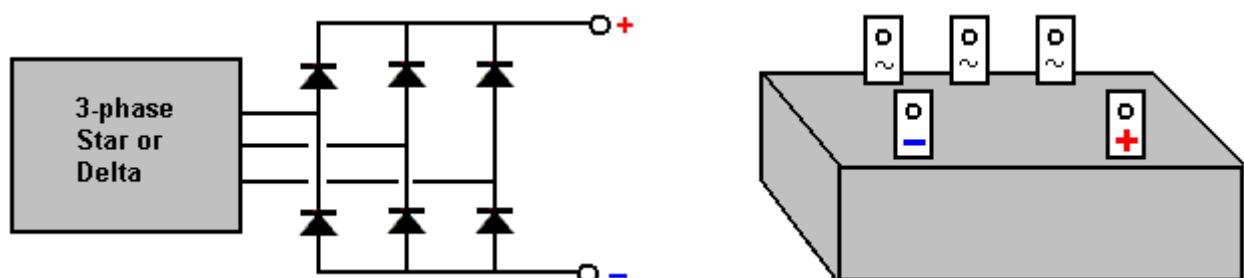
Skinner also took advantage of his very large workshop to use a belt-driven mechanism above the top of the shaft, in order to reduce the effort of moving the top of the axle shaft even further (to the level where it could be driven by a cotton thread). He used four separate identical shafts in his construction for two reasons: first, the overall output power is increased and second, any sideways forces stressing the mounting frame are matched on every side, which is helpful when you have heavy weights on a rotating arm as Skinner did.

As the output shafts appear to be rotating at about 150 rpm, Skinner opted to use a straight mechanical drive. Back in 1939, electrically-driven equipment was not as widespread as it is today, but nowadays we would probably prefer to have an electrical output rather than a mechanical drive although that mechanical drive could be used for driving pumps and other low-speed devices. So, we are faced with introducing some form of gearing which can raise that 150 rpm to the much higher level preferred by most alternators.

While it would be possible to use an ordinary 12-volt motor as a generator and produce a 12-volt electrical output, it is likely to be more convenient to use an off-the-shelf electrical generator, perhaps a very low-friction one like this which has been designed for wind-power operation and which has a 12V or 24V 3-phase output:

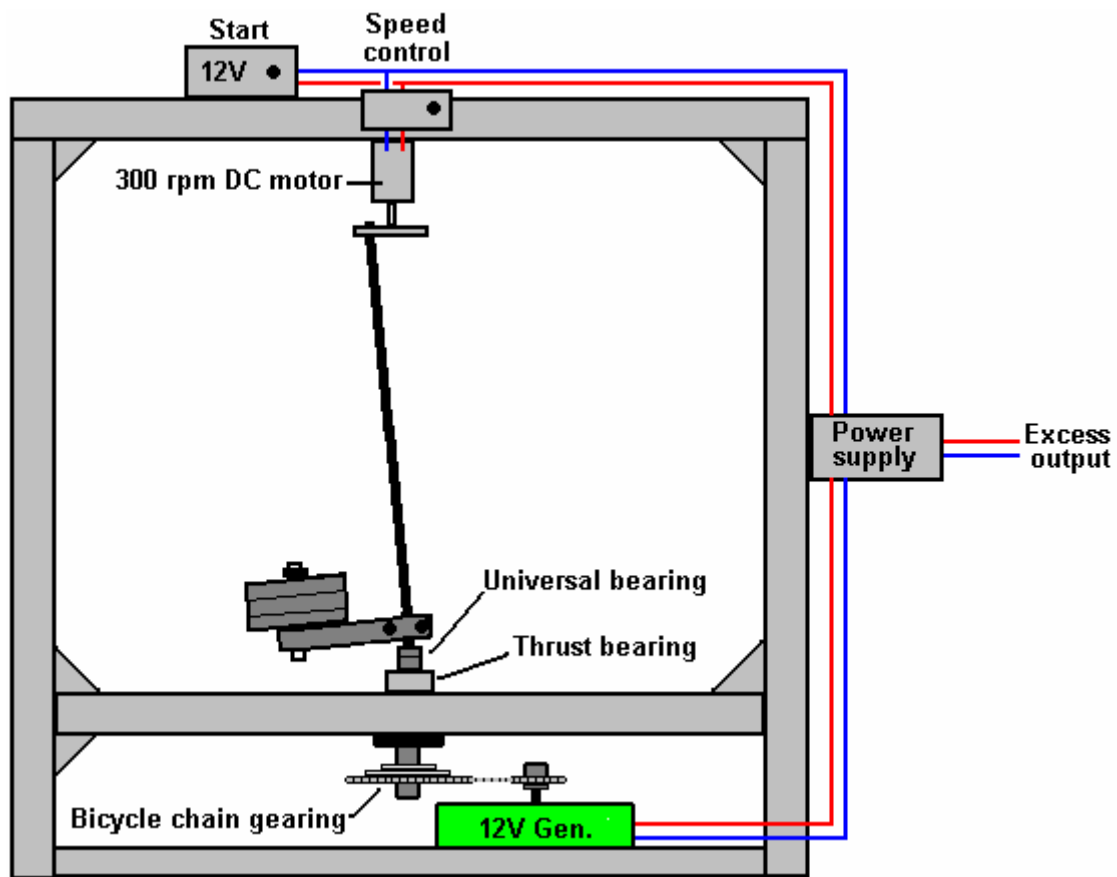


The fact that the output is 3-phase can sound a little daunting, but the conversion to DC is quite straightforward:

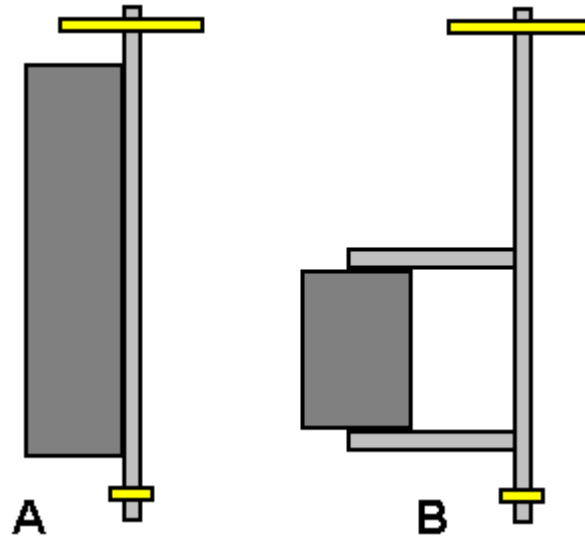


The output can be converted to DC with six ordinary diodes or a integrated diode arrangement can be used where there is a connecting tag for each of the three outputs and a separate tag for the DC Plus and for the DC Minus. The currents involved are quite high as 400 watts at 12-volts represents more than 33 amps and the peak output of 500 watts is a current of about 42 amps. For that reason, the 3-phase rectifier blocks are rated at 50 amps which sounds very high until you do the calculations and discover what the current is likely to be. It should also be borne in mind that the DC output wire has to carry that level of current on a continuous basis and so fairly robust wire is needed. If the voltage were 220V then the wire would be carrying more than 9 kilowatts at that current flow, and so the normal 13-amp mains wire is just not sufficient and instead, we need to use thick wire or more than one strand of wire for both the Plus and the Minus connections.

This particular generator is not expensive and can output 400 watts of electricity (33 amps) continuously. As the Skinner type appears to be spinning at 150 Hz, a gearing up of the output speed would allow greater output, so perhaps for a home-builder, the physical arrangement might be like this:



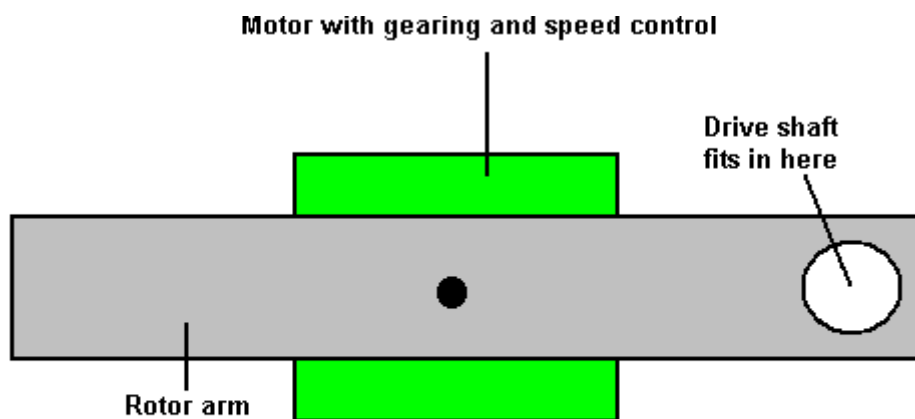
There are, of course, many different forms of construction which might be used, but with each of them, the question is, "how do you make the angled shaft rotate powerfully?". If you can work out the complexities of Skinner's fifth version shown in the newsreel, then that would certainly do the job. However, we would prefer a much more simple design and so we do not necessarily have to copy what Skinner did but instead we can just apply the principle which he demonstrated. One possible arrangement might be to imitate the chair experiment using a strong shaft with a weight attached to one side of it, perhaps like this:



Version “A” uses the weight to stiffen the shaft but doing that raises the centre of gravity of the combined shaft and weight which may not be convenient. Version “B” increases the torque for any given weight by moving the centre of gravity of the weight away from the centreline of the shaft by means of extension arms. As the shaft rotates at a constant rate, the load on the shaft will be essentially constant and there should not be any significant flexing of the shaft although it might bend and remain with that same bend during all of the time when it is spinning if the weight is very high relative to the stiffness of the shaft.

We do have to input some power to rotate the top of the drive shaft, but if we arrange things in any one of the hundreds of viable configurations, then the output power will be massively greater than our input power. An alternative arrangement which allows speed control (and so, output power control) is to take some of the generated output of electricity and use that to power an electrical drive which positions the top of the drive shaft.

There will be many different ways of achieving that movement. One method for doing this might be:



SEEN FROM UNDERNEATH

Here, the small electric motor shown in green is geared down and used to move the top of the drive shaft at whatever rate of revolution that we consider to be satisfactory, using a standard DC motor speed controller.

It should be noted that no matter what angle is chosen for the axle shaft, that is always a constant relative to the motor arm moving it round in the circle at the top of the shaft. This means that no roller bearing is needed as there is no relative movement and the shaft will automatically take up that fixed

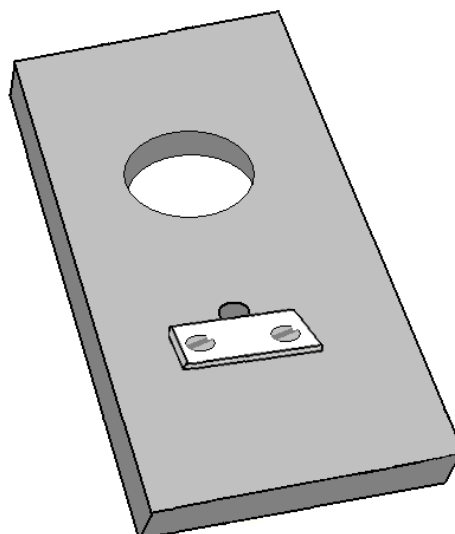
angle. The drive motor arm moving the top of the shaft will probably not be long, as Skinner appeared to be moving the top of his shafts by about 40 mm away from the centreline of the bottom pivot, making only one degree or so for the angle of the shaft on every side of the vertical.

It is, of course, not essential to convert the output power to electricity and instead it could be used in the same way that Skinner did, driving mechanical equipment such as water pumps for irrigation or extracting water from wells, milling operations for processing grain or for operating any form of workshop equipment. It is also not necessary to build the device anywhere near as large as Skinner did, and small versions could be used to power lighting systems, operate fans or cooling systems or for any other minor household requirements.

The power output from the machine can be increased by increasing the weight attached to the output shaft, or by increasing the length of the arm holding the weight, or by tilting the output shaft through a greater angle (which increases the input power needed, but probably not by much), or perhaps by scaling the whole thing up so that it is physically bigger. Skinner's design uses stiffening bracing on the output shaft, which suggests that the lighter the shaft is, the better the performance. Because of this, a prototype build might use a timber shaft of perhaps, 33 mm square as that is both light and very strong and rigid and it is a good shape for ensuring that there is no slipping of the arm which supports the weights. The top of the shaft is reduced slightly so that it has a circular cross-section. A 300 rpm motor rotates at a maximum of 5 turns per second and so is suitable for rotating the axle shaft. A suitable, low-cost motor of that type, looks like this:



The motor needs to be linked to the shaft in a simple way which ensures that there will be no shaft slippage:



Perhaps cutting a suitable sized hole through a strip of material and using a strip of metal pressed into the flat face of the motor drive shaft (in addition to the hole being a tight push fit) would be adequate for this. A screwed collar or layer of epoxy resin holds the plate firmly to the motor as the plate is positioned below the motor and so gravity tends to pull the plate off the motor shaft at all times.

It would initially be assumed that a ball bearing or roller bearing would be needed in this motor arm, but that is not the case as the axle shaft does not rotate relative to the motor arm and while the axle shaft can be a loose fit in the hole, there is certainly no need for a bearing.

A commercial DC Motor Speed Controller can be used to bring the shaft rotation speed gradually up from a stationary start to the chosen rate of revolution:

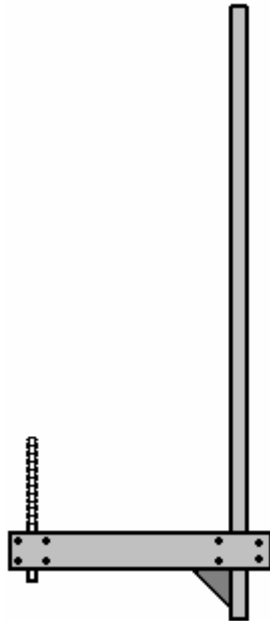


Using a commercial module like this means that no electronics knowledge is needed to build a working generator of this type.

There are many options for providing the necessary weight which drives the generator. One possibility is to use a barbell shaft with as many weights as are required, that being a very simple alteration:

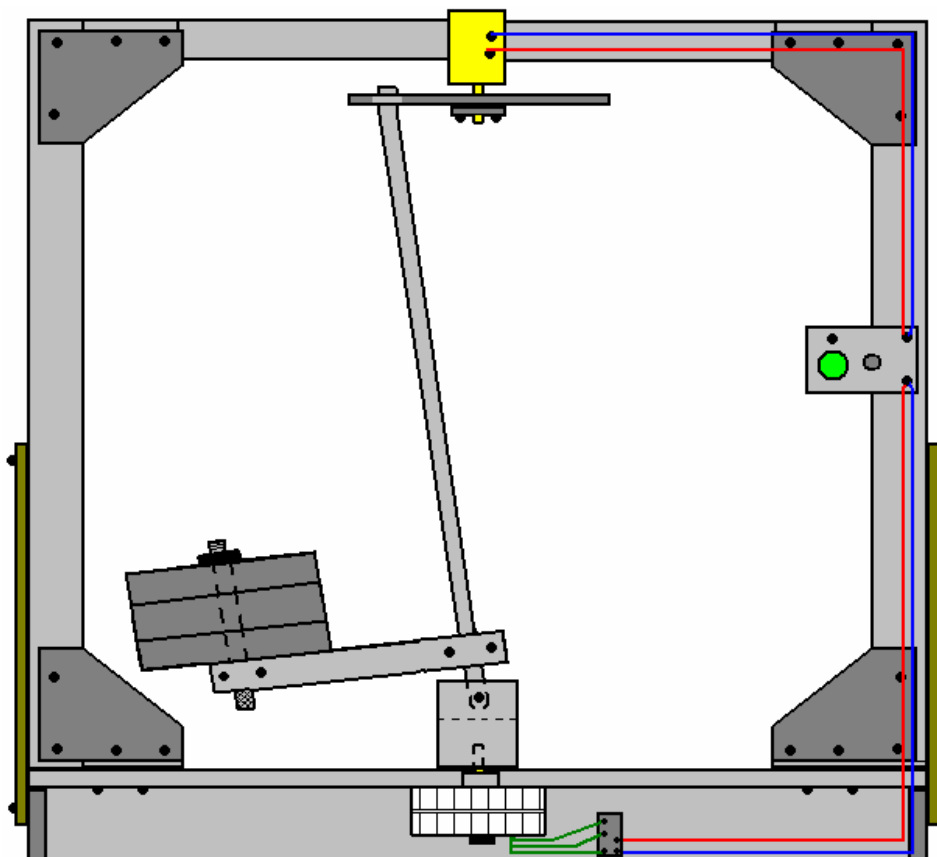


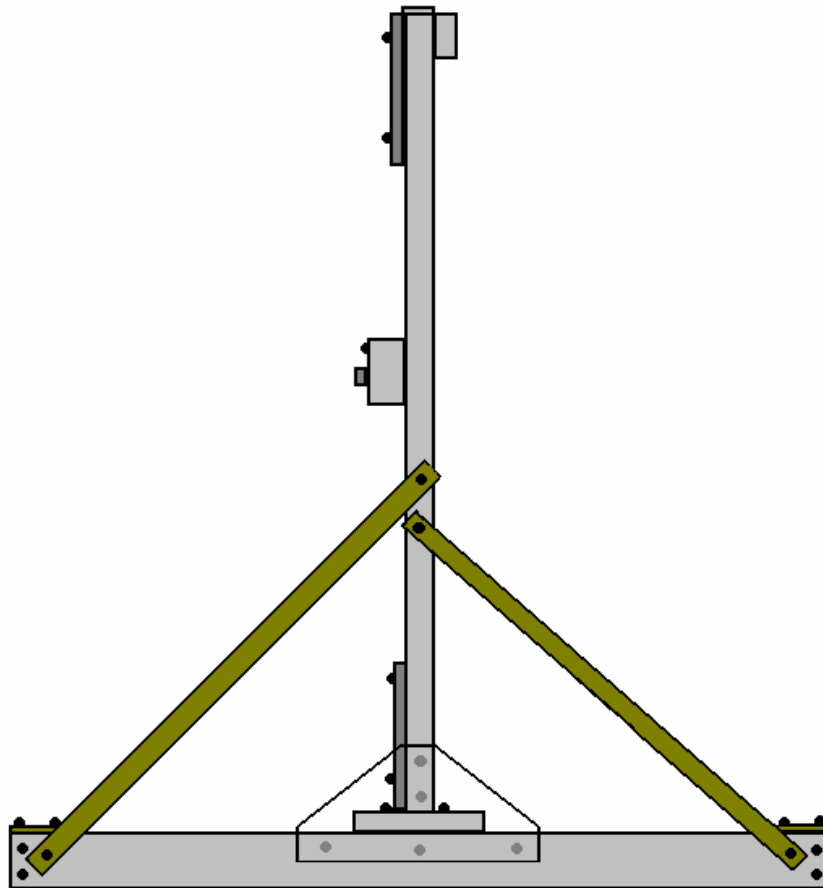
One of the hand grips can be cut and used directly as part of the mounting, perhaps like this:



This simple arrangement allows the weight discs to be added and secured in any combination desired. As dumbbells are supplied in pairs, there are four discs of each side which allows a wide range of weight options going up in jumps of just 1 Kg which is very convenient. If the axle shaft has a square cross section, there is no tendency for the lever arm to slide around the shaft

The following sketches are not to scale, but one form of construction might be:

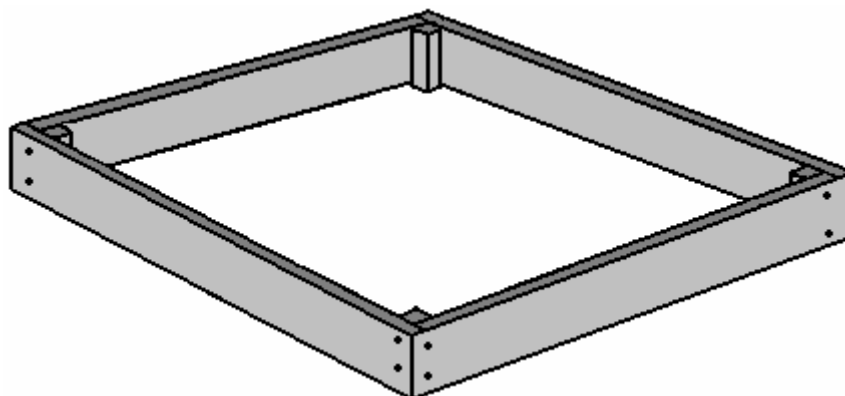




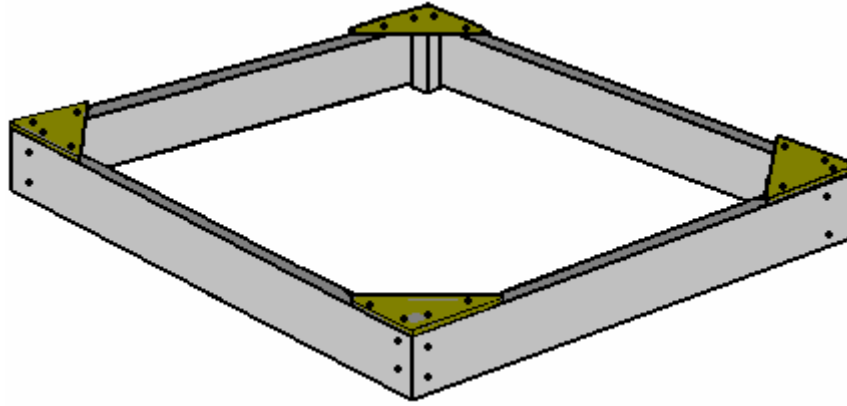
For this style of construction, four pieces of, perhaps, 70 x 18 mm Planed Square Edge timber are cut to perhaps 1050 mm and two 33 x 33 x 65 mm pieces epoxied and screwed to two of the pieces, 18 mm in from the ends:



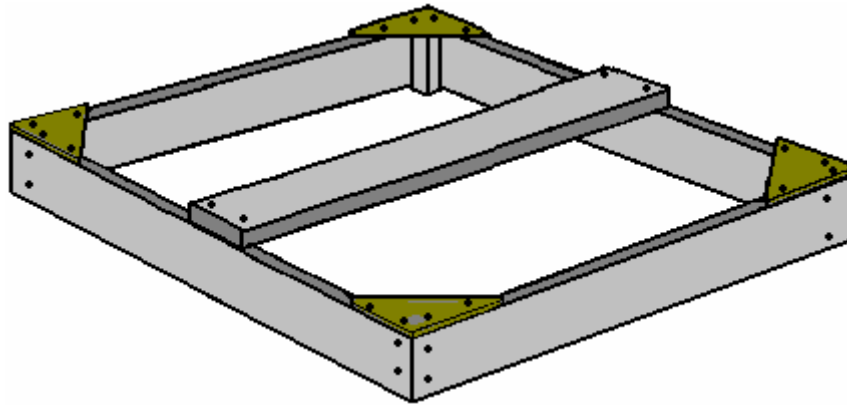
Then the four pieces are screwed together while resting on a flat surface:



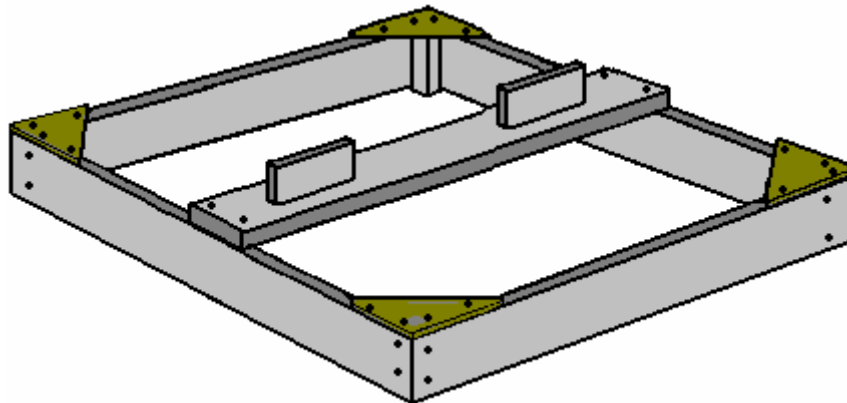
Then corner bracing triangles of MDF are screwed in place:



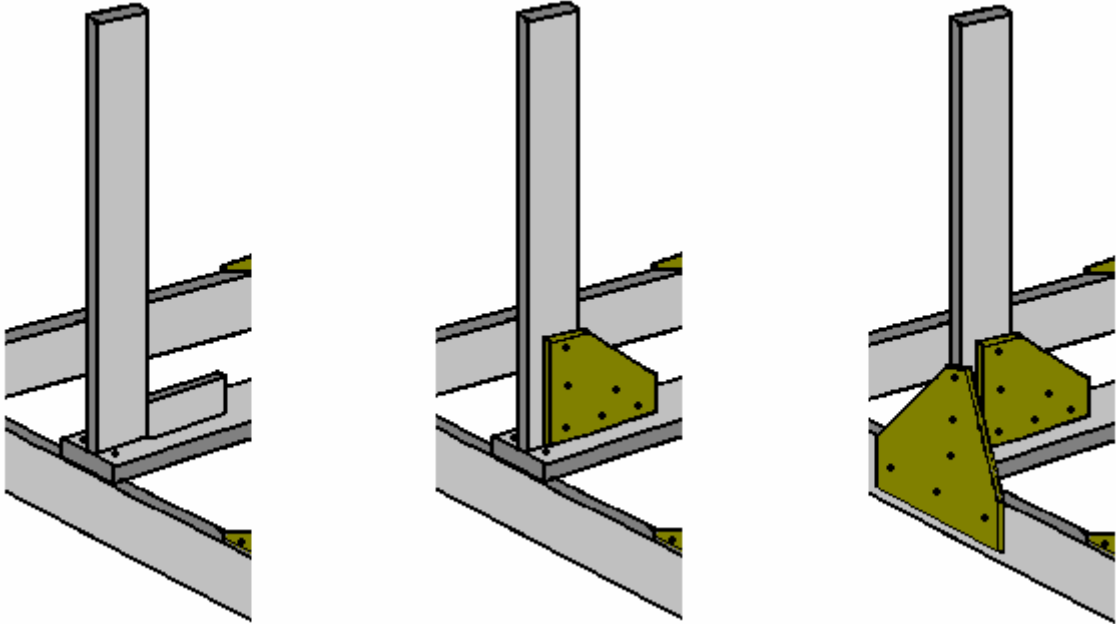
Then a 130 x 25 mm thick plank is attached across the width at the centre point and screwed in place:



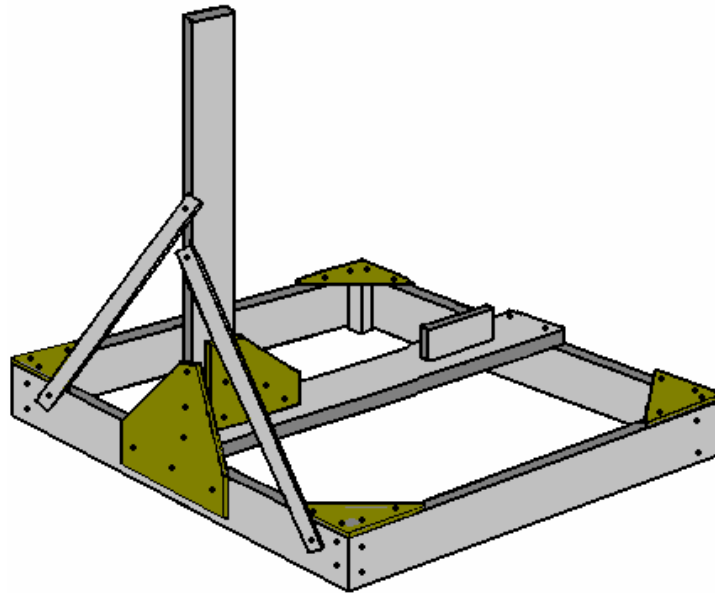
Next, two lengths of the 18 mm thick timbers about 180 mm long are epoxied and screwed to the centre of the 25 mm thick plank, leaving 70 mm clearance to the end of the plank:



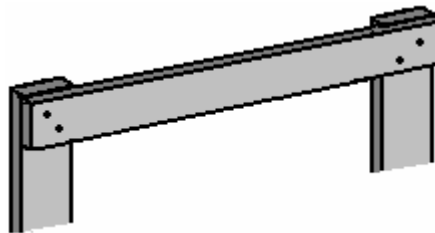
Two timber strips 1350 mm long, are cut and erected vertically, being attached by screws coming upwards through the 25 mm thick plank, and by MDF bracing triangles on one side and across the lower end of the verticals. If a spirit level is used to ensure that the vertical timber is actually vertical, then first, the four corners of the floor frame need to be weighted down to overcome any twisting and the floor frame confirmed to be actually horizontal before attaching the vertical timbers:



Each vertical needs to be braced on both sides with diagonal strip, either metal or timber:



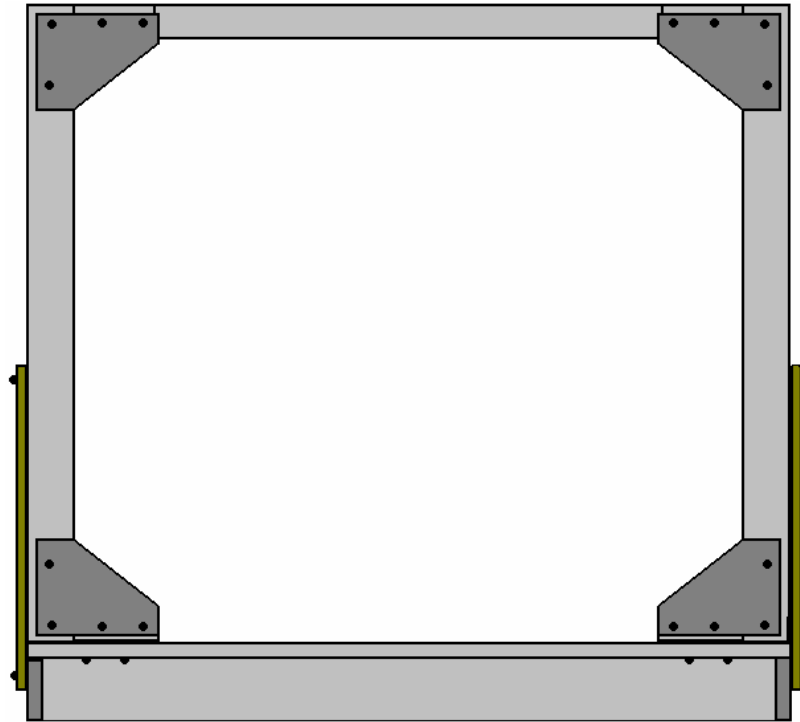
An 18 mm thick timber strip is screwed to the tops of the verticals. This deliberately positions the timber 18 mm off centre as the motor which rotates the top of the axle shaft has to be attached to the middle of this newest timber and that places the motor shaft very close to the central point of the base:



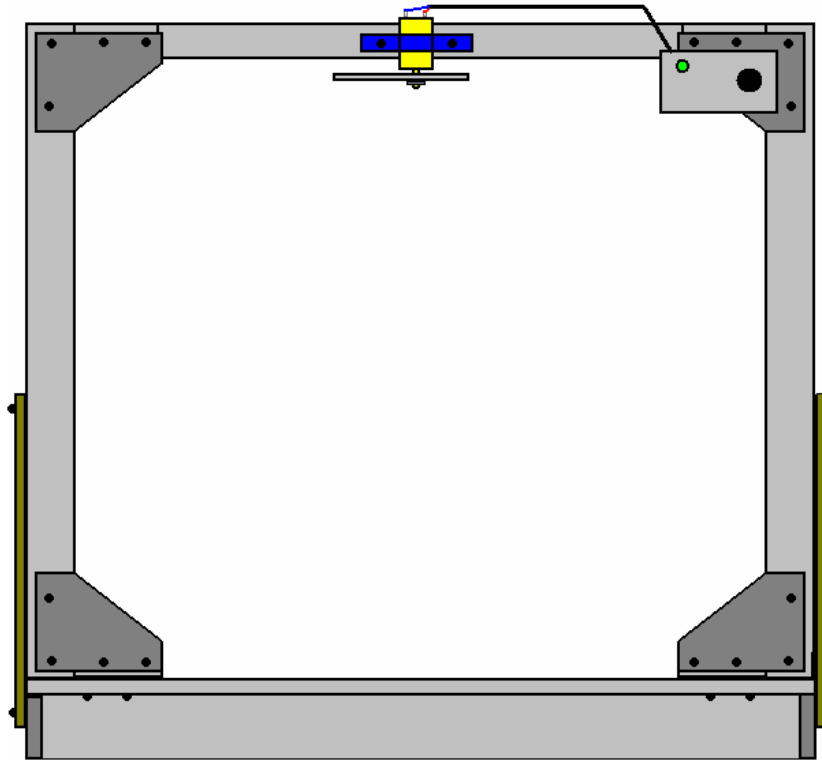
One slight disadvantage is that a packing piece is needed for the triangular MDF bracing pieces which increase the frame rigidity at the top:



At this stage, the construction will look like this:



At this point, the 300 rpm motor with its actuator arm and the speed-control box can be fitted. The motor is located centrally, and the control box can be positioned anywhere convenient. The control box is merely a 12-volt battery pack of 1.2V NiMH AA-size batteries connected through a push-to-make press button switch and the commercial DC Motor Speed Controller, to the 300 rpm motor. With this arrangement, the motor can be powered up by pressing the button and adjusting the speed slowly up from stationary, getting the rotor weight moving gradually faster and faster until its best operating speed is reached. When everything is in place, then the rectified output of the alternator is fed into the control box, so that the Start button can be released and the device becomes self-powered from part of the output power. The initial step looks like this:

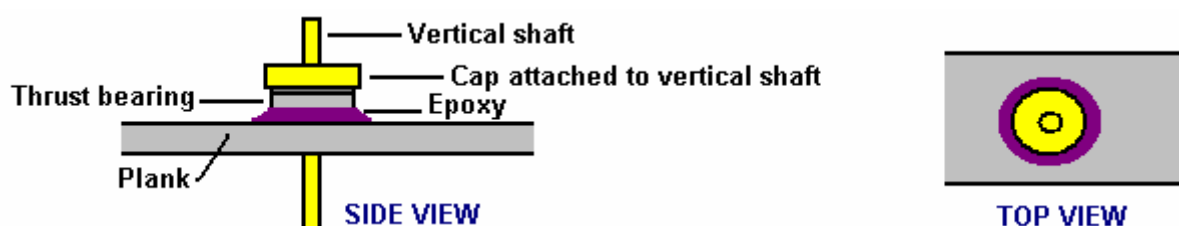


It should be explained that, with the exception of the 25 mm thick plank, all of this construction is only loaded very lightly as rotating the top of the axle shaft does not take much power or effort at all. Almost all of the rotating weight is located at the bottom of the axle shaft and that weight rests on some form of bearing which rests in the middle of the 25 mm plank.

For a small version of the generator, such as this one, the rotating weight does not need to be all that great and so, the forces generated by the weight and its rotation about the bearing need not be a major thing. However, in spite of the fact that we are only dealing with limited forces which can be handled by simple components, people may be inclined to use a thrust bearing instead of allowing the weight to rest on the shaft of the alternator. A bearing of that kind may look like this:

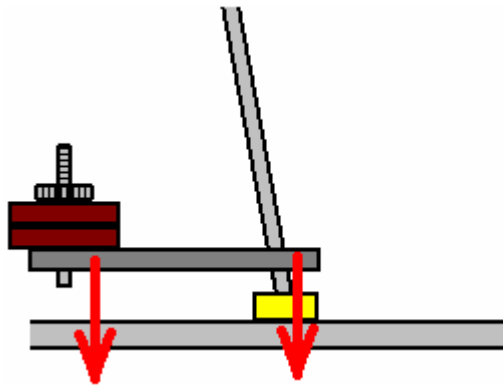


Here, the base and inner ring do not move while the top outer ring revolves freely and can support a major load while it rotates. If we choose to use one of these, then an arrangement like this could be used:

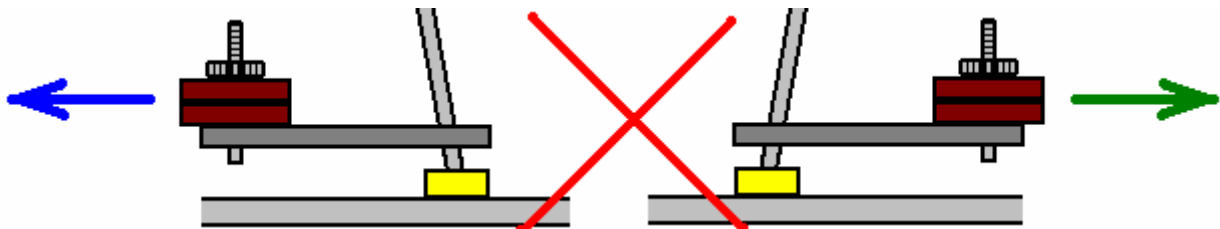


This combination has a cap (shown in yellow) with a central vertical shaft (yellow) attached to it, tightly encasing the upper ring of the bearing whose lower ring is securely attached to the 25 mm thick plank (grey) perhaps using epoxy resin (purple). This allows free rotation of the upper ring and vertical shaft while carrying significant loading. The power take-off in the arrangement shown is from the shaft projecting beneath the plank. Generally speaking, the electrical power output increases with increased speed of rotation, so gearing the alternator up so that it rotates much faster than the axle shaft is desirable and this arrangement may be convenient for that. If it is important to have the power take-off above the plank, then a strong bracket can be used to raise the bearing high enough above the plank to accomplish that.

There are two separate forces acting on the bearing. One is always downwards as the bearing supports the rotating weight:

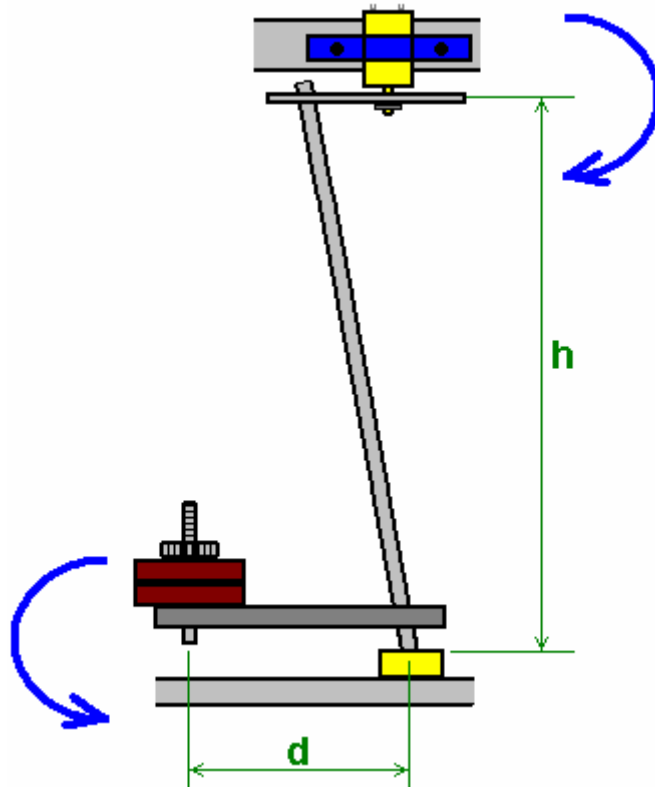


Then there is the sideways forces caused by the rotation of the (unbalanced) weight:



This sideways force is normally considered to be a major problem, however, in this instance, the weight is not being whirled around and trying to escape from the shaft in a horizontal direction, but instead, the weight is turning under gravity powered by its own weight, and the forces generated are quite different and in a different direction. Also, the rate of rotation is very small compared to the speeds which we automatically think about when considering an orbiting weight, typically, this rotation only being between 150 and 300 rpm.

As far as the loading on the axle drive motor is concerned, the situation is like this:



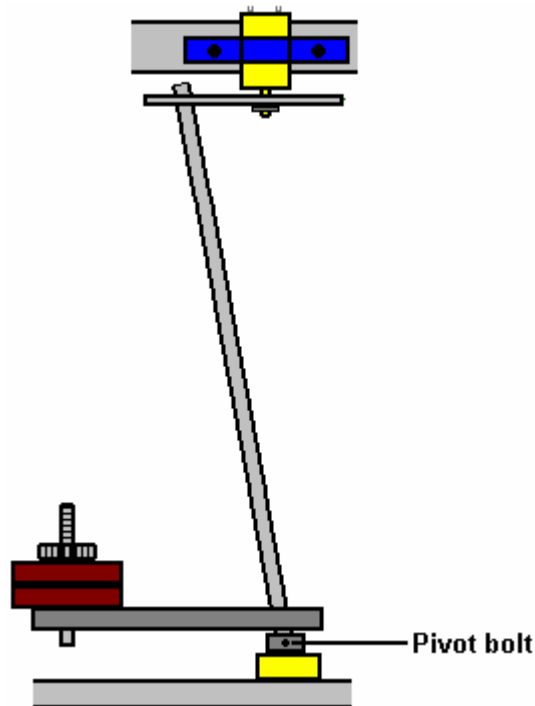
This is the position when at rest. The pull on the motor shaft at the top of the axle shaft is $\mathbf{W \times d / h}$ where \mathbf{W} is the weight at the end of arm \mathbf{d} . The situation changes immediately the top of the axle shaft is rotated and the weight \mathbf{W} starts to swing under the influence of gravity.

I am told that the axle shaft needs to be light. With small weights, a rigid wooden shaft is adequate and it does not flex under the loading. I am assured that the bottom of the axle shaft needs a universal joint and a major version of this generator where the weights are very high, that is certainly true as the shaft will flex if designed to its minimum specification, but under these much less stressed conditions, there will be no flexing of the shaft when it is pulled sideways and as the shaft angle is a constant, I do not believe that any such joint is necessary. However, many people will wish to include one. These bearings come in different forms, and one of them looks like this:

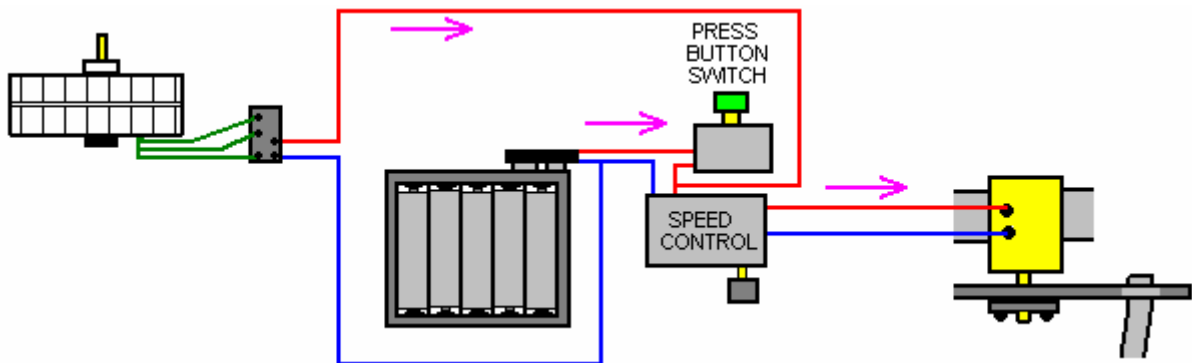


It must be remembered that if a joint like this is fitted, then it will not be in constant motion, that is, the joints will take up one particular position and will maintain that position during the whole of the time that the generator is in operation.

A compromise would be to provide a hinged movement in one plane by pivoting the axle shaft joint just above the thrust bearing:



The electrical connections are quite straightforward:



The 12-volt battery pack of 1.2V AA-size batteries is connected to the motor speed controller when the button of the press-button switch is held down. This powers the motor, and as the axle shaft speeds up progressively, the generator starts producing power which is always fed to the speed controller box. As soon as the generator gets up to speed the press button switch can be released and the system runs on power produced by the generator. Excess power will be drawn from the generator output, but those links are not shown in the diagram.

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Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 12: Power from a Water Pump

There is a video on Google which shows an interesting self-powered water-pump driven, electrical generator at: http://www.youtube.com/watch?v=IGpXA6qhH_Q

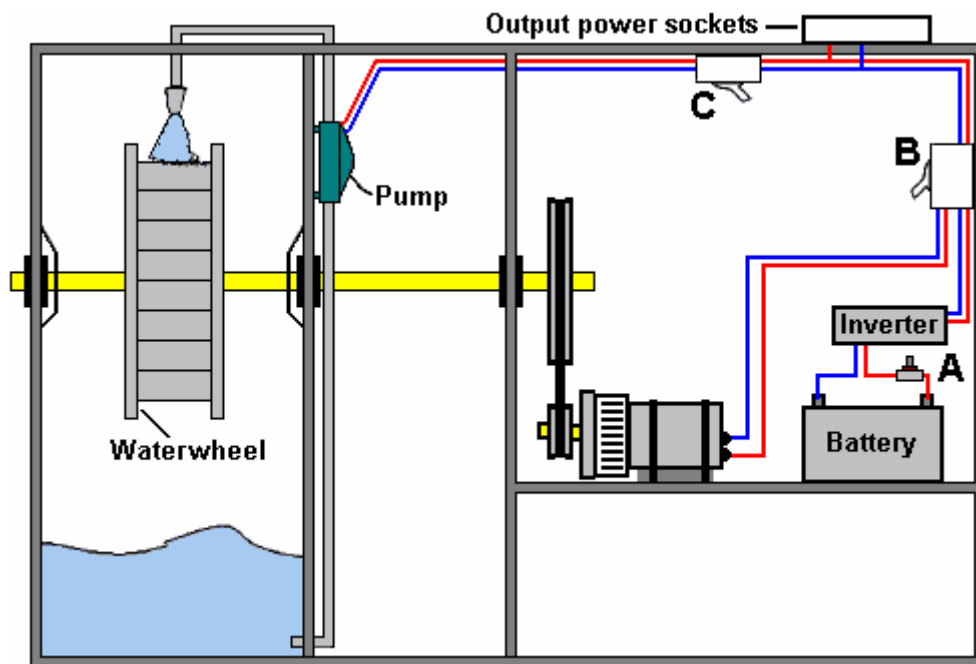
This is a very simple device where the jet of water from the pump is directed at a simple water-wheel which in turn, spins an electrical alternator, powering both the pump and an electric light bulb, demonstrating free-energy.



Initially, the generator is got up to speed, driven by the mains electrical supply. Then, when it is running normally, the mains connection is removed and the motor/generator sustains itself and is also able to power at least one light bulb. The generator output is normal mains current from a standard off-the-shelf alternator.

James Hardy is the designer and he has Patent Application US 2007/0018461 A1 published in 2007 on his design. In that application he points out that a major advantage of his design is the low noise level produced when the generator is running. In the video and the pictures above, the demonstration has the housing opened up in order to show how the generator system works, but during normal use, the compartments are completely sealed.

In his document, James shows the overall system like this:



The housing is divided into three separate compartments. The first compartment has a strong axle shaft running through it, supported on ball or roller bearings – possibly ceramic for this environment. The bearings are protected by being covered by splash guards which keep the water (or other liquid) off them. A waterwheel of almost any type is mounted on the shaft and a high-capacity water pump directs a stream of liquid on to the waterwheel, striking the paddles at right angles in order to provide the maximum impact.

This first compartment is sealed in order to contain all of the liquid inside it and the bottom is effectively a sump for the liquid. A pipe located near the bottom of the compartment feeds the liquid to the pump which is located in the second compartment. The pump boosts the liquid through a nozzle, directing it at the waterwheel. While almost any nozzle will work, it is usual to choose one which produces a concentrated jet of liquid in order to generate the largest possible impact. One would expect that the larger the diameter of the waterwheel, the more powerful the system would be. However, that is not necessarily the case as other factors such as the overall weight of the rotating members might affect the performance. Experimentation should show the most effective combination for any given pump.

The rotating shaft is given a third bearing supported by the side of the final compartment. The shaft then has a large diameter belt pulley mounted on it, the belt driving a much smaller pulley mounted on the shaft of the generator. This raises the rate at which the generator shaft is rotated. If the pump operates on AC mains voltage, then the generator will be one which generates mains voltage AC. If the pump operates on, say, 12 volts, then the generator will be one which generates 12 volts DC. The diagram above, shows the arrangement for a mains voltage system as that is probably the most convenient. If a 12-volt system is chosen, then the inverter can be omitted.

The generator is started by pressing the 'normally open' press-button switch marked "A" in the diagram. This passes the battery power through to the 1-kilowatt inverter which then generates AC mains voltage. The switch marked "B" is a "changeover" switch, and for starting, it is set so that it passes the AC power through switch "A" to the pump. This causes the pump to turn on and direct a powerful jet of liquid at the waterwheel, forcing it around and so powering the generator. When the generator gets up to full speed, switch "B" is flipped over, disconnecting the inverter and feeding the generator power through to the pump, keeping it running and supplying additional power to the output power sockets mounted on top of the housing. The press-button switch is released, disconnecting the battery which is no longer needed. Switch "C" is an ordinary On/Off mains switch which is needed if you want to turn the generator off.

A major advantage of this generator system is that the main components can be bought ready-made and so only very simple constructional skills and readily available materials are needed. Another advantage is that what is happening can be seen. If the pump is not working, then it is a simple task to discover why. If the generator is not spinning, then you can see that and sort the problem. Every component is simple and straightforward.

James suggests that a suitable pump is the 10,000 gallons per hour "Torpedo Pump" from Cal Pump, web site: http://www.calpumpstore.com/products/productdetail/part_number=T10000/416.0.1.1:



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Simple Free-Energy Devices

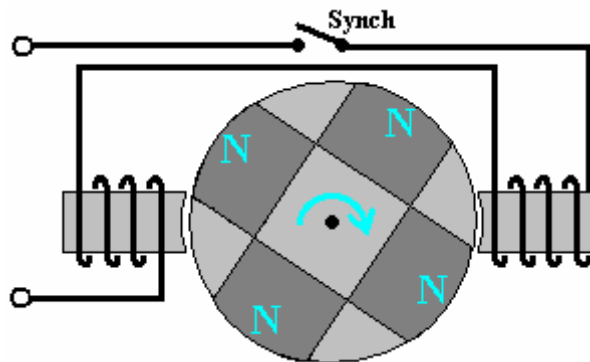
There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 13: The Adams Motor/Generator

The late Robert Adams, an electrical engineer of New Zealand designed and built several varieties of electric motor using permanent magnets on the rotor and pulsed electromagnets on the frame of the motor (called the "stator" because it does not move). He found that if they were configured correctly, then the output from his motors exceeded their input power by a large margin (800%).



The diagram of his motor intended to show the basic operating principle is shown here:



If a motor is built like this, then it will most certainly work but it will never reach 100% efficiency let alone exceeding the 100% mark. It is only with a specific configuration which is hardly ever publicised that high performance figures can be achieved. While Robert has shown several different configurations, in order to avoid confusion I will describe and explain just one of them. I am indebted to several of Robert's friends and colleagues for the following information and I should like to express my thanks to them for their help and support in bringing you this information.

First and foremost, high performance can only be achieved with the clever use of power collection coils. These coils need to be positioned accurately and their power collection restricted to just a very short arc of operation by connecting them to, and disconnecting them from, the output circuit at just the right instant so that the back EMF generated when the current draw stops, actually contributes to the drive of the rotor, speeding it on it's way and raising the overall efficiency of the motor/generator as a whole.

Next, the shape of the magnets used is important as the length to width proportion of the magnet alters the pattern of it's magnetic fields. In direct opposition to the diagram shown above, the magnets need

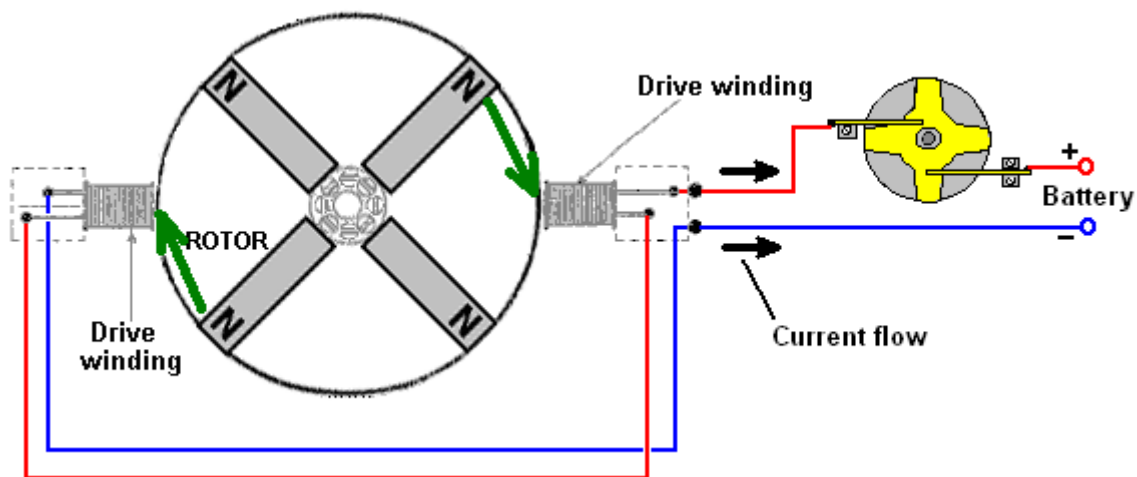
to be much longer than their width (or in the case of cylindrical magnets, much longer than their diameter).

Further, a good deal of experimentation has shown that the size and shape of the electromagnets and pick-up coils has a major influence on the performance. The cross-sectional area of the core of the pick-up coils should be four times that of the cross-sectional area of the permanent magnets in the rotor. The reverse is true for the cores of the drive coils as their cores should have a cross-sectional area of just one quarter of the rotor magnet cross-sectional area.

Another point which is almost never mentioned is the fact that big circuit gains will not be achieved unless the drive voltage is high. The minimum should be 48 volts but the higher the voltage, the greater the energy gain, so voltages in the 120 volts (rectified US mains voltage) to 230 volts (rectified mains voltage elsewhere) should be considered. Neodymium magnets are not recommended for drive voltages under 120 volts.

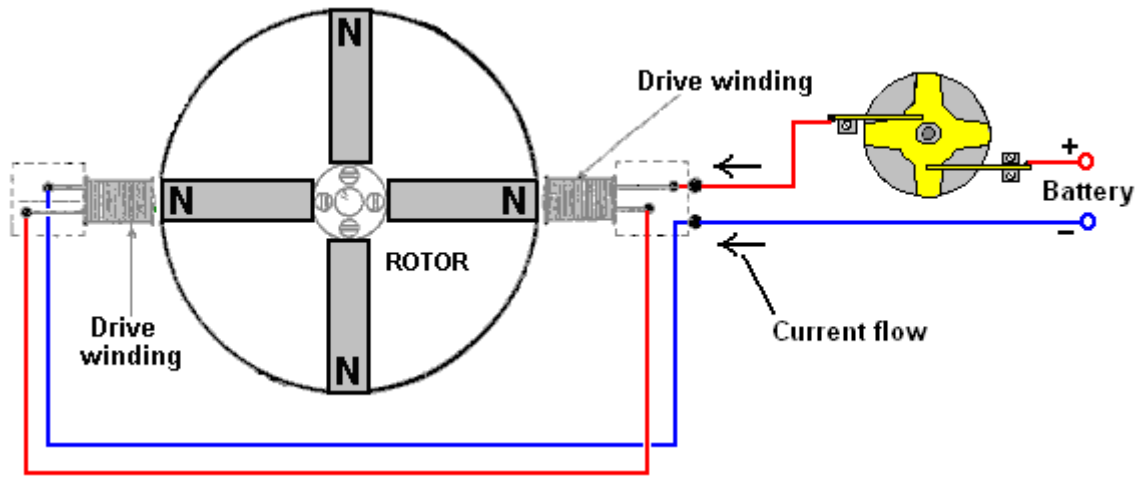
There are several important steps in the way that the Robert Adams motor/generator works and it is important for you to understand each of the steps.

Step 1: A rotor magnet is attracted to the iron core of a stator “drive” electromagnet. As it approaches the drive electromagnet, the lines of magnetic force from the stator magnet move across the drive electromagnet coil. This generates an electric current in the drive electromagnet coil and that current is fed back to the battery which is powering the motor/generator:



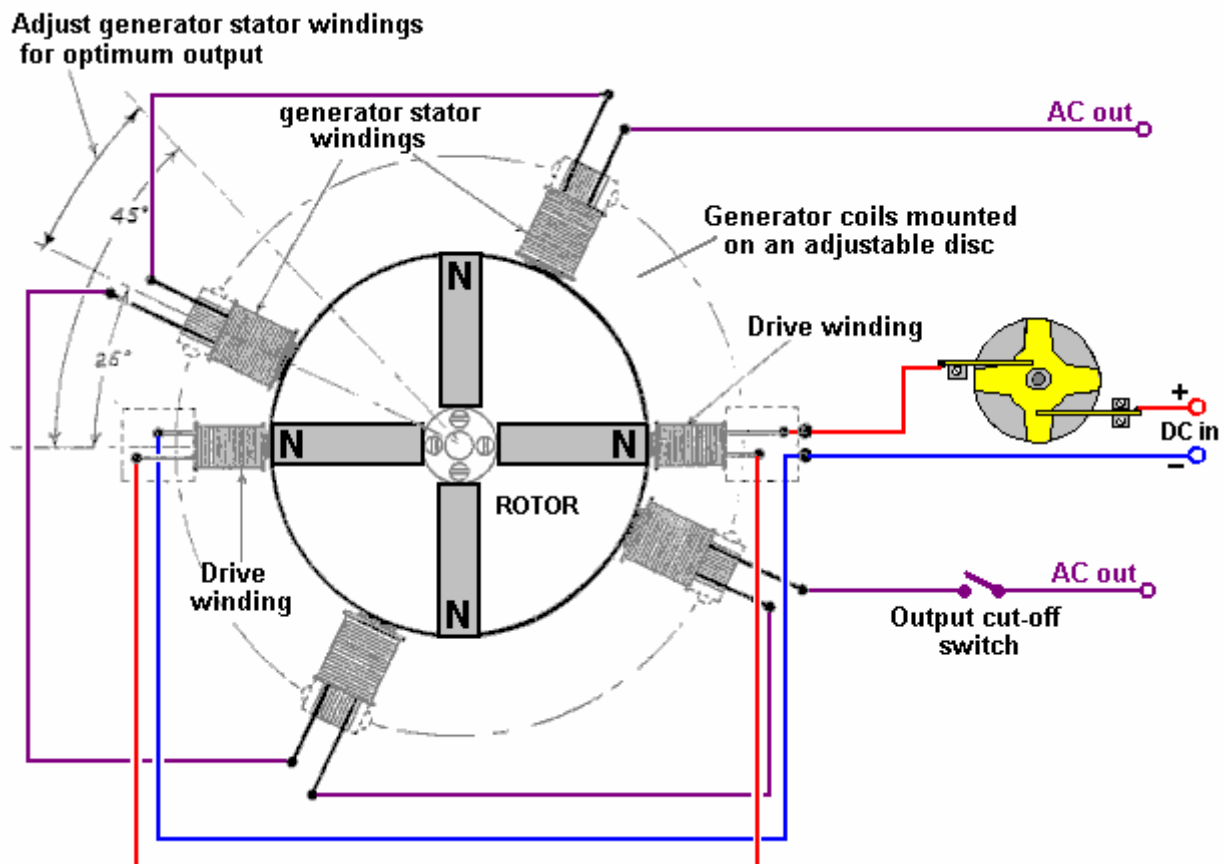
Notice that the movement of the rotor is caused by the permanent magnets being attracted to the iron cores of the drive electromagnets and **not** by any electric current. The electric flow is going back into the battery and is being caused by the movement of the rotor which in turn is being caused by the permanent magnets.

Step 2: When the rotor turns far enough, the magnets align exactly with the cores of the drive electromagnets. The rotor continues to rotate because of its inertia, but if we do nothing about it, the rotor magnet attraction to the drive electromagnet core will act to slow it down and then drag it back to the drive coil core. We want to prevent that, so we feed a small amount of current into the drive electromagnet coils – just enough current to stop the backward drag of the rotor magnets. This current is **NOT** to push the rotor magnets away, it is just enough to prevent the rotor being slowed down:



Step 3: When the rotor magnet has moved away far enough, the current being fed to the drive electromagnets is cut off. As happens with any coil, when the current is cut off a large reverse voltage spike is generated. That voltage spike is rectified and fed back to the battery.

The system so far produces a spinning rotor for very little current draw from the battery. But we want the system to provide us with excess electrical output, so for that, four additional electromagnets are added around the rotor. These output coils are mounted on a non-magnetic disc which can be rotated to adjust the gap between the drive coils and the output coils. Like the rotor magnets, the output coils are spaced evenly around the circumference of the rotor at 90-degree intervals:



Step 4: Surprisingly, the output coils are switched Off for most of the time. This sounds mad but it most definitely isn't mad. With the output coils disconnected, the approaching rotor magnets generate a voltage in the output coil windings but no current can flow. As no current is flowing, no magnetic field is

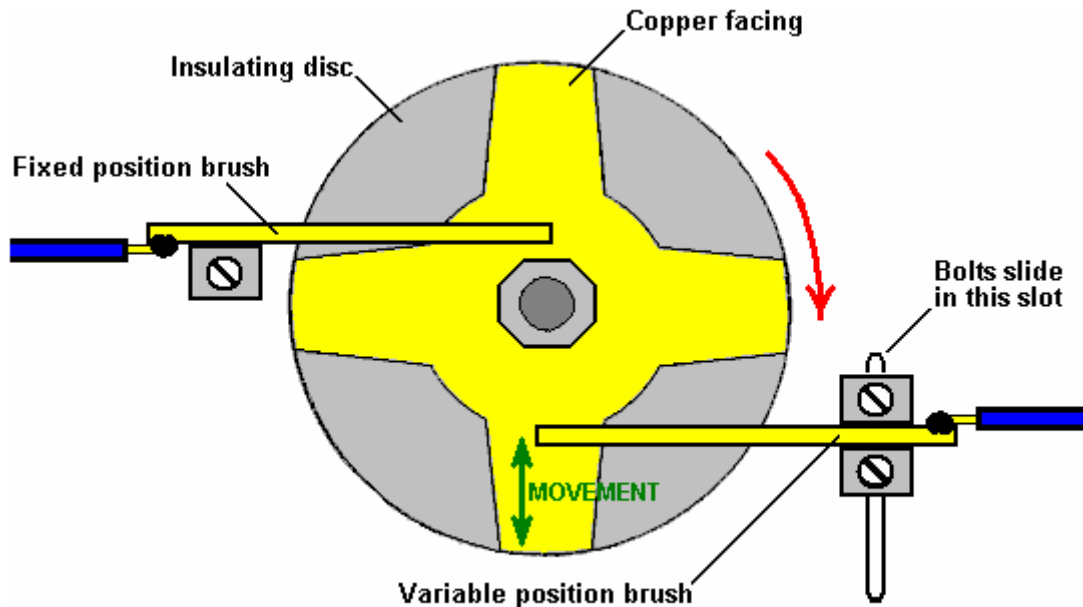
generated and so the rotor magnets just pull directly towards the output coil iron cores. The maximum output coil voltage is when the rotor magnets are aligned with the output coil cores. At that instant the output switch is closed and a strong pulse of current is drawn off and then the switch is opened again, cutting off the output current. The output switch is closed for only three degrees or so of the rotor's rotation and it is off again for the next eighty seven degrees, but the opening of the switch has a major effect. The switch being opened cuts off the current flowing in the output coils and that causes a major reverse voltage spike causing a major magnetic field which pushes the rotor on its way. That voltage spike is rectified and passed back to the battery.

The rectification of every possible spare voltage pulse as described, returns 95% of the drive current to the battery, making this an extremely effective motor/generator. The performance can be further enhanced by rotating the set of output coils to find their optimum position and then locking the disc in place. When properly set up, this generator has an output current which is eight times greater than the input current.

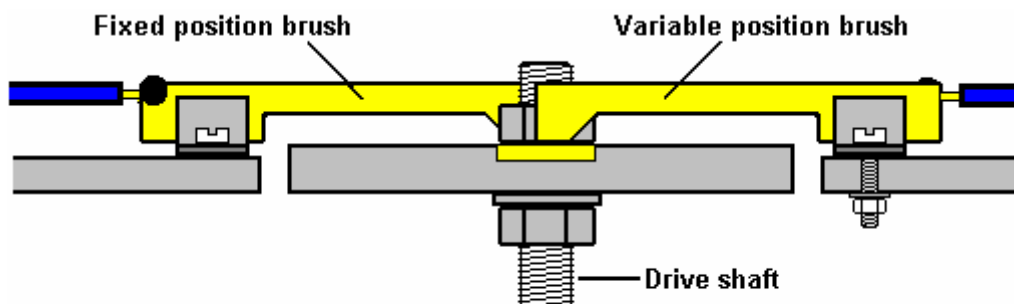
Notice that the cores of the "generator" pick-up coils are very much wider than the cores of the drive coils. Also notice the proportions of the magnets where the length is much greater than the width or diameter. The four generator windings are mounted on a single disc allowing them to be moved through an angle to find the optimum operating position before being locked in position and the two drive coils are mounted separately and held clear of the disc. Notice also that the power pick-up coils are much wider compared to their length than the drive coils are. This is a practical feature which is explained in greater detail later.

The DC input is shown passing through Robert's custom-made contactor switch which is mounted directly on the shaft of the motor/generator. This is a mechanical switch which allows an adjustable On / Off ratio, which is known as the "Mark/Space Ratio" or, if the "On" period is of particular interest, the "Duty Cycle". Robert Adams indicates that when the motor is running and has been adjusted to it's optimum performance, then the Mark/Space ratio should be adjusted to minimise the On period and ideally get it down to about 25% so that for three quarters of the time, the input power is actually switched off. There are various ways of achieving this switching while still having a very sharp turn on and turn off of the power.

Robert considered mechanical switching of the drive current to be a very good option although he was not opposed to using the contact to power a transistor to do the actual switching and so reduce the current through the mechanical contacts by a major factor. His reasons for his preference for mechanical switching are that it gives very sharp switching, needs no electrical power to make it operate and it allows current to flow in both directions. The current flow in two directions is important because Robert produced various ways of getting the motor to feed current back into the driving battery, allowing it to drive the motor for long periods without lowering its voltage hardly at all. His preferred method of switching is shown here:



TIMING GEAR - TOP VIEW



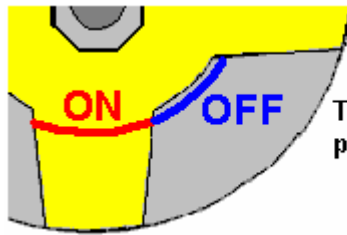
TIMING GEAR - SIDE VIEW

This switching gear operates as follows: The timing disk is bolted securely to the drive shaft of the motor and its position is set so that the electrical switch-on occurs when the rotor magnet is exactly aligned with the drive coil core. Adjustment of that timing is done by loosening the locking nut, rotating the disc very slightly and clamping the disc in position again. A spring washer is used to keep the assembly tight when the device is running. The disc has a star-shaped piece of copper sheet set into its surface and two silver-tipped, copper arm "brushes" slide across the surface of the copper star.

One of these two brushes is fixed in position and slides across the copper star near the drive shaft, making a permanent electrical connection to it. The second brush slides alternatively on the non-conducting surface of the disc and then over the conducting arm of the copper. The second brush is mounted so that its position can be adjusted and, because the copper arms taper, that alters the ratio of the "On" time to the "Off" time. The actual switching is achieved by current flowing through the first brush, through the copper arm and then through the second brush. The brush arms shown in the diagram above rely on the springiness of the copper arm to make a good brush-to-copper electrical connection. It might be preferred to use a rigid brush arm, pivot it and use a spring to ensure a very good contact between the brush and the copper star at all times.

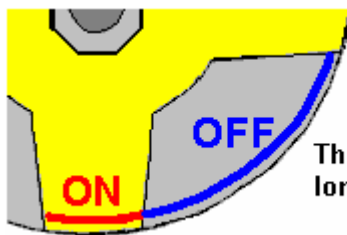
The adjustment of the On to Off time, or "Mark/Space Ratio" or "Duty Cycle" as the technical people describe it, could perhaps do with some description. If the moveable brush is positioned near the centre of the disc, then, because of the tapering of the copper arms, the part of the non-conducting disc

that it slides over is shorter and the part of the conducting copper arm with which it connects is longer, as the two sliding paths are about the same length, the current is on for about the same length as it is off, giving a Mark/Space ratio of about 50% as shown here:



The On path is about the same length as the Off path and so the Mark/Space ratio is about 50%

If, instead, the moveable brush is positioned near the outside edge of the disc, then because of the tapering of the copper arm, the On path is shorter and the non-conducting Off path is very much longer, being about three times as long as the On path, giving a Mark/Space ratio of about 25%. As the moveable brush can be positioned anywhere between these two extremes, the Mark/Space ratio can be set to any value from 25% to 50%.

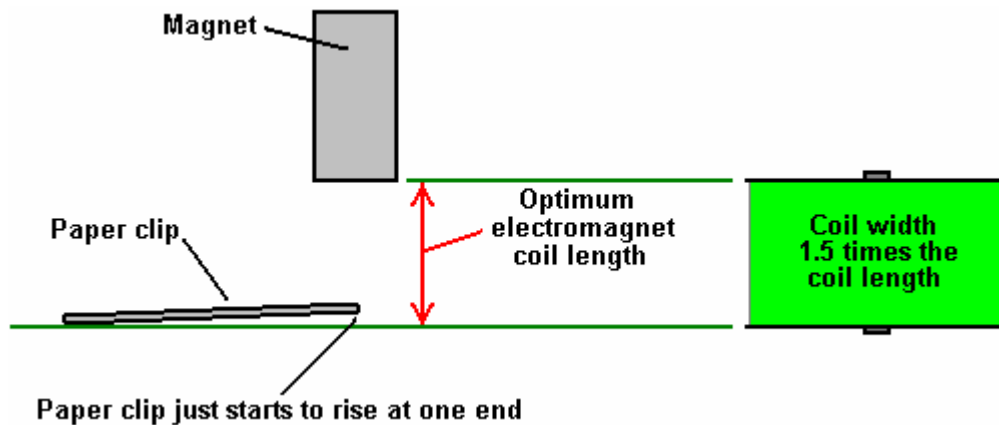


The On path is shorter and the Off path is much longer giving a Mark/Space ratio of about 25%

The two brushes can be on the same side of the drive shaft or on opposite sides as shown. One important feature is that the brushes touch in a position where the disc surface is always moving directly away from the brush mounting, causing any drag to be directly along the arm and giving no sideways loading on the brush. The diameter of the device is usually one inch (25 mm) or less.

You will also notice that the output is switched although the diagram does not give any indication of how or when that switching takes place. You will notice that the diagram has angles marked on it for the optimum positioning of the pick-up coils, well, an Adams Motor builder with a forum ID of "Maimariati" who achieved a Coefficient Of Performance of 1,223, found that the optimum switching for his motor is On at 42 degrees and Off at 44.7 degrees. That tiny 2.7 degree part of the rotor turn gives a substantial power output and cutting the output current off at that point causes the back EMF of the coils to give the rotor a substantial additional boost on its way. His input power is 27.6 watts and the output power is 33.78 kilowatts

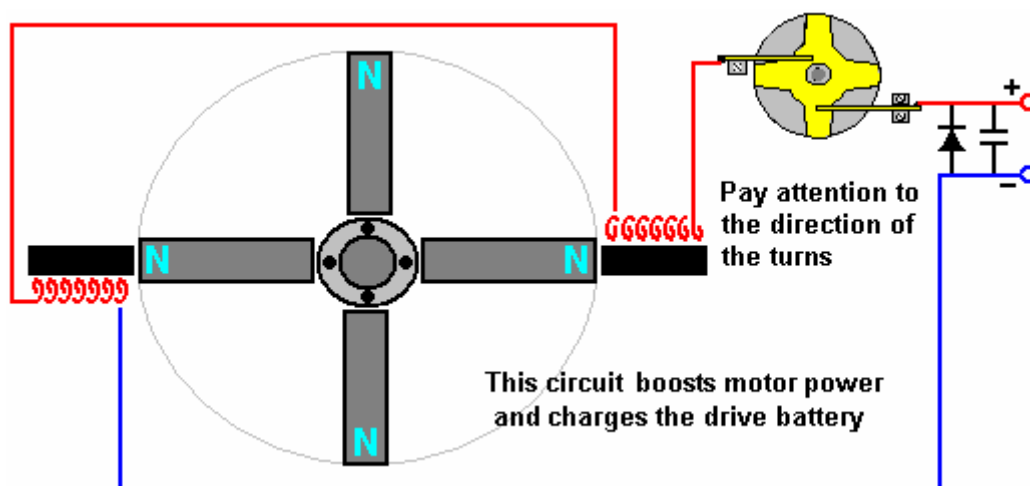
Now for some practical details. It is suggested that a good length for the power pick-up coils can be determined by using the "paper clip test" described by Ron Pugh of Canada. This is done by taking one of the permanent magnets used in the rotor, and measuring the distance at which that magnet just begins to lift one end of a 32 mm (1.25 inch) paper clip off the table. The optimum length of each coil from end to end is exactly the same as the distance at which the paper clip starts to lift.



The core material used in the electromagnets can be of various different types including advanced materials and alloys such as 'Somalloy' or 'Metglas'. The power pick-up coil proportions are important as an electromagnet becomes less and less effective as its length increases, and eventually, the part furthest from the active end can actually be a hindrance to the effective operation. A good coil shape is one which you would not expect, with the coil width being, perhaps 50% greater than the coil length:

Contrary to what you would expect, the device draws in energy from the local environment better if the end of the pick-up coil farthest from the rotor is left unaffected by any other part of the device and the same applies to the magnet facing it. That is, the coil should have the rotor at one end and nothing at the other end, that is, no second rotor behind the coil. The speed at which the voltage is applied to, and removed from, the coils is very important. With very sharp voltage rises and falls, additional energy is drawn from the surrounding environmental energy field. If using transistor switching, then the IRF3205 FET has been found to be very good and a suitable driver for the FET is the MC34151.

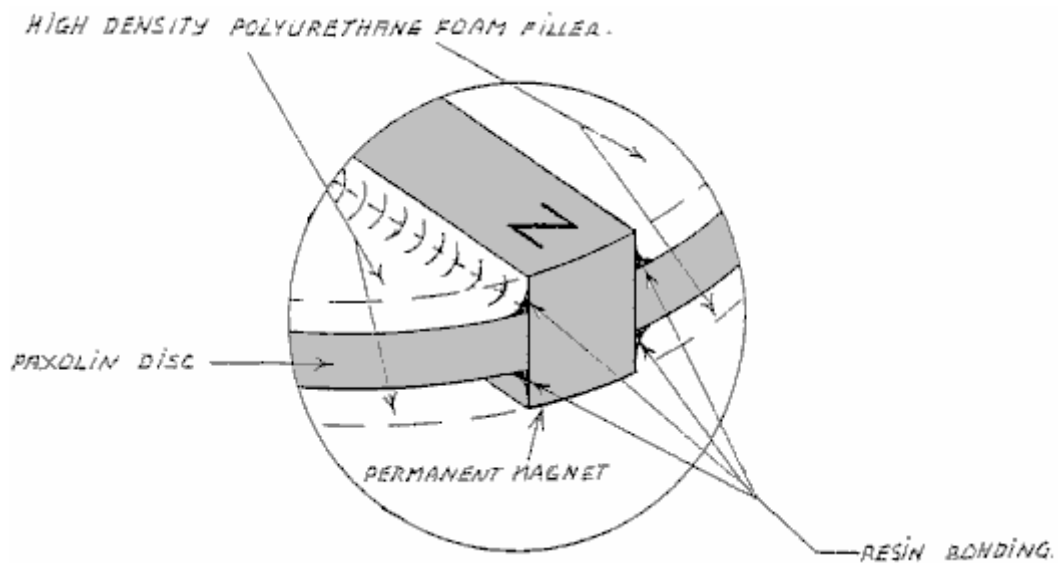
If using a Hall-effect semiconductor to synchronise the timing, say the UGN3503U which is very reliable, then the life of the Hall-effect device is much improved if it is provided with a 470 ohm resistor between it and the positive supply line, and a similar 470 ohm resistor between it and the negative line. These resistors in series with the Hall-effect device effectively "float" it and protect it from supply-line spikes".



Here, two electromagnets are driven by the battery via Robert's 4-arm commutator which is mounted on the rotor shaft. Some of the recommendations given by Robert are the opposite of what you would expect. For example, he says that a single rotor construction tends to be more electrically efficient than one where several rotors are mounted on a single shaft. Robert is against the use of reed switches and he recommends making one of his commutators.

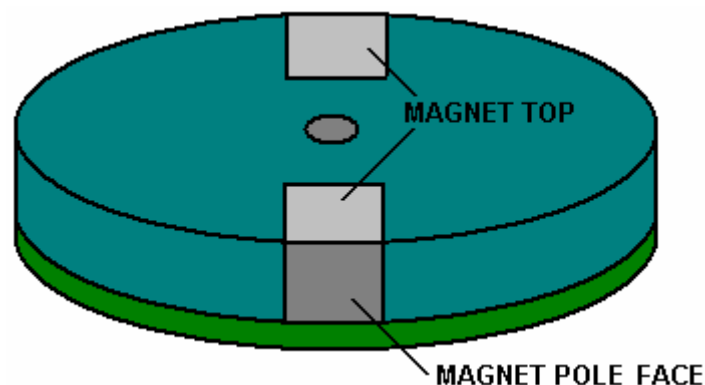
At one stage, Robert recommended the use of standard transformer shims for constructing the cores of the electromagnets. This has the advantage that matching bobbins for holding the coil windings are

readily available and can still be used for pick-up coils. Later on, Robert swung towards the use of solid cores from the old PO Series 3000 telephone relays and eventually said that electromagnet cores should be solid iron.

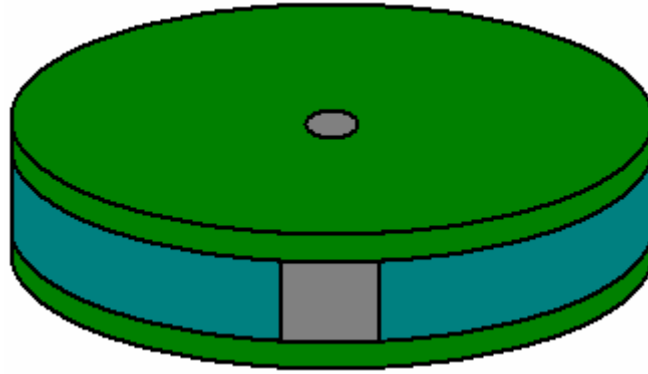


The diagrams presented by Robert show the magnets located on the rim of the rotor and pointing outwards. If this is done, then it is essential that the magnets in the rotor are firmly attached on at least five of their six faces and the possibility of using a ring of non magnetic material such as duct tape around the outside should be considered. That style of construction also lends itself to streamlining the rotor by having a completely solid construction, although it might be remarked that the motor would run better and more quietly if it were enclosed in a box which had the air pumped out of it. If that is done, then there will be no air resistance and because sound can't pass through a vacuum, quieter operation is bound to result.

While this may sound a bit complicated, there is no reason why it should be. All that is needed is two discs and one central disc which is the thickness of the magnets, with slots cut in it, the exact size of the magnets. The assembly starts with the lower disc, magnets and central disc. These are glued together, probably with epoxy resin, and that holds the magnets securely on four faces as shown here:



Here, the magnets are attached on the lower face, the right and left faces, and the unused pole face, and when the upper disc is attached, the upper faces are also secured and there is the minimum of air turbulence when the rotor spins:

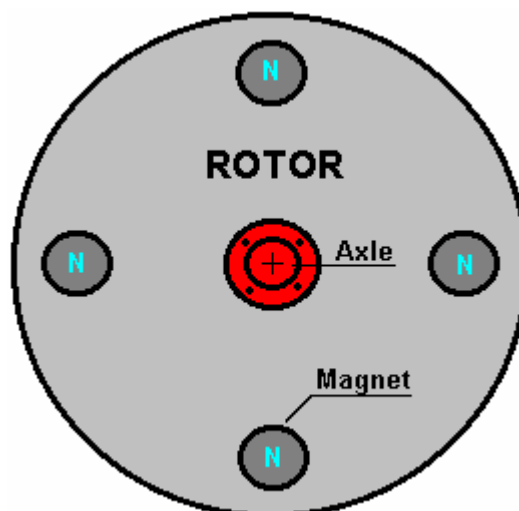


There is a "sweet spot" for the positioning of the power pick-up coils and it will usually be found that this is two or three millimeters away from the rotor. If that is the case, then there will be room for an outer band of duct tape on the rim of the rotor to provide additional protection against the failure of the magnet attachment method.

High-power versions of the motor/generator need to be enclosed in a metal box which is earthed as they are quite capable of generating a substantial amount of high frequency waves which can damage equipment such as oscilloscopes and create TV reception interference. There would probably be an improvement in performance as well as a reduction in sound if the box was airtight and had the air pumped out of it. If that is done, then there will be no air resistance as the rotor spins and since sound does not pass through a vacuum, quieter operation is possible.

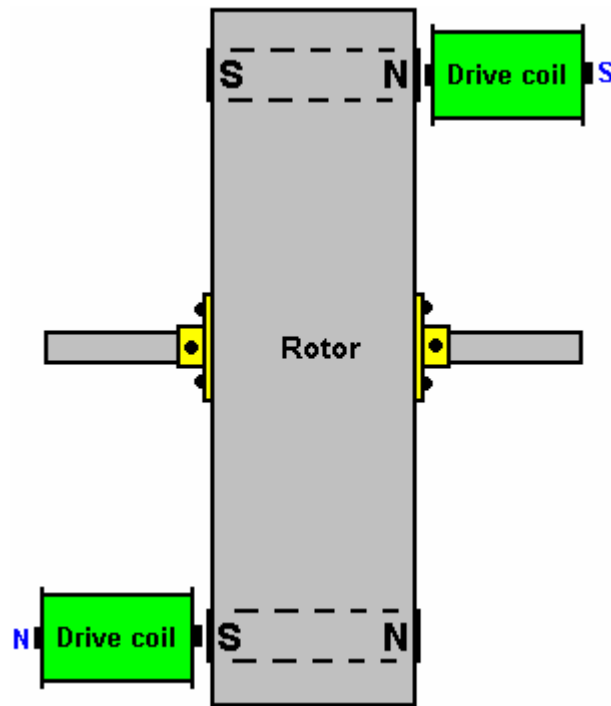
Experienced rotor builders do not like the radial magnets style of construction because of the stresses on the magnet attachments if high rotational speeds are reached. It should not need to be said, but it is obviously a major requirement to keep your hands well away from the rotor when the motor is running as it is perfectly possible to be injured by the high-speed movement if you are careless. Please remember that this presentation must not be considered to be a recommendation that you build or use any device of this nature and it must be stressed that this text, in common with the entire contents of this eBook, is intended to be for information purposes only and no representations or warranties are implied by this presentation. Should you decide to construct, test or use any device, then you do so entirely at your own risk and no liability attaches to anybody else if you sustain any kind of injury or property damage as a result of your own actions.

Because of the mechanical stresses caused during rotation, some experienced constructors feel that the magnets should be embedded in the rotor as shown here where they are kept well clear of the rim of a rotor which is made from a tough material. This is so that the outer strip of the material prevents the magnets breaking loose and becoming dangerous high-speed projectiles, which at best would destroy the electromagnets and at worst could injure someone quite badly:



It needs to be remembered that the proportions of the magnets are for the magnet length to be more than the diameter, so in cases like this where circular magnet faces are to be used, the magnets will be cylindrical and the rotor needs to have a significant thickness, which will depend on the magnets which are available locally. The magnets should be a tight push-fit in their holes and securely glued in place.

Robert Adams has used this construction style as well. However, if an arrangement like this is used, then there will be a substantial sideways pull on the rotor as it reaches the electromagnet core, tending to pull the magnets out of the rotor.



It is important that the rotor should be perfectly balanced and have the minimum amount of bearing friction possible. This calls for precision construction and either roller or ball bearings. The construction style shown above has the distinct advantage that it has an open end to both the magnet and the coils and this is believed to facilitate the inflow of environmental energy into the device.

When getting ball-race bearings for an application like this, please be aware that "closed" bearings such as these are not suitable as supplied:



This is because this type of bearing is usually packed with dense grease which completely destroys its free motion, making it worse as a bearing than a simple hole-and-shaft arrangement. However, in spite of this, the closed or "sealed" bearing is popular as the magnets tend to attract dirt and dust and if the device is not enclosed in a steel box as is necessary for the high power versions, then having the seal

is considered to be an advantage. The way to deal with the grease packing is to soak the bearing in an isopropyl solvent cleaner to remove the manufacturer's grease, and then, when it has dried out, lubricate the bearing with two drops of a high quality thin oil. If it is intended to house the motor/generator in an earthed, sealed steel box then an alternative type of bearing which might be suitable is an open design like this:



especially if the air is removed from the box. Some constructors prefer to use ceramic bearings which are supposed to be immune to dirt. One supplier is <http://www.bocabearings.com/main1.aspx?p=docs&id=16> but as with everything else, these choices have to be made by the builder and will be influenced by his opinions.

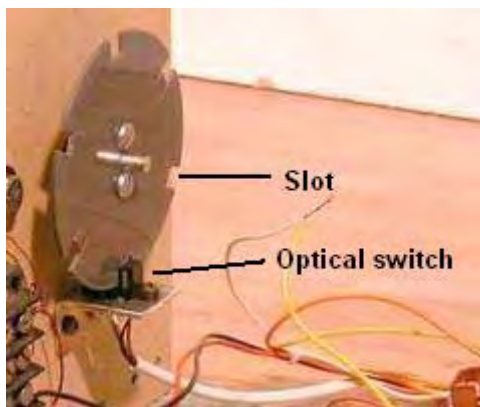
To help with assessing the wire diameter and length which you could use, here is a table of some of the common sizes in both American Wire Gauge and Standard Wire Gauge:

AWG	Dia mm	SWG	Dia mm	Max Amps	Ohms / 100 m
11	2.30	13	2.34	12	0.47
12	2.05	14	2.03	9.3	0.67
13	1.83	15	1.83	7.4	0.85
14	1.63	16	1.63	5.9	1.07
15	1.45	17	1.42	4.7	1.35
16	1.29	18	1.219	3.7	1.48
18	1.024	19	1.016	2.3	2.04
19	0.912	20	0.914	1.8	2.6
20	0.812	21	0.813	1.5	3.5
21	0.723	22	0.711	1.2	4.3
22	0.644	23	0.610	0.92	5.6
23	0.573	24	0.559	0.729	7.0
24	0.511	25	0.508	0.577	8.7
25	0.455	26	0.457	0.457	10.5
26	0.405	27	0.417	0.361	13.0
27	0.361	28	0.376	0.288	15.5
28	0.321	30	0.315	0.226	22.1
29	0.286	32	0.274	0.182	29.2
30	0.255	33	0.254	0.142	34.7
31	0.226	34	0.234	0.113	40.2
32	0.203	36	0.193	0.091	58.9
33	0.180	37	0.173	0.072	76.7
34	0.160	38	0.152	0.056	94.5
35	0.142	39	0.132	0.044	121.2

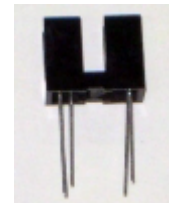
Robert Adams states that the DC resistance of the coil windings is an important factor. The overall resistance should be either 36 ohms or 72 ohms for a complete set of coils, whether they are drive coils or power pick-up coils. Coils can be wired in parallel or in series or in series/parallel. So, for 72 ohms with four coils, the DC resistance of each coil could be 18 ohms for series-connected, 288 ohms for parallel connected, or 72 ohms for connection in series/parallel where two pairs of coils in series are then wired in parallel.

So far, we have not discussed the generation of the timing pulses. A popular choice for a timing system is to use a slotted disc mounted on the rotor axle and sensing the slots with an "optical" switch. The "optical" part of the switch is usually performed by UV transmission and reception and as ultra violet is not visible to the human eye, describing the switching mechanism as "optical" is not really correct. The actual sensing mechanism is very simple as commercial devices are readily available for performing the task. The sensor housing contains both a UV LED to create the transmission beam, and a UV dependent resistor to detect that transmitted beam.

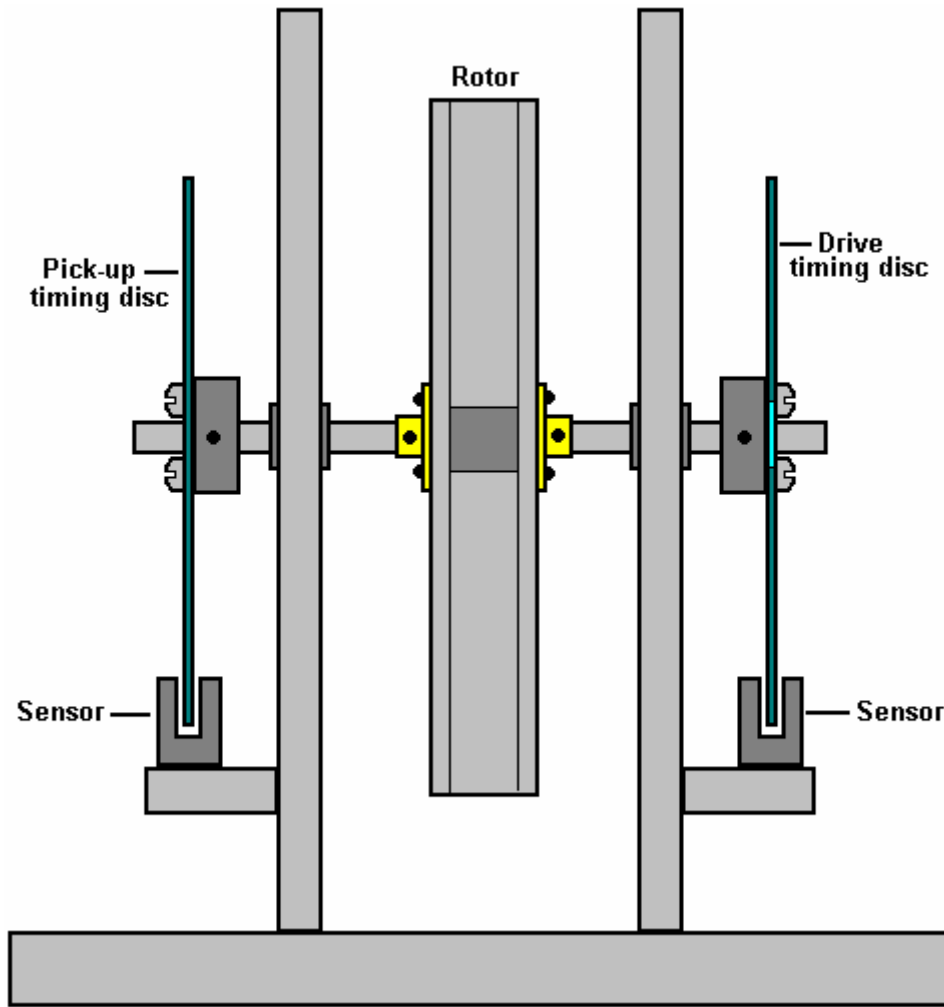
Here is an example of a neatly constructed timing mechanism made by Ron Pugh for his six-magnet rotor assembly:



and the switch/sensor:



As the slotted disc rotates, one of the slots comes opposite the sensor and allows the UV beam to pass through to the sensor. That lowers the resistance of the sensor device and that change is then used to trigger the drive pulse for whatever length of time the slot leaves the sensor clear. You will notice the balanced attachment method used by Ron to avoid having an unbalanced rotor assembly. There can be two timing discs, one for the drive pulses and one for switching the power pickup coils in and out of the circuit. The slots in the power pick-up timing disk will be very narrow as the switch-on period is only about 2.7 degrees. For a six-inch diameter disc where 360 degrees represents a circumference length of 18.85 inches (478.78 mm) a 2.7 degree slot would be only 9/64 inch (3.6 mm) wide. The arrangement for an axial magnet rotor set-up could be like this:



So to recap, the things which are necessary for getting an Adams Motor output into the serious bracket are:

1. A performance of $COP > 1$ can only be achieved if there are power pick-up coils.
2. The rotor magnets need to be longer than they are wide in order to ensure the correct magnetic field shape and the rotor must be perfectly balanced and have bearings as low-friction as possible.
3. The face area of the rotor magnets needs to be four times that of the drive coil cores and one quarter the area of the core of the power pick-up coils. This means that if they are circular, then the drive coil core diameter needs to be half the diameter of the magnet and the magnet diameter needs to be half the diameter of the power pick-up core. For example, if a circular rotor magnet is 10 mm across, then the drive core should be 5 mm across and the pick-up core 20 mm across.
4. The drive voltage needs to be a minimum of 48 volts and preferably, a good deal higher than that.
5. Do not use neodymium magnets if the drive voltage is less than 120 volts.
6. The drive coils should not be pulsed until they are exactly aligned with the rotor magnets even though this does not give the fastest rotor speed.
7. Each complete set of coils should have a DC resistance of either 36 ohms or 72 ohms and definitely 72 ohms if the drive voltage is 120 volts or higher.
8. Collect the output power in large capacitors before using it to power equipment.

It may also be possible to boost the output power further, by using the Coil-Shorting technique shown in the section of this chapter on the RotoVerter.

If you want the original drawings and some explanation on the operation of the motor, then two publications from the late Robert Adams can be bought from www.nexusmagazine.com where the prices are quoted in Australian dollars, making the books look much more expensive than they actually are.

There is a video on this presentation at
https://www.youtube.com/edit?o=U&ar=1&video_id=J2bPDDWqSvM

Patrick J Kelly
www.free-energy-info.co.uk

Simple Free-Energy Devices

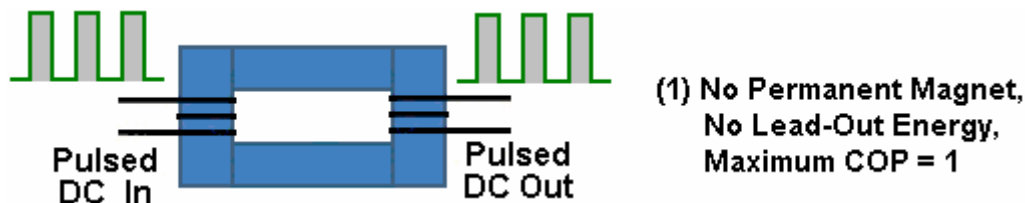
There is nothing magic about free-energy and by "free-energy" I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 14: Special Transformers

It is widely thought that any transformer will have less power coming out of it than the power being fed into it. That idea is quite wrong, and transformers have been made with their output power some forty times greater than their input power.

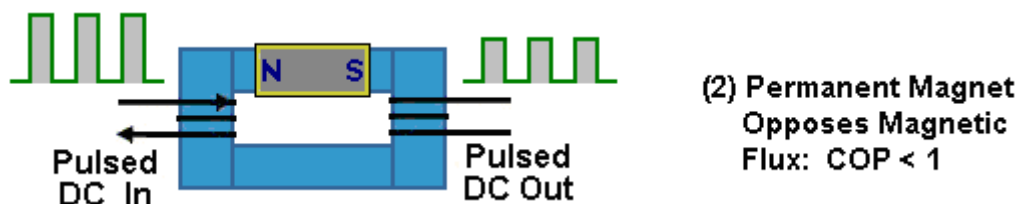
To start with, let's consider the small and very simple transformer from Lawrence Tseung. He takes a magnetic frame made of standard thin strips and he inserts a permanent magnet in one of the arms of the frame. He then applies sharp DC pulses to a coils wound on one side of the frame and draws off energy from a coil wound on the other side of the frame.

He shows three separate operating modes for the devices as follows:

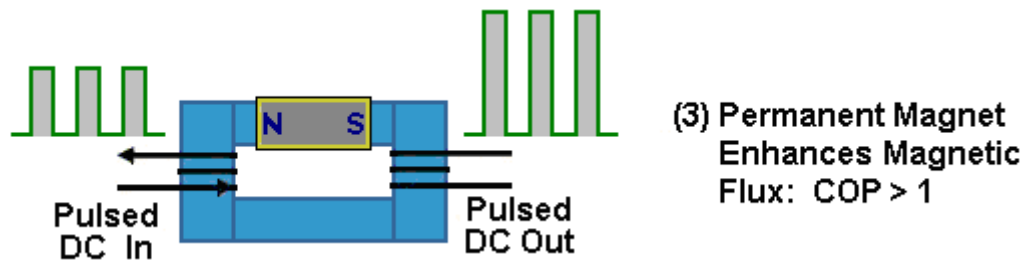


Lawrence comments on three possible arrangements. The first one shown above is the standard commercial transformer arrangement where there is a frame made from insulated iron shims in order to cut down the "eddy" currents which otherwise would circulate around inside the frame at right angles to the useful magnetic pulsing which links the two coils on the opposite sides of the frame. As is very widely known, this type of arrangement never has an output power greater than the input power.

However, that arrangement can be varied in several different ways. Lawrence has chosen to remove a section of the frame and replace it with a permanent magnet as shown in the diagram below. This alters the situation very considerably as the permanent magnet causes a continuous circulation of magnetic flux around the frame before any alternating voltage is applied to the input coil. If the pulsing input power is applied in the wrong direction as shown here, where the input pulses generate magnetic flux which opposes the magnetic flux already flowing in the frame from the permanent magnet, then the output is actually **lower** than it would have been without the permanent magnet.



However, if the input coil is pulsed so that the current flowing in the coil produces a magnetic field which reinforces the magnetic field of the permanent magnet then it is possible for the output power to exceed the input power. The "Coefficient of Performance" or "COP" of the device is the amount of output power divided by the amount of input power [which the user](#) has to put in to make the device operate. In this instance the COP value can be greater than one:



As it upsets some purists, perhaps it should be mentioned that while a square wave input signal is applied to the input of each of the above illustrations, the output will not be a square wave although it is shown that way for clarity. Instead, the input and output coils convert the square wave to a low-quality sine wave which only becomes a pure sine wave when the pulse frequency exactly matches the resonant frequency of the output winding.

There is a limit to this as the amount of magnetic flux which any particular frame can carry is determined by the material from which it is made. Iron is the most common material for frames of this type and it has a very definite saturation point. If the permanent magnet is so strong that it causes saturation of the frame material before the input pulsing is applied, then there can't be any effect at all from positive DC pulsing as shown. This is just common sense but it makes it clear that the magnet chosen must not be too strong for the size of the frame, and why that should be.

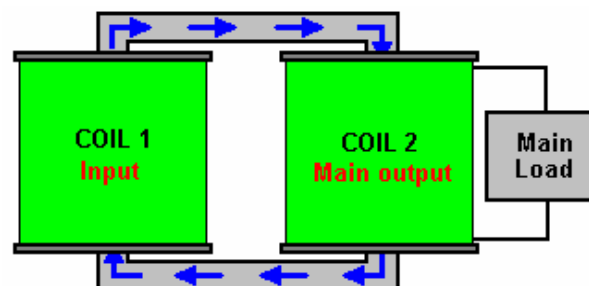
As an example of this, one of the people replicating Lawrence's design found that he did not get any power gain at all and so he asked Lawrence for advice. Lawrence advised him to omit the magnet and see what happened. He did this and immediately got the standard output, showing that both his input arrangement and his output measuring system both worked perfectly well. It then dawned on him that the stack of three magnets which he was using in the frame were just too strong, so he reduced the stack to two magnets and immediately got a performance of $COP = 1.5$ (50% more power output than the input power).

The Transformers of Thane Heins.

Thane has developed, tested and patented a transformer arrangement where the output power of his prototype can be more than thirty times greater than the input power. He achieves this by using a figure-of-eight double toroid transformer core. His Canadian patent CA2594905 is titled "Bi-Toroid Transformer" and dated 18th January 2009. The abstract says: The invention provides a means of increasing transformer efficiency above 100%. The transformer consists of a single primary coil and two secondary coils.

Magnetic flow is a thousand times easier through iron than it is through air. Because of that fact transformers are generally constructed on a frame made of iron or a similarly magnetic material. The operation of a transformer is nothing like as simple as school teaching would suggest. However, leaving parametric excitation aside for the moment, let us consider the effects of magnetic flow.

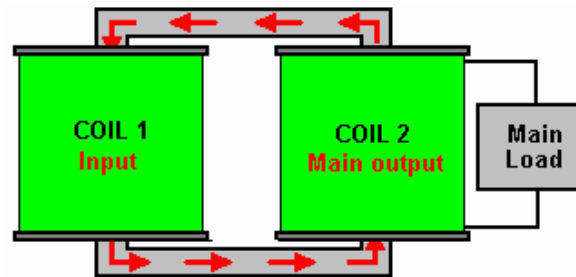
The way that off-the-shelf transformers work at the moment is like this:



When a pulse of input power is delivered to Coil 1 (called the "Primary winding"), it creates a magnetic wave which passes around the frame or "yoke" of the transformer, passing through Coil 2 (called the "Secondary winding") and back to Coil 1 again as shown by the blue arrows. This magnetic pulse

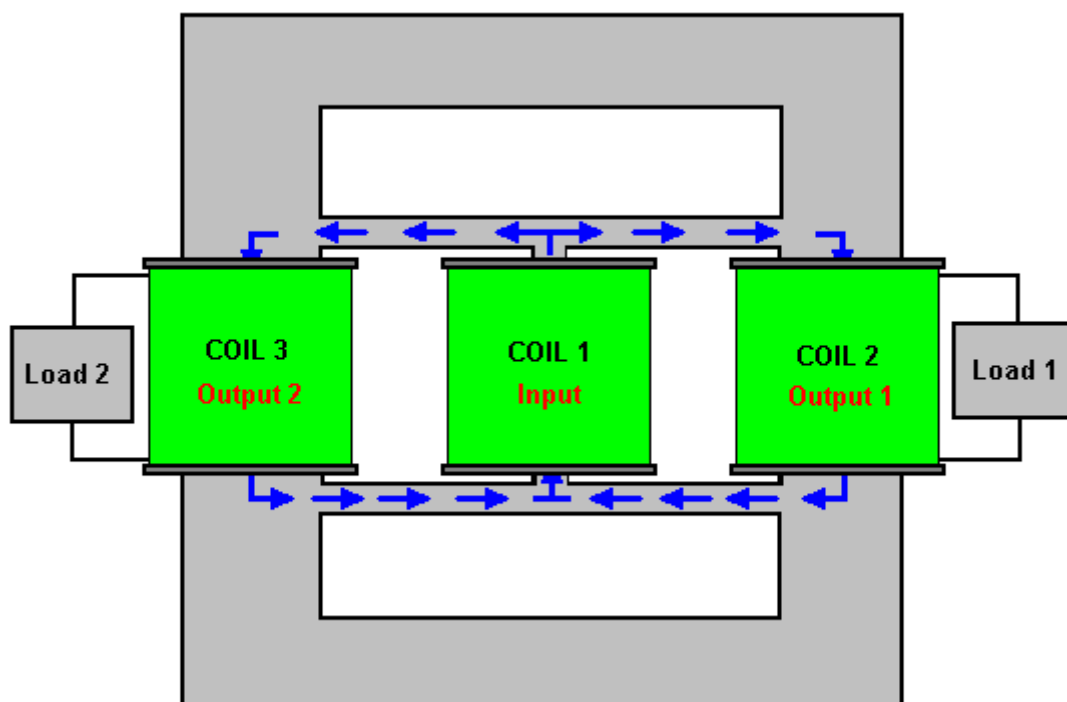
generates an electrical output in Coil 2, which flows through the electrical load (lighting, heating, battery charging, video displays, or whatever) providing it with the power which it needs to operate.

This is all well and good but the catch is that when the pulse in Coil 2 finishes, it also generates a magnetic pulse, and unfortunately, that magnetic pulse runs in the opposite direction, opposing the operation of Coil 1 and causing it to have to boost it's input power in order to overcome this magnetic flow in the opposite direction, shown here by the red arrows:

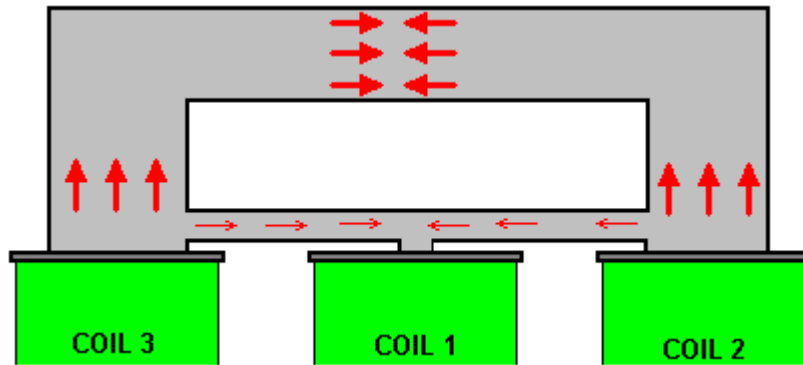


This is what makes current scientific "experts" say that the electrical efficiency of a transformer will always be less than 100%. This effect is caused by the magnetic path being symmetrical. Like the flow of electricity, magnetic flow passes along every possible path. If the magnetic path has low magnetic resistance (generally due to having a large cross-sectional area), then the magnetic flow through that path will be large. So, faced with several paths, magnetic flow will go along all of them in proportion to how good each path is for carrying magnetism.

Thane Heins has made use of this fact by making a transformer like this:



This style of transformer has got quite complicated magnetic flows when it is operating, although the diagram above only shows some of the flow paths generated when the input coil "Coil 1" is pulsed. The really interesting result is seen when that input pulse cuts off and we expect return magnetic flow from coil 2 and coil 3. What happens is this:



Assume that coil 2 and coil 3 are identical. The reverse magnetic flux coming out of coil 2 immediately encounters a junction with one path being far easier to use than the other. As a result, the vast majority of that magnetic flow follows the broad path, and only a small percentage flows through the narrow path. The broad path flow meets and is opposed by an identical large flow coming from coil 3, and those flows effectively cancel each other out. This produces a major improvement over an ordinary transformer. But, the small flow reaching the entrance to Coil 1 encounters two identical paths, and only one of those paths goes to coil 1, so the flux divides with half going towards coil 3 and half going through coil 1. That halves the strength of the already small percentage of the original, unwanted reverse magnetic flow into coil 1. The other half runs into the reduced flow from coil 3 and those halves cancel each other out. The overall effect is a really major improvement in the performance of the transformer as a whole.

In the patent document, Thane quotes a prototype test which had a primary coil winding with 2.5 ohms resistance, carrying 0.29 watts of power. The secondary coil 1 had a winding with 2.9 ohms resistance, receiving 0.18 watts of power. The resistive load 1 was 180 ohms, receiving 11.25 watts of power. The secondary coil 2 had a winding with 2.5 ohms resistance, and received 0.06 watts of power. Resistive load 2 was 1 ohm, receiving 0.02 watts of power. Overall, the input power was 0.29 watts and the output power 11.51 watts, which is a COP of 39.6 that is, the output power is nearly forty times greater than the input power. Where does the extra power come from? Well there is no magic about it, as the extra current flows into the transformer from our local environment which is a massive energy field.

A variation of this arrangement is to attach an outer toroid to the existing bi-toroid arrangement, like this:



This prototype, as you can see, is fairly simple construction, and yet, given an input power of 106.9 milliwatts, it produces an output power of 403.3 milliwatts, which is 3.77 times greater.

This is something which needs to be considered carefully. Conventional science say that "there is no such thing as a free meal" and with any transformer, you will get less electrical power out of it than you put into it. Well, this simple looking construction demonstrates that this is not the case, which shows that some of the dogmatic statements made by present day scientists are completely wrong.

This simple and elegant modification of the humble transformer, converts it into a free-energy device which boosts the power used to drive it and outputs much greater power. Congratulations are due to Thane for this technique and for his sharing it openly with anyone who is interested.

Patrick J Kelly

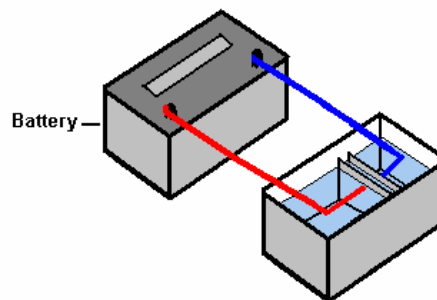
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Simple Free-Energy Devices

There is nothing magic about free-energy and by "free-energy" I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 15: Converting Water into Gas

Converting water into gas is useful as the gas produced can be used as a fuel. In its most simple form, two metal plates are placed in water and an electric current is passed between the plates. This causes the water to break down into a mixture of hydrogen gas and oxygen gas (The two components used in the Space Shuttle). The greater the flow of current, the larger the volume of gas which will be produced. The arrangement is like this:

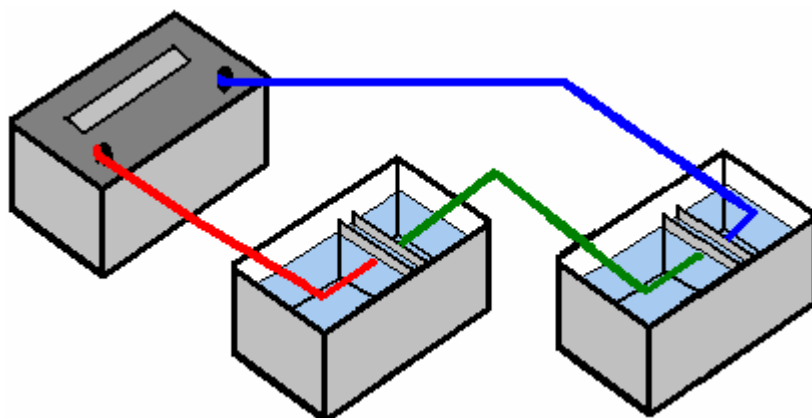


Remembering that the result of doing this is to produce fuel for the Space Shuttle, you should avoid doing this indoors and letting the gas produced by the process collect on the ceiling. There are many videos on the web where people act in a dangerous manner and perform electrolysis indoors using a container which is open at the top as shown above. Please, please don't do that as it is highly dangerous - it is not a party popper which pushes the Space Shuttle into space! If you were to collect a cupful of HHO gas and light it, the resulting ignition would probably damage your hearing permanently, so don't do it under any circumstances. Just like the fact that a very useful chain saw is a dangerous device which needs to be treated with respect, so too, please understand that the very useful HHO gas mix contains a lot of energy and so needs to be treated with respect.

This style of electrolysis of water was investigated by the very talented and meticulous experimenter Michael Faraday. He presented his results in a very technical and scientific format which are not understood by most ordinary people. But in simple terms, he tells us that the amount of HHO gas produced is proportional to the current flowing through the water, so to increase the rate of gas production, you need to increase the current flow. Also, he found that the working voltage between the two "electrode" plates is 1.24 volts.

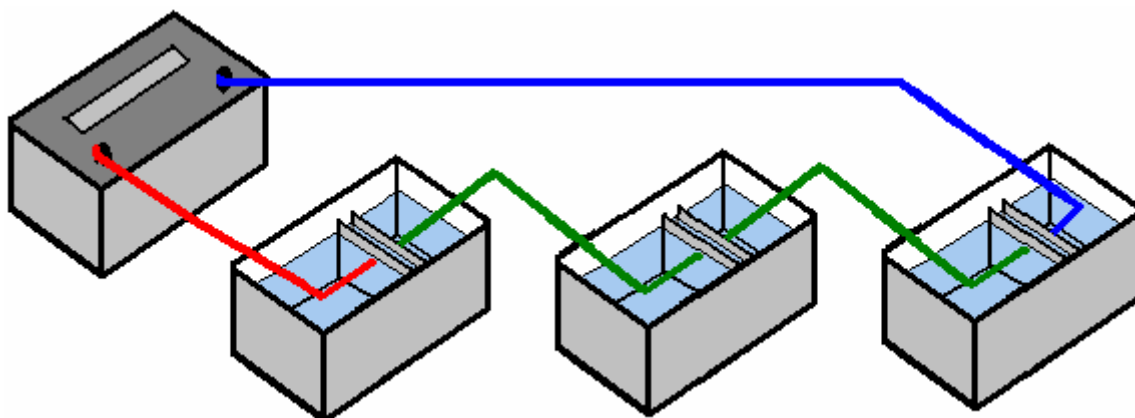
This sounds a bit technical, but it is a highly useful piece of information. In the arrangement shown above, twelve volts is being connected across two plates in water. Faraday tells us that only 1.24 volts of that twelve volts will go to make HHO gas and the remaining 10.76 volts will act as an electric kettle and just heat the water, eventually producing steam. As we want to make HHO gas and not steam, this is bad news for us. What it does tell us is that if you choose to do it that way, then only 10% of the power taken by the booster actually makes HHO gas and a massive 90% is wasted as heat.

We really don't want a low electrical efficiency like that. One way around the problem is to use two cells like this:

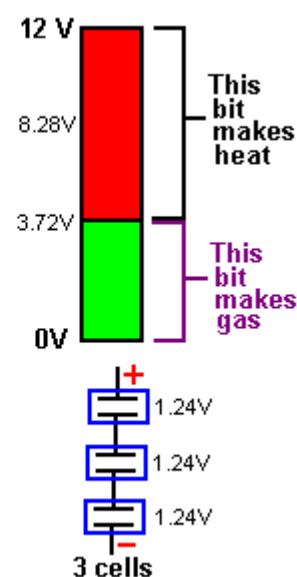
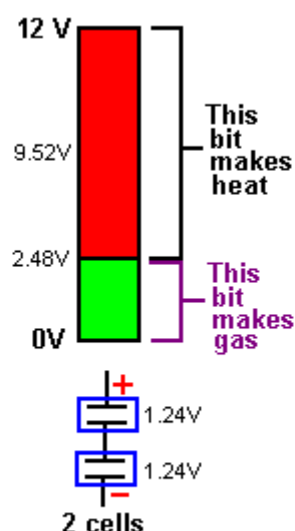
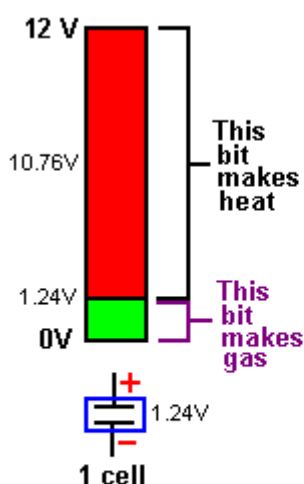


This arrangement uses our 1.24 volts twice while the twelve volts stays unchanged and so the electrical efficiency goes up to 20% and the heat loss drops to 80%. That is quite an improvement but even more important is the fact that twice as much HHO gas is now produced, so we have doubled the electrical efficiency **and** doubled the gas output, giving a result which is four times better than before.

We could go one step further and use three cells like this:



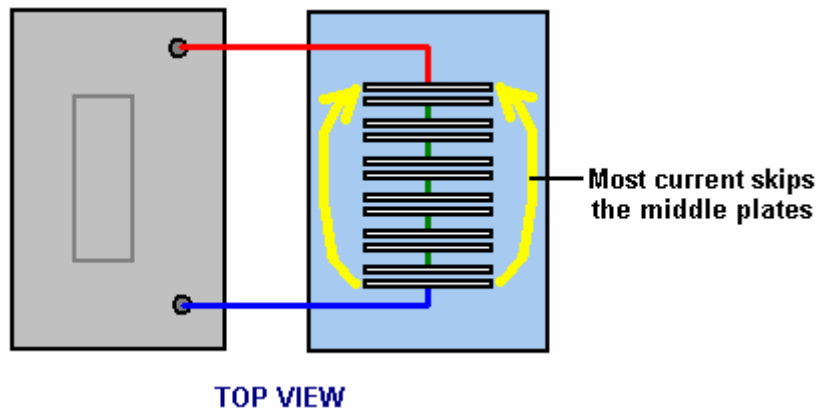
This time we are using three of our 1.24 volt sections and this gives us an electrical efficiency of 30% and three times the amount of gas, making the system nine times more effective.



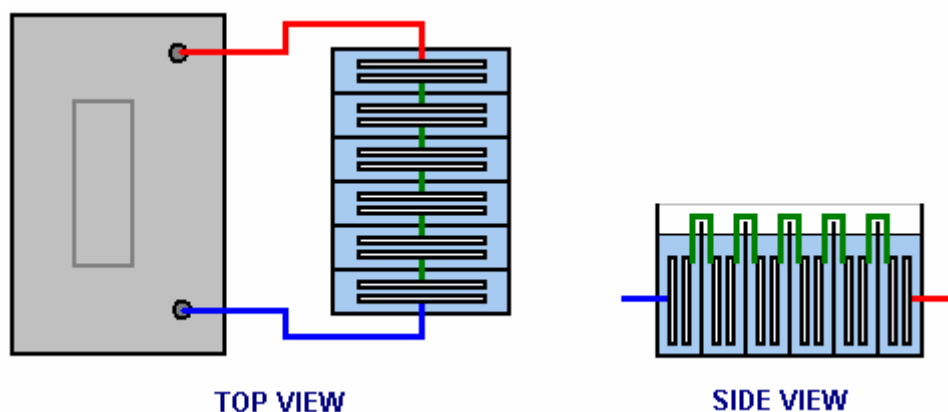
This is definitely going in the right direction, so how far can we take it when using a twelve volt battery? When we use the construction materials which years of testing has shown to be particularly effective, there is a small voltage drop across the metal plates, which means that the very best voltage for each cell is about 2 volts and so with a twelve volt battery, six cells is about the best combination, and that gives us an electrical efficiency of 62% and six times as much gas, which is 37 times better than using a

single cell, and the wasted electrical power drops down from 90% to 38%, which is about as good as we can get.

Of course, it would not be practical to have six boxes each as large as a car battery as we would never manage to fit them into most vehicles. Perhaps we could just put all the plates inside a single box. Unfortunately, if we do that, a good deal of the electric current would flow around the plates and not make much gas at all. A top view of this arrangement is shown here:



This is a disaster for us as now we will not get your six times the gas production or our massively reduced heating. Thankfully, there is a very simple fix for this problem, and that is to divide the box up into six watertight compartments using thin partitions like this:



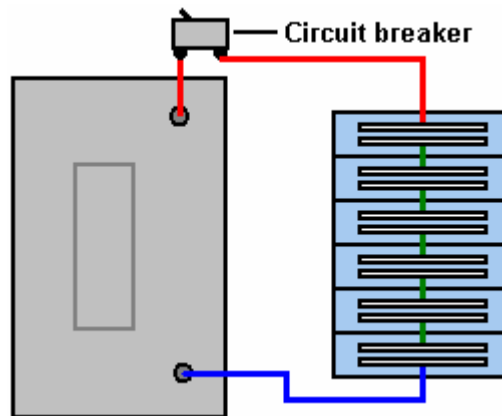
This gives us back our high efficiency by blocking the current flow past the plates and forcing the current to flow through the plates, producing gas between every pair of plates.

In passing, if this booster were to be powered by the electrics of a vehicle, then the voltage although called "twelve volts" will actually be almost fourteen volts when the engine is running so that the "twelve volt" battery will get charged. This would allow us to use seven cells inside our electrolyser, rather than the six cells shown above and that would give us seven times the gas volume that a single pair of plates would give. Some people prefer six cells, and others, seven cells - the choice is up to the person constructing the unit.

We have been discussing the methods of increasing the gas production and reducing the wasted energy, but please don't assume that the objective is to make large volumes of HHO gas. It has been found that with many vehicle engines, very good performance gains can be had with a HHO gas production rate of less than 1 litre per minute ("lpm") added to the air entering the engine. Flow rates of as little as 0.5 to 0.7 lpm are frequently very effective. Remember, the HHO gas from a booster is being used as an igniter for the regular fuel used by the engine and not as an additional fuel.

The big advantage of an efficient booster design is that you can produce the wanted volume of gas using a much lower current, and so there will be a lesser extra load on the engine. Admittedly, there is not much additional engine load needed by a booster, but we should reduce the extra amount by intelligent design.

In the discussion above, the battery has been shown connected directly across the booster or "electrolyser". This should **never** be done as there is no protection against a short-circuit caused by a loose wire or whatever. There should be a fuse or a circuit-breaker as the first thing connected to the battery. Circuit breakers are available from any electrician's supply outlet as they are used in the "fuse box" in homes, to provide protection for each lighting circuit and each power socket circuit. They are not expensive as they are manufactured in very large volumes. They are also available on eBay. The circuit breaker is wired like this:

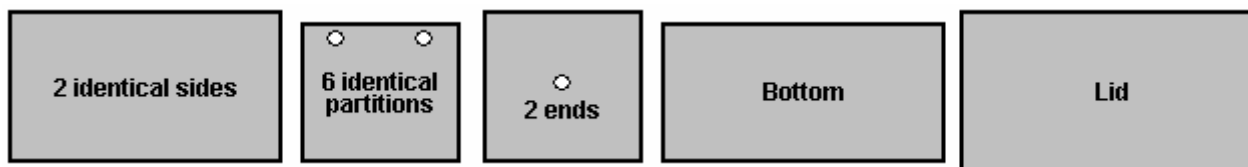


a common design (rated at 32 amps) looks like this:

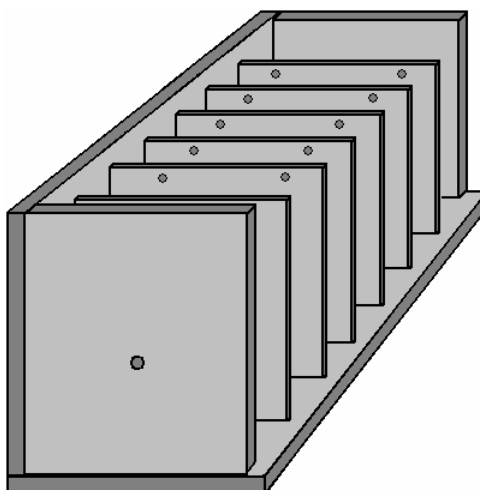


Some would-be constructors feel that some aspects of the construction are too difficult for them. Here are some suggestions which might make construction more straightforward.

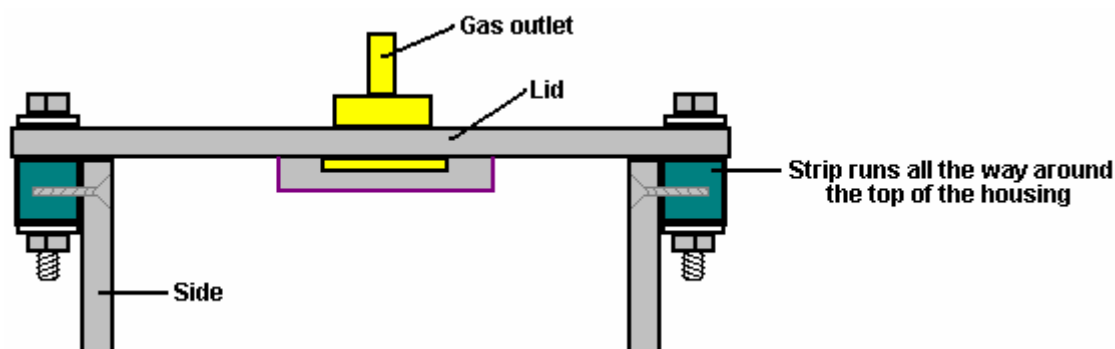
Constructing a seven-cell housing is not difficult. Pieces are cut out for two sides, one base, one lid and six absolutely identical partitions. These partitions must be exactly the same so that there is no tendency for leaks to develop. If you decide to use the bent-plate system of electrodes shown on the next few pages, then drill the bolt holes in the partitions before assembling them:



The bottom piece is the same length as the sides, and it is the width of the partitions plus twice the thickness of the material being used to build the housing. If acrylic plastic is being used for the construction, then the supplier can also provide an "adhesive" which effectively "welds" the pieces together making the different pieces appear to have been made from a single piece. The case would be assembled like this:

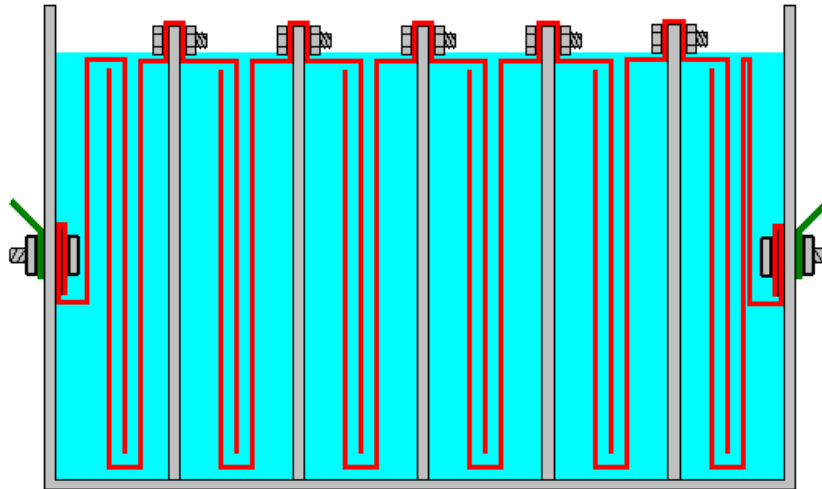


Here, the partitions are fixed in place one at a time, and finally, the second side is attached and will mate exactly as the partitions and ends are all exactly the same width. A simple construction for the lid is to glue and screw a strip all the way around the top of the unit and have the lid overlap the sides as shown here:

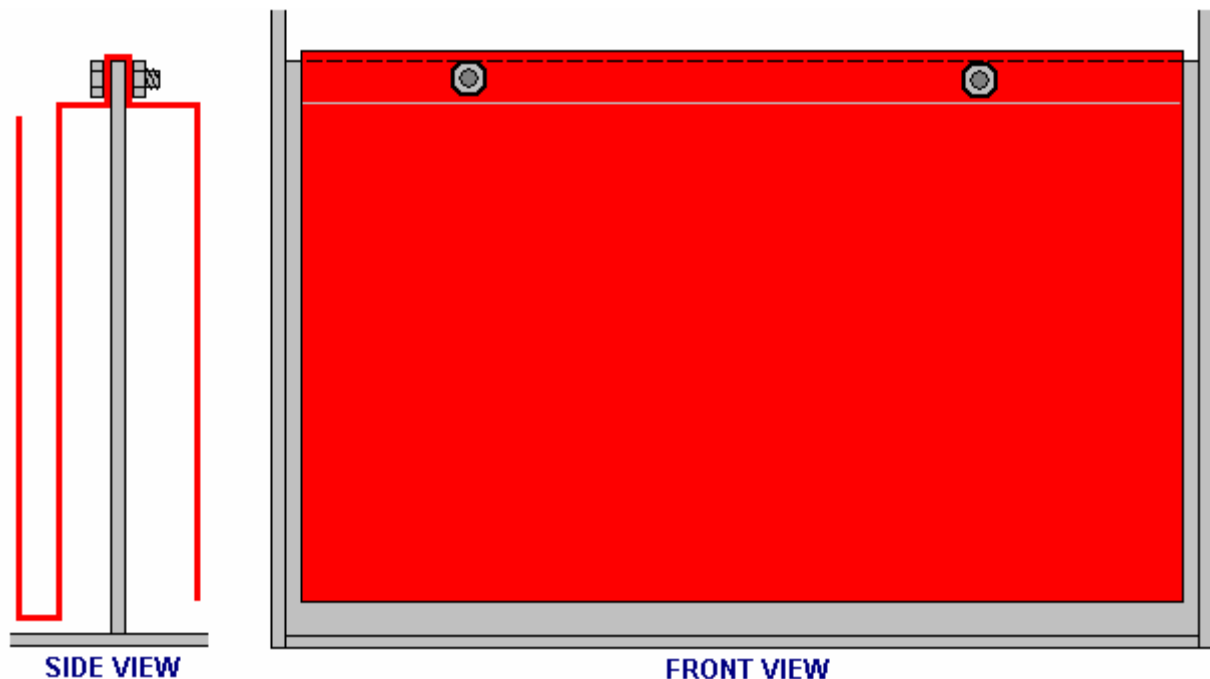


A gasket, perhaps of flexible PVC, placed between the sides and the lid would assist in making a good seal when the lid is bolted down. The gas outlet pipe is located in the centre of the lid which is a position which is not affected if the unit is tilted when the vehicle is on a steep hill.

Years of testing have shown that a really good choice of material for the electrode plates is 316-L grade stainless steel. However, it is very difficult to connect those plates electrically inside the cells as you need to use stainless steel wire to make the connections and bolted connections are really not suitable. That leaves welding the wires to the plates and welding stainless steel is not something which a beginner can do properly as it is much more difficult than welding mild steel. There is a good alternative, and that is to arrange the plate material so that no wire connections are needed:



While this six-cell design may look a little complicated to a quick glance, it is really a very simple construction. Each of the plates used in the central cells is just this shape:

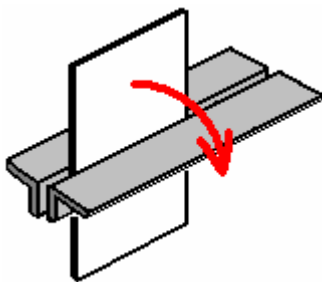


The plate shapes shown above are arranged so that there is access to the bolts from above and they can be reached by a spanner and held steady while the other nut is being tightened.

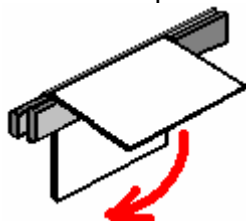
Unless you are skilled in bending plates, I suggest that you use stainless steel mesh for the plates. It works very well, can be readily cut using tin snips or any similar tool and it can be bent into shape by the home constructor using simple tools - a vice, a piece of angle iron, a small piece of mild steel sheet, a hammer, etc.

You will find a skip outside any metal fabrication shop where scrap pieces are tossed for recycling. There will be off-cuts of various sizes of angle iron and all sorts of other small sections of sheet and strip. They are in the skip mainly to get rid of them as the fabrication business gets paid almost nothing for them. You can use some of these pieces to shape your booster plates, and if you feel bad about costing the business about a penny, then by all means put them back in the skip afterwards.

If you clamp your plate between two angle irons in a vice, then careful, repeated gently tapping with a hammer close to the bend location, will produce a very clean and neat bend in the plate:

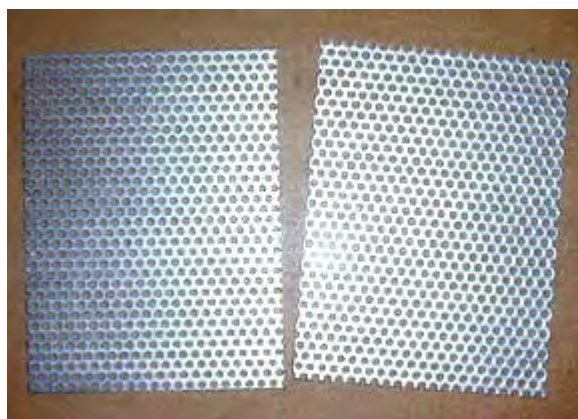


The bent sheet can then be clamped between two steel strips and a sharp U-shaped bend produced by tapping with a hammer, again, along the line of the required bend:



The thickness of the steel bar on the inside of the bend has to be the exact width of the required gap between the finished plate faces. This is not particularly difficult to arrange as 3 mm, 3.5 mm, 4 mm, 5 mm and 6 mm are common thicknesses used in steel fabrication, and they can be combined to give almost any required gap.

There are many varieties of stainless steel mesh. The style and thickness are not at all critical but you need to choose a type which is reasonably stiff and which will hold its shape well after it is bent. This style might be a good choice:

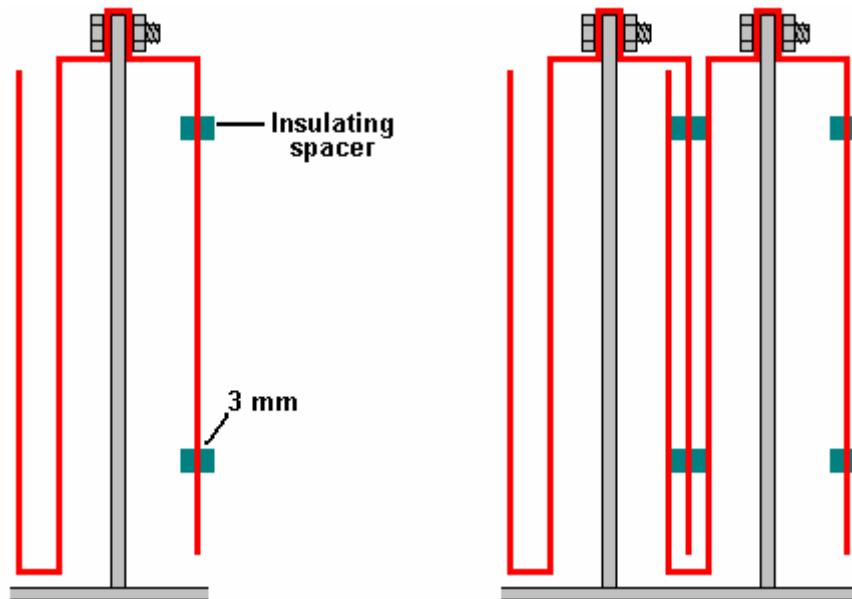


Your local steel supplier probably has some types on hand and can let you see how flexible a particular variety is. The shape shown above is for a "three plate per cell" design where there are two active plate faces. Ideally, you want two to four square inches of plate area per amp of current flowing through the cell, because that gives very long electrode life and minimum heating due to the plates.

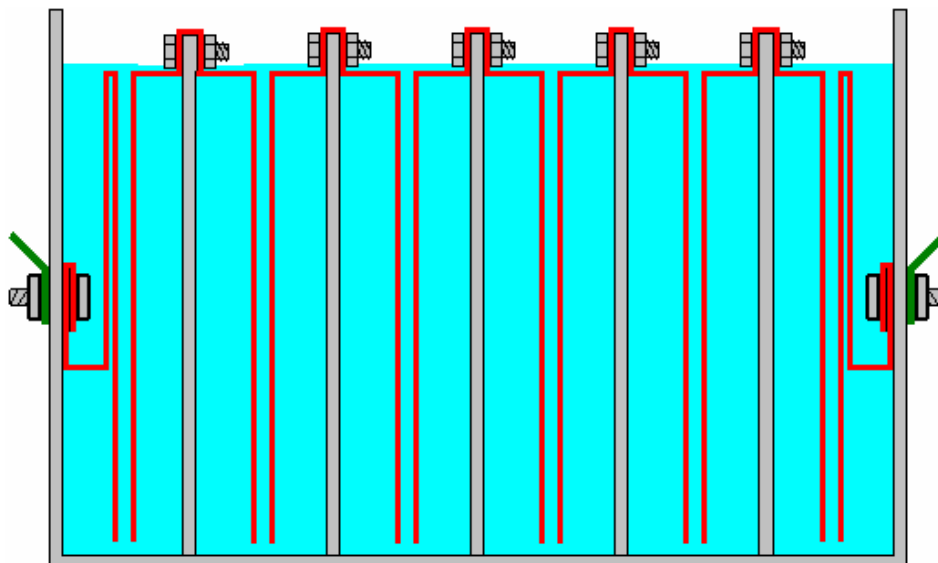
This style of construction is reasonably easy to assemble as the two bolts which pass through the partitions and which hold the plates rigidly in place, can be accessed from above, two spanners being used to lock them tight. Lock nuts are optional. If you feel that your particular mesh might be a little too flexible or if you think that the bolts might eventually loosen, then you can attach two, or more, separator insulating pieces - plastic washers, plastic bolts, cable ties or whatever to one of the plate faces.

These will hold the plates apart even if they were to become loose. They also help to maintain the gap between the plates. This gap has to be a compromise because the closer the plates are together, the better the gas production but the more difficult it is for the bubbles to break away from the plates and float to the surface and if they don't do that, then they block off some of the plate area and prevent further gas production from that part of the plate as the electrolyte no longer touches the plate there. A

popular choice of gap is 1/8 inch which is 3 mm as that is a good compromise spacing. Circular spacers would look like this:

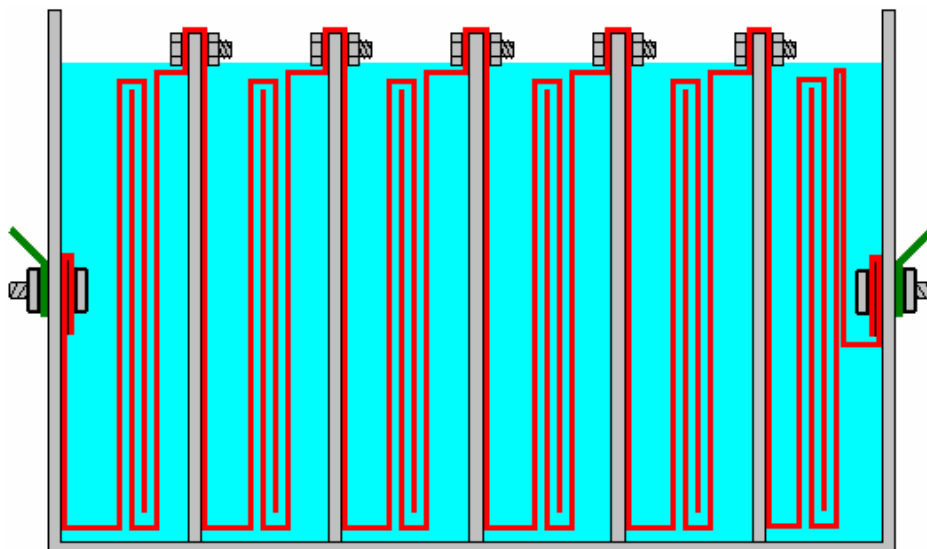


If the current is low enough, an even more simple shape which has just a single pair of active plate surfaces per cell, can be used as shown here:



Any of these designs can be 6-cell or 7-cell and the plates can be constructed without outside help. You will notice that the electrical connections at each end of the booster are submerged to make sure that a loose connection can't cause a spark and ignite the HHO gas in the top of the housing. There should be a gasket washer on the inside to prevent any leakage of the electrolyte past the clamping bolt.

If you want to use three active plate pairs in each cell, then the plate shape could be like this:



The electrolyte is a mix of water and an additive to allow more current to flow through the liquid. Most of the substances which people think of to use to make an electrolyte are most unsuitable, producing dangerous gasses, damaging the surfaces of the plates and giving uneven electrolysis and currents which are difficult to control. These include salt, battery acid and baking soda and I strongly recommend that you do not use any of these.

What is needed is a substance which does not get used up during electrolysis and which does not damage the plates even after years of use. There are two very suitable substances for this: sodium hydroxide, also called "lye" or "caustic soda". In the USA, this is available in Lowes stores, being sold as "Roebic 'Heavy Duty' Crystal Drain Opener". The chemical formula for it is NaOH.

One other substance which is even better is potassium hydroxide or "caustic potash" (chemical formula KOH) which can be got from soap-making supply shops found on the web. Both NaOH and KOH are very caustic materials and they need to be handled with considerable care.

Bob Boyce of the USA is one of the most experienced people in the construction and use of boosters of different designs. He has kindly shared the following information on how to stay safe when mixing and using these chemicals. He says:

These materials are highly caustic and so they need to be handled carefully and kept away from contact with skin, and even more importantly, eyes. If any splashes come in contact with you, it is very important indeed that the affected area be rinsed off immediately with large amounts of running water and if necessary, the use of vinegar which is acidic and so will neutralise the caustic liquid.

When making up a solution, you add small amounts of the hydroxide to distilled water held in a container. The container must **not** be glass as most glass is not high enough quality to be a suitable material in which to mix the electrolyte. The hydroxide itself should always be stored in a sturdy, air-tight container which is clearly labelled "DANGER! - Potassium (or Sodium) Hydroxide". Keep the container in a safe place, where it can't be reached by children, pets or people who won't take any notice of the label. If your supply of hydroxide is delivered in a strong plastic bag, then once you open the bag, you should transfer all of its contents to sturdy, air-tight, plastic storage containers, which you can open and close without any risk of spilling the contents. Hardware stores sell large plastic buckets with air tight lids that can be used for this purpose.



When working with dry hydroxide flakes or granules, wear safety goggles, rubber gloves, a long sleeved shirt, socks and long trousers. Also, don't wear your favourite clothes when handling hydroxide solution as it is not the best thing to get on clothes. It is also no harm to wear a face mask which covers your

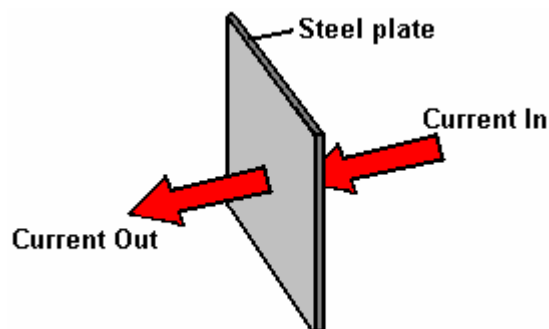
mouth and nose. If you are mixing solid hydroxide with water, **always** add the hydroxide to the water, and not the other way round, and use a plastic container for the mixing, preferably one which has twice the capacity of the finished mixture. The mixing should be done in a well-ventilated area which is not draughty as air currents can blow the dry hydroxide around.

When mixing the electrolyte, **never** use warm water. The water should be cool because the chemical reaction between the water and the hydroxide generates a good deal of heat. If possible, place the mixing container in a larger container filled with cold water, as that will help to keep the temperature down, and if your mixture should “boil over” it will contain the spillage. Add only a small amount of hydroxide at a time, stirring continuously, and if you stop stirring for any reason, put the lids back on all containers.

If, in spite of all precautions, you get some hydroxide solution on your skin, wash it off with plenty of cold running water and apply some vinegar to the skin. Vinegar is acidic, and will help balance out the alkalinity of the hydroxide. You can use lemon juice if you don't have vinegar to hand - but it is always a good idea to have a bottle of vinegar handy.

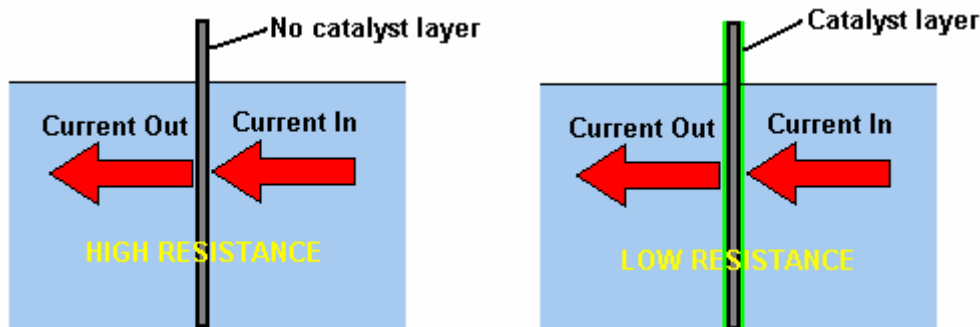
The concentration of the electrolyte is a very important factor. Generally speaking, the more concentrated the electrolyte, the greater the current and the larger the volume of HHO gas produced. However, there are three major factors to consider:

1. The resistance to current flow through the metal electrode plates.
 2. The resistance to current flow between the metal plates and the electrolyte.
 3. The resistance to current flow through the electrolyte itself.
1. In a good electrolyser design like those shown above, the design itself is about as good as a DC booster can get, but understanding each of these areas of power loss is important for the best possible performance. We were taught in school that metals conduct electricity, but what was probably not mentioned was the fact that some metals such as stainless steel are quite poor conductors of electricity and that is why electrical cables are made with copper wires and not steel wires. This is how the current flow occurs with our electrolyser plates:



The fact that we have folds and bends in our plates has no significant effect on the current flow. Resistance to current flow through the metal electrode plates is something which can't be overcome easily and economically, and so has to be accepted as an overhead. Generally speaking, the heating from this source is low and not a matter of major concern, but we provide a large amount of plate area to reduce this component of power loss as much as is practical.

2. Resistance to flow between the electrode and the electrolyte is an entirely different matter, and major improvements can be made in this area. After extensive testing, Bob Boyce discovered that a very considerable improvement can be made if a catalytic layer is developed on the active plate surface. Details of how this can be done are given later in the companion "D9.pdf" document as part of the description of Bob's electrolyser.



3. Resistance to flow through the electrolyte itself can be minimised by using the best catalyst at its optimum concentration. When using sodium hydroxide, the optimum concentration is 20% by weight. As 1 cc of water weighs one gram, one litre of water weighs one kilogram. But, if 20% (200 grams) of this kilogram is to be made up of sodium hydroxide, then the remaining water can only weigh 800 grams and so will be only 800 cc in volume. So, to make up a 20% "by weight" mix of sodium hydroxide and distilled water, the 200 grams of sodium hydroxide are added (very slowly and carefully, as explained above by Bob) to just 800 cc of cool distilled water and the volume of electrolyte produced will be about 800 cc.

When potassium hydroxide is being used, the optimum concentration is 28% by weight and so, 280 grams of potassium hydroxide are added (very slowly and carefully, as explained above by Bob) to just 720 cc of cold distilled water. Both of these electrolytes have a freezing point well below that of water and this can be a very useful feature for people who live in places which have very cold winters.

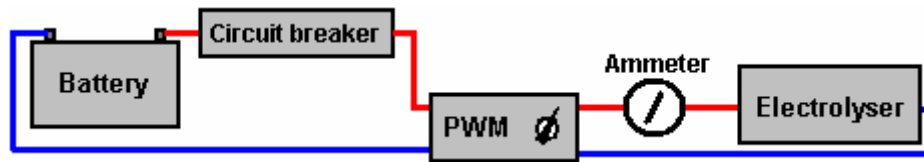
Another factor which affects current flow through the electrolyte is the distance which the current has to flow through the electrolyte - the greater the distance, the greater the resistance. Reducing the gap between the plates to a minimum improves the efficiency. However, practical factors come into play here as bubbles need sufficient space to escape between the plates, and a good working compromise is a spacing of 3 mm. which is one eighth of an inch.



However, there is a problem with using the optimum concentration of electrolyte and that is the current flow caused by the greatly improved electrolyte is likely to be far more than we want. To deal with this we can use an electronic circuit called a "Pulse-Width Modulator" (or "PWM") circuit. These are often sold as "DC Motor-Speed Controllers" and if you buy one, then pick one which can handle 30 amps of current.

A PWM circuit operates in a very simple way. It switches the current to the electrolyser On and Off many times every second. The current is controlled by how long (in any one second) the current is On, compared to how long it is Off. For example, if the On time is twice as long as the Off time (66%), then the average current flow will be much greater than if the On time were only half as long as the Off time (33%).

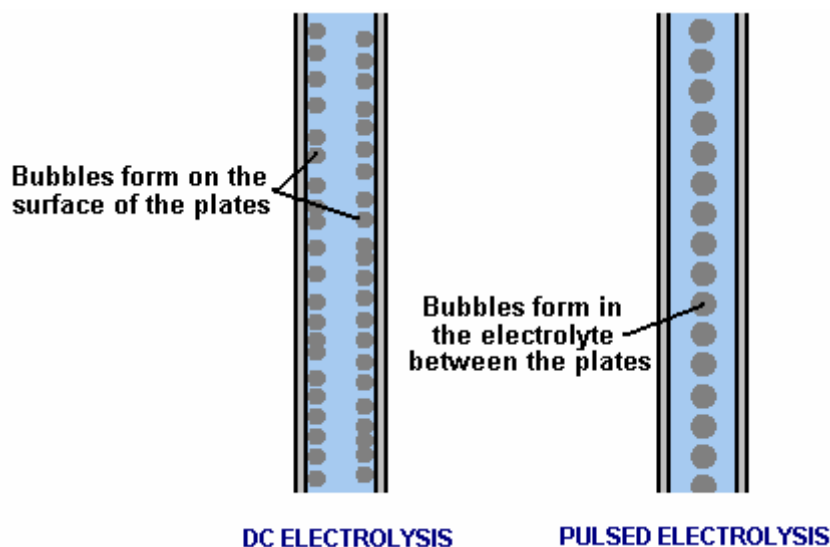
When using a PWM controller, it is normal to place its control knob on or near the dashboard and to mount a simple low-cost ammeter beside it so that the driver can raise or lower the current flow as is considered necessary. The arrangement is like this:



There is a more sophisticated circuit controller called a "Constant-current Circuit" and that allows you to select the current you want and the circuit then holds the current at your set value at all times. However, this type of circuit is not readily available for sale although some outlets are preparing to offer them.

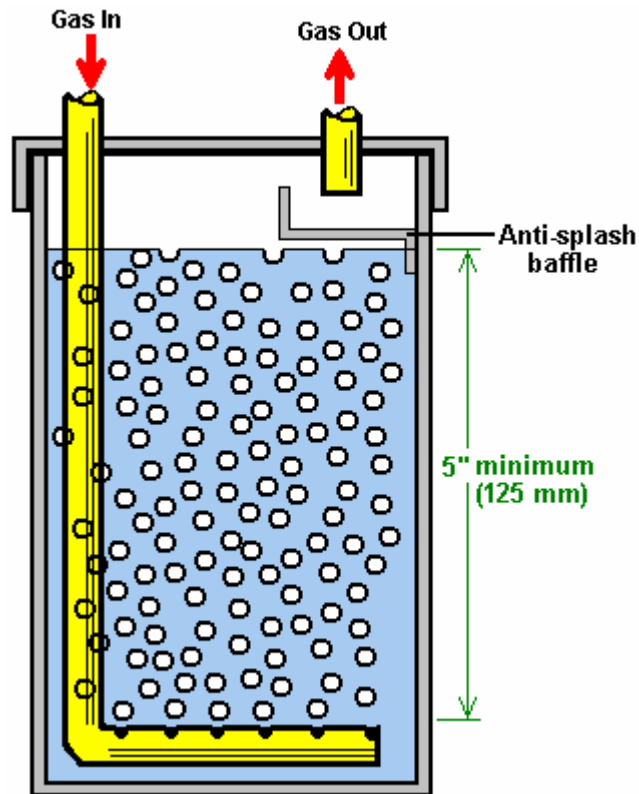
Some of the most simple boosters don't use a PWM circuit because they control the current flow through the booster by making the concentration of the electrolyte very low so that the resistance to current flow through the electrolyte chokes off the current and holds it down to the desired level. This, of course, is far less efficient and the resistance in the electrolyte causes heating, which in turn, is an operational problem which needs careful handling by the user. The advantage is that the system appears to be more simple.

There is a difference in the gas produced by a DC Motor-speed Controller pulsed current. The gas quality is higher and the bubbles form between the plates rather than on the plates:



Feeding HHO gas to any engine is highly beneficial as in addition to improving the miles per gallon of the engine, harmful emissions are massively reduced and any old carbon deposits inside the engine get cleaned away over time, giving a smoother and more powerful engine performance.

No matter which variety of electrolyser cell is used, it is essential to put a bubbler between it and the engine air intake if the gas is to be fed to the engine. This is to prevent any accidental ignition of the gas reaching the electrolysis cell. Also, no electrolyser should be operated or tested indoors. This is because the gas is lighter than air so any leak of gas will cause the gas to collect on the ceiling where it can ignite if triggered by the slightest spark (such as is generated when a light switch is turned on or off). Hydrogen gas escapes very easily indeed as its atoms are very, very small and can get through any tiny crack and even directly through many apparently solid materials. Testing electrolyses should be done outdoors or at the very least, in very well-ventilated locations. Using at least one bubbler is an absolutely vital safety measure. A typical bubbler looks like this:

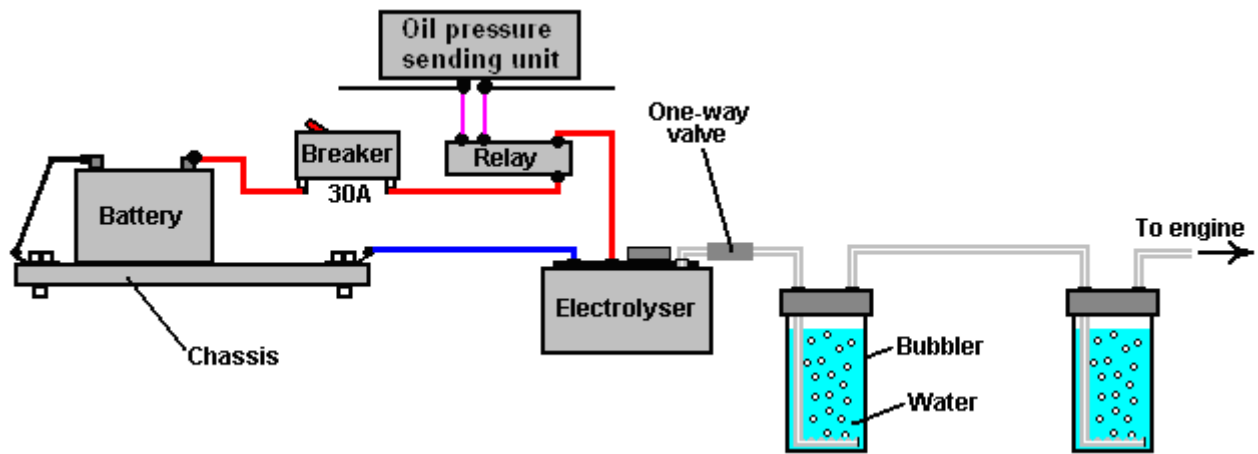


Bubbler construction is very simple indeed. It can be any size or shape provided that the outlet of the entry tube has at least five inches (125 mm) of water above it. Plastic is a common choice for the material and fittings are easy to find. It is very important that good sealed joints are made where all pipes and wires enter any container which has HHO gas in it. This, of course, includes the bubbler. It is also a good idea to drill additional holes in the entry pipe from half way down below the surface of the water, in order to create a larger number of smaller bubbles

The anti-slosh filling or a baffle plate in the cap is to prevent the water in the bubbler from splashing up into the exit pipe and being drawn into the engine. Various materials have been used for the filling including stainless steel wool and plastic pot scourers. The material needs to prevent, or at least minimise, any water passing through it, while at the same time allowing the gas to flow freely through it.

Caution: An electrolyser is not a toy. If you make and use one of these, you do so entirely at your own risk. Neither the designer of the electrolyser, the author of this document or the provider of the internet display are in any way liable should you suffer any loss or damage through your own actions. While it is believed to be entirely safe to make and use an electrolyser, provided that the safety instructions are followed, it is stressed that the responsibility is yours and yours alone.

An electrolyser feeding gas to an engine should not be considered as an isolated device. You need to remember that both electrical and gas safety devices are an essential part of any such installation. The electrical safety devices are a circuit-breaker (as used by any electrician when wiring a house) to protect against accidental short-circuits, and a relay to make sure that the booster does not operate when the engine is not running. A fairly typical arrangement is like this:



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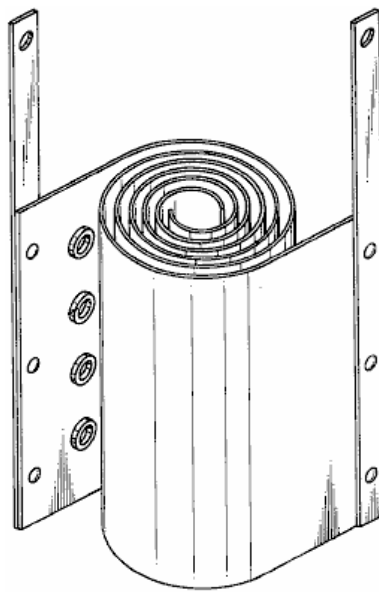
Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

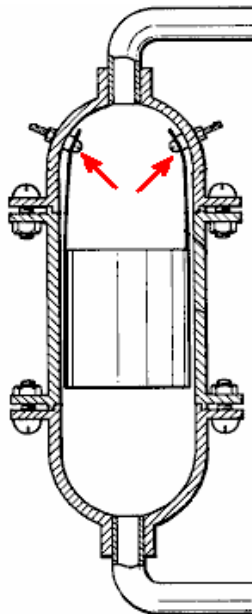
Chapter 16: The Shigeta Hasebe Electrolyser

In August 1978, Shigeta Hasebe was granted US Patent 4,105,528 for an electrolyser design. The gas production from his DC cell was seven litres of HHO per minute for an input power of just 84 watts using a Sodium Hydroxide electrolyte.

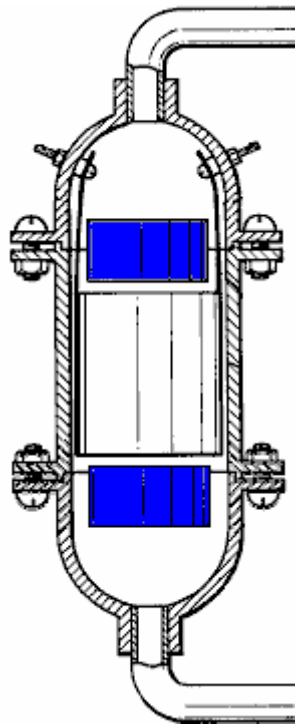
The cell consists of two coiled electrodes with spacers every quarter turn:



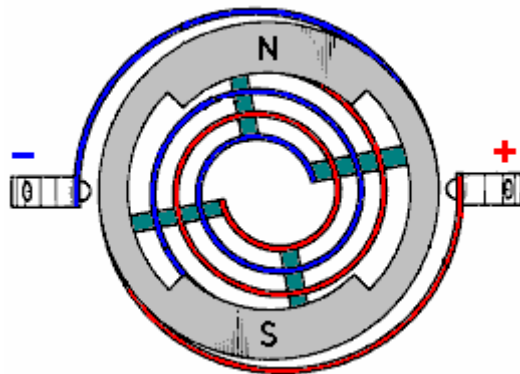
These electrodes are surprisingly difficult to make by hand but they should be very simple to construct using a 3D printer. These electrodes are then bolted to a non-conducting enclosure:



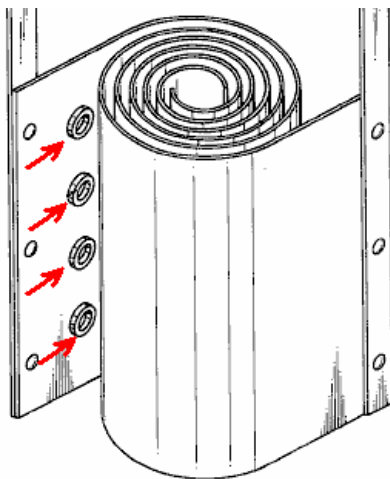
Next, two powerful permanent magnets are mounted in the container, one above the electrodes and one below them:



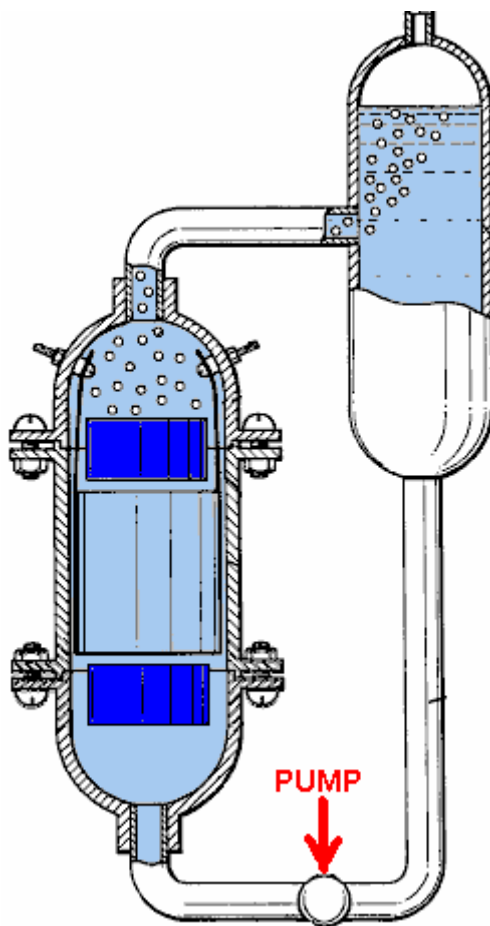
Looking down on the magnets and electrodes they look like this:



The magnets are arranged to produce a magnetic field which runs across the axis of the electrolyser. The spacers (shown in green) are not continuous but are quite separate, and they are there to cause turbulence as well as to force the desired electrode spacing:

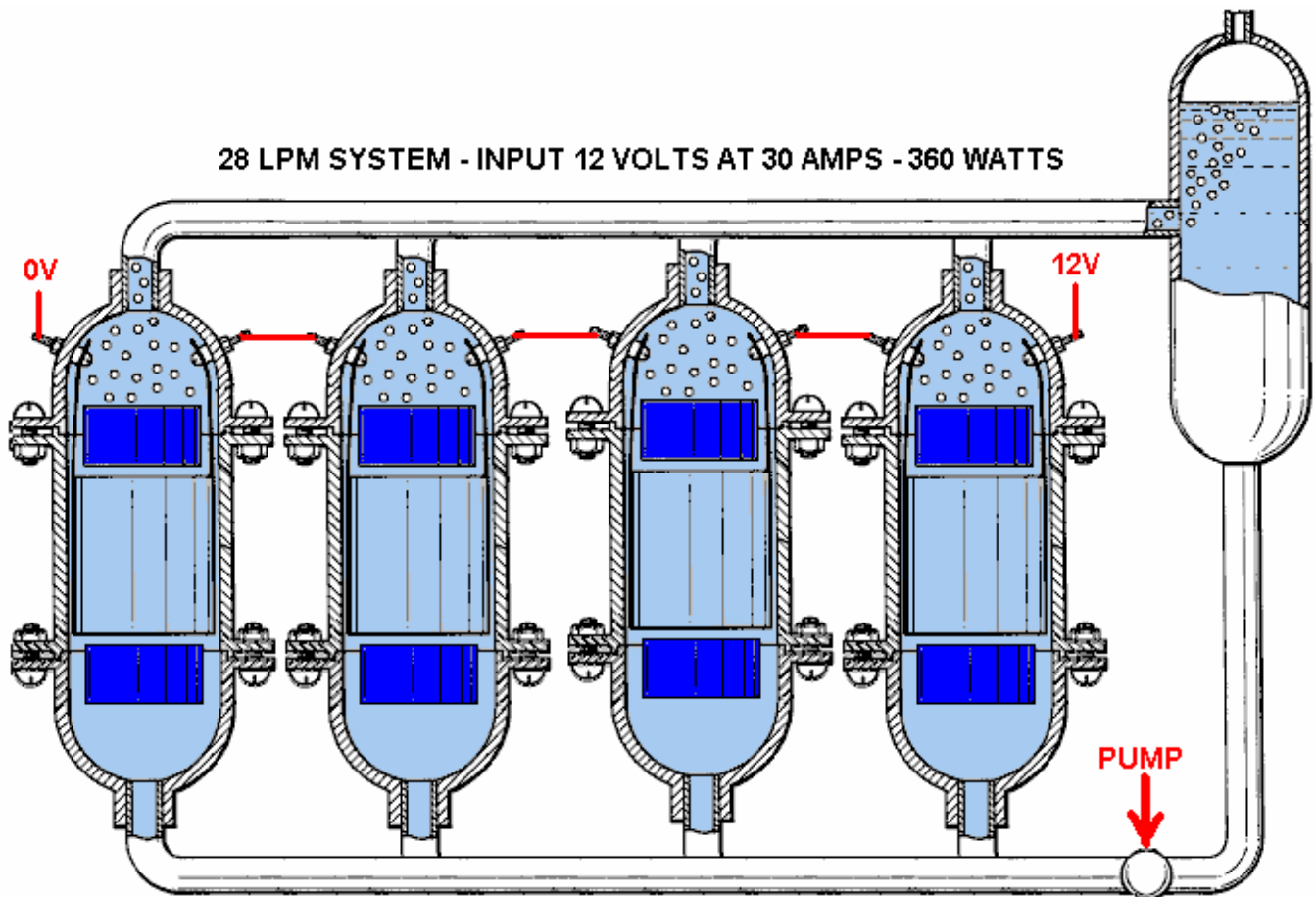


The electrolyser is connected directly to a reservoir of electrolyte and a pump is used to circulate the electrolyte which brushes bubbles off the electrodes:



The output pipe of the electrolyser is connected to the side of the electrolyte reservoir and there, the bubbles float upwards and exit through a bubbler while the remaining electrolyte gets circulated again by the pump.

The test results from this design were 7 litres of HHO gas per minute from just 84 watts of input power. The input power was 30 amps from a 2.8 volt power supply. Consequently, it should be possible to run four of these cells from a 12-volt supply which is a commonly used voltage. Alternatively, two of these cells could be run from a 6-volt supply if that is what is available:



An alternative nowadays would be to run just one cell using a cheap DC-to-DC step-down converter as a standard generator has great deal of spare electrical capacity. A generator running on HHO only needs about 5 litres per minute of HHO to provide kilowatts of excess power to run a household.

It is probably worth remarking that this generator design produces about ten times the HHO output that Michael Faraday considered to be the maximum possible. However, Shigeta was disappointed by the performance as his calculations showed that he could expect twice the gas volume that he was actually getting.

In passing, Bob Boyce of America has produced an electrolyser system which produces 100 litres of HHO per minute. With that rate of gas production, it is a major challenge to get the gas out of the electrolyser while leaving the electrolyte behind. The efficiency of Bob Boyce's electrolyser is about twelve times that of Faraday's presumed maximum.

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Simple Free-Energy Devices

There is nothing magic about free-energy and by "free-energy" I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 17: Running a Generator on Water

There are two ways to run a generator with water as the fuel. The first way is to use some of the electricity output from the generator to convert water into a gas mix and then use that gas mix to power the engine of the generator.



In Broad Outline

In order to achieve this objective, we need to feed the engine three things:

1. Air - this is fed in as normal through the existing air filter.
2. HHO gas - how to make this has already been explained in considerable detail.
3. A mist of very small water droplets, sometimes called "cold water fog".

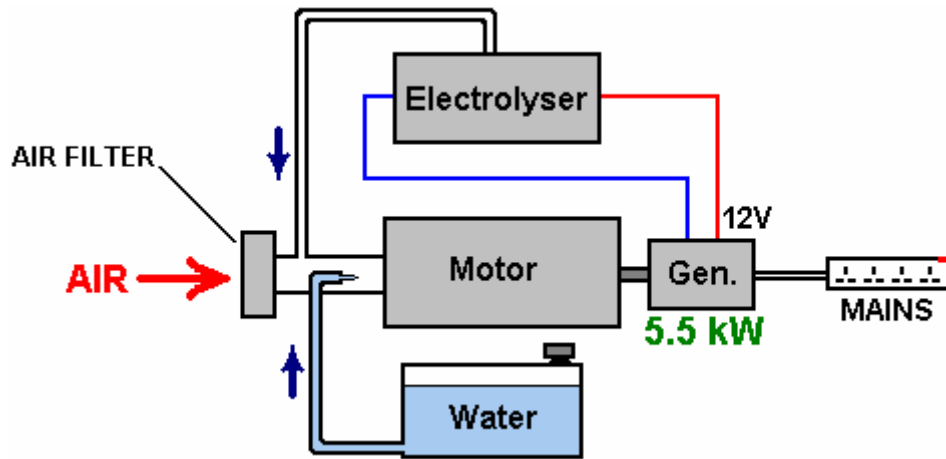
Also, we need to make two adjustments to the engine:

1. The spark timing needs to be retarded by about eleven degrees.
2. If there is a "waste" spark, then that needs to be eliminated.

To summarise then, a good deal of work needs to be done to achieve this effect:

1. An electrolyser needs to be built or bought, although the required gas production rate is not particularly high.
2. A generator of cold water fog needs to be made or bought.
3. Pipes need to be installed to carry these two items into the engine.
4. The engine timing needs to be retarded.
5. Any waste spark needs to be suppressed.
6. Water tanks are needed for the cold water fog and to keep the electrolyser topped up.
7. Ideally, some form of automatic water refill for these water tanks should be provided so that the generator can run for long periods unattended.

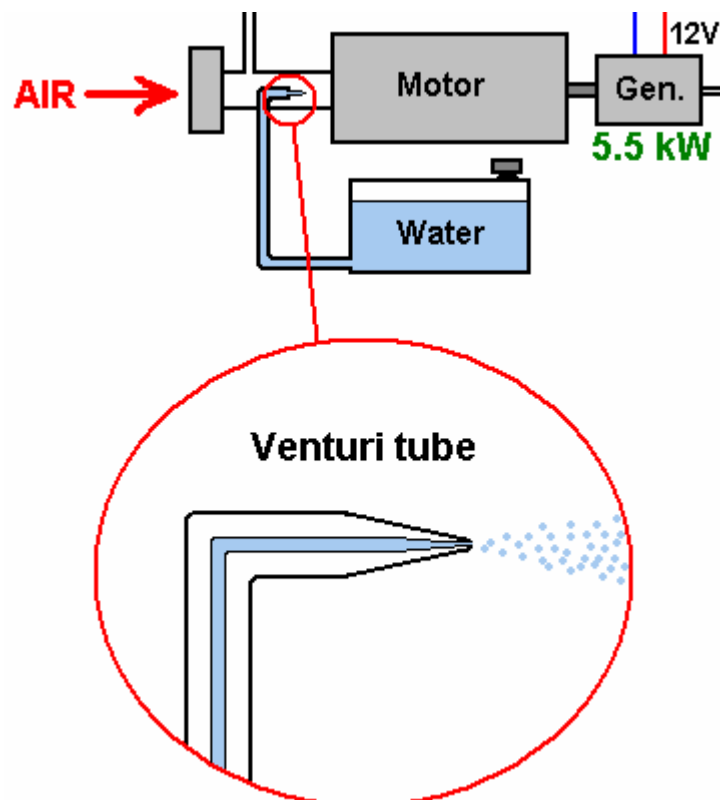
If we omit the electrical safety equipment which has already been explained in detail, and omit the HHO gas safety equipment which has already been explained in detail, and skip the automated water supply details and the starting battery, then, a generalised sketch of the overall arrangement looks like this:



Here, the design has opted to feed the HHO gas into the air system after the air filter (a thing which we normally avoid as it is not helpful for the HHO gas production efficiency, but the first step is to reproduce the existing successful method exactly before seeing if it can be improved further). Also fed into this same area is the cold water fog which is comprised of a very large number of very tiny droplets. The air enters this area as normal, through the existing air filter. This gives us the three necessary components for running the generator engine without using any fossil fuel.

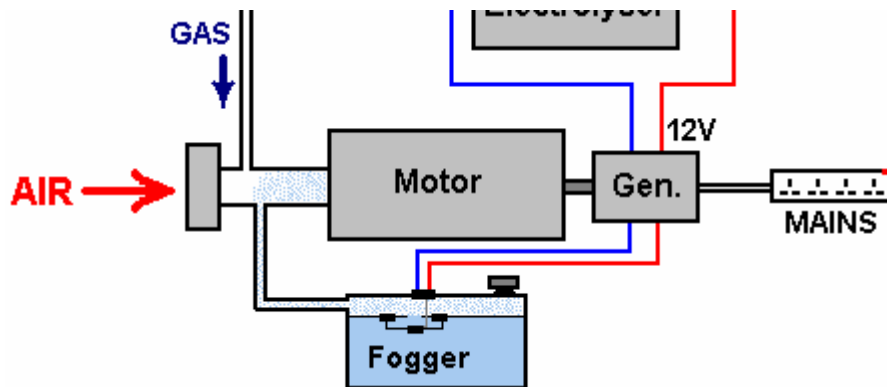
Creating the cold water fog

There are three different ways to generate the spray of very fine water droplets which are a key feature of the success of this way of running the engine. One way is to use a Venturi tube, which, while it sounds like an impressive device, is actually very simple in construction:



It is just a pipe which tapers to a point and which has a very small nozzle. As the engine draws in the air/HHO mix on it's intake stroke, the mixture rushes past the nozzle of the Venturi tube. This creates an area of lower pressure outside the nozzle and causes water to exit through the nozzle in a spray of very fine droplets. Some perfume spray bottles use this method as it is both cheap and effective.

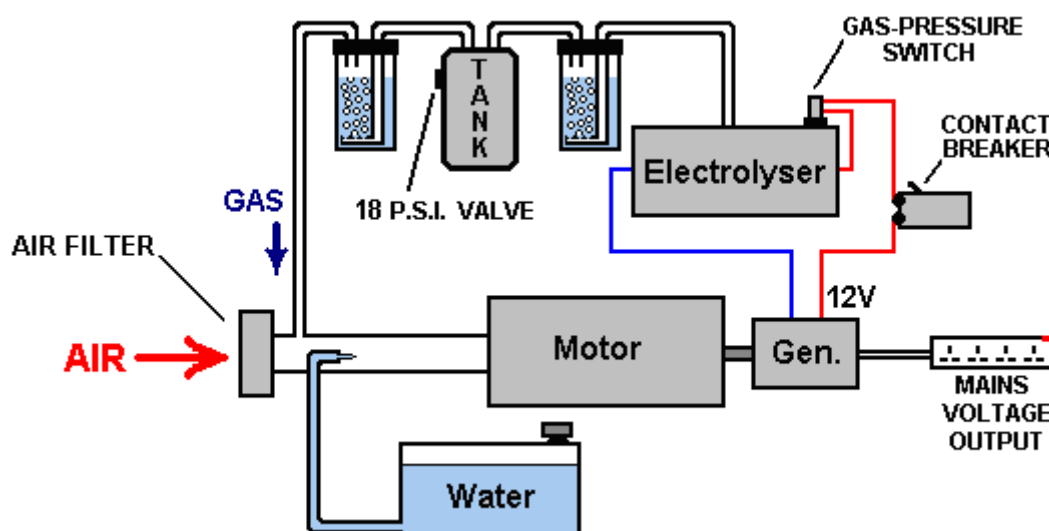
An alternative method of making the cold water fog is to use one or more "pond foggers". These are small ultrasonic devices which are maintained at the optimum operating depth in the water by a float. They produce large amounts of cold water fog which can be fed into the engine like this:



A third method is to use a small carburettor of the type used with model aircraft. This does the same job as a regular engine carburettor, feeding a spray of tiny water droplets into the engine air intake. The physical arrangement of this option depends on the construction of the air filter of the generator being modified. You will notice that the people in the UK who did this, used a small gas tank with an eighteen pounds per square inch pressure release valve. This is not possible with the highest quality of HHO gas as it cannot be compressed that much. However, with a lower grade of HHO which has some water vapour mixed in with it, it is possible to have a gas reservoir with that sort of pressure in it. In this case, except possibly for starting, their gas production rate is probably not high enough to allow much raised pressure inside the tank. Obviously, the gas-pressure switch on the electrolyser and the one on the gas storage tank will have similar operational pressures.

Some Safety Features

Up to this point, the electrolyser has been shown in bare outline. In practice, it is essential that some safety features are incorporated as shown here:

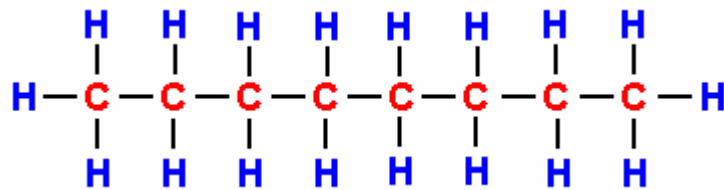


These safety devices should be familiar to you by now as they have already been explained earlier.

The Reason for Changing the Timing

The fuels used with most internal combustion engines are either petrol (gasoline) or diesel. If you are not interested in chemistry, then you are probably not aware of the structure of these fuels. These fuels are called "hydrocarbons" because they are composed of hydrogen and carbon. Carbon has four

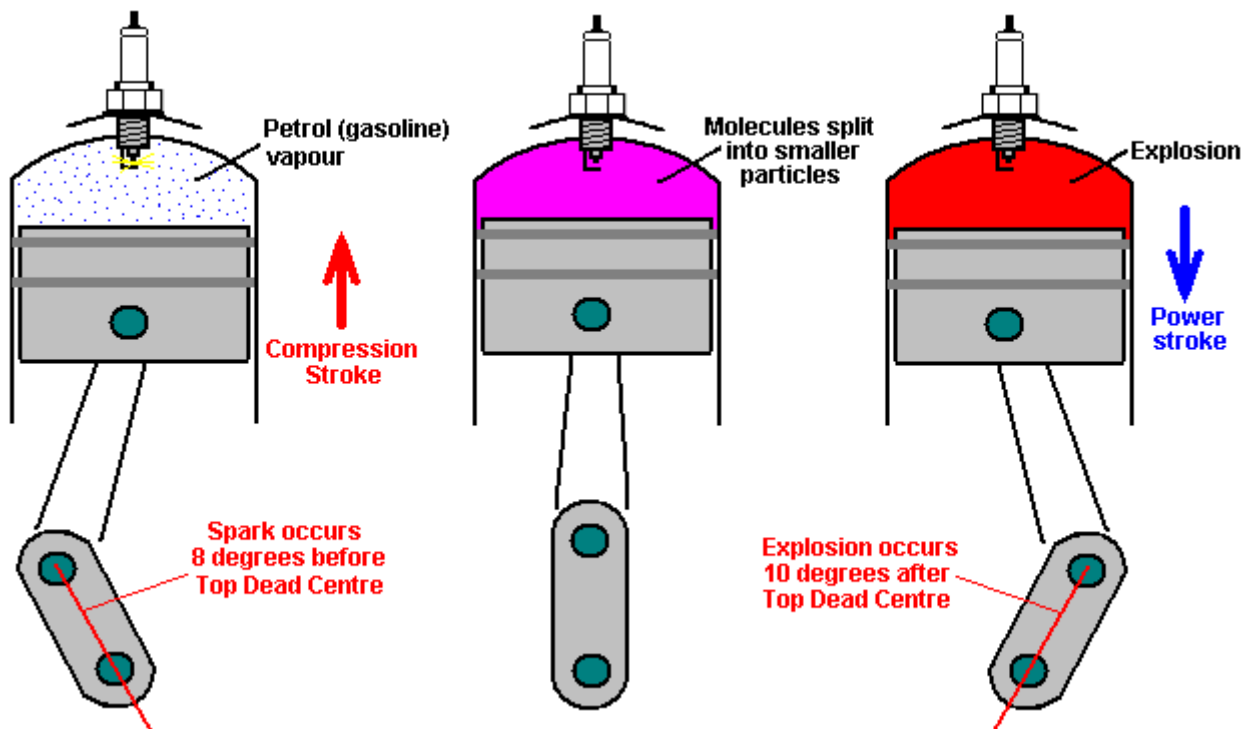
bonds and so a carbon atom can link to four other atoms to form a molecule. Petrol is a long chain molecule with anything from seven to nine carbon atoms in a chain and is crudely sketched here in a simplified structure:



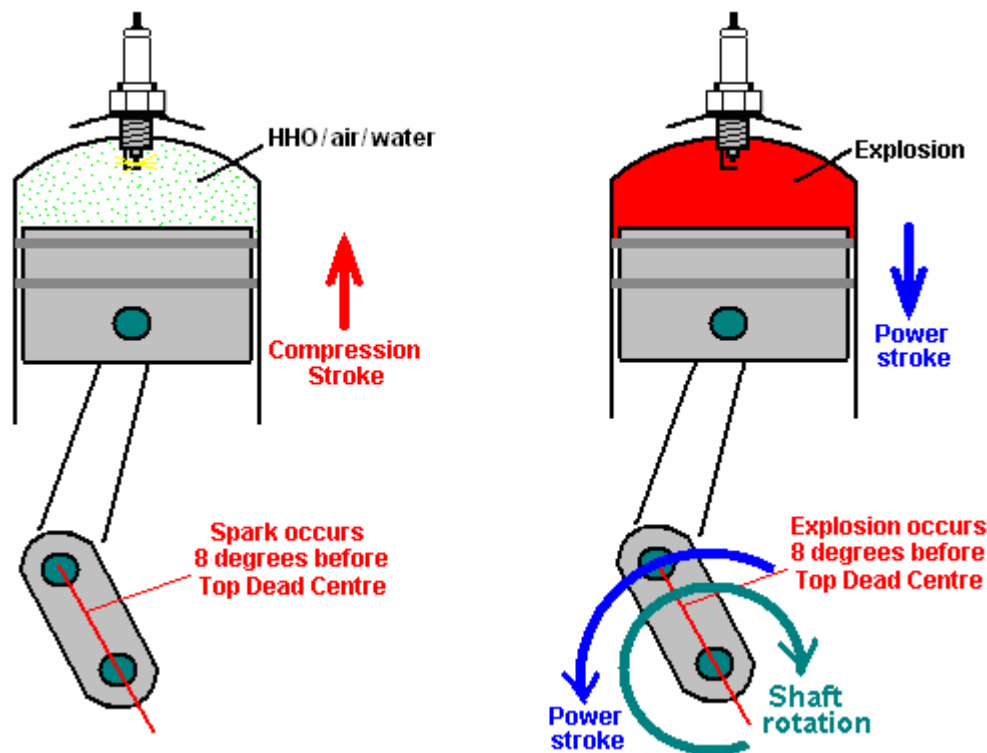
Diesel has the same structure but with eleven to eighteen carbon atoms in a chain. In a petrol engine, a fine spray of petrol is fed into each cylinder during the intake stroke. Ideally, the fuel should be in vapour form but this is not popular with the oil companies because doing that can give vehicle performances in the 100 to 300 mpg range and that would cut the profits from oil sales.

The petrol in the cylinder is compressed during the compression stroke and that reduces its volume and raises its temperature substantially. The air/fuel mix is then hit with a powerful spark and that provides enough energy to start a chemical reaction between the fuel and the air. Because the hydrocarbon chain is such a large molecule, it takes a moment for that chain to break up before the individual atoms combine with the oxygen in the air. The main engine power is produced by the hydrogen atoms combining with oxygen, as that reaction produces a large amount of heat. The carbon atoms are not particularly helpful, forming carbon deposits inside the engine, not to mention some carbon monoxide (CO) and some carbon dioxide (CO₂) as well.

The key factor here is the slight delay between the spark and the combustion of the fuel. The combustion needs to happen a few degrees after Top Dead Centre when the piston is about to start its downward movement in the power stroke. Because of the delay caused by the hydrocarbon chain breaking down, the spark occurs a few degrees **before** Top Dead Centre:



If you were to replace the petrol vapour with HHO gas, then there would be a major problem. This is because HHO gas has very small molecule sizes which do not need any kind of breaking down and which burn instantly. The result would be an explosion which occurs far too soon and which opposes the movement of the rising piston as shown here:



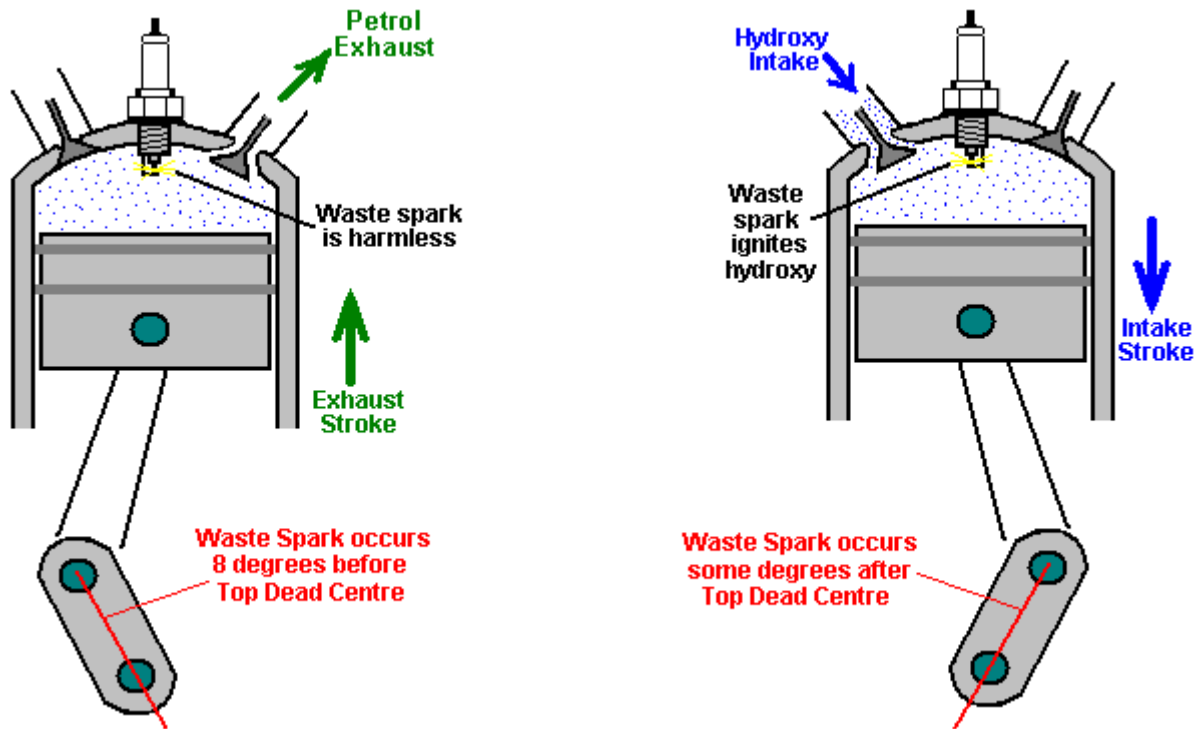
The forces imposed on the piston's connecting rod would be so high that it would be quite liable to break and cause additional engine damage.

In the case of our electrical generator, we will not be feeding it a mix of air and HHO gas, but instead, a mix of air, HHO gas and cold water fog. This delays the combustion of the HHO gas by a small amount, but it is still important to have the spark occur after Top Dead Centre, so the ignition of the generator needs to be retarded by eleven degrees.

Engine design varies considerably in ways which are not obvious to a quick glance at the engine. The timing of the valves is a big factor here. In the smallest and cheapest engines, the engine design is simplified by not having the spark timing taken off the cam-shaft. Instead, production costs are cut by taking the spark timing off the output shaft. This produces a spark on every revolution of the engine. But, if it is a four-stroke engine, the spark should only occur on the power stroke which is every second revolution of the output shaft. If the fuel is petrol, then this does not matter as the extra spark will occur near the end of the exhaust stroke when only burnt gasses are present in the cylinder.

Some people are concerned when they think of HHO gas burning and producing water inside the engine. They think of hydrogen embrittlement and rusting. However, because of the nature of the hydrocarbon fuel already being used, the engine runs primarily on hydrogen anyway and it always has produced water. The water is in the form of very hot vapour or steam and the engine heat dries it out when the engine is stopped. Hydrogen embrittlement does not occur as a result of using a HHO gas booster.

Anyway, if we were to delay the spark until after Top Dead Centre as we must, then the situation is quite different as the waste spark will also be delayed by the same amount. With most engines, at this point in time the exhaust valve will have closed and the intake valve opened. Our very flammable gas mix will be being fed into the engine on it's intake stroke. This means that our gas supply system is openly connected to the cylinder through the open intake valve, and so, the waste spark would ignite our gas supply system (as far as the bubbler which would smother the flashback). The situation is shown here:



we definitely do not want that to happen, so it is very important that we suppress that additional "waste" spark. So, this leaves us with two engine adjustments: timing delay and waste spark elimination. There are various ways in which these can be done and as each engine design is different, it is difficult to cover every possibility. However, there is a technique which can be used with many engines and which deals with both issues at the same time.

Most engines of this type are four-stroke engines with intake and exhaust valves, perhaps something like this:



The intake valve (shown on the right in this illustration) is pushed down by a cam shaft, compressing the spring and opening the inlet port. The exact arrangement will be different from one engine design to the next. What is fixed is the movement of the valve itself and that movement only takes place every second revolution. There are various ways of using those movement to eliminate the waste spark and retard the timing. If a switch were mounted so that it opens when the intake valve opens and closes when the intake valve closes, then the switch closure shows when the piston starts upwards on its compression stroke and a simple electronic circuit can then give an adjustable delay before firing the

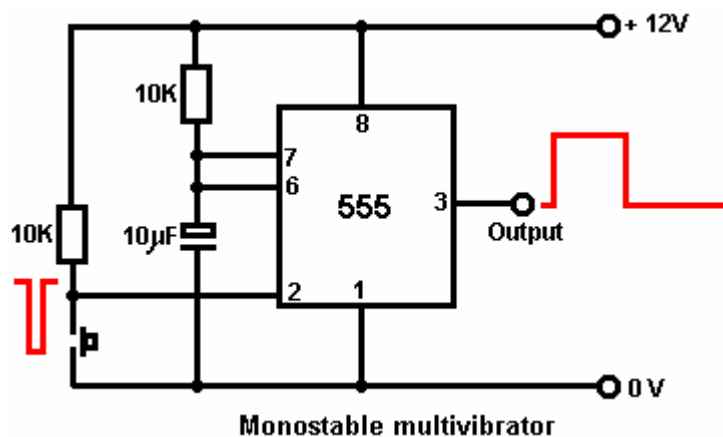
coil which produces the spark. This, of course, involves disconnecting the original electrical circuit so that no waste spark is generated. The current flowing through the switch contacts can be arranged to be so low that there will be no sparking at the contacts when the circuit is broken again. The switch positioning might be like this:



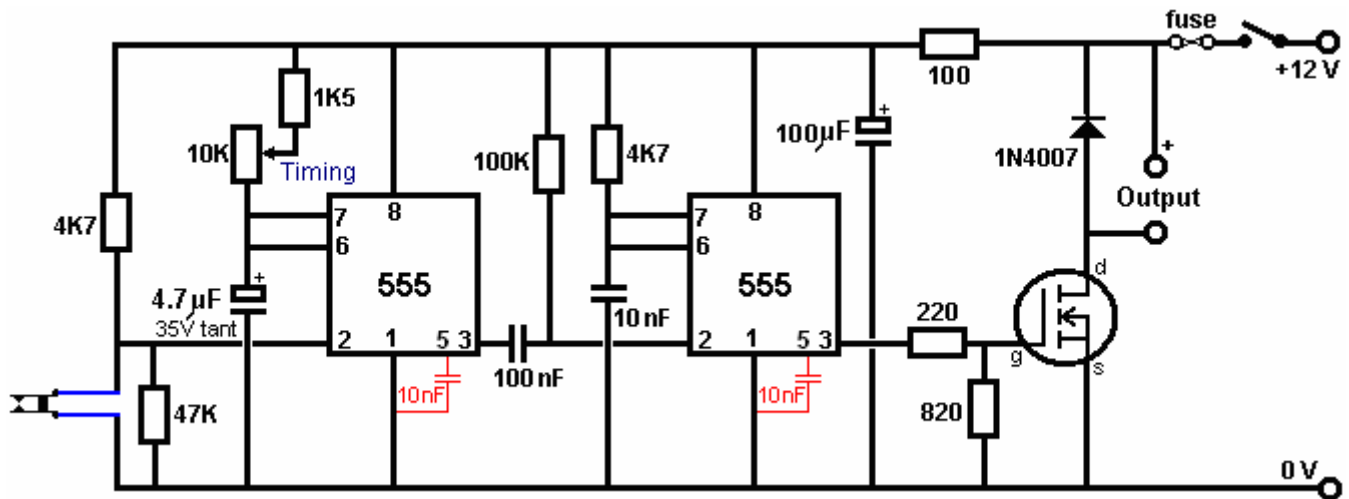
An alternative is to attach a strong permanent magnet to the rocker arm, using epoxy resin, and then position a solid state "Hall-effect" sensor so that it triggers the delay before the spark is generated.

If the engine did not have a waste spark, then in theory, the timing mechanism of the engine could be used to retard the spark. However, in practice, the timing mechanism is almost never capable of retarding the spark to the position that is needed for running without fossil fuel, and so, some kind of delay circuit will be needed anyway.

The sort of delay circuit needed is called a "monostable" as it has only one stable state. A basic circuit of that type is:



If you are not at all familiar with electronic circuits, then take a look at the beginner's electronics tutorial found in the Appendix as that explains how circuitry works and how to build any simple circuit from scratch. We can use two of these circuits, the first to give the adjustable delay and the second to give a brief pulse to the ignition circuit to generate the spark:

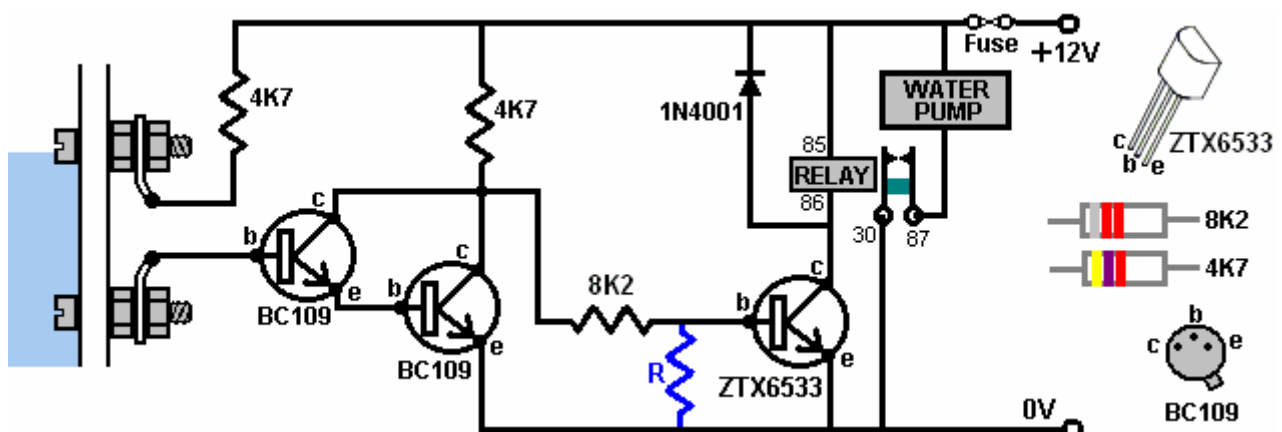


Making the HHO gas

When the generator is running, we have a ready supply of electrical energy, coming from a piece of equipment which has been specifically designed to supply large quantities of electricity for any required application. We are not dealing with the spare capacity of some low-grade alternator in a car, but we have substantial electrical power available.

Having said that, the electrolyzers already described are efficient and it is unlikely that an excessive amount of power would be needed when using one of those designs. Another convenient factor is that this is a stationary application, so the size and weight of the electrolyser is not at all important, and this gives us further flexibility in our choices of dimensions.

As this is an application where it is highly likely that the electrolyser will be operated for long periods unattended, an automated water supply system should be provided. The main details of such a system have already been covered, but what has not yet been dealt with is the switching for the water pump. The water pump itself can be an ordinary windscreen-washer pump, and we need some form of switch which operates on the electrolyte level inside the electrolyser. It is sufficient to sense the level in just one of the cells inside the electrolyser as the water usage will be pretty much the same in every cell. If you make the electrolyser in a suitable size or shape, then a simple off-the-shelf miniature float switch can be used. If you prefer, an electronic level sensor can be operated, using two bolts through the side of the electrolyser as the level sensor. A suitable circuit for this simple switching task could be:



When the electrolyte level inside the electrolyser is in contact with the upper bolt head, the circuit is switched off and the water pump is powered down. The electrolyte has a low resistance to current flow, and so it connects the 4.7K resistor through to the base of the BC109 Darlington pair (as described in the Appendix). This keeps the two transistors switched fully on which keeps the 8.2K resistor connection well below the 0.7 volts needed to switch the ZTX6533 transistor on. If you are concerned about the ZTX6533 transistor being partially on, then resistor "R" could be added, although the prototype did not need one. The value would be about 2K. When the electrolyte level falls below the

It has been demonstrated that a gas production rate of around 3 lpm (180 lph) is sufficient to run a generator which produces 5,500 watts of output electrical power. The gain is in running a generator as an internal combustion steam engine and not in the great efficiency of the electrolyser. The facts speak for themselves, with several people scattered around the world, already running generators on water. Many different generator designs have been adapted, typically, by modifying the flywheel, filling in the keyway and cutting another one to give a spark 2 degrees after TDC. Experience has shown that the 6.6 kVA Honda V-twin petrol motor generator and the Vanguard V-twin work very well long-term when adapted to run on water only.

Wear and Tear Issues

A man who lives in Alaska is very experienced in the use of renewable energy sources and unconventional fuel systems. His experiences are likely to be helpful for anyone who intends to use an electrical generator, whether running on water or on a fossil fuel. He recalls the experiences of a friend:

He decided to live off-the-grid because it was going to cost him \$20,000 to get connected to the grid and as his house was not that large, he decided to go the alternative route. We designed a system which would use a 4 kW inverter and have an 8 kW Briggs & Stratton generator with a 13 kW surge capacity, for back up. The system has 6 solar panels and a 24 volt battery bank with 400 amp capacity. Having long summer days here in Alaska, the solar panels have more than enough capacity for charging the battery bank on sunny days. However, but when the day is overcast or when it is winter when there are only six hours of sunlight, the battery bank does not get charged fully. At these times, the generator is used to top up the battery bank.

American generators normally have either two or four 120-volt outputs each rated at 15 amps, plus one 240-volt output rated at 33 amps. If one of the two 120-volt outputs is used to charge the battery bank, then you get left with just the other 120-volt output for any other power needs during the time when the battery bank is being charged. This is not a satisfactory arrangement as operating with one field at maximum power and the other one lightly loaded or unused, causes a field imbalance in the generator, engine crank imbalance and ring or regulator failure within six months. It also causes noisy running and excessive fuel consumption.

Run in this way, providing a 60-amp charge rate, the generator ran hard and loud for two to two and a half hours per day, and running it was costing \$350 per month for gasoline. The generator failed after four months.

In order to balance the loading on the replacement generator, a 15 kVA step-down transformer costing less than \$1000 was purchased so that the 240-volt output could be used to drive 120-volt equipment. A transformer to be used for this needs to have a power-handling capacity which is greater than the surge capacity of the generator. A major advantage is that the generator current is halved for any given level of equipment current drawn because the equipment is running at only half of the generator voltage.

Using this transformer made a massive difference, giving a balanced output and providing a 90-amp charging rate for the battery bank as well as having ample power to run other household equipment when the battery bank was being charged. The result was a charge time of just one hour twenty minutes per day, with the generator running quietly and smoothly. The fuel consumption also dropped to just \$70 per month which is just one fifth of what it was, covering the cost of the transformer in under four months. This generator has been running now for two years without any problems at all.

The Step-by-Step Conversion of a Generator

Selwyn Harris of Australia has kindly agreed to share detailed information on how he performs the conversion of a standard electrical generator to enable it to run on water alone. The generator which he uses as an example for this tutorial is a GX4000i generator:



The supplier is AGR Machinery which is an Australian company on eBay which buys up stock from collapsed companies and resells the equipment. The supplier says: [GX4000i portable type generators](#) have smoother output power, comparable to public utility sources. Ideal for powering medium loads such as:

- Power tools - Both Single & 3 Phase
- Game consoles, Digital Cameras
- Laptops, Camcorders
- Lighting and Microwave Ovens
- Drills, Grinders
- Resistive Load Kitchen Appliances (i.e. Coffee Maker, Toaster)
- Emergency Home Back up power where 240v power is required

Also, these units are significantly quieter than others due to refined engine technology

Features:

- Commercial Grade Engine: 196 cc 4-stroke, 7 horsepower, overhead camshaft, T.D.I. ignition
- Maximum output 4.0 kVA at 240 or 415V AC (Rated output: 2.7 kilowatts)
- Quality Heavy-Duty Construction
- AVR (Auto Voltage Regulator)
- Three 240V and one 415V Protected Outlets
- 100% Pure Copper Core

- Gearless direct drive
- Robust Square frame Design
- Easy – Recoil Start
- Oil capacity: 0.7 litres
- Powder Coated Finish
- Light and Compact for easy manoeuvrability (38.5 Kg)
- Noise level: 69 dB

The first step of the conversion is to remove the fuel tank which is held in place with four bolts:



This allows access to the carburettor which is then removed as it will not be used:



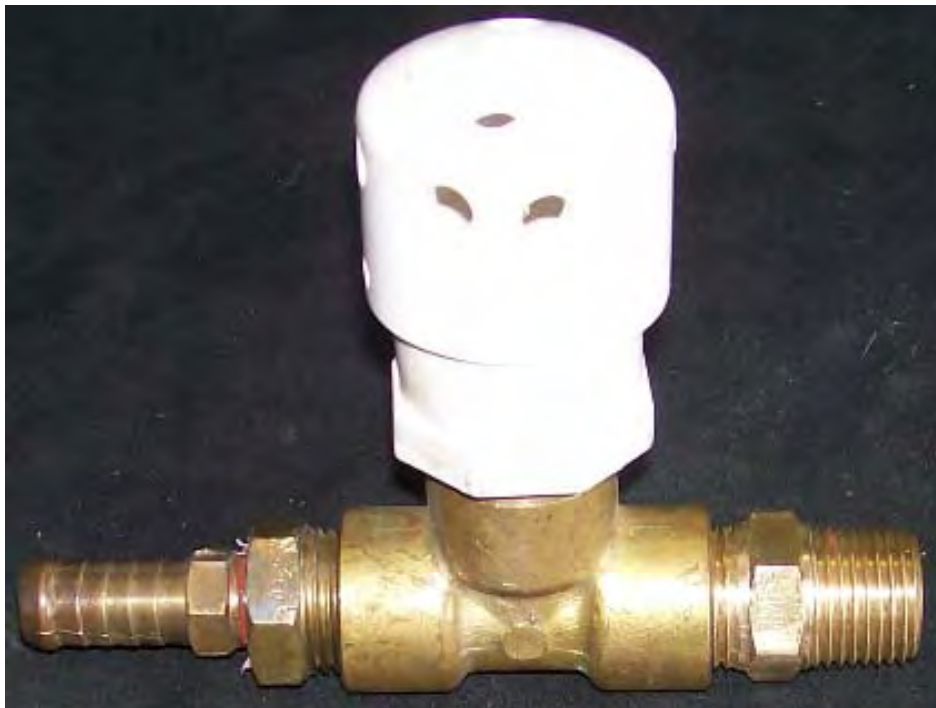
The next step is to construct a pressure-release valve mechanism which will protect the equipment from damage in the unlikely event of a major, sudden rise in pressure caused by the unwanted ignition of the HHO gas mix used to power the generator. For this, parts are purchased from the local hardware store. The brass fittings are a 12mm barrel, a 12mm female T-fitting and a 12mm to 9mm hose reducer as shown here:



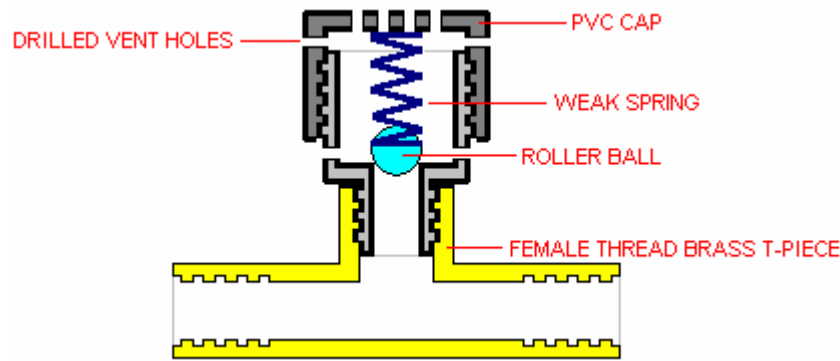
The PVC plastic fittings are a ½" to 1-1/4" reducer and a 1-1/4" End Cap, along with the roller ball from an old-fashioned mouse and a relatively weak compression spring to hold the ball in place during normal operation where the gas pressure is low:



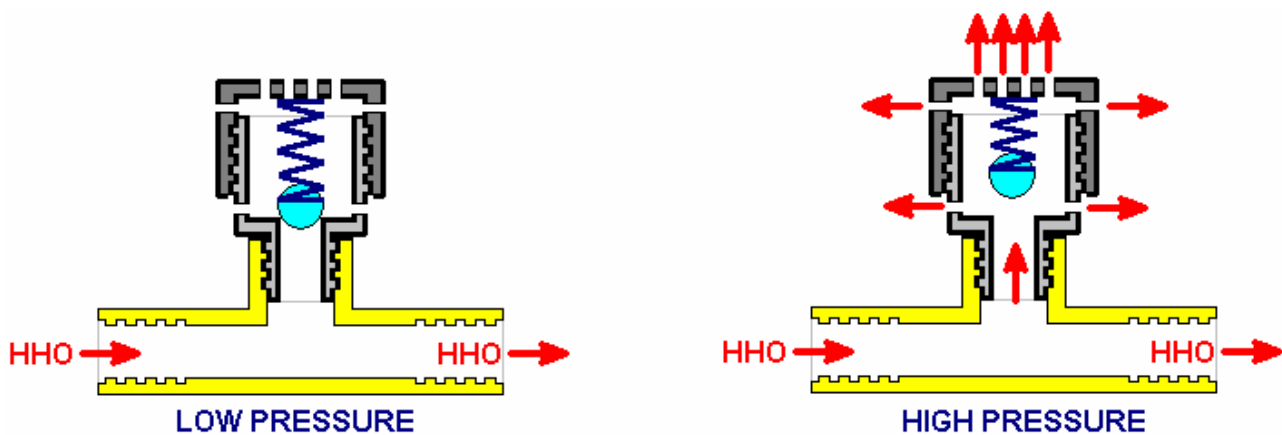
These components are then assembled to produce the pressure-release valve:



The inside of the flash-arrestor looks like this:



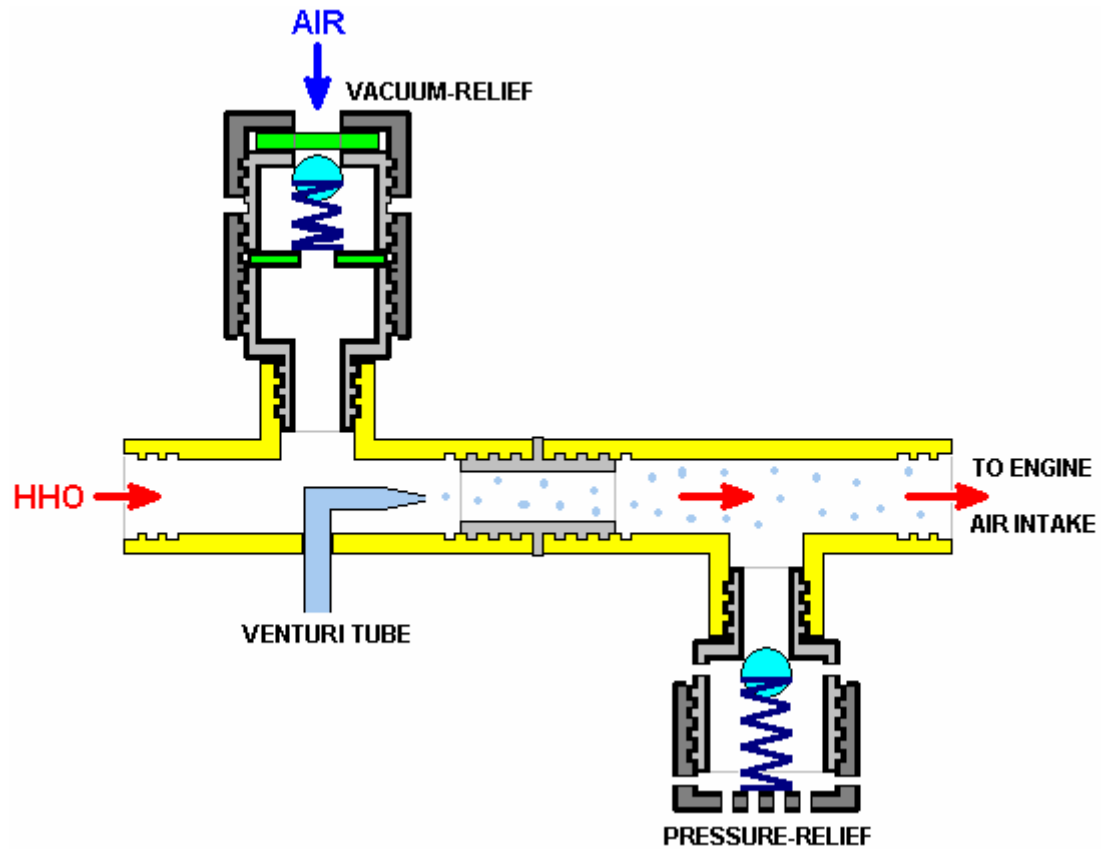
The ball is held in place by the spring allowing the HHO to flow past it, but if a sudden increase in pressure should occur, then the ball is forced upwards, opening a path to the many holes drilled in the plastic fittings:



When the gas pressure drops again, the spring pushes the roller ball down to seal off the pressure-release holes.

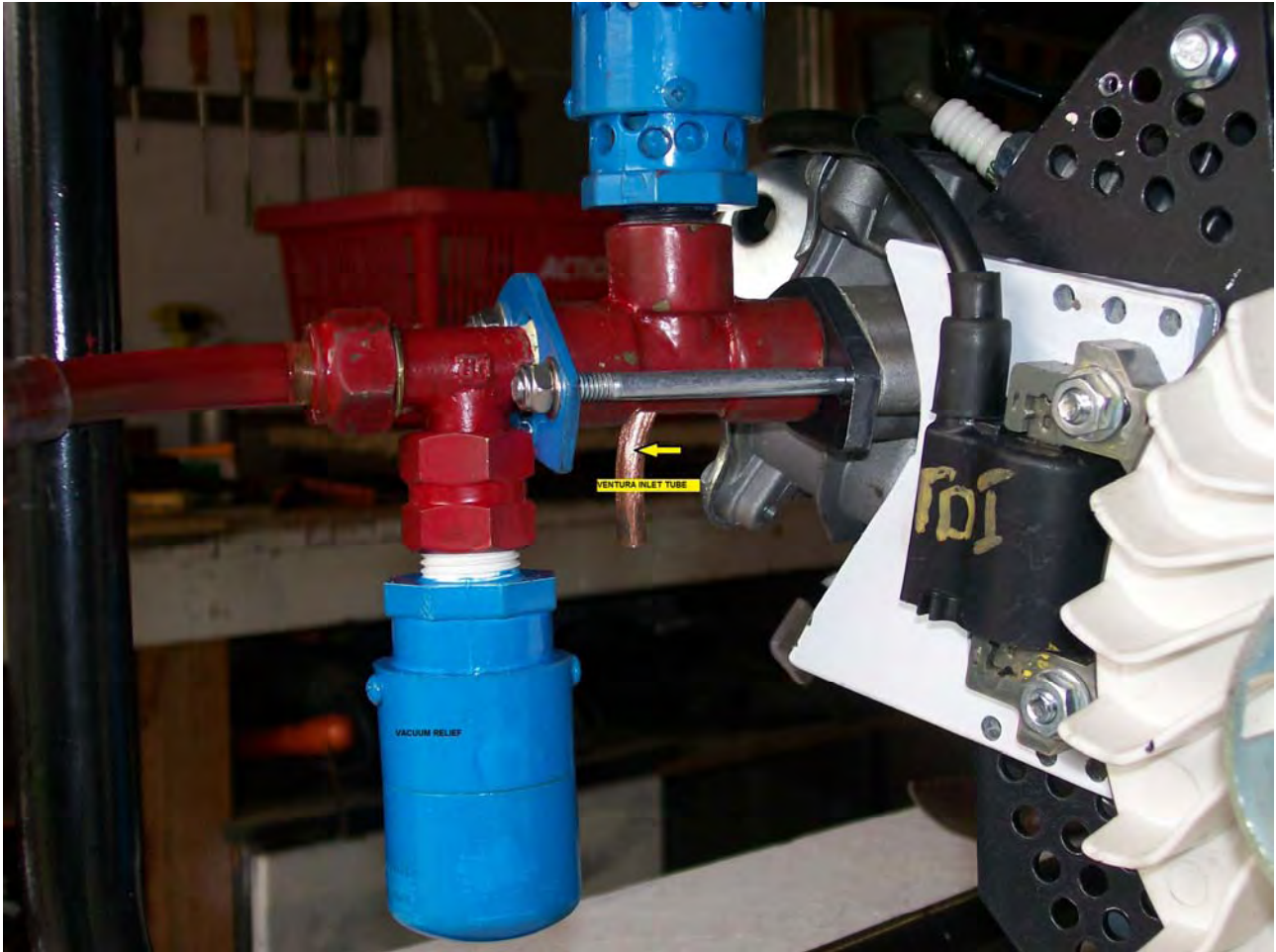
However, Selwyn adds an additional spring-loaded valve to the arrangement. This one is there in case the electrolyser fails to produce a sufficient volume of gas in the event of a sudden increase in demand. This valve is marked as a “vacuum-relief” valve although, strictly speaking, it deals with reduced pressure rather than an actual vacuum. The arrangement is shown below. Please take note of the fact that Selwyn uses the Hogg style of electrolyser and that design has a bubbler built into it, so if you are using some other design of electrolyser, please be very sure to use at least one bubbler between the electrolyser and the engine, in spite of the fact that there is very little chance of the engine misfiring and igniting the HHO gas in the electrolyser. For an engine of this size, an electrolyser which produces 4.5 or 5 lpm of HHO should be adequate.

The addition of cold water mist through a Venturi tube as shown, both lowers the engine temperature and increases the engine power as the mist converts instantly to flash-steam when the HHO gas ignites, raising the pressure inside the cylinder and boosting the power output.



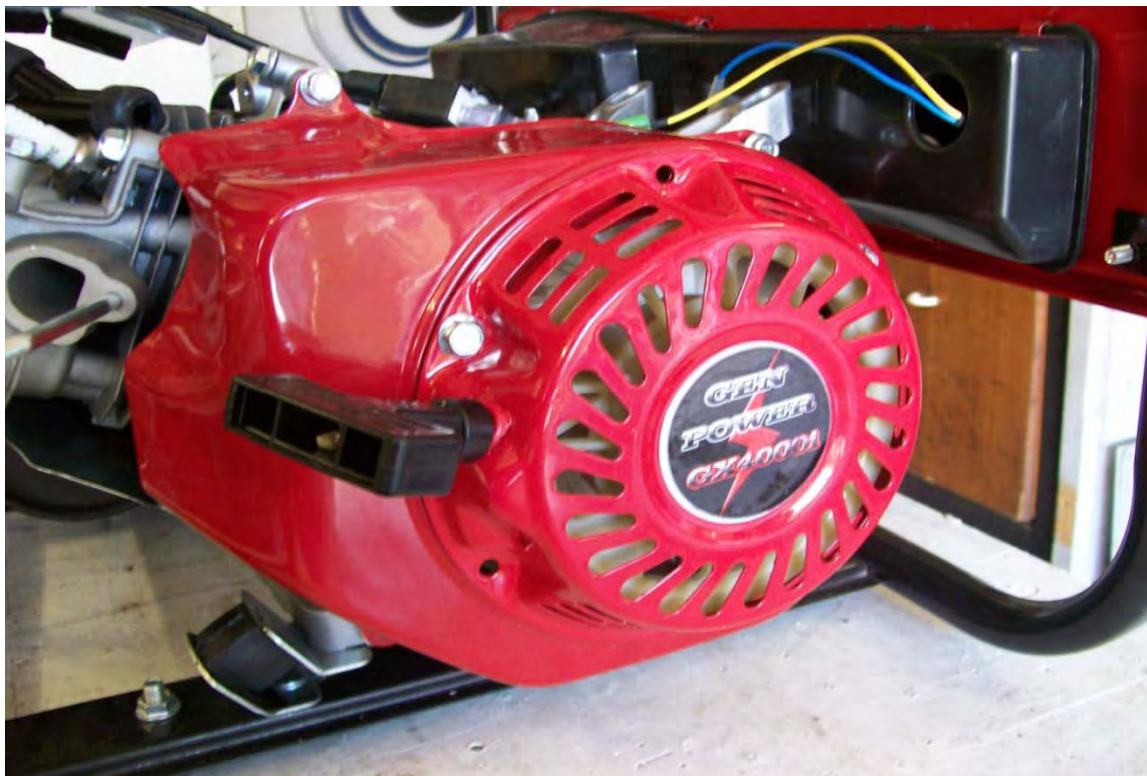
Next, a piece of $\frac{1}{4}$ " (6 mm) thick aluminium plate is cut and shaped to the size of the carburettor gasket which is not a symmetrical item. This is done by tracing the gasket and transferring it on to the aluminium plate, drilling the holes and then cutting out the outline shape. The edges are then filed to create a nice fit on the engine port.



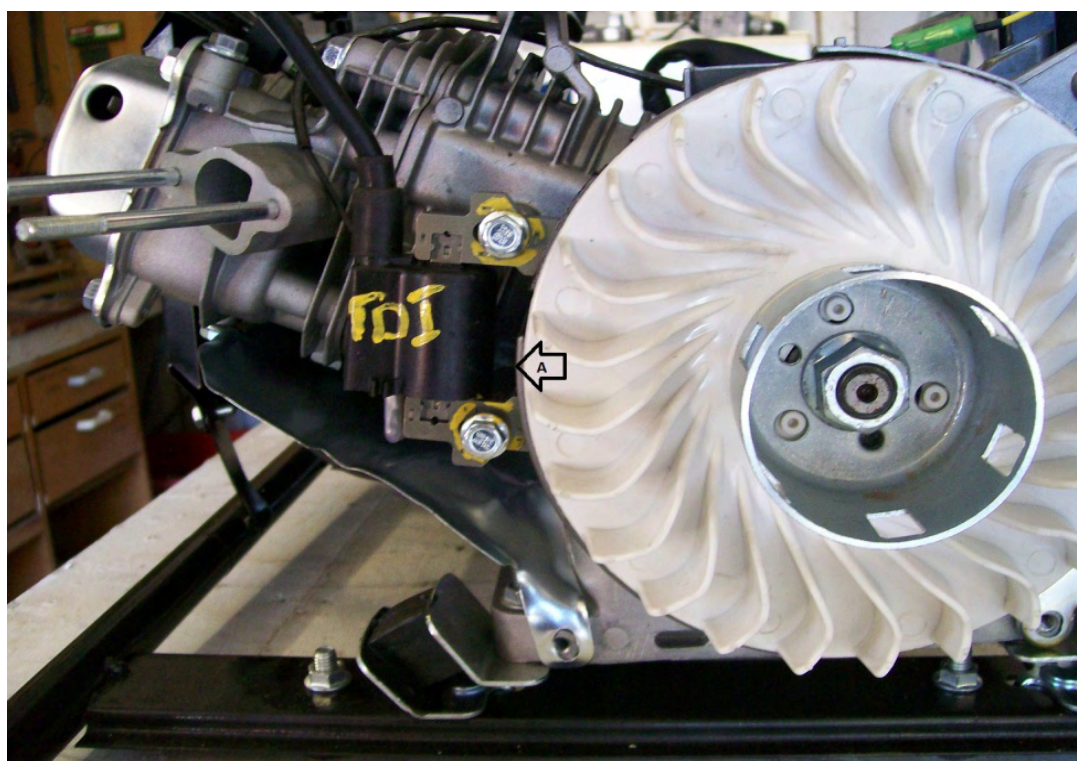


The pipes, backing plate, pressure-relief, vacuum-relief, gaskets, nuts and bolts are then assembled as shown above. Most of the pressure-relief valve components shown in the photograph have been painted, which happens to conceal the different materials being used.

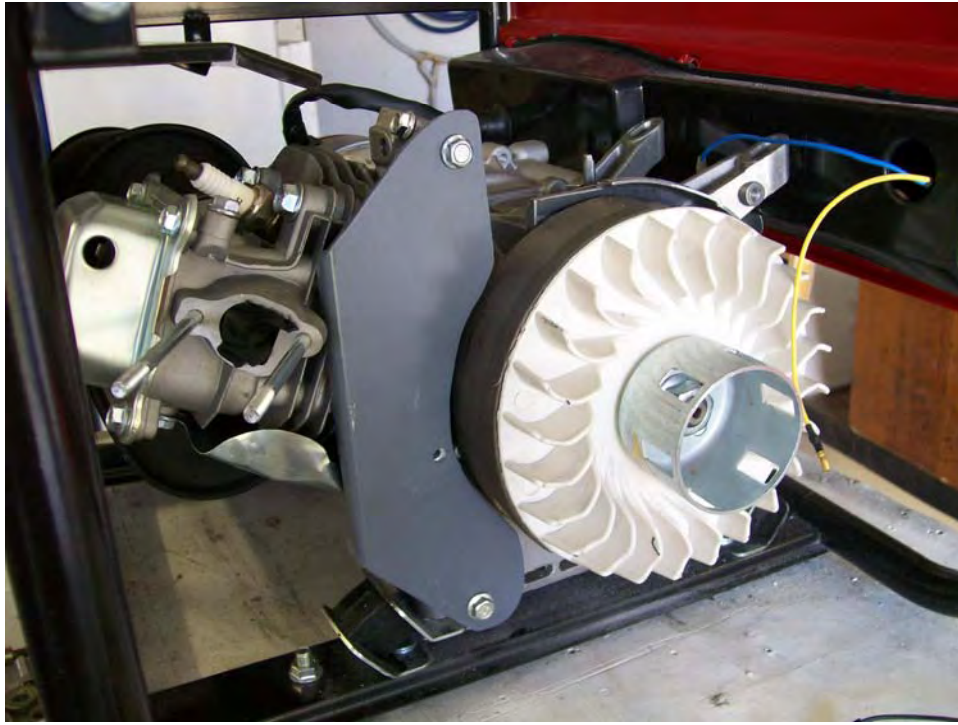
At this point an electrolyser of any design which can produce at least 4.5 litres of HHO gas mix per minute is connected to the intake. The electrolyser most often used by Selwyn is the Hogg design disclosed by him earlier.



The manual Pull-start and the generator cover are now removed. It is only necessary to remove four of the bolts to take the cover off:



This is the engine with the starter pull and the blower cover removed. At "A" you can see the magnetic pulse type **Transistor Discharge Ignition** pick-up in it's original position, bolted in place at 8 degrees before Top Dead Centre. This needs to be removed and an aluminium plate inserted to allow the TDI to be mounted in it's new position. Because of the new fuel, it is necessary to retard the ignition system. This can be done in one of two ways, neither of which is particularly easy, so you may need the help of an engineering shop. The easiest way is to modify the installed ignition to Top Dead Centre. This is Selwyn's aluminium TDI adaptor plate which he made from 2mm thick aluminium sheet:

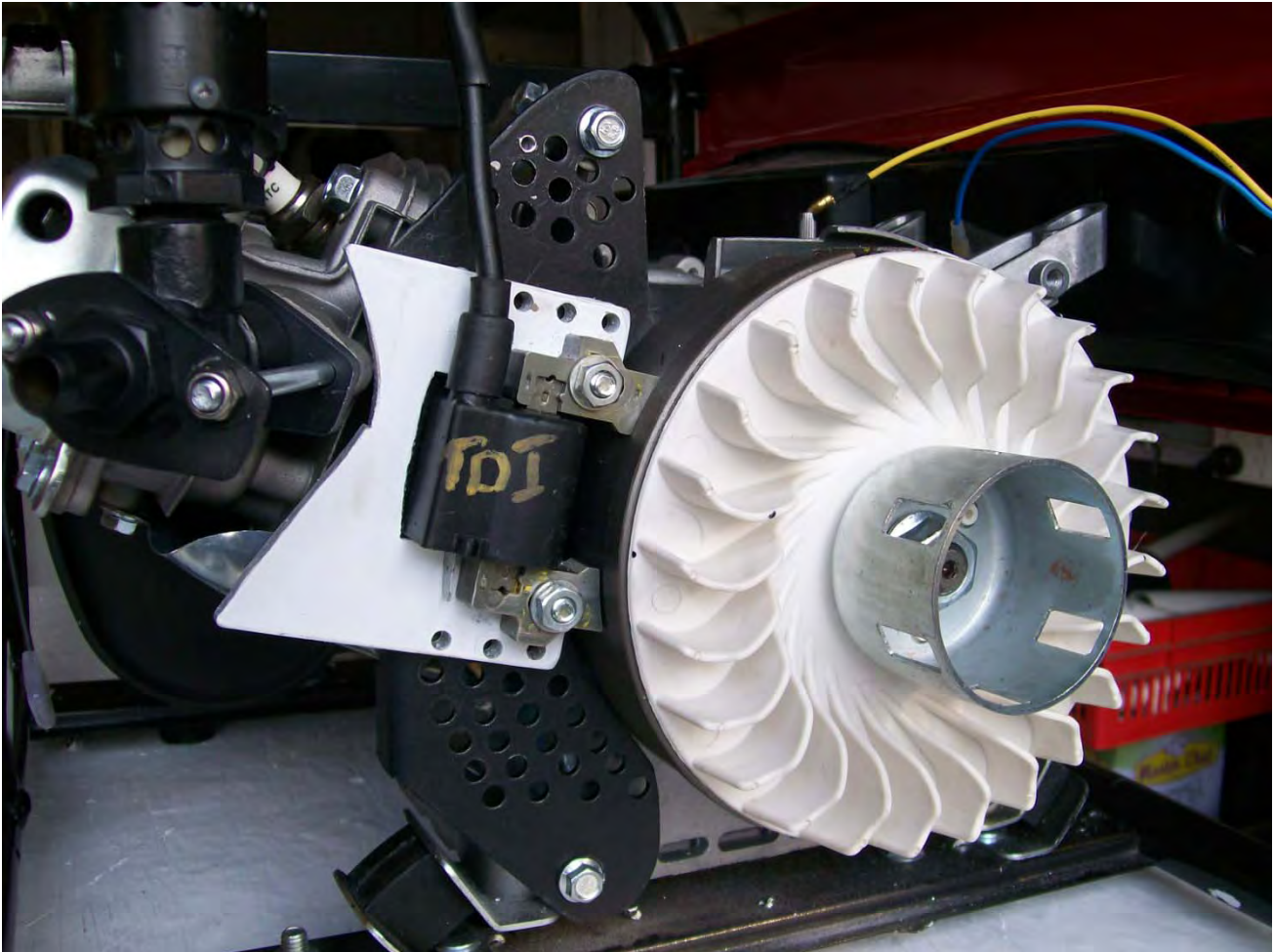


In this picture, the outline of the fuel intake port is obscured due to it having been temporarily blocked off during the construction. The tools required for constructing these components are a drill press and a jig saw fitted with a metal blade. Selwyn used this timing alteration method on his own smaller generator which has run trouble-free for a year. The objective is to delay the ignition spark from 8 degrees before Top Dead Centre to either Top Dead Centre or to 1 degree after TDC. This allows for a good spark on the compression stroke and when the waste spark occurs, the inlet valve has not yet opened and so there is no HHO is in the ignition area. That is to say, the exhaust valve has just closed and the inlet valve has not yet opened. This results in a good compression stroke for the HHO and does not try to send the piston backwards due to premature ignition of the gas mix. The above picture shows the aluminium plate mounted and ready to accept the pick-up. This plate needs to have air holes drilled in it in order to allow cooling air to flow over the engine fins behind it.

The TDI adaptor plate looks like this:



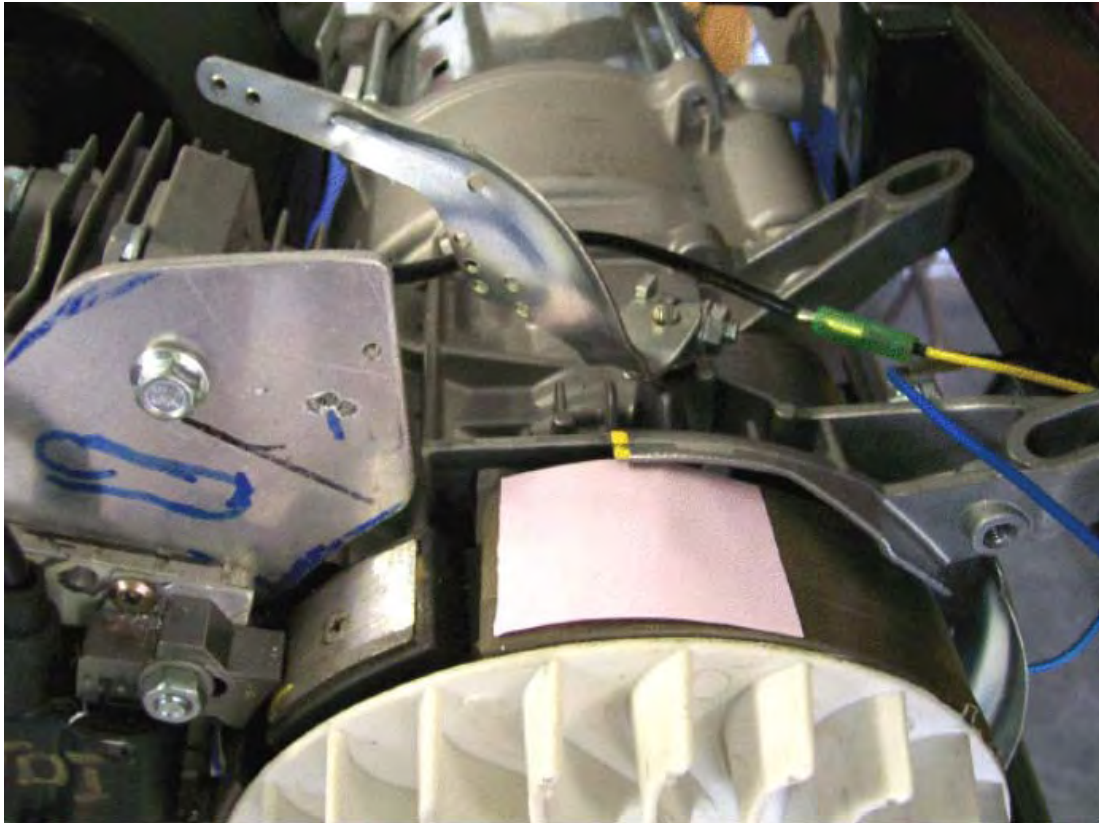
And as shown below, the support plate is drilled with the ventilation holes. In this photograph the adaptor plate is just resting on the support plate. Later, when the TDC timing position is established, the adaptor plate will be bolted to it using the three holes top and bottom on the white plate. This locks the timing to that setting and the timing is never changed. In 2010, when adapting a previous generator, an experienced mechanic was asked to establish the TDI plate position and he charged sixty Australian dollars for doing that.



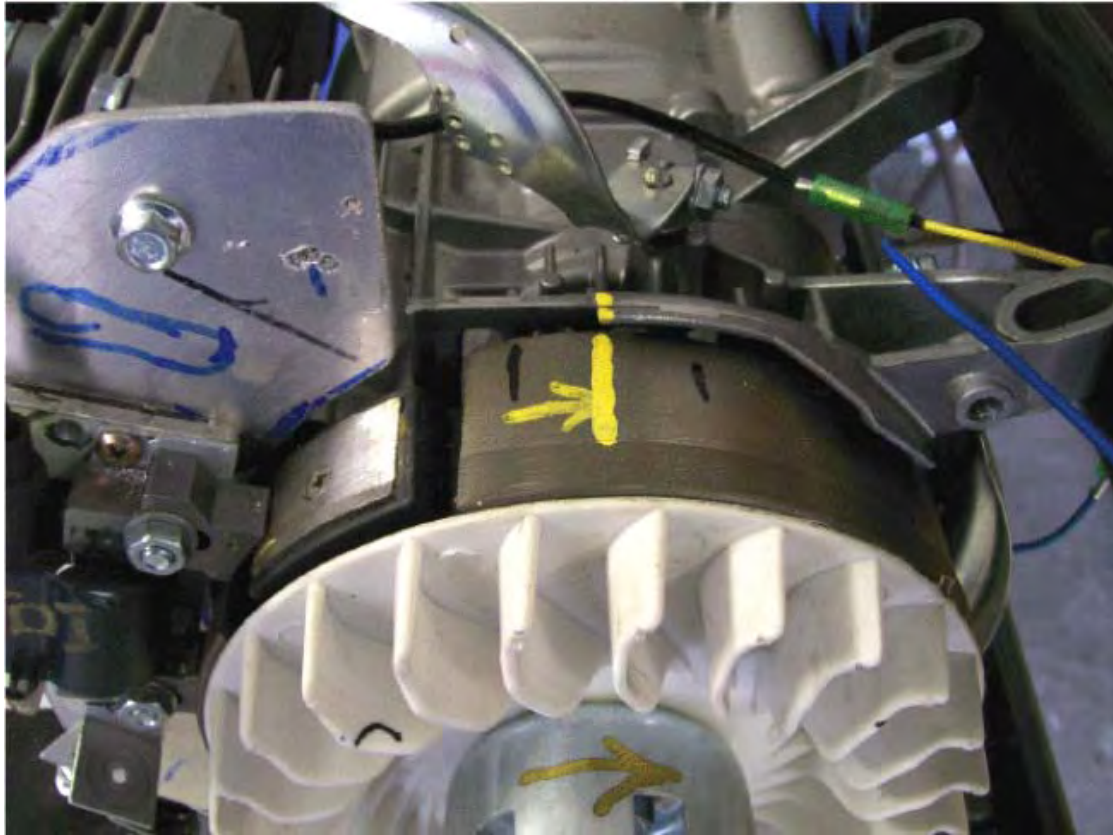
Finally, the covers and the Starter handle need to be bolted back in place.

Instead of paying somebody else to set the new spark timing, it is perfectly possible to do that yourself. One effective method is as follows:

1. Mark the casing of the engine in a convenient location as shown in yellow in this photograph:



2. Remove the spark plug and insert a long screwdriver until the top of the piston is felt. Manually rotate the engine (clockwise for this generator as can be seen from the curved fan pieces on the flywheel) until the screwdriver is no longer pushed upwards. It may take more than one rotation to find this point accurately. When that point is found, mark the flywheel directly in line with the casing mark which you just made. This marking needs to be very accurate.
3. Continue rotating the flywheel very slowly until the screwdriver starts to go down again and mark that point on the flywheel. Again, this marking needs to be very accurate.
4. Measure the distance along the flywheel between the two flywheel marks which you have just made and then make a larger mark on the flywheel exactly half way between your two marks. If accurately done, this new point is where the flywheel is when the piston is exactly at Top Dead Centre, which is where we want the spark to occur. This marking on Selwyn's flywheel is like this:



5. Next comes a bit of arithmetic. The diameter of the flywheel is 180 mm which means that it's circumference is $3.14159 \times 180 = 565.5$ mm and as there are 360 degrees in each rotation of the flywheel, then the outside edge of the flywheel will move 1.57 mm for each of those degrees.

The engine specification states that the spark timing is 8 degrees before Top Dead Centre and we want the spark to occur exactly at TDC, which means that we want $8 \times 1.57 = 12.5$ mm of the flywheel circumference to have passed by before the spark occurs.

6. To achieve this delay in the spark timing, the TDI needs to be moved 12.5 mm in the direction which the flywheel rotates. You will notice that for this major timing change, the TDI adjustment is very small, only half an inch.
7. When the TDI adjustment has been made, the timing can be checked using an automotive timing light connected to the spark plug lead. The engine can be spun using an electric drill. As the flywheel is spinning fast and the flash of light from the timing light is very short, it makes the flywheel mark appear to be stationary in spite of the fact that it is passing by very rapidly. If the TDI adjustment is correct, then the central mark made on the flywheel will appear to be stationary and exactly aligned with the mark made on the casing.

This is exactly what happened when Selwyn's motor had it's timing adjusted, but the important factor is to have the spark close to the Top Dead Centre point to make sure that the inlet valve is fully closed before the spark occurs. Two degrees after Top Dead Centre is a popular point for the spark with many of the existing generator conversions which I have been told about, possibly to reduced the loading on the piston's connecting rod. Here is a photograph of Selwyn's latest generator conversion having it's new spark timing checked out:



8. Most small petrol engines have the spark timing set between 8 degrees and 10 degrees before Top Dead Centre. If it so happens that you do not know what the timing of your particular generator is, then complete the flywheel marking procedure of step 4 above, but make three additional marks on each side of the TDC mark. Space those marks 1.5 mm apart as they will then make a scale which shows each degree from 3 degrees before TDC to 3 degrees after TDC. When the timing light is used, it then shows exactly where the spark occurs and if the engine had an original spark timing which was not 8 degrees before TDC, then the scale shows immediately how much further the TDI needs to be moved to set the spark exactly where you want it to occur.

The Cold Water Mist.

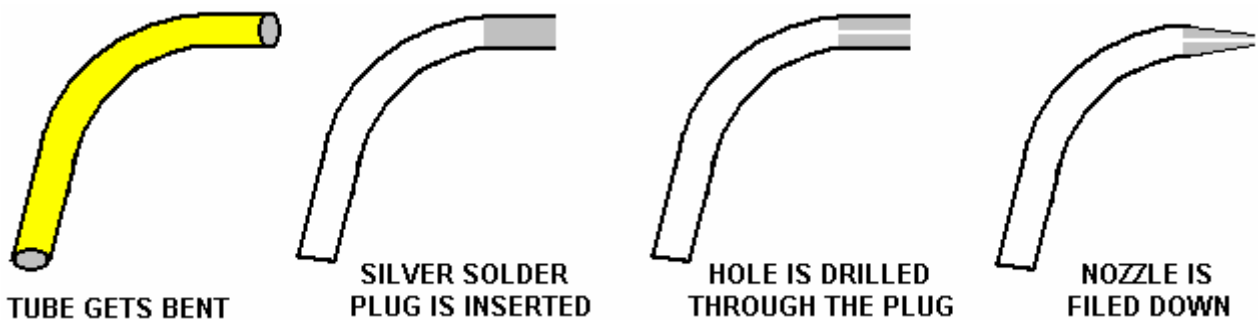
Getting the fine droplets of water into the engine can be done two different ways. The first way is to use a Venturi tube which generates a fine spray of droplets when air moves rapidly past a small water-filled hole. You may not have noticed, but this method has been used extensively in perfume sprays and it is very effective. Selwyn describes how he constructs a Venturi tube:

A short length of 1/4" (5 or 6 mm) diameter copper tubing is used. This is generally available as central heating supplies and if there is any difficulty in finding some, then your local garage can probably direct you to a supplier (if they don't just give you a short length from their own supply).

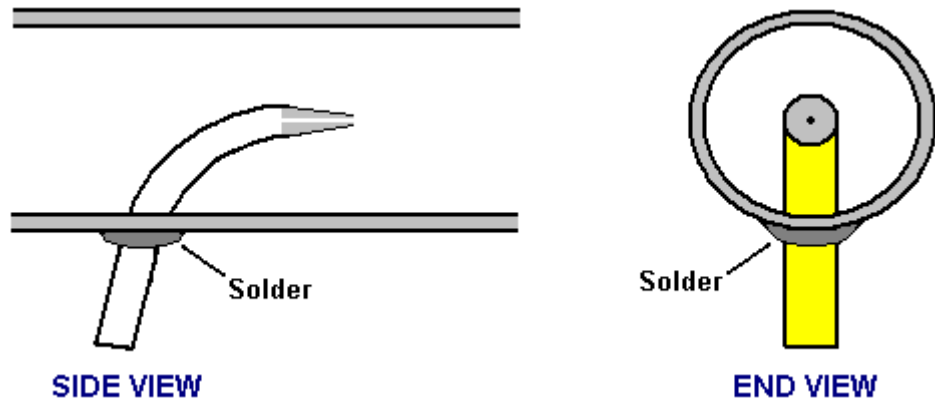


The copper pipe is then heated with a plumber's gas torch and bent very slowly and carefully to the shape shown above. Some people find it helpful to insert a length of suitable flexible material into the pipe before starting the bending – something like the coiled steel spring material used to support net curtains – as that helps to keep the copper pipe from kinking when being bent.

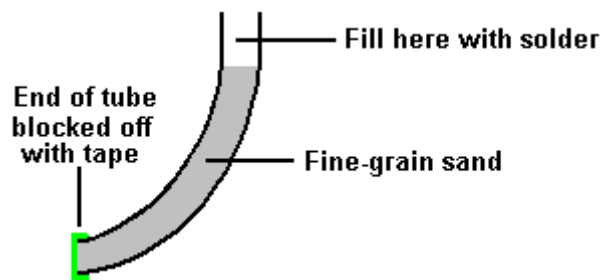
Next, the end of the copper pipe is filled with silver solder and the end filed flat. Then, a small hole is drilled through that silver solder plug. The smallest possible drill bit should be used for this, although the hole may need to be drilled out to a slightly larger diameter, depending on what the engine requires (which is found by successive trials):



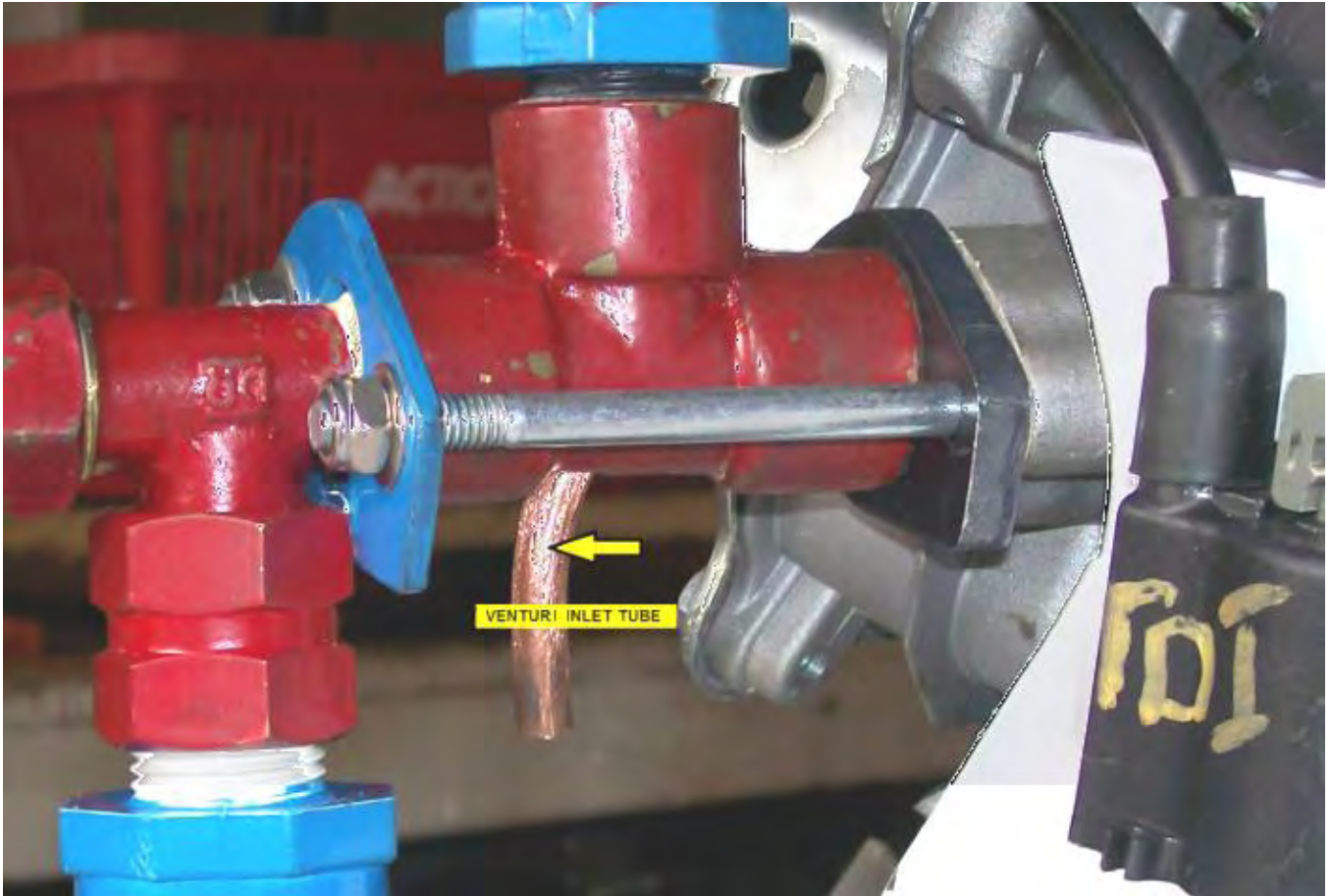
This Venturi tube is to be inserted into the last brass fitting before the engine, so a 1/4" hole is drilled through the brass and then the drill is removed very slowly at a slight angle, the angle of drag being down the axis length of the brass fitting. The copper Venturi tube is then inserted through the hole and positioned so that the Venturi hole is aligned up exactly with the centreline of the brass fitting and positioned exactly in the middle of the cross-section of the brass fitting and then soldered in place:



The method which Selwyn uses to block off the end of the copper tube with silver solder is to seal the far end of the tube with tape and fill the tube with fine-grained sand like this:



And then the tube is heated with the gas torch flame and the solder run into the top part of the tube. When the solder has cooled, the tape is removed and the sand removed by tapping the tube. When the hole has been drilled through the solder, air is blown through it to dislodge any remaining sand, and then water is forced through the hole. As the tube is short, any remaining sand can be removed with a pipe-cleaner or any similar slender cleaning device. The installed Venturi tube can be seen here:



The second way to introduce cold water mist into the airstream entering the engine is to use a commercial “pond fogger” which can be bought at pet supplies outlets. These have to be powered electrically and housed in their own water container. Some of the more advanced versions float on the surface of the water so that the fog-generating section is always submerged to the ideal operational depth below the surface of the water.

The generator should run well with 5 lpm of HHO gas plus cold water mist. Any design of electrolyser can be used. However, when used with rainwater, the Hogg electrolyser will draw about 1.4 amps per cell, giving a total input of about 115 watts when run on a 12-volt electrical supply. While rainwater is supposedly pure, the reality is that it seldom is and it's ability to carry a current varies dramatically from place to place and even more widely from country to country. However, regarding the water, Selwyn says:

The water I use is treated in a special way to make sure that the electrolyser runs at the lowest temperature and amperage possible. For this, using rain water is a must and the rain water coming off a steel roof is the best.

The water is then treated by inserting a double coil of stainless steel wire into a volume of about 5 litres of water. A supply of 12-volts DC is applied to the coils, and the resulting current allowed to run through the coils for about 5 hours. This results in hot and very dirty water. The water is then filtered using a 0.5 micron filter making the water ready for use in the electrolyser. If more water is needed, say 30 litres, then leave the coils running for at least 24 hours.

I use an old 35 litre beer keg and prepare 30 litres at a time. A major reason for doing this is to remove all the solids suspended in the water so that they will not clog up the stainless steel mesh inside the electrolyser.

After the construction of the Hogg electrolyser is completed, then the stainless steel mesh electrodes need to be treated and cleaned. For this I use distilled water and fill the electrolyser enough to cover all the plates, and then add 1 packet of citric acid for each 3 litres of water used to fill the electrolyser. I got the citric acid from www.hho-research.com.au which is an Australia-only supplier and each packet has about 22 grams of citric acid in it:



The pumps are then run for about an hour after which the Hogg tubes are washed out completely with distilled water and then allowed to dry completely. This removes any residue from the stainless steel mesh electrodes, making the gas production rate much greater.

I use an ordinary car battery to generate the HHO gas needed to start the generator running, after which, a standard battery charger powered by the generator output is used to keep the starting battery topped up.

Please Note: This document has been prepared for information purposes only and must not be construed as an encouragement to build any new device nor to adapt any existing device. If you undertake any kind of construction work, then you do so entirely at your own risk. You, and only you, are responsible for your own actions. This document must not be seen as an endorsement of this kind of generator adaption nor as providing any kind of guarantee that an adaption of this kind would work for you personally. This document merely describes what has been achieved by other people and you must not consider it as being a foolproof blueprint for replication by anyone else.

There are YouTube videos which show generators being operated on what appears to be just HHO gas alone and while the operation does not appear to be anywhere close to full power, the addition of cold water mist would probably make a major difference to the performance, but it does demonstrate that a generator can certainly be run without using any fossil fuel. The spark circuit in the first video appears to be powered by a small mains unit, but as the generator is lighting a powerful lamp, that electrical input could almost certainly be met by the output from the generator when it is running.

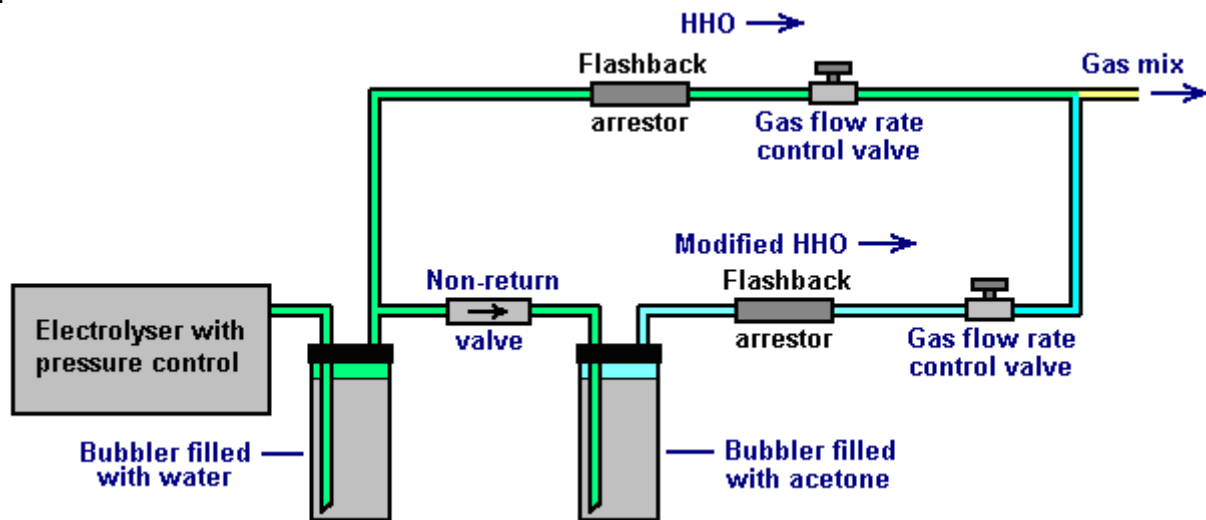
Running an Unmodified Generator on HHO

The reason for the modification of standard generators as shown above is due to the fact that the HHO gas mix produced by an electrolyser, ignites about a thousand times faster than a hydrocarbon fuel, and because of that, the spark which ignites the fuel needs to be delayed. That mechanical adaption of the generator can be avoided if the HHO gas mix is modified so that it ignites more slowly. This can, and has been done.

David Quirey of New Zealand has been operating an unmodified generator and a welding torch on the HHO output from his 6 lpm own-design of electrolyser, for many years now. Henry Paine's US Letters Patent No. 308,276 dated 18th November 1884, states that HHO gas can be converted into a more convenient gas which is much easier to handle, by the simple process of bubbling it through a suitable liquid such as turpentine or linseed oil. Although unaware of Henry Paine's patent, David discovered the technique independently and he has extended the technology further so that the gas ignition speed can be set manually.

One important point which David stresses is that it is essential that the HHO coming from the electrolyser is passed through an ordinary bubbler containing water, before it passes through the second bubbler containing the modifying liquid. David finds that the lighter liquid, acetone, works better than the liquids suggested by Henry Paine although white spirit, carbon tetrafluoride, aviation fuel, hexane or even petrol can be used and any of them will slow the flame speed right down to that of butane. If the flame is being used for a specialist task such as jewellery making or glass blowing, then there may be an advantage in using one particular modifying liquid. Please note that the bubbler holding the acetone needs to be made of stainless steel as acetone can dissolve some plastics.

David has further modified the characteristics of the output gas by adding in a percentage of the unmodified HHO gas. Although it is actually, subtle and sophisticated, David's overall system is easy to understand. The ratio of the two gasses is adjusted by the settings of the two control valves as shown here:



Adjusting the ratio of modified HHO to unmodified HHO allows a high degree of control over the characteristics of the resulting gas mix. Added to that, David has developed an electronic control system which oversees and manages the gas flow rate according to the user's needs at any given moment. The result is a system which allows water and electricity to be the means of supplying a gas which can be used as a safe, general purpose fuel. If it is used to run a generator, then the system appears to become self-powered if part of the generator output is used to drive the electrolyser. It should be possible to substitute the modified gas mix for propane or butane and so operate a wide range of existing equipment for heating, cooking and/or lighting.

David runs a 4 horsepower Honda generator using this system:



The generator runs very well for David, however, I suspect that if cold water mist were introduced into the incoming air, then the power output would be increased due to the mist turning into flash-steam and providing greater pressure on the piston during it's power stroke. Alternatively, it might be possible to match the present performance with a lesser gas flow rate, possibly powering a much larger generator if that were a requirement.

It needs to be understood that David uses electronics which manages and controls the gas flow volume, suiting it to whatever the needs are at any given moment. Consequently, it is probable that the six litres per minute which David's electrolyser can produce, is not actually used for most of the time. David also does welding, brazing and cutting with the same modified electrolyser gas mix which can provide adjustable flame heat and a flame length of anything up to two feet in length:

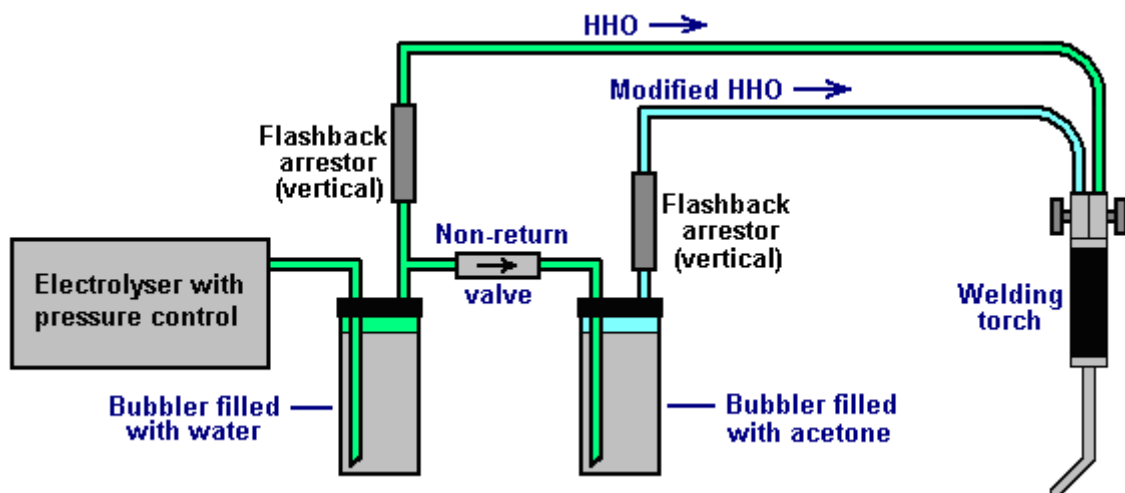


It is a good idea to use a proven design with full control electronics. David can help here with detailed step by step construction plans and instructional videos.

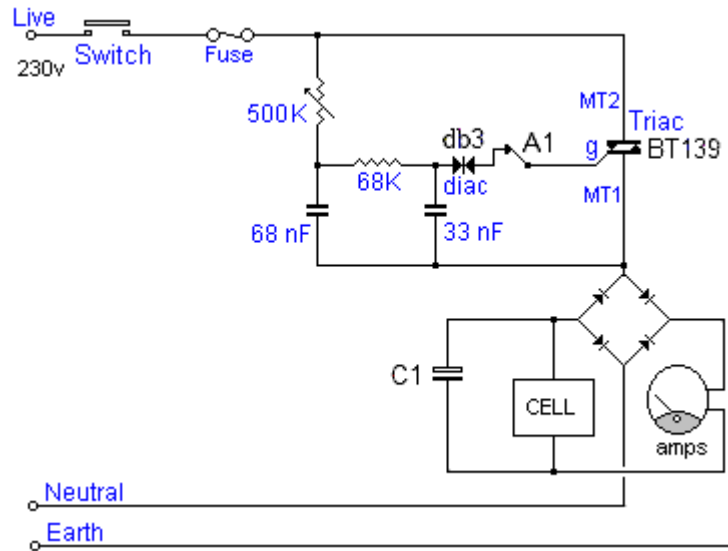


You can contact David at dahq@clear.net.nz for information on what is available to help you at the present time.

When using the system for welding, David uses the mains to power the electrolyser, the arrangement being like this:



The flashback arrestors are a sand-filled design and so are mounted vertically. The gas production rate is knob controlled using this circuit:

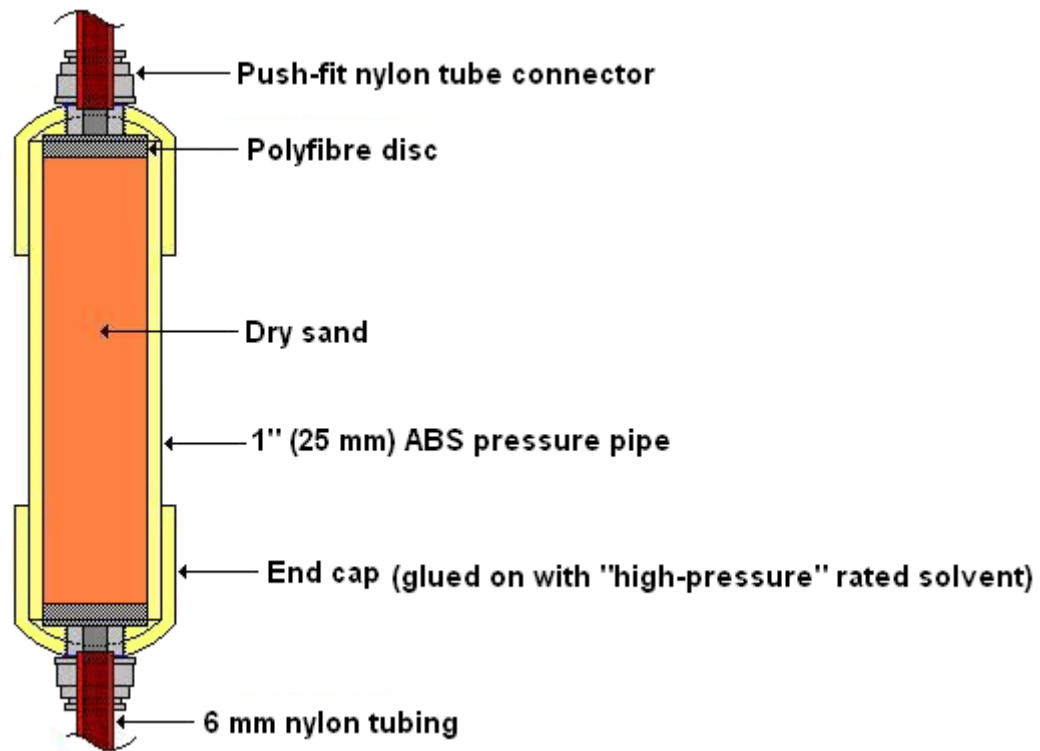


The first part of David Quirey's circuit acts very much like a dimmer light switch. The 230-volt AC mains is fed through an On/Off switch and then an ordinary mains fuse. The current flow on through the circuit is blocked by the BT139 triac until it receives a pulse from the db3 diac (which is a component specifically designed to feed pulses to a triac).

As the voltage builds up on the 68 nanofarad capacitor it eventually reaches the point at which it triggers the triac, which then switches on and remains on until the mains voltage drops down to zero again. The 500K variable resistor sets the rate at which the capacitor charges up, and so it controls the length of time that the triac is on in any given second (and so, the level of power fed onwards to the rest of the circuit). This happens on both the positive-going half of the AC waveform and the negative-going half of the mains sinewave voltage supply. Both the diac and the triac operate with AC and trigger either 100 or 120 times per second depending on the frequency at which the local mains runs.

The current flow is then passed to a bridge rectifier in order to convert the AC into pulsing DC and the capacitor C1 which is 400-volt rated, smoothes the resulting DC. David's cell has a large number of plates and so, operates off the 300 volts produced by this system. The ammeter between the diode bridge and the cell indicates the current flow and so, the amount of gas being produced at any given moment.

The flashback arrestors are constructed as shown here:



Sincere thanks are due to David Quirey for freely sharing his design and experiences.

Patrick J Kelly
www.free-energy-info.co.uk

Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 18: Clemente Figuera’s Generator

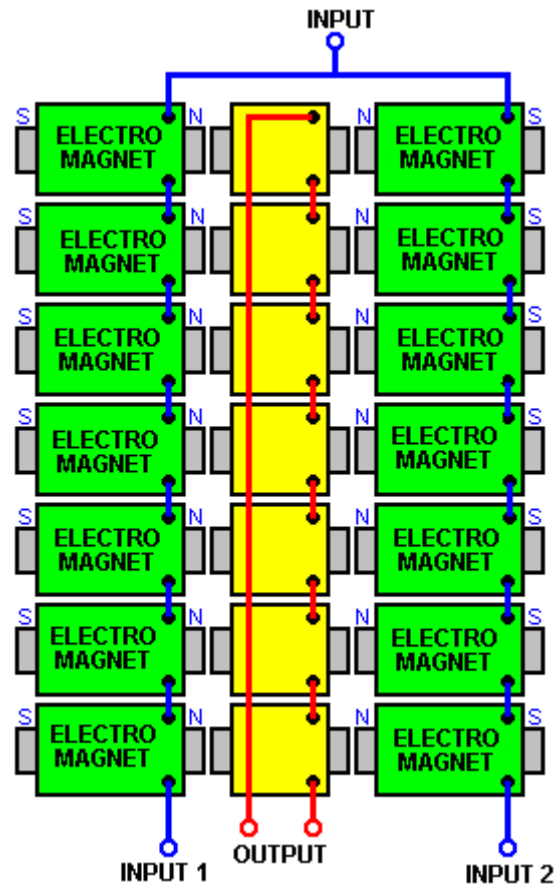
In 2012 a contributor who uses the ID ‘Wonju-Bajac’ started a forum to investigate the work of Clemente Figuera at <http://www.overunity.com/12794/re-inventing-the-wheel-part1-clemente-figuera-the-infinite-energy-achine/#.UXu9gzcQHqU> and member ‘hanlon1492’ contributed enormously by producing English translations of Figuera’s patents.

Clemente Figuera of the Canary Islands died in 1908. He was a highly respected individual, an Engineer and University Professor. He was granted several patents and was known to Nikola Tesla. Figuera's design is very simple in outline.

In 1902 the Daily Mail announced that [Mr. Figuera, a Forestry Engineer in the Canary Islands, and for many years Professor of Physics at St. Augustine’s College, Las Palmas, had invented a generator which required no fuel. Señor Figuera has constructed a rough apparatus by which, in spite of it’s small size and it’s defects, he obtains 550 volts, which he utilises in his own house for lighting purposes and for driving a 20 horse-power motor.](#)

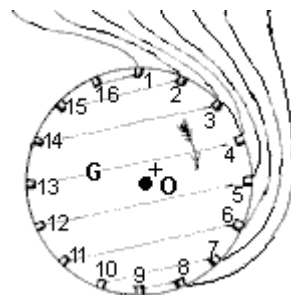
The Figuera Device looks like a complicated transformer, but in fact, it isn’t. Instead, it is two sets of seven opposing electromagnets with an output coil positioned between each opposing pair of electromagnets. The physical position of the electromagnets and output coils is important as they are positioned very close to each other and there are induced magnetic fields between adjacent electromagnets and between the output coils due to their close proximity.

The two sets of electromagnets are wound with very low-resistance, high-current wire or possibly, even with thick foil. The information given in the Figuera patent states that the electromagnets will be referred to in the patent by the letters “N” and “S” and it is now thought that those two letters are deliberately misleading as people tend to think of those letters referring to “North magnetic pole” and “South magnetic pole” while in reality, the electromagnets almost certainly oppose each other, that is, with North poles facing each other or possibly, with South poles facing each other. The arrangement is believed to be like this when seen from above:



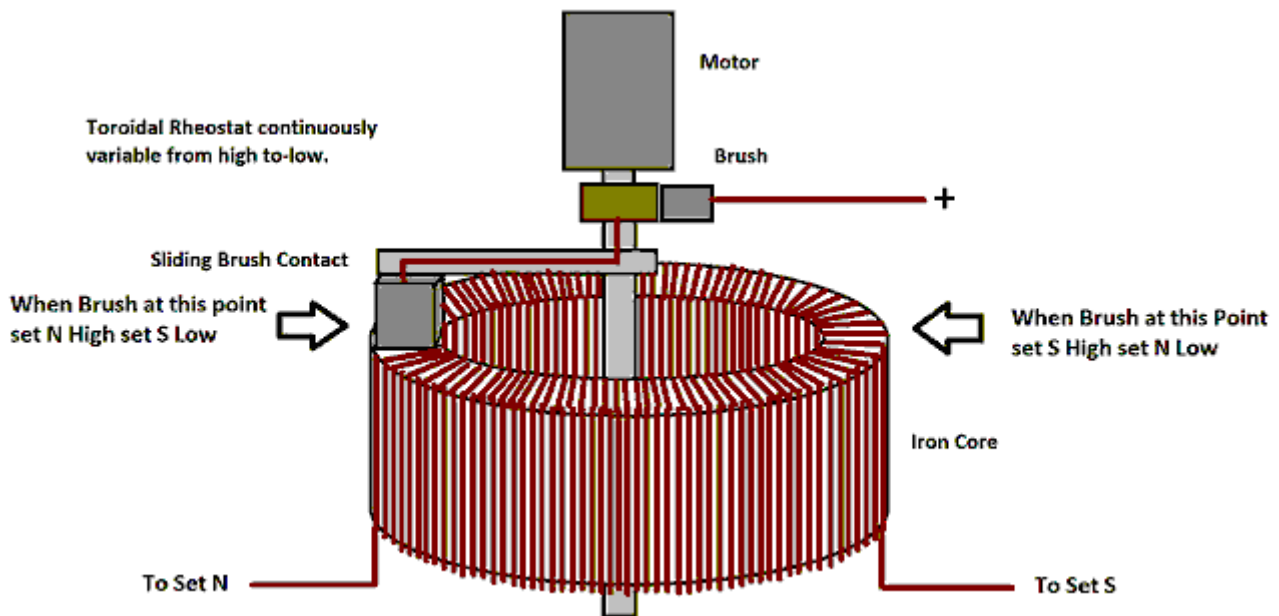
This arrangement creates a magnetic Bloch wall (or magnetically null point) in the centre of the yellow output coils and the position of that magnetic balance point is very easily moved if the power supply to the two sets of electromagnets is altered slightly and any movement of that magnetic balance point creates a substantial electrical output due to the alteration of the magnetic lines cutting the turns of wire in the yellow output coils. While the sketch shown above indicates a small gap between the electromagnets and the output coils, it is by no means certain that any such gap is needed and while winding the three coils is more convenient if they are separate, when wound and being assembled, their cores may well be pushed together to form one continuous magnetic path.

Another thing which has confused people (including me), is the drawing in the patent which looks like an electrical commutator, but which is **not** part of the Figuera generator design. It looks like this:

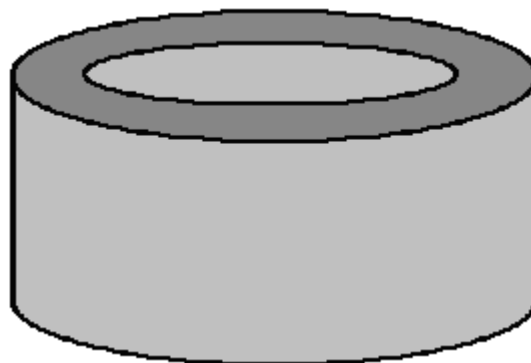


The dotted lines indicate internal electrical connections, so for example, contact 14 is connected to contact 3, but let me stress again that this unit is **not** part of the design and while it is used to “explain” the actual operation, I would not be surprised if it were not intended to misdirect people from the actual operation.

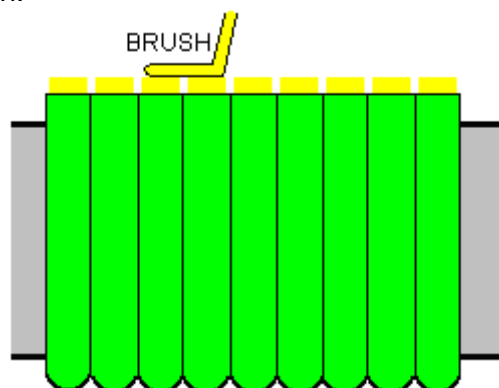
This point has been stressed and it has been suggested that the actual working device is magnetic in nature and could be constructed like this:



This looks like a very simple device but it is an item of major importance in the Figuera design. First, the core is solid iron (sometimes called “soft iron” but if you were beaten with a bar of it you certainly wouldn’t call it “soft”). The most important characteristic of such a core is its magnetic properties as it is able to store energy. Please remember that this switching device is primarily magnetic in nature. It looks like this:



This core is then wound with thick wire – perhaps AWG #10 or 12 SWG (2.3 x 2.3 mm square wire) . The turns of wire should be tight, side by side and sit exactly flat on the top surface as the wire there will be contacted by the sliding brush:



The sliding brass contact or “brush” is dimensioned so that it connects across two adjacent wires so that there is never any sparking as the brush contact slides around the circle of wires. The brush is driven by a small DC motor. In order for the sliding brush to contact the wire, the plastic insulation needs to be removed from the top half of the wire with the remaining insulation keeping the turns from

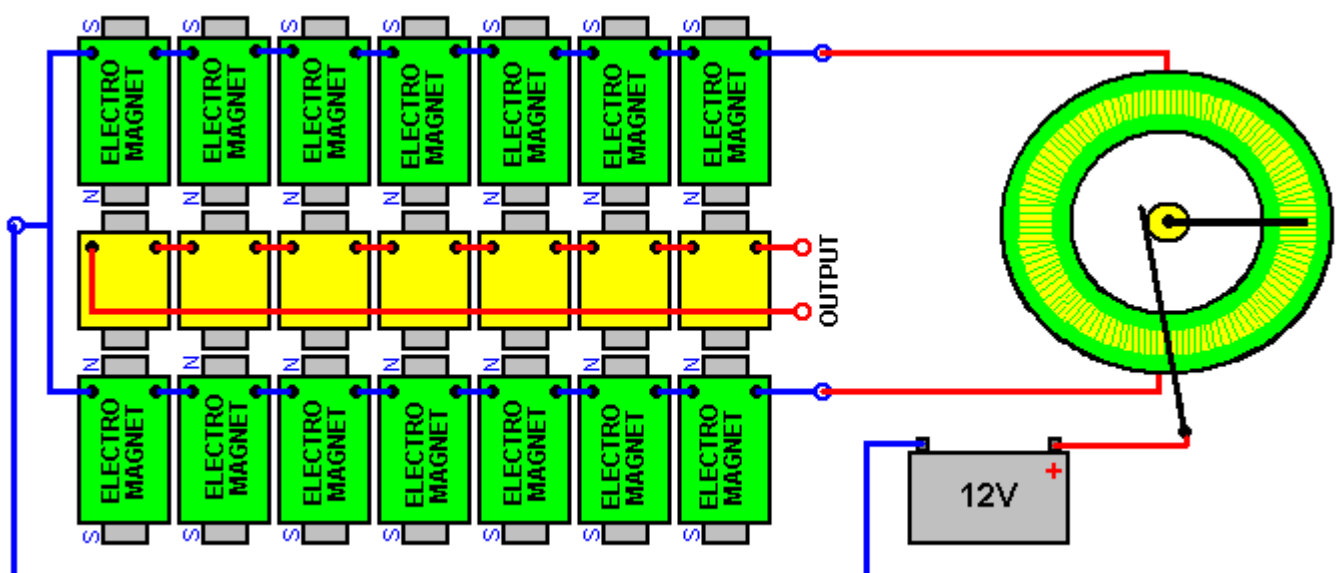
short-circuiting together. The wire is wound half of the way around the iron core and a short length of wire is left to make an electrical connection. An additional winding is then made to cover the remaining half of the core and again, a length for connection is left before cutting the wire. This gives you two windings each covering 180 degrees around the core. The wire turns are strapped tightly with tape or cord wound around the side of the core as that holds the wires securely in place. The two wire ends on each side are connected together, giving a 360 degree winding with good electrical connections 180 degrees apart.

There are many ways to arrange the small DC motor so that it drives the brush slider. The motor could be mounted on a strip passing over the core, or on the baseboard, or to one side using a belt or gearwheel drive link. It does not matter which direction the brush moves around the core. The speed of rotation is not critical either although it does determine the alternating frequency of the output. In most cases, the output will power a heating element or will be converted to DC to give the local mains frequency and voltage.

When we first look at a device like this, we immediately think of the flow of electric current passing through the wire wound around the iron core. It appears as if the current is limited by the overall length of the wire between the brush position and the two outputs, but the reality is that while that is correct to a certain extent, the main control of the current flow is the magnetic field inside the circular iron core, and that field causes reluctance (resistance to current flow) proportional to the number of coil turns between the brush and each output. This alters the current flow to the set of "N" electromagnets compared to the current flow to the set of "S" electromagnets.

As the magnetic intensity generated by the set of "N" electromagnets increases, the magnetic intensity generated by the set of "S" electromagnets decreases. But, as the magnetic power of the set of "N" electromagnets overcomes the magnetic field of the set of "S" electromagnets, that magnetic field gets pushed back into the soft iron core of the commutator device, essentially storing energy in that core. When the system needs to replace the energy lost in heating, it can use that stored magnetic energy in the commutator core, raising the overall efficiency. In this design, the current flowing through the electromagnets is always in the same direction and never drops to zero, merely oscillating in its intensity.

The overall arrangement is like this:



While the sketch above shows a 12-volt battery, there is no great reason why it should not be 24-volt or higher, especially if the wire used to wind the electromagnets is smaller diameter. The amount of power needed to create a magnetic field is not related to strength of the magnetic field and a larger number of turns of thinner wire with a small current flowing through the wire can create a stronger magnetic field than few turns of thick wire with a large current flowing through those turns, however the effects of those different coils is quite marked.

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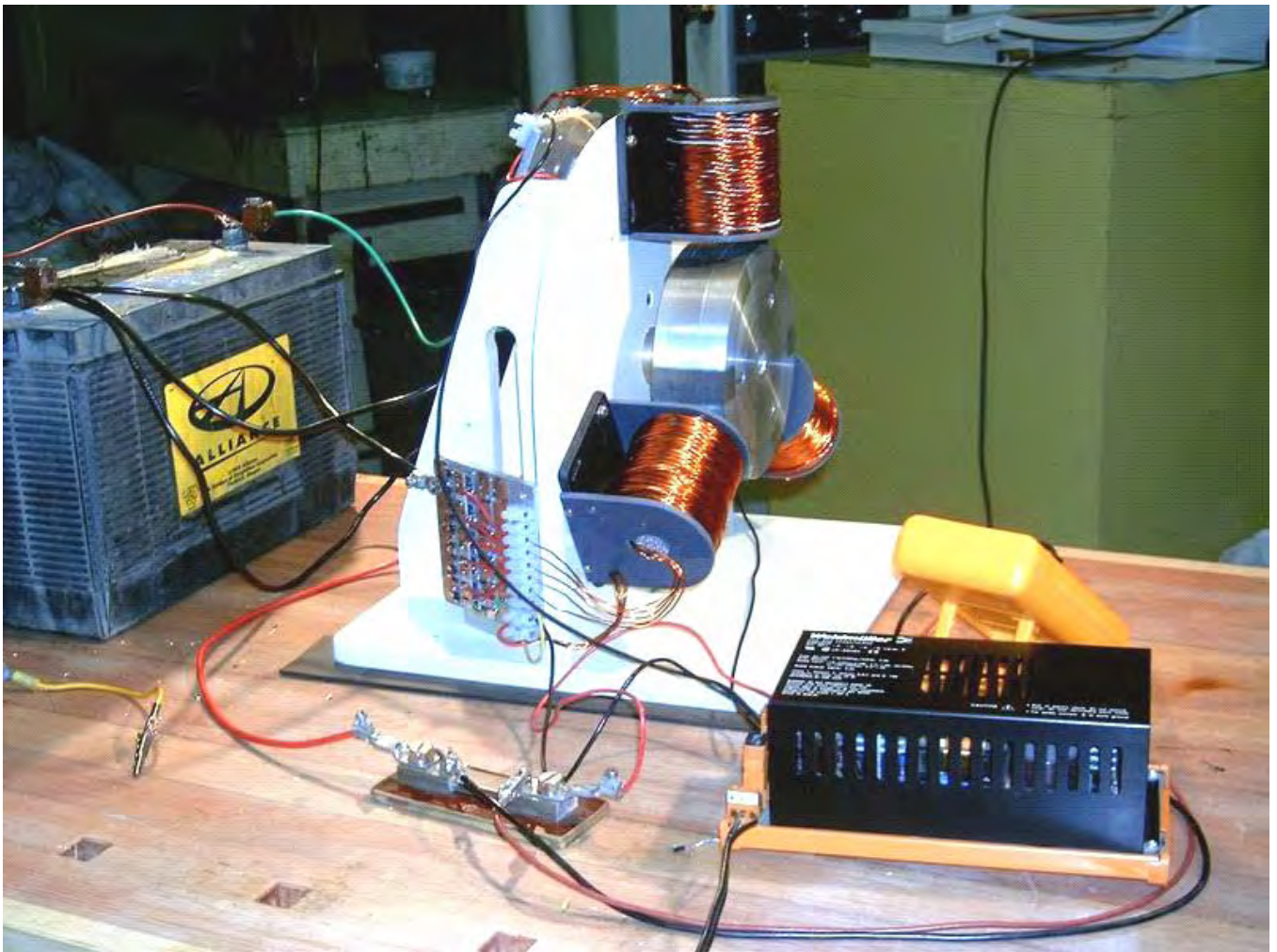
Simple Free-Energy Devices

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Chapter 19: Ron Pugh's Battery Charger

John Bedini's designs have been experimented with and developed by a number of enthusiasts. This in no way detracts from fact that the whole system and concepts come from John and I should like to express my sincere thanks to John for his most generous sharing of his systems. Thanks is also due to Ron Pugh of Canada who has kindly agreed for the details of one of his Bedini generators to be presented here. Let me stress again, that if you decide to build and use one of these devices, you do so entirely at your own risk and no responsibility for your actions rests with John Bedini, Ron Pugh or anyone else. Let me stress again that this document is provided for information purposes only and is not a recommendation or encouragement for you to build a similar device.

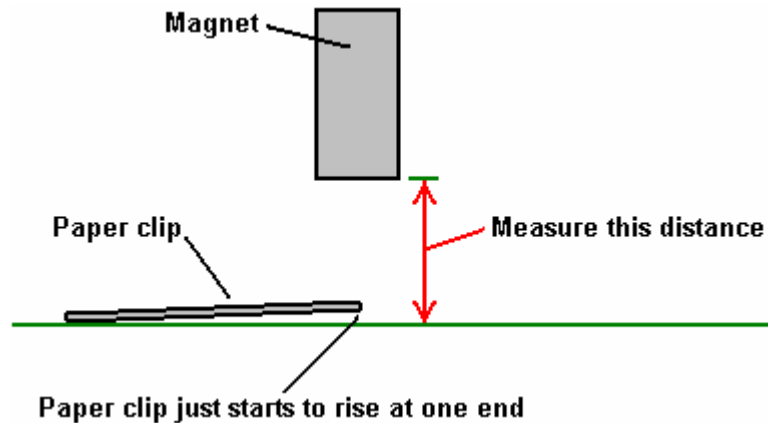
Ron's device is much more powerful than the average system, having fifteen coil windings and it performs most impressively. Here is a picture of it rotating at high speed:



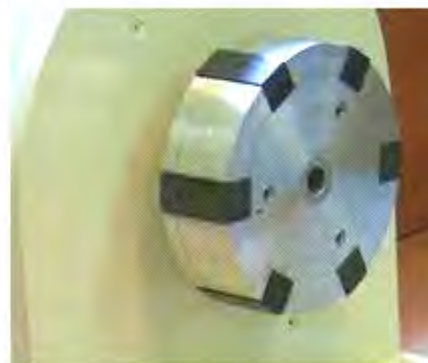
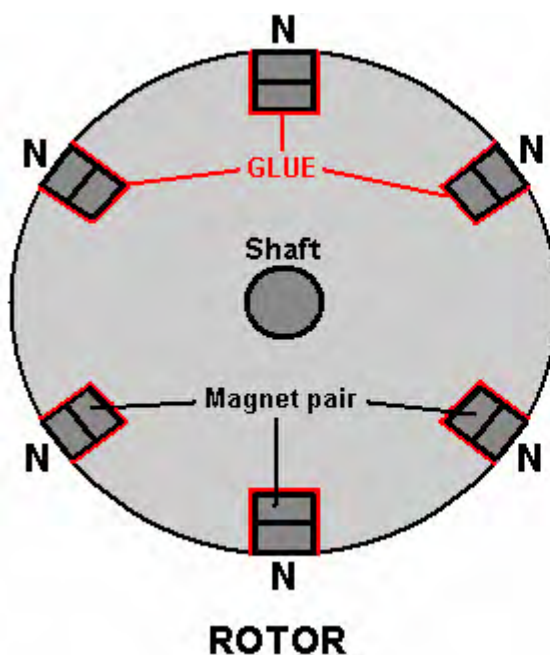
This is not a toy. It draws significant current and produces substantial charging rates. This is how Ron chose to build his device. The rotor is constructed from aluminium discs which were to hand but he would have chosen aluminium for the rotor if starting from scratch as his experience indicates that it is a

very suitable material for the rotor. Aluminium has a highly dampening effect on magnetic fields. The rotor has six magnets inserted in it. These are evenly spaced 60 degrees apart with the North poles all facing outwards.

The magnets are normal ceramic types about 22 mm wide, 47 mm long and 10 mm high. Ron uses two of these in each of his six rotor slots. He bought several spare ones and then graded all of them in order of their magnetic strength, which varies a bit from magnet to magnet. Ron did this grading using a gauss meter. An alternative method would have been to use a paper clip about 30 mm in size and measure the distance at which one end of the clip just starts to rise up off the table as the magnet is moved towards it:

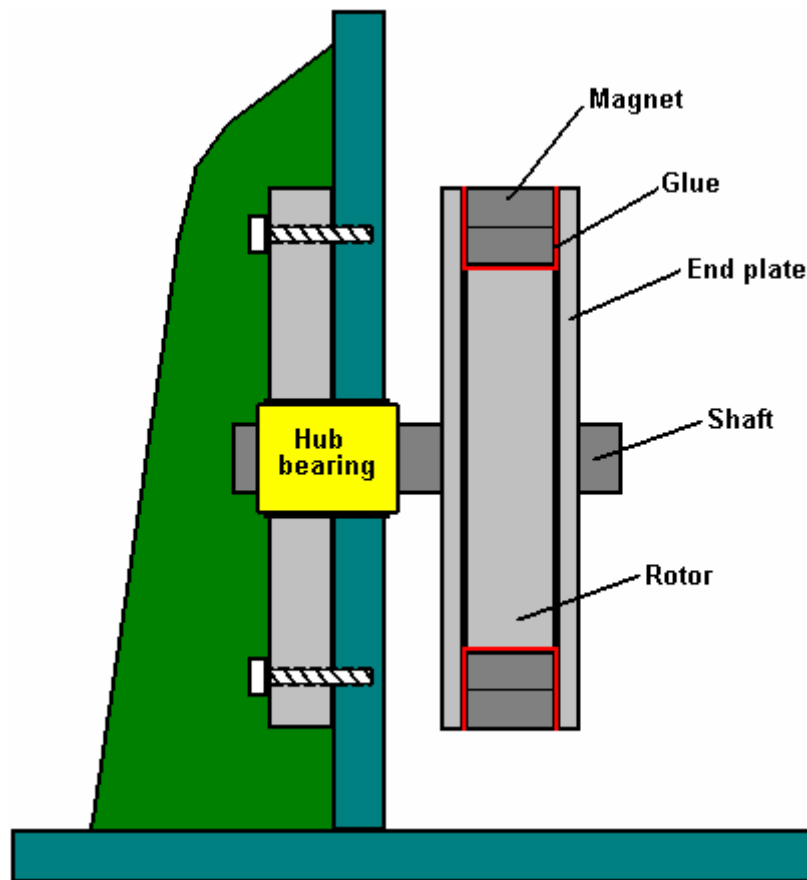


Having graded the magnets in order of strength, Ron then took the best twelve and paired them off, placing the weakest and strongest together, the second weakest and the second strongest, and so on. This produced six pairs which have fairly closely matching magnetic strengths. The pairs of magnets were then glued in place in the rotor using super glue:



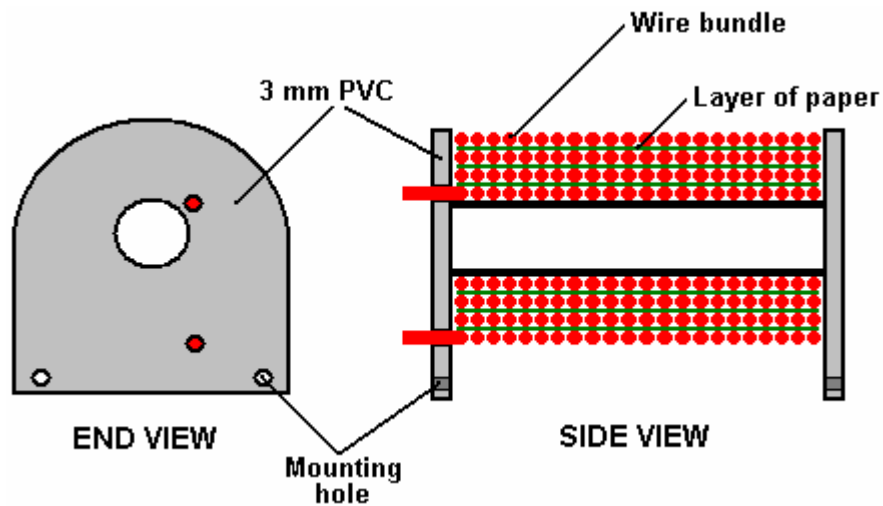
It is not desirable to recess the magnets though it is possible to place a restraining layer around the circumference of the rotor as the clearance between the magnet faces and the coils is about a quarter of an inch (6 mm) when adjusted for optimum performance. The North poles of the magnets face

outwards as shown in the diagram above. If desired, the attachment of the magnets can be strengthened by the addition of blank side plates to the rotor which allows the magnet gluing to be implemented on five of the six faces of the magnet pairs:

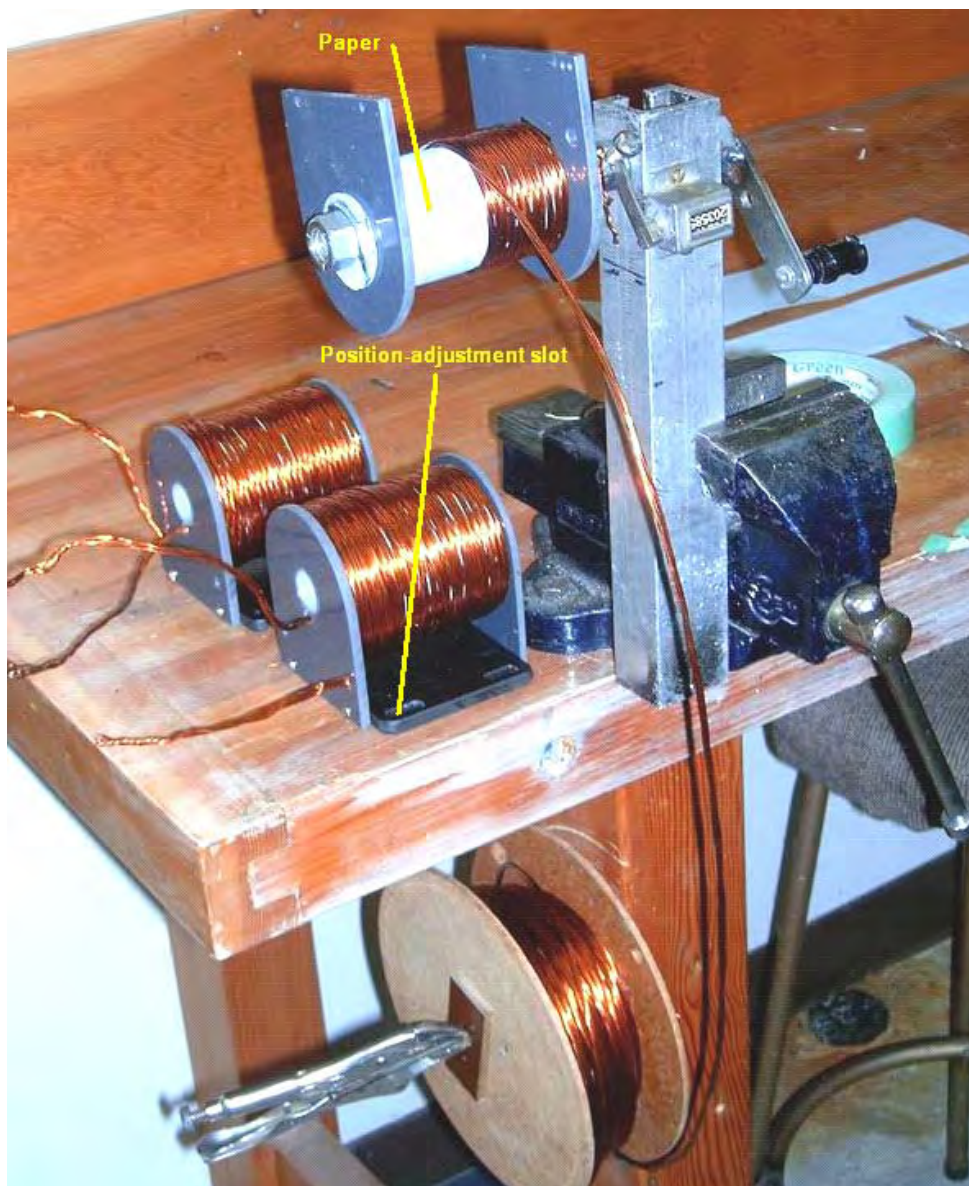


The magnets embedded in the outer edge of the rotor are acted on by wound “coils” which act as 1:1 transformers, electromagnets, and pickup coils. There are three of these “coils”, each being about 3 inches long and wound with five strands of #19 AWG (20 SWG) wire of 0.91 mm diameter. The coil formers were made from plastic pipe of 7/8 inch (22 mm) outer diameter which Ron drilled out to an inner diameter of 3/4 inch (19 mm) which gives a wall thickness of 1/16 inch (1.5 mm). The end pieces for the coil formers were made from 1/8 inch (3 mm) PVC which was fixed to the plastic tube using plumbers PVC glue. The coil winding was with the five wires twisted around each other. This was done by clamping the ends of the five wires together at each end to form one 120 foot long bundle.

The bundle of wires was then stretched out and kept clear of the ground by passing it through openings in a set of patio chairs. A battery-powered drill was attached to one end and operated until the wires were loosely twisted together. This tends to twist the ends of the wires together to a greater extent near the end of the bundle rather than the middle. So the procedure was repeated, twisting the other end of the bundle. It is worth remarking in passing, that the drill turns in the same direction at each end in order to keep the twists all in the same direction. The twisted bundle of wires is collected on a large-diameter reel and then used to wind one of the coils.



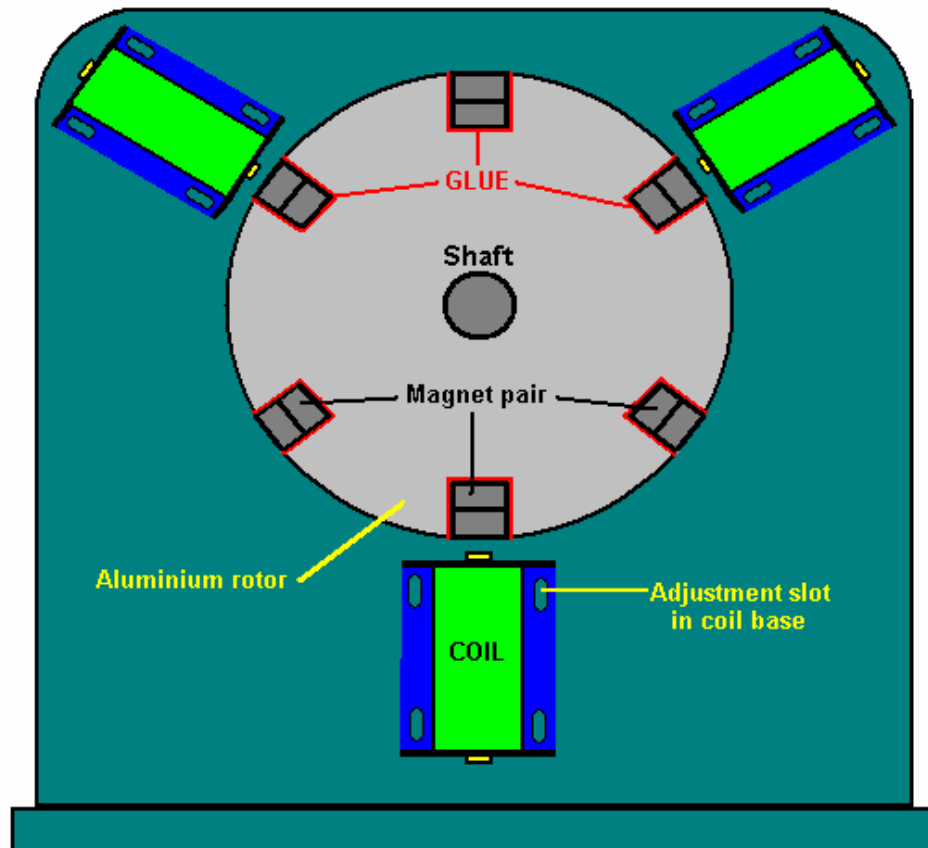
The coils are wound with the end plates attached and drilled ready to screw to their 1/4 inch (6 mm) PVC bases, which are the bolted to the 3/4 inch (18 mm) MDF supporting structure. To help the winding to remain completely even, a piece of paper is placed over each layer of the winding:



The three multi-strand coils produced in this way were then attached to the main surface of the device. There could just as easily have been six coils. The positioning is made so as to create an adjustable

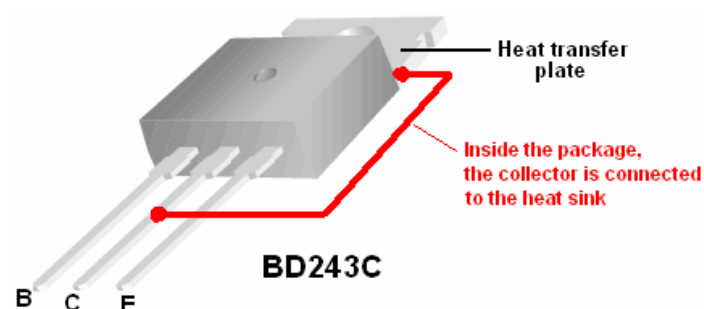
gap of about 1/4 inch (6 mm) between the coils and the rotor magnets in order to find the optimum position for magnetic interaction. The magnetic effects are magnified by the core material of the coils. This is made from lengths of oxyacetylene welding wire which is copper coated. The wire is cut to size and coated with clear shellac to prevent energy loss through eddy currents circulating inside the core.

The coils are positioned at equal intervals around the rotor and so are 120 degrees apart. The end pieces of the coil formers are bolted to a 1/4 inch (6 mm) PVC base plate which has slotted mounting holes which allow the magnetic gap to be adjusted as shown here:

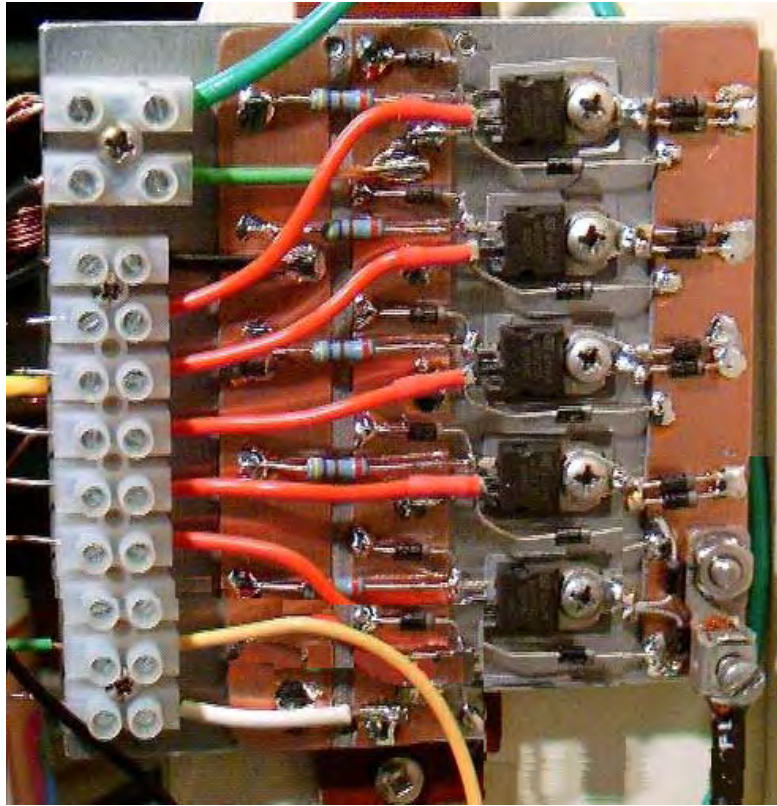


The three coils have a total of fifteen identical windings. One winding is used to sense when a rotor magnet reaches the coils during its rotation. This will, of course happen six times for each revolution of the rotor as there are six magnets in the rotor. When the trigger winding is activated by the magnet, the electronics powers up all of the remaining fourteen coils with a very sharp, pulse which has a very short rise time and a very short fall time. The sharpness and brevity of this pulse is a critical factor in drawing excess energy in from the environment and will be explained in greater detail later on. The electronic circuitry is mounted on three aluminium heat sinks, each about 100 mm square. Two of these have five BD243C NPN transistors bolted to them and the third one has four BD243C transistors mounted on it.

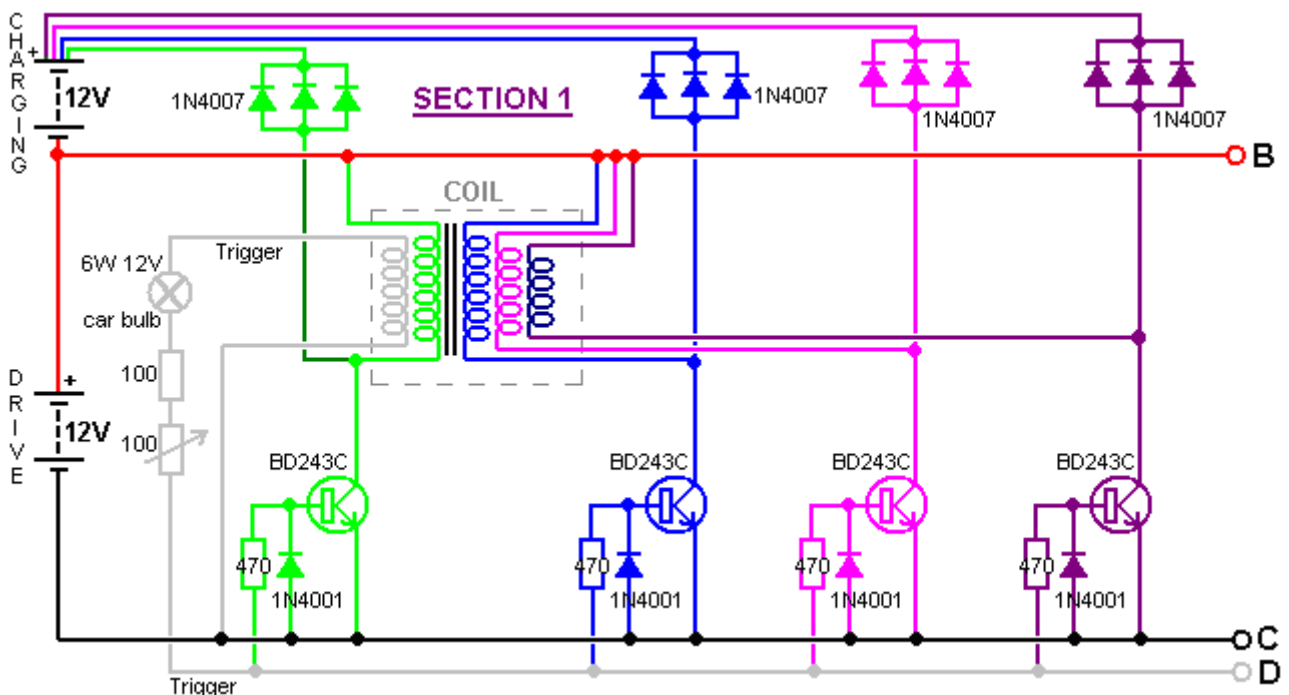
The metal mounting plate of the BD243 transistors acts as its heat sink, which is why they are all bolted to the large aluminium plate. BD243C transistors look like this:

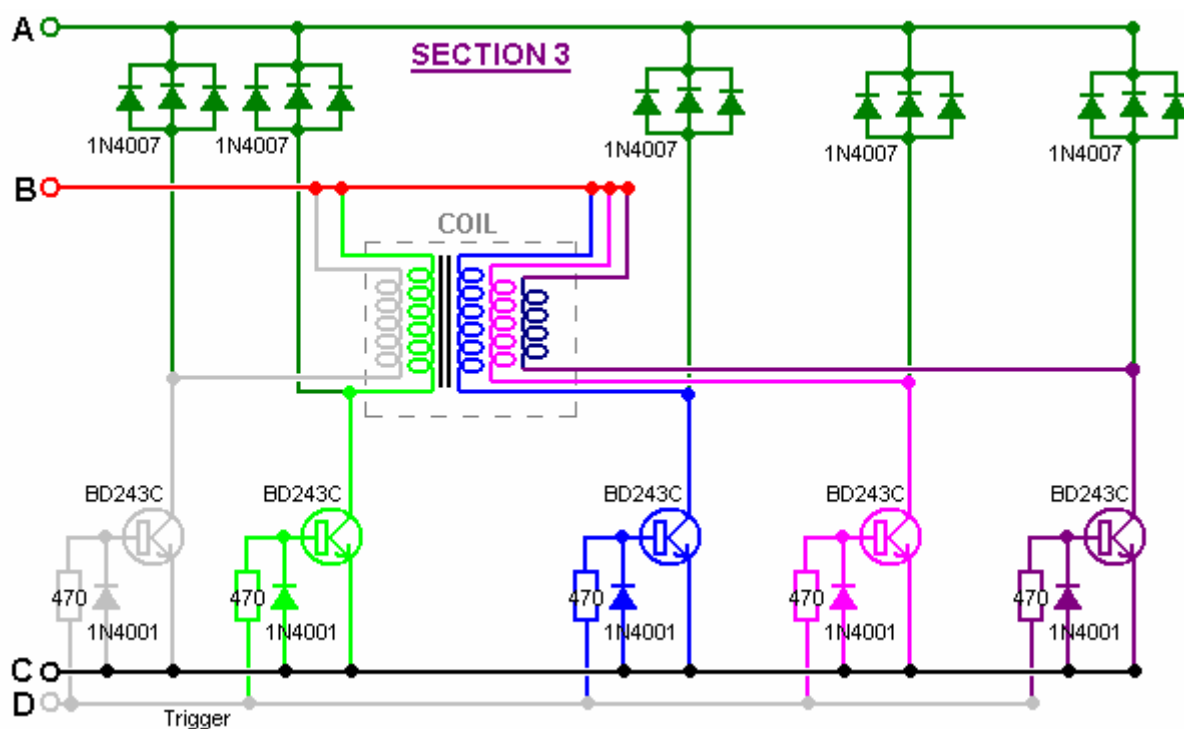
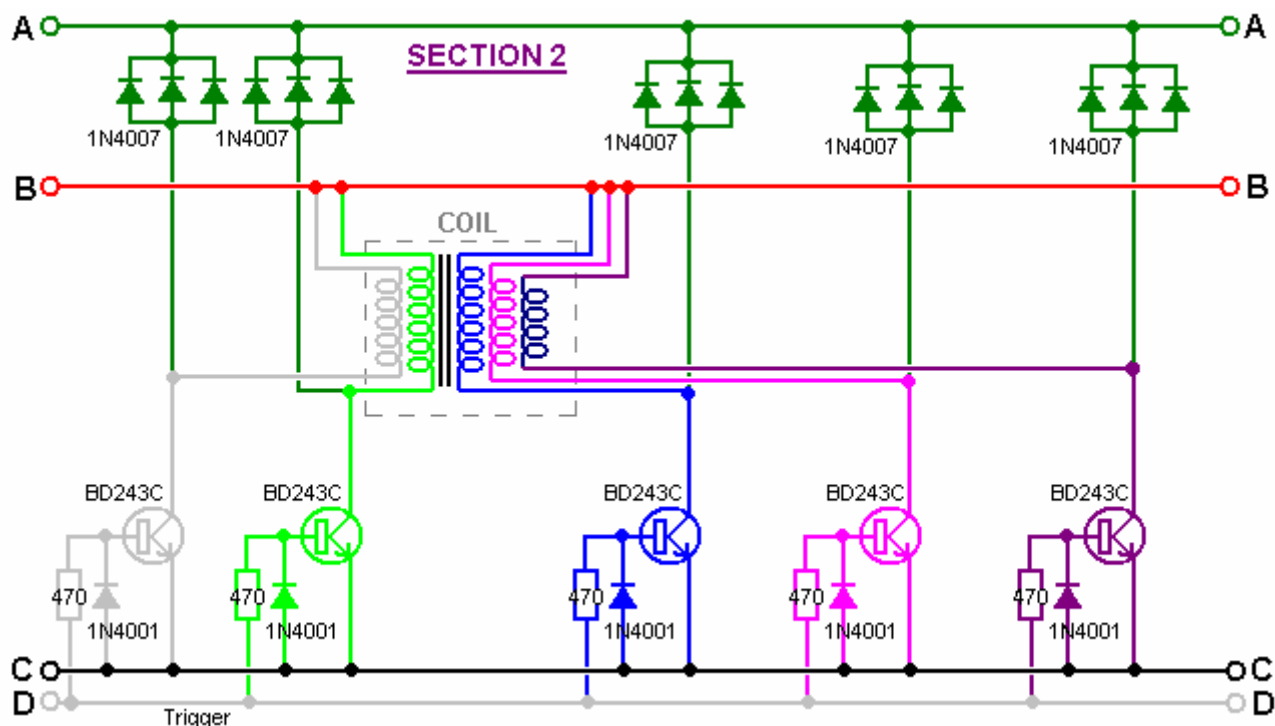


The circuit has been built on the aluminium panels so that the transistors can be bolted directly on to it, and provided with insulating strips mounted on top of it to avoid short circuits to the other components. Standard strip connector blocks have been used to inter-connect the boards which look like this:

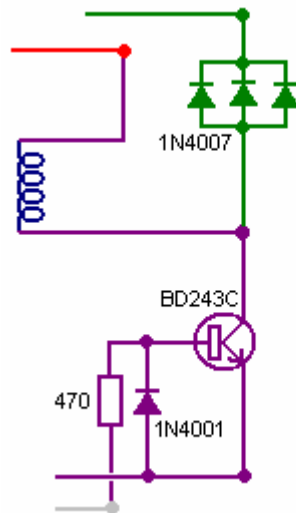


The circuit used with this device is simple but as there are so many components involved, the diagram is split into parts to fit on the page. These diagrams are usually drawn with a common charging wire going to the top of the battery which is being charged. However, it needs to be understood that drawing it that way is just for convenience and better performance is achieved if each charging circuit has its own separate wire going to the charging battery as shown in Section 1 here:



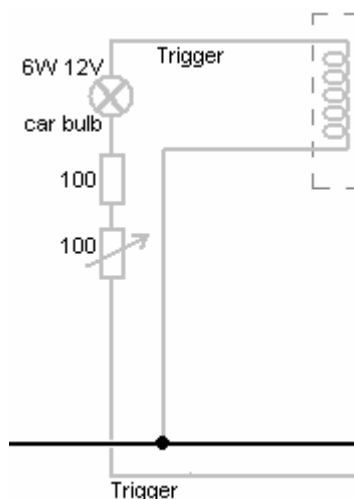


While this looks like a fairly large and complicated circuit, it actually is not. You will notice that there are fourteen identical circuit sections. Each of these is quite simple:



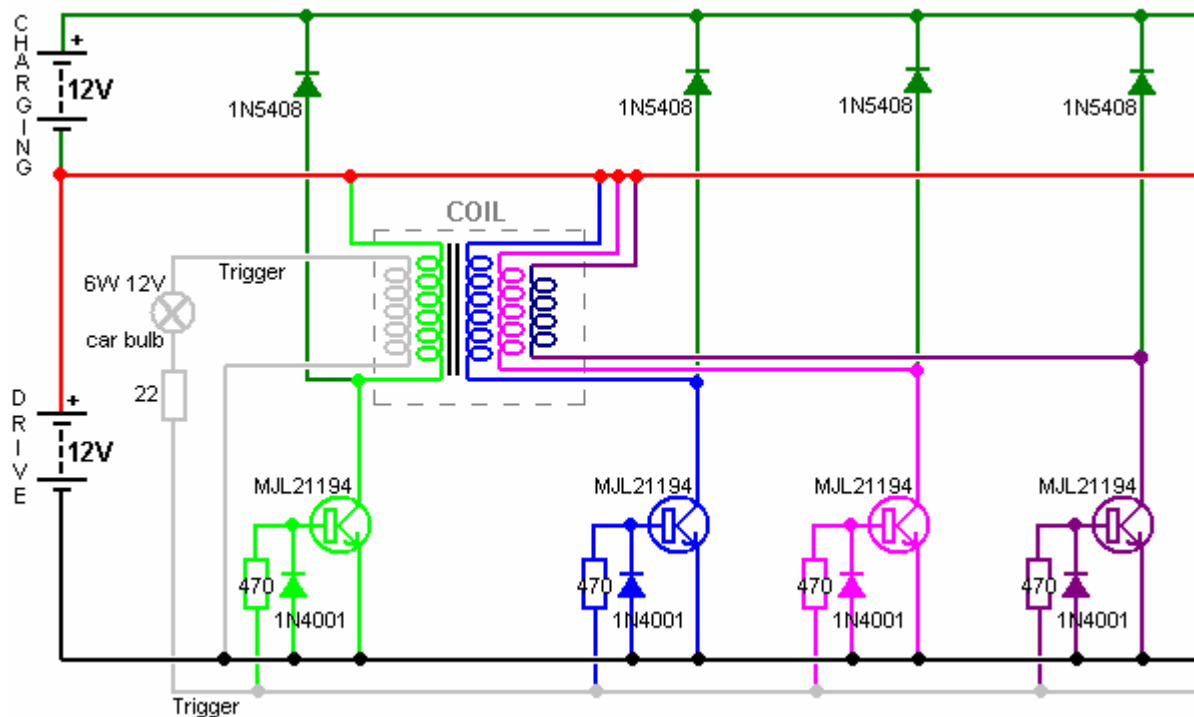
This is a very simple transistor circuit. When the trigger line goes positive (driven by the magnet passing the coil) the transistor is switched on hard, powering the coil which is then effectively connected across the driving battery. The trigger pulse is quite short, so the transistor switches off almost immediately. This is the point at which the circuit operation gets subtle. The coil characteristics are such that this sharp powering pulse and sudden cut-off cause the voltage across the coil to rise very rapidly, dragging the voltage on the collector of the transistor up to several hundred volts. Fortunately, this effect is energy drawn from the environment which is quite unlike conventional electricity, and thankfully, a good deal less damaging to the transistor. This rise in voltage, effectively “turns over” the set of three 1N4007 diodes which then conducts strongly, feeding this excess free-energy into the charging battery. Ron uses three diodes in parallel as they have a better current-carrying capacity and thermal characteristics than a single diode. This is a common practice and any number of diodes can be placed in parallel, with sometimes as many as ten being used.

The only other part of the circuit is the section which generates the trigger signal:

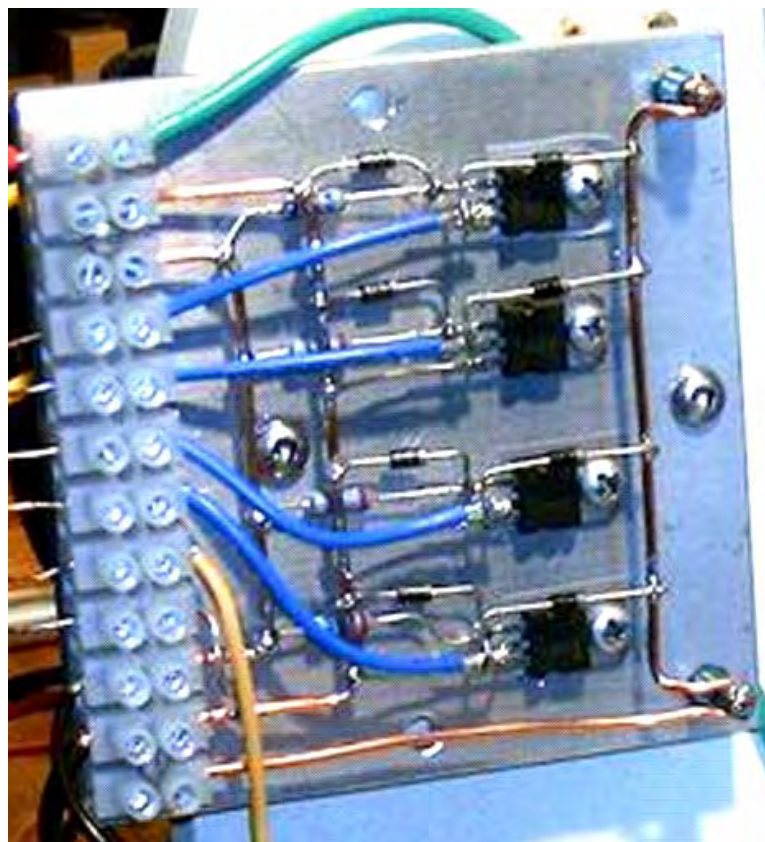


When a magnet passes the coil containing the trigger winding, it generates a voltage in the winding. The intensity of the trigger signal is controlled by passing it through an ordinary vehicle 6 watt, 12 volt bulb and then further limiting the current by making it pass through a resistor. To allow some manual control of the level of the trigger signal, the resistor is divided into a fixed resistor and a variable resistor (which many people like to call a “pot”). This variable resistor and the adjustment of the gap between the coils and the rotor are the only adjustments of the device. The bulb has more than one function. When the tuning is correct, the bulb will glow dimly which is a very useful indication of the operation. The trigger circuit then feeds each of the transistor bases via their 470 ohm resistors. Better switching is produced if a Hall-effect sensor is used instead of the Bedini-style switching.

This is the starting section of the circuit:



There are various ways of constructing this circuit. Ron shows two different methods. The first is shown above and uses paxolin strips (printed-circuit board material) above the aluminium heat sink to mount the components. Another method which is easy to see, uses thick copper wires held clear of the aluminium, to provide a clean and secure mounting for the components as shown here:

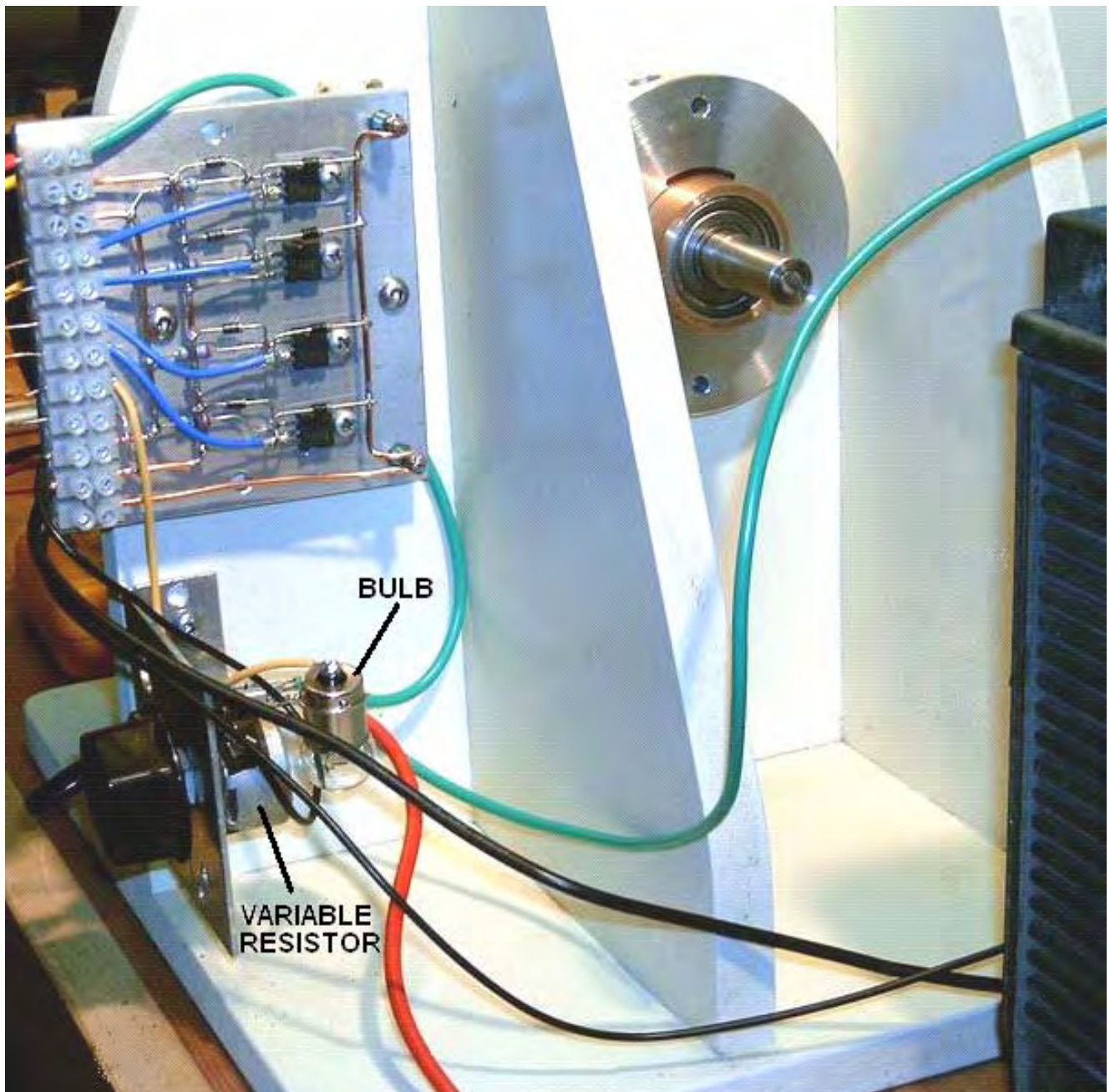


It is important to realise that the collector of a BD243C transistor is internally connected to the heat-sink plate used for the physical mounting of the transistor. As the circuit does not have the collectors of these transistors connected together electrically, they cannot just be bolted to a single heat-sink plate.

The above picture might give the wrong impression as it does not show clearly that the metal bolts fastening the transistors in place do not go directly into the aluminium plate, but instead, they fasten into plastic tee-nuts.

An alternative, frequently used by the builders of high-powered electronic circuits, is to use mica washers between the transistor and the common heat sink plate, and use plastic fastening bolts or metal bolts with a plastic insulating collar between the fastening and the plate. Mica has the very useful property of conducting heat very well but not conducting electricity. Mica “washers” shaped to the transistor package are available from the suppliers of the transistors. In this instance, it seems clear that heat dissipation is not a problem in this circuit, which in a way is to be expected as the energy being drawn from the environment is frequently called “cold” electricity as it cools components down with increasing current as opposed to heating them up as conventional electricity does.

This particular circuit board is mounted at the rear of the unit:



Although the circuit diagram shows a twelve volt drive supply, which is a very common supply voltage, Ron sometimes powers his device with a mains operated Power Supply Unit which shows a power input of a pretty trivial 43 watts. It should be noted that this device operates by pulling in extra power

from the environment. That drawing in of power gets disrupted if any attempt is made to loop that environmental power back on itself or driving the unit directly from another battery charged by the unit itself. It may be just possible to power the unit successfully from a previously charged battery if an inverter is used to convert the power to AC and then a step-down transformer and regulated power rectification circuit is used. As the power input is so very low, off-grid operation should be easily possible with a battery and a solar panel.

It is not possible to operate a load off the battery under charge during the charging process as this disrupts the energy flow. Some of these circuits recommend that a separate 4 foot long earthing rod be used to earth the negative side of the driving battery, but to date, Ron has not experimented with this.

When cutting the wire lengths for coating and pushing into the coil formers, Ron uses a jig to ensure that all of the lengths are identical. This arrangement is shown here:



The distance between the shears and the metal angle clamped to the workbench makes each cut length of wire exactly the required size while the plastic container collects the cut pieces ready for coating with clear shellac or clear polyurethane varnish before use in the coil cores.

Experience is particularly important when operating a device of this kind. The 100 ohm variable resistor should be a wire-wound type as it has to carry significant current. Initially the variable resistor is set to its minimum value and the power applied. This causes the rotor to start moving. As the rate of spin increases, the variable resistor is gradually increased and a maximum speed will be found with the variable resistor around the middle of its range, i.e. about 50 ohm resistance. Increasing the resistance further causes the speed to reduce.

The next step is to turn the variable resistor to its minimum resistance position again. This causes the rotor to leave its previous maximum speed (about 1,700 rpm) and increase the speed again. As the speed starts increasing again, the variable resistor is once again gradually turned, increasing its resistance. This raises the rotor speed to about 3,800 rpm when the variable resistor reaches mid point again. This is probably fast enough for all practical purposes, and at this speed, even the slightest imbalance of the rotor shows up quite markedly. To go any faster than this requires an exceptionally high standard of constructional accuracy. Please remember that the rotor has a large amount of energy stored in it at this speed and so is potentially very dangerous. If the rotor breaks or a magnet comes off it, that stored energy will produce a highly dangerous projectile. That is why it is advisable, although not shown in the above photographs, to construct an enclosure for the rotor. That could be a U-shaped channel between the coils. The channel would then catch and restrain any fragments should anything break loose.

If you were to measure the current during this adjustment process, it would be seen to reduce as the rotor speeds up. This looks as if the efficiency of the device is rising. That may be so, but it is not necessarily a good thing in this case where the objective is to produce radiant energy charging of the battery bank. John Bedini has shown that serious charging takes place when the current draw of the device is 3 to 5+ amps at maximum rotor speed and not a miserly 50 mA draw, which can be achieved but which will not produce good charging. The power can be increased by raising the input voltage to 24 volts or even higher - John Bedini operates at 48 volts rather than 12 volts

The device can be further tuned by stopping it and adjusting the gap between the coils and the rotor and then repeating the start-up procedure. The optimum adjustment is where the final rotor speed is the highest.

Patrick J Kelly
www.free-energy-info.tuks.nl

Simple Free-Energy Devices

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Chapter 20: The Joe Cell and Coil

The device called the “Joe Cell” used to be one of the most difficult devices for any experimenter to get operating properly but new design data has changed all that. It is a passive device for concentrating energy drawn from the local environment and it takes great perseverance and patience to use one to power a vehicle. Here is some practical information on the Joe Cell.

In 1992 in Australia, Graham Coe, Peter Stevens and Joe Nobel developed previously patented units which are now known by the generic name of the “Joe Cell”. Peter introduced Joe to Graham and they rehashed the patented cells which Graham knew about, using materials from the Local Dairy Production Facility NORCO. A two hour long video showing the Joe Cell was produced by Peter and Joe and the unit shown operating in the video was attached to Peter’s Mitsubishi Van. Joe had his equipment stolen and his dog killed, so he decided to keep a low profile, moving out into the wilds and not generating much publicity, in spite of fronting the two hour video recording.

First, you need to understand that, at this point in time, building and using a Joe Cell of any variety, is as much an art as a science. It might best be explained by saying that creating building plans for it is rather like producing plans for painting a copy of the famous Mona Lisa painting. The instructions for the painting might be:

1. Buy a canvas, if one is not available, then here is how to make one.
2. Buy some oil-based paints, if none are available, then here is how you make them
3. Buy an artists brush, palette and charcoal, if none are available then this is how you make them.
4. Here is how you paint the picture.

Even given the most complete and detailed instructions, many people, including myself, are unlikely to produce a top-quality copy of the Mona Lisa. It is not that the instructions are lacking in any way, it is the skill and ability of the person attempting the task which are not up to the job. It used to be that not everybody who built a Joe Cell had instant success. However, recent advances have changed all that.

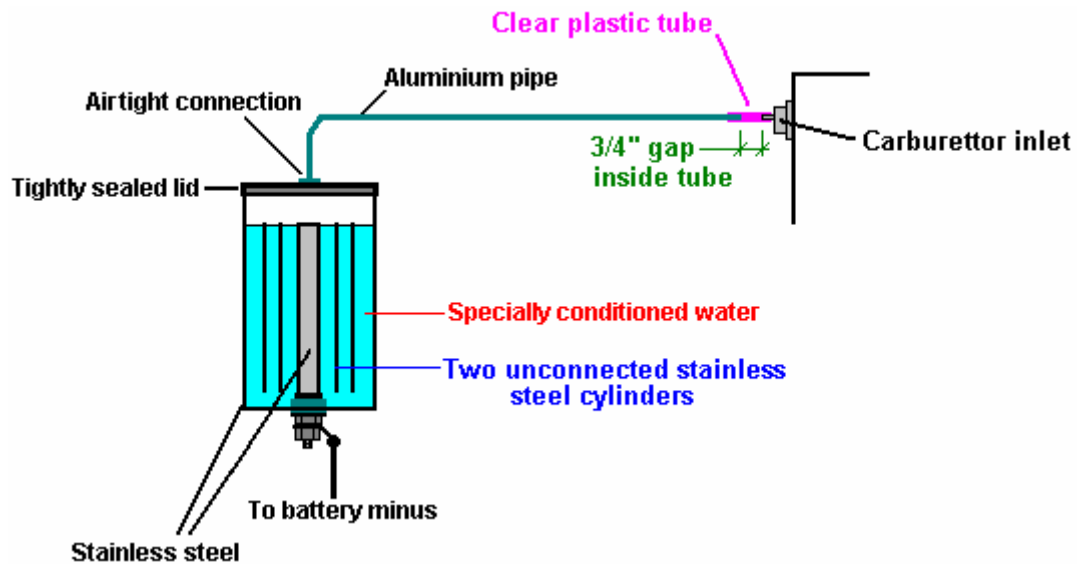
A Joe Cell is capable of powering a vehicle engine without needing to use conventional fossil fuel. So, what does the engine run on? I suggest that it runs on an energy field not yet spoken of by mainstream science. It is not unusual for newcomers to the subject to get confused by the Cell itself. The Cell consists of a metal container with tubes inside it. The container has what looks like ordinary water in it and it sometimes has a DC voltage applied across it. This causes many people to immediately jump to the false conclusion that it is an electrolyser. It isn’t. The Joe Cell does **not** convert water to hydrogen and oxygen gasses to be combined in the engine. The water in a Joe Cell does not get used up no matter how far the vehicle travels. It **is** possible to run a car on the gasses produced by electrolysis of water, but the Joe Cell has absolutely nothing whatsoever to do with electrolysis. The Joe Cell acts as a concentrator for our universal energy field.

At the present time, there are at least fifteen different people who have built Joe Cells and managed to power vehicles using them. Several of these people use their Joe Cell-powered vehicles on a daily basis. Most of these are in Australia. The first Joe Cell-powered vehicle was driven some 2,000 kilometers across Australia.

In broad outline, a Joe Cell is a 316L-grade stainless steel container, with a central cylindrical electrode, surrounded by a series of progressively larger stainless steel cylinders, and filled with water. This arrangement of steel shells and water focuses the energy field used to power the vehicle.

The Cell itself is made up with the battery negative taken to the central electrode. The connection to this stainless steel electrode is made at the bottom with the electrical connection passing through the base of the cell container. This obviously needs careful construction to prevent any leakage of the conditioned water or the energy focused by the Cell.

Surrounding the central electrode are two or three cylinders made of either solid or mesh stainless steel. These cylinders are not connected electrically and are held in position by insulating material which needs to be selected carefully as the insulation is not just electrical insulation but is also energy-field insulation. The outside stainless steel cylinder forms the container for the cell:



The picture above shows the general construction of a cell of this type although, unlike the description below, this one does not have the lip which is used for attaching the lid. It is included here just as a general illustration of how the cylinders are positioned relative to each other.

A length of aluminium tubing typically three quarters of an inch (20 mm) in diameter will be needed for connecting the Cell to the engine, and a short length of strong, clear plastic pipe for the actual final connection to the engine, needed to prevent an electrical short-circuit between the Cell and the engine. This plastic pipe needs to be a tight push-fit as clamping clips are not used. A stainless steel compression fitting to fit the pipe is needed to make the seal between it and the lid of the Cell. It is very important that this fitting is stainless steel as other materials such as brass will prevent the cell from operating. The wrong material for this fitting has been the reason for many Cells not operating. Neither

brass nor any other material (other than stainless steel) should not be used anywhere in the construction, whether it be for nuts, bolts, fittings, metal connections, or anything else.

Ideally, natural rubber with no additives or colouring, failing that "Buna-n" (nitrile rubber) o-ring, or teflon, is needed for inter-cylinder bracing and some sheet to make the circular lid gasket. Also some white marine-grade Sikaflex 291 bedding compound. Natural rubber with no colouring or additives is the best insulator and should be used if at all possible. After extended use, Bill Williams of America has found that teflon spacers work better than the rubber and so he has switched to teflon.

Don't polish the tubes and never, ever use sandpaper or wet-and-dry paper on any of the components as the result is scored surfaces and each score reduces the effectiveness of the Cell. The Joe Cell looks like a very simple steel construction which could easily be made by any amateur. While it can be constructed by an amateur, it is not a simple construction as it is important to keep any acquired magnetic properties to a minimum. Consequently, it is suggested that an angle grinder is not used for any of the metalwork, and hand tools used for cutting and shaping. Also, if the cutting tool has previously been used to cut anything other than stainless steel it should not be used, or at the very least, thoroughly cleaned before use as contamination of your Cell components through particles of another material is critical and can prevent the Cell from working. It should be stressed again that the materials used in the construction of a Cell are absolutely critical if success is to be assured. If you have an experienced friend who has made many Cells work, then you can experiment with different materials, but if this is your first Cell and you are working on your own, then use the exact materials shown here and don't end up with a Cell which doesn't work.

Recent Joe Cell Developments.

One of the greatest problems with using a Joe Cell has been to get it operational. The reason for this has probably been due to the lack of understanding of the background theory of operation. This lack is being addressed at this time and a more advanced understanding of the device is being developed. These design dimensions cause ordinary tap water to go immediately to the fully functional "Stage 3" and remain in that state indefinitely, so, the only way of stopping the Cell is to physically take it apart.

While it is still rather early to draw hard and fast conclusions, a number of results indicate that there are three separate, unrelated dimensions which are of major importance in constructing a properly "tuned" Joe Cell. It needs to be stressed that these measurements are very precise and construction needs to be very accurate indeed, with one sixteenth of an inch (1 mm) making a major difference.

The dimensions are specified to this degree of accuracy as they represent the tuning of the Cell to the frequency of the energy which is being focussed by the Cell. The fact that there are three separate dimensions, suggests to me that there are probably three components of the energy field, or possibly, three separate energy fields.

These three dimensions have been assigned names and are as follows:

Golden dimension: 1.89745" (48.195 mm)

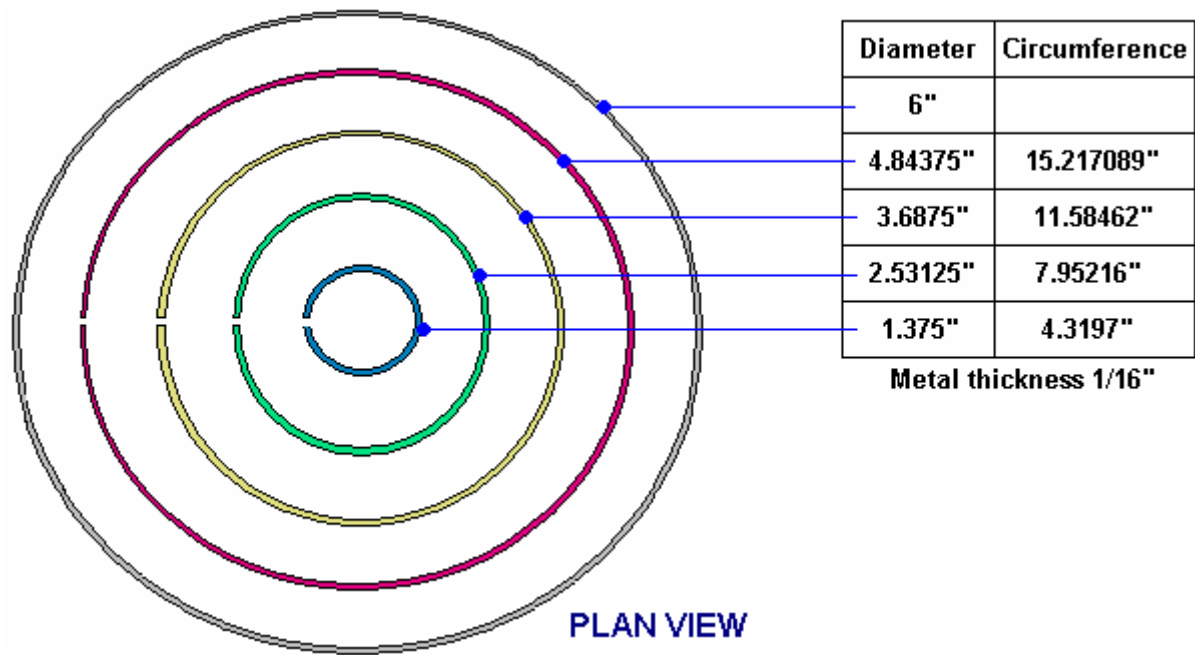
Blue dimension: 3.458" (87.833 mm)

Diamagnetic dimension: 0.515625" (13.097 mm)

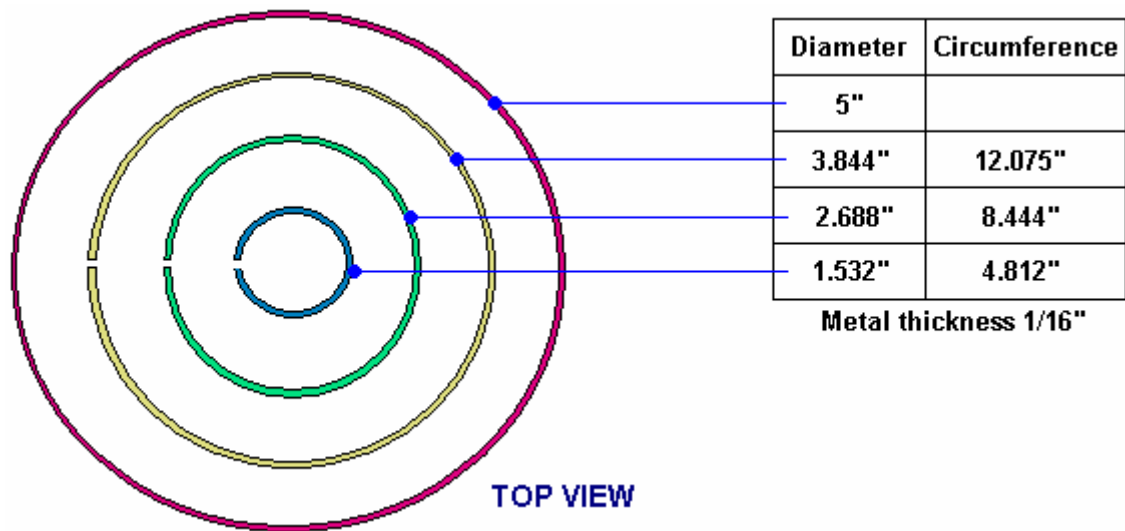
It is suggested that a Joe Cell should be constructed with cylinder heights which are a multiple of the 'Golden' length. Also, the water height inside the container should be below the tops of the inner cylinders and be a multiple of the basic length chosen for construction. The inner cylinders should be positioned the 'Diamagnetic' dimension above the base of the Cell. They should also be constructed from stainless steel of thickness 0.06445" (1.637 mm, which is very close to 1/16") and there should be a horizontal "Diamagnetic" gap between all of the vertical surfaces.

The inner cylinders should be constructed from stainless steel sheet which is tack welded at the top and bottom of the seam, and all of the seams should be exactly aligned. The lid should be conical and sloped at an angle of 57° , with it's inner surface matching the inner surface of the housing and the inner surface of the outlet pipe. The outer casing should not have any dome-headed fasteners used in its construction. The length of the outlet pipe should be made of aluminium and should be 15.1796" (385 mm) for 'Golden' height cylinders. That is 8H for Golden and should there be a need for a longer pipe,

then those lengths should be doubled or tripled as the single dimensions no longer apply (this being a fractal effect). At this point in time, these are only suggestions as the science has not yet been firmly established. One possible arrangement is shown here



It is not necessary for there to be four inner cylinders so an alternative might be:

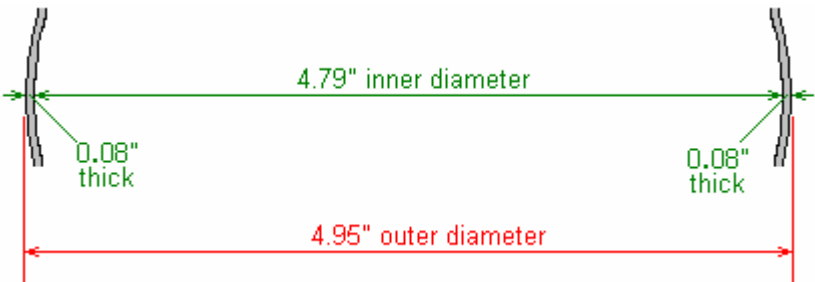


A suggested Joe Cell design is shown below. This diagram shows a cross-section through a Joe Cell with four inner concentric stainless steel tubes. These tubes are positioned 0.515625 inches (13.097 mm) above the bottom of the Cell and the gap between each of the tubes (including the outer casing) is exactly that same ‘Diamagnetic’ resonant distance.

It should be clearly understood that a Joe Cell has the effect of concentrating one or more energy fields of the local environment. At this point in time we know very little about the exact structure of the local environment, the fields involved and the effects of concentrating these fields. Please be aware that a Joe Cell which is properly constructed, has a definite mental / emotional effect on people near it. If the dimensions are correct and the construction accurate, then the effect on nearby humans is beneficial.

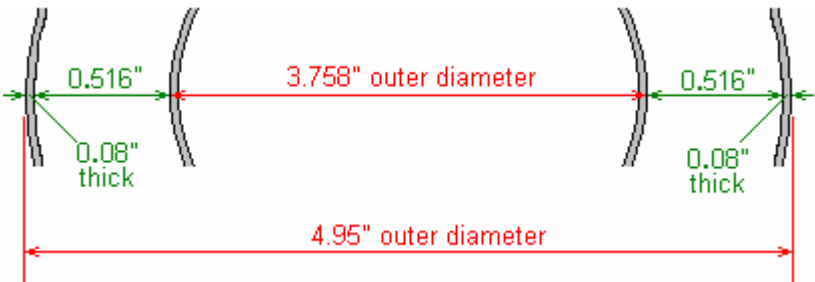
For the purposes of this example, and not because these figures have any particular significance, let's say that the steel sheet is 0.06" thick and the outer cylinder happens to be 4.95" in diameter and it is 0.085" thick.

People wanting to work in metric units can adjust the numbers accordingly where 1" = 25.4 mm.

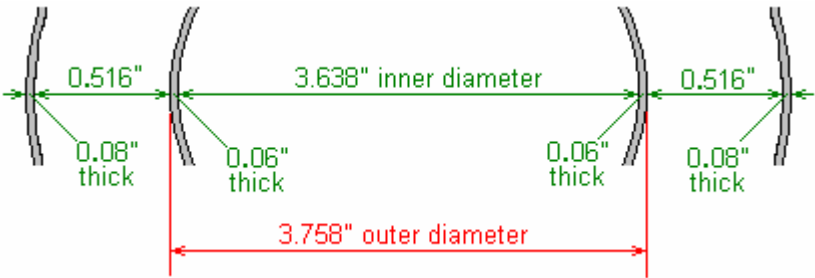


Then, the inner diameter of the outside cylinder will be its outer diameter of 4.95", less the wall thickness of that cylinder (0.08") on each side which works out to be 4.79".

As we want there to be a gap of 0.516" (in practical terms as we will not be able to work to an accuracy greater than that), then the outside diameter of the largest of the inner cylinders will be twice that amount smaller, which is 3.758" :



And, since the material of the inner cylinder is 0.06" thick, then the inner diameter of that cylinder will be 0.12" less as that thickness occurs at both sides of the cylinder, which works out to be 3.838" :

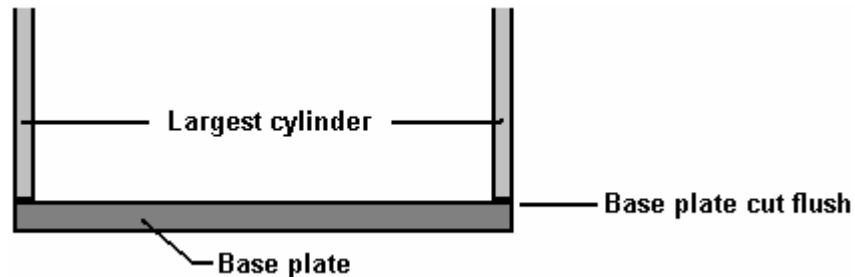


The length of stainless steel needed to form that cylinder will be the circumference of the outer diameter of 3.758" which will be 3.758" x 3.1415926535 = 11.806 inches.

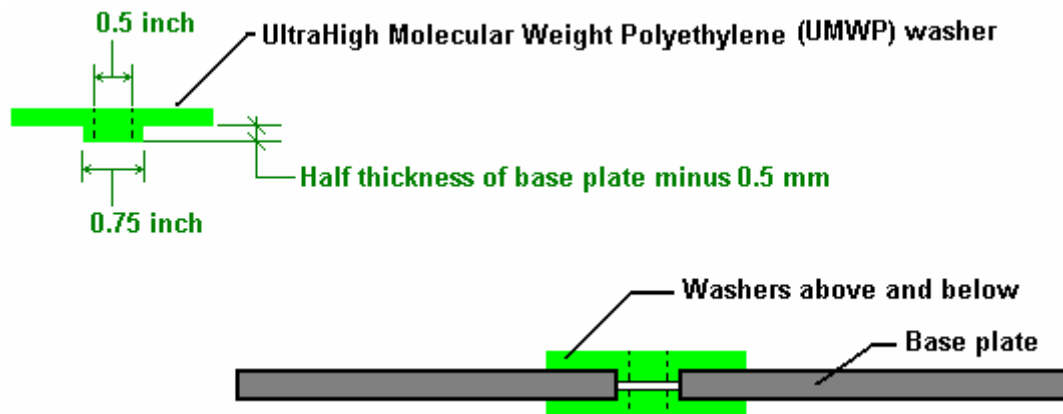
The dimensions of the other inner cylinders are worked out in exactly the same way, bearing in mind that every steel thickness is 0.06". The results for three inner cylinders would then be:

Diameter	Circumference	OR	Diameter	Circumference
4.95"			125.7 mm	
3.758"	11.806"		95.5 mm	299.9 mm
2.606"	8.187"		66.2 mm	208.0 mm
1.454"	4.568"		36.9 mm	116.0 mm

The first step is to construct the base plate, used to form the bottom of the container. Cut the largest diameter pipe to its correct length. (If you have difficulty in marking the cutting line, try wrapping a piece of paper around it, keeping the paper flat against the tube and making sure that the straight edge of the paper aligns exactly along the overlap, then mark along the edge of the paper). Place the pipe on a sheet of umwp (chopping board) plastic and mark around the bottom of the pipe. Cut the plastic to form a circular plate which sits flush with the bottom of the tube:



The next step is to mount the innermost pipe rigidly to the base plate. The pipe mounting needs to be exactly in the centre of the plate and exactly at right angles to it. This is probably where the most accurate work needs to be done. To complicate matters, the mounting needs to be connected electrically outside the base, be fully insulated from the base plate, and make a completely watertight fit with the base plate. For that reason, the arrangement looks a little complicated. Start by drilling a three quarter inch (18 mm) hole in the centre of the base plate. Construct and fit two insulating washers so that a half-inch stainless steel bolt will fit through the base plate while being securely insulated from it. The washers are made from Ultra-High Molecular Weight Polyethylene (plastic food-chopping boards are usually made from this material):

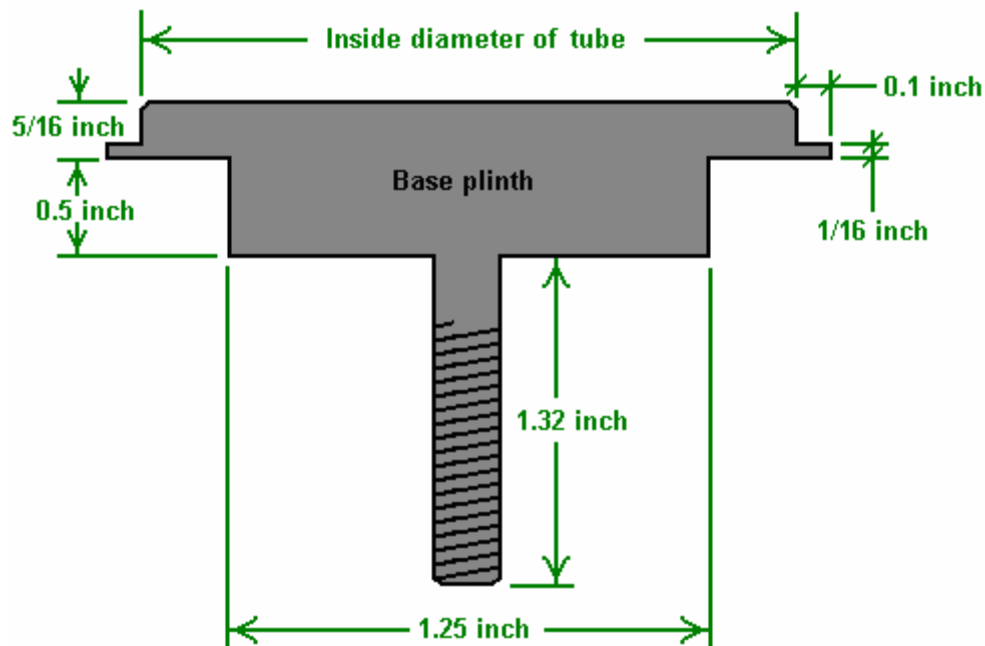


The washers which fit into the hole in the base plate need to be slightly less than half the thickness of the plate so that they do not actually touch when clamped tightly against the base plate, as shown in the lower part of the diagram. Cut another washer, using the full thickness of the plastic sheet. This will act as a spacer.

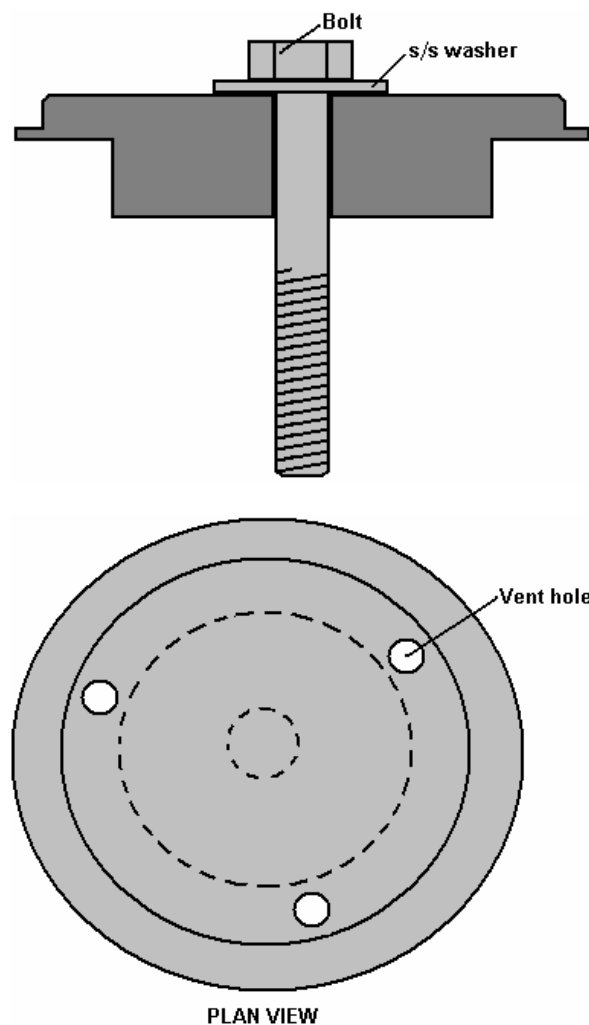
Next, the plinth for the central cylinder needs to be made. This is the only complicated component in the construction. It is possible to make this component yourself. The local university or technical college will often be willing to allow you to use their lathe and their staff will usually do the job for you or help you to do it yourself. Failing that, your local metal fabrication shop will certainly be able to do it for you. If all else fails and this equipment is just not available, then a 3D printer may have to be used.

A large piece of 316L stainless steel needs to be machined to produce the plinth shown below. The actual central cylinder needs to be a tight push-fit on the top of this component. To facilitate assembly, the central boss is given a slight chamfer which helps alignment when the tube is forced down on top of

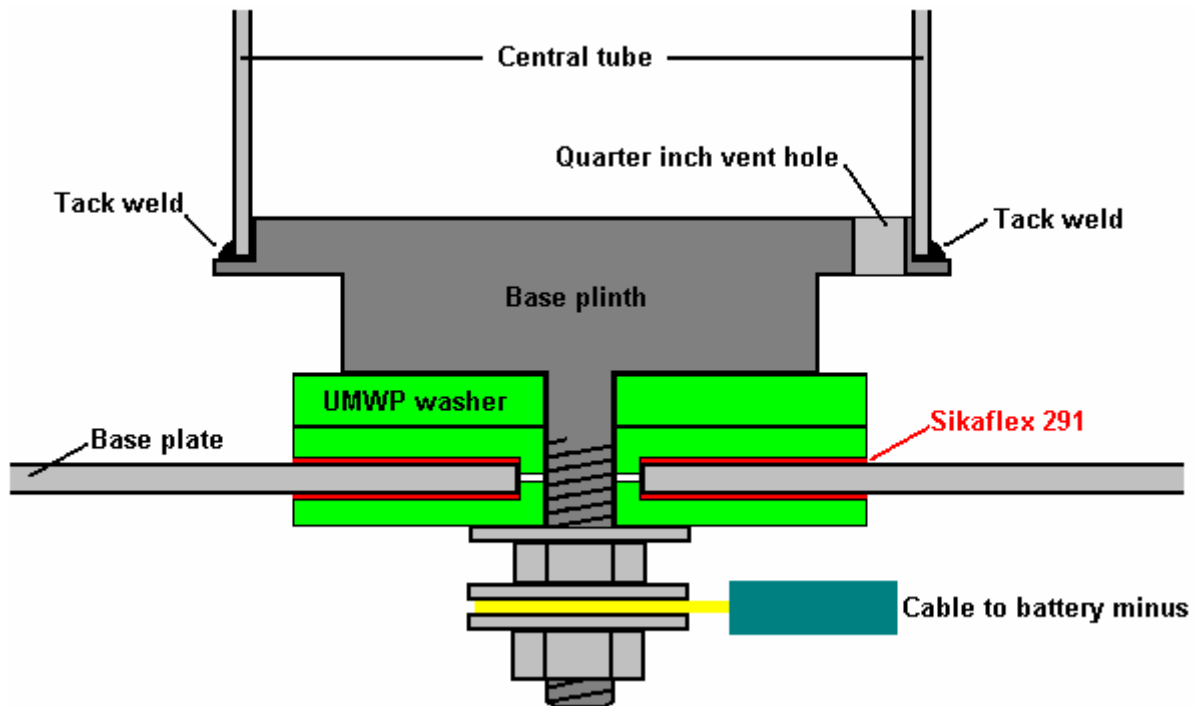
it. Peter Stevens recommends that tack welds (in stainless steel using a TIG welder) are used to connect the plinth to the outside of the cylinder. Three evenly-spaced vent holes are drilled in the plinth to allow the liquid inside the Cell to circulate freely inside the central cylinder.



An alternative method of construction which does not call for such a large amount of machining is to machine the plinth to take a standard stainless steel bolt as shown here:

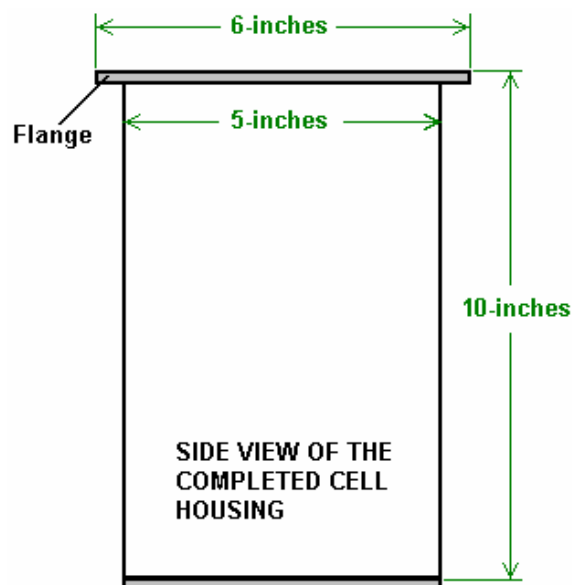


When assembled, the arrangement should look like this:



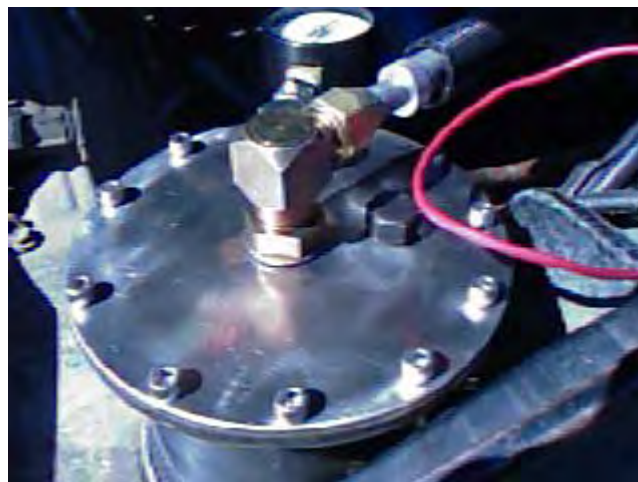
This arrangement looks more complicated than it really is. It is necessary to have a construction like this as we want to mount the innermost tube securely in a central vertical position, with the battery negative connected to the cylinder, by a connection which is fully insulated from the base plate and which forms a fully watertight seal with the base plate, and to raise the central cylinder above the base plate.

However, as the plastic washers would be affected by the heat when the base plate is joined to the outermost pipe, when all of the components shown have been prepared, they are taken apart so that the base plate can be fuse-welded to the outside tube. Unless you have the equipment for this, get your local steel fabrication workshop to do it for you. Be sure that you explain that it is not to be TIG welded, but fuse-welded and that the joint has to be fully watertight. At the same time, get them to fuse-weld a half-inch wide lip flush with the top edge of the tube. You cut this piece as a 6-inch (150 mm) circle with a 5-inch (125 mm) circular cut-out in the centre of it. When it is welded, it should look like this:



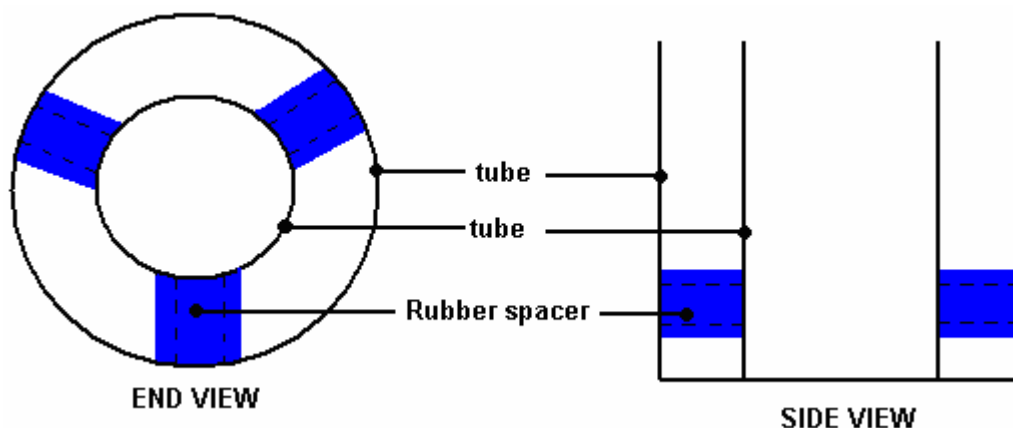
Cut a six-inch (150 mm) diameter lid out of 1/8 inch (3 mm) stainless steel. Cut a matching ring gasket of natural rubber (Buna-n material if natural rubber can't be obtained), place it on top of the flange with the lid on top of it and clamp the lid firmly down on the flange. Drill a hole to take a 1/4 inch (6 mm) stainless steel bolt, through the lid and the middle of the flange. Insert a bolt and tighten its nut to further clamp the lid in place. An alternative to this for the more experienced metalworker, is to drill a hole slightly smaller than the bolt, and when all holes have been drilled, remove the lid, enlarge the lid holes to allow free passage of the bolts, and cut a thread inside the flange holes which matches the thread on the bolts to be used. This gives a very neat, nut-free result, but it calls for a greater skill level and more tools.

If using nuts and bolts, drill a similar hole 180 degrees away and fasten a bolt through it. Repeat the process for the 90 degree and 270 degree points. This gives a lid which is held in place at its quarter points. You can now complete the job with either four more evenly-spaced bolts or eight more evenly-spaced bolts. The complete bolting for the twelve-bolt choice will look something like this when the cell is installed:



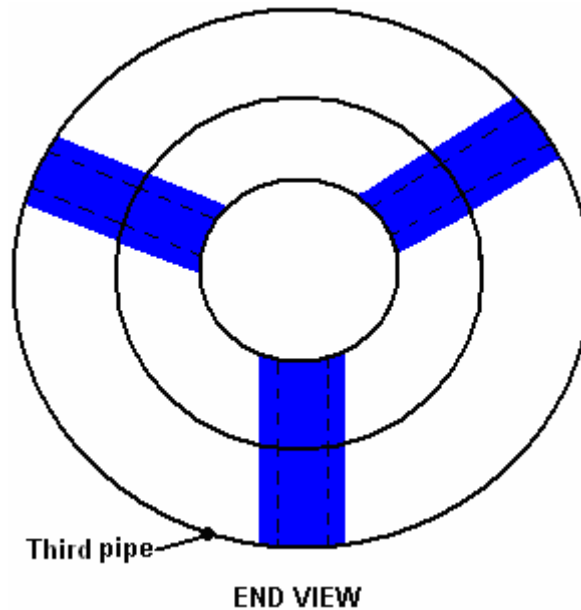
The lid can be finished off by drilling its centre to take the fitting for the aluminium pipe which will feed the output from the cell to the engine. This fitting, in common with every other fitting **must** be made of stainless steel. Video at <http://youtu.be/-7075bVmDQo>.

The next step is to assemble the neutral pipes. These pipes are held in place by the natural rubber insulators. These pieces are **not** placed lengthwise:



Place similar insulators at the other end of the pipes, directly above the ones already in place. If you look down the length of the tubes, then only three of the six insulators should be seen if they are correctly aligned. The spacers will be more effective if the ends are given a thin layer of the Sikaflex 291 bedding compound before the ends get compressed against the cylinder walls.

Do the same for the next pipe, pushing tightly squeezed natural rubber insulators strips between the inner and outer pipes. Place them directly outside the insulators between the previous pipes so that when viewed from the end, it looks as if the rubber forms a single strip running through the middle pipe:



Carefully clean the surface of the base plate of the outer casing around the central hole, both inside and outside. Under no circumstances use sandpaper or wet-and-dry paper, here or anywhere else, as these abrade and score the surface of the steel and have a major negative effect on the operation of the Cell. Carefully lower the outer casing on to the assembly so that the threaded shaft goes through the central hole and the shaped washer fits tightly into the hole in the base of the outer housing. Apply a thin layer of the bonding compound to the face of the second shaped washer, place it over the shaft of the bolt and press it firmly into place to completely seal the hole in the base plate. Add a stainless steel washer and bolt and tighten the bolt to lock the assembly together. If using a bolt, a long-reach box spanner may be needed inside the central pipe for tightening the locking bolt. If one is not available, use a longer bolt through the washers, screw a second nut up on to the shank of the bolt, file two flats on the end of the bolt, clamp them in a vice to hold the bolt securely and tighten the locking nut. When the spare nut is unscrewed, it pushes any damaged fragments of the bolt thread back into place.

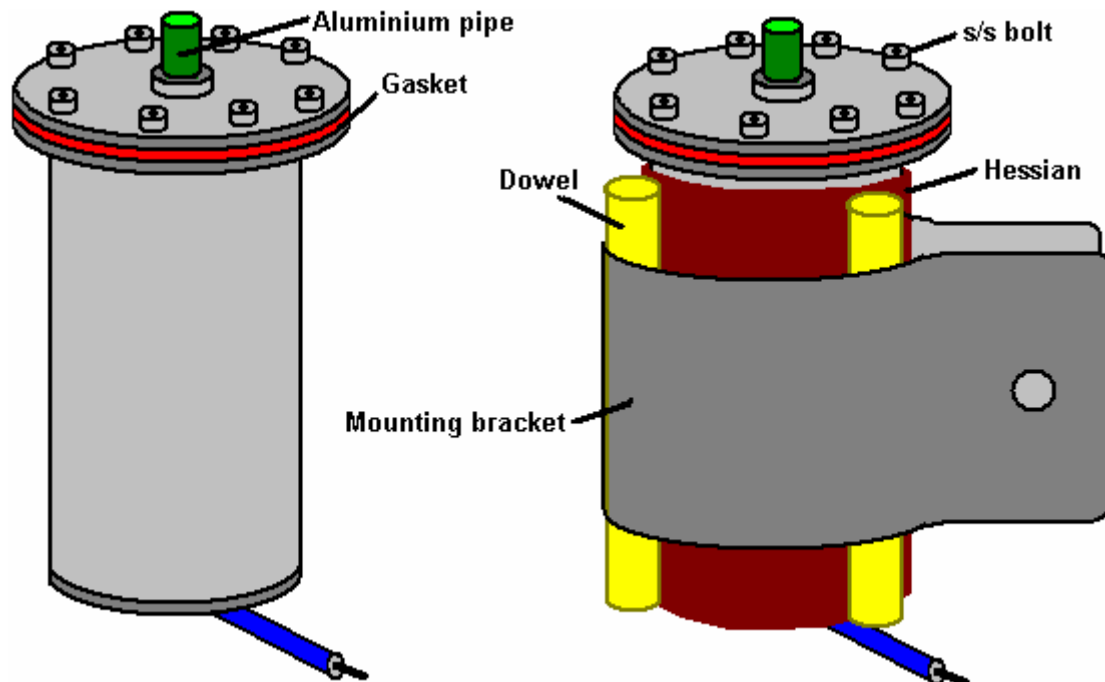
Finish the assembly by adding three further rubber insulators between the top of the outermost pipes. Use a thin layer of Sikaflex 291 bonding compound on the cut faces of the insulators as this improves the insulation. Line the new insulators up with the insulators already in place and make them a tight fit. These extra insulators support the end of the tube assembly and reduce the stress on the plinth fitting at the base of the central tube when the unit is subjected to knocks and vibration when the vehicle is in motion.



The construction of the basic unit is now complete, with the exception of the lid fitting for the aluminium pipe which feeds the engine. The construction so far has been straightforward engineering with little complication, but if you do not feel confident about this construction, then advice and help can be got from the experienced members at the Yahoo Group <http://groups.yahoo.com/group/joecellfreeenergydevice/> or alternatively, the companion Group <http://groups.yahoo.com/group/JoesCell2>.

Bill Williams in America found that when he fitted a Joe Cell to his Ford pickup, the performance suddenly became like a Formula One racing car and very gentle use of the throttle was needed. He says: "Over the summer, I used the truck to haul firewood for this winter's wood supply. I added 5 gallons of fuel to bring the fuel level to the half tank mark. I ran the truck with the cell which I installed a month earlier. Basically, I tried to forget about the cell being installed in the truck. The Ignition timing was set at about 25 degrees before TDC with no vacuum connect to the distributor. The fuel line was still connected so "shandy" mode was being used. The surprising thing is that the truck did not use any fuel during the two and a half months of driving in the woods. In fact, when I parked the truck at the end of the wooding season, I physically sounded the fuel tank (it is a 'behind the seat' tank). It was still showing the half full mark. I pulled the cell for the winter and have it sitting on the bench waiting for spring to arrive for it to be installed again. I don't even pretend to understand this technology, but I keep hoping that someone will come up with a viable explanation of how the cell works".

When installing the Joe Cell in a vehicle, the first step is to insulate the Cell from the engine components. This insulation is not just electrical insulation which is easily accomplished, but it is a case of introducing sufficient separation between the Cell and the engine to stop the concentrated (invisible) energy leaking away instead of being fed to the engine through the aluminium tube. So, wrap the Cell walls in three layers of double-laminated hessian sacking ("burlap"), pulling it tightly around the outer tube. Tie (a minimum of) three wooden dowels along the length of the Cell and bend the mounting bracket around the dowels. The purpose of this is solely to ensure that there is at least a three quarter inch air gap between the walls of the Cell and everything else, including the mounting bracket:



The mounting details depend on the layout of the engine compartment. The really essential requirement is that the aluminium pipe running to the engine must be kept at least 4 inches (100 mm) away from the engine electrics, radiator, water hoses and air-conditioning components.

The last four inches or so, of the tube going to the engine cannot be aluminium as that would cause an electrical short-circuit between the (occasional) positive outer connection to the outside of the Cell and the engine itself which is connected to the battery negative. To avoid this, the final section of the pipe is

made using a short length of clear plastic piping, forming a tight push-fit on the outside of the aluminium tube and on the connection to the intake of the engine's carburettor. There should be a 3/4 inch (18 mm) gap between the end of the aluminium pipe and the nearest metal part of the carburettor. If it is just not possible to get an airtight fit on the intake to the carburettor and a hosepipe clamp has to be used, be sure that the fitting is non-magnetic stainless steel. If such a fitting cannot be found, then improvise one yourself, using only 316L grade stainless steel.



In the installation shown above, you will notice that the aluminium tube has been run well clear of the engine components. A vacuum gauge has been added but this is not necessary. For the early stages of installation, the aluminium pipe runs to the vacuum port of the carburettor but stops about 3/4 inch (20 mm) short of it, inside the plastic tubing. This method of connection is advisable for the initial setting up of the vehicle modification. At a later date, when the engine has been running with the Cell and is attuned to it, the Cell operates better if the pipe is connected to one of the bolt heads on the engine block, again using the plastic tube and a gap between the aluminium tube and the bolt head. Some people feel that a safety pressure -release valve with a safe venting arrangement should be used if the pipe feeding the engine, terminates on a bolt head. If it is still available, the <http://www.youtube.com/watch?v=DexBoYfDoNw> video shows Bill Williams operating his Joe Cell.

Notes:

Engines running while powered by a Joe Cell act in a somewhat different manner. They can idle at a very low number of revs per minute, the power available on acceleration is much greater than normal and they appear to be able to rev very much higher than ever before without any difficulty or harm.

The type of Cell described in this document was built by Bill Williams in the USA with the help and assistance of Peter Stevens of Australia. Bill describes his first driving experience with his 1975 F 250, 360 cu. in. (5.9 litre) Ford pickup:

Well, all I can say is "who needs an Indy car when you can drive an old FORD" – WOW!!!! The first five miles after leaving home were wild. I had to be extremely careful on how I pressed the accelerator. I gingerly crept up to 45 mph and that was with moving the pedal maybe half an inch. The throttle response was very crisp or touchy. With about a 1/8" of movement the next thing I knew I was close to 80 mph. If I lifted off ever so slightly on the throttle, it felt like I was putting the brakes on and the speed would drop down to 30 mph or so. "Very erratic". If I barely even touched or bumped the pedal it felt like I had pushed a nitrous oxide booster button. WOW !!!

As stated earlier, the first 5 miles were wild and things started to change. The engine started to buck or surge with very large rpm changes and literally threw me against my seat belt. It got so bad I just took my foot completely off the pedal and rode the brakes to stop the truck. The truck left skid marks on the pavement every time the engine surged in rpm. Well anyway, I manage to get it stopped and shut it off with the ignition key - thank GOD !

I retarded the timing, turned the gasoline back on, crossed my fingers and hit the ignition key, and the engine took right off, revving to maybe 4,000 rpm and then gradually decreased to 700 rpm. I took a deep breath and put it into drive and the truck responded close to normal again. I made it into work a little late, but late is better than never the way I see it. After working during the day at the job and thinking what I could do to stop this erratic rpm oscillation, I decided to disable the cell and drive home on gas. WOW !!!

Peter Stevens states that the main reason for the erratic behaviour of the Cell was due to outside air leaking into the Cell, and he stresses that Cells need to be completely airtight. It is also clear that the timing was not set in the correct position. All properly built Cells give enhanced engine power.

Comments from an expert in July 2012:

We are into an entirely different approach now, one which entails introducing specific vibrations into the cell. An optimum implementation involves cutting each tube to a specific length so as to make it self-exciting, but that's not necessary because the frequencies can be introduced just using a caliper, or a precise length of metal touched against the tubes in a sequence. Since this approach was totally different from traditional Joe Cell work, we set up a discussion group specifically for it: http://tech.groups.yahoo.com/group/vibrational_combustion_technology/

The nice thing about this approach is that it's ultra stable. Once the vibration is set up the only way to stop it is to take the cell apart. This construction method totally eliminates the human influence factor problem! In fact, a cell can affect the engine even without there being water in the cell. Another nice thing about it is the mathematical design process is implemented in a couple of spreadsheets. My thinking at this time, is that we now need to incorporate specific engine parameters into the design to tune the cell to a particular engine.

We have been a bit sidetracked lately and have been working a lot on the healing aspects of Torsion fields: http://groups.yahoo.com/group/awaken_to_vibration/ but I hope to get back into engine testing soon.

Advances in 2011. In an effort to develop a device to emulate the function of a Joe cell without it's inherent stability issues, Dave Lowrance came up with the idea of a set of 3 concentrically-wound torsion field coils. In early testing it has become apparent that a field **is** being generated, as demonstrated by their effect on two test engines, even with no power being applied to the coils.

This is the very early stage of the investigation so this initial design is being released with the hope that others will wind and test similar coils and report their results to the appropriate groups, so that we can learn more about them through further experimenting on a variety of different engines.

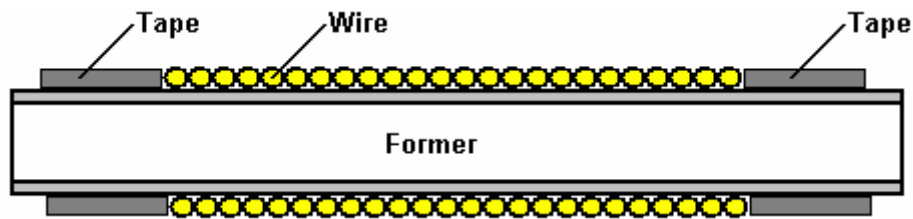
The initial set of coils were wound on 7/8" (22 mm) diameter stainless steel tubing which happened to be to hand. The use of stainless steel is not significant and two successful replications have used half-inch (12 mm) PVC plastic pipe, as using a non-ferrous material is the main requirement.

The wire diameter has an effect and while 20 gauge (0.812 mm diameter) enamelled copper wire was used for the coils shown here, coils wound with 12 gauge (2.05 mm diameter) copper wire work much better and it is now thought that the weight of copper in the winding is important.

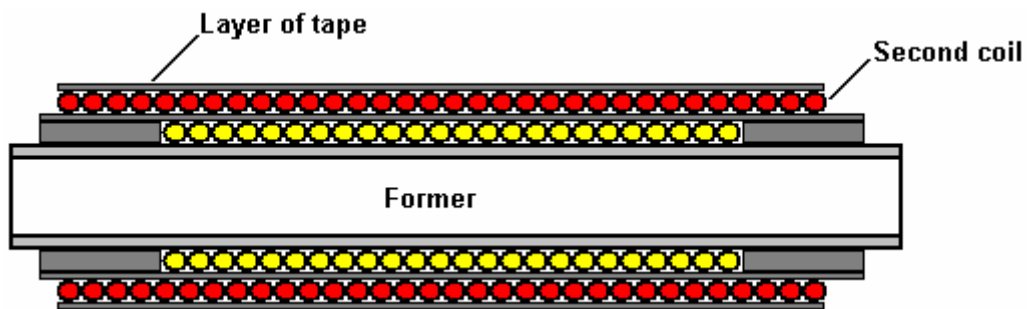
For the first layer, a length of 311 cm is used and wound on the former in a clockwise direction. The ends of the wire are secured with tape, leaving three or four centimeters of wire exposed at each end of the coil, for connection purposes. This is the first layer wound and secured:



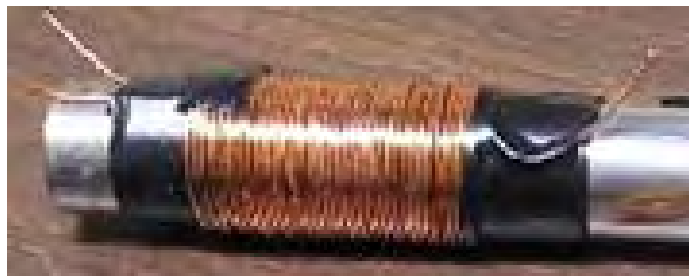
The wire for the second layer is cut to a length of 396 centimeters. This second coil layer will be longer than the first layer, so before winding it, it's necessary to build up the area at both ends of the first layer with tape:



This is so that the second layer of wire will have the same diameter along it's entire length. It is probably a good idea to completely cover the first layer of wire with tape to ensure good electrical insulation.



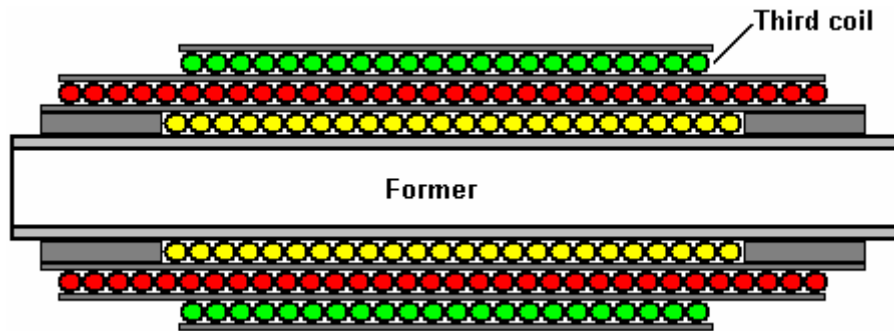
The second wire layer is also wound in a clockwise direction:



The wire for the third layer is cut to a length of 313 centimeters. Since it will be covering less length along the former, there is no need to build up the ends of the earlier layers. So, simply cover the second winding with tape, and then wind on the third layer, but this time, the coil is wound in a counter-clockwise direction and then the entire coil is covered in tape to protect it.



To be sure that the second and third layers are centred over the earlier layers, it is a good idea to locate the centre of the wire and start winding from the middle outwards in both directions:



It has been found that one end of the centre winding is similar to the centre tube of the Joe cell, and the opposite end of the outer winding functions like the canister of a Joe cell. In theory, this can be tested by connecting a small capacitor between these two points, and checking for a low DC voltage using a digital voltmeter. Like a Joe cell, polarity is really the important issue to test for, since we do want the positive polarity end to transfer the energy, and the negative polarity end to be connected to engine ground. If the polarity is wrong, simply use the opposite ends of both coils.

In the testing the negative end was connected to chassis ground, and the positive end to a Hull-effect type oil probe already installed in each test vehicle. The oil probe is Robert Hull's contribution to this technology. He found that if you apply a torsion field to the oil, it will charge up an engine in a way similar to a Joe cell, but more consistently than a Joe cell would. There are two basic types of Hull-effect probe - the simplest is just a wire inserted down the dipstick tube. However, the preferred method is to remove the oil-pressure sensor and insert a T-fitting, then slide an insulated stainless steel rod into the high-pressure oil at that point. By using an oil probe, one can eliminate the aluminium transfer tube in favour of a length of wire.

The experimenter who wound the 20-gauge coils then wound a larger diameter set using 12-gauge wire on a 1.5-inch (38 mm) diameter former. He fitted these over the original set and connected just two wires, one end of the innermost of the six coils and the opposite end of the outermost coil. This gave about a 25% reduction in the fuel used by an old Honda Accord car with an Electronic Fuel Injection system.

Fuel-less operation has not yet been achieved, but that could just be a matter of getting the engine set up properly. Some of the issues we need to deal with are things like antifreeze, which destroys the dielectric properties of water, and inhibits it from charging up. This has never been discussed, but it is one of the key things which limited the ability of people to succeed with their cells. Oil is a similar issue. Some oils, particularly the ones with all the additives and detergents, simply won't charge up.

There still needs to be a lot of testing done. For instance, with this setup it might be better to connect one end of each coil to ground. Or possibly the coils would do better if the windings were all connected in series. This is all uncharted territory! Dave's original concept was to use a set of these coils to replace each tube of a Joe cell.

The engine from an old Pinto car is also being used as a test bed. Attempts were made to run it completely fuel-less. It would kick repeatedly, but just wasn't quite there. It would only kick at a very specific timing setting - somewhere between 50-60 degrees before Top Dead Centre. The Pinto has antifreeze and with just water it's more likely to run fuel-less. But that should be a last-resort option, since most people do need antifreeze.

Devices such as the Joe cell tend to work really well on engines which have a carburettor because the spark timing can be adjusted quite easily. They work well on older EFI engines (probably those prior to OBD2) but they can be a real problem on the newer EFI models as they are liable to cause a fuel injection error state to be reached almost immediately. The newer ECUs control everything so tightly that they are almost impossible to work with (which was probably a design objective of the ECU design).

The Pinto engine had not been started for over six months. No T-field devices were connected to the engine during this period, so we can assume that there was little or no residual charge on the engine.

The cooling system had only water in it. The crankcase was filled with NAPA brand 30-weight oil. We fiddled with the engine to get it started. At that time the car had a little motorcycle carburettor on it, rather than the stock carburettor and the timing was set quite a bit advanced.

After just a few minutes of idling we realised that the engine was getting extremely hot with the exhaust manifold glowing red. So we shut it down. Being the optimist that I am, we went ahead and connected the coils at this time.

The next morning I took a little compass and found that it didn't point to North anywhere within about 2 feet of the car body - a very good sign! So we went ahead and started it up, and carefully monitored the head temperature with an infra-red thermometer. The temperature rose slowly to about 170 degrees F which is a little below normal. After verifying that the temperature held steady at that value, I tested with the compass again, and now it was messed up out to about 10 feet from the body. So the field strength had jumped up about 500% after starting the engine.

We then played with the carburettor and timing to get the smoothest operation at the lowest RPM at which it would idle smoothly. The RPM appeared to be well below a normal idle RPM., and when I went back and checked the timing, it was very close to 60 degrees before Top Dead Centre. At this point everything was looking so good that we tried a few attempts at fuel-less operation, but the engine died each time.

Due to pressure of other work, the car was ignored for a couple of months. When I finally got back to doing a little further testing, I found it surprisingly easy to get it started again. I didn't have to reset the timing to get it running. It actually started up with little effort, which was amazing, since the timing was still way advanced. It should be nearly impossible to start an engine with the timing set like that. The spark is just occurring at the wrong time in the cycle so it should try to push the pistons in the wrong direction.

Anyhow, it was starting to get cold here, so I decided to install some antifreeze, and that just set everything way back. It reduced the field strength by over 80%.

Since then Dave has come up with a coil-set designed to charge up antifreeze, but I was disappointed when I tried it. It did better with the antifreeze than the original set did, but we came to the conclusion that the antifreeze destroys water's diamagnetic properties to the point that the mixture is just hard to charge up. Working on this problem is the reason why I didn't release the coil info sooner. I kept hoping that we might solve this problem as well, but we didn't. However, this just might not be as big a problem as I thought, because I've heard that well-charged water just might have a significantly lower freezing point. This has not been tested yet to verify it.

An interesting side issue is the fact that the water which I drained out when adding antifreeze, showed no sign of rust. It was perfectly clear. Under normal circumstances, with no additives in the cooling system, this water should have been a horrible orange mess. It wasn't, and that has to be because of the field on the engine.

The Pinto is not roadworthy, so I have no way of knowing what kind of fuel consumption is possible with this setup or what power it might be capable of producing. At this time, I just use it to test different devices, and to try for fuel-less operation. However, if I was to achieve a consistent, repeatable fuel-less operation, it could become roadworthy very quickly, so I could do some actual road testing.

Patrick J Kelly
www.free-energy-info.tuks.nl

Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

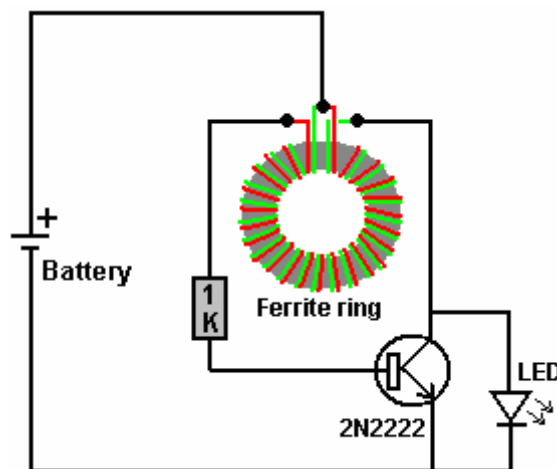
Chapter 21: A Perpetual Light

People are familiar with the concept of powering a light from a battery and then recharging the battery using a solar panel or a wind-powered generator. However, we really want to be able to recharge the battery when there is no daylight and no wind.

What I personally would like is a light which shines whenever I switch it on and which uses a battery which I never have to recharge. While that sounds a bit far fetched, it is actually achievable if the battery is recharged when I am asleep. Let’s see what can be achieved using the knowledge which we already have.

In the November 1999 edition of the magazine “Everyday Practical Electronics”, Mr Z. Karparnik showed one of the most simple and robust circuits ever produced. He called it the “Joule Thief” and originally it was intended to light a 3-volt Light-Emitting Diode using a dry cell battery which had been exhausted and run down to 0.5 volts or so.

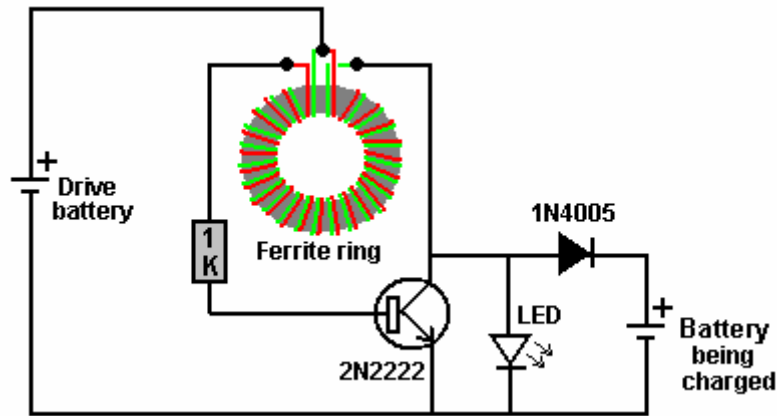
The Joule Thief circuit is very, very simple, using just one transistor, one resistor and one coil. Mr Karparnik wound his coil with just a short length of wire, making just a few turns on a tiny, scavenged toroid. The circuit looks like this:



The circuit oscillates automatically and it generates a much higher voltage than that of the supply battery, and while it can most certainly light an LED which can't be lit by the battery on its own, the circuit can do much more than that.

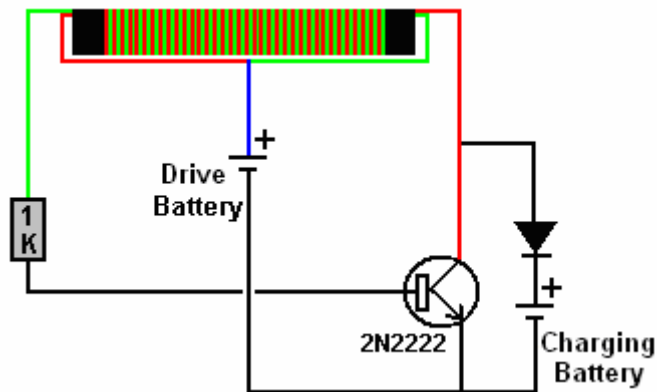
It is not necessary to wind the coil on a ring as a simple paper cylinder is perfectly adequate, with a 1-volt battery generating a 19-volt output.

The circuit was adapted by Bill Sherman to charge a second battery as well as lighting an LED. Bill adapted the circuit like this:

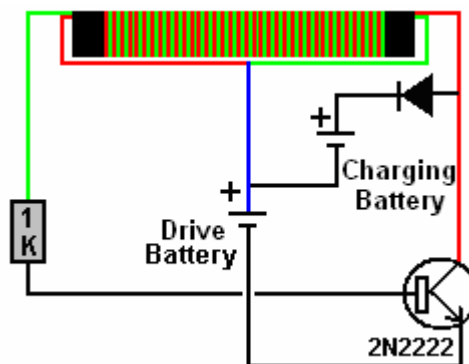


I have used a circuit of this type (minus the LED) to charge a “1.2V NiMh” rechargeable battery of 2285 maHr capacity from 0.6 volts to 1.34 volts in just one hour. The drive battery started out with a voltage of 1.34 volts and ended up with a voltage of 1.29 volts (which is generally considered to be fully charged). We live in a massive energy field and so the extra energy flowing into the circuit came from the excess energy of our local environment. Please understand clearly that batteries are **NOT** charged by back-EMF voltage spikes. Instead, those voltage spikes disturb our local energy field, causing an inflow of environmental energy into our circuit and it is that environmental energy which recharges batteries.

With a paper cylinder coil, the circuit is like this:



The circuit has a minor weakness in that if the drive battery has a voltage greater than that of the charging battery plus the voltage drop across the diode, then the drive battery feeds current directly to the charging battery through the coil windings and we don't want that to happen as it just wastes power. That weakness can be overcome by putting the batteries in series like this:



A suitable coil can be wound quite easily. A pencil makes a good former for a coil, so a 100 mm or 150 mm wide strip of paper can be wrapped around a pencil to form a cylinder several layers thick and sealed with Selotape:



Make sure that the paper is not stuck to the pencil and the cylinder is not so tight that it can't be slid off the pencil when the coil has been wound. There is a wide scope for experimentation with the number of turns in the coil and the wire diameter used. I used 0.375 mm diameter enamelled solid copper wire.

There are many different ways to wind a coil. The method which I used is to leave more than 100 mm of wire before the start of the coil and then make three or four turns like this:



Then those few turns are held in place with Selotape before winding the rest of the coil in a single side-by-side layer using two wires to form a bi-filar coil. Then both ends are covered with electrical insulating tape because Selotape deteriorates as time passes. One single layer of wire is adequate, and finally, the coil is slid off the pencil.

While the diagram above shows the two strands of wire in two colours, the reality is that both wires will be the same colour and so you end up with a coil which has two identical looking wires coming out of each end. Be sure to leave more than 100 mm of wire free at the finishing end before cutting the wire as you need that extra length of wire to make the circuit connections later on. Use a multimeter or a battery and LED to identify the two ends of one strand of wire and then connect the end of one wire to the start of the other wire. This is the central tap "B" of the coil:



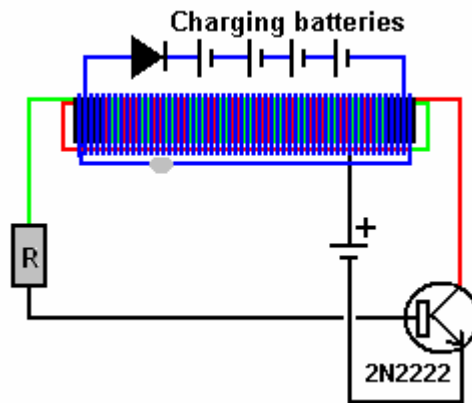
The coil needs to be checked carefully before use. Ideally, the central joint is soldered and if the wire is the "solderable" type, then the heat of the soldering iron will burn the enamel away after a few seconds, making a good quality soldered joint on what used to be enamelled wires.

A resistance test needs to be carried out to check the quality of the coil. First, check the DC resistance between points "A" and "B". The result should be between 1 and 2 ohms. Then check the resistance between points "B" and "C" and that should be exactly the same value.

Finally, check the resistance between points "A" and "C". That value must be higher than the "A" to "B" resistance but surprisingly, it is never twice the value in spite of the seeming impossibility of that. However, if the solder joint is very poor, then the resistance will be doubled or more and so the joint needs to be improved before the coil is used.

The simple circuit shown above can charge four AA-size batteries in series when the circuit is being powered by just one AA-size battery. It is generally considered that using three diodes in parallel makes the circuit perform better but a single diode works perfectly well for me.

There is a method of raising the circuit efficiency and that is to add a second bi-filar winding on top of the first one and taking the charging current from the second winding. This makes the circuit Lawrence Tseung's "FLEET" circuit:

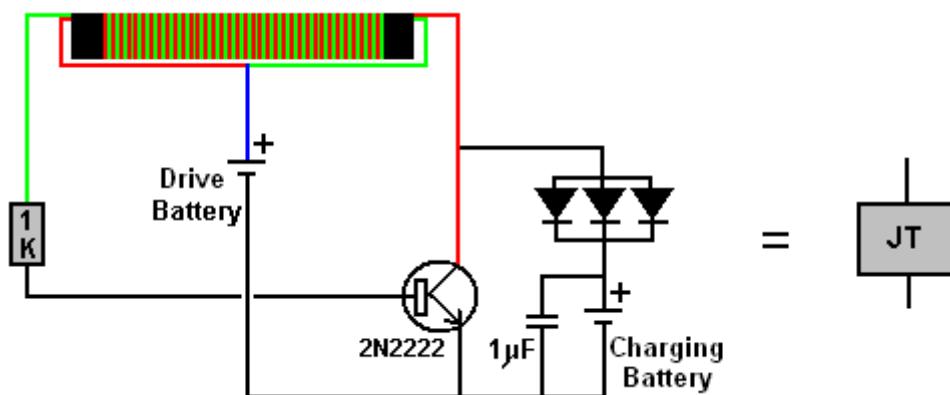


Current drawn from the second winding does not affect the current draw of the drive battery which is running the circuit.

If you have an oscilloscope, then the circuit can be tuned for optimum performance by placing a small capacitor across the resistor "R" and finding the value of capacitor which gives the highest rate of pulsing with your particular components. The capacitor is not essential and I have never used one, but values such as 2700 pF are sometimes shown.

I have used the "FLEET" circuit to charge two identical lead-acid batteries, with one battery powering the circuit which charges the other battery. Swapping the batteries over and repeating the process a couple of times ended up with both batteries having more genuine, usable power than when they started the process. Since a lead-acid battery has only a 50% efficiency and as such loses half of all of the current that you feed into it, my test showed clearly that the "FLEET" circuit performed for me with more than twice the output power compared to the input power. That additional power is drawn in from the surrounding environment which is a massive energy field.

However, keeping things simple and concentrating on the Joule Thief circuit. Some NiMh rechargeable batteries stop charging after a few weeks, so to offset this we can connect a one microfarad capacitor across the battery being charged. This changes the cold electricity charging to hot electricity charging. If we represent the most simple version with three output diodes connected in parallel, like this:



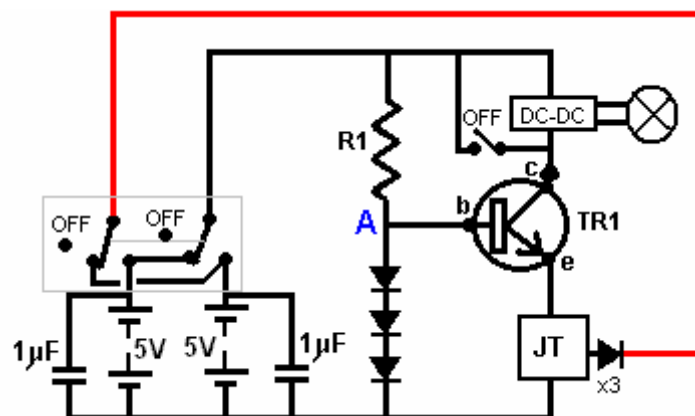
And, for example, we decide to produce a serious level of lighting using 24 LED 12V arrays:



Then we might choose to use a commercial DC-to-DC converter like this one:



And the circuit arrangement might be like this:

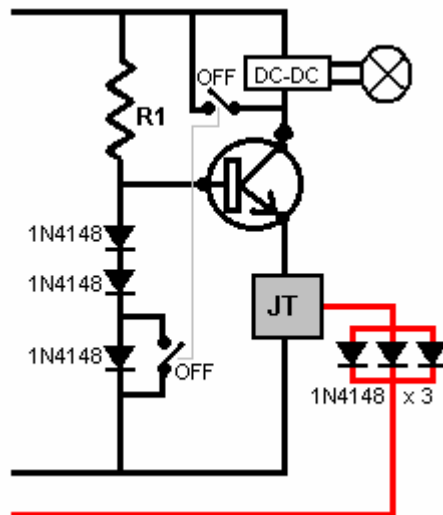


This circuit works really well. The current fed to the DC-DC step-up converter is controlled by the voltage at point “A” combined with the resistance of the Joule Thief circuit as the transistor is operating in “emitter-follower” mode. Consequently, the voltage supplied to the Joule Thief circuit will be about 0.7 volts lower than at point “A”.

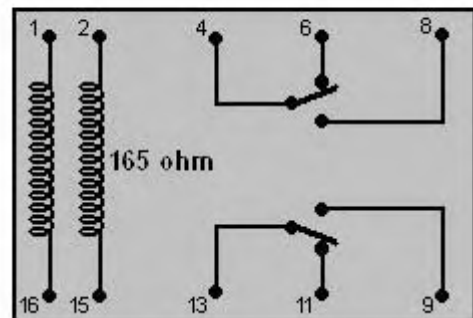
The strategy for this lighting system is to provide lighting during the hours of darkness when the user is not asleep, and then when the light is turned off and the user is sleeping, the battery gets recharged. Living at the latitude of Ireland, the longest that I use lighting is seven hours in mid winter and far, far

less in summer. A study carried out in Africa where there is no electrical service at all, states that the people there require lighting for 4 hours at night and 2 hours in the morning, so, with say, seven hours of lighting, that leaves 17 hours during which the battery can be recharged.

As shown, the circuit draws about 70 milliamps of current when lighting two or more LED arrays brightly for seven hours when powered by one set of four AA-size Digimax 2285 mAhr batteries. When the light is turned on, all of the lighting current is fed into the Joule Thief circuit and that allows it to charge a second set of four batteries. The very many extra hours during each day allows a very much greater period for recharging. While the circuit shows the off switch short-circuiting the lighting LEDs, there is nothing remotely like 70 milliamps of current draw and so the switch could drop the Joule Thief current down to just a few milliamps without lowering the charging rate. That would look like this:



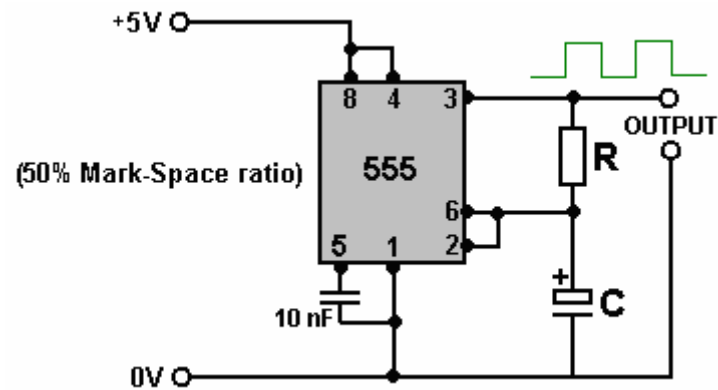
The circuit shown so far has two sets of four batteries. It would be nice to swap them over every few minutes. Batteries which are powering a load don't charge nearly as well as disconnected batteries which are being charged. However, the mechanism which switches between the two sets of batteries needs to have extremely low current draw in order not to waste current. One possibility for that would be to use a 5-volt latching relay like this one:



This is the electromechanical equivalent of a manual two-pole changeover switch. A brief pulse of current through the relay coil connected between the relay pins 1 and 16 locks the relay switch in one position while a brief pulse through the coil connected between pins 2 and 15 locks the switch in the other position. The current drain on the circuit would be almost zero.

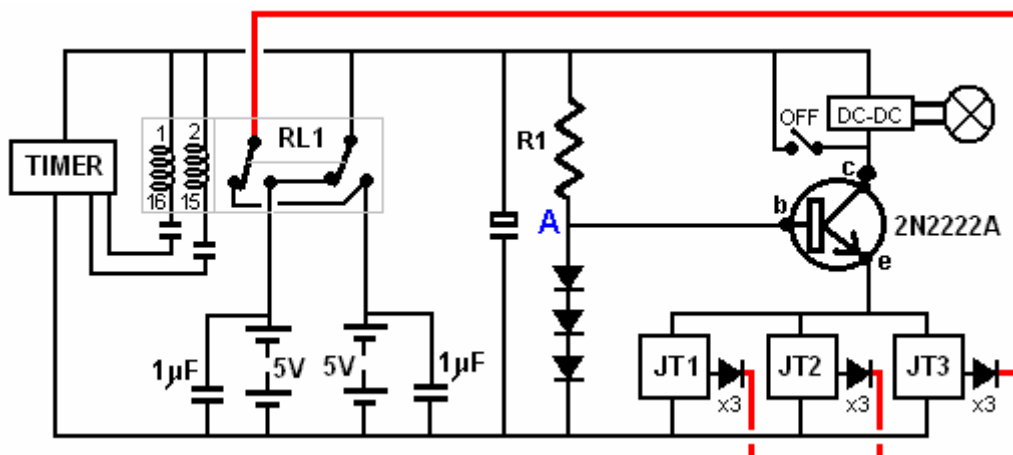
We could use a 555 timer chip to do the required switching. While a standard 555 chip can generally operate with a voltage as low as 4.5 volts, there are several more expensive 555 timers which are

designed to work with much lower supply voltages. One of these is the TLC555 which has a supply voltage range from just 2 volts right up to 15 volts, which is a very impressive range. Another version is the ILC555N with a voltage range from 2 volts to 18 volts. Combining one of those chips with a latching relay produces a very simple circuit:

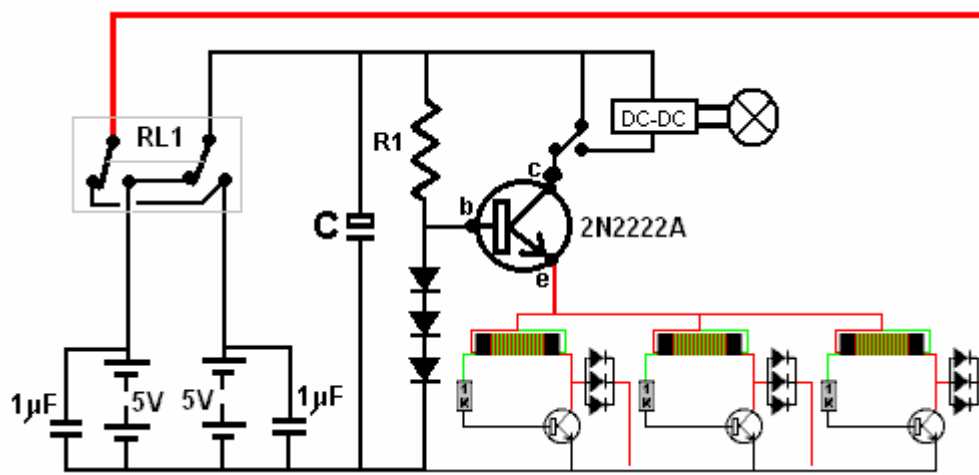


Joule Thief circuits do not need anything remotely like 70 milliamps of input current in order to charge a battery pack well. Consequently, we can use two or more Joule Thief circuits to share the current flowing through the lighting LED arrays.

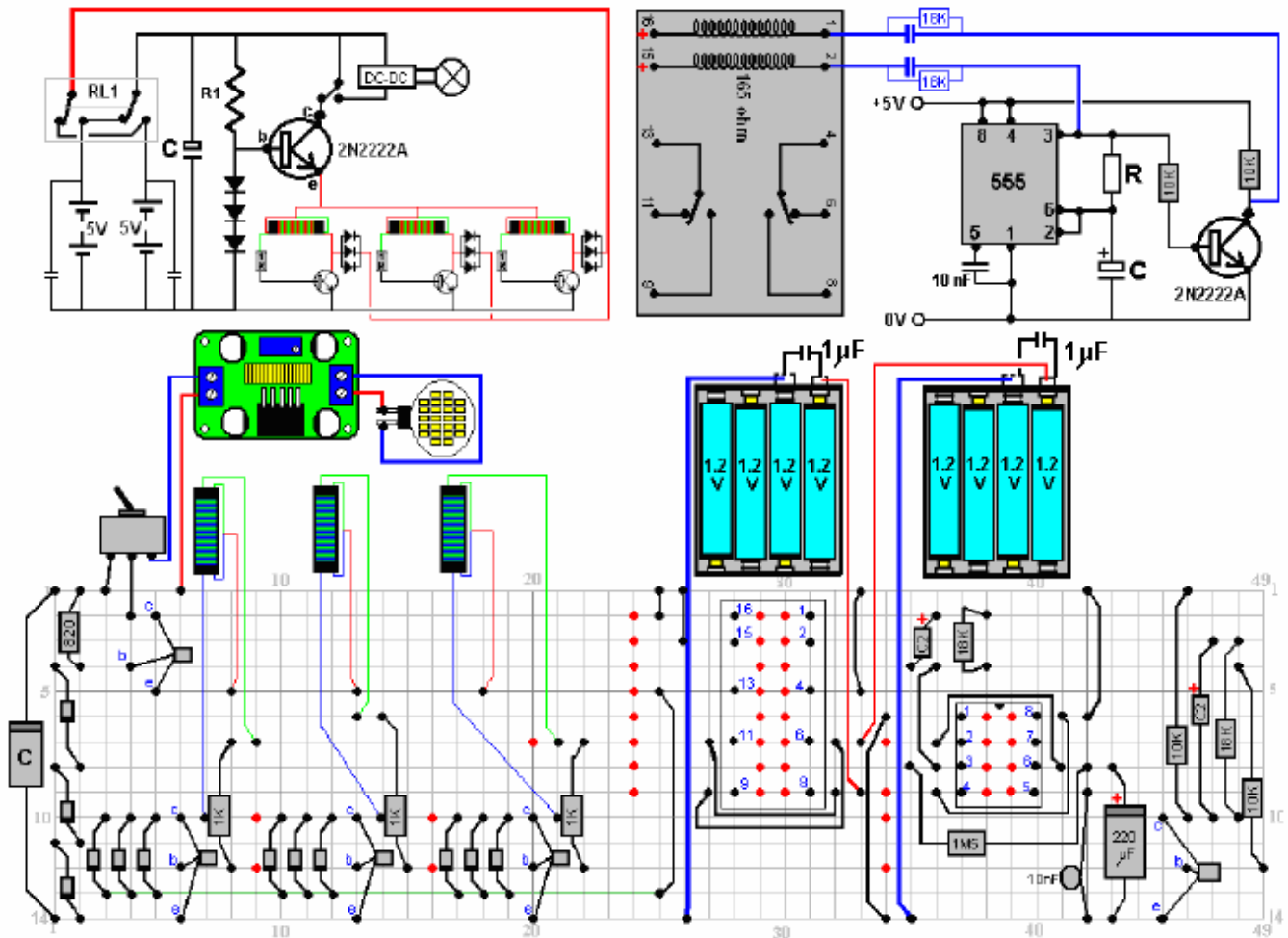
One addition which is helpful is a large capacitor "C" which supplies the circuit during the fraction of a second when the relay switches over:



or:

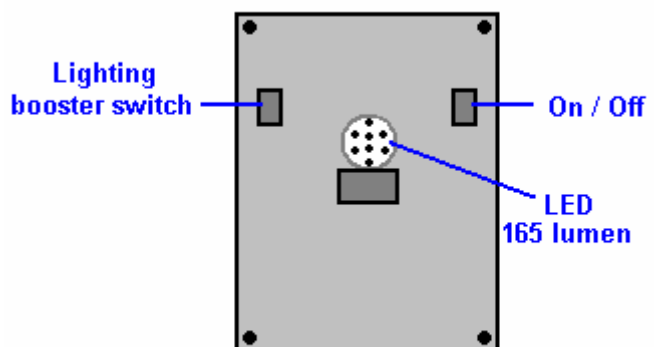


The capacitors which pass a brief pulse to the relay depend on your particular relay but they are generally around 100 microfarads and 16-Volt working capacity. Here is a possible physical layout for a three Joule Thief circuit version. It uses a 125 mm x 35 mm piece of stripboard, that is, a piece which has 14 horizontal copper strips and each strip has 49 holes in it. Why that odd size? Because a piece that size was available as an offcut when the prototype was being built. The prototype layout is like this:



The red dots in the suggested physical layout indicate places where the copper strip on the underside of the board is broken.

The question then arises, what do we do with the circuitry? There are various options. For example, a physical construction like this is excellent for general room lighting:



While this construction is very effective for desk work:



However, we tend to be unduly influenced by the style of living which we have experienced and we tend not to understand the needs of other people. For example, studies have been carried out in Africa, and here are the findings of one such study:

Anna Brüderle's "*Solar Lamps – Africa*" marketing research published by GIZ GmbH Uganda, has raised many previously unknown facts which should result in physical design changes. This survey shows:

1. Using a solar panel indoors is not possible due to lack of windows and major roof overhang.
2. Using a solar panel light being recharged outdoors is liable to have it stolen.
3. Using an outside solar panel connected by a wire is liable to damage and/or child injury when at play.

The survey-area lifestyle has the following characteristics:

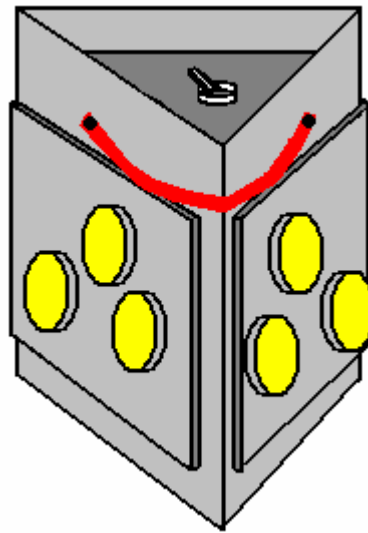
1. Seven people living in one building is not unusual and so 360-degree lighting is preferred.
2. The kitchen is normally separate and has no windows and yet needs meal-preparation lighting.
3. Burning a fuel for lighting is liable to cause poor health from the fumes produced.
4. Child education is hindered by lack of lighting.
5. Light usage is usually 3 or 4 hours at night plus 2 hours in the morning.
6. Tests with 100 lumen lighting level have been considered to be satisfactory.
7. Lamps are normally placed on the dining table during meals and hung from the ceiling at other times.
8. When carried outside, a narrow forward lighting arc of say, 90-degrees is preferred for safety.
9. Units with variable lighting levels are preferred but why is not specified – probably light duration.

In these houses, there can be internal walls which do not reach the ceiling so that light in the central room spills over into the additional rooms.

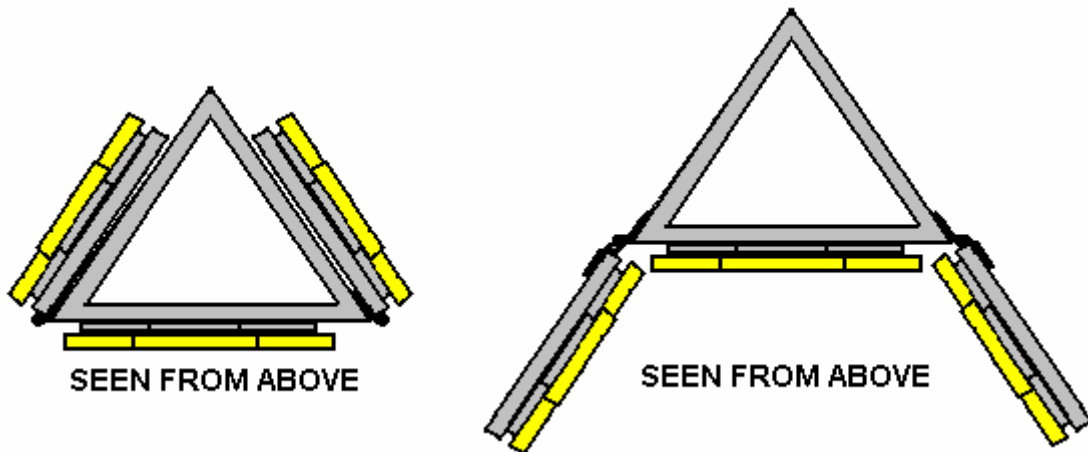
These features call for a lighting unit which is:

1. Able to provide 360-degree illumination.
2. Able to give a restricted 90-degree lighting arc when used outside.
3. Stable when standing on a horizontal surface.
4. Able to be carried comfortably.
5. Able to be suspended from a ceiling.
6. Able to provide considerably more than 100 lumens for the lighting periods used.
7. Is cheap enough to be bought.
8. Is very robust.
9. Is free of any glass components as hurricane lamp accidents are mainly cuts from broken glass.

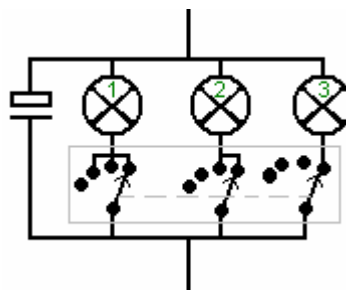
It is possible to design a lamp which meets all of these requirements although low cost is the most challenging requirement. To meet the user's needs, it might be possible to use a housing like this:



The triangular shape makes for easy construction and is very robust from an engineering point of view. It also cuts down the number of faces needed for 360-degree lighting to just three. The versatility is increased greatly if two faces are hinged:

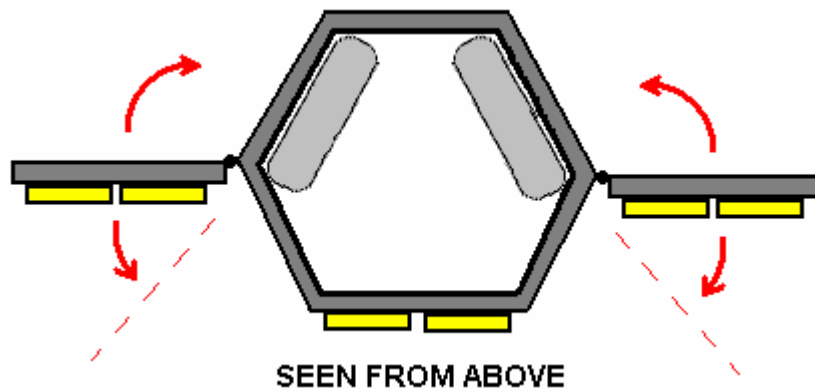


This arrangement allows two faces to be aligned with the fixed front face, giving all horizontal lighting in one direction which is a very, very bright arrangement. The two faces can be moved further around to give the wanted narrow forward beam for walking outdoors. If desired, the lighting level can be controlled by making the On/Off switch a three-pole four-way rotary switch:

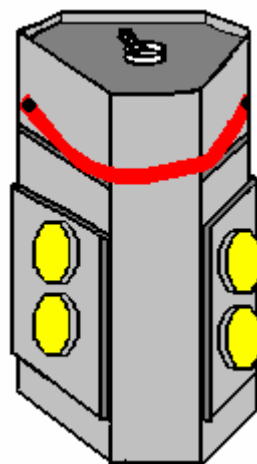


This arrangement gives Off, One panel, Two panels and Three panels of illumination, but it could also be that instead of switching off an entire panel that the switching illuminates one LED array per panel, two LED arrays per panel and three LED arrays per panel.

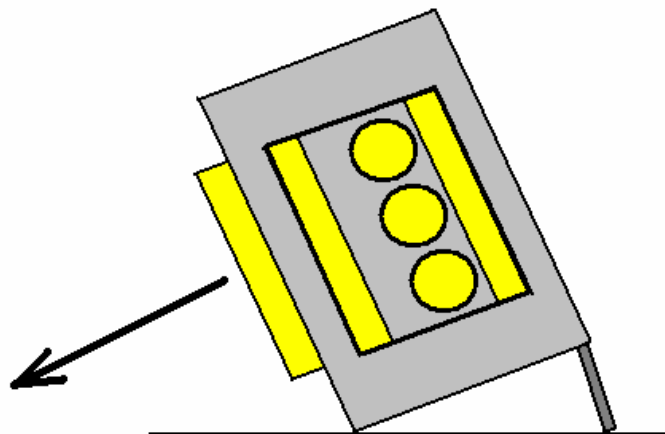
If ordinary 4-battery holders are used, then the lamp housing can be made more compact as the corners of the triangle are not needed. The battery packs fit in like this:



Giving a compact hexagonal shape which is strong and has the same lighting capability and open like this can be hung from the ceiling. The sides extend above the top and below the base so that the unit can stand on a flat surface either way up. The hinges need to be stiff so that they hold their position when set to the desired angle.



The addition of a simple hinged flap to the base allows a tilted option which imitates the downward lighting style of a desk lamp:



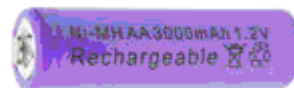
One important point which we have not yet discussed is the type of battery to use. Contrary to what you might expect, batteries do not perform anything like you would expect and battery choice is important for a project like this.

Tests which I have run show that a 1000 lux very realistic level of lighting can be provided with a total of just 1.5 watts of electrical power. The best lighting source that I have found is the “G4” style, LED arrays made in China using the “5050” chip technology. These are cheap and have a very heavily non-linear light output for current draw, which is a fact which we can use to our advantage. These LED arrays come in “white” or “warm white” versions and they look like this:

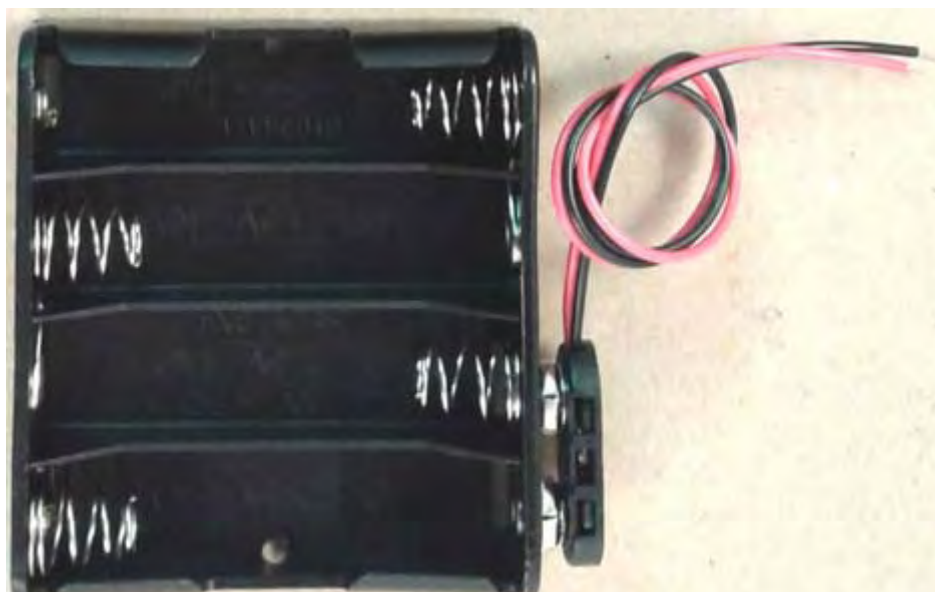


With a diameter of 30 mm and pins which are easy to connect to, these are very convenient devices which have an excellent lighting angle of 160 degrees and a light output of 165 lumens for a 1.2 watt electrical input.

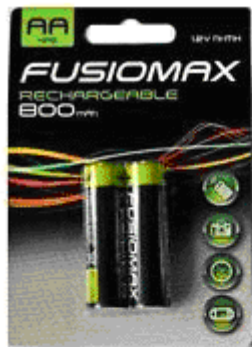
One of the problems with such a unit is the selection of a suitable battery. Lithium batteries are excellent but the cost of a suitable lithium battery is ten times greater than the cost envisaged for the whole unit, effectively excluding lithium batteries. Lead-acid batteries are far too large, too heavy and too expensive for this application. Surprisingly, what appears to be the best choice is the very popular AA size Nickel-Manganese rechargeable battery which is 50 mm long and 14 mm in diameter:



Rated at up to 3 Amp-Hour capacity, they are very low cost, are lightweight and can be placed in a battery box like this:



However, some of these small NiMH batteries do not live up to the maker's claims and so you need to run a load test on any particular make of battery which you may consider using. For example, here are six different types of these batteries tested in groups of four, with a load of about 50 milliamps at five volts. The same load was used to test each of these batteries:



Fusiomax 800



Digimax 2850



Duracell 2400



SDNMY 3800

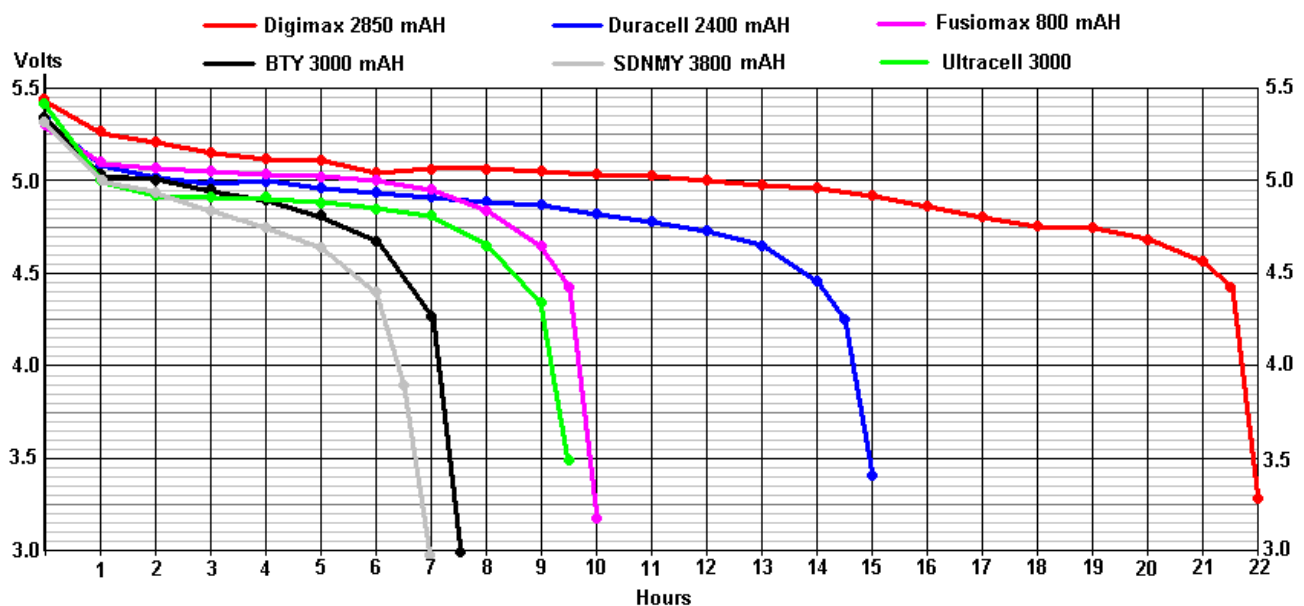


BTY 3000



Ultracell 3000

The results were most revealing:



The BTY 3000 batteries do not actually claim on the battery to be 3000 mAhr (although the sellers do) and so, the "3000" could just be a trading name. The tests results for the BTY 3000 were so staggeringly poor that the test was repeated three times with longer recharging time for each test, and

the one shown above is the 'best' result. You will notice how far short it falls when compared to the low-cost Fusiomax 800 mAh batteries costing only 50 pence each from Poundland. The terrible performance of the BTY 3000 batteries is only exceeded by the incredible "SDNMY 3800 mAh" batteries which show almost negligible capacity in spite of their amazing claims of 3800 mAh.

You will notice that the Digimax 2850 mAh batteries outperform the Duracell batteries and that the very cheap Fusiomax batteries which only claim 800 mAh capacity perform very well indeed.



NiMh batteries are 66% efficient. You should only ever charge a 3000 milliamp-hour NiMh battery at 300 milliamps or less. Light meter tests provide some very interesting results for the LED arrays. When using two LED arrays side by side in a light box, the voltage / current draw / light-produced results using 1.2-volt NiMh batteries were:

9 batteries 11.7V 206 mA 1133 lux: 2.41 watts 470 lux per watt (the manufacturer's intended performance)

8 batteries 10.4V 124 mA 725 lux 1.29 watts 562 lux per watt

7 batteries 9.1V 66 mA 419 lux 0.60 watts **697** lux per watt (a very realistic performance level)

6 batteries 7.8V 6 mA 43 lux 0.0468 watts 918 lux per watt

This is very revealing information, showing that one of these LED arrays fed with just 33 milliamps can produce very impressive 210 lux lighting at a wide angle of illumination. To put that another way, feeding five LED arrays with 9 volts, generates a very acceptable 1000-lux lighting level for just 165 milliamps which is only 1.5 watts. That is spectacular performance.

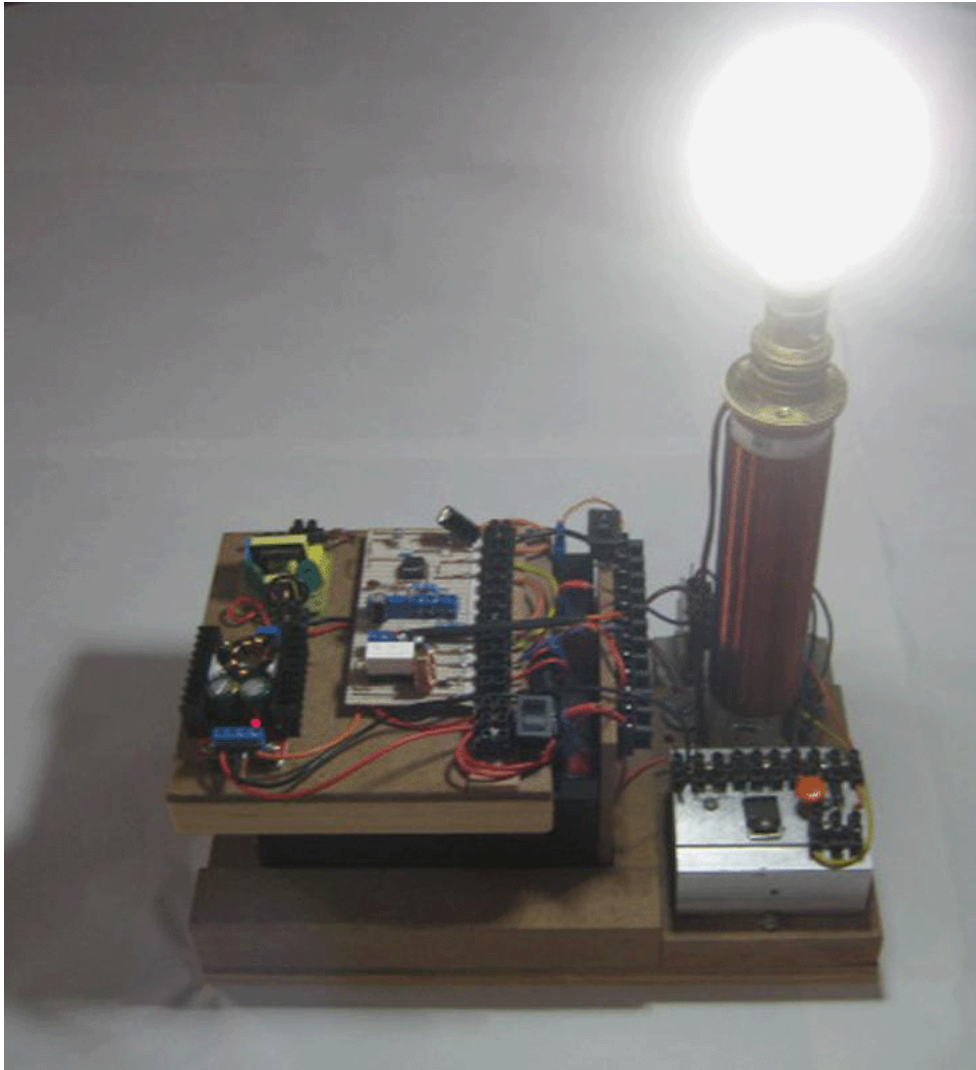
Equally impressive is what happens if the battery voltage were to drop. The LED efficiency performance rises to combat the loss of voltage and even at a ridiculously small 3 milliamps fed into each LED, there is a 21 lux light output from each LED array. The effect is that while the lighting does dim slightly if the battery voltage were to drop, the light level drops very gradually in a barely noticeable way. But, of course, we don't expect that to happen with this circuit.

While this arrangement of using the light at night and letting it recharge when switched off has worked well for me, the South African developer who developed his self-powered 150 watt generator has recently been experiencing power cuts which average seven hours per day. Because of this, he has built three of these lights for different positions in his house and to power his wi-fi.

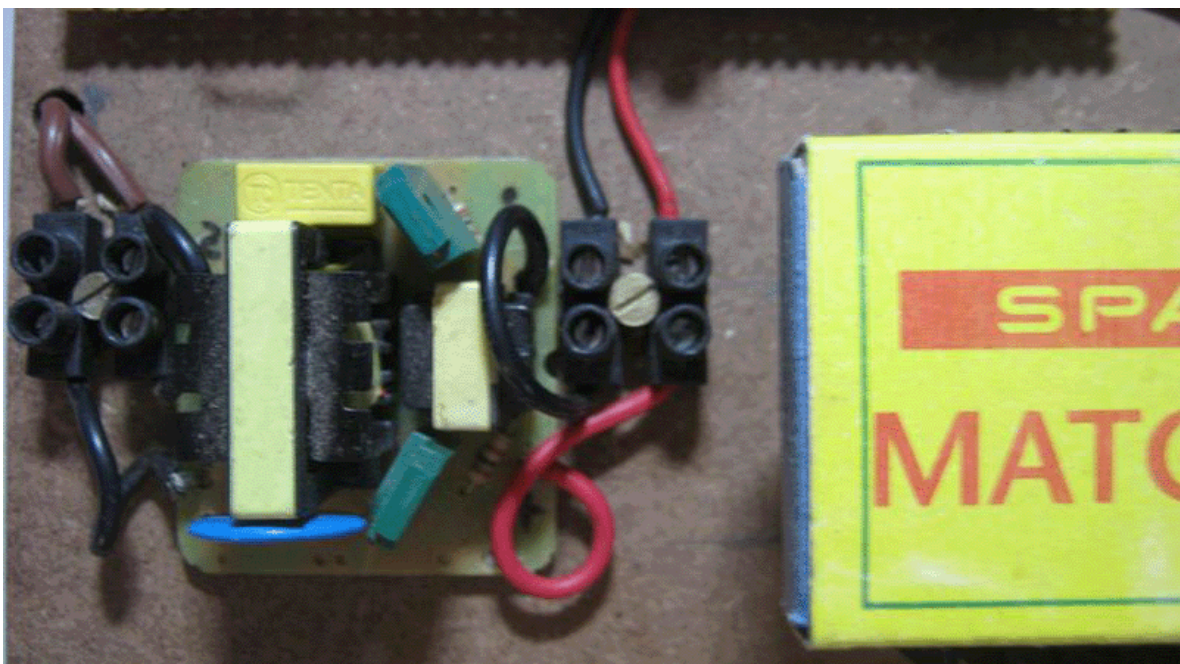
He has taken the circuit further and has changed the arrangement slightly as a result, winding the bi-filar coil of 2 x 100 turns on a 40 mm diameter white (NOT grey) PVC pipe 150 mm long. He uses 220-volt LED bulbs of 7 watts in power to produce the lighting and a tiny 12v to 220 volt inverter to drive the light. He uses a modified version of one of Alexkor's Joule Thief circuits to generate recharging feedback.

The arrangement is like this:

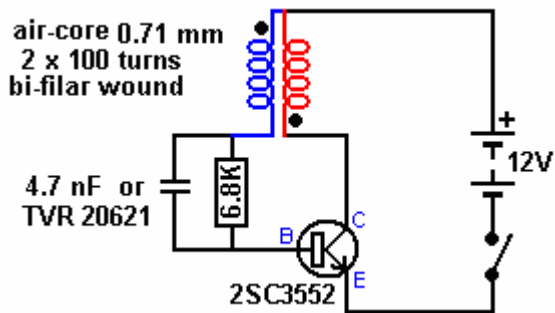




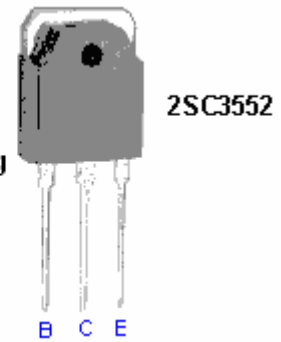
He uses a tiny 50 watt inverter to power the lamp:



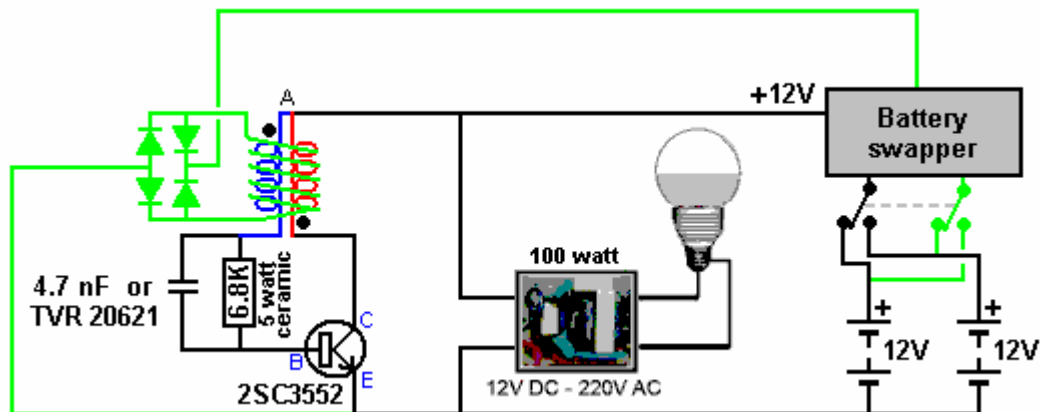
The oscillator circuit is:



500 to 1100 volt
12 amp continuous
150 watt Fast-acting



The circuit gives bright lighting for many hours and recharges the batteries whether providing lighting or not. The developer adds a coil of 200 turns of 0.71 mm wire around the existing bi-filar coil and uses that through a diode bridge to recharge the 12-volt batteries via his battery swapping module. This "FLEET" style arrangement is like this:



Again, our thanks go to the South African developer for sharing his development work. As with all circuitry, although not shown in any circuit diagram, a fuse or circuit breaker is connected to each battery so that any unintentional short circuit immediately isolates the battery and prevents any damage.

The Chinese are now producing 100 watt inverters which convert 12 volt DC to 220V AC and they are offered for sale at a ridiculously low price:



[Auto Car Power Inverter USB Charger Adapter 12V /24V to 220V Converter Adapter](#)

Brand new

£1.92

[Buy it Now](#)

Free Postage

[See more like this](#)

From China

The important thing about this circuitry is the battery recharging. Please understand very clearly that the recharging is NOT the resulting back-EMF voltage spikes being fed into the battery being charged. Instead, the recharging comes from energy flowing in from the local environment. That inflow of energy

is caused by back-EMF voltage spikes caused when the current flowing through a coil is cut off suddenly. That effect is governed more by the speed of the circuit switching, that is, how fast the transistor switches off, than by anything else. 1N4148 diodes are particularly good in these type of circuits because they switch in only 4 nanoseconds which is spectacularly fast.

There is no magic about any of this. We live in a massive energy field and gaining useful “free” energy is only a matter of persuading the energy field to divert the minutest fraction of itself to flow into your circuit. The South African developer uses 12-volt lead-acid batteries in these circuits as he has many of those batteries which he has recovered from discarded equipment in his local area. It's only a matter of convenience for him.

However, please understand that the pulse charging method shown here is enormously helpful for lead-acid batteries. It de-sulphates the batteries, increases their capacity and performance and extends the battery life almost indefinitely.

Patrick J Kelly

www.free-energy-info.tuks.nl

www.free-energy-info.com

www.free-energy-devices.com

Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

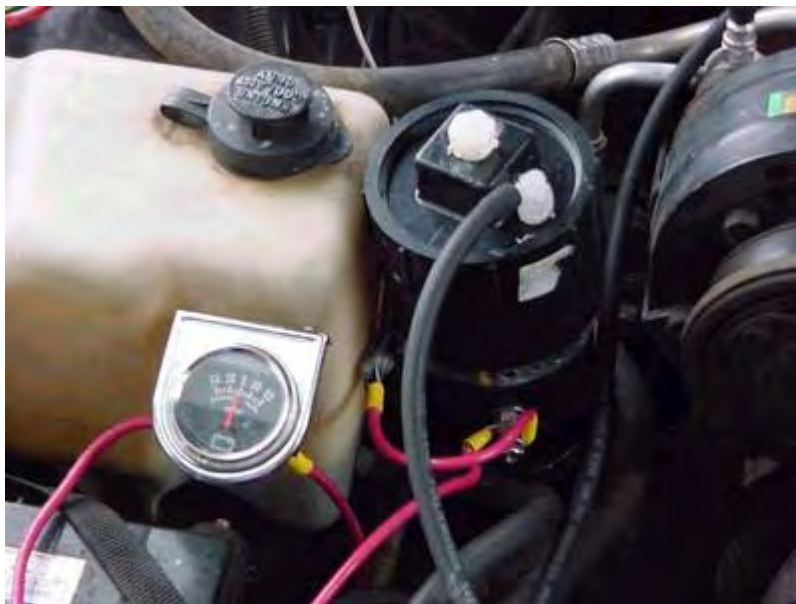
Chapter 22: HHO Boosters

HHO boosters are popular. They are used to add a hydrogen/oxygen gas mix to the air entering an internal combustion engine. That added mixture improves the quality of the burn of the normal fuel and as a result the miles per gallon performance of the engine is improved, usually by not less than 20% and sometimes by as much as 50% or even more. However, a really major additional benefit is the fact that harmful emissions are normally reduced to zero or very close to zero.

Boosters are easy to make as they are only a simple electrolyser which breaks down water into a gas mix which is then normally fed into the air filter of the engine. We will look at two different designs which their designers have very kindly shared with us:

The ‘Hotsabi’ Booster

Here are the full step-by-step instructions for making a very simple single-cell booster design from “HoTsAbI” - a member of the Yahoo ‘watercar’ forum group. This is a very neat and simple electrolysis booster unit which has raised the average mpg from 18 to 27 (50% increase) on the designer’s 1992 5-litre engined Chevy Caprice.

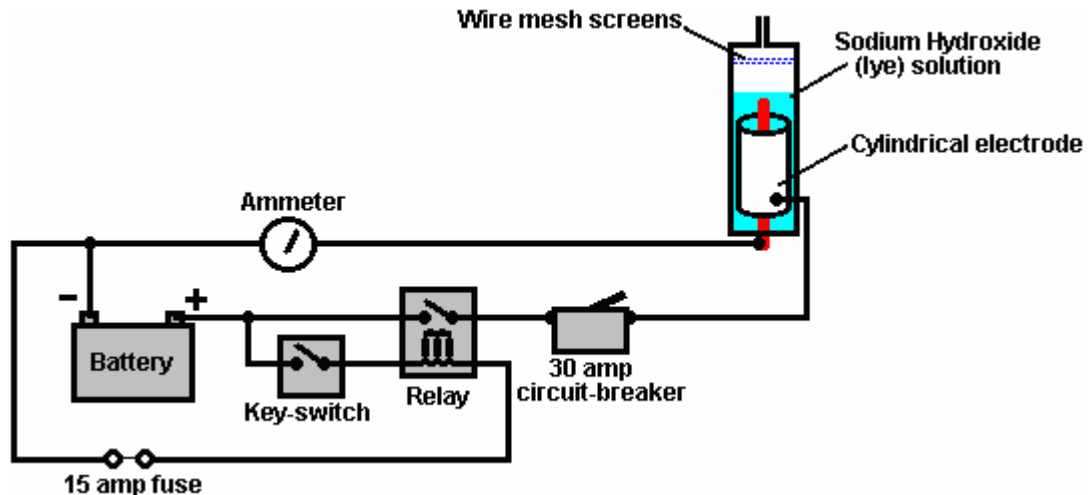


Caution: This is not a toy. If you make and use one of these, you do so entirely at your own risk. Neither the designer of the booster, the author of this document or the provider of the internet display are in any way liable should you suffer any loss or damage through your own actions. While it is believed to be entirely safe to make and use a booster of this design, provided that the safety instructions shown below are followed, it is stressed that the responsibility is yours and yours alone.

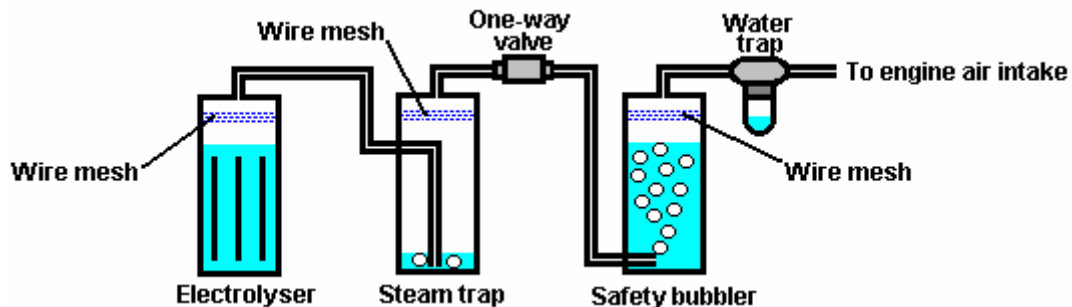
The unit draws 15 amps which is easily handled by the existing vehicle alternator. The construction uses ABS (Acrylonitrile Butadiene Styrene) plastic tubing with an electrolyte containing Sodium

Hydroxide (NaOH – sold in America as “Red Devil” lye, 1 teaspoon mixed into 8 litres of distilled water) and the gas-mixture produced is fed directly into the air intake filter of the car engine. The electrodes are stainless steel with the negative electrode forming a cylinder around the positive electrode.

The circuit is wired so that it is only powered up when the car ignition switch is closed. A relay feeds power to the electrolyser which is three inches (75 mm) in diameter and about 10 inches (250 mm) tall. The electrolyser circuit is protected by a 30-amp circuit breaker. The electrolyser has several stainless steel wire mesh screens above the water surface:



The output of the electrolyser is fed to a steam trap, also fitted with several stainless steel wire mesh screens, and then on via a one-way valve into a safety bubbler. The bubbler also has stainless steel wire mesh screens which the gas has to pass through before it exits the bubbler. The gas is then passed through an air-compressor style water trap to remove any remaining moisture, and is injected into the air intake of the vehicle. Although not shown in the diagram, the containers are protected by pop-out fittings which provide extra protection in the extremely unlikely event of any of the small volumes of gas being ignited by any means whatsoever.



The ammeter is used to indicate when water should be added to the electrolyser, which is typically, after about 80 hours of driving and is done through a plastic screw cap on the top of the electrolyser cap (shown clearly in the first photograph). This unit used to be available commercially but the designer is now too busy to make them up, so he has generously published the plans free as shown here.

The designer says: please read all of these instructions carefully and completely before starting your project. This project is the construction of an electrolyser unit which is intended to improve the running of a vehicle by adding gases produced by the electrolysis of water, to the air drawn into the engine when it is running. There is no magic about this. The ‘HHO’ gas produced by the electrolysis acts as an igniter for the normal fuel used by the vehicle. This produces a much better burn quality, extracting extra energy from the normal fuel, giving better pulling power, smoother running, cooler engine operation, the cleaning out of old carbon deposits inside the engine and generally extending the engine life.

ELECTROLYSER PARTS LIST

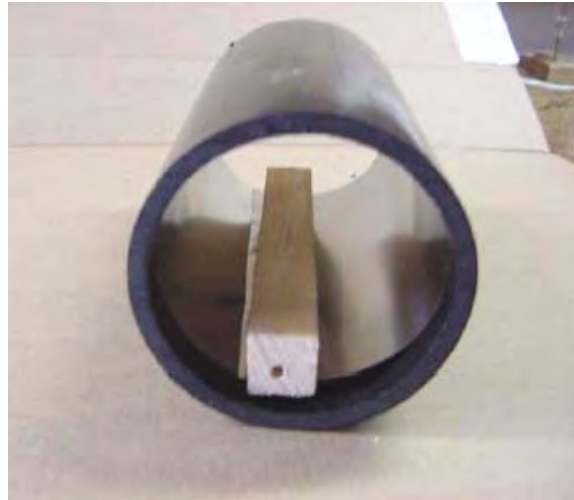
1. One 7 inch long x 3 inch diameter piece of ABS tubing cut with square ends - de-burr the edges
2. One 3 inch (75 mm) diameter ABS Plug - clean out the threaded cap
3. One Threaded adaptor DWV 3 inch (75 mm) diameter HXFPT threaded cap ("DWV" and "HXFPT" are male and female threaded sewer-type plastic caps)
4. One 3 inch (75 mm) diameter ABS cap
5. One 4 inch (100 mm) Stainless steel cap screw 1/4 x 20
6. Two stainless steel 1 inch long (25 mm) 1/4 x 20 cap screw
7. One 10/32 inch x 1/4 inch stainless steel screw
8. Five washers and Eight stainless steel nuts 1/4 x 20
9. One piece of stainless steel shimstock 11 inch x 6 inch 0.003 inch thick
10. One piece of stainless steel 14 gauge wire mesh 8 inch x 3 inch
11. One 3/8 inch nylon plug
12. One 1/4 inch x 1/4 inch NPT (National Pipe Tap) barbed fitting
13. Plumbers tape

TOOLS LIST

1. Hand drill
2. Tin Snips (for cutting steel mesh and shimstock)
3. 1/4 inch NPT tap and 5/16 inch drill bit
4. 3/8 inch NPT tap and 1/2 inch drill bit
5. 10/32 inch tap and 1/8 inch drill bit
6. One clamp and a piece of 1 inch x 1 inch wood strip
7. Hexagonal key "T-handle" wrench to fit the capscrew
8. Philips screwdriver
9. Small adjustable wrench



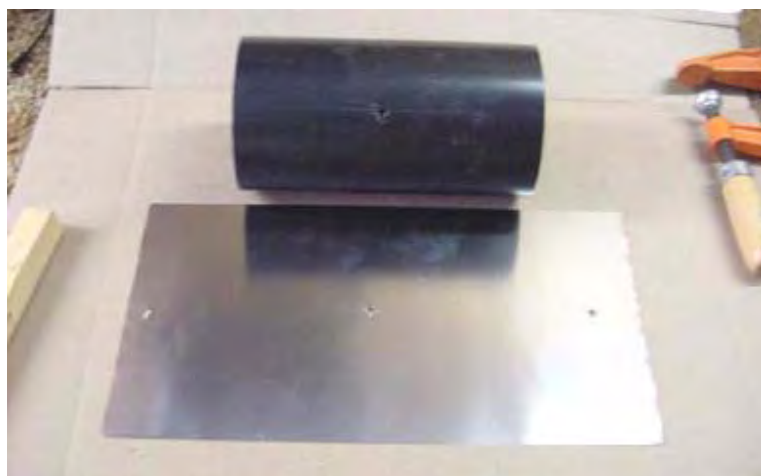
Cut and fit shimstock into ABS tubing, 11 inch works well as this gives a 1 inch overlap.



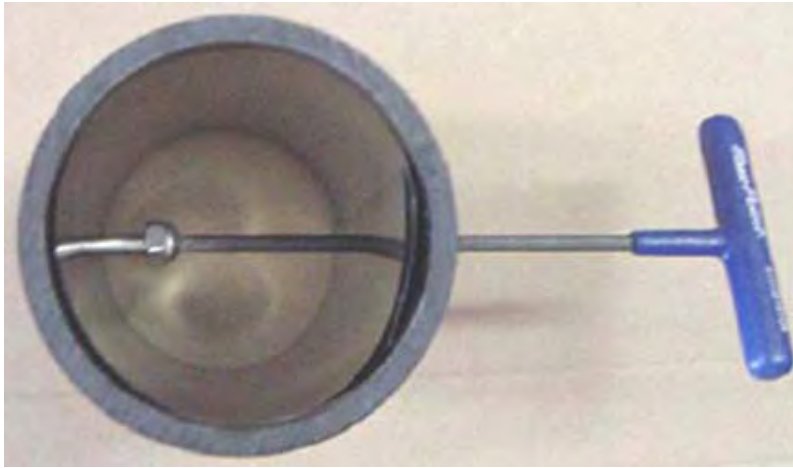
For drilling, use a strip of wood. Be sure that the shimstock is flush with at least one edge of the tube. Use the flush edge as the bottom of the electrolyser.



Clamp securely and drill two 0.165 inch holes, one on either side, perpendicular to each other, as best you can. These holes will be tapped 1/4 inch x 20



The shimstock holes need to be reamed out to accept the capscrew.



Note: This is why 2 holes are drilled (to facilitate assembly). Next, attach the electrode inside the barrel. It is **important** to use a stainless steel nut inside to seat the capscrew.



Note that the shimstock is flush with the bottom of the tube. Final assembly for the electrodes. Note that the capscrews each have stainless steel nuts inside the barrel to seat to the shimstock. The screw on the left will be used as the Negative battery connection to the cell while the screw on the right merely seats the shimstock.



The upper component is a Threaded Adaptor DWV 3 inch HXFPT. The lower component is a 3 inch ABS Plug, clean out the threaded cap. Prepare the top cap and plug: Drill and tap a 3/8 inch diameter NPT in the centre of the threaded cap (this is the main filling plug). Drill and tap a 1/4 inch NPT on the side (to take the barbed fitting).



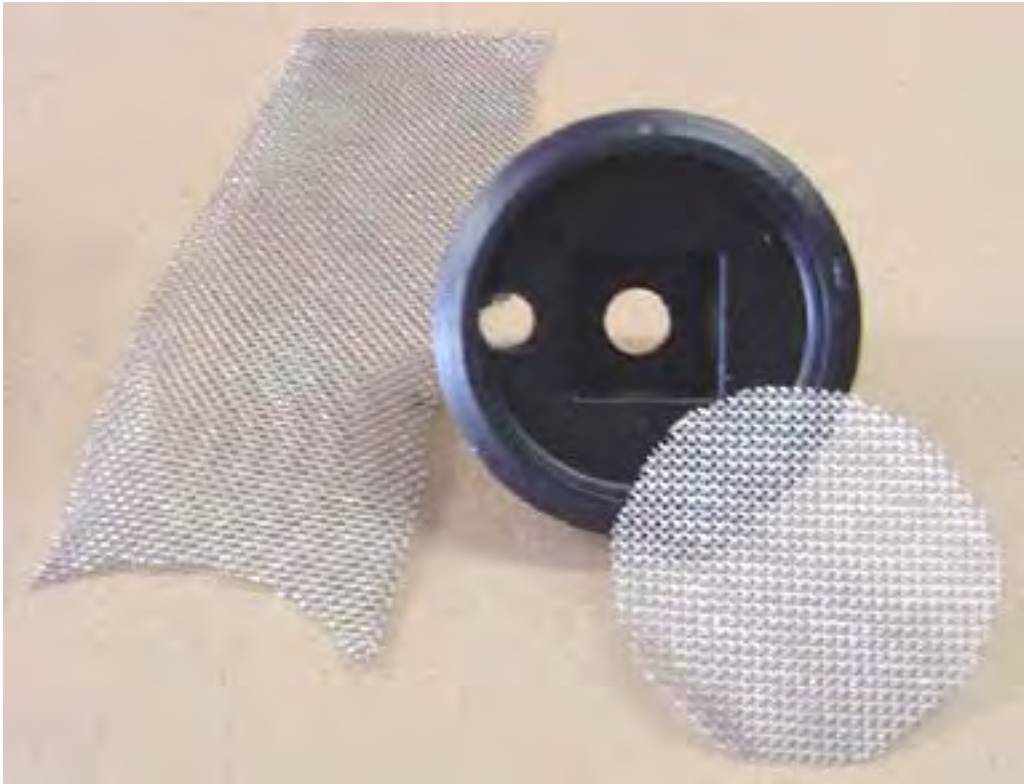
Prepare the bottom cap: Drill and tap 1/4 inch x 20 hole in the centre. Install the capscrew with a stainless steel nut. Tighten and install a washer and stainless steel nut outside.



This is the Positive battery connection.



This is the finished cell shown here upside down. Assemble the unit using ABS glue.



Next, prepare the stainless steel mesh. Cut it carefully to fit inside the threaded cap. Use at least 3 pieces.



After fitting the mesh tightly into the cap, mount it with a 10/32 inch stainless steel screw on the opposite side to the 1/4 inch tapped hole for the barbed fitting. This is a flame arrestor, so make CERTAIN that the entire inside is covered tightly. Note that the sides wrap up. Turn each layer to cross the grain of the mesh in the successive layers.



Use white "plumber's tape" on all threaded fittings.

This unit has raised the average miles-per-gallon performance of my 1992 5-litre Chevy Caprice from 18 to 27 mpg which is a 50% increase. It allows a very neat, professional-looking installation which works very well:



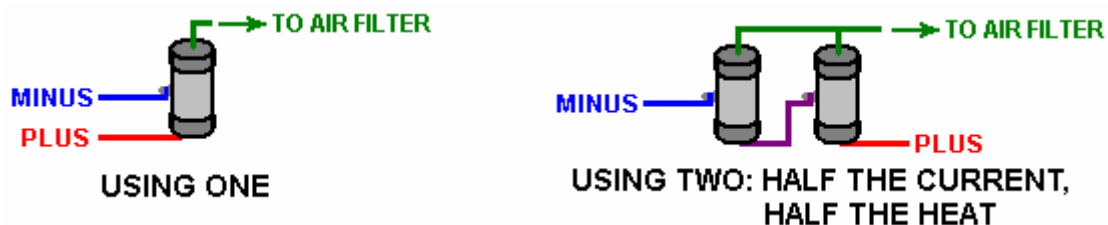


All of the 3/8 inch plastic fittings including one way valves, come from Ryanherco and are made of Kynar to withstand heat. The water trap is from an air compressor. The 3/16 inch tubing or hose is also high-heat type from automatic transmission coolant lines. I use Direct Current and limited with a thermal breaker and LYE mixture adjustment.

Comments by Patrick Kelly:

This design is very simple to construct, but as it is just a single cell with the whole of the vehicle's voltage placed across it, a good deal of the electrical power goes in heating the electrolyte rather than making the wanted HHO gas.

If there is sufficient space to fit two in, then using two allows you use half the current and that halves the heat generated in the units and doubles the length of time between topping up the unit with water:



Please don't get the impression that if a small amount of HHO gas produces a very beneficial effect on the running of a vehicle, that adding much more HHO gas will give even better results, as that is not the case. Each vehicle is different and will have a different optimum flow rate of HHO gas and if that optimum rate is exceeded, then although the mpg improvement may actually be reduced rather than increased. If in doubt, start with a low current (with more dilute electrolyte) which will produce less gas and see what the mpg results are. Then try a slightly stronger mix and check the mpg over several gallons of fuel. This will allow you to determine the booster current at which your particular vehicle operates best. This is not a competition to see who can produce the highest gas output, instead, it is a process to find out what the highest mpg your vehicle can give when using this simple booster design.

Mixing the electrolyte: Please remember that the sodium hydroxide or 'lye' (Lowes store: Roebic 'Heavy Duty' Crystal Drain Opener) is a strongly caustic substance which needs to be treated with care.

Always store it in a sturdy air-tight container which is clearly labelled "DANGER! - Sodium Hydroxide". Keep the container in a safe place, where it can't be reached by children, pets or people who won't take any notice of the label. If your supply of sodium hydroxide is in a strong plastic bag, then once you

open the bag, you should transfer all its contents to a sturdy, air-tight, plastic storage container, which you can open and close without risking spilling the contents. Hardware stores sell plastic buckets with air tight lids that can be used for this purpose.

When working with dry flakes or granules, wear safety goggles, rubber gloves, a long sleeved shirt, socks and long trousers. Also, don't wear your favourite clothes when handling electrolyte solution as it is not the best thing to get on clothes. It is also good practice to wear a face mask which covers your mouth and nose. If you are mixing solid sodium hydroxide with water, always add the hydroxide to the water, and not the other way round, and use a plastic container for the mixing, preferably one which has double the capacity of the finished mixture. The mixing should be done in a well-ventilated area which is not draughty as air currents can blow the dry hydroxide around.

When mixing the electrolyte, **never** use warm water. The water should be cool because the chemical reaction between the water and the hydroxide generates a good deal of heat. If possible, place the mixing container in a larger container filled with cold water, as that will help to keep the temperature down, and if your mixture should "boil over" it will contain the spillage. Add only a small amount of hydroxide at a time, stirring continuously, and if you stop stirring for any reason, put the lids back on all containers.

If, in spite of all precautions, you get some hydroxide solution on your skin, wash it off with plenty of running cold water and apply some vinegar to the skin. Vinegar is acidic, and will help balance out the alkalinity of the hydroxide. You can use lemon juice if you don't have vinegar to hand - but it is always recommended to keep a bottle of vinegar handy.

Then there is the second booster design:

The 'Smacks' Booster

The Smack's Booster is a piece of equipment which increases the mpg performance of a car or motorcycle, and reduces the harmful emissions dramatically. It does this by using some current from the vehicle's battery to break water into a mixture of hydrogen and oxygen gasses called "HHO" gas which is then added to the air which is being drawn into the engine. The HHO gas improves the quality of the fuel burn inside the engine, increases the engine power, cleans old carbon deposits off the inside of an old engine, reduces the unwanted exhaust emissions and improves the mpg figures under all driving conditions, provided that the fuel computer does not try to pump excess fuel into the engine when it detects the much improved quality of the exhaust.

This booster is easy to make and the components don't cost much. The technical performance of the unit is very good as it produces 1.7 litres of gas per minute at a very reasonable current draw. This is how to make and use it.

Caution: This is not a toy. If you make and use one of these, you do so entirely at your own risk. Neither the designer of the booster, the author of this document or the provider of the internet display are in any way liable should you suffer any loss or damage through your own actions. While it is believed to be entirely safe to make and use a booster of this design, provided that the safety instructions shown below are followed, it is stressed that the responsibility is yours and yours alone.

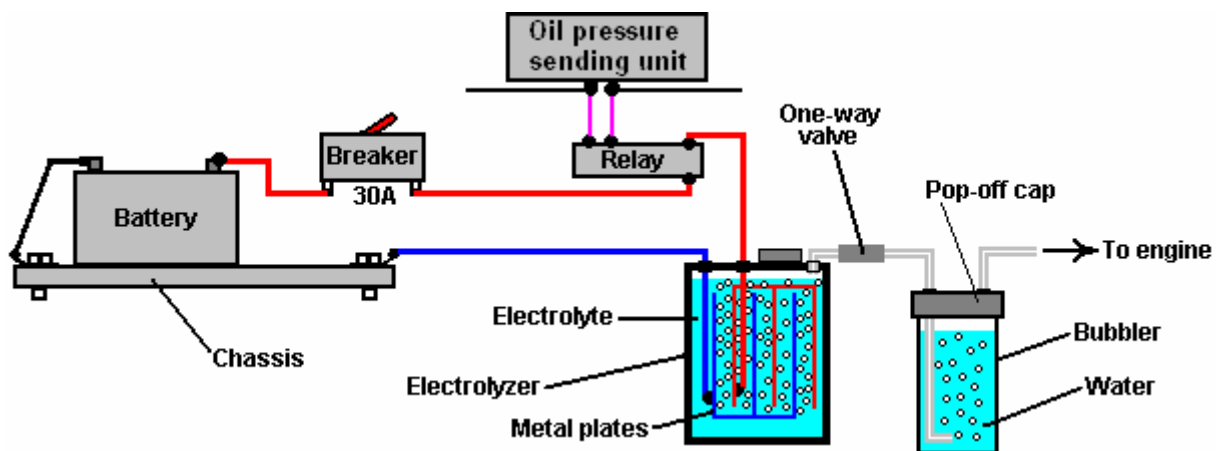
The Safety Gear

Before getting into the details of how to construct the booster, you must be aware of what needs to be done when using any booster of any design. Firstly, HHO gas is highly explosive. If it wasn't, it would not be able to do it's job of improving the explosions inside your engine. HHO gas needs to be treated with respect and caution. It is important to make sure that it goes into the engine and nowhere else. It is also important that it gets ignited inside the engine and nowhere else.

To make these things happen, a number of common-sense steps need to be taken. Firstly, the booster must not make gas when the engine is not running. The best way to arrange this is to switch off the current going to the booster. It is **not** sufficient to just have a manually-operated dashboard On/Off switch as it is almost certain that switching off will be forgotten one day. Instead, the electrical supply to the booster is routed through the ignition switch of the vehicle. That way, when the engine is turned off and the ignition key removed, it is certain that the booster is turned off as well.

So as not to put too much current through the ignition switch, and to allow for the possibility of the ignition switch being on when the engine is not running, instead of wiring the booster directly to the switch, it is better to wire a standard automotive relay across the oil pressure sending unit and let the relay carry the booster current. If the engine stops running, the oil pressure drops and if the booster is connected as shown, then this will also power down the booster.

An extra safety feature is to allow for the (very unlikely) possibility of an electrical short-circuit occurring in the booster or its wiring. This is done by putting a fuse or contact-breaker between the battery and the new circuitry as shown in this sketch:



If you choose to use a contact-breaker, then a light-emitting diode ("LED") with a current limiting resistor of say, 680 ohms in series with it, can be wired directly across the contacts of the circuit breaker. The LED can be mounted on the dashboard. As the contacts are normally closed, they short-circuit the LED and so no light shows. If the circuit-breaker is tripped, then the LED will light up to show that the circuit-breaker has operated. The current through the LED is so low that the electrolyser is effectively switched off when the contact breaker opens. This is not a necessary feature, merely an optional extra:



In the first sketch, you will notice that the booster contains a number of metal plates and the current passing through the liquid inside the booster (the "electrolyte") between these plates, causes the water to break up into the required gas mix. A very important safety item is the "bubbler" which is just a simple container with some water in it. The bubbler has the gas coming in at the bottom and bubbling up through the water. The gas collects above the water surface and is then drawn into the engine through an outlet pipe above the water surface. To prevent water being drawn into the booster when the booster is off and cools down, a one-way valve is placed in the pipe between the booster and the bubbler.

If the engine happens to produce a backfire, then the bubbler blocks the flame from passing back through the pipe and igniting the gas being produced in the booster. If the booster is made with a tightly-fitting lid rather than a screw-on lid, then if the gas in the bubbler is ignited, it will just blow the lid off the bubbler and rob the explosion of any real force. A bubbler is a very simple, very cheap and very sensible thing to install. It also removes any traces of electrolyte fumes from the gas before it is drawn into the engine.

You will notice that the wires going to the plates inside the electrolyser are both connected well below the surface of the liquid. This is to avoid the possibility of a connection working loose with the vibration of the vehicle and causing a spark in the gas-filled region above the surface of the liquid, and this volume is kept as low as possible as another safety feature.

The Design

The booster is made from a length of 4-inch diameter PVC pipe, two caps, several metal plates, a couple of metal straps and some other minor bits and pieces.

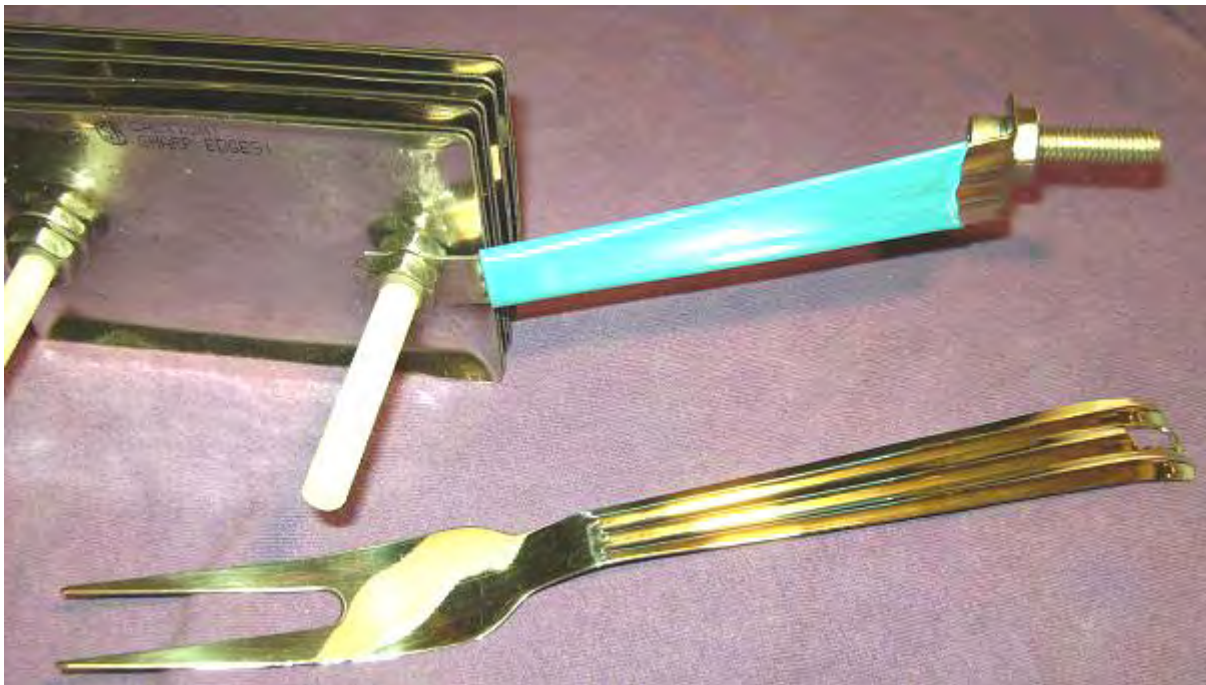
This is not rocket science, and this booster can be built by anybody. A clever extra feature is the transparent plastic tube added to the side of the booster, to show the level of the liquid inside the booster without having to unscrew the cap. Another neat feature is the very compact transparent bubbler which is actually attached to the booster and which shows the gas flow coming from the booster. The main PVC booster pipe length can be adjusted to suit the available space beside the engine.



Bubbler connections close up:



This booster uses cheap, standard electrical stainless steel wall switch covers from the local hardware store and stainless steel straps cut from the handles of a wide range of stainless steel food-preparation ladles:



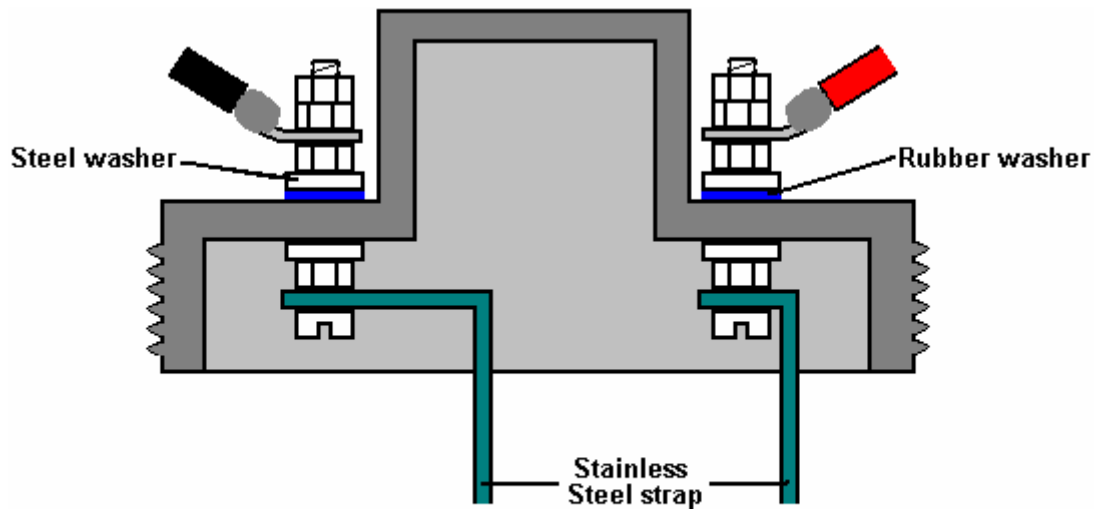
The electrical cover plates are clamped together in an array of eight closely-spaced pairs of covers. The plates are held in a vise and the holes drilled out to the larger size needed. The covers are further treated by being clamped to a workbench and dented using a centre-punch and hammer. These indentations raise the gas output from 1.5 lpm to 1.7 lpm as the both increase the surface area of the cover and provide points from which the gas bubbles can drop off the cover more easily. The more indentations the better.

The active surfaces of the plates - that is, the surfaces which are 1.6 mm apart from each other, need to be prepared carefully. To do this, these surfaces are scored in an X-pattern using 36-grade coarse sandpaper. Doing this creates miniature sharp-crested bumps covering the entire surface of each of these plates. This type of surface helps the gas bubbles break away from the surface as soon as they are formed. It also increases the effective surface area of the plate by about 40%. I know that it may seem a little fussy, but it has been found that fingerprints on the plates of any electrolyser seriously hinder the gas production because they reduce the working area of the plate quite substantially. It is important then, to either avoid all fingerprints (by wearing clean rubber gloves) or finish the plates by cleaning all grease and dirt off the working surfaces with a good solvent, which is washed off afterwards with distilled water. Wearing clean rubber gloves is by far the better option as cleaning chemicals are not a good thing to be applying to these important surfaces.



Shown above are typical hand tools used to create the indentations on the plates. The active plate surfaces – that is, the surfaces which are 1.6 mm apart – are indented as well as being sanded.

An array of these prepared plates is suspended inside a container made from 4-inch (100 mm) diameter PVC pipe. The pipe is converted to a container by using PVC glue to attach an end-cap on one end and a screw-cap fitting on the other. The container then has the gas-supply pipe fitting attached to the cap, which is drilled with two holes to allow the connecting straps for the plate array to be bolted to the cap, as shown here:



CROSS-SECTION THROUGH CAP



In order to ensure that the stainless steel straps are tightly connected to the electric wiring, the cap bolts are both located on the robust, horizontal surface of the cap, and clamped securely both inside and out. A rubber washer or rubber gasket is used to enhance the seal on the outside of the cap. If available, a steel washer with integral rubber facing can be used.



As the stainless steel strap which connects the booster plates to the negative side of the electrical supply connects to the central section of the plate array, it is necessary to kink it inwards. The angle used for this is in no way important, but the strap should be perfectly vertical when it reaches the plates.



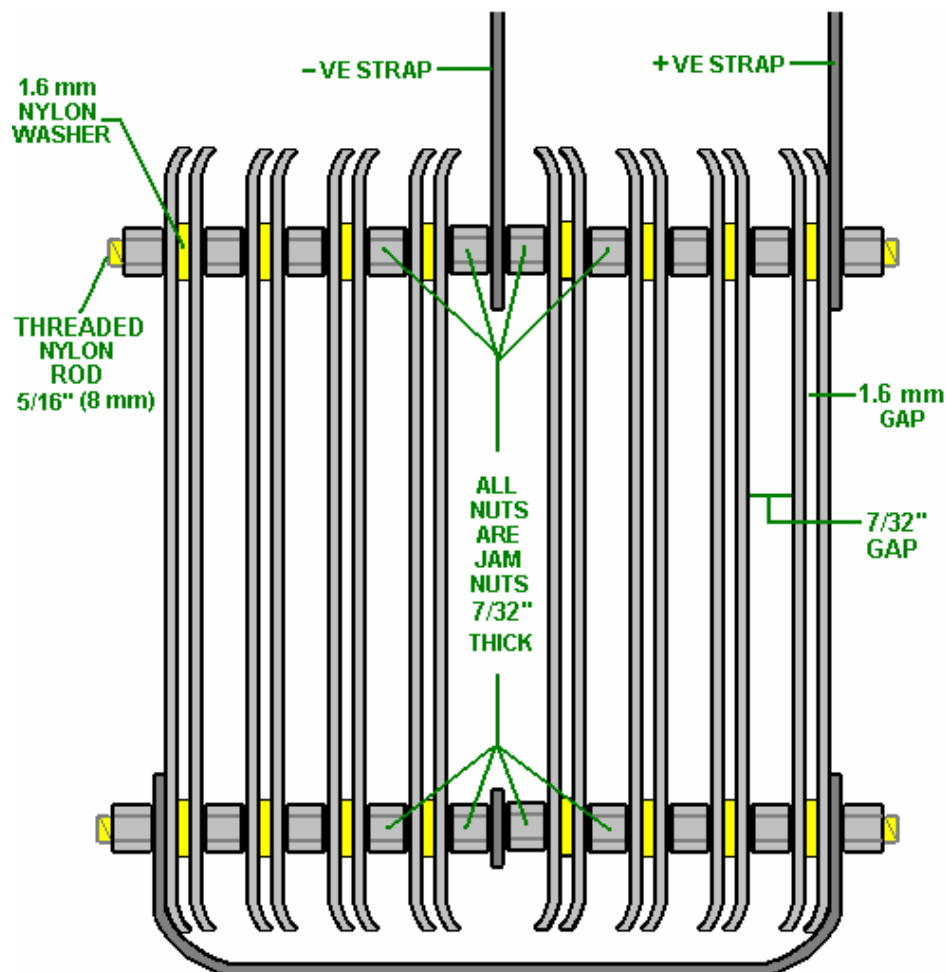
The picture above shows clearly the wall plates being used and how the bubbler is attached to the body of the booster with super-glue. It also shows the various pipe connections. The stainless steel switch-cover plates are 2.75 inch x 4.5 inch (70 mm x 115 mm) in size and their existing mounting holes are drilled out to 5/16 inch (8 mm) diameter in order to take the plastic bolts used to hold the plates together to make an array. After a year of continuous use, these plates are still shiny and not corroded in any way.

Three stainless steel straps are used to connect the plate array together and connect it to the screw cap of the booster. These straps are taken from the handles of cooking utensils and they connect to the outer two plates at the top and the third strap runs across the bottom of the plate array, clear of the plates, and connects to both outside plates as can be seen in the diagrams.

The plates are held in position by two plastic bolts which run through the original mounting holes in the plates. The arrangement is to have a small 1.6 mm gap between each of eight pairs of plates. These gaps are produced by putting plastic washers on the plastic bolts between each pair of plates.

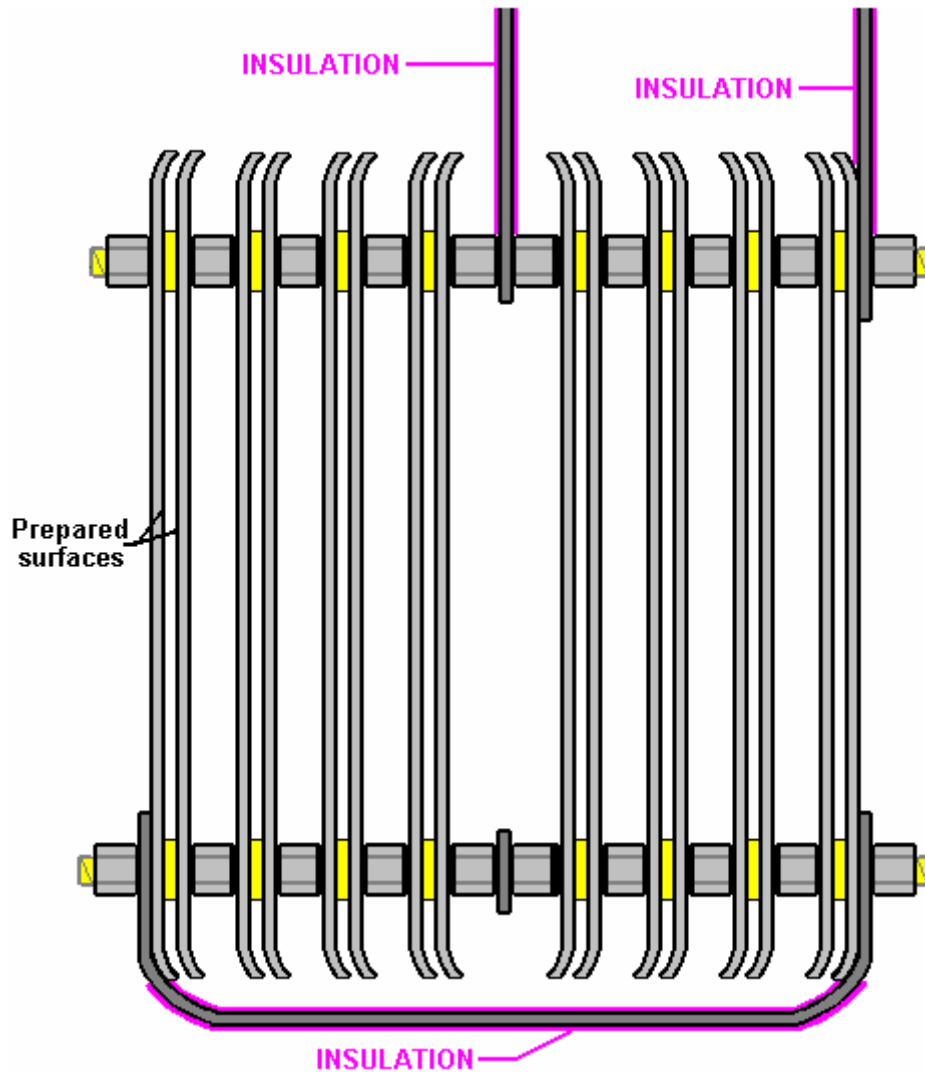
The most important spacing here is the 1.6 mm gap between the plates as this spacing has been found to be very effective in the electrolysis process. The way that the battery is connected is unusual in that it leaves most of the plates apparently unconnected. These plate pairs are called "floaters" and they do produce gas in spite of looking as if they are not electrically connected (they are connected through the electrolyte).

Stainless steel nuts are used between each pair of plates and these form an electrical connection between adjacent plates. The plate array made in this way is cheap, easy to construct and both compact and robust. The electrical straps are bolted to the screw cap at the top of the unit and this both positions the plate array securely and provides electrical connection bolts on the outside of the cap while maintaining an airtight seal for the holes in the cap.

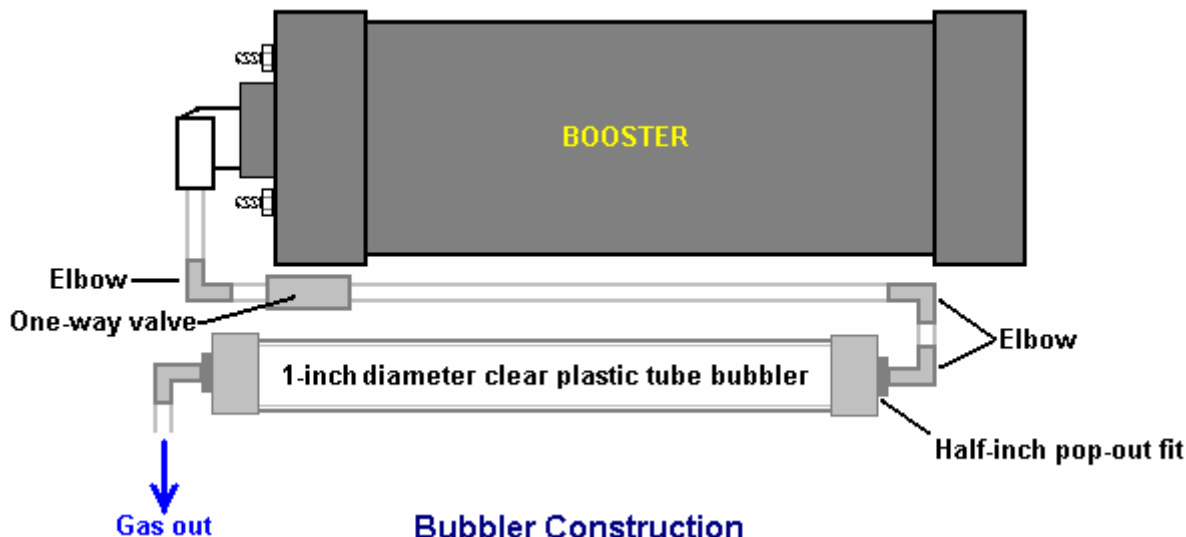


SIDE VIEW OF PLATE ARRAY

Another very practical point is that the stainless steel straps running from the screw cap to the plate array, need to be insulated so that current does not leak directly between them through the electrolyte. The same applies to the strap which runs underneath the plates. This insulating is best done with shrink-wrap. Alternatively, good quality tool dip (McMaster Carr part number 9560t71) is an effective method, but if neither of these methods can be used, then the insulating can be done by wrapping the straps in electrical insulating tape. Using that method, the tape is wrapped tightly around the straps, being stretched slightly as it is wrapped. The section running underneath the covers is insulated before the array is assembled.



The PVC housing for the booster has two small-diameter angle pipe fittings attached to it and a piece of clear plastic tubing placed between them so that the level of the electrolyte can be checked without removing the screw cap. The white tube on the other side of the booster is a compact bubbler which is glued directly to the body of the booster using super-glue in order to produce a single combined booster/bubbler unit. The bubbler arrangement is shown here, spread out before gluing in place as this makes the method of connection easier to see.



The half-inch diameter elbows at the ends of the one-inch diameter bubbler tube have their threads coated with silicone before being pushed into place. This allows both of them to act as pressure-relief pop-out fittings in the unlikely event of the gas being ignited. This is an added safety feature of the design.

This booster is operated with a solution of Potassium Hydroxide also called KOH or Caustic Potash which can be bought from various suppliers such as:

<http://www.essentialdepot.com/servlet/the-13/2-lbs-Potassium-Hydroxide/Detail>

<http://www.organic-creations.com/servlet/the-653/caustic-potassium-hydroxide-KOH/Detail>

<http://www.aaa-chemicals.com/pohy2posa.html> or

<http://www.nuscentcandle.com/PHFLAKES.html>

To get the right amount in the booster, I fill the booster to its normal liquid level with distilled water and add the Hydroxide a little at a time, until the current through the booster is about 4 amps below my chosen working current of 20 amps. This allows for the unit heating up when it is working and drawing more current because the electrolyte is hot. The amount of KOH is typically 2 teaspoonfuls. It is very important to use distilled water as tap water has impurities in it which make a mess which will clog up the booster. Also, be very careful handling potassium hydroxide as it is highly caustic. If any gets on you, wash it off immediately with large amounts of water, and if necessary, use some vinegar which is acidic and will offset the caustic splashes.

The booster can be built using different materials to give it a cool look:



And attached to a cool bike:



The final important thing is how the booster gets connected to the engine. The normal mounting for the booster is close to the carburettor or throttle body so that a short length of piping can be used to connect the booster to the intake of the engine. The connection can be to the air box which houses the filter, or into the intake tube. The closer to the butterfly valve the better, because for safety reasons, we

want to reduce the volume of HHO gas hanging around in the intake system. You can drill and tap a 1/4" (6 mm) NPT fitting into the plastic inlet tubing with a barbed end for connecting the 1/4" (6 mm) hose.

The shorter the run of tubing to the air ductwork of the engine, the better. Again, for safety reasons, we want to limit the amount of unprotected HHO gas. If a long run of 3 feet (1 metre) or more must be used due to space constraints, then it would be a good idea to add another bubbler at the end of the tube, for additional protection. If you do this, then it is better to use a larger diameter outlet hose, say 3/8" or 5/16" (10 mm or 8 mm).

Powering your Booster

Use wire and electrical hardware capable of handling 20 amps DC, no less. Overkill is OK in this situation, so I recommend using components that can handle 30 amps. Run your power through your ignition circuit, so that it only runs when the vehicle is on. A 30 amp relay should be used to prevent damaging the ignition circuit which may not be designed for an extra 20 amp draw. Make sure to use a properly rated fuse, 30 amps is ideal. You can use a toggle switch if you like for further control. As an added safety feature, some like to run an oil pressure switch to the relay as well, so the unit operates only when the engine is actually running. It is very important that all electrical connections be solid and secure. Soldering is better than crimping. Any loose connections will cause heat and possibly a fire, so it is up to you to make sure those connections are of high quality. They must be clean and tight, and should be checked from time to time as you operate the unit just to be sure the system is secure.

Adjusting the Electrolyte

Fill your booster with distilled water and NaOH (sodium hydroxide) or KOH (potassium hydroxide) **only**. No tap water, salt water or rainwater! **No table salt or baking soda!** These materials will permanently damage the booster!

First, fill the booster with distilled water about 2" from the top. Add a teaspoon of KOH or NaOH to the water and then slide the top into place. Do not tighten it for now, but leave the top loose and resting in place. Connect your 12V power supply to the leads and monitor the current draw of the unit. You want 16 amps flowing when the booster is cold. As the water heats up over time, the current draw will increase by around 4 amps until it reaches about 20 amps, and this is why you are aiming for only 16 amps with a cold system.

If the current is too high, dump out some electrolyte and add just distilled water. If the current is too low, add a pinch or two at a time of your catalyst until the 16 amps is reached. Overfilling your booster will cause some of the electrolyte to be forced up the output tube, so a liquid level tube was added to monitor electrolyte level.

The booster generally needs to be topped off once a week, depending on how long it is in operation. Add distilled water, then check your current draw again. You may observe a drop in current over the course of a few refills, and this is normal. Some of the catalyst escapes the cell suspended in water vapour droplets, so from time to time you may need to add a pinch or two. The water in the bubbler acts to scrub this contaminant out of the gas as well. I highly recommend installing an ammeter to monitor current draw as you operate your booster.

Mounting the Booster

Choose a well ventilated area in the engine compartment to mount your booster. Since every vehicle design is different, I leave it up to you to figure out the best method to mount it. It must be mounted with the top orientated upwards. Large 5" diameter hose clamps work well, but do not over tighten them or the PVC may deform. I recommend mounting the booster behind the front bumper in the area usually present between it and the radiator. Support the weight of the unit from the bottom with a bracket of your design, then use two hose clamps to secure the unit, one near the top and one near the bottom. Never install the unit in the passenger compartment for safety reasons.

Output hose and Bubbler

The bubbler on the side of the unit should be filled about 1/3 to 1/2 full of water - tap water is fine for the bubbler. The check valve before the bubbler is there to prevent the bubbler water from being sucked back into the booster when it cools and the gases inside contract. **Make sure the bubbler level is maintained at all times. Failure to do so could result in an unwanted backfire explosion.** That water inside the bubbler is your physical shield between the stored HHO volume in the generator and the intake of your engine. Install the output hose as close to the carburettor/throttle body as close as possible by making a connection into the intake tube/air cleaner. Try to make the hose as short as possible to reduce the amount of gas volume it contains. I recommend using the same type of 1/4" poly hose that is used on the unit.

Here is a list of the parts needed to construct the booster and bubbler if you decide to build it yourself rather than buying a ready-made unit:

The Main Parts Needed

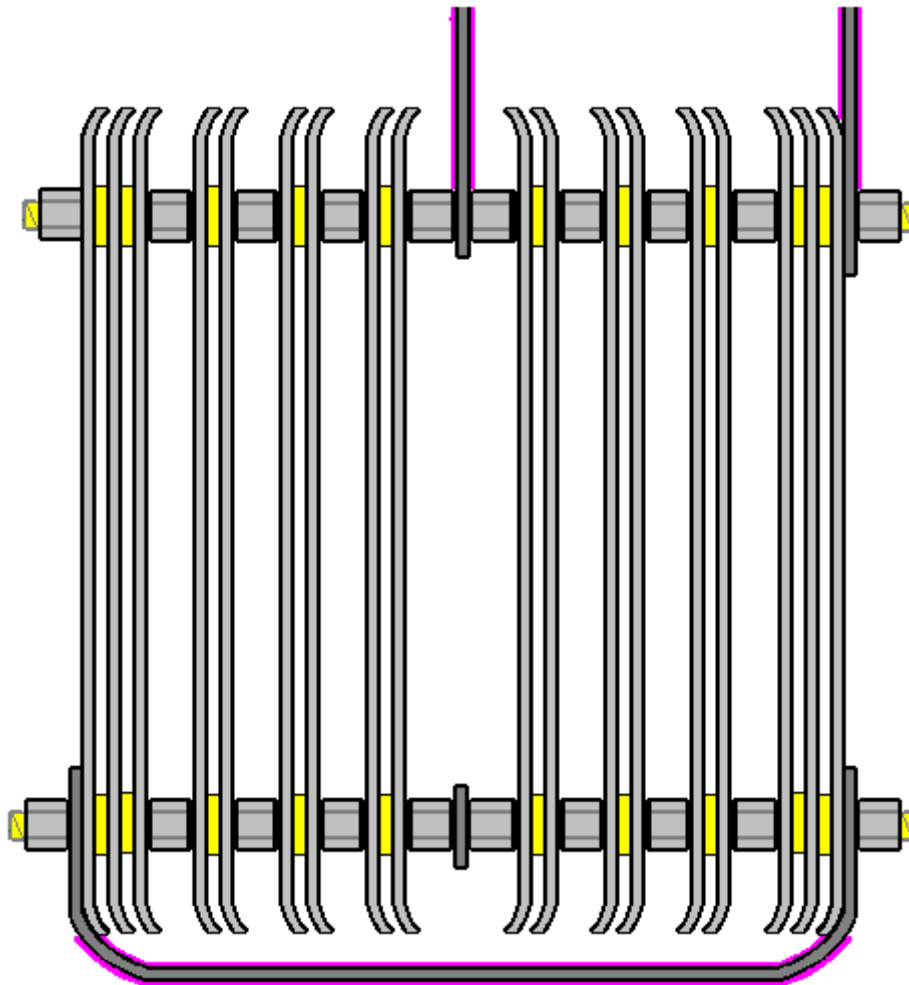
Part	Quantity	Comment
4-inch diameter PVC pipe 12-inches long	1	Forms the body of the booster
4-inch diameter PVC pipe end-cap	1	Closes the bottom of the booster
4-inch diameter PVC pipe screw cap	1	The top of the booster
90-degree Quick Connect Outlet fitting	1	3/8" O.D. Tube x 1/4" NPT from Hardware store
Level indicator Nylon barbed tube fitting	2	1/4" Tube x 1/8" NPT Part Number 2974K153 or from your local hardware store
Quarter-inch I.D. Poly sight tube	8"	Water-level indicator tubing - Hardware store
Stainless steel switch covers	16	The plate array components
Stainless steel straps 12-inches long	2	The electrical connections to the plates
3/4" Inside Diameter Clear poly tube	12-inch	From your local hardware store
5/16" stainless steel bolts 1.25" long	2	Electrical strap connection to the top cap
5/16" stainless steel nuts & washers	6 each	To fit the steel bolts in the cap
5/16" diameter nylon threaded rod	8" min.	Nylon Threaded Rod 5/16"-18 Thread. McMaster Carr Part No 98831a030
5/16" inch nylon washers 1.6 mm thick	1-pack	Nylon 6/6 Flat Washer 5/16", Pack of 100 McMaster Carr Part No 90295a160
5/16"-18 s/s jam nuts (7/32" thick)	20	McMaster Carr Part No 91841A030
90 degree Bubbler Fittings	2	1/4" Barbed Tube 1/2" NPT. McMaster Carr Part No 2974K156
Check valve	1	1/4" tube, McMaster Carr Part No 47245K27 or from your local Hardware store
PVC glue	1 tube	Same colour as the PVC pipe if possible
5/16" Neoprene sealing washer	2	McMaster Carr Part No 94709A318 or from your local Hardware store
Tool dip – 14.5 oz	1	McMaster Carr Part No 9560t71
Optional: Light Emitting Diode	1	10 mm diameter, red, with panel-mounting clip
Quarter-watt resistor	1	470 ohm (code bands: Yellow, Purple, Brown)

Now, having shown how this very effective booster and bubbler are constructed, it should be pointed out that if you use it with a vehicle fitted with an Electronic Control Unit which monitors fuel injection into the engine, then the fuel-computer section will offset the gains and benefits of using this, or any other,

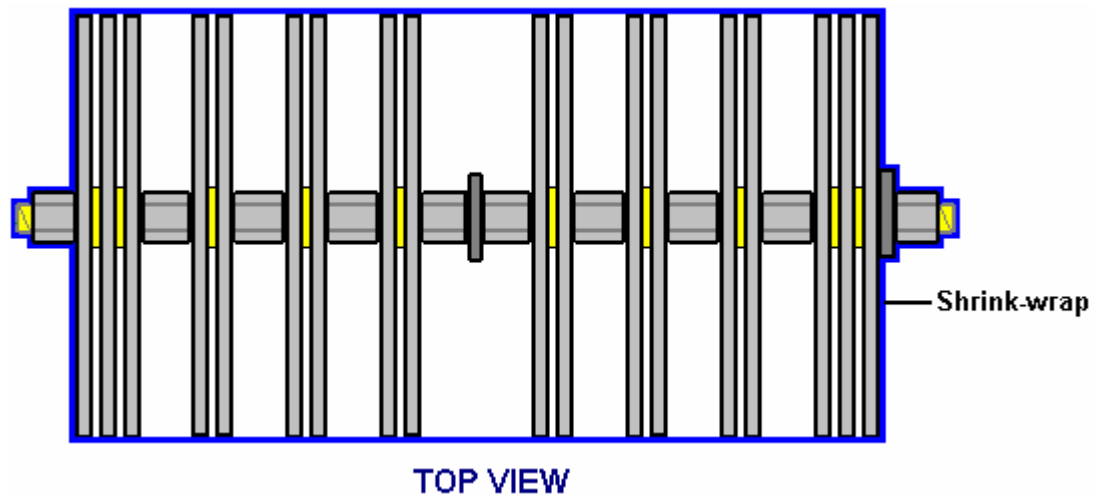
booster. The solution is not difficult, as the fuel-computer can be controlled by adding in a little circuit board to adjust the sensor signal fed to the computer from the oxygen sensor built into the exhaust of the vehicle. Ready-built units are available for this or you can make your own. If you want to make your own, then the web site document <http://www.free-energy-info.com/D17.pdf> shows you how and as well, points to Eagle-Research, the suppliers of alternative, ready-made units, also stocked by The Hydrogen Garage.

Quite an amount of testing and experimenting has been carried out by many of the people who have made copies of this booster and two variations which have been found to be helpful are shown here:

Firstly, in spite of the very restricted space inside the housing, it is possible to introduce two extra wall plates, one at each end of the plate stack. These plates are spaced 1.6 mm apart using plastic washers and this triple-plate group causes an extra voltage drop across the sub-set of three plates. The construction is then as shown here:



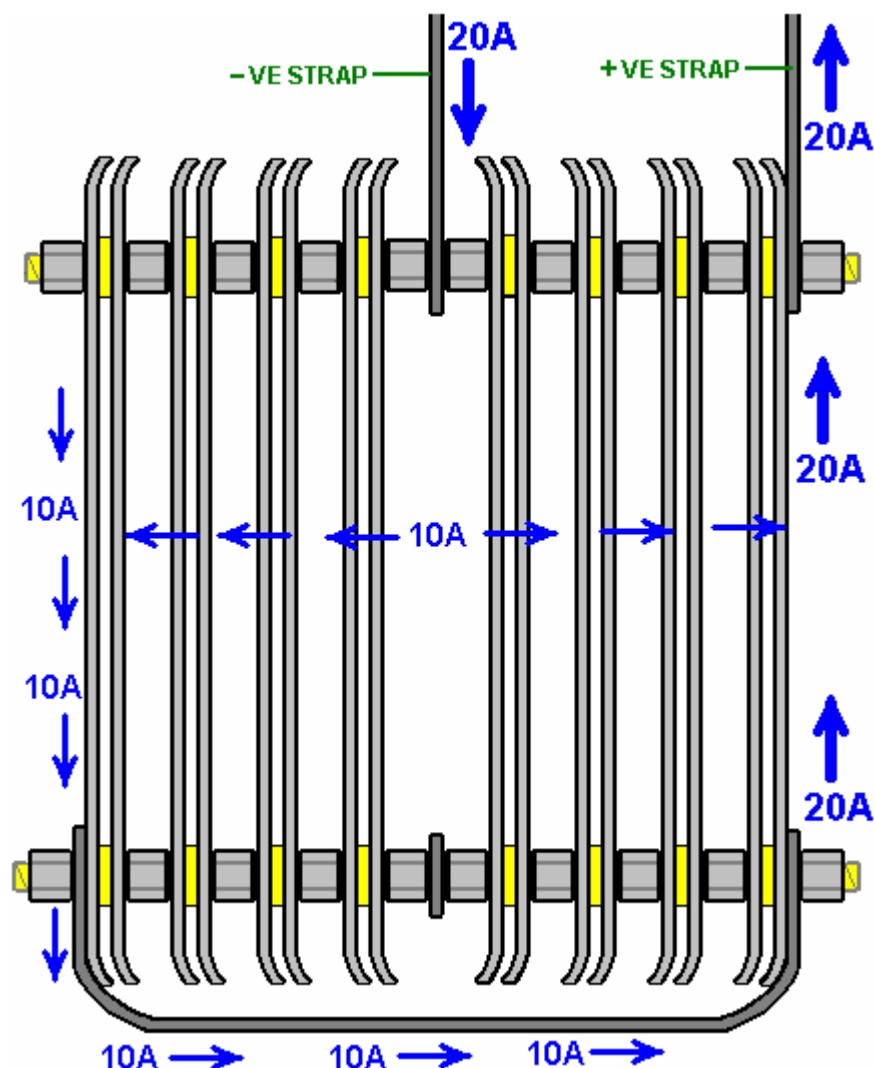
The second modification is wrapping the plate array in 4-inch shrink-wrap. This wrapping extends around the sides of the plates and helps by cutting out some of the unwanted electrical leakage paths through the electrolyte. This arrangement is shown here:



Background Information

Many people find the plate arrangement of the Smack's Booster, rather difficult to understand, so this additional section is just to try to explain the operation of the cell. This has nothing to do with actually building or using a Smack's Booster, so you can just skip this section without missing anything.

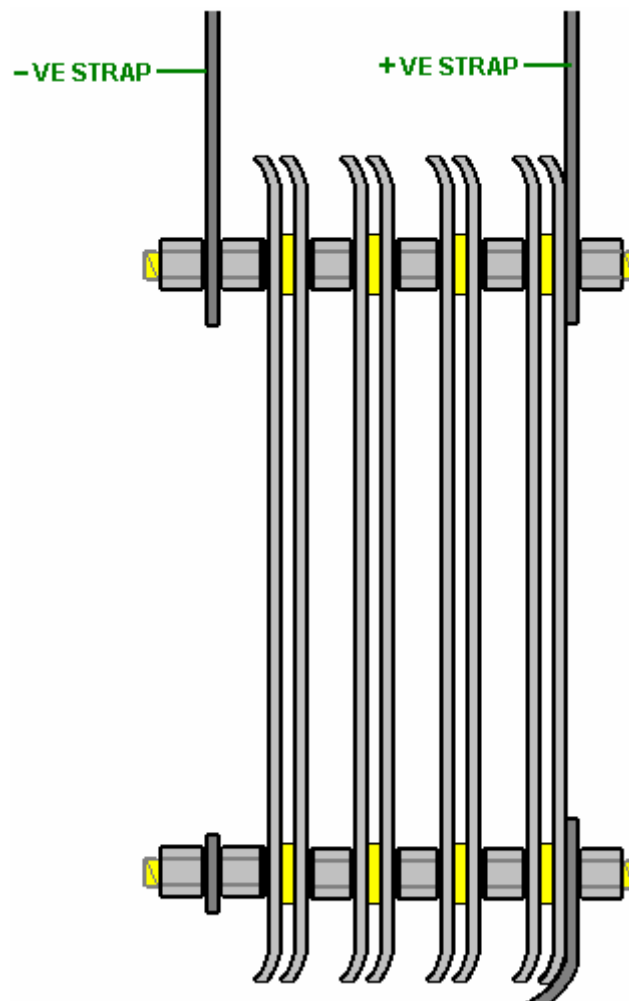
The Smack's Booster plate arrangement does look confusing. This is mainly because Eletrik has squeezed two identical sets of plates into one container as shown here:



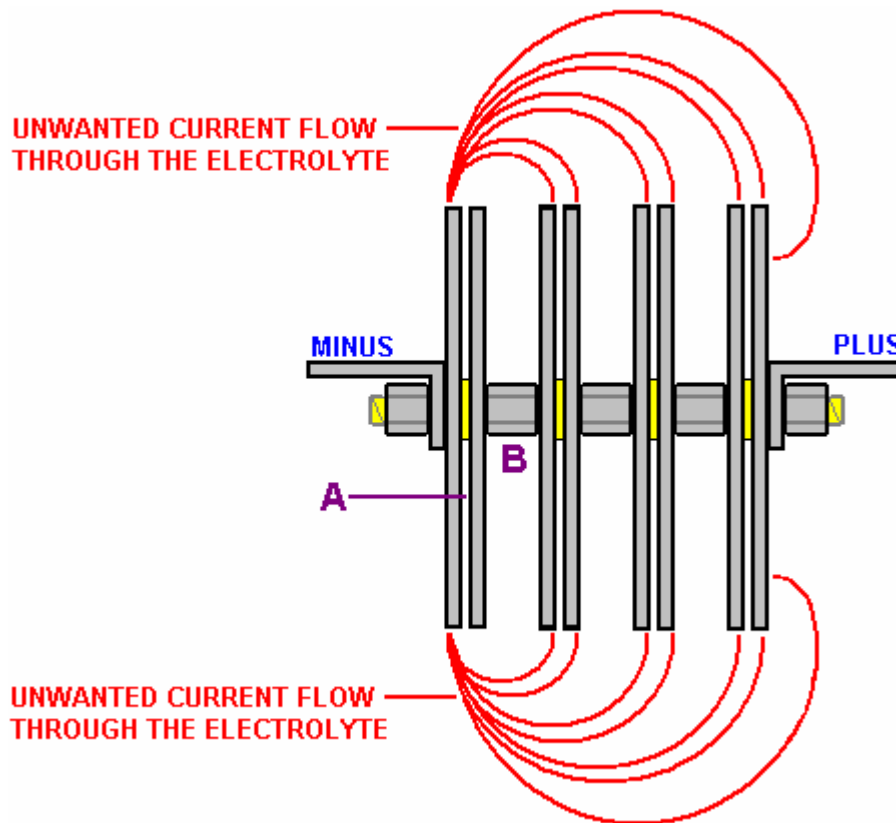
This arrangement is two identical sets of plates positioned back-to-back. To make it easier to understand the operation, let's just consider just one of the two sets of plates.

Here, you have just the electrical Plus linked to the electrical Minus by a set of four pairs of plates in a daisy chain (the technical term is: connected "in series" or "series-connected"). Easily the most electrically efficient way for doing this is to exclude all possible current flow paths through the electrolyte by closing off around the edges of all the plates and forcing the current to flow through the plates and only through the plates.

Unfortunately, this is very difficult to do in a cylindrical container and it has the disadvantage that it is difficult to keep the unit topped up with water and difficult to maintain the electrolyte level just below the top of the plates.



So, a compromise is reached where the current flow around and past the plates is combatted by strategic spacing of the plates:



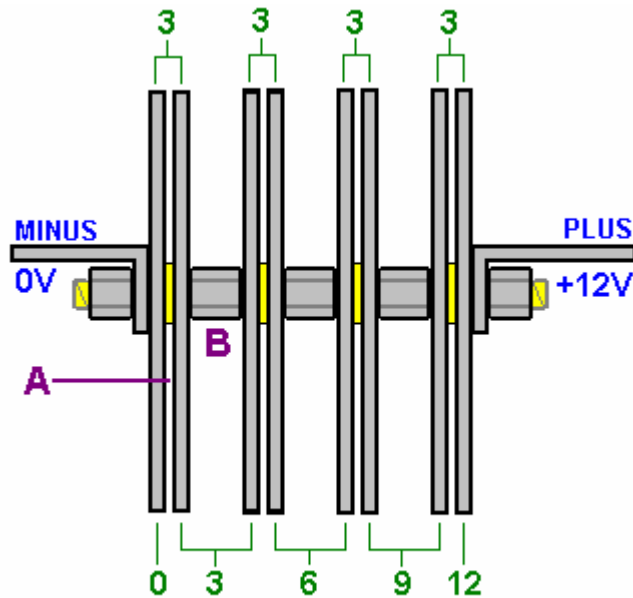
This diagram shows the way that the plates are connected. The red lines show paths of unwanted current flow which produce almost no gas. This wasted current flow is opposed by the useful current flow across gap "A" in the diagram.

To favour the flow across the 1.6 mm gap "A", an attempt is made to make the waste flows as long as possible by comparison. This is done by the gap "B" being made as large as possible, limited only by the size of the booster housing.

The voltage applied to the cell (13.8 volts when the engine is running) divides equally across the four plate pairs, so there will be one quarter of that voltage (3.45 volts) across each plate pair.

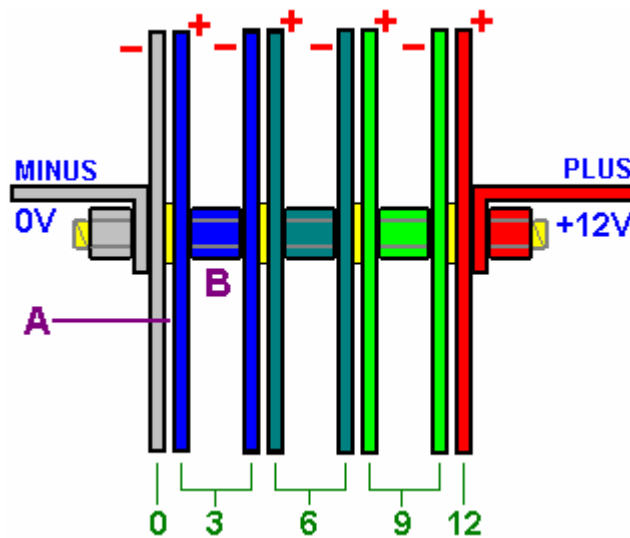
If you look again at the original diagram, you will see that there are two of these sets of four plate pairs, positioned back-to-back in the container. Each of these acts separately, except for the fact that there are additional current leakage paths through the electrolyte between the plates of one set and the plates of the second set.

There is a steady voltage drop progressively across the array of plates. Remember that they are connected in pairs in the middle due to the metal-to-metal connection created by the steel nuts between the plates:



VOLTAGE DROPS FOR A 12-VOLT SUPPLY

It is often difficult for people to get the hang of how the voltage drops across a chain of resistors (or matrix of plates). The voltages are relative to each other, so each plate pair thinks that it has a negative electrical connection on one plate and a positive connection on the other plate.



For example, if I am standing at the bottom of a hill and my friend is standing ten feet up the hill, then he is ten feet above me.

If we both climb a hundred feet up the mountain and he is at a height of 110 feet and I am at a height of 100 feet, he is still ten feet above me.

If we both climb another hundred feet up the mountain and he is at a height of 210 feet and I am at a height of 200 feet, he is still ten feet above me. From his point of view, I am always ten feet below him.

The same thing applies to these plate voltages. If you one plate is at a voltage of +3 volts and the plate 1.6 mm away from it is at a voltage of +6 volts, then the 6 volt plate is 3 volts more positive than the 3 volt plate, and there is a 3 volt difference across the gap between the two plates. The first plate looks to be 3 volts negative to the 6 volt plate when it “looks” back at it.

You can also say that the +3 volt plate is 3 volts lower than the +6 volt plate, so from the point of view of the +6 volt plate, the +3 volt plate is 3 volts lower down than it, and it therefore “sees” the other plate as being at -3 volts relative to it.

In the same way, my friend sees me as being at -10 feet relative to him, no matter what height we are on the mountain. It is all a matter of being "higher up" whether in terms of height above sea level on a mountain or in terms of higher up in voltage inside a booster.

Now, having shown how this booster and bubbler are constructed, it should be pointed out that if you use it with a vehicle fitted with an Electronic Control Unit which monitors fuel injection into the engine, then the fuel-computer section will offset the mpg gains and benefits of using this, or any other, booster. The solution is not difficult, as the fuel-computer can be controlled by adding in a little circuit board to adjust the sensor signal fed to the computer from the oxygen sensor built into the exhaust of the vehicle, to allow for the improved quality of the fuel being burnt in the engine. This is necessary because the exhaust will be so much cleaner than it used to be, that the computer will think that the engine is being starved of fuel (which it most definitely isn't. With a booster, the engine runs cleaner, cooler and more smoothly and it has enhanced pulling power called “torque”. Ready-built units are available for correcting the oxygen sensor signal for the improved situation, or alternatively, you can make your own.

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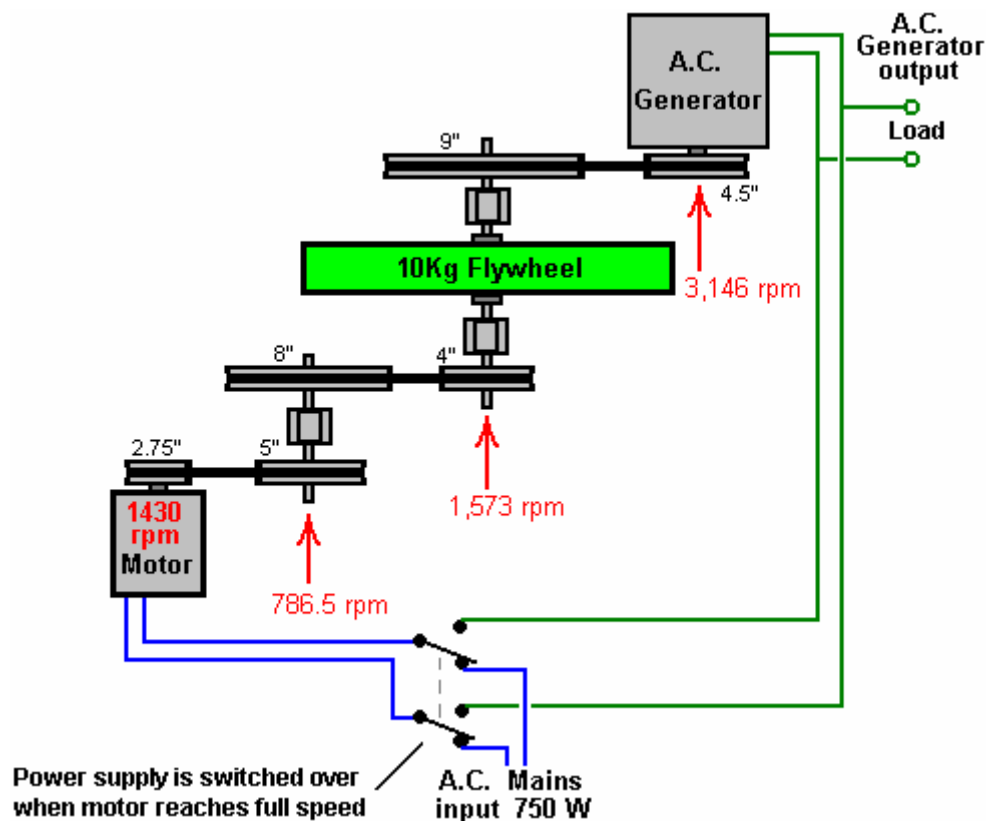
Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 23: Power From Inertia

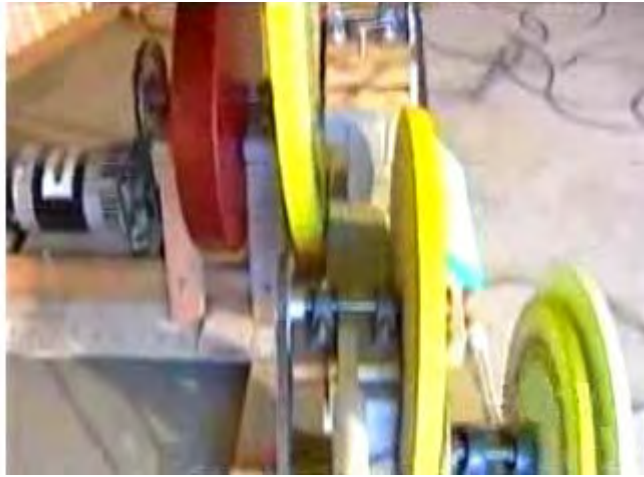
Chas Campbell's Flywheel System.

Recently, Mr. Chas Campbell of Australia demonstrated electrical power gain with a flywheel system which he developed. Essentially, he spins a mains motor, gears it appropriately through a drive train which includes a ten kilogram flywheel so that it spins an AC generator at it's optimum speed of just over three thousand revs per minute. When the system is running at full speed, Chas switches the mains motor over so that it is powered by the output of the generator. This works very well and allows his self-powered system to power other tools like drills. This is the arrangement:

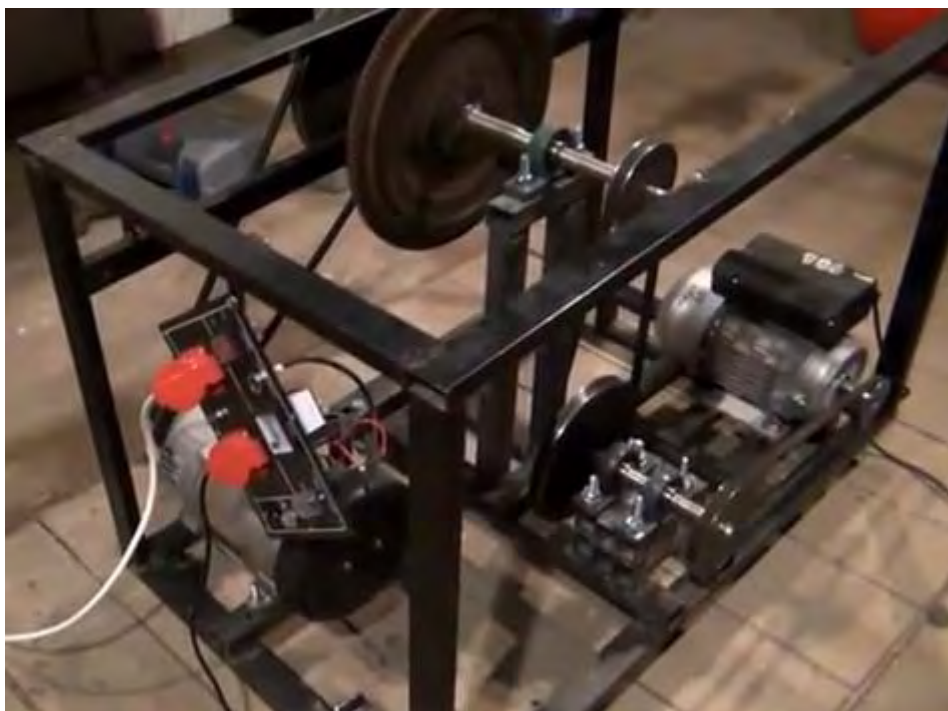


Let me explain the overall system. A mains motor of 750 watt capacity (1 horsepower) is used to drive a series of belts and pulleys which form a gear-train which produces over twice the rotational speed at the shaft of an electrical generator. The intriguing thing about this system is that greater electrical power can be drawn from the output generator than appears to be drawn from the input drive to the motor. How can that be? Well, although it does not appear to be widely known, the rim of a rotating flywheel is considered to be continuously accelerating inwards towards the axle. That constant acceleration produces an inflow of energy from the gravity field into the system. The important point is that Chas Campbell's system is self-powered and can power other equipment as well.

Now take a look at the construction which Chas has used:

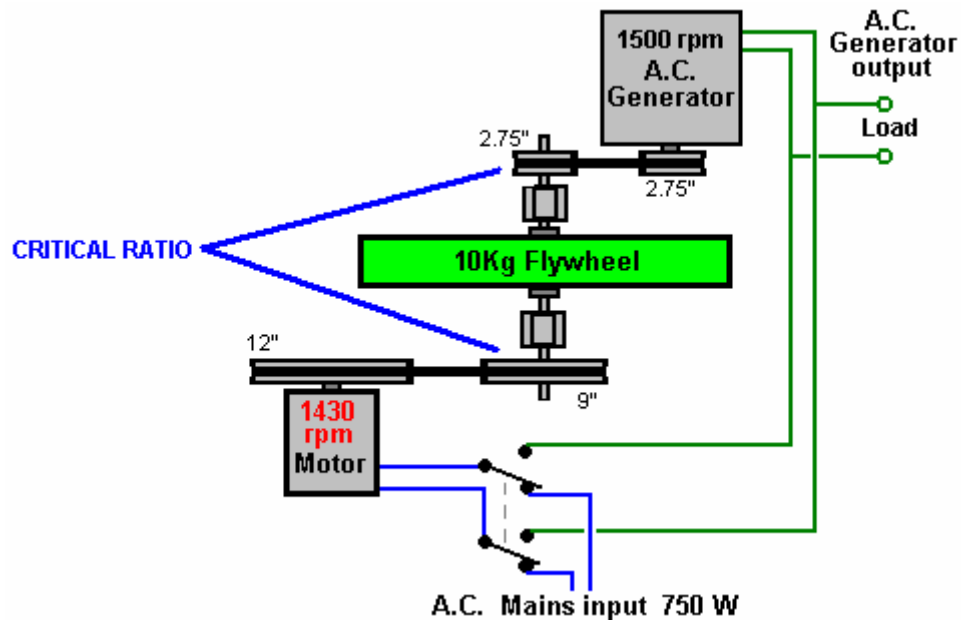


You notice that not only does he have a heavy flywheel of a fair size, but that there are three or four other large diameter discs mounted where they also rotate at the intermediate speeds of rotation. While these discs may well not have been placed there as flywheels, nevertheless, they do act as flywheels, and each one of them will be contributing to the free-energy gain of the system as a whole. A video of a neat replication, with 750 watts input power and 2340 watts of output power is here: <http://www.youtube.com/watch?v=98aiSB2DNw> and this implementation does not appear to have a heavy flywheel as you can see from this picture, although the largest pulley wheel looks as if it contains considerable weight:



Jacob Byzehr's Analysis.

In 1998, Jacob lodged a patent application for a design of the type shown by Chas Campbell. Jacob has analysed the operation and he draws attention to a key design factor:



Jacob states that a very important feature for high performance with a system of this kind is the ratio of the diameters of the driving and take-off pulleys on the shaft which contains the flywheel, especially with systems where the flywheel rotates at high speed. The driving pulley needs to be three or four times larger than the power take-off pulley. Using Chas' 1430 rpm motor and a commonly available 1500 rpm generator, the 12:9 step-up to the shaft of the flywheel gives a satisfactory generator speed while providing a 3.27 ratio between the 9-inch diameter driving pulley and the 2.75" diameter power take-off pulley. If a generator which has been designed for wind-generator use and which has it's peak output power at just 600 rpm is used, then an even better pulley diameter ratio can be achieved.

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Simple Free-Energy Devices

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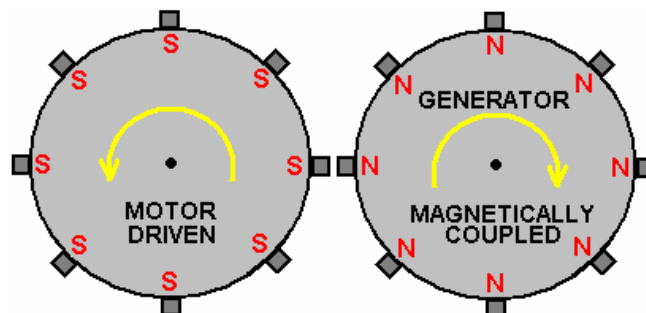
Chapter 24: Power From Rotation

Raoul Hatem’s Magnetic Coupling System.

The techniques introduced by Raoul Hatem in 1955, are some which conventional science will not accept because according to current theory, any such energy gain has to be “impossible” and so, cannot happen no matter what evidence there is:

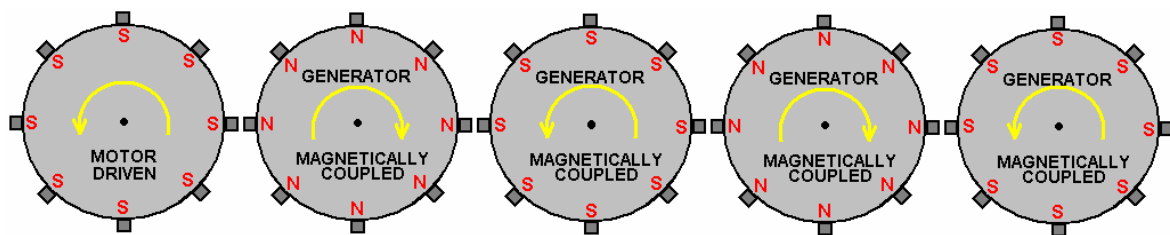


Raoul Hatem’s heretical statement is that using spinning magnets draws in energy from the environment, allowing a system to have an output power which is greater than the input power needed to run it. His method is to use a motor to spin a heavy rotor disc with 36 powerful neodymium magnets mounted on it. Then, using an identical heavy disc with magnets mounted on a generator to give a magnetic coupling between the motor and the generator will give not just coupling, but an energy gain as well, an energy gain which Hatem says is 20 times:

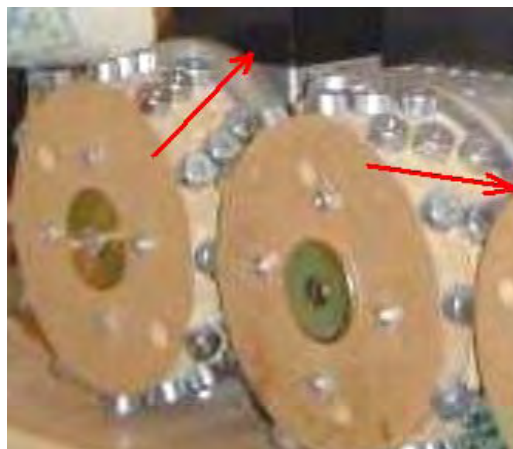


The heavy rotor provides some flywheel effect which helps with the operation of the system. Even with one motor as shown above, there is an energy gain as demonstrated in a recent video demonstration of the effect at http://www.dailymotion.com/video/xi9s9b_moteur-magnetique-de-leon-raoul-hatem_webcam#.UaGyVTcr6Bo where a simple system produces 144 watts of excess power. However, the really big gains are when several generators are driven by just the one motor. In passing, it may be remarked that there are two separate energy gain systems operating here. Firstly, the rotating magnetic field acts directly on the excess electrons in the local environment, drawing them into the system just as the fluctuating magnetic field of the secondary winding of any transformer does. Secondly, the rotors are receiving a rapid stream of drive pulses, and as Chas Campbell has demonstrated, that draws in excess energy from the gravitational field.

Anyway, you will notice that the powerful magnets used have their North poles outwards on one rotor while the adjacent rotor has the South poles outwards. The very strong attraction between these opposite poles causes the generator disc to rotate in step with the motor disc. This process allows many generators to be driven by just the one motor as shown here and in the photograph above:



For ease of drawing, the diagram above shows only eight magnets per rotor disc, but you will notice in the photograph (and in the video) that there are three stepped rows of magnets on each rotor:



You will also notice that direction of the stepping is reversed on every second rotor disc in order for the magnets to match each other in position as they rotate in opposite directions. The relevant patent on this is FR 2,826,800 of January 2003. Hatem has an interesting video at: <https://www.youtube.com/watch?v=3UJZ9hDQnyA&ebc=ANyPxKp3VkBv2ly9UZEwfogEY TYOSbbmUFDqY a5zZ88hiyitlyUlniyVjlUzu6hUluHgoT2>

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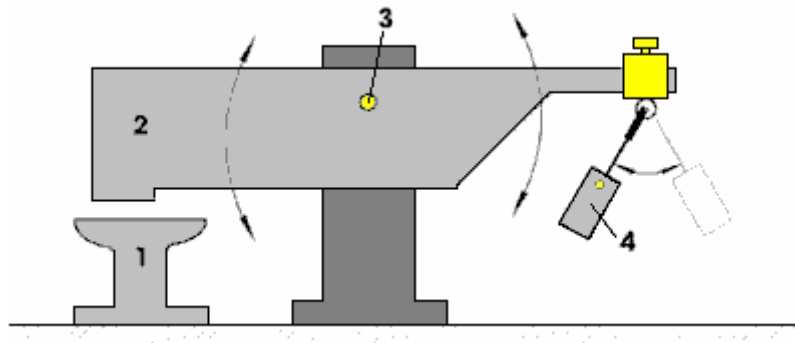
There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 25: Power From A Pendulum

Veljko Milkovic's Pendulum/Lever System.

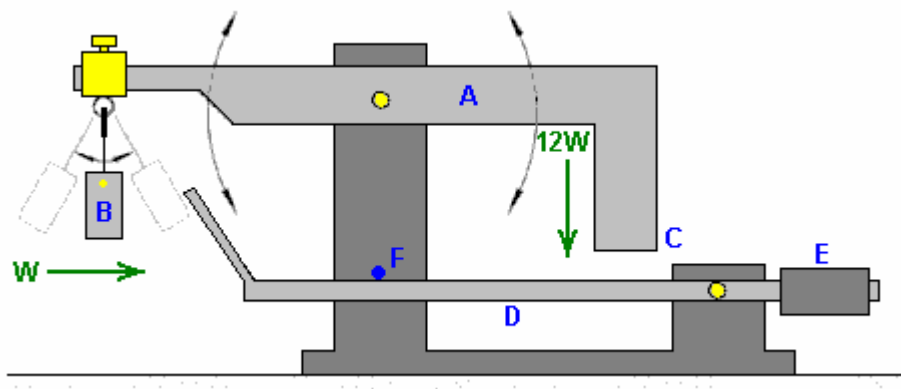
The general idea that it is not possible to have excess power from a purely mechanical device is clearly wrong as has recently been shown by Veljko Milkovic at <http://www.veljkomilkovic.com/OscilacijeEng.html> where his two-stage pendulum/lever system shows a $COP = 12$ output of excess energy. COP stands for “Coefficient Of Performance” which is a quantity calculated by dividing the output power by the input power **which the operator has to provide** to make the system work. This purely mechanical system has output power twelve times greater than the power needed to swing the pendulum. Please note that we are talking about power levels and not efficiency. It is not possible to have a system efficiency greater than 100% and it is almost impossible to achieve that 100% level.

Here is Veljko's diagram of his very successful lever / pendulum system:



Here, the beam **2** is very much heavier than the pendulum weight **4**. But, when the pendulum is set swinging by a slight push, the beam **2** pounds down on anvil **1** with considerable force, certainly much greater force than was needed to make the pendulum swing.

As there is excess energy, there appears to be no reason why it should not be made self-sustaining by feeding back some of the excess energy to maintain the movement. A very simple modification to do this could be:



Here, the main beam **A**, is exactly balanced when weight **B** is hanging motionless in it's "at-rest" position. When weight **B** is set swinging, it causes beam **A** to oscillate, providing much greater power at point **C** due to the much greater mass of beam **A**. If an additional, lightweight beam **D** is provided and counterbalanced by weight **E**, so that it has a very light upward pressure on its movement stop **F**, then the operation should be self-sustaining.

For this, the positions are adjusted so that when point **C** moves to its lowest point, it just nudges beam **D** slightly downwards. At this moment in time, weight **B** is at its closest to point **C** and about to start swinging away to the left again. Beam **D** being nudged downwards causes its tip to push weight **B** just enough to maintain its swinging. If weight **B** has a mass of "**W**" then point **C** of beam **A** has a downward thrust of $12W$ on Veljko's working model. As the energy required to move beam **D** slightly is quite small, the majority of the $12W$ thrust remains for doing additional useful work such as operating a pump.

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Simple Free-Energy Devices

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Chapter 26: Power From The Ground

The 3-Kilowatt Earth Battery

This battery does not need to be charged. Earth batteries are well known. They are pairs of electrodes buried in the ground. Electricity can be drawn from them, but they are generally of little interest as the power levels are not great. However, in his patent of 1893, Michael Emme, a Frenchman living in America determined how to get very serious levels of power from an earth battery of his design. In this particular unit which he describes in his US 495,582 patent, he gets 56 amps at just under 54 volts, which is three kilowatts or 4 HP. At that early date, there was generally, not much need for electricity, but Michael states that by selecting the number and connection method of the individual components, any desired voltage and/or current supply can be had. This, of course, is a simple system which involves no electronics.

Please bear in mind that some forms of construction utilise strong acids and careless handling of strong acid can result in skin and other damage. Protective clothing should be used when handling acids and an alkali should be ready for immediate use if careless handling causes splashes.

Summarising his patent, Michael says:

My invention relates to chemical generators of electricity where a prepared body of earth is the support and excitation medium for the electrodes or elements. Any number of elements can be assembled in the same piece of ground and connected in a chain or series of chains in order to produce the desired voltage and/or amperage.

I find that several straight chains of elements can function separately provided that the gap between the chains is much greater than the gap between the elements which form the chain. Being quite separate, those chains can be connected in series to increase the voltage, or in parallel to increase the available current.

It is necessary to prepare the soil in the ground in the immediate area around the electrodes which form each element in the chain.

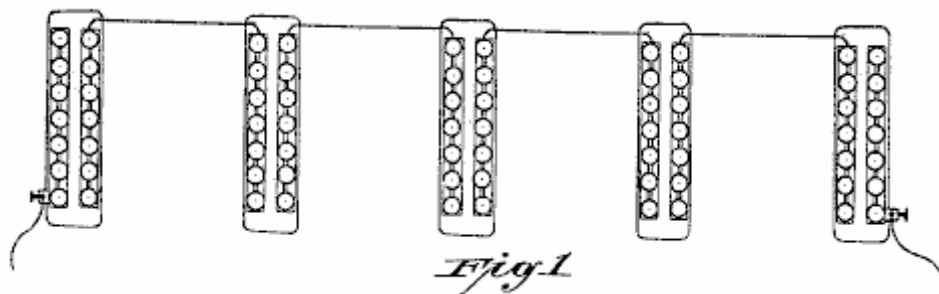


Fig.1 shows five elements connected in a chain. This view is from above with the rectangles indicating holes in the ground where each hole contains seven separate pairs of electrodes.

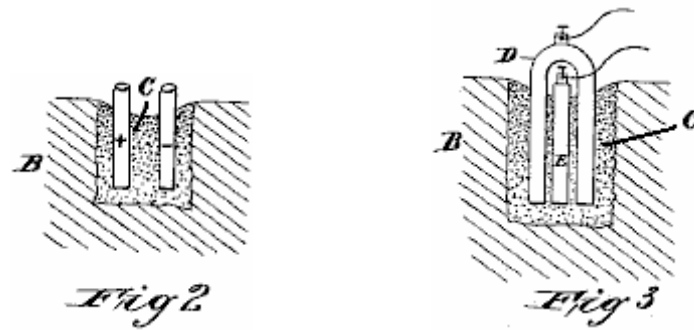


Fig.2 and Fig.3 show how individual electrodes are inserted into the prepared soil "C" which is surrounded by untreated ground "B". Electrode "D" is made of iron and "E" is made of carbon.

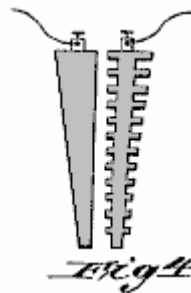


Fig.4 shows how wedge-shaped electrodes can be used as an alternative construction. The advantage is that it is easier to pull a tapering electrode out of the ground.

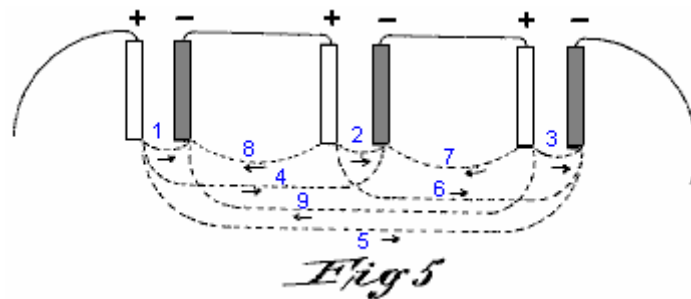


Fig.5 shows the internal current flow circuits which operate when a chain of elements is used. The arrows indicate the direction of current flow.

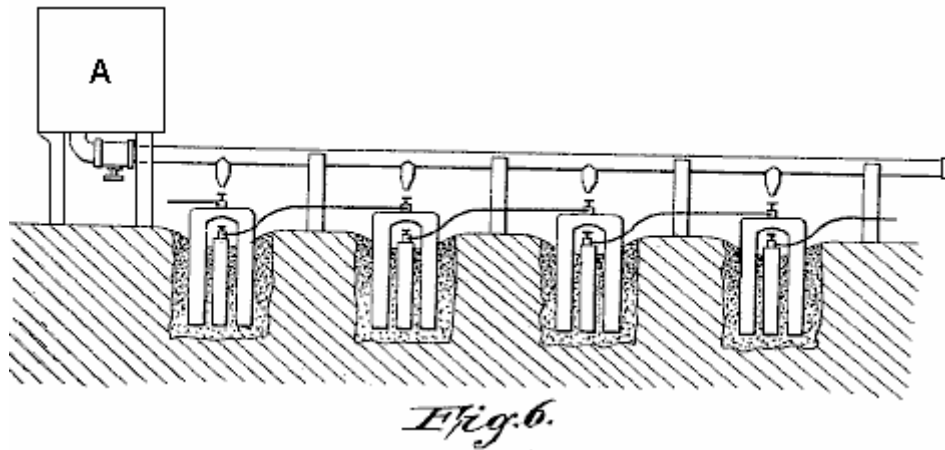
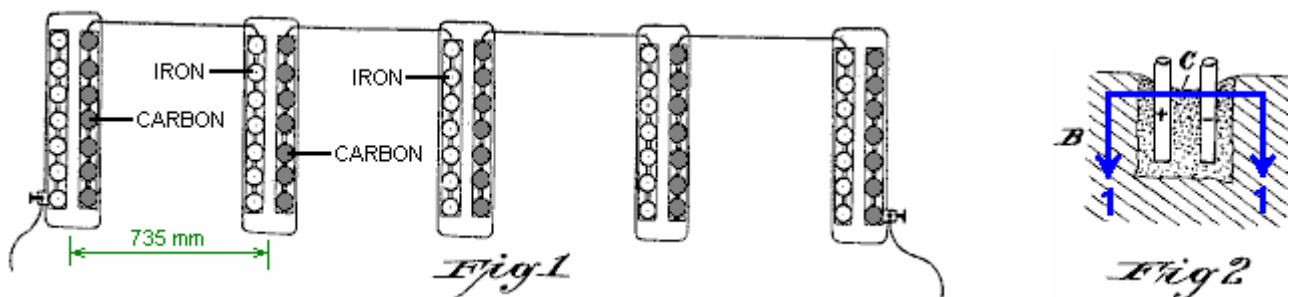


Fig.6 shows a convenient method for periodically moistening the prepared soil areas.

Soil of any type can be adapted for use with an electrical generator of this kind by saturating the soil immediately surrounding each pair of electrodes with a suitable solution which is rich in oxygen, chlorine, bromine, iodine or fluorine, or with a solution of a salt of an alkali.

For the electrodes, I prefer to use soft iron for the positive electrode and hard pressed coke carbon for the negative electrode. The positive electrode is preferably a U-shaped bar of iron which has a circular cross-section. The two limbs of the U straddle the rod of carbon. Cast iron can be used but it gives a lower voltage, presumably due to the carbon and other impurities in it.

Magnesium gives excellent results, producing 2.25 volts per electrode pair where carbon is the negative electrode.



In implementing my invention, I level a piece of ground of sufficient area to contain the generating chain or chains. For instance, for three hundred positive elements each twenty inches (500 mm) long and two inches (50 mm) in diameter, bent as shown in Fig.3, the length of the piece of ground should be about 107 feet (32 metres) and 3 feet (1 metre) wide. I dig 43 holes at a distance of 30 inches (735 mm) apart (centre to centre) in a line. Each hole is 10 inches (250 mm) wide and 30 inches (750 mm) long and deep enough to contain the seven pairs of electrodes.

The loose soil dug from the holes is mixed with the chosen salt or acid in order to make the generator active. For instance, if the ground is a vegetable mould, then commercial concentrated nitric acid should be added in sufficient quantity to saturate the soil, and manganese peroxide or pyrolusite should be mixed with the mass. If the soil has a sandy character, then hydrochloric acid or sodium carbonate ("washing soda") or potash can be used. If the soil is a clay, then hydrochloric or sulphuric acid and sodium chloride may be used, the salt being dissolved in water and poured into the hole before the acid is mingled with the soil. The bottom of the hole is moistened with water and the prepared soil mixed with water to the consistency of a thick paste is then placed in the hole, surrounding the electrodes. The 43 groups of electrodes when wired in series as shown in Fig.1, will yield 53.85 volts and 56 amps, developing a total of 3015 watts.

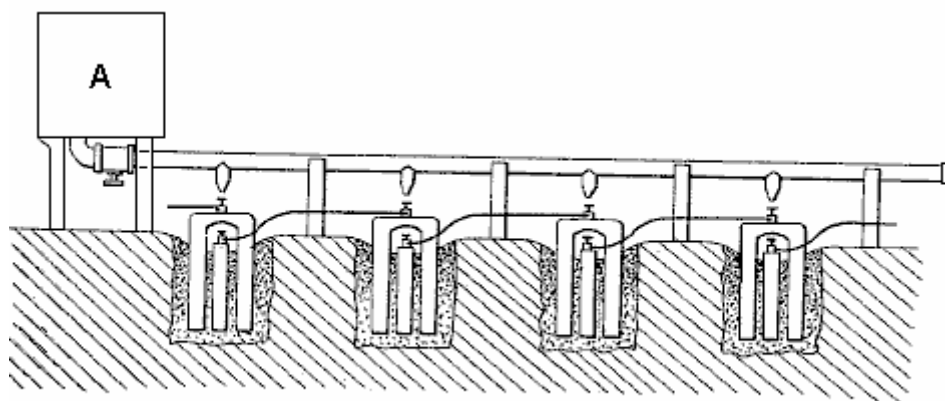


Fig.6.

By increasing the number of cells, the capacity of the generator may be correspondingly increased to any desired power output. The prepared body of soil should be periodically moistened, preferably with the acid with which it was treated when first prepared for action. In a generator intended for continuous use, I prefer to provide a reservoir as shown as "A" in Fig.6, and run a pipe made of a material which is not attacked by the acid, along the chain of elements, with a nozzle over each element so that they all can be moistened very easily. Any accumulation of oxides or other products of the reaction between the prepared soil and the electrodes may be removed by raising the positive electrode and then forcing it back into place again. The carbon electrode can be cleansed by simply turning it without lifting it from its place.

I find that the period of use of the generator during which no addition of salt or acid is needed, increases with the period of use. For example, during the first day of use, the acid or salt should be added after 10 hours of use, after which it will yield 26 hours of service, and then after another moistening it will operate for 48 hours, and so on, progressively increasing in duration between being moistened. This generator operates very consistently and reliably.

* * * *

Nowadays, we find mains voltage alternating current to be the most convenient to use. For a system like this, we would be inclined to use an ordinary inverter which runs on twelve volts or twenty-four volts. However, it needs to be remembered that the working input current is high and so, the wire used to carry that current needs to be thick. At 12V, each kilowatt is a current of at least 84 amps. At 24V that current is 42 amps (the inverter itself is more expensive as fewer are bought). Considerable household usage can be had from a 1500 watt inverter.

The soft iron / carbon construction described by Michael Emme produces 54V from 43 sets of electrodes, indicating around 1.25V per set at high current draw. It seems reasonably likely that ten or eleven sets of electrodes would give around 12V at high current and three of those chains connected in parallel should be able to power a 1500 watt 12V inverter continuously at extremely low running cost.

Patrick J Kelly

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Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 27: Power From Buoyancy

Buoyancy

While we are aware of buoyancy being used to convert wave power into electricity, we seem to neglect the idea of using the very powerful buoyancy forces as a direct tool at locations away from the sea. This is definitely a mistake because serious levels of power can be generated from such a system. One such system is:

The “Hidro” Self-Powered Generator of James Kwok.

This design demonstrates yet again, the practical nature of drawing large quantities of energy from the local environment. Commercial versions are offered in three standard sizes: 50 kilowatt, 250 kilowatt and 1 megawatt. This generator which James has designed can be seen at the Panacea-bocaf.org web site at <http://panacea-bocaf.org/hidrofreeenergysystem.htm> and on James’ own web site at <http://www.jameskwok.com/tech/hidro.html> both of which have video clips explaining how the design works. The method is based on different pressures at different depths of water, gravity, and on the buoyancy of air-filled containers. The system does not rely on wind, weather, sunlight, fuel of any type, and it can operate all the time, day or night, without causing any kind of pollution or hazard. This particular design calls for a water-filled structure of some height, a source of compressed air and a pulley system, and without wishing to be in any way critical, it seems rather more complicated than it needs to be. If, unlike James, you have not done the mathematics for the system, you would assume that the amount of power generated by a system like this would be less than the amount of power needed to make it operate. However, that is definitely very far from reality as considerable excess power is gained through the natural forces of the local environment which make the system operate. Part of the patent application which James made is shown here:

US 2010/0307149 A1

Date: 9th Dec. 2010

Inventor: James Kwok

HYDRODYNAMIC ENERGY GENERATION SYSTEM

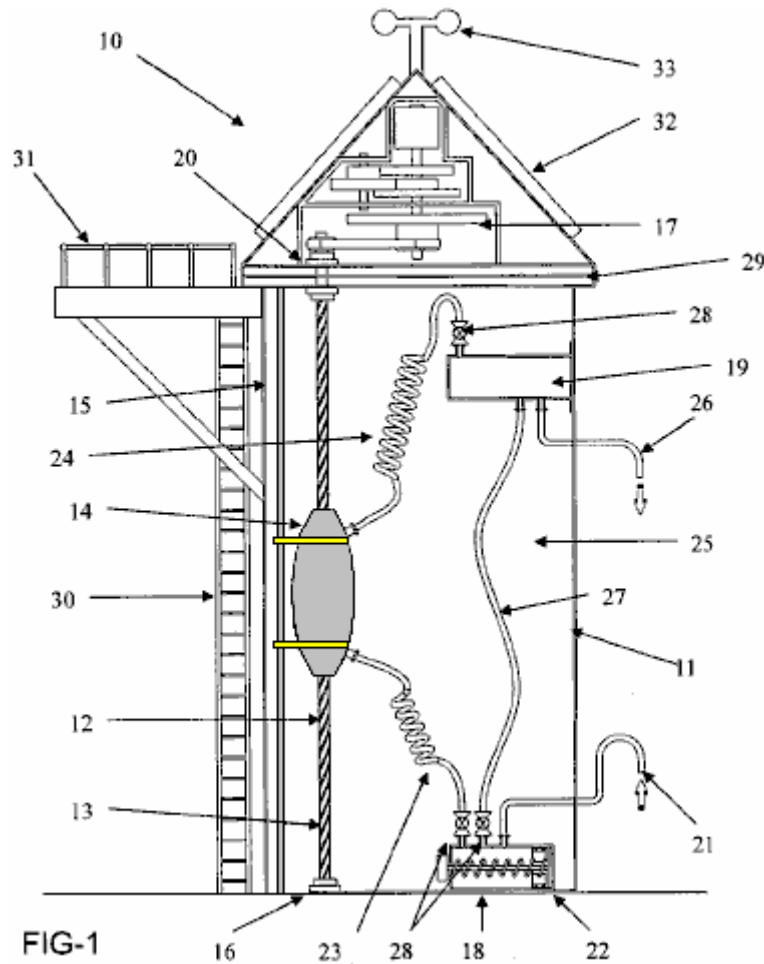


Fig.1 is a cross-sectional view of an embodiment of the energy generation system of the present invention. Here, the energy generation system **10** comprises a vessel **11** in the form of a water tank and a shaft **12** which can rotate about its longitudinal axis. The shaft **12** is provided with a helical screw groove **13** and is connected at its lower end to a bearing **16** which allows it to rotate freely about its longitudinal axis.

The upper end of the shaft is connected to a generator **17** which is a flywheel system. The rotational energy of shaft **12** may be transferred to the generator through a ratchet-cog system **20**. A buoyant inflatable capsule **14** is provided along with its guiding mechanism **15** which is in the form of a wire or pole to assist in the smooth vertical movement of buoy **14**.

There is a first air reservoir **18** located in a lower portion of the vessel **11** and a second air reservoir **19** located in an upper portion of the vessel **11**. The first reservoir **18** draws air from the atmosphere, in through air intake port **21**. Once the pressure in the first reservoir has reached a predetermined value, a piston **22** is actuated, forcing air through hose **23** into the buoyant capsule **14**, which, when inflated, begins to move upwards through water tank **11**, as the buoy **14** has become less dense than the fluid **25** (such as fresh water or saltwater) in tank **11**. This in turn causes rotation of shaft **12**, and activation of the power generator **17**, thereby generating power.

When buoy **14** reaches the upper limit of its travel, the air in the buoy may be forced to flow through a second hose **24** and into the second air reservoir **19**. When air is removed from the buoy it moves downwards through vessel **11** under gravity and with the assistance of ballast (not shown). The downward movement of buoy **14**, causes rotation of the shaft **12**, which drives the generator **17**, thereby generating power.

Air stored in the second reservoir **19** may be vented to the atmosphere through a vent **26** if the pressure in the second reservoir **19** becomes too high. Alternatively, air may flow from the second reservoir **19** into the first reservoir **18** through a third hose **27** so that less air must be drawn into the first reservoir **18**

when buoy **14** reaches the lower limit of its travel and must once again be inflated with air from the first reservoir **18**.

The hoses **23**, **24** and **27** are provided with non-return valves **28** to ensure that air will flow in only one direction through the system **10**. Vessel **11** may be provided with ventilation **29** as required and it may also be provided with access stairs **30** and an access platform **31** so that maintenance may be carried out as required. The system may also be provided with a solar energy collection device **32** to generate at least a portion of the energy required to drive piston **22** and the non-return valves **28**. Energy produced by the solar energy collection device **32** may also be used to power a light or beacon **33** to indicate the location of the system **10**.

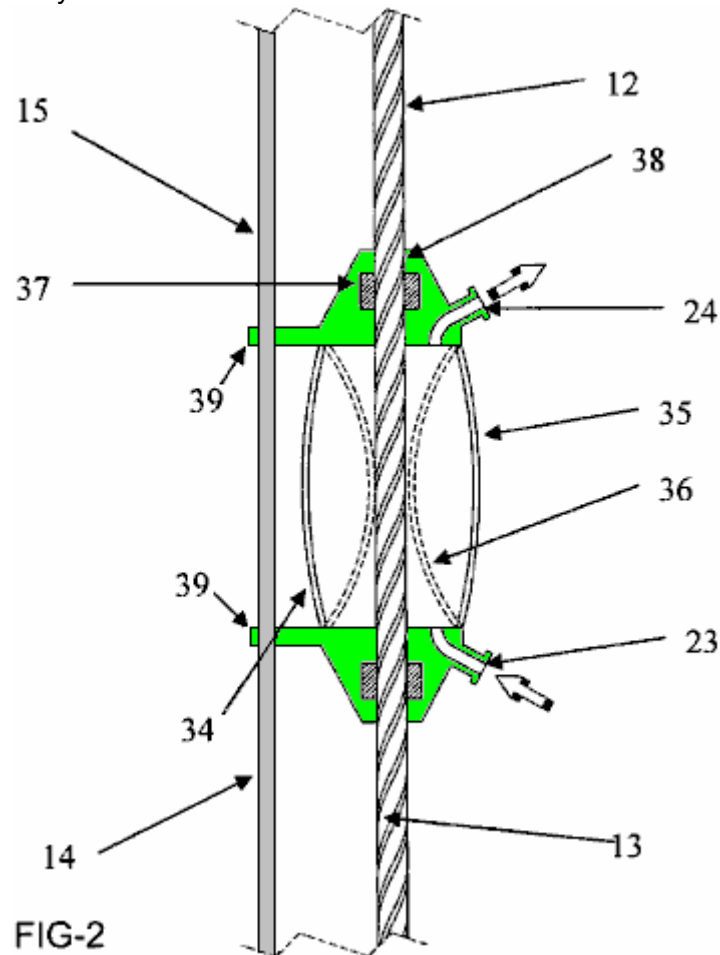


Fig.2 shows one arrangement for buoy **14** comprising an inflatable capsule **34**. This figure illustrates the shape of the walls of the inflatable capsule **34** when inflated **35** and when deflated **36**. Air passes into capsule **34** through hose **23** and exits from the capsule through hose **24**.

The buoy **14** also has a sleeve **37** attached to it. This sleeve has projections which engage with the helical groove **13** of shaft **12**, thereby causing rotation of the shaft when the buoy moves relative to shaft **12**. Sleeve **37** is provided with ballast **38**, such as stainless steel weights that assist in the downward movement of the buoy when it is deflated.

Buoy **14** is attached to a guide pole **15** and the buoy has a pair of arms **39** which slide on the guiding pole **15** and assist in the smooth vertical movement of the buoy.

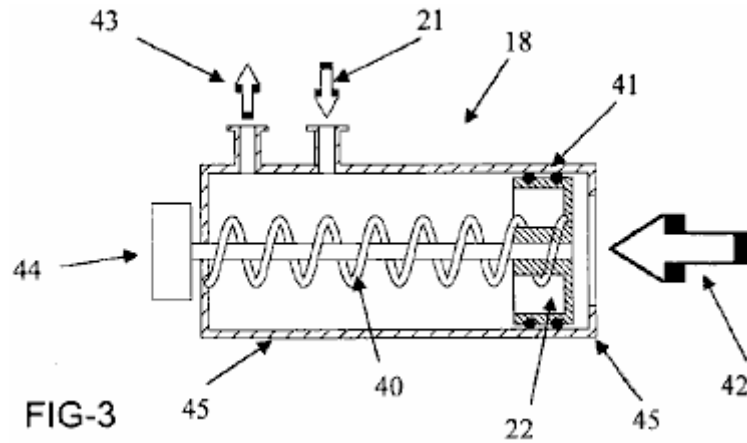
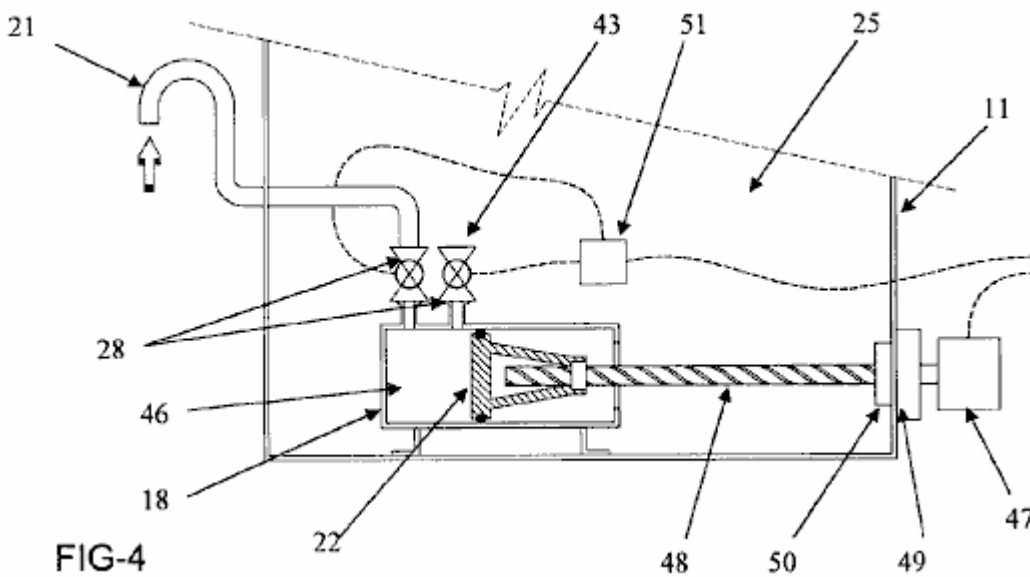


Fig.3 shows one version of the first air reservoir **18**. Air is drawn into reservoir **18** through air intake **21**. The reservoir includes a piston **22** associated with a spring **40**, the piston **22** being provided with seals **41** to prevent leakage of air.

When pressure, such as hydrostatic pressure, is applied in the direction of arrow **42**, the piston moves to the left of the reservoir **18** compressing spring **40** and forcing air out through outlet **43**. A motor **44** is provided to reverse the movement of the piston **22**. Reservoir **18** may be fixed to the floor of the vessel.



An alternative construction of the first air reservoir **18** is shown in **Fig.4**. In this embodiment, reservoir **18** is housed within a vessel **11** containing a fluid **25**. Air enters reservoir **18** through air intake **21** and is held in a chamber **46**. The reservoir has a piston **22** and the movement of the piston **22** towards the left of the reservoir **18** forces air in the chamber **46** out through air outlet **43**.

Piston **22** is driven by motor **47** which rotates the helically-grooved shaft **48**. The motor is linked to the shaft by a ratchet and cog mechanism **49**, which is provided with a spring loaded seal **50** on the inner surface of vessel **11**. An actuator **51**, may be used to control the opening and closing of non-return valves **28** as well as the actuation of motor **47**.

Fig.5 illustrates a cross-sectional view of an energy generation system according to one of the embodiments of the present invention:

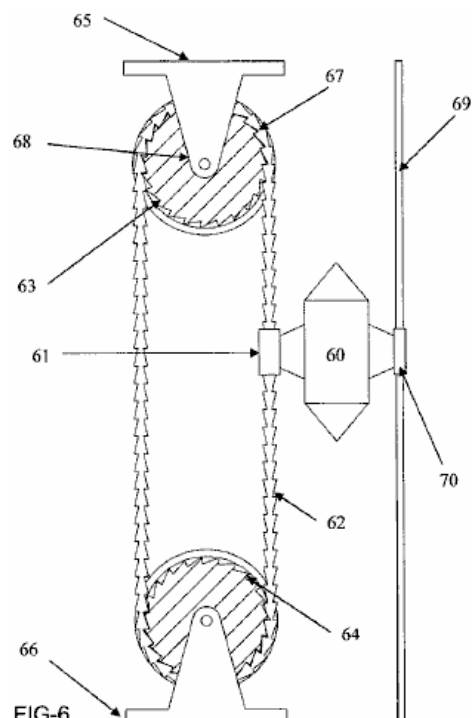
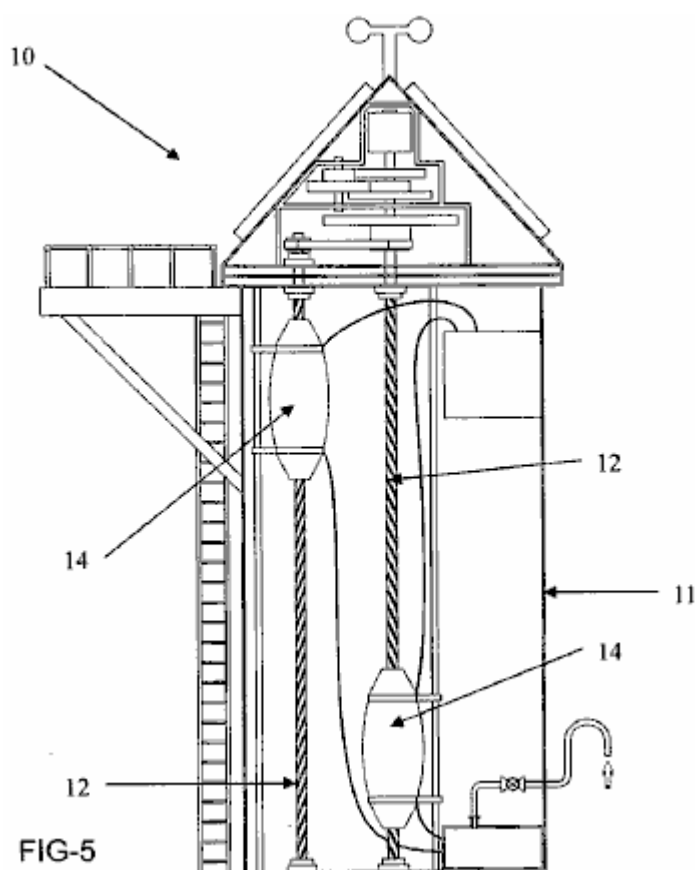


Fig.5 shows an embodiment where which a pair of buoys **14** are present. Each buoy is associated with its own shaft **12** and may move up and down inside vessel **11** independent of one another.

In **Fig.6**, an alternative embodiment of the present invention is illustrated, where the buoy **60** has a connecting method **61** in the form of a cylindrical sleeve through which a guide chain **62** passes. Chain **62** is provided in an endless loop and is located on an upper tracking device **63** and a lower tracking device **64**, both of which are pulleys. The upper pulley **63** may be fixed to an upper wall (not shown) of a vessel (not shown) via a bracket **65**, while the lower pulley **64** may be fixed to a lower wall (not shown) of a vessel (not shown) via a bracket **66**.

The connection mechanism **61** contains ratchets which engage with the links of the chain **62** when buoy **60** moves downwards. Thus, as buoy **60** moves downwards, chain **62** also moves, thereby causing both the upper and lower pulleys to rotate in a clockwise direction. The upper and lower **64** pulleys have a series of indentations **67** corresponding to the shape of the links of the chain **62**. In this way, the chain **62** sits in the indentations **67** and grips the tracking device (**63**, **64**), thereby ensuring that the tracking device (**63**, **64**) rotates.

In the embodiment of the invention illustrated in **Fig.6**, a work shaft **68** is associated with the upper pulley **63** such that rotation of the upper pulley results in rotation of the work shaft **68**. The work shaft **68** is located substantially perpendicular to the direction of travel of the buoy **60**. The work shaft drives a generator to produce power.

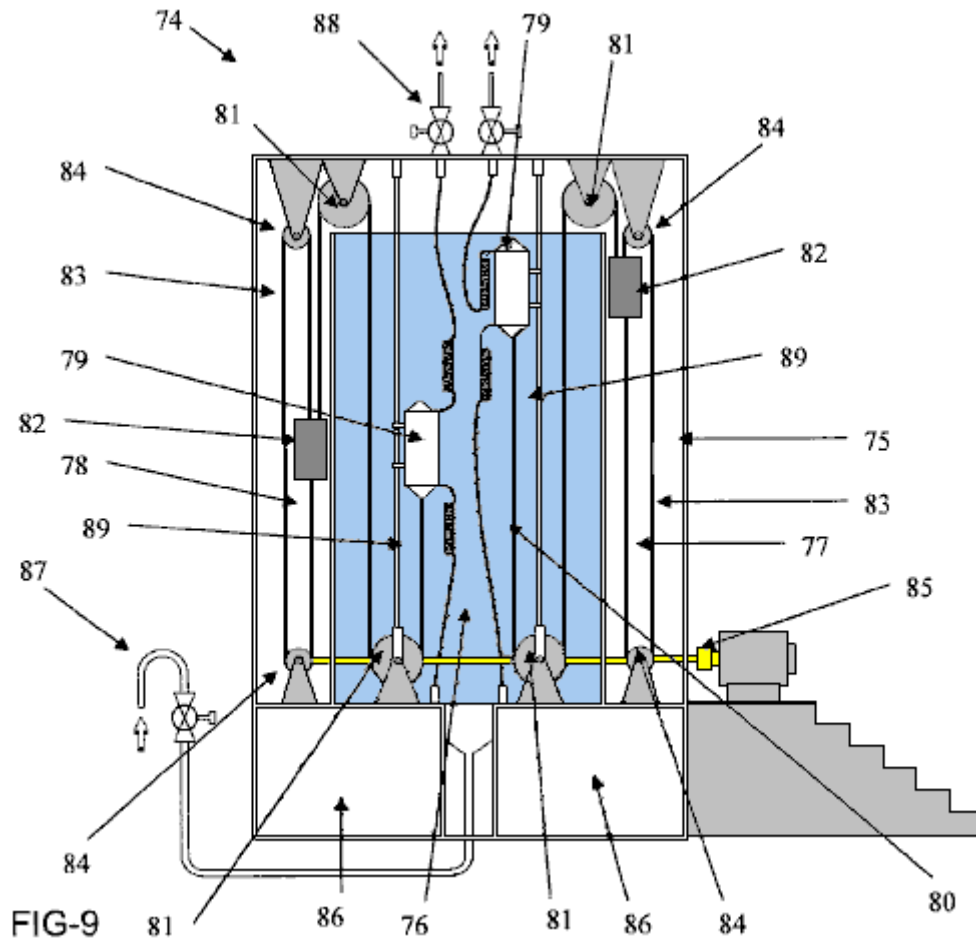


Fig.9 shows an alternative embodiment of this energy generation system **74**. The system is comprised of a vessel **75** having a fluid-filled “wet” compartment **76** and one or more “dry” compartments (in this case, a pair of dry compartments **77, 78**) with no liquid in them. These dry compartments may be fabricated from any suitable material, such as, concrete, steel, fibreglass, plastic or any combination of materials.

The system also has a pair of buoys **79** each with a deflatable bladder-like construction. The buoys have guide rails **89** which ensure that the buoys move smoothly up and down inside the vessel **75**.

In this embodiment of the invention, air reservoirs **86** are located in the base of the vessel **75**. Air enters the reservoirs **86** through inlet **87**, while air exiting from the buoy **79** is vented through valves **88**. The vented air may either be expelled to the atmosphere or recycled to the reservoirs **86**.

Each of the buoys is designed to be connected to one end of a chain or rope **80**. A weight **82** is connected to the other end of the chain or rope **80**. The chain or rope **80** has a series of pulleys **81** such that when the buoy is inflated and filled with air, the buoyancy is greater than the weight **82** and so the buoy rises in the vessel.

When the buoy **79** is deflated, weight **82** is heavier than the buoyancy and so the buoy sinks in vessel **75**. In the embodiment illustrated here, the weights **82** are located in the dry compartments **77,78**. There are several reasons for this, including that, by locating the weights **82** in the dry compartments **77,78**, the velocity of the weights **82** in the downward direction is increased, and therefore an increase in the energy produced by the system **74** is experienced.

The weights **82** are associated with second ropes or chains **83**, such that vertical movement of the weights **82** results in the rotation of the second ropes or chains **83** around a pair of sprockets **84**. Rotational energy generated by the rotation of the second ropes or chains **83** is transferred to a power generation device **85** (such as a turbine or the like) in order to generate power (e.g. electrical power)

In spite of its mechanical complexity, the Hidro design is offered as a commercial generator with tens of kilowatts of excess power, indicating that buoyancy is a significant method of generating power, based on the fact that water is hundreds of times heavier than air. Due to its weight, movement in water is slow but can be very powerful. The helical groove method of converting the vertical movement of the floats into rotational power is used because of this as it has a very high ratio between shaft turns and movement along the shaft. This can be understood when you consider the fact that a complete revolution of the shaft is caused by the float moving up just one step to the next thread position directly above. The turns ratio for the complete float movement is determined by the angle of the groove cut into the drive shaft.

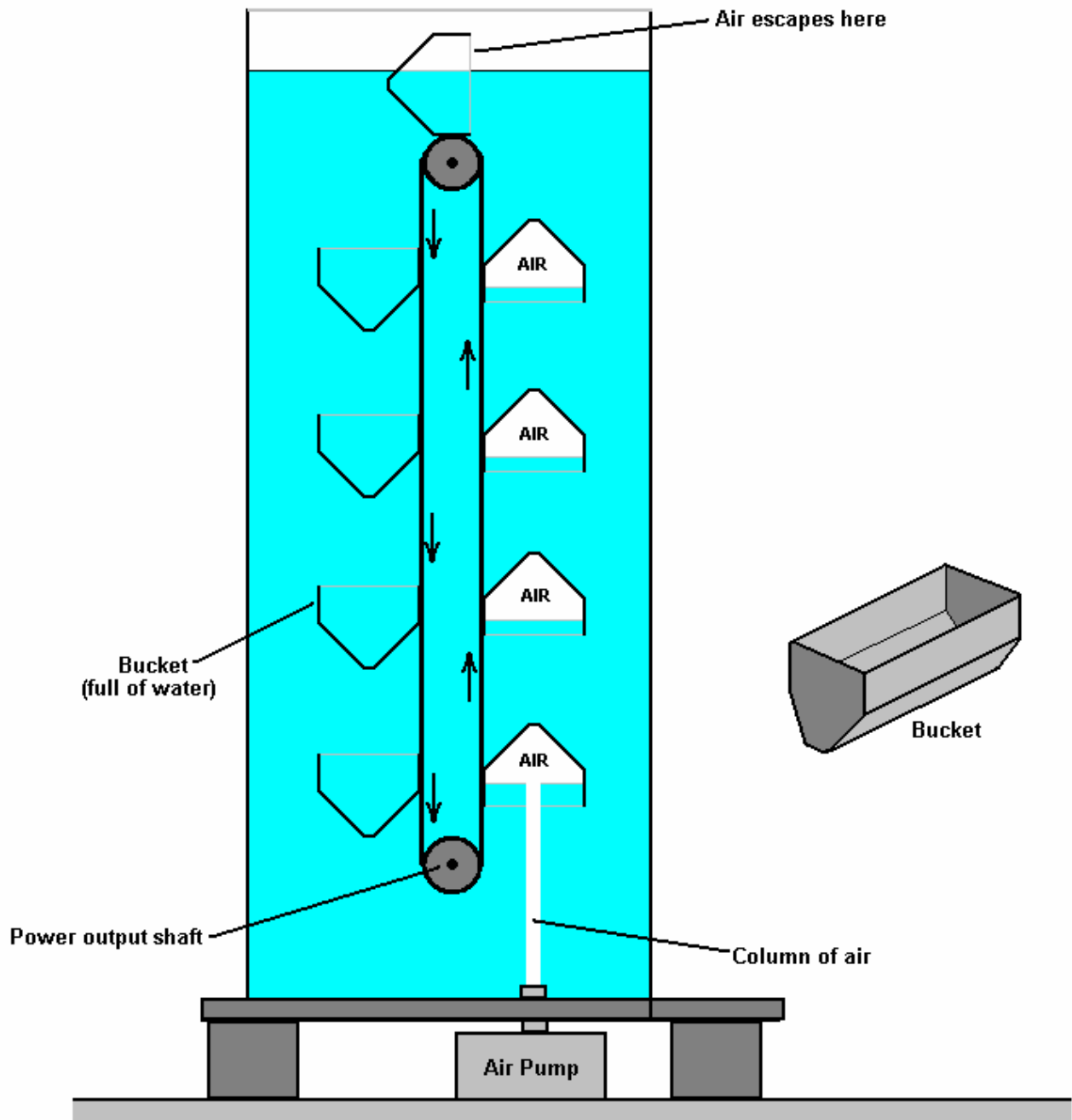
One other thing which needs to be considered for such a project is the weight of the overall structure when filled with water. The overall weight is liable to be many tons and so the footing underneath the generator needs to be very robust. Also, while compressed air is mentioned, giving the impression of cylinders of compressed air or gas, For continuous operation one would expect an air pump to be used. Whether or not an air pump is used, the diameter of the air hoses needs to be considered. Most people think that a gas can flow along a pipe or tube very easily. That is not the case. If you want to get a feel for the constriction caused by a pipe, then take a one metre length of 6 mm diameter plastic tube and try blowing through it. No significant amount of air will pass through the tube even if you blow very hard. The web site http://www.engineeringtoolbox.com/natural-gas-pipe-sizing-d_826.html shows this table:

Capacity of Pipe (MBH \approx CFH)							
Pipe Size (inches)		Pipe Length (feet)					
Nominal	Inside diameter	10	20	40	80	150	300
1/2	0.622	120	85	60	42	31	22
3/4	0.824	272	192	136	96	70	50
1	1.049	547	387	273	193	141	100
1 1/4	1.380	1200	849	600	424	310	219
1 1/2	1.610	1860	1316	930	658	480	340
2	2.067	3759	2658	1880	1330	971	686
2 1/2	2.469	6169	4362	3084	2189	1593	1126
3	3.068	11225	7938	5613	3969	2898	2049
4	4.026	23479	16602	11740	8301	6062	4287
5	5.047	42945	30367	21473	15183	11088	7841
6	6.065	69671	49265	34836	24632	17989	12720
8	7.981	141832	100290	70916	50145	36621	25895

Notice the major difference in carrying capacity of any of these pipes with just the change from a 10-foot (3 metre) length to a modest 20-foot (6 Metre) length, and those lengths are the sort of lengths needed for many applications. Also, look at the figures for, say, the 0.5 inch (nominal) diameter pipe. With just a 10-foot length, it would take a full two minutes to pump just one cubic foot of air through it. It follows then, that pipes of considerably larger diameter are needed for a project like the 'Hidro'.

It is possible to construct a much more simple version of the 'Hidro', perhaps like this:

A Simple Buoyancy Power Generator



A simple hydraulic, buoyancy-powered generator can be constructed, with two or more horizontal, rotating shafts submerged in water in such a way that they are effectively positioned one above the other. Each shaft has one, and preferably two or more sprocket wheels mounted on it. Each of these sprocket wheels engages with a continuous chain loop which also engages with the sprocket wheel which is positioned vertically above it. These vertical chain loops form a belt-style support for a series of identical buckets. On one side of the vertical belt the buckets have their open face upwards and on the other side the bucket openings are facing downwards. An air pump is positioned directly underneath the set of buckets which have the bucket openings facing downwards. The air pump generates an upward-moving stream of air which collects in the rising buckets, displacing the water filling the bucket. This results in a powerful upward thrust caused by the buoyancy of that bucket, and the thrust causes the bucket to move upwards, rotating both horizontal shafts and bringing another water-filled bucket into position above the air pump. A gearing system transfers the rotation torque thus produced, to a generator which produces electricity for general purpose uses.

This is a generator whose input shaft is rotated through buoyancy caused by air-filled containers submerged in a tank of water or some other suitable heavy liquid. Continuous, powerful rotation of the generator shaft is produced through the use of one or more conventional, commercially available air

pumps. An air pump is used to fill a series of containers which are open at one end and which are attached to what is effectively a belt arrangement created by two strong chain-link loops which mesh with sprocket wheels mounted on two shafts, either, or both of which can be utilised for the extraction of useful power, preferably for driving an electricity generator but not necessarily limited to that function as any powerful torque has many useful applications.

Objectives are to provide a power generation system which is very simple in form and which can be understood, operated and maintained by people with minimal training. Also, a system which uses components which are already readily available, thus avoiding significant manufacturing costs, and one which operates without the need for any kind of complex mechanism or high-precision equipment and which can operate with a wide range of commercially available products.

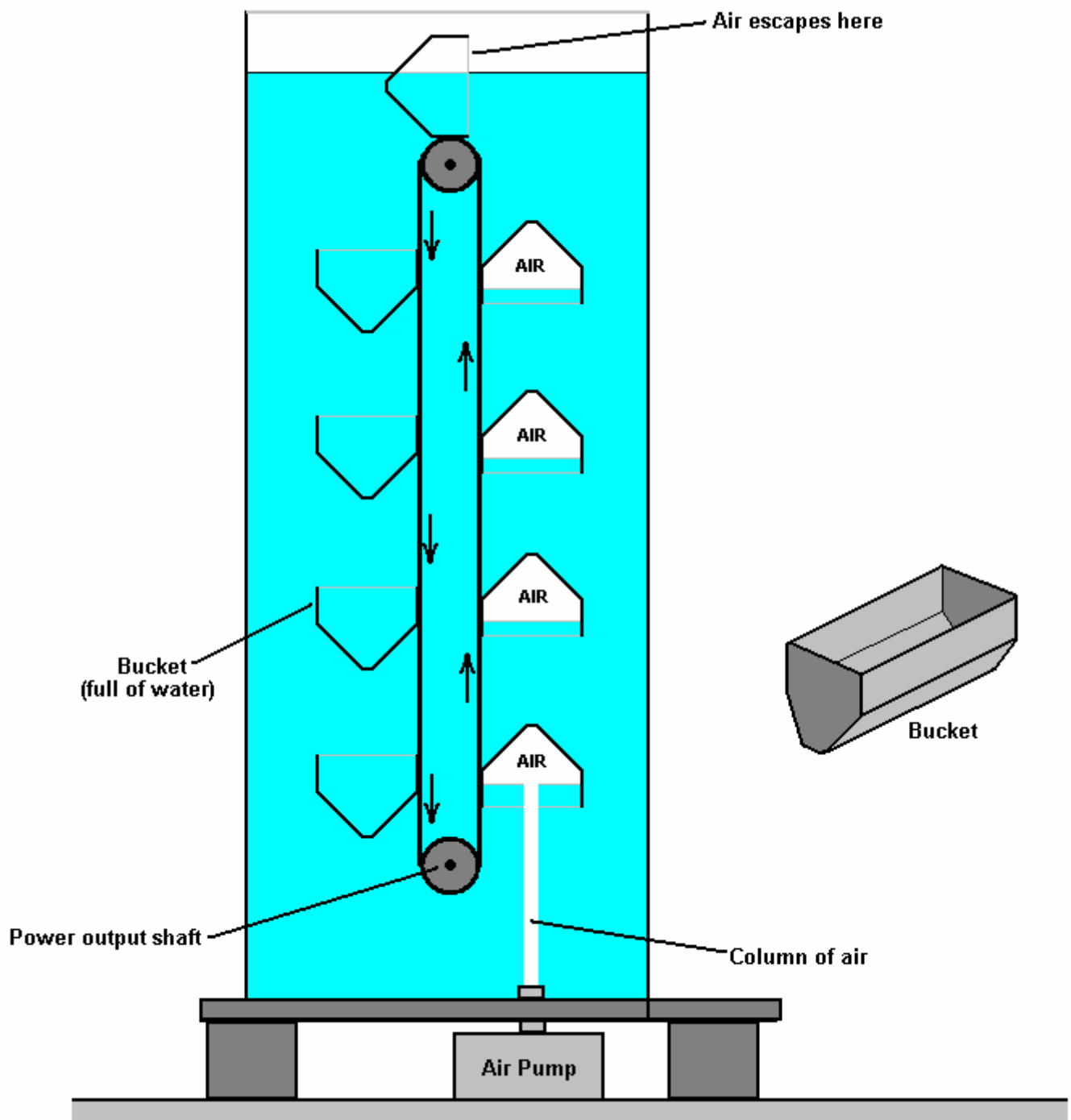


Fig.1, is a simplified partial schematic cross-sectional view showing the main components of the generator as seen from one end.

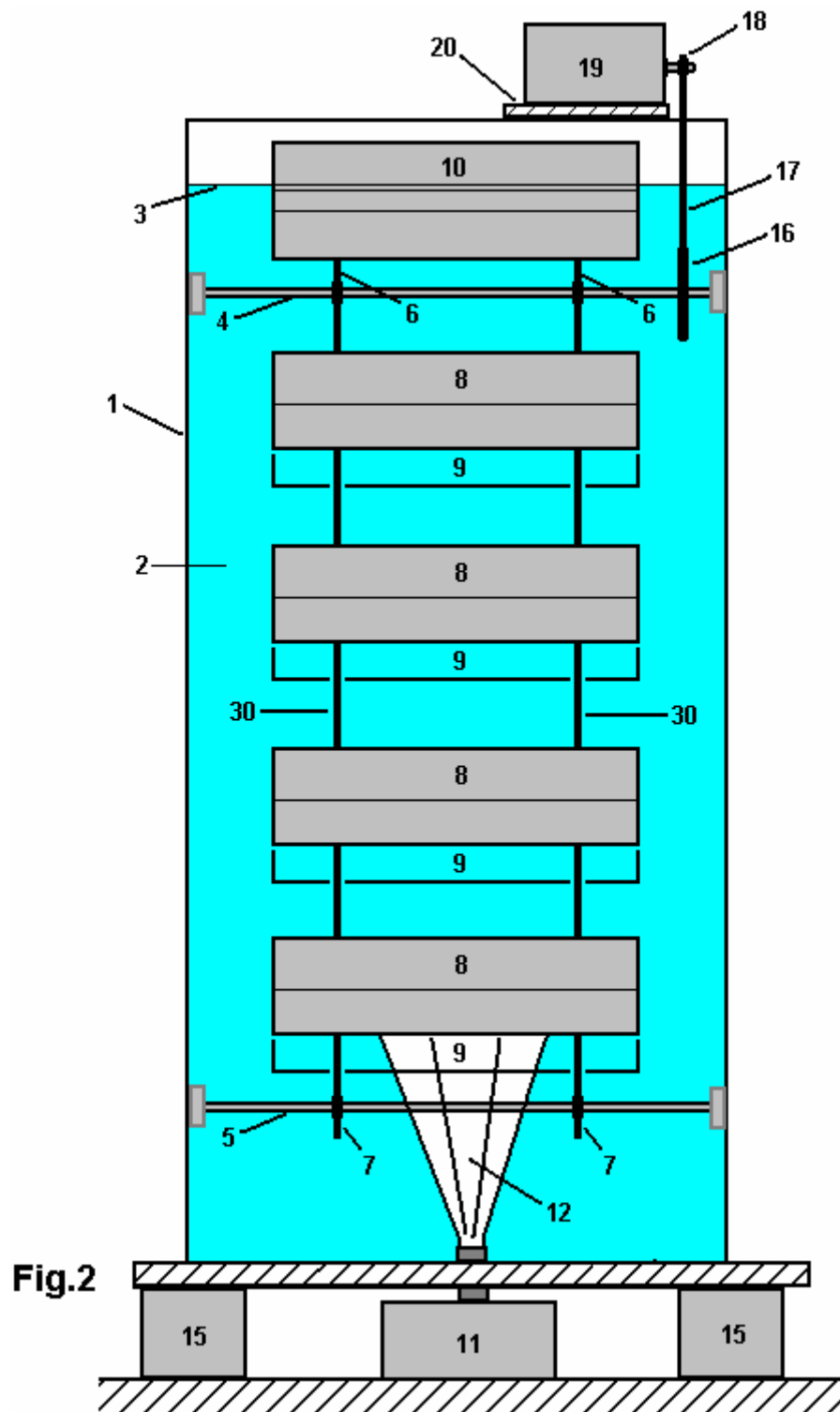


Fig.2, is a cross-sectional conceptual schematic view showing the front view of the generator in its most simple form.

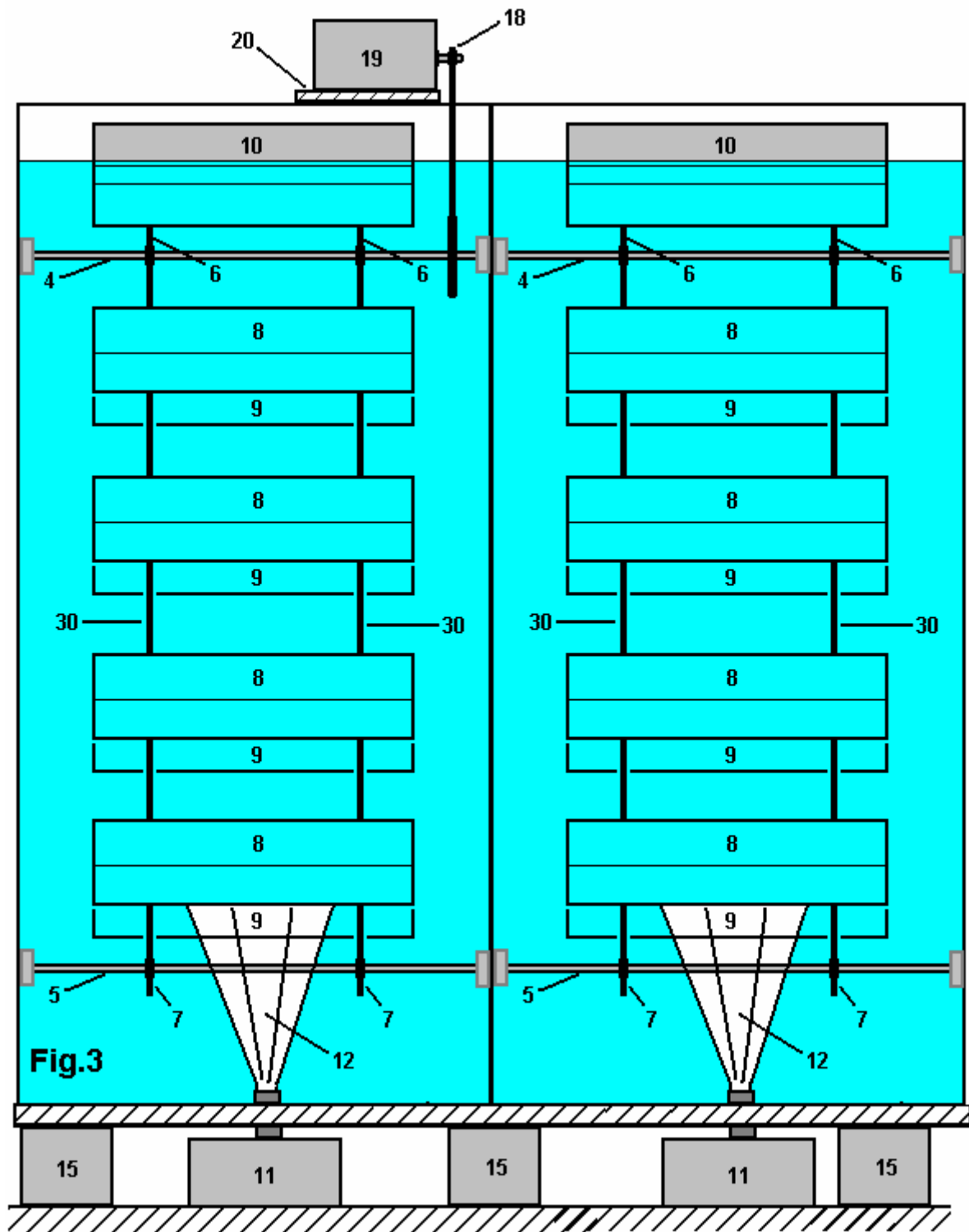


Fig.3, is a cross-sectional conceptual schematic view showing the front view of the generator where more than one set of buckets is used.

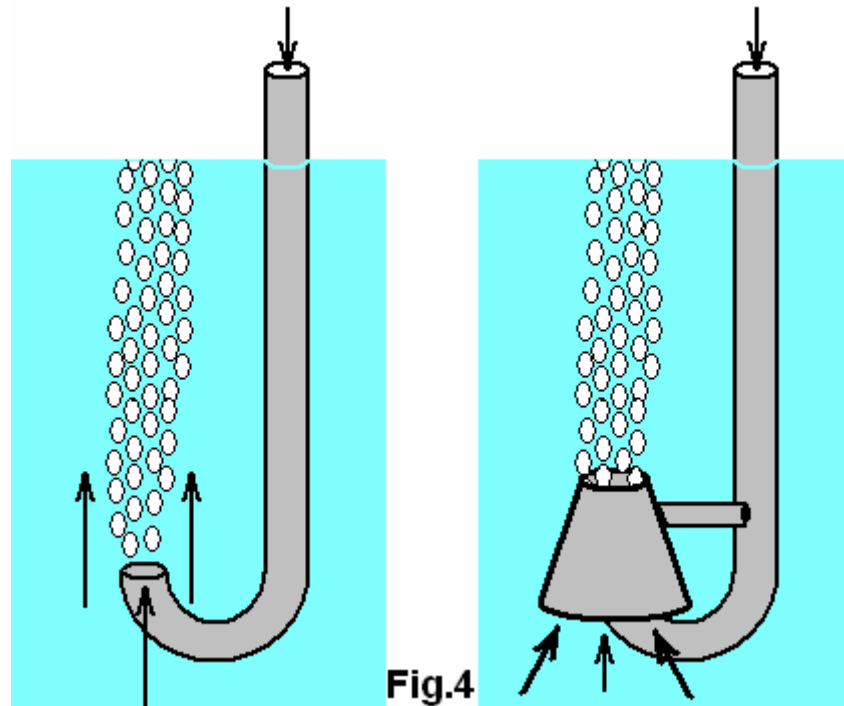


Fig.4

Fig.4, is a perspective conceptual view showing arrangements for a simplified air-feed system which operates from above the tank.

Fig.1, illustrates the overall concept of the generator in its most simple form where lightweight rigid buckets are used to capture the rising air from the air pump. In this Figure, a water tank **1**, holds water or other suitable liquid **2**. The surface of the liquid **3**, is indicated to illustrate the fact that a bucket **10**, which is in the process of turning over at the top of its orbital motion, is positioned so that one edge of the bucket is clear of the surface of the water, which allows the air which was trapped inside the bucket to escape into the atmosphere and the water fill the entire bucket causing only a very minor turbulence when doing so. This is a desirable, but not essential feature as the air trapped in any bucket will escape upwards as soon as the bucket starts its downward movement, positioning its open end upwards, although this causes unnecessary turbulence inside the tank. One possible bucket shape is shown in perspective view, but many different bucket shapes may be used, including flexible membrane types or alternatively, hinged-plate types which have very much reduced resistance to moving through the water when in their collapsed state during their downward movement.

The buckets **8**, **9** and **10**, are attached to two strong chains **30**, which mesh with the upper sprocket wheel **6**, mounted on the upper axle **4**, and the lower sprocket wheel **7**, which is mounted on the lower axle **5**. Although it is not visible in **Fig.1**, there are two upper sprocket wheels **6**, two lower sprocket wheels **7**, and two chain loops **30**, although these can be seen in **Fig.2**.

The tank is supported on a robust plate **14**, which itself is supported by a series of pillars **15** which rest on a secure footing **16**, providing operating space underneath the tank for the installation and maintenance of the air pumping equipment. As fresh water weighs 1000 Kg per cubic metre, the weight of the operational generator system is substantial and so this must be allowed for when assessing the footing needed to support the tank and its contents. While a thin-wall tank is shown in **Fig.1**, many different forms of tank may be utilised, including earth bank and plastic membrane styles, or resurfaced abandoned well shafts. The tank of **Fig.1** presumes that the lower axle **5** is taken out through the wall of tank **1**, using an arrangement similar to that used for the drive shafts which power the screws of ships and other power vessels. While an arrangement of that type provides a drive shaft which is conveniently close to the ground, the much more simple arrangement shown in **Fig.2** where the output power is taken off using the very simple chain and sprocket wheel method utilised for the bucket supports (chain **30**, and sprocket wheels **6** and **7**). In general, the more simple and straightforward any design is, the better it works in practice and the lower any maintenance costs become.

Referring again to **Fig.1**, when activated, air pump **11** produces a stream of air **12**, which flows rapidly upwards. This stream of air **12**, once established, does not have to push against the head of water as

immediately above the nozzle of the pump is a rapidly rising column of air, sustained both by the exit velocity from pump **11** and the natural upward movement caused by the relative weights of water and air (as water is several hundred times heavier than air). This column of air would normally flow straight upwards in calm water, but should it be found that turbulence in the water tends to push the rising air away from its vertical path, baffles can be placed around the pump and positioned so that the air stream is forced to stay within the same section of water taken up by the rising buckets.

The rising air enters the lowest of the rising buckets and collects in it, forcing the water out of the open bottom of the bucket. If the rising bucket is not completely filled with air before the next bucket moves between it and the air pump, the trapped air will expand as the bucket rises and the water pressure reduces due to the lesser depth. Any one bucket with a substantial amount of air in it will create a very significant upward force due to buoyancy, air being about one thousand times lighter than water.

Each bucket on the rising side adds to that upward force and consequently, the chains **30** need considerable strength. The weight of the buckets on each side of the chain match and so the main advantage of light buckets is to lower the inertial mass of the moving parts. Movement through the water is relatively slow but this is offset by gearing between the output drive shaft and the generator's input shaft. The power of the system can be increased by adding more buckets in the vertical chain, increasing the water depth accordingly. Other ways of increasing the power include increasing the volume inside each bucket and/or increasing the flow rate produced by the air pump or pumps used. Another simple method is shown in **Fig.3** and discussed below. An alternative to air pumps is to use tanks of a compressed, non-polluting gas, possibly air.

The buckets shown in the various Figures are rigid, very simple shapes, possibly made by a plastic moulding process in order to be cheap, strong, lightweight and permanently water-resistant. There are, of course, many possible variations on this including using rigid hinged plates sealed with a strong flexible membrane, allowing the buckets to fold and become streamlined on their downward path, and opening as soon as they turn to start their upward movement. There are many mechanisms which can provide this movement, but it is a matter of opinion as to whether or not the extreme simplicity of rigid buckets is worth sacrificing

Fig.2 shows a schematic layout of the generator when seen from the side. The same numbers apply to the components already seen in **Fig.1**. The arrangement seen in **Fig.2** is the most simple, basic, single bucket set. The near-side rising buckets **8** obscure the view of the far-side falling buckets **9** and only the lowest part of the falling buckets **9** can be seen in this view. **Fig.1** shows buckets which are some two and a half times longer than they are wide, but this, of course, is just one option among literally thousands of possible proportions. The size and shape of buckets is related to the performance and number of air pumps being used for any one set of buckets and that choice depends on what is available locally at a reasonable price. It would not be unusual for two or three air pumps to be used side by side along the length of the bucket **8** although **Fig.2** only shows a single pump.

Fig.2 also shows a simple method for power take off where a large diameter sprocket wheel **16** is mounted on the upper axle **4**, and driving a much smaller diameter sprocket wheel **18** which is mounted on the drive shaft of the electricity generator **19** which is mounted on plate **20** which is attached securely to the top of tank **1**.

Fig.3 shows one of the possible arrangements for increasing the system power without increasing the depth of water used. Here, the axles **4** and **5** extend far enough to allow another set of buckets to drive them, increasing the torque very substantially. While **Fig.3** shows one extra set of buckets, there is, of course, no reason why there should not be three or more sets of buckets side by side. It should be noted however, that the partitions shown between the bucket sets are not there just to reduce the water swirling but are needed to support the bearings which are essential for the extended axles, since without those, the diameter of the bars used for the axles would have to increase very markedly to avoid unwanted flexing along their length. While the second set of buckets has been shown aligned exactly with the first set, there is an advantage in offsetting them relative to each other so that the output torque is more even with buckets emptying and filling at different points in the bucket cycle.

Fig.4. shows a method for further simplification, where the air is pumped from above the water surface. It is a matter of concern to most people, that the pressure of the head of water above the air pump is a

major obstacle to overcome and will be a continuous opposing force during operation of the generator. If air is being injected from underneath the tank, then initially, that pressure head has to be overcome. However, once the air flow is established, a vertical cigar-shaped area of water vortex is established by the rising air stream. This three-dimensional annular vortex negates the water head in the small area immediately above the air nozzle, and almost sucks the air out of the pump, after the initial introduction of the air has been accomplished.

There is another way of achieving this desirable effect without ever having to pump against the total head of water, and that is to use a mobile air pipe as shown in **Fig.4**. Initially, the air pump is started and lowered a short distance into the water. The opposing head of water is not large and the water vortex can be established quite easily. The pipe is then lowered very slowly, so as to maintain the vortex at a progressively lower depth, where, in spite of the increased head of water, the pump does not have to overcome that head. When the pipe outlet reaches the operational depth, it is then rotated to bring it under the set of rising buckets. The major advantage of this arrangement is that the tank is as simple as possible, with no possibility of leaking, and so abandoned wells can be modified to become energy generators. Alternatively, an earth bank can be erected to form an above-ground tank, possibly sealed with a plastic membrane. This method also avoids needing to support the weight of tank and water above a work-area where the air pump or compressed-air cylinders are located and maintained. The creation of the water vortex can be assisted by the addition of a cowl around the pipe exit as shown in this figure, but that is an optional feature.

Patrick J Kelly

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Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

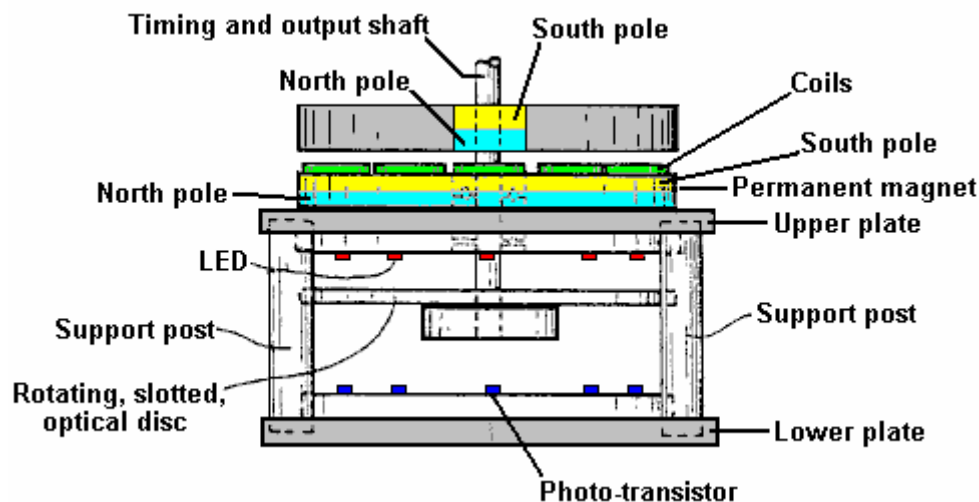
Chapter 28: Power From Magnets

There are many different successful designs which extract power from permanent magnets, including the magnet motor/generators of Wang, Shenhe which produce kilowatts of electrical power. Here, we will look at just one example:

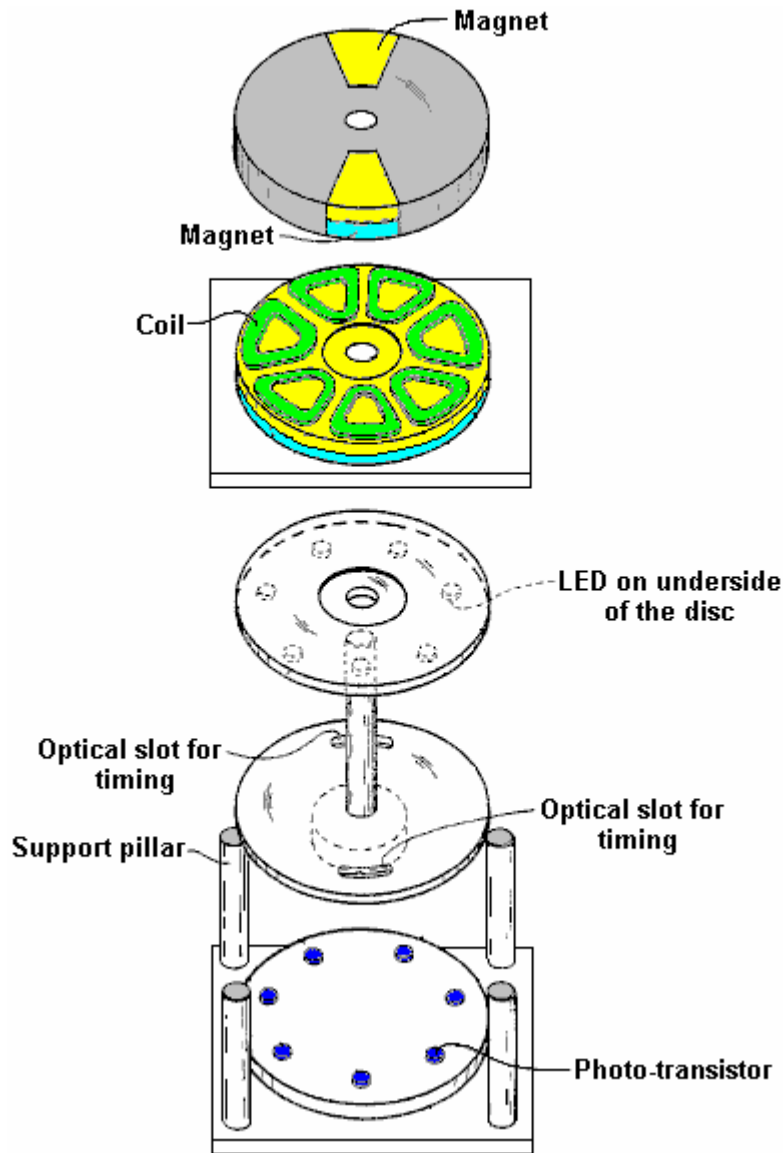
Charles “Joe” Flynn’s Permanent Magnet Motor.

Patent US 5,455,474 dated 3rd October 1995, gives details of this interesting design. It says: “This invention relates to a method of producing useful energy with magnets as the driving force and represents an important improvement over known constructions and it is one which is simpler to construct, can be made to be self starting, is easier to adjust, and is less likely to get out of adjustment. The present construction is also relatively easy to control, is relatively stable and produces an amazing amount of output energy considering the source of driving energy that is used. The present construction makes use of permanent magnets as the source of driving energy but shows a novel means of controlling the magnetic interaction or coupling between the magnet members and in a manner which is relatively rugged, produces a substantial amount of output energy and torque, and in a device capable of being used to generate substantial amounts of energy.”

The patent describes more than one motor. The first one is like this when seen from the side:

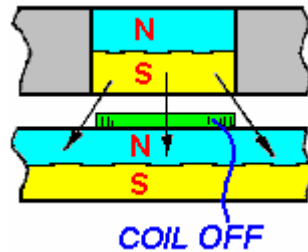


An exploded view, shows the different parts clearly:

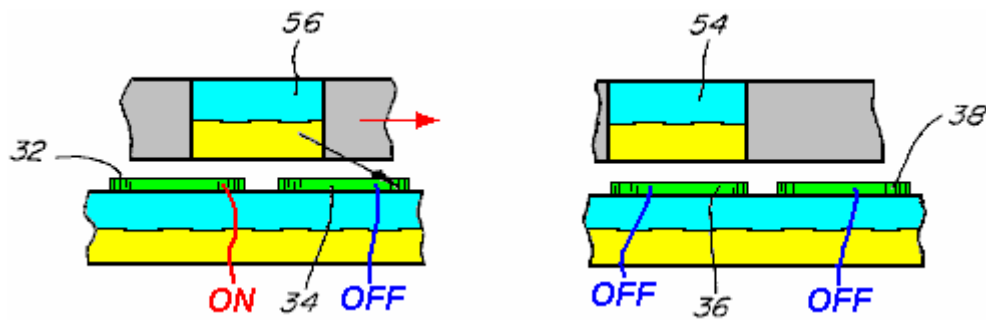


This construction is relatively simple and yet the operation is powerful. The power is provided by three magnets, shown shaded in blue and yellow. The lower magnet is in the form of a disc with the poles arranged on the large, circular, flat faces. This is the stator magnet which does not move. Positioned above it is a disc made of non-magnetic material (shaded in grey) and which has two magnets embedded in it. This disc is the rotor and is attached to the central vertical shaft.

Normally, the rotor would not rotate, but between the two discs there is a ring of seven coils which are used to modify the magnetic fields and produce powerful rotation. The powering up of these coils is very simple and it is arranged by shining a beam of Ultra Violet light from one of the Light-Emitting Diodes through a slot in an optical-timing disc attached to the rotating shaft. The LEDs and the photo-transistors are aligned with the centres of the seven coils. The position and width of the slot controls which photo-transistor gets switched on and for how long it remains powered up. This is a very neat and compact arrangement. The really interesting part of the design is how the coils modify the magnetic fields to produce the output power of the device. The orientation of the magnet poles can be swapped over, provided that this is done for all three magnets.



Shown here is the situation when one of the rotor magnets has rotated to where it is above one of the coils which is not yet powered up. The South pole of the rotor magnet is attracted to the North pole which is the entire upper face of the stator magnet as shown by the three arrows. If a voltage is applied to the coil, then this magnetic coupling is disrupted and altered. If any torque is developed as a result of the coil being powered up, then it will be developed to either side of the energised coil. If the coil is not powered up, then there will be full attraction between the magnets and no rotational force will be produced. You will notice that there are two rotating magnets (an even number) and seven coils (an odd number) so when one of the rotor magnets is above a coil, then the other isn't. This staggering of the two positions is essential for generating smooth, continuous rotational torque and self-starting without any need to rotate the shaft manually.



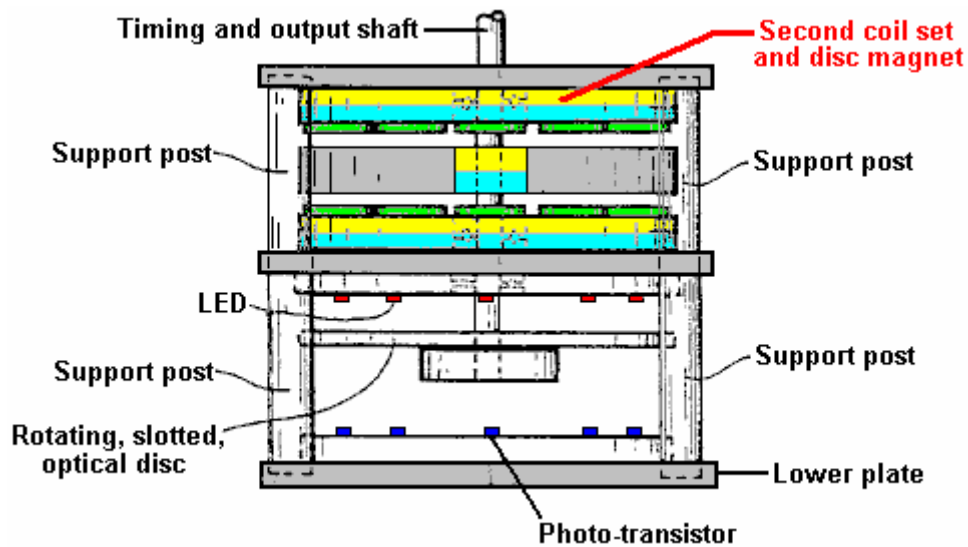
The diagram above shows a piece from both sides of the rotor disc, to explain the operation of the coils. On the left, magnet **56** overlaps coil **32** and coil **34**. Coil **32** is powered up and this breaks the magnetic link on the left hand side of magnet **56**. But, coil **34** is not powered up, so the attraction between magnet **56** and the disc magnet under the coils remains. Even though this attraction is at a downward angle, it creates a push on the rotor, driving it towards the right as shown by the red arrow.

While this is happening, the situation around the other side of the rotor disc, is shown on the right. Here, magnet **54** is above coil **36** and that coil is not powered up, so there is no resulting drive in either direction - just a downward pull on the rotor magnet, towards the stator magnet below it. The adjacent coil **38** is also not powered up and so has no effect on the rotation. This method of operation is **very** close to that of the motor design of Robert Adams described in the next chapter. It is important to understand that this method of operation is nothing like that of the John Bedini pulsers where the rotation of a disc is caused by the electrical pulse applied to a coil creating a repulsion thrust to a rotor magnet. Instead, here, the coil acts as a magnetic shield, being provided with the minimum possible power to do its job. The coil is, in effect, a shield which has no moving parts, and so is a very clever mechanism for overcoming the tendency for the rotor magnets to lock on to the stator magnets and preventing rotation.

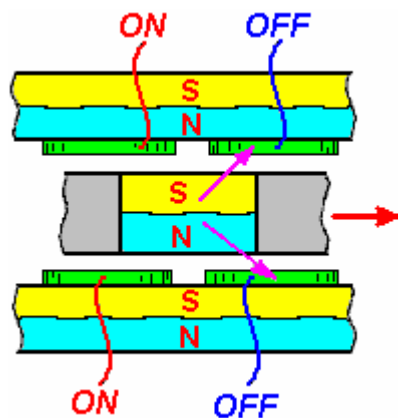
At any moment, six of the seven coils in this design are inactive, so in effect, just one coil is powered. This is not a major current drain. It is important to understand that the power of this motor is provided by the permanent magnets pulling towards each other. Each of the two magnets applies a horizontal pull on the rotor every seventh of a turn, that is, every 51.1 degrees in the rotation. As the coils are an uneven number, the rotor gets a magnetic pull every 25.5 degrees in the rotation, first from one rotor magnet and then from the other rotor magnet.

It follows then, that the power of the motor can be increased by adding more magnets. The first step in this search for additional power is to add a second disc magnet and coils on the other side of the rotor,

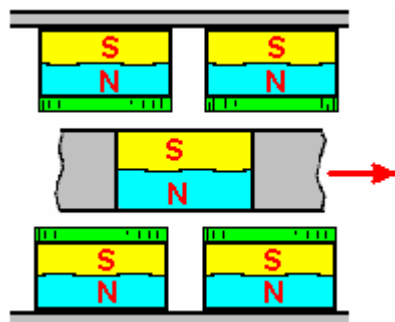
so that there is a second pull on the magnet. This has the added advantage that it balances the downwards pull of the first disc magnet with an upward pull, giving an enhanced and balanced horizontal thrust as shown here:



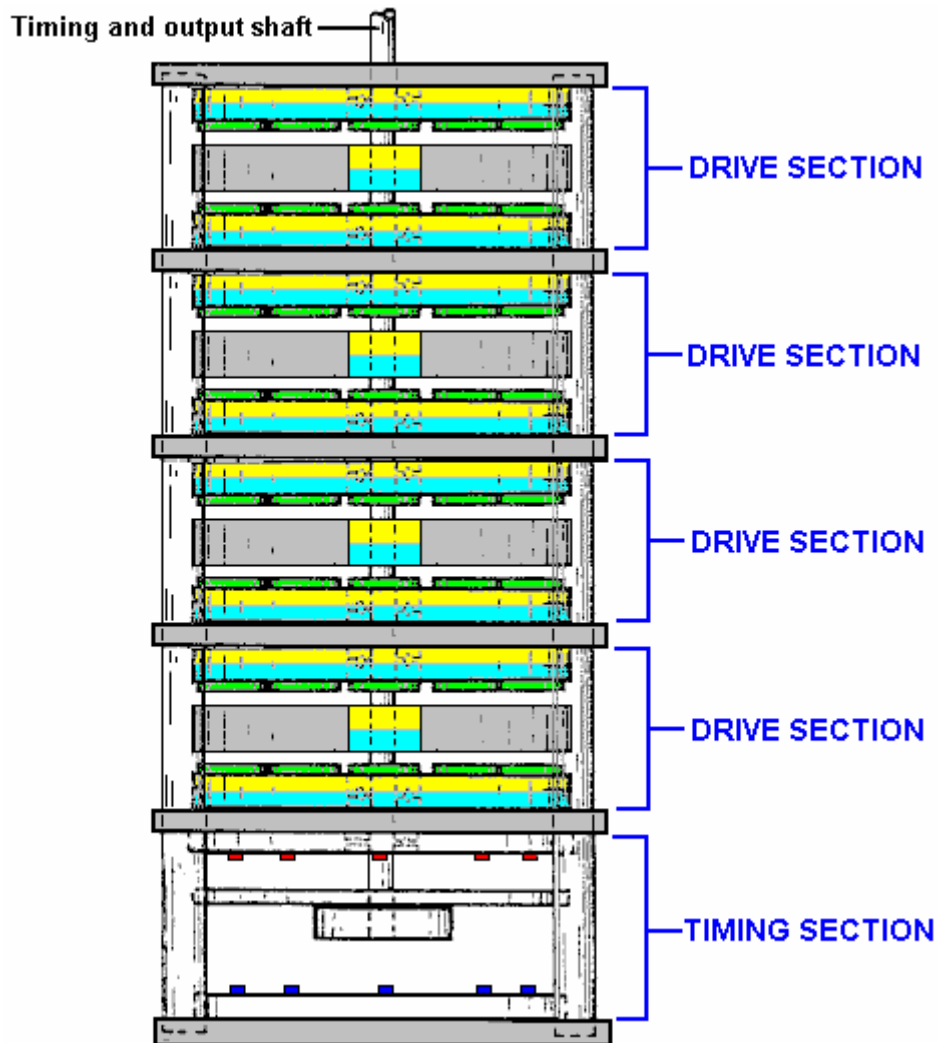
The coil switching with the additional layer of coils is shown here:



This produces a larger horizontal thrust. While this design goes for optimum performance, I suggest that a much more simple form of construction with a ring of standard circular neodymium magnets could be used instead of one large disc magnet, and ordinary circular coils placed on top of the circular magnets, and this allows large diameter rotors to be constructed, the larger diameter giving greater output shaft power:

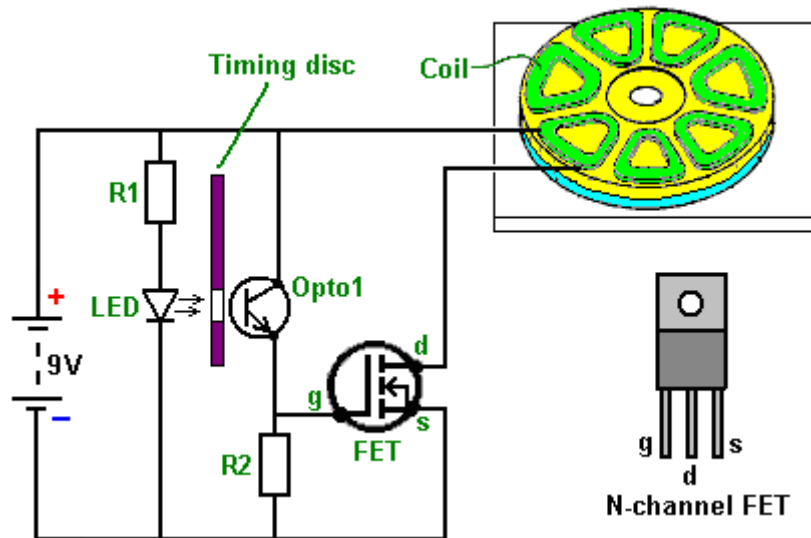


To increase the power of the output shaft further again, additional sets of magnets and coils can be added as shown here:



It should be remembered that the timing section shown above could be replaced by a NE555 timer circuit which generates a steady stream of On / Off pulses. When those pulses are fed to the coils, the motor rotates, slaving itself to the pulse rate. This gives an immediate speed control for the motor as well as avoiding the need for the precise positioning of the slotted disc which allows the LEDs to shine directly on to the phototransistors at the appropriate instant. If that approach is taken, then the timing section shown above would be omitted.

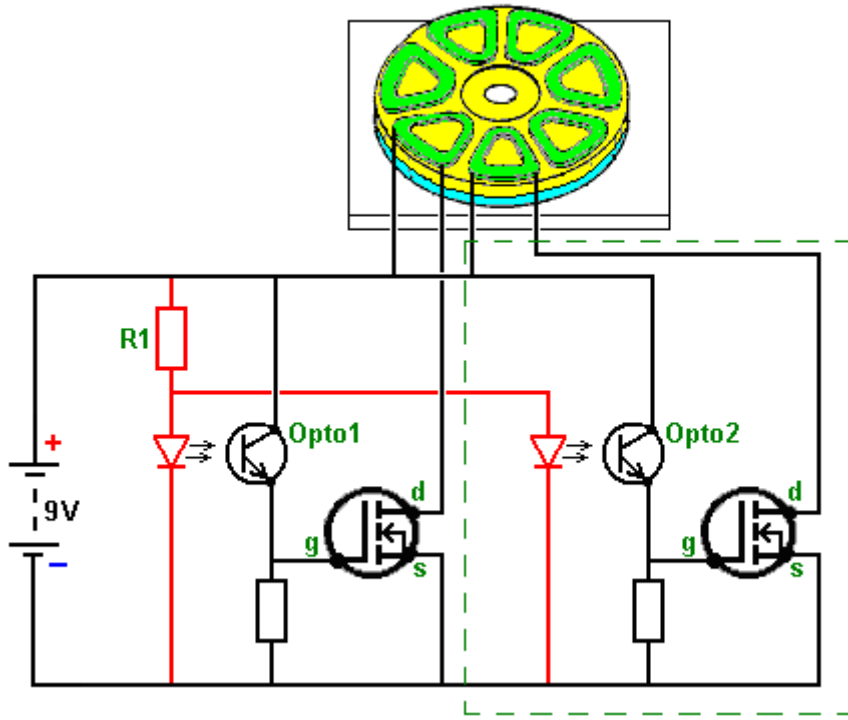
The circuitry that Charles specifies for powering the coils to block the magnetic fields of the permanent magnets uses N-channel MOSFETs and is very simple. Here is his circuit for driving one of the coils:



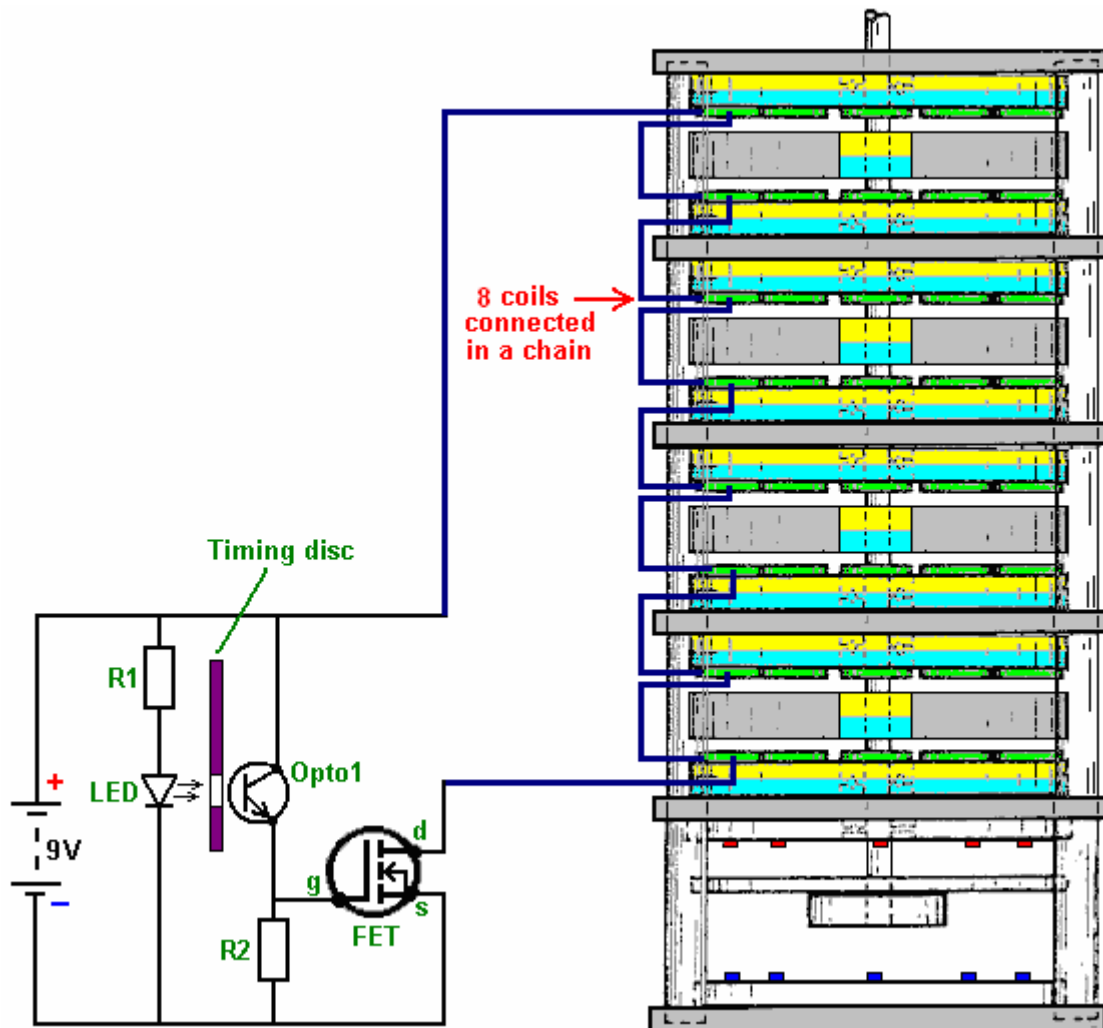
Just five components are used. The current through the coil is controlled by a transistor. In this case it is a Field-Effect Transistor usually called a "FET". The most common type of FET is used, namely an "N-channel" FET which is the rough equivalent to an NPN transistor as described in Chapter 12. A FET of this type is switched off when the voltage on it's "gate" (marked "g" in the diagram) is 2.5 volts or lower. It is switched on when the voltage on it's gate is 4.5 volts or more.

In this circuit we want the FET to switch on when the motor's timing disc is in the right position and be off at all other times. This is arranged by shining the light from a Light-Emitting Diode or "LED" through a hole in the timing disc which rotates with the shaft of the motor. When the hole is opposite the LED for the coil which is to be powered up, light shines through the hole and on to a light-sensitive device, Charles has opted to use a Light-Sensitive transistor, but a light-dependent resistor such as an ORP12 could be used instead. When the light shines on the "Opto1" device in the circuit diagram, it's resistance falls dramatically, raising the voltage on the gate of the FET and switching it on. When the timing disc hole moves past the LED, the light is cut off and the FET gate voltage drops down, switching the FET off. This arrangement causes the coil of the motor to be switched on and off at just the right time to give a powerful rotation of the motor shaft. In the circuit, the resistor "R1" is there to make sure that the current flowing through the LED is not excessive. The resistor "R2" has a low value compared to the resistance of "Opto1" when no light falls on it, and this holds the gate voltage of the FET down to a low value, making sure that the FET is completely off.

As you can see, this is basically a very simple circuit. However, as one of these circuits is used for each coil (or each pair of coils if there is an even number of coils in this slice of the motor), the circuit in the patent looks quite complicated. It is actually very simple. The resistor "R1" is used to limit the current flow through all of the LEDs used and not just one LED. You could, of course, use one resistor for each LED if you wanted to. The circuit for powering two coils (and not showing the timing disc) looks like this:



The section inside the green dashed line being the identical circuit for the second coil. This addition to the circuit is made for each coil, at which point, the motor is ready to run. If, as would be normal, several layers of magnets are being used, then the coils positioned above each other can be connected in a chain like this:



Connecting several coils "in series" (in a chain) like this, reduces the number of electronic components needed and it makes sure that the pulses to each of these coils is at exactly the same instant. Alternatively, it is possible to wire these coils across each other "in parallel", the choice is generally dictated by the resistance of the coils. The patent drawing shown above seems to indicate that there is a big gap between the LEDs and the optical devices. This is probably not the case as most people would choose to keep the gap between the LED and the light-dependent device as small as possible, mounting them so that they are just clear of the timing disc on each side of it.

In this patent, Charles Flynn remarks that this magnet motor can be used for almost any purpose where a motor or engine drive is required and where the amount of energy available or required to produce the driving force may vary little to nil. Charles has produced motors of this type which are capable of rotating at very high speed - 20,000 rpm and with substantial torque. Lesser speeds can also be produced, and the motor can be made to be self-starting. Because of the low power required to operate the device, Charles has been able to operate the motor using just a nine volt dry battery.

One application which seems most appropriate for this motor design is the Frenette heater shown in Chapter 14. Using this motor to drive the discs inside the heater drum would produce a heater which appears to be driven by just a nine-volt battery. However, while that is the appearance, the reality is that the power of this motor comes from the permanent magnets and **not** from the battery. The battery current is only used to prevent the backward pull of the magnets and it is **not** used to drive the motor.

Patrick J Kelly

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Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 29: Power From Circuitry

In July 2013, two Brazilian men, Nilson Barbosa and Cleriston Leal, demonstrated a simple device which extracted more than 190 kilowatts of power from the ground. While many people have tried to replicate the Barbosa and Leal power generator design which draws power from the Earth, and failed. One man whose forum ID is “Clarence” read the relevant patents and knew immediately how the design works and what items in the patents are misdirection by Barbosa and Leal. He has built his own implementation of the circuit and it works perfectly. He has generously shared the relevant details. Please understand that what follows is not a description of where to start experimenting, but instead it is an actual working design. Build it as described and it will work. Build it differently and it won’t work. Clarence has this to say:

In the Barbosa and Leal patent they make a vague reference to the Lenz Law. It just so happens that this is the **key** to the whole device. On the overunity forum, a circuit diagram posted by member “ZeroZero” showed the exact and complete method of defeating the Lenz Law, although most forum members did not seem to understand the importance of the circuit. However, I knew immediately that Lenz’s Law was just another name for back-EMF. The Lenz Law effect is overcome by winding the single primary coil in a clockwise direction and the AWG #4 2.5 turn windings are wound on the bare core in an anti-clockwise direction and that totally negates the Lenz Law.

What does this achieve? It gets rid of the voltage component in the secondary windings, leaving only the amperage component! When you wind two toroids exactly the same using this method and connect them as shown below, you create a loop similar to a horseshoe magnet with a keeper on it and the amperage in the loop just goes on circulating round and round as shown by Ed LeedsKalin. This is the same principle. The loop has the ability within itself to add unlimited amperage, instantaneously to the neutral green Ground Return wire accordingly as the load requires. The only limit to the available amperage is the current-handling capacity of the looped black wire.

You can touch the black wire loop connections with bare hands because as there is no voltage, there is no resulting shock. The connecting of the AWG #10 phase wire to the bottom loop wire only serves to orient the polarisation of the amperage.

The oriented spinning of the amperage in the loop **induces** the amperage needed by the load, into the Captor output. This little toroid can allow the loop to load an AWG #4 wire enough to **melt** it !!

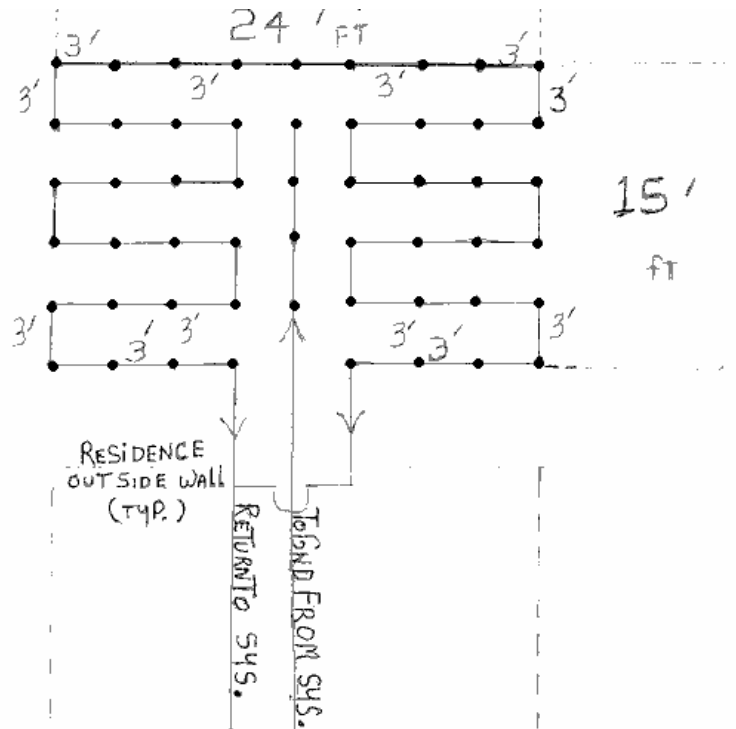
The toroid primary wires Live to Live and Neutral to Neutral should be powered from the inverter by a separate circuit

Another separate circuit should be used with the Live connected to the bottom black looped wire in order to polarise it. The Neutral powers the input to ground.

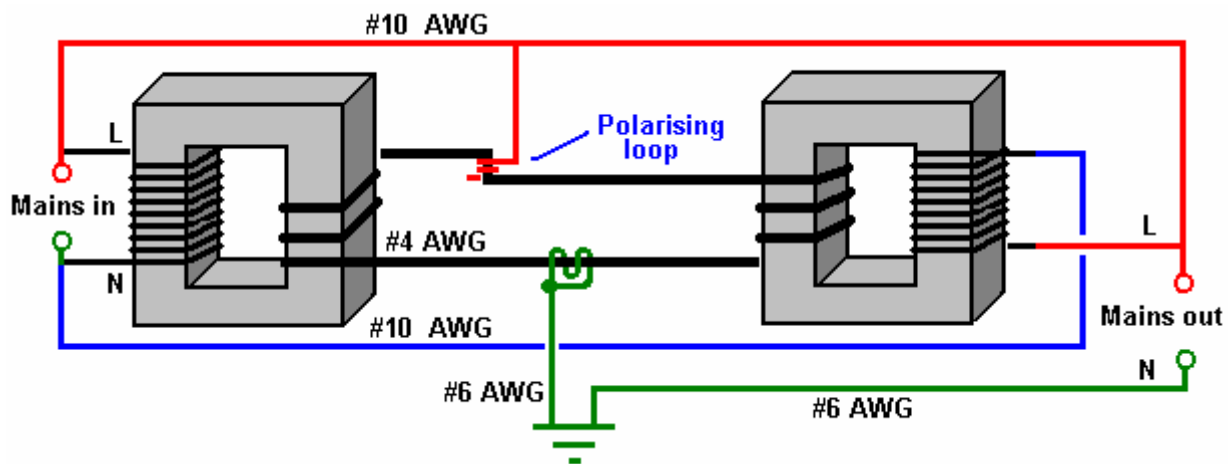
The return ground rods are linked in a series loop and then, from a convenient ground rod to the green 2.5-turn loop around the black captor loop and then on to serve as the captor Neutral to the load.

You will know that you have enough ground rods when the Captor rms output voltage **matches** the rms voltage of the inverter, and then, you will probably have to add about another ten ground rods in order to keep the rms voltage of the Captor output from dropping. If the Captor rms output voltage drops – simple – add more ground rods. Please understand clearly that without sufficient ground rods, the

apparatus just will **not** work. Here is a connection pattern where many 6-foot (1.8 m) long earthing rods are used:



The circuit diagram from ZeroZero shows this arrangement:

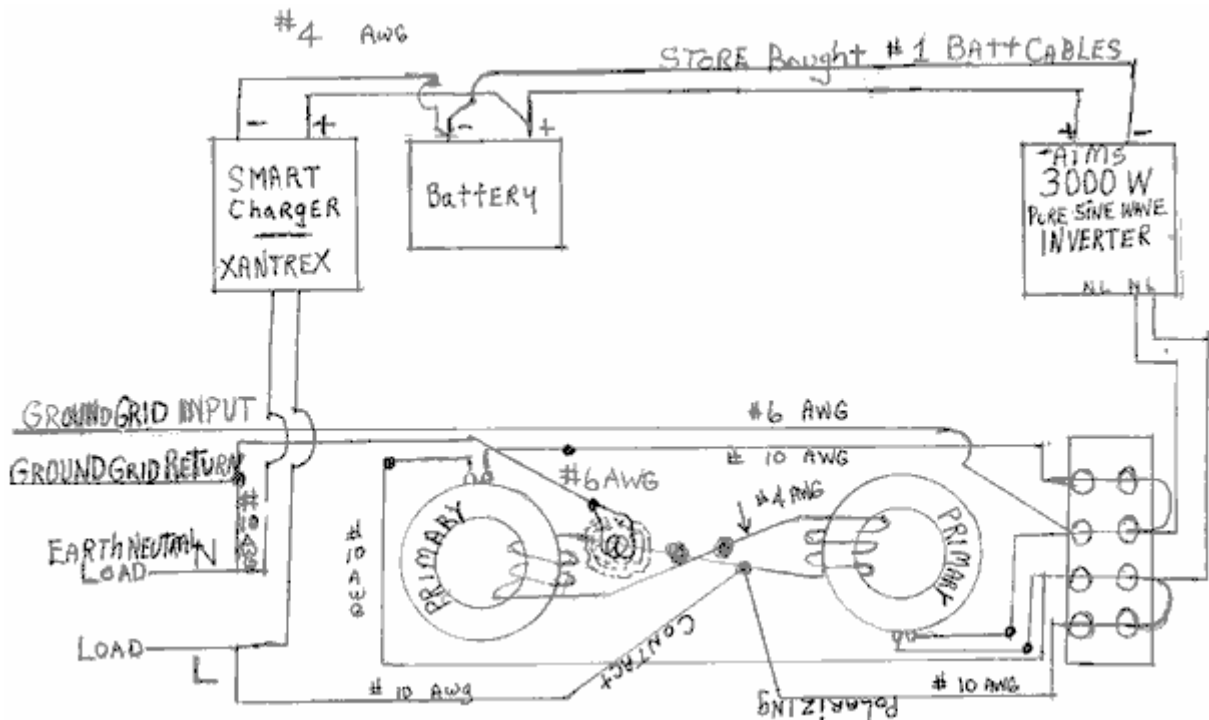


The direction of winding is vitally important as are the wire sizes. You will notice that the windings on the two magnetic frames are in opposite directions, **and**, the thick wire loop windings are both in opposite directions, **and**, the thick wire winds also oppose the thin wire winding on the same frame. Looking from above, the thick wire forms the shape of the numeral 8. The thick wire is AWG #4 with a diameter of 5.19 mm and the other core windings are AWG #10 with a diameter of 2.59 mm. The “polarising loop” is produced by taking a few turns of the AWG #10 wire around the insulation of the AWG #4 wire – the wires inside the cables are **not** actually joined together. The input and output are marked as “mains” as either 110V or 220V can be used, however, not actually fed from the mains as that would create a ground loop, but instead, the input is from an inverter. The earth wire is AWG #6 with a core diameter of 4.11 mm.

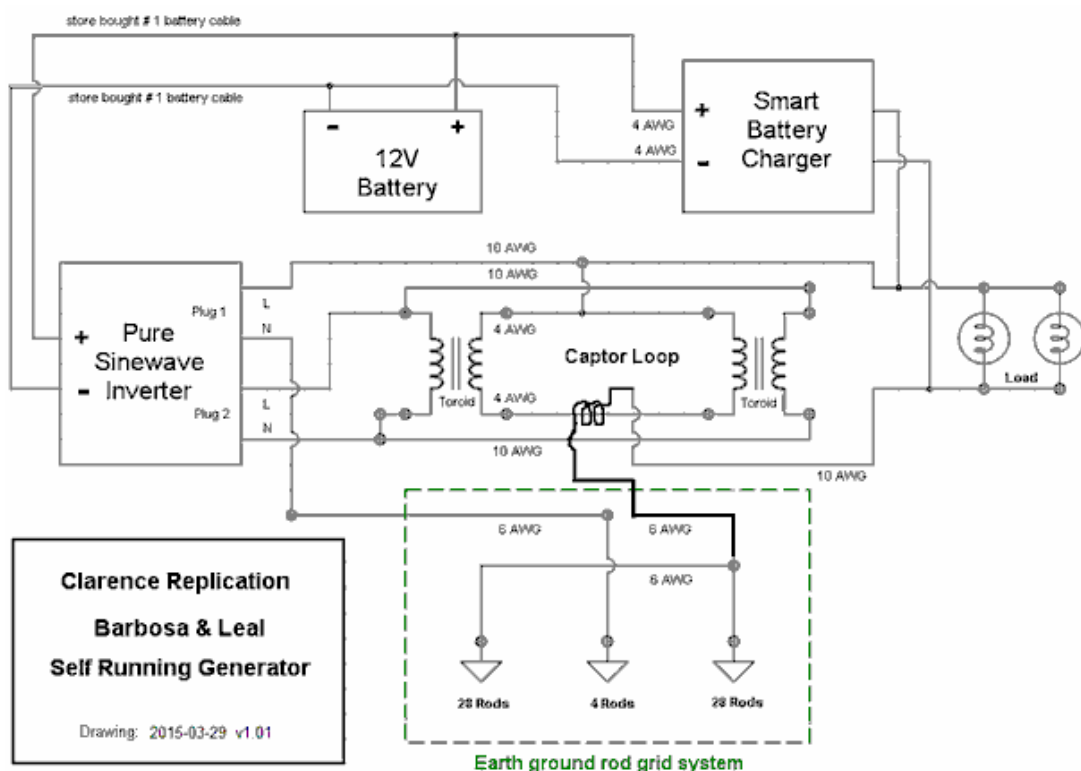
While the magnetic frames above are shown as rectangular, they are actually circular toroids (which was what Barbosa and Leal used but failed to mention). The ones used by Clarence are type TD300 1120 toroids with a diameter of 5.2 inches (132 mm) and a thickness of 2.3 inches (58 mm) each weighing 6.2 pounds (2.8 Kg) and available from

http://www.tortran.com/standard_isolation_transformers.html. Clarence remarks that building this power generator replication is not cheap and he has spent more than US \$2000 on his replication. Mind you, with an output power of 3 kW, this unit meets all of his household electrical requirements.

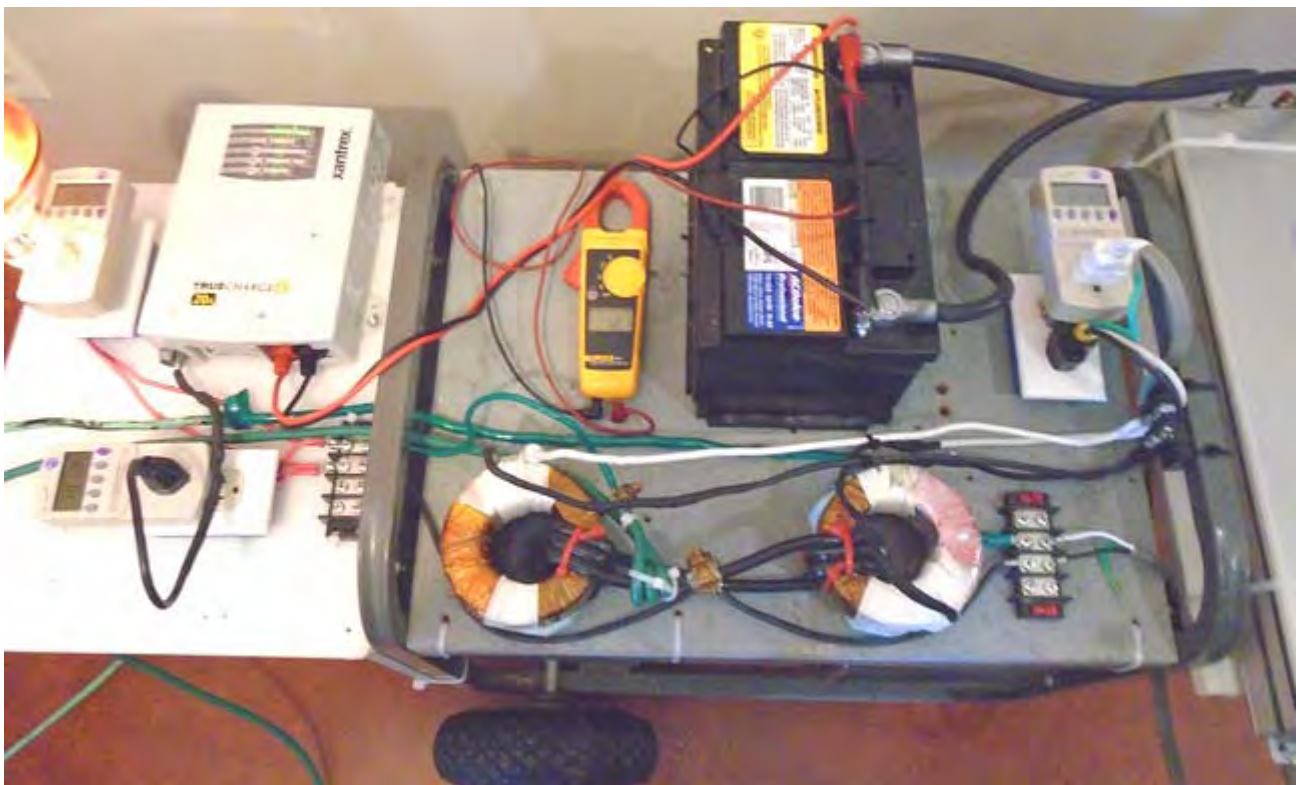
It is said that all builders should get a global or national Geomagnetic Map of their area before building, but Clarence says that he is in a “dead” area anyway, so there is probably little point in this as the number of earthing rods needed in your area is found by trial anyway, and knowing in advance does not change that number.

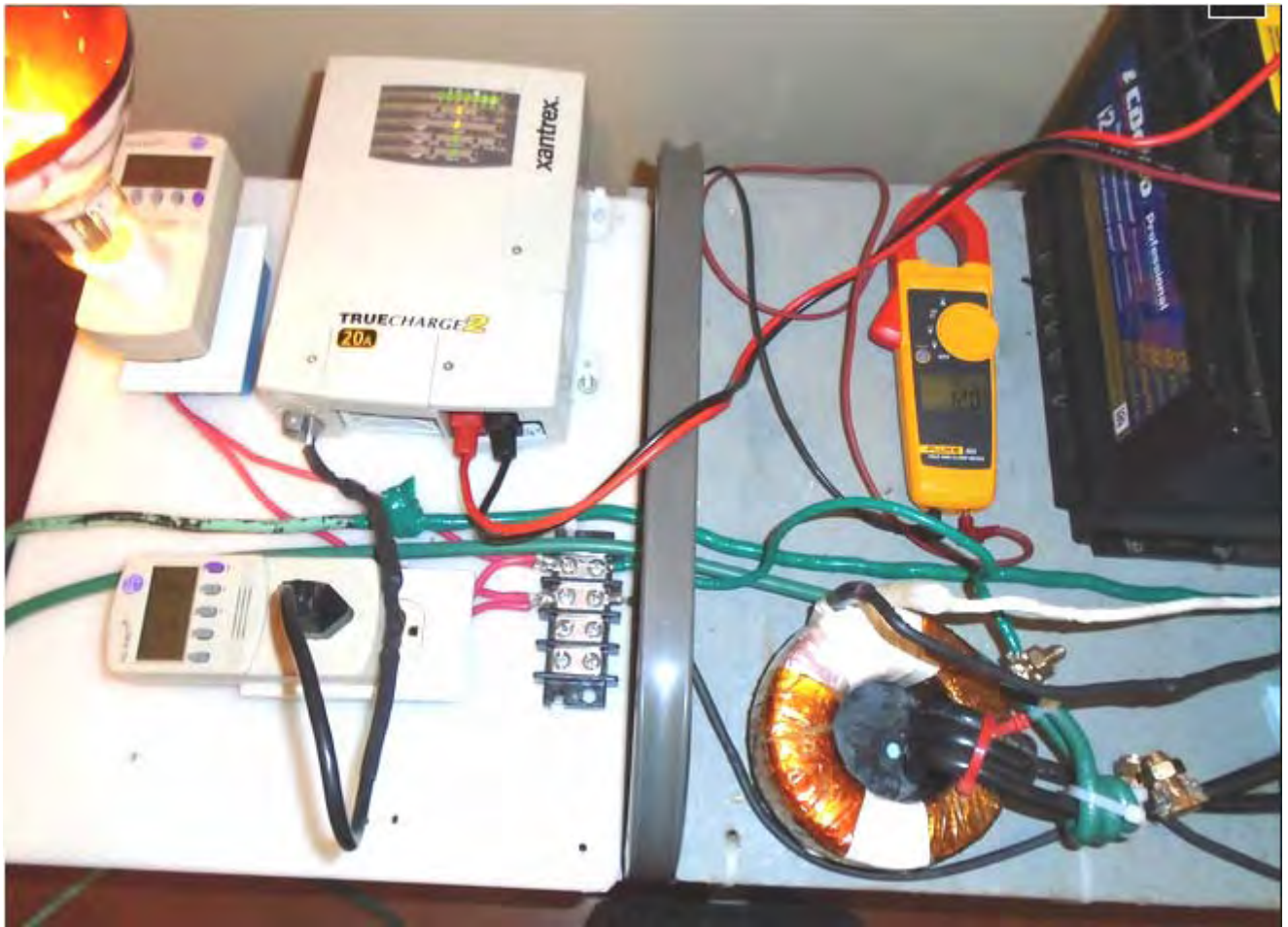


Another edition of the circuit diagram is:



Here are some pictures of Clarence's successful build:





Components used were:

Toroids:

Bridgeport Magnetics :

[Tortran - In Stock Standard Design Toroidal Isolation Transformers - Bridgeport Magnetics Group](#)

Contact: Michael Kharaz E-mail: sales@bridgeportmagnetics.com

[Tortran Division- Contact us - Bridgeport Magnetics Group](#)

Custom ordered toroid (2 required):

TD300-1120-P, 300VA, 60Hz, Primary 120V, 160 degrees winding on toroid surface, no secondary winding - \$125 USD each

Smart Battery Charger:

Xantrex TrueCharge2 Battery Charger - 20Amp model

Website: [Truecharge Battery Charger | Truecharge2 20A, 40A, 60A | Xantrex](#)

Xantrex Dealers list:

[Where to Buy - N. America](#)

Available from Amazon.com:

[Amazon.com: Xantrex 804-1220-02 TRUECharge2 12V 20A Parallel Stackable Battery Charger: GPS & Navigation](#)

Looks like the price is around \$260 to \$300 USD - depending where you order from.

Minimum recommended battery bank size for use with the 20Amp Charger model is 40 Ah

12V Pure Sinewave Power Inverter

AIMS POWER 3000 Watt 12VDC Pure Sine Wave Power Inverter - Model: PWRIG300012120S

Website: <http://www.aimscorp.net/3000-Watt-Pu...-Inverter.html>

Available from:

InvertersRUs - \$699 USD <http://www.invertersrus.com/aims-pwrig300012120s.html>

Amazon - \$799 USD <http://www.amazon.com/AIMS-Power-PWR...+wave+inverter>

Forum moderator "Level" who has done an excellent job of retrieving and displaying Clarence's material here: <http://www.energeticforum.com/renewable-energy/20091-barbosa-leal-devices-info-replication-details-2.html>, says:

Stick to the battery and inverter method as the power source, as that is the only way you can avoid a ground loop to the mains electrical power system. The one exception is you might be able to avoid such a problem when powering from the mains if you use an isolation transformer, but isolation transformers can be expensive and have a limited capacity as well.

Caution: Also beware that an inverter with an output of 120 volts or 240 Volts can kill you if you touch live wires, so don't build such a setup if you don't understand such things. You need to take necessary safety precautions.

Patrick J Kelly

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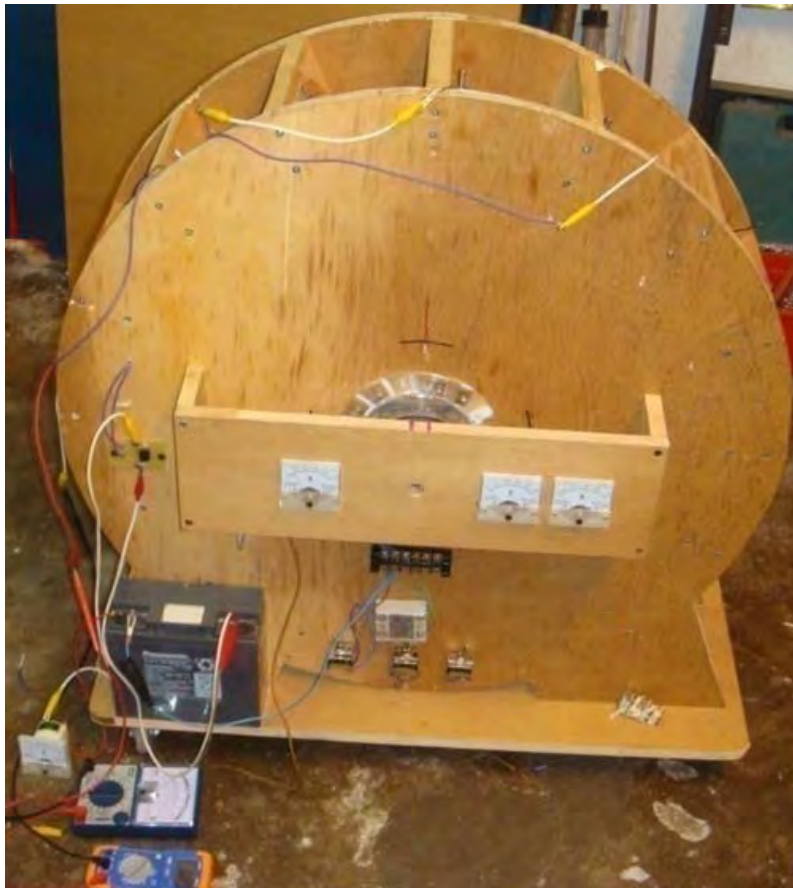
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Simple Free-Energy Devices

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Chapter 30: Lawrence Tseung's Generator

Lawrence has been presenting his theory of lead-out energy which indicates that excess energy can be drawn from the environment. The method of producing this effect which he has followed is to create an unbalanced wheel and demonstrate that excess energy is produced. It should be stressed that energy is never created or destroyed and so, when he measures more energy in his device than the energy which he uses to power it, energy is not being created but is instead, being drawn in from the local environment. Lawrence has recently demonstrated a prototype to members of the public:



This simple device was demonstrated to have 3.3 times as much output power as the input power needed to make it operate. This is an early prototype which was demonstrated in October 2009 and Lawrence and his helpers are working on to produce more advanced models which have kilowatts of excess electrical power.

Mr Tseung remarks: "The Lee-Tseung Lead-Out Energy Theory was first disclosed to the world on 20th December 2004 at Tai Po, in Hong Kong. The Lead-Out Energy Theory basically says that one can lead-out (or bring-in) Energy from the surrounding environment into a Lead-Out Energy Machine. The total Input energy is equal to the sum of the Supplied Energy plus the Lead-Out Energy. For example, if the supplied energy is 100 units and the lead-out energy is 50 units, the device's total Input Energy will

be 150 units. This means that the Output Energy can be more than the Supplied Energy of 100 units provided by the person using the device.

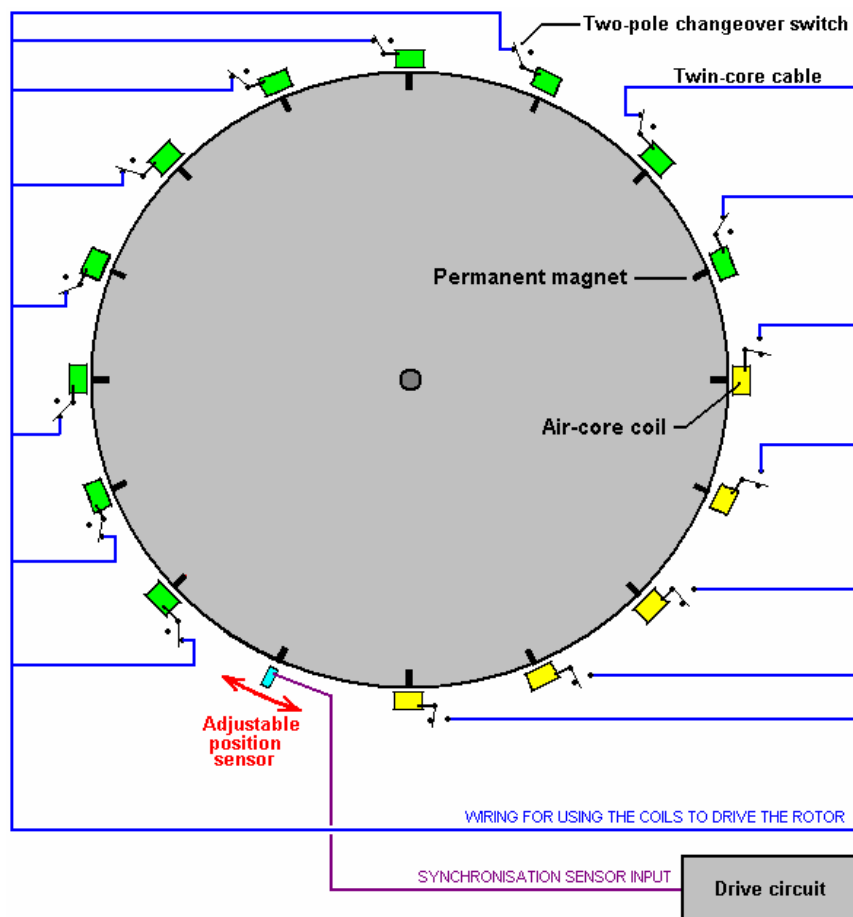
If we ignore the small loss of energy caused by less than 100% efficiency of the device itself, then the Output Energy will be the whole of the 150 units. If we use 50 of the output energy units and feed back 100 of the output units as the Supplied Energy, then that Supplied Energy can again lead-out another 50 units of excess output Energy for us to use. Thus a Lead-Out Energy Machine can continuously lead-out pollution-free, virtually inexhaustible and readily available energy for us to use. We do not need to burn any fossil fuel or pollute our environment. The two examples of Lead-Out energy which we access are Gravitational and Electron-Motion energy.

The Lead-Out Energy theory does not violate the Law of Conservation of Energy. The Law of Conservation of Energy has been used as a roadblock for the so called "Overunity" devices. The patent offices and the scientific establishment routinely dismiss an invention as belonging to the impossible "perpetual-motion machine" category if the inventor cannot identify the energy source of his invention.

We got the help of Mr. Tong Po Chi to produce a 60 cm diameter Lead-Out Energy machine in October 2009. The Output Energy of that device is greater than the Input Energy by a factor of 3 times. These results are confirmed by voltmeters and ammeters measuring the Input and Output energies.

The Tong wheel has been shown at two Open Shows in Hong Kong (Inno Carnival 2009 and Inno Design Tech Expo) in November and December 2009. Over 25,000 people have seen it. The Better Hong Kong Radio Show has video recorded it, the discussions being conducted in Chinese. At this time, the Tong wheel is at the Radio Studio available for experts to view and examine with their own instruments."

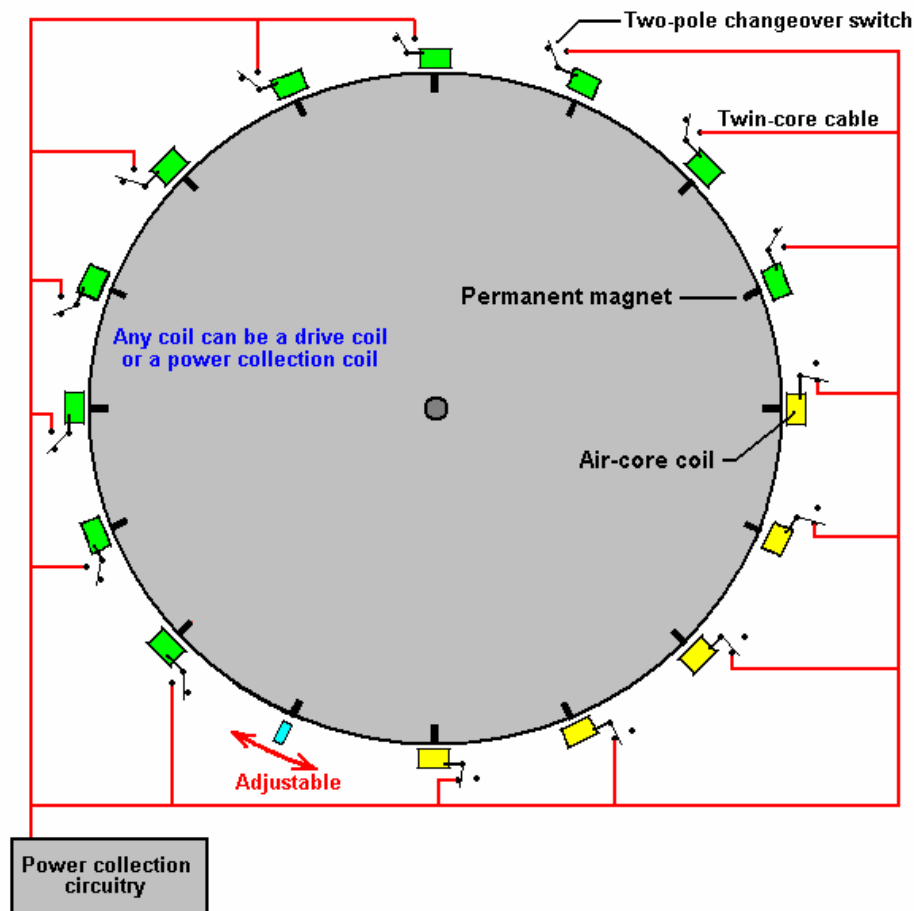
The Tong wheel has a diameter of 600 mm and this large size is considered to be important. It has 16 permanent magnets mounted on its rim and 15 air-core coils mounted around it on the stator. There is one position sensor. The coils can be switched to act as drive coils or as energy collection coils:



With this arrangement, if the positions the switches as shown for ten of the fifteen coils shown here, then they act as drive coils. The sensor is adjusted so that the drive circuit delivers a brief energising pulse to those coils just after the magnets have passed their exact alignment position with the coils. This causes them to generate a magnetic field which repels the magnets, thrusting the rotor around.

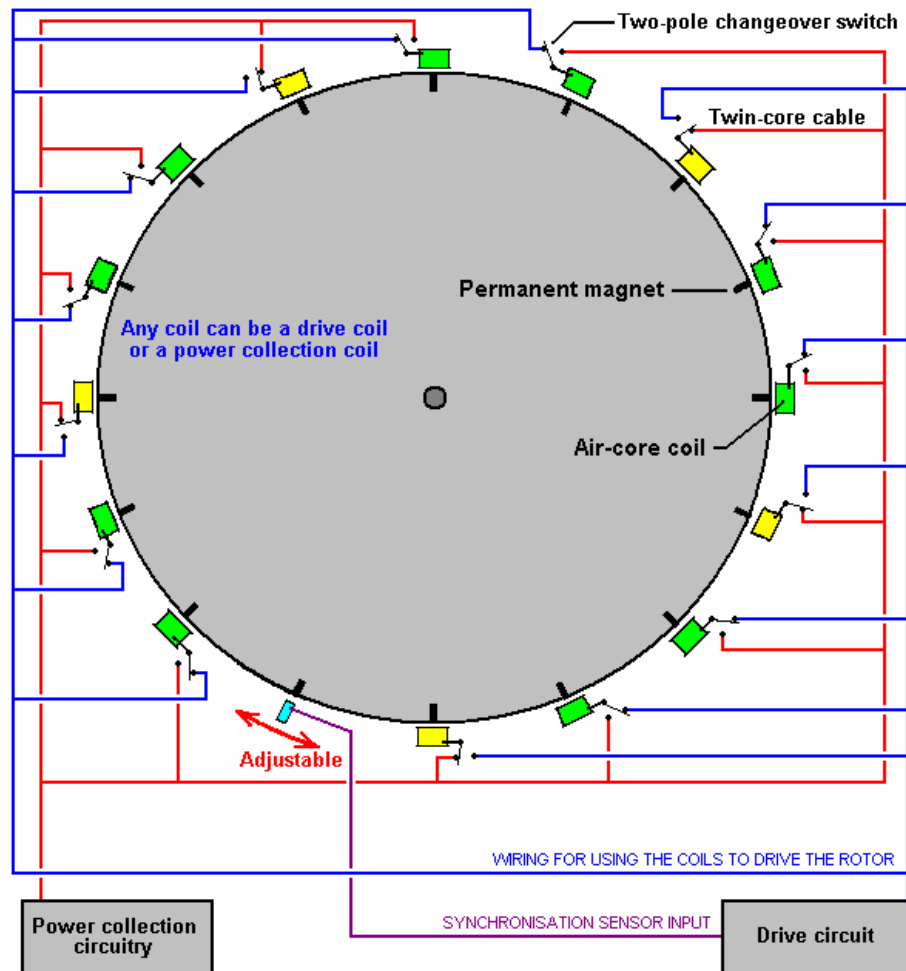
The pulse is very brief, so very little power is needed to accomplish this pulsing. As mentioned before, any number of coils can be switched to provide this driving force. With this particular wheel construction by Mr Tong, the best number has been found to be ten drive coils.

The power pick-up is achieved by gathering the electricity generated in some of the coils as the magnets move past them:



In this particular arrangement, five of the coils gather energy while ten provide the drive. For the sake of simplicity, the diagram shows the five collection coils adjacent to each other and while that would work, the wheel is better balanced if the drive coils are evenly spaced out around the rim. For that reason, this switching would actually be selected to give five sets of two drive coils followed by one pick-up coil as that gives a perfectly balanced thrust on the wheel.

The two diagrams above are shown separately in order to make it clear how the drive switching and the power pick-up switching are arranged. The full design arrangement and the balanced switching are shown in the following diagram which indicates how the full design is implemented on this particular implementation of the wheel design. The sensor can be a coil feeding a semiconductor switching circuit, or it can be a magnetic semiconductor called a Hall-effect device which can also feed a semiconductor circuit. An alternative would be a reed switch which is a simple mechanical switch encased in an inert gas inside a tiny glass envelope. Suitable switching circuits are described and explained in chapter 12 of this eBook.

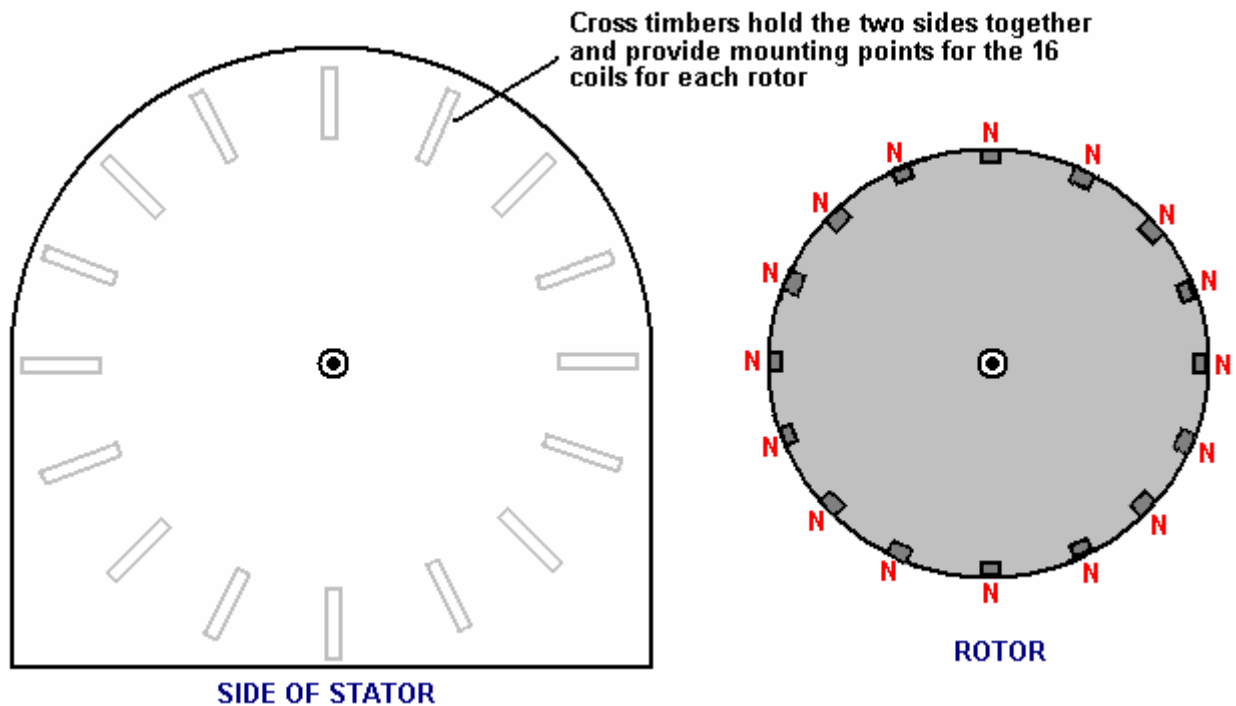


Mr Tseung remarks that the large wheel size is due to the fact that the Pulse Force takes time to impart the impulse to the wheel and lead-out energy from the environment into the system. If you want to see this actual wheel, you can email Dr. Alexandra Yuan at ayuan@hkstar.com to make an appointment. The Tong wheel is located at the Better Hong Kong Radio Studio in Causeway Bay, Hong Kong. Just say that you want to see the Lead-Out Energy Machine. The demonstration can be in English or in Chinese. Ideally, there should be a group of at least six visitors with one or more being a qualified engineer or scientist, and you are welcome to bring your own cameras and/or test equipment. It is planned to produce a version which has a 300 watt output, and another with a 5 kilowatt output. Educational kits are also planned.

If you decide to replicate this particular design, then to raise the output power level you might consider putting another set of coils around the wheel and either using them as fifteen additional energy pick-up coils or alternatively, pulsing the wheel twice as often. Adding one or more additional rotor discs to the same rotating shaft is also an option and that has the advantage of increasing the rotor weight and improving the effect of the impulses on the rotor.

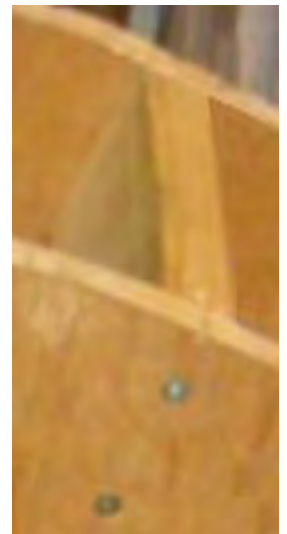
The diameter of the wire used to wind the coils is a design choice which has a wide scope. The thicker the wire, the greater the current and the larger the impulse given to the wheel. The coils are normally connected in parallel as shown in the diagrams.

Because of the way magnetic field strength drops off with the square of the distance, it is generally considered good design practice to make the coils one and a half times as wide as they are deep, as indicated in the diagrams above, but this is not a critical factor. This design is, of course, a version of the Adams motor described at the start of this chapter. Although motors of this kind can be built in many different ways, the construction used by Mr Tong has some distinct advantages, so here is a little more detail on how I understand the construction to be carried out.



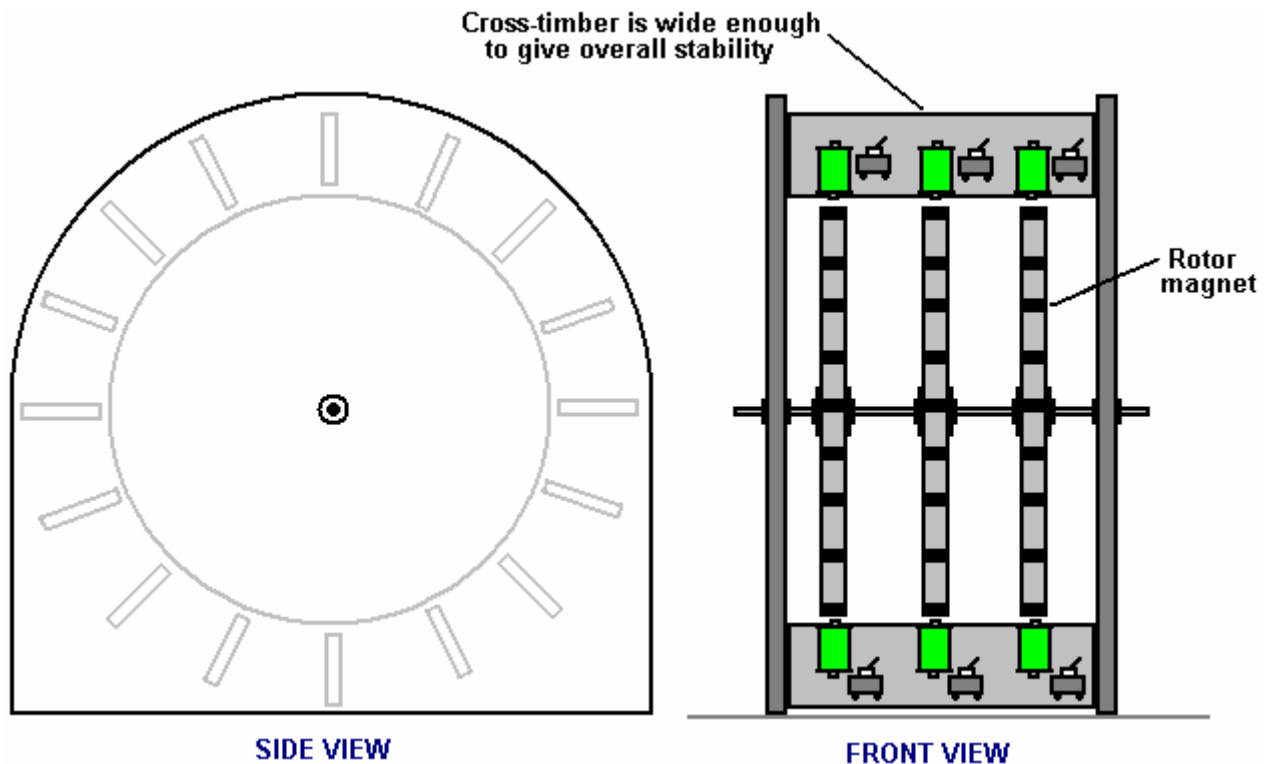
There are two side pieces which are attached together by sixteen cross timbers, each of which are held in place by two screws at each end. This produces a rigid structure while the construction method is as simple as is possible, using readily available materials which are worked with the most basic of hand tools. The construction also allows the motor to be taken apart completely without any difficulty, transported as a "flat-pack" package and then assembled at a new location. It also facilitates people who want to see the motor taken apart after a demonstration in order to assure themselves that there is no hidden power source.

Each of the cross timbers provide a secure mounting platform for an electromagnet and it's associated switch. In the implementation by Mr Tong, there appears to be just the one rotor, configured as shown above with sixteen permanent magnets mounted in it's rim. The magnetic poles of these magnets are all orientated in the same direction. That is to say, the magnetic poles facing outwards are all either South or all North poles. It is not critical whether the outward facing poles are North or South as Robert Adams used both arrangements with great success, but having said that, most people prefer to have the North poles facing outwards.



Robert has always said that one rotor was enough, but his techniques were so sophisticated that he was able to extract kilowatts of excess power from a single small rotor. For us, just starting to experiment and test a motor of this type, it seems sensible to stick with what Mr Tong has experienced success. However, this build by Mr Tong is not his final motor but just one in a series of continuously improved motors.

The following diagram shows an arrangement which has three rotors attached to a single shaft and while you may choose to construct this with just one rotor, if the cross timbers are long enough, then one or two extra rotors can be added in very easily at a later date.



Here, just two of the cross timbers are shown. The electromagnet coils used by Mr Tong are air-core as that type have the least effect on the passing magnets. However, electromagnets with cores tend to be much more power for any given current flowing through them. In theory, the core should be made of lengths of insulated iron wire as that would reduce power loss through eddy currents flowing in the core, but Robert actually recommends solid metal cores, and as he was the most experienced person in this field, paying attention to what he said seems sensible.

The core material needs to be a metal which magnetises easily and powerfully, but which does not retain any of its magnetism when the current stops flowing. Not many metals have those characteristics and soft iron is usually recommended. Nowadays, soft iron is not always readily available and so a convenient alternative is the central bolt of a masonry anchor which has excellent properties:

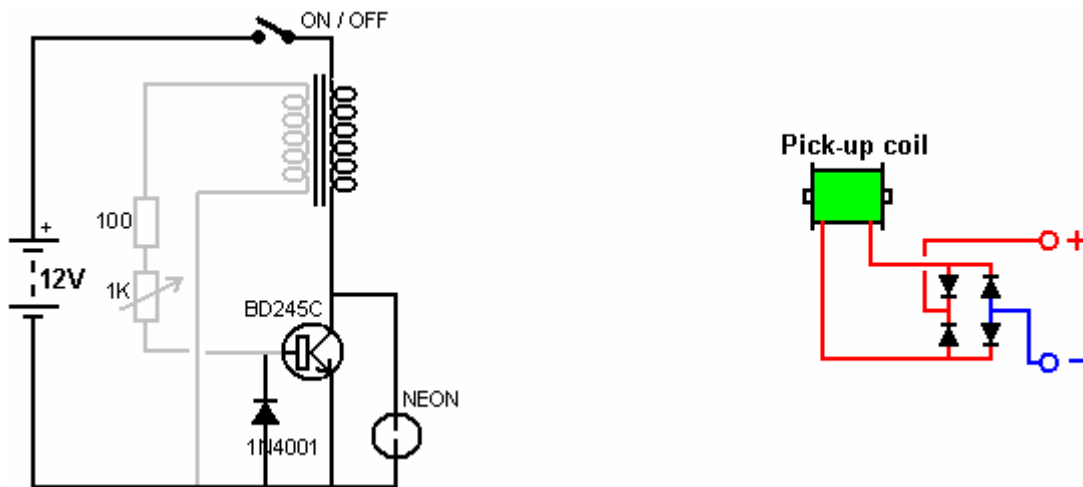


The shaft of the bolt can be cut quite easily with a hacksaw, but be sure to remove (or file down) the head of the bolt as the increase in diameter has a marked effect on the magnetic properties of the electromagnet core if it is left in place. The bolt shown above is a M16 x 147 mm masonry anchor bolt with a bolt diameter of 10 mm. Some makes of dry-ink felt white-board markers have a rigid body which fits the 10 mm bolt exactly and provide an excellent tube for constructing an electromagnet bobbin.

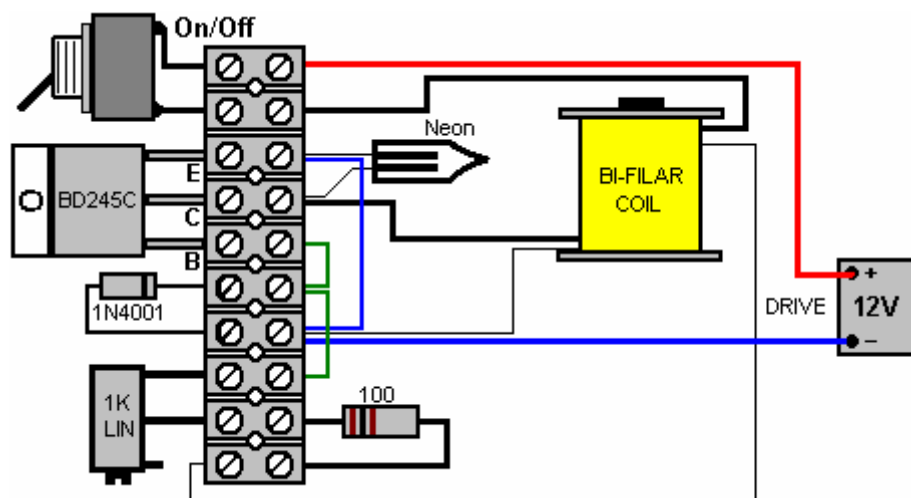
With a core in the electromagnets, the rotor gets additional rotating power. Initially, the magnets on the rotor are attracted to the electromagnet cores, giving the rotor a turning force which does not require any current to be supplied. When the rotor magnets are at their closest point to the electromagnet cores, the windings are powered up briefly and that gives the rotor magnets a strong push away, causing the rotor to spin.

There are many different designs of simple drive circuits and it is probably worth trying out different types to see which works best with your particular build of motor. In the same way, there are many kinds of collection circuits for taking off some of the excess power generated. The most simple of these is just a diode bridge, perhaps feeding a battery and charging it up for use at a later time. If you

get sophisticated with the collection circuit and just take power off for a very short period of time at the correct moment, the cutting off of the current draw, causes a back-EMF magnetic pulse in the collection electromagnet which causes it to give the rotor an extra drive push – both current collection and rotor drive in one combined package.



Here are two of the most simple circuits possible, one for drive and one for power collection. The drive circuit transistor is switched on by a voltage generated in the grey coil by a rotor magnet passing by. The transistor then feeds a large current pulse to the black coil, driving the rotor on its way. The neon and the diode are there to protect the transistor and a physical layout for this circuit might be:



The 1K variable resistor is adjusted to give the best performance and the On/Off switch is optional. More advanced circuits can also be tried and the performance compared. Generally speaking, I would expect a three-rotor version to give a better performance than a single rotor implementation, but experimentation would be needed to verify that.

Patrick J Kelly
www.free-energy-info.tuks.nl
www.free-energy-info.com
www.free-energy-info.co.uk
www.free-energy-devices.com

Simple Free-Energy Devices

There is nothing magic about free-energy and by "free-energy" I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 31: Donald Lee Smith's Designs



Donald Lee Smith died a few years ago. He is famous for his high-power self-powered free energy designs. There are several videos on the web, showing some of his lectures. He produced one pdf document which is shown at the end of this chapter, and in May 2004 he was granted one patent. Don stated clearly in one of his lectures, that he never did disclose the full details of his designs. However, Don says that he discloses enough for somebody who is experienced in radio-frequency electronics to be able to deduce the things which he does not disclose and so build a device for his own use. If that is the case, then anybody who has succeeded in doing so has kept very quiet about it afterwards (which would be understandable).

Don produced at least forty eight different devices which draw energy from what Don prefers to call "the ambient background". His devices are capable of supplying kilowatts of excess energy and in most cases they do not require any input energy to be supplied by the user.

Don's work is subtle and not easy to replicate. It is based on the principle that the power output of a circuit increases with the square of the frequency and the square of the voltage. So, if you double the frequency and double the voltage, then the output power goes up and becomes sixteen times greater. As a result of this, Don's best known design uses a Neon Sign Transformer circuit which raises the frequency to around 35,000 cycles per second and raises the voltage to anything from 2,000 volts to 12,000 volts, giving a power output is physically quite small and yet it has an output of 160 kilowatts (8000 volts at 20 amps) from an input of 12 volts 1 amp. That is, the output power is more than thirteen thousand times greater than the input power. Consequently, **his designs are dangerous and can kill you instantly**. In other words, his designs are for experienced developers only. **Please bear in mind that the voltages here and their associated power levels are literally lethal and perfectly capable of killing anyone who handles the device carelessly when it is powered up. When a replication of this device is ready for routine use, it must be encased so that none of the high-voltage connections can be touched by anyone. This is not a suggestion, but it is a mandatory requirement, despite the fact that the components shown in the photographs are laid out in what would be a most dangerous fashion were the circuit to be powered up as it stands. Under no circumstances, construct and test this circuit unless you are already experienced in the use of high-voltage circuits or can be supervised by somebody who is experienced in this field. This is a "one hand in the pocket at all times" type of circuit and it needs to be treated with great care and respect at all times, so be sensible.**

Don Smith considered himself to be self taught. Don says that his understanding comes from the work of Nikola Tesla as recorded in Thomas C. Martin's book "The Inventions, Researches, and Writings of

Nikola Tesla" ISBN 0-7873-0582-0. This book can be downloaded from <http://www.free-energy-info.com/TeslaBook.pdf> as a pdf file.

Don states that he repeated each of the experiments found in the book and that gave him his understanding of what he prefers to describe as the 'ambient background energy' which is also called the 'zero-point energy field'. Don remarks that he advanced further than Tesla in this field, partly because of the devices now available to him and which were not available when Tesla was alive.

Don stresses two key points. Firstly, a dipole can cause a disturbance in the magnetic component of the 'ambient background' and that imbalance allows you to collect large amounts of electrical power, using capacitors and inductors (coils). Secondly, you can pick up as many powerful electrical outputs as you want from that one magnetic disturbance, without depleting the magnetic disturbance in any way. This allows massively more power output than the small power needed to create the magnetic disturbance in the first place. This is what produces a "Coefficient Of Performance">1 device and Don has created nearly fifty different devices based on that understanding.

Although they get removed quite frequently, there is one video which is definitely worth watching if it is still there. It is located at http://www.metacafe.com/watch/2820531/don_smith_free_energy/ and was recorded in 2006. It covers a good deal of what Don has done. In the video, reference is made to Don's website but you will find that it has been taken over by Big Oil who have filled it with innocuous similar-sounding things of no consequence, apparently intended to confuse newcomers searching for information on Don's designs.

The present situation in 2019 is that few people understand Don's designs fully (and I myself, fall into that category), the high-voltage components are expensive and hard to find, and the high voltages are dangerous. However, we will look at three of his many designs and try to understand them as best we can. We will start with his patented design:

Patent NL 02000035 A

20th May 2004

Inventor: Donald Lee Smith

TRANSFORMER GENERATOR MAGNETIC RESONANCE INTO ELECTRIC ENERGY

ABSTRACT

The present invention refers to an Electromagnetic Dipole Device and Method, where wasted radiated energy is transformed into useful energy. A Dipole as seen in Antenna Systems is adapted for use with capacitor plates in such a way that the Heaviside Current Component becomes a useful source of electrical energy.

DESCRIPTION

Technical Field:

This invention relates to loaded Dipole Antenna Systems and their Electromagnetic radiation. When used as a transformer with an appropriate energy collector system, it becomes a transformer/generator. The invention collects and converts energy which is radiated and wasted by conventional devices.

Background Art:

A search of the International Patent Database for closely related methods did not reveal any prior art with an interest in conserving radiated and wasted magnetic waves as useful energy.

DISCLOSURE OF THE INVENTION

The invention is a new and useful departure from transformer generator construction, such that radiated and wasted magnetic energy changes into useful electrical energy. Gauss meters show that much energy from conventional electromagnetic devices is radiated into the ambient background and wasted. In the case of conventional transformer generators, a radical change in the physical construction allows

better access to the energy available. It is found that creating a dipole and inserting capacitor plates at right angles to the current flow, allows magnetic waves to change back into useful electrical (coulombs) energy. Magnetic waves passing through the capacitor plates do not degrade and the full impact of the available energy is accessed. One, or as many sets of capacitor plates as is desired, may be used. Each set makes an exact copy of the full force and effect of the energy present in the magnetic waves. The originating source is not depleted or degraded as is common in conventional transformers.

BRIEF DESCRIPTION OF THE DRAWINGS

The Dipole at right angles, allows the magnetic flux surrounding it to intercept the capacitor plate, or plates, at right angles. The electrons present are spun such that the electrical component of each electron is collected by the capacitor plates. Essential parts are the South and North component of an active Dipole. Examples presented here exist as fully functional prototypes and were engineer constructed and fully tested in use by the Inventor. In each of the three examples shown in the drawings, corresponding parts are used.

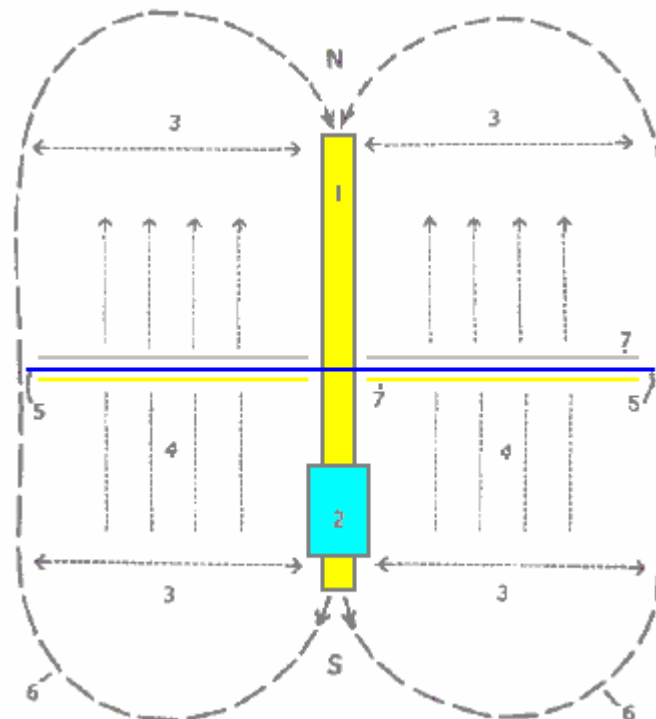


Fig.1 is a View of the Method, where **N** is the North and **S** is the South component of the Dipole.

Here, **1** marks the Dipole with its North and South components. **2** is a resonant high-voltage induction coil. **3** indicates the position of the electromagnetic wave emission from the Dipole. **4** indicates the position and flow direction of the corresponding Heaviside current component of the energy flow caused by the induction coil **2**. **5** is the dielectric separator for the capacitor plates **7**. **6** for the purposes of this drawing, indicates a virtual limit for the scope of the electromagnetic wave energy.

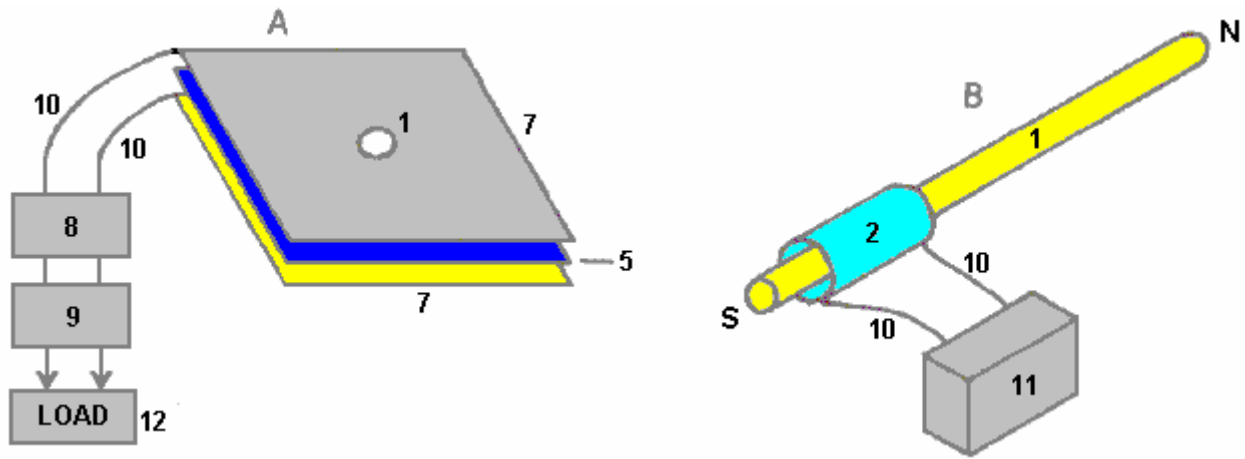


Fig.2 has two parts; **A** and **B**.

In **Fig.2A** **1** is the hole in the capacitor plates through which the Dipole is inserted and in **Fig.2B** it is the Dipole with its North and South poles shown. **2** is the resonant high-voltage induction coil surrounding part of the Dipole **1**. The dielectric separator **5**, is a thin sheet of plastic placed between the two capacitor plates **7**, the upper plate being made of aluminium and the lower plate made of copper. Unit **8** is a deep-cycle battery system powering a DC inverter **9** which produces 120 volts at 60 Hz (the US mains supply voltage and frequency, obviously, a 240 volt 50 Hz inverter could be used here just as easily) which is used to power whatever equipment is to be driven by the device. The reference number **10** just indicates connecting wires. Unit **11** is a high-voltage generating device such as a neon transformer with its oscillating power supply.

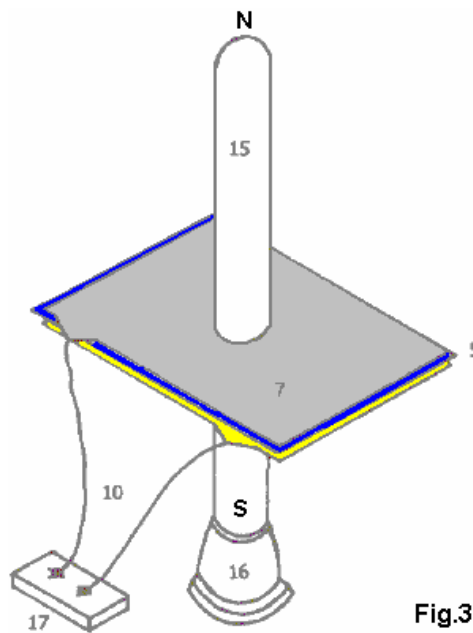


Fig.3

Fig.3 is a Proof Of Principal Device using a Plasma Tube as an active Dipole. In this drawing, **5** is the plastic sheet dielectric separator of the two plates **7** of the capacitor, the upper plate being aluminium and the lower plate copper. The connecting wires are marked **10** and the plasma tube is designated **15**. The plasma tube is four feet long (1.22 m) and six inches (100 mm) in diameter. The high-voltage energy source for the active plasma dipole is marked **16** and there is a connector box **17** shown as that is a convenient method of connecting to the capacitor plates when running tests on the device.

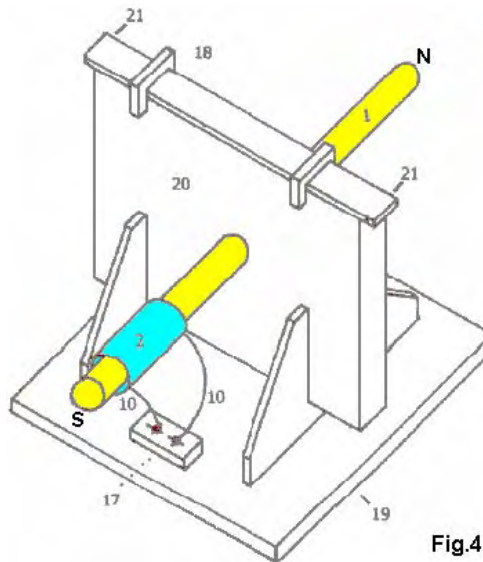


Fig.4

Fig.4 shows a Manufacturer's Prototype, constructed and fully tested. **1** is a metal Dipole rod and **2** the resonant high-voltage induction coil, connected through wires **10** to connector block **17** which facilitates the connection of it's high-voltage power supply. Clamps **18** hold the upper edge of the capacitor packet in place and **19** is the base plate with it's supporting brackets which hold the whole device in place. **20** is a housing which contains the capacitor plates and **21** is the point at which the power output from the capacitor plates is drawn off and fed to the DC inverter.

BEST METHOD OF CARRYING OUT THE INVENTION

The invention is applicable to any and all electrical energy requirements. The small size and it's high efficiency make it an attractive option, especially for remote areas, homes, office buildings, factories, shopping centres, public places, transportation, water systems, electric trains, boats, ships and 'all things great and small'. The construction materials are commonly available and only moderate skill levels are needed to make the device.

CLAIMS

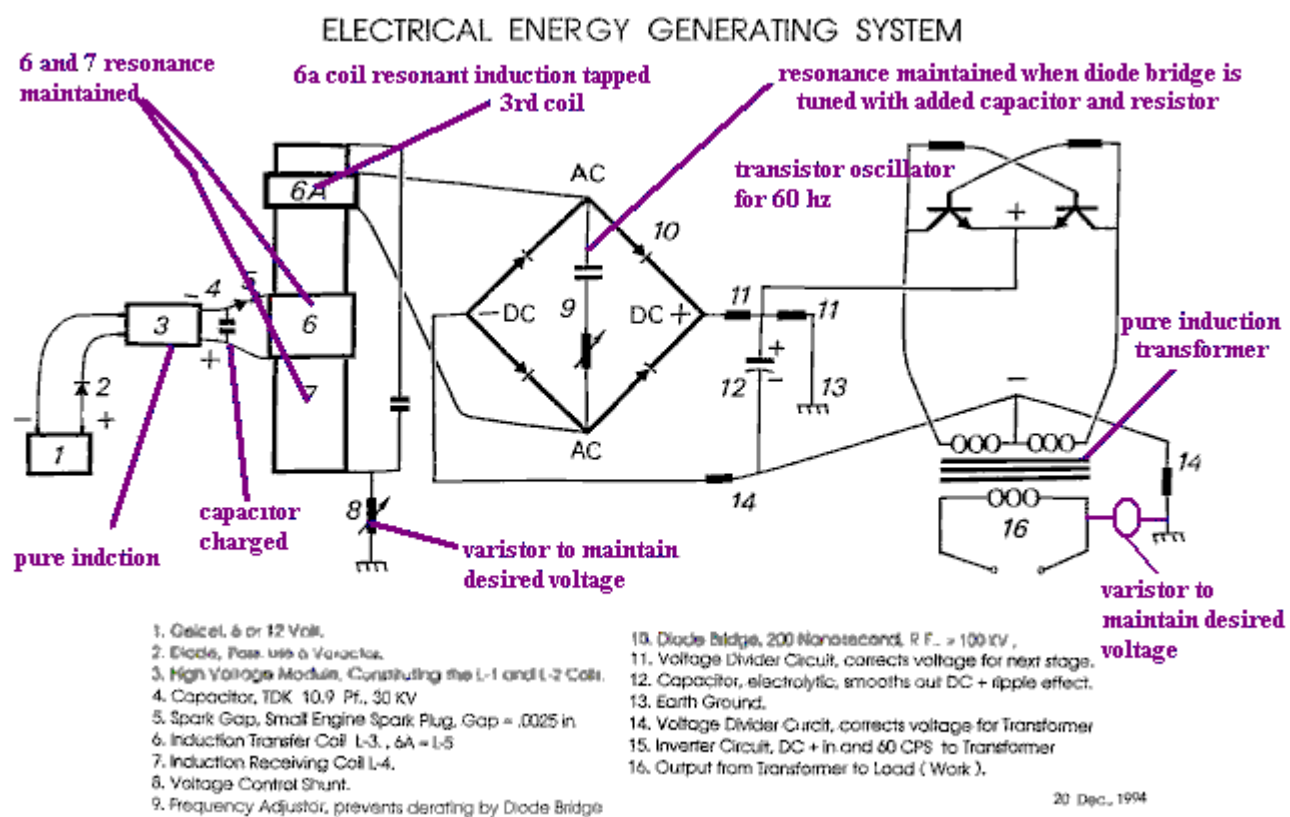
1. Radiated magnetic flux from the Dipole, when intercepted by capacitor plates at right angles, changes into useful electrical energy.
2. A Device and Method for converting for use, normally wasted electromagnetic energy.
3. The Dipole of the Invention is any resonating substance such as Metal Rods, Coils and Plasma Tubes which have interacting Positive and Negative components.
4. The resulting Heaviside current component is changed to useful electrical energy.

This patent does not make it clear that the device needs to be tuned and that the tuning is related to its physical location on Earth. The tuning will be accomplished by applying a variable-frequency input signal to the neon transformer and adjusting that input frequency to give the maximum output.

The second of Don's devices to consider is his table-top very high power generator. This is effectively a Tesla Coil system and so the normal electromagnetic effect of the ratio of the number of coil turns does NOT determine the effect between the coils. The demonstration device looks like this:



This device is not the easiest thing in the world to understand. Here is the circuit diagram:



it is probably worth mentioning some of the main points which Don Smith appears to be making. There are some very important points being made here, and grasping these may make a considerable difference to our ability to tap into the excess energy available in our local environment. There are four points worth mentioning:

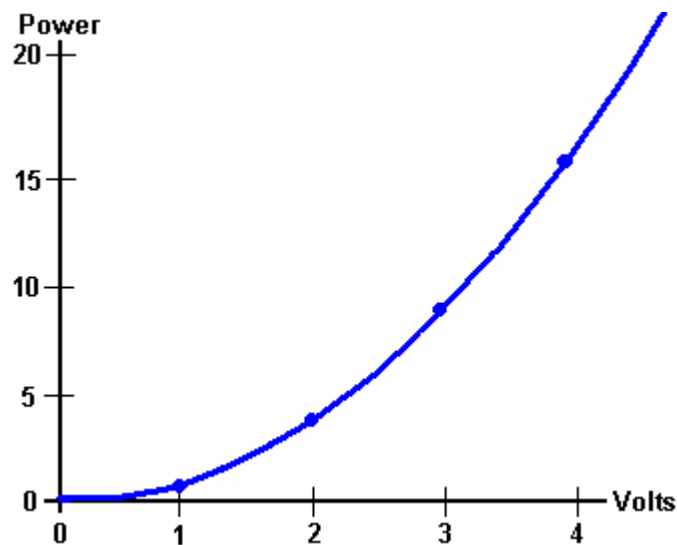
1. Voltage
2. Frequency
3. Magnetic / Electric relationship
4. Resonance

1. Voltage. We tend to view things with an 'intuitive' view, generally based on fairly simple concepts. For example, we automatically think that it is more difficult to pick up a heavy object than to pick up a light one. How much more difficult? Well, if it is twice as heavy, it would probably be about twice as

much effort to pick it up. This view has developed from our experience of things which we have done in the past, rather than on any mathematical calculation or formula.

Well, how about pulsing an electronic system with a voltage? How would the output power of a system be affected by increasing the voltage? Our initial 'off-the cuff' reaction might be that the power output might be increased a bit, but then hold on... we've just remembered that Watts = Volts x Amps, so if you double the voltage, then you would double the power in watts. So we might settle for the notion that if we doubled the voltage then we could double the output power. If we thought that, then we would be wrong.

Don Smith points out that as capacitors and coils store energy, if they are involved in the circuit, then the output power is proportional to the **square** of the voltage used. Double the voltage, and the output power is four times greater. Use three times the voltage and the output power is nine times greater. Use ten times the voltage and the output power is one hundred times greater !



Don says that the energy stored, multiplied by the cycles per second, is the energy being pumped by the system. Capacitors and inductors (coils) temporarily store electrons, and their performance is given by:

Capacitor formula: **$W = 0.5 \times C \times V^2 \times \text{Hz}$** where:

W is the energy in Joules (Joules = Volts x Amps x seconds)

C is the capacitance in Farads

V is the voltage

Hz is the cycles per second

Inductor formula: **$W = 0.5 \times L \times A^2 \times \text{Hz}$** where:

W is the energy in Joules

L is the inductance in henrys

A is the current in amps

Hz is the frequency in cycles per second

You will notice that where inductors (coils) are involved, then the output power goes up with the square of the current. Double the voltage **and** double the current gives four times the power output due to the increased voltage and that increased output is increased by a further four times due to the increased current, giving sixteen times the output power.

2. Frequency. You will notice from the formulas above, that the output power is directly proportional to the frequency "Hz". The frequency is the number of cycles per second (or pulses per second) applied to the circuit. This is something which is not intuitive for most people. If you double the rate of pulsing,

then you double the power output. When this sinks in, you suddenly see why Nikola Tesla tended to use millions of volts and millions of pulses per second.

However, Don Smith states that when a circuit is at its point of resonance, resistance in the circuit drops to zero and the circuit becomes effectively, a superconductor. The energy for such a system which is in resonance is:

Resonant circuit: $W = 0.5 \times C \times V^2 \times (\text{Hz})^2$ where:

W is the energy in Joules

C is the capacitance in Farads

V is the voltage

Hz is the cycles per second

If this is correct, then raising the frequency in a resonating circuit has a massive effect on the power output of the device. The question then arises: why is the mains power in Europe just fifty cycles per second and in America just sixty cycles per second? If power goes up with frequency, then why not feed households at a million cycles per second? One major reason is that it is not easy to make electric motors which can be driven with power delivered at that frequency, so a more suitable frequency is chosen in order to suit the motors in vacuum cleaners, washing machines and other household equipment.

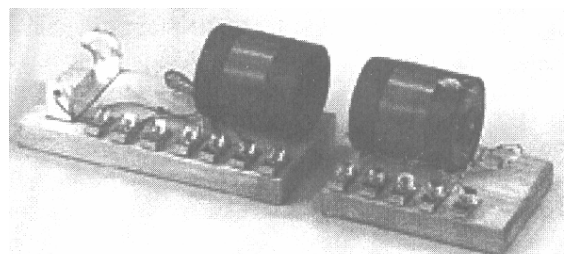
However, if we want to extract energy from the environment, then we should go for high voltage and high frequency. Then, when high power has been extracted, if we want a low frequency suited to electric motors, we can pulse the already captured power at that low frequency.

It might be speculated that if a device is being driven with sharp pulses which have a very sharply rising leading edge, that the effective frequency of the pulsing is actually determined by the speed of that rising edge, rather than the rate at which the pulses are actually generated. For example, if pulses are being generated at, say, 50 kHz but the pulses have a leading edge which would be suited to a 200 kHz pulse train, then the device might well see the signal as a 200 kHz signal with a 25% Mark/Space ratio, the very suddenness of the applied voltage having a magnetic shocking effect equivalent to a 200 kHz pulse train.

3. Magnetic / Electric relationship. Don states that the reason why our present power systems are so inefficient is because we concentrate on the electric component of electromagnetism. These systems are always $\text{COP} < 1$ as electricity is the 'losses' of electromagnetic power. Instead, if you concentrate on the magnetic component, then there is no limit on the electric power which can be extracted from that magnetic component. Contrary to what you might expect, if you install a pick-up system which extracts electrical energy from the magnetic component, you can install any number of other identical pick-ups, each of which extract the same amount of electrical energy from the magnetic input, **without** loading the magnetic wave in any way. Unlimited electrical output for the 'cost' of creating a single magnetic effect.

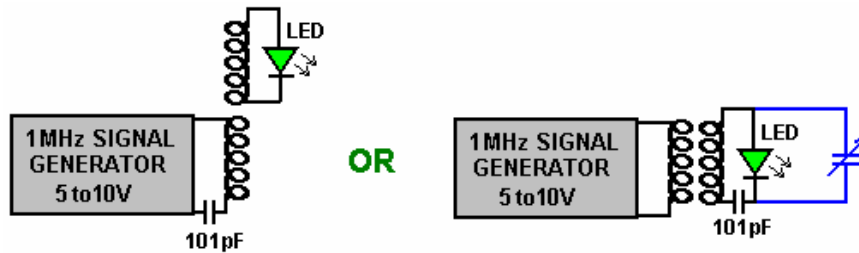
The magnetic effect which we want to create is a ripple in the zero-point energy field, and ideally, we want to create that effect while using very little power. Creating a dipole with a battery which has a Plus and a Minus terminal or a magnet which has North and South poles, is an easy way to do create an electromagnetic imbalance in the local environment. Pulsing a coil is probably an even better way as the magnetic field reverses rapidly if it is an air-core coil, such as a Tesla Coil. Using a ferromagnetic core to the coil can create a problem as iron can't reverse its magnetic alignment very rapidly, and ideally, you want pulsing which is at least a thousand times faster than iron can handle.

Don draws attention to the "Transmitter / Receiver" educational kit "Resonant Circuits #10-416" which was supplied by The Science Source, Maine. This kit demonstrated the generation of resonant energy and its collection with a receiver circuit. However, if several receiver circuits are used, then the energy collected is increased several times without any increase in the



transmitted energy. This is similar to a radio transmitter where hundreds of thousands of radio receivers can receive the transmitted signal without loading the transmitter in any way. In Don's day, this kit was driven by a 1.5 volt battery and lit a 60-watt bulb which was supplied. Not surprisingly, that kit has been discontinued and a trivial kit substituted.

If you get the Science Source educational kit, then there are some details which you need to watch out for. The unit has two very nice quality plastic bases and two very neatly wound coils each of 60 turns of 0.47 mm diameter enamelled copper wire on clear acrylic tubes 57 mm (2.25") in diameter. The winding covers a 28 mm section of the tube. The layout of the transmitter and receiver modules does not match the accompanying instruction sheet and so considerable care needs to be taken when wiring up any of their circuits. The circuit diagrams are not shown, just a wiring diagram, which is not great from an educational point of view. The one relevant circuit is:

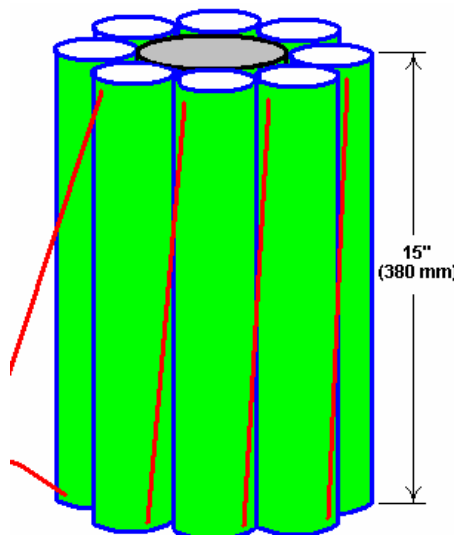


Before you buy the kit, it is not mentioned that in order to use it, you now need a signal generator capable of producing a 10-volt signal at 1 MHz. The coil has a DC resistance of just 1.9 ohms but at a 1 MHz resonant frequency, the necessary drive power is quite low.

A variable capacitor is mounted on the receiver coil tube, but the one in my kit made absolutely no difference to the frequency tuning, nor was my capacitance meter able to determine any capacitance value for it at all, even though it had no trouble at all in measuring the 101 pF capacitor which was exactly the capacitance printed on it. For that reason, it is shown in blue in the circuit diagram above. Disconnecting it made no difference whatsoever.

In this particular kit, standard screw connectors have had one screw replaced with an Allen key headed bolt which has a head large enough to allow finger tightening. Unfortunately, those bolts have a square cut tip where a domed tip is essential if small diameter wires are to be clamped securely. If you get the kit, then I suggest that you replace the connectors with a standard electrical screw connector strip.

In tests, the LED lights up when the coils are aligned and within about 100 mm of each other, or if they are close together side by side. This immediately makes the Hubbard device spring to mind. Hubbard has a central "electromagnetic transmitter" surrounded by a ring of "receivers" closely coupled magnetically to the transmitter, each of which will receive a copy of the energy sent by the transmitter:



Don points to an even more clearly demonstrated occurrence of this effect in the Tesla Coil. In a typical Tesla Coil, the primary coil is much larger diameter than the inner secondary coil:



If, for example, 8,000 volts is applied to the primary coil which has four turns, then each turn would have 2,000 volts of potential. Each turn of the primary coil transfers electromagnetic flux to every single turn of the secondary winding, and the secondary coil has a very large number of turns. Massively more power is produced in the secondary coil than was used to energise the primary coil. A common mistake is to believe that a Tesla Coil can't produce serious amperage. If the primary coil is positioned in the middle of the secondary coil as shown, then the amperage generated will be as large as the voltage generated. A low power input to the primary coil can produce kilowatts of usable electrical power.

4. Resonance. An important factor in circuits aimed at tapping external energy is resonance. It can be hard to see where this comes in when it is an electronic circuit which is being considered. However, everything has its own resonant frequency, whether it is a coil or any other electronic component. When components are connected together to form a circuit, the circuit has an overall resonant frequency. As a simple example, consider a swing:



If the swing is pushed before it reaches the highest point on the mother's side, then the push actually opposes the swinging action. The time of one full swing is the resonant frequency of the swing, and that is determined by the length of the supporting ropes holding the seat and not the weight of the child nor the power with which the child is pushed. Provided that the timing is exactly right, a very small push can get a swing moving in a substantial arc. The key factor is, matching the pulses applied to the swing, that is, to the resonant frequency of the swing. Get it right and a large movement is produced. Get it wrong, and the swing doesn't get going at all (at which point, critics would say "see, see ...swings just don't work - this proves it !!"). This principle is demonstrated in the video at <http://www.youtube.com/watch?v=irwK1VfoiOA>.

Establishing the exact pulsing rate needed for a resonant circuit is not particularly easy, because the circuit contains coils (which have inductance, capacitance and resistance), capacitors (which have capacitance and a small amount of resistance) and resistors and wires, both of which have resistance and some capacitance. These kinds of circuit are called "LRC" circuits because "L" is the symbol used for inductance, "R" is the symbol used for resistance and "C" is the symbol used for capacitance.

Don Smith provides instructions for winding and using the type of air-core coils needed for a Tesla Coil. He says:

1. Decide a frequency and bear in mind, the economy of the size of construction selected. The factors are:

- (a) Use radio frequency (above 20 kHz).
- (b) Use natural frequency, i.e. match the coil wire length to the frequency - coils have both capacitance and inductance.

(c) Make the wire length either one quarter, one half of the full wavelength.

(d) Calculate the wire length in feet as follows:

If using one quarter wavelength, then divide 247 by the frequency in MHz.

If using one half wavelength, then divide 494 by the frequency in MHz.

If using the full wavelength, then divide 998 by the frequency in MHz.

For wire lengths in metres:

If using one quarter wavelength, then divide 75.29 by the frequency in MHz.

If using one half wavelength, then divide 150.57 by the frequency in MHz.

If using the full wavelength, then divide 304.19 by the frequency in MHz.

2. Choose the number of turns to be used in the coil when winding it using the wire length just calculated. The number of turns will be governed by the diameter of the tube on which the coil is to be wound. Remember that the ratio of the number of turns in the "L - 1" and "L - 2" coils, controls the overall output voltage. For example, if the voltage applied the large outer coil "L - 1" is 2,400 volts and L - 1 has ten turns, then each turn of L - 1 will have 240 volts dropped across it. This 240 volts of magnetic induction transfers 240 volts of electricity to every turn of wire in the inner "L - 2" coil. If the diameter of L - 2 is small enough to have 100 turns, then the voltage produced will be 24,000 volts. If the diameter of the L - 2 former allows 500 turns, then the output voltage will be 120,000 volts.
3. Choose the length and diameter of the coils. The larger the diameter of the coil, the fewer turns can be made with the wire length and so the coil length will be less, and the output voltage will be lower.
4. For example, if 24.7 MHz is the desired output frequency, then the length of wire, in feet, would be 247 divided by 24.7 which is 10 feet of wire (3,048 mm). The coil may be wound on a standard size of PVC pipe or alternatively, it can be purchased from a supplier - typically, an amateur radio supply store.

If the voltage on each turn of L - 1 is arranged to be 24 volts and the desired output voltage 640 volts, then there needs to be $640 / 24 = 26.66$ turns on L - 2, wound with the 10 feet of wire already calculated.

PJK: At this point, Don's calculations go adrift and he suggests winding 30 turns on a 2-inch former. If you do that, then it will take about 16 feet of wire and the resonant point at 10-feet will be at about 19 turns, giving an output voltage of 458 volts instead of the required 640 volts, unless the number of turns on L1 is reduced to give more than 24 volts per turn. However, the actual required diameter of the coil former (plus one diameter of the wire) is $10 \times 12 / (26.67 \times 3.14159) = 1.43$ inches. You can make this size of former up quite easily if you want to stay with ten turns on the L1 coil.

5. Connect to the start of the coil. To determine the exact resonant point on the coil, a measurement is made. Off-the-shelf multimeters are not responsive to high-frequency signals so a cheap neon is used instead. Holding one wire of the neon in one hand and running the other neon wire along the outside of the L - 2 winding, the point of brightest light is located. Then the neon is moved along that turn to find the brightest point along that turn, and when it is located, a connection is made to the winding at that exact point. L - 2 is now a resonant winding. It is possible to increase the ("Q") effectiveness of the coil by spreading the turns out a bit instead of positioning them so that each turn touches both of the adjacent turns.
6. The input power has been suggested as 2,400 volts. This can be constructed from a Jacob's ladder arrangement or any step-up voltage system. An off-the-shelf module as used with lasers is another option.
7. Construction of the L - 1 input coil has been suggested as having 10 turns. The length of the wire in this coil is not critical. If a 2-inch diameter PVC pipe was used for the L - 2 coil, then the next larger size of PVC pipe can be used for the L - 1 coil former. Cut a 10-turn length of the pipe (probably a 3-inch diameter pipe). The pipe length will depend on the diameter of the insulated wire used to make the winding. Use a good quality multimeter or a specialised LCR meter to measure the capacitance (in Farads) and the inductance (in henrys) of the L - 2 coil. Now, put a capacitor for

matching L - 1 to L - 2 across the voltage input of L - 1, and a spark gap connected **in parallel** is required for the return voltage from L - 1. A trimmer capacitor for L - 1 is desirable.

8. The performance of L - 2 can be further enhanced by attaching an earth connection to the base of the coil. The maximum output voltage will be between the ends of coil L - 2 and lesser voltages can be taken off intermediate points along the coil if that is desirable.

This frequency information can be rather hard to understand in the way that Don states it. It may be easier to follow the description given by one developer who says:

I have noticed that any machine can be made a super machine just by adding a bipolar capacitor across the coil. Nothing else is needed. With the correct capacitor the coil becomes Naturally Resonant and uses very little Amperage. Each machine uses a different size capacitor. The correct capacitor size can be calculated by dividing the speed of light by the coil's wire length first to get the coil's Natural Frequency and then dividing the voltage to be used by that frequency. The result is the correct size for the capacitor. Your machine will then be very powerful even working from a 12V car battery, no other additions needed.

My coil's wire length is 497.333 meters.

$299000000 \text{ m/sec} / 497.333 \text{ m} = 600000 \text{ Hz}$.

$12\text{V} / 600000 = 0.00002$ or 20 microfarads. A beautiful Naturally Resonant Tank circuit. You can use this with any coil for overunity!

Once we have a Naturally Resonant Coil/Capacitor combination we can bring the frequency down to 50 Hz by calculating for the Power Factor Correction:

$\text{Hz} = \text{Resistance} \times \text{Farads}$ then

$50 \text{ Hz} = R \times 0.00002$

so $50 / 0.00002 = 2500000$

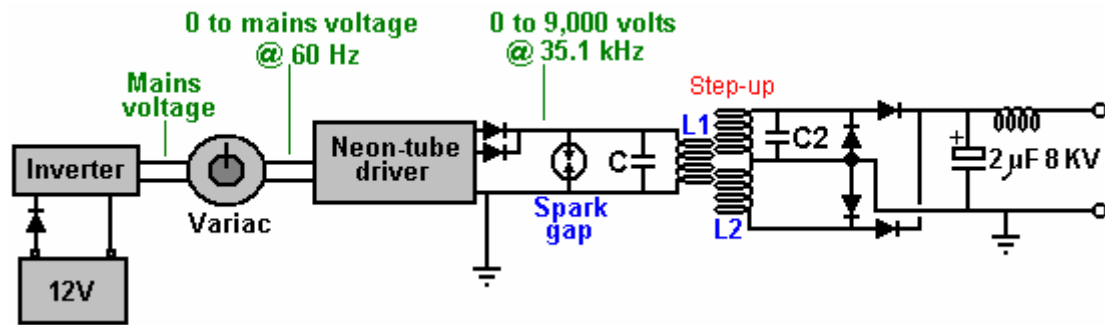
and $R = 2500000$ or 2.5 Meg Ohms.

We then place all three components in parallel and our coil should give us a 50 Hz output.

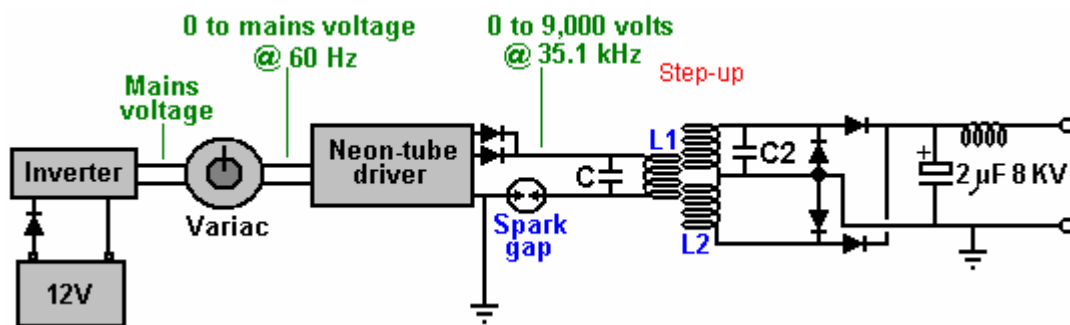
Don provides quite an amount of information on one of his devices shown here:



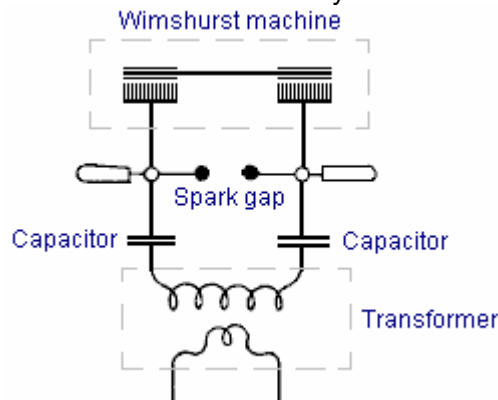
Without his description of the device, it would be difficult to understand it's construction and method of operation. As I understand it, the circuit of what is mounted on this board is as shown here:



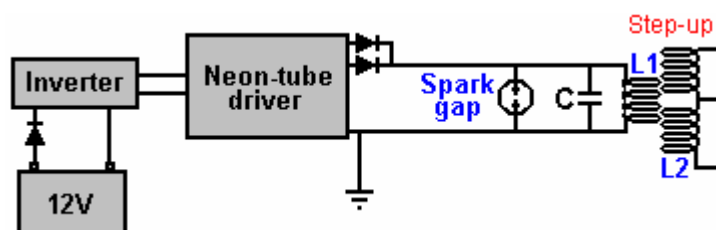
This arrangement has bothered some readers recently as they feel that the spark gap should be in series with the L1 coil, like this:



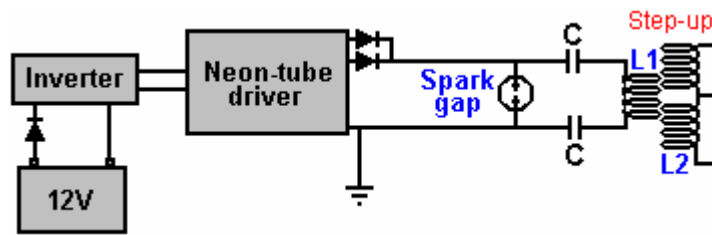
This is understandable, as there is always a tendency to think of the spark gap as being a device which is there to protect against excessive voltages rather than seeing it as an active component of the circuit, a component which is in continuous use. In 1925, Hermann Plauson was granted a patent for a whole series of methods for converting the high voltage produced by a tall aerial system into useable, standard electricity. Hermann starts off by explaining how high voltage can be converted into a convenient form and he uses a Wimshurst static electricity generator as an example of a constant source of high voltage. The output from a rectified Tesla Coil, a Wimshurst machine and a tall aerial are very much alike, and so Hermann's comments are very relevant here. He shows it like this:



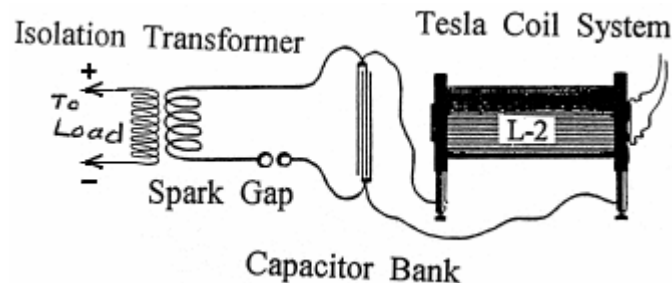
Here, the output of the Wimshurst machine is stored in two high-voltage capacitors (Leyden jars) causing a very high voltage to be created across those capacitors. When the voltage is high enough, a spark jumps across the spark gap, causing a massive surge of current through the primary winding of the transformer, which in his case is a step-down transformer as he is aimed at getting a lower output voltage. Don's circuit is almost identical:



Here the high voltage comes from the battery/inverter/neon-tube driver/rectifiers, rather than from a mechanically driven Wimshurst machine. He has the same build up of voltage in a capacitor with a spark gap across the capacitor. The spark gap will fire when the capacitor voltage reaches its designed level. The only difference is in the positioning of the capacitor, which if it matched Hermann's arrangement exactly, would be like this:



which would be a perfectly viable arrangement as far as I can see. You will remember that Tesla, who always speaks very highly of the energy released by the very sharp discharge produced by a spark, shows a high-voltage source feeding a capacitor with the energy passing through a spark gap to the primary winding of a transformer:



However, with Don's arrangement, it can be a little difficult to see why the capacitor is not short-circuited by the very low resistance of the few turns of thick wire forming the L1 coil. Well, it would do that if we were operating with DC, but we are most definitely not doing that as the output from the neon-tube driver circuit is pulsing 35,000 times per second. This causes the DC resistance of the L1 coil to be of almost no consequence and instead, the coil's "impedance" or "reactance" (effectively, it's AC resistance) is what counts. Actually, the capacitor and the L1 coil being connected across each other have a combined "reactance" or resistance to pulsing current at this frequency. This is where the nomograph diagram comes into play, and there is a much easier to understand version of it a few pages later on in this document. So, because of the high pulsing frequency, the L1 coil does not short-circuit the capacitor and if the pulsing frequency matches the resonant frequency of the L1 coil (or a harmonic of that frequency), then the L1 coil will actually have a very high resistance to current flow through it. This is how a crystal set radio receiver tunes in a particular radio station, broadcasting on it's own frequency.



Anyway, coming back to Don's device shown in the photograph above, the electrical drive is from a 12-volt battery which is not seen in the photograph. Interestingly, Don remarks that if the length of the wires connecting the battery to the inverter are exactly one quarter of the wave length of the frequency of the oscillating magnetic field generated by the circuit, then the current induced in the battery wires will recharge the battery continuously, even if the battery is supplying power to the circuit at the same time.

The battery supplies a small current through a protecting diode, to a standard off-the-shelf "true sine-wave" inverter. An inverter is a device which produces mains-voltage Alternating Current from a DC battery. As Don wants adjustable voltage, he feeds the output from the inverter into a variable transformer called a "Variac" although this is often made as part of the neon-driver circuit to allow the brightness of the neon tube to be adjusted by the user. This arrangement produces an AC output voltage which is adjustable from zero volts up to the full mains voltage (or a little higher, though Don does not want to use a higher voltage). The use of this kind of adjustment usually makes it essential for the inverter to be a true sine-wave type. As the power requirement of the neon-tube driver circuit is so low, the inverter should not cost very much.

The neon-tube driver circuit is a standard off-the-shelf device used to drive neon tube displays for commercial establishments. The one used by Don contains an oscillator and a step-up transformer, which together produce an Alternating Current of 9,000 volts at a frequency of 35,100 Hz (sometimes written as 35.1 kHz). The term "Hz" stands for "cycles per second". Don lowers the 9,000 volts as he gets great power output at lower input voltages and the cost of the output capacitors is a significant factor. The particular neon-tube driver circuit which Don is using here, has two separate outputs out of phase with each other, so Don connects them together and uses a blocking diode in each line to prevent either of them affecting the other one. Not easily seen in the photograph, the high-voltage output line has a very small, encapsulated, Gas-Discharge Tube spark gap in it and the line is also earthed. The device looks like this:



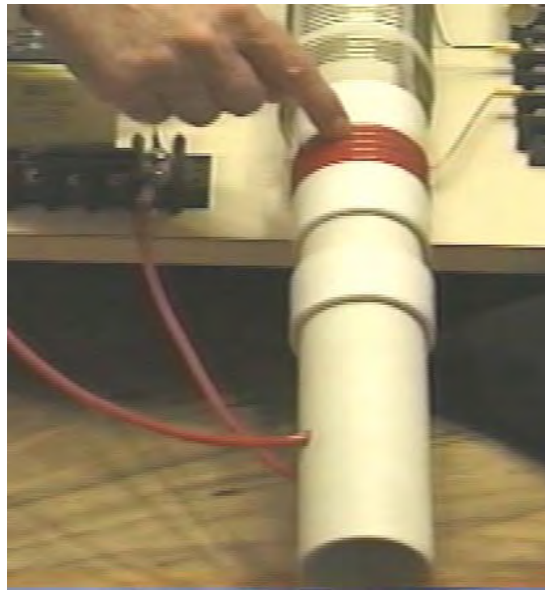
Please note that when an earth connection is mentioned in connection with Don Smith's devices, we are talking about an actual wire connection to a metal object physically buried in the ground, whether it is a long copper rod driven into the ground, or an old car radiator buried in a hole like Taniel Kapanadze uses. When Thomas Henry Moray performed his requested demonstration deep in the countryside at a location chosen by the sceptics, the light bulbs which formed his demonstration electrical load, glowed more brightly with each hammer stroke as a length of gas pipe was hammered into the ground to form his earth connection.

It should be remarked that since Don purchased his neon-tube driver module that newer designs have generally taken over completely, especially in Europe, and these designs have built in "earth-leakage current" protection which instantly disables the circuit if any current is detected leaking to ground. This feature makes the unit completely unsuitable for use in a Don Smith circuit because there, the transfer of current to the ground is wholly intentional and vital for the operation of the circuit.

The output of the neon-tube driver circuit is used to drive the primary "L1" winding of a Tesla Coil style transformer. This looks ever so simple and straightforward, but there are some subtle details which need to be considered.

The operating frequency of 35.1 kHz is set and maintained by the neon-tube driver circuitry, and so, in theory, we do not have to do any direct tuning ourselves. However, we want the resonant frequency of the L1 coil and the capacitor across it to match the neon-driver circuit frequency. The frequency of the "L1" coil winding will induce exactly the same frequency in the "L2" secondary winding. However, we need to pay special attention to the ratio of the wire lengths of the two coil windings as we want these two windings to resonate together. A rule of thumb followed by most Tesla Coil builders is to have the same weight of copper in the L1 and L2 coils, which means that the wire of the L1 coil is usually much thicker than the wire of the L2 coil. If the L1 coil is to be one quarter of the length of the L2 coil, then we

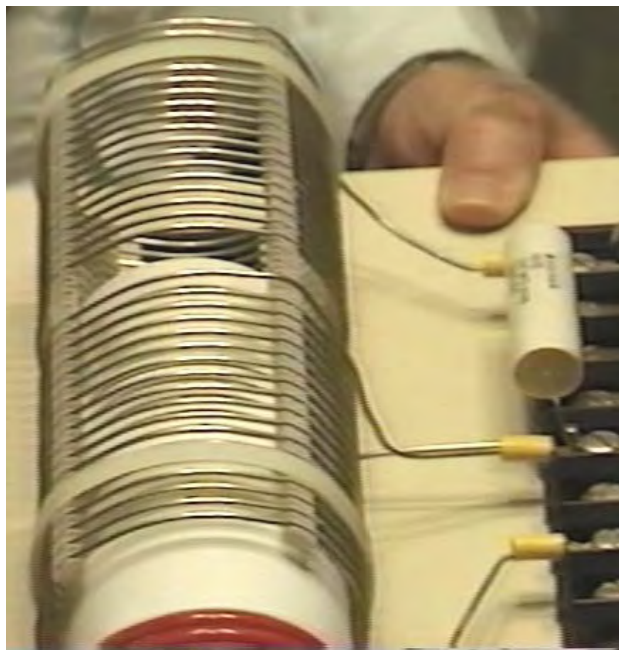
would expect the cross-sectional area of the L1 coil to be four times that of the wire of the L2 coil and so the wire should have twice the diameter (as the area is proportional to the square of the radius, and the square of two is four).



Don uses a white plastic tube as the former for his "L1" primary coil winding. As you can see here, the wire is fed into the former, leaving sufficient clearance to allow the former to slide all the way into the outer coil. The wire is fed up inside the pipe and out through another hole to allow the coil turns to be made on the outside of the pipe. There appear to be five turns, but Don does not always go for a complete number of turns, so it might be 4.3 turns or some other value. The key point here is that the length of wire in the "L1" coil turns should be exactly one quarter of the length of wire in the "L2" coil turns.

The "L2" coil used here is a commercial 3-inch diameter unit from Barker & Williamson, constructed from uninsulated, solid, single-strand "tinned" copper wire (how to make home-build versions is shown later on). Don has taken this coil and unwound four turns in the middle of the coil in order to make a centre-tap. He then measured the exact length of wire in the remaining section and made the length of the "L1" coil turns to be exactly one quarter of that length. The wire used for the "L1" coil looks like Don's favourite "Jumbo Speaker Wire" which is a very flexible wire with a very large number of extremely fine uninsulated copper wires inside it.

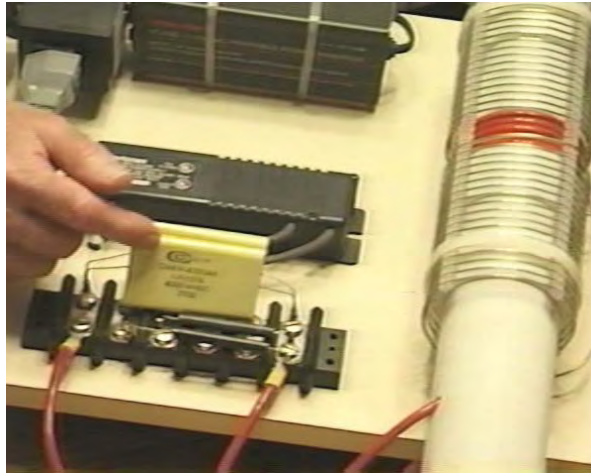
You will notice that Don has placed a plastic collar on each side of the winding, matching the thickness of the wire, in order to create a secure sliding operation inside the outer "L2" coil, and the additional plastic collars positioned further along the pipe provide further support for the inner coil. This sliding action allows the primary coil "L1" to be positioned at any point along the length of the "L2" secondary coil, and that has a marked tuning effect on the operation of the system. The outer "L2" coil does not have any kind of tube support but instead, the coil shape is maintained by the stiffness of the solid wire plus four slotted strips. This style of construction produces the highest possible coil performance at radio frequencies. With a Tesla Coil, it is most unusual to have the L1 coil of smaller diameter than the L2 coil.



The "L2" coil has two separate sections, each of seventeen turns. One point to note is the turns are spaced apart using slotted strips to support the wires and maintain an accurate spacing between adjacent turns. It must be remembered that spacing coil turns apart like this alters the characteristics of the coil, increasing its "capacitance" factor substantially. Every coil has resistance, inductance and capacitance, but the form of the coil construction has a major effect on the ratio of these three characteristics. The coil assembly is held in position on the base board by two off-white plastic cable ties. The nearer half of the coil is effectively connected across the further half as shown in the circuit diagram above.

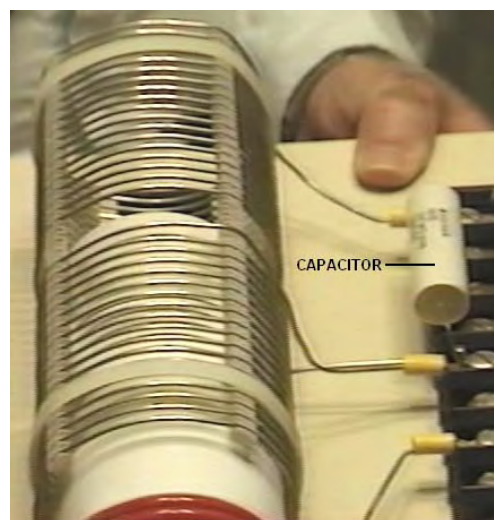
One point which Don stresses, is that the length of the wire in the "L1" coil and the length of wire in the "L2" coil, must be an exact even division or multiple of each other (in this case, the "L2" wire length in each half of the "L2" coil is exactly four times as long as the "L1" coil wire length). This is likely to cause the "L1" coil to have part of a turn, due to the different coil diameters. For example, if the length of the "L2" coil wire is 160 inches and "L1" is to be one quarter of that length, namely, 40 inches. Then, if the "L1" coil has an effective diameter of 2.25 inches, (allowing for the thickness of the wire when wound on a 2-inch diameter former), then the "L1" coil would have 5.65 (or 5 and 2/3) turns which causes the finishing turn of "L2" to be 240 degrees further around the coil former than the start of the first turn - that is, five full turns plus two thirds of the sixth turn.

The L1 / L2 coil arrangement is a Tesla Coil. The positioning of the "L1" coil along the length of the "L2" coil, adjusts the voltage to current ratio produced by the coil. When the "L1" coil is near the middle of the "L2" coil, then the amplified voltage and amplified current are roughly the same. The exact wire ratio of these two coils gives them an almost automatic tuning with each other, and the exact resonance between them can be achieved by the positioning of the "L1" coil along the length of the "L2" coil. While this is a perfectly good way of adjusting the circuit, in the build shown in the photograph, Don has opted to get the exact tuning by connecting a capacitor across "L1" as marked as "C" in the circuit diagram. Don found that the appropriate capacitor value was around the 0.1 microfarad (100 nF) mark. It must be remembered that the voltage across "L1" is very high, so if a capacitor is used in that position it will need a voltage rating of at least 9,000 volts. Don remarks that the actual capacitors seen in the photograph of this prototype are rated at fifteen thousand volts, and were custom made for him using a "self-healing" style of construction. As has already been remarked, this capacitor is an optional component. Don also opted to connect a small capacitor across the "L2" coil, also for fine-tuning of the circuit, and that component is optional and so is not shown on the circuit diagram. As the two halves of the "L2" coil are effectively connected across each other, it is only necessary to have one fine-tuning capacitor. However, Don stresses that the "height" length of the coil (when standing vertically) controls the voltage produced while the coil "width" (the diameter of the turns) controls the current produced.



The exact wire length ratio of the turns in the "L1" and "L2" coils gives them an almost automatic synchronous tuning with each other, and the exact resonance between them can be achieved by the positioning of the "L1" coil along the length of the "L2" coil. While this is a perfectly good way of adjusting the circuit, in the 1994 build shown in the photograph, Don has opted to get the exact tuning by connecting a capacitor across "L1" as marked as "C" in the circuit diagram. Don found that the appropriate capacitor value for his particular coil build, was about 0.1 microfarad (100 nF) and so he connected two 47 nF high-voltage capacitors in parallel to get the value which he wanted. It must be remembered that the voltage across "L1" is very high, so a capacitor used in that position needs a voltage rating of at least 9,000 volts. Don remarks that the actual capacitors seen in the photograph of this prototype are rated at fifteen thousand volts, and were custom made for him using a "self-healing" style of construction.

Don has also connected a small capacitor across the "L2" coil, and that optional component is marked as "C2" in the circuit diagram and the value used by Don happened to be a single 47nF, high-voltage capacitor. As the two halves of the "L2" coil are effectively connected across each other, it is only necessary to have one capacitor for "L2":

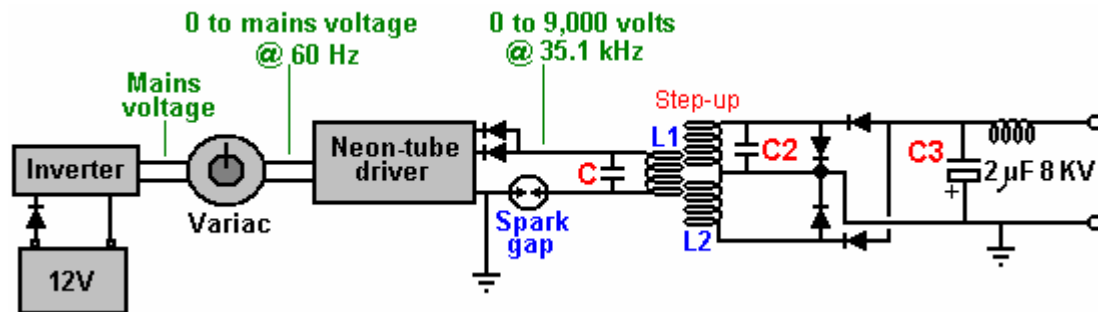


There are various ways of dealing with the output from the "L2" coil in order to get large amounts of conventional electrical power out of the device. The method shown here uses the four very large capacitors seen in the photograph. These have an 8,000 or 9,000 volt rating and a large capacity and they are used to store the circuit power as DC prior to use in the load equipment. This is achieved by feeding the capacitor bank through a diode which is rated for both high voltage and high current, as Don states that the device produces 8,000 volts at 20 amps, in which case, this rectifying diode has to be able to handle that level of power, both at start-up when the capacitor bank is fully discharged and "L2" is producing 8,000 volts, and when the full load of 20 amps is being drawn.

This capacitor bank is fed through a diode which is rated for both high voltage and high current, as Don states that the device produces 8,000 volts at 20 amps, in which case, this rectifying diode has to be able to handle that level of power, both at start-up when the capacitor bank is fully discharged and "L2" is producing 8,000 volts, and when the full load of 20 amps is being drawn. The actual diodes used by Don happen to be rated at 25 KV but that is a far greater rating than is actually needed.

In passing, it might be remarked that the average home user will not have an electrical requirement of anything remotely like as large as this, seeing that 10 kW is more than most people use on a continuous basis, while 8 KV at 20 A is a power of 160 kilowatts. As the neon-tube driver circuit can put out 9,000 volts and since the L1 / L2 coil system is a step-up transformer, if the voltage fed to the capacitor bank is to be kept down to 8,000 volts, then the Variac adjustment must be used to reduce the voltage fed to the neon-tube driver circuit, in order to lower the voltage fed to the L1 / L2 coil pair, typically, to 3,000 volts.

A very astute and knowledgeable member of the EVGRAY Yahoo EVGRAY forum whose ID is "silverhealtheu" has recently pointed out that Don Smith says quite freely that he does not disclose all of the details of his designs, and it is his opinion that a major item which has not been disclosed is that the diodes in the circuit diagrams shown here are the wrong way round and that Don operates his voltages in reverse to the conventional way. In fact, the circuit diagram should be:



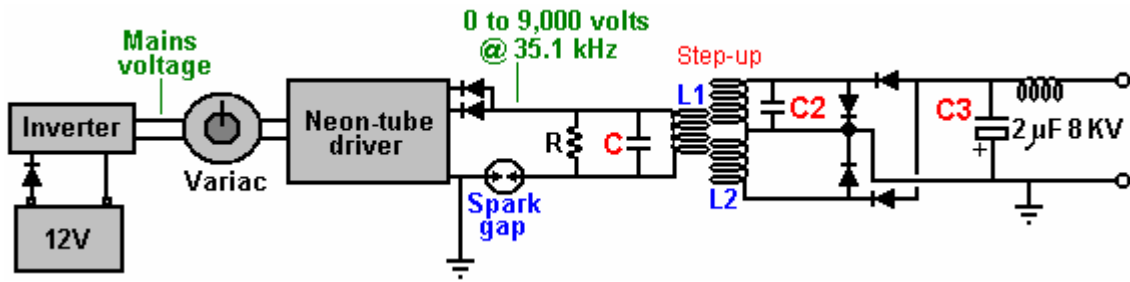
He comments: "the diodes leaving the Neon-tube Driver may need to be reversed as we want to collect the negative polarity. The spark gap will then operate on ambient inversion and the spark will look and sound totally different with a much faster crack and producing very little heat and even becoming covered in frost is possible.

The Variac should be raised up just enough to get a spark going then backed off slightly. Any higher voltage is liable to make the Neon-tube Driver think that it has a short-circuit condition, and the new electronic designs will then shut down automatically and fail to operate at all if this method is not followed.

When running, C, L1 and L2 operate somewhere up in the Radio Frequency band because the Neon-tube Driver only acts as a tank-circuit exciter. The large collection capacitor C3, should fill inverted to earth polarity as shown above. The load will then be pulling electrons from the earth as the cap is REFILLED back to ZERO rather than the joules in the capacitor being depleted.

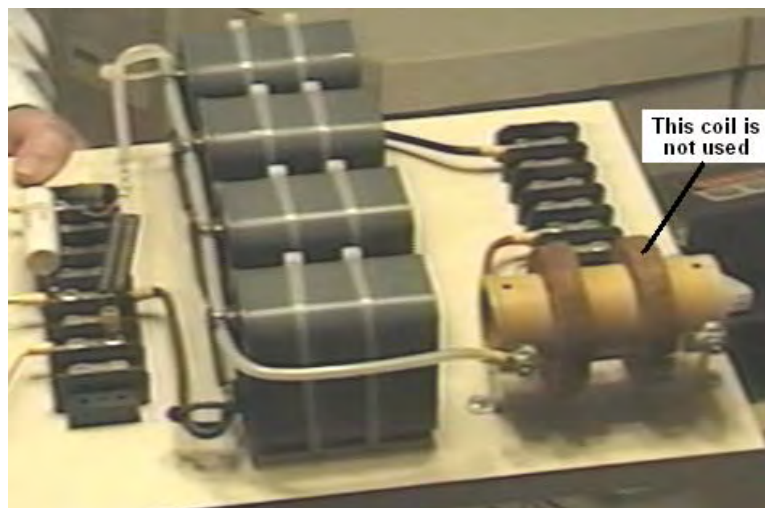
Also remember that the Back-EMF systems of John Bedini and others, create a small positive pulse but they collect a super large NEGATIVE polarity spike which shoots off the bottom of an oscilloscope display. This is what we want, plenty of this stored in capacitors, and then let the ambient background energy supply the current when it makes the correction."

This is a **very important point** and it may well make a really major difference to the performance of a device of this nature.

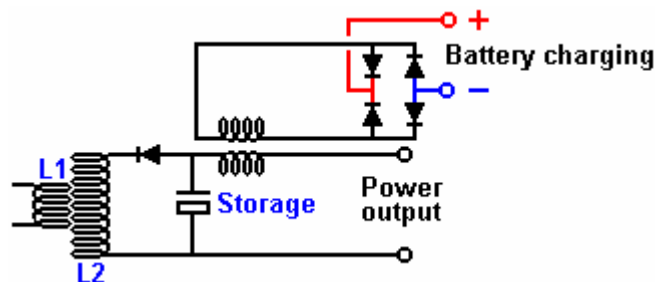


One reader has drawn attention to the fact that Don's main document indicates that there should be a resistor "R" across the L1 coil as well as the capacitor "C" and he suggests that the circuit should actually be as shown above, considering what Don said earlier about his "suitcase" design. Another reader points out that the wire in the output choke shown in the photograph below appears to be wound with wire that is far too small diameter to carry the currents mentioned by Don. It seems likely that a choke is not needed in that position except to suppress possible radio frequency transmissions from the circuit, but a more powerful choke can easily be wound using larger diameter wire.

When the circuit is running, the storage capacitor bank behaves like an 8,000 volt battery which never runs down and which can supply 20 amps of current for as long as you want. The circuitry for producing a 220 volt 50 Hz AC output or a 110 volt 60 Hz AC output from the storage capacitors is just standard electronics. In passing, one option for charging the battery is to use the magnetic field caused by drawing mains-frequency current pulses through the output "choke" coil, shown here:

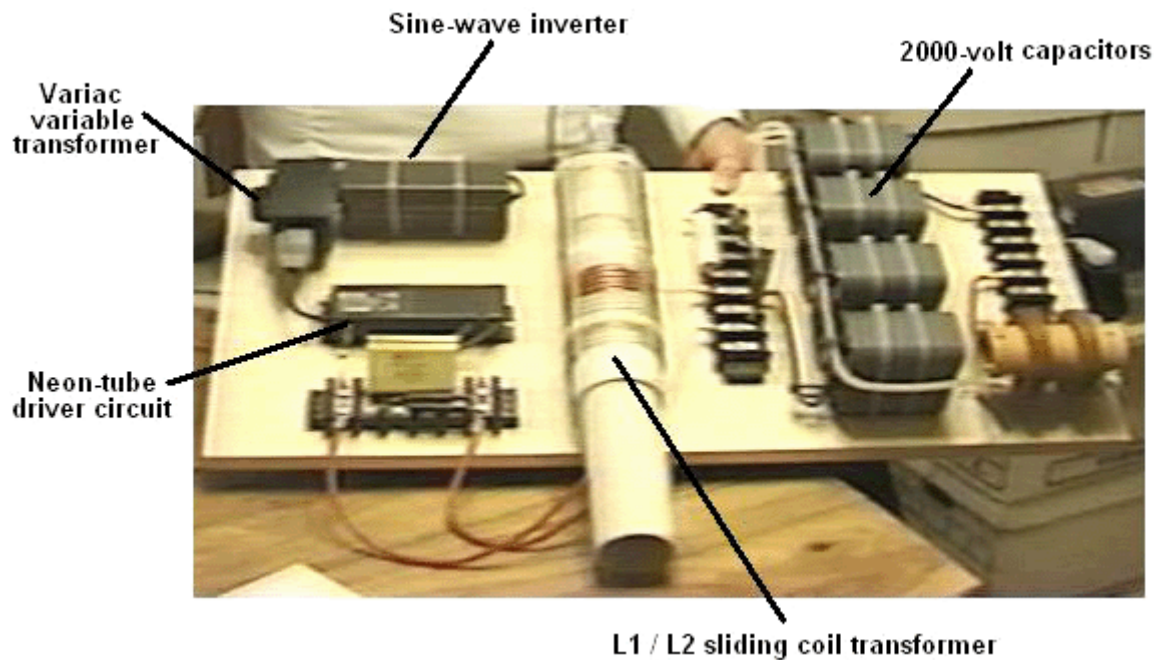


The output current flows through the left hand winding on the brown cylindrical former, and when the photograph was taken, the right-hand winding was no longer in use. Previously, it had been used to provide charging power to the battery by rectifying the electrical power in the coil, caused by the fluctuating magnetic field caused by the pulsing current flowing through the left hand winding, as shown here:



The DC output produced by the four diodes was then used to charge the driving battery, and the power level produced is substantially greater than the minor current drain from the battery. Consequently, it is

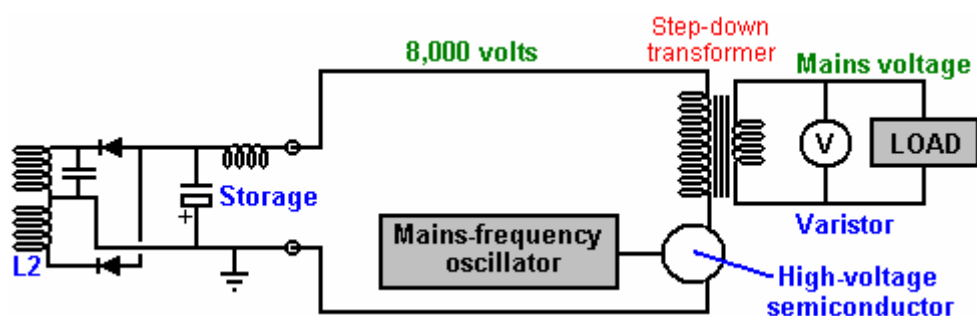
a sensible precaution to pass this current to the battery via a circuit which prevents the battery voltage rising higher than it should. A simple voltage level sensor can be used to switch off the charging when the battery has reached its optimum level. Other batteries can also be charged if that is wanted. Simple circuitry of the type shown in chapter 12 can be used for controlling and limiting the charging process. The components on Don's board are laid out like this:



Don draws attention to the fact that the cables used to connect the output of "L2" to the output of the board, connecting the storage capacitors on the way, are very high-voltage rated cables with special multiple coverings to ensure that the cables will remain sound over an indefinite period. It should be remarked at this point, that the outer 3" diameter coil used by Don, is not wound on a former, but in order to get higher performance at high frequencies, the turns are supported with four separate strips physically attached to the turns - the technique described later in this document as being an excellent way for home construction of such coils.

Please bear in mind that the voltages here and their associated power levels are literally lethal and perfectly capable of killing anyone who handles the device carelessly when it is powered up. When a replication of this device is ready for routine use, it must be encased so that none of the high-voltage connections can be touched by anyone. This is not a suggestion, but it is a mandatory requirement, despite the fact that the components shown in the photographs are laid out in what would be a most dangerous fashion were the circuit to be powered up as it stands. Under no circumstances, construct and test this circuit unless you are already experienced in the use of high-voltage circuits or can be supervised by somebody who is experienced in this field. This is a "one hand in the pocket at all times" type of circuit and it needs to be treated with great care and respect at all times, so be sensible.

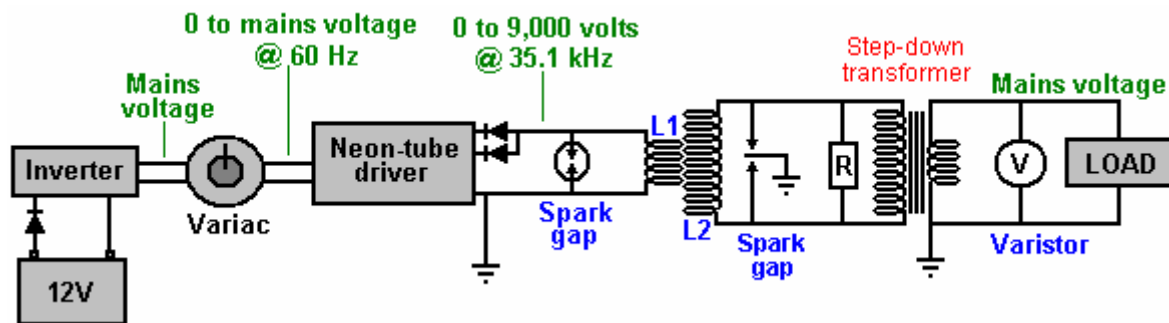
The remainder of the circuit is not mounted on the board, possibly because there are various ways in which the required end result can be achieved. The one suggested here is perhaps the most simple solution:



The voltage has to be dropped, so an iron-cored mains-frequency step-down transformer is used to do this. To get the frequency to the standard mains frequency for the country in which the device is to be used, an oscillator is used to generate that particular mains frequency. The oscillator output is used to drive a suitable high-voltage semiconductor device, be it an FET transistor, an IGBT device, or whatever. This device has to switch the working current at 8,000 volts, though admittedly, that will be a current which will be at least thirty six times lower than the final output current, due to the higher voltage on the primary winding of the transformer. The available power will be limited by the current handling capabilities of this output transformer which needs to be very large and expensive.

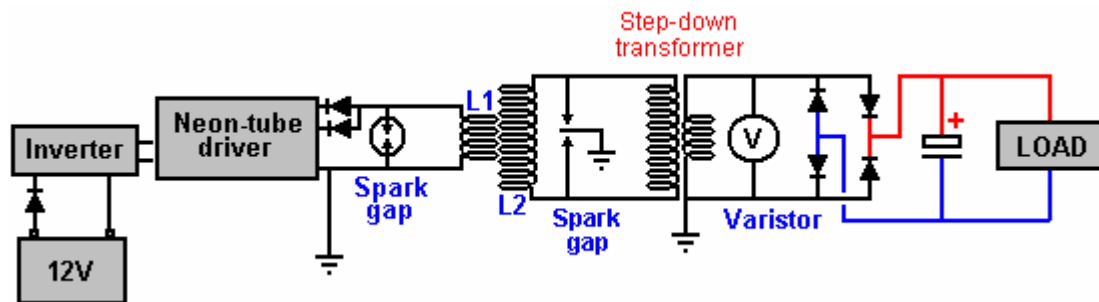
As the circuit is capable of picking up additional magnetic pulses, such as those generated by other equipment, nearby lightning strikes, etc. an electronic component called a "varistor" marked "V" in the diagram, is connected across the load. This device acts as a voltage spike suppressor as it short circuits any voltage above its design voltage, protecting the load from power surges.

Don also explains an even more simple version of the circuit as shown here:

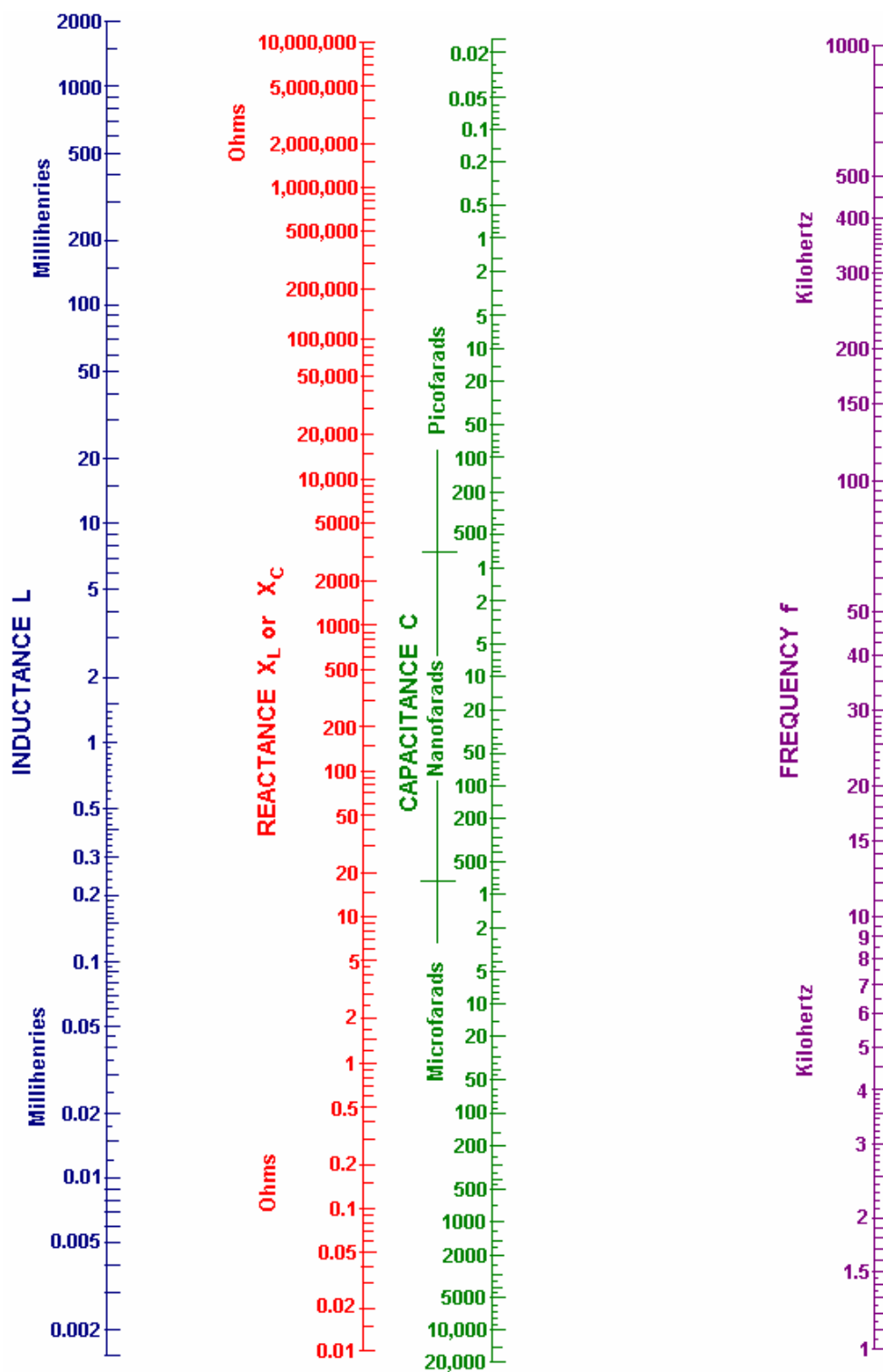


This simplified circuit avoids the need for expensive capacitors and the constraints of their voltage ratings, and the need for electronic control of the output frequency. The wire length in the turns of coil "L2" still needs to be exactly four times the wire length of the turns in coil "L1", but there is only one component which needs to be introduced, and that is the resistor "R" placed across the primary winding of the step-down isolation transformer. This transformer is a laminated iron-core type, suitable for the low mains frequency, but the output from "L2" is at much higher frequency. It is possible to pull the frequency down to suit the step-down transformer by connecting the correct value of resistor "R" across the output transformer (or a coil and resistor, or a coil and a capacitor). The value of resistor needed can be predicted from the American Radio Relay League graph (shown as Fig.44 in Don's pdf document). The sixth edition of the Howard Sams book "Handbook of Electronics Tables and Formulas" (ISBN-10: 0672224690 or ISBN-13: 978-0672224690) has a table which goes down to 1 kHz and so does not need to be extended to reach the frequencies used here. The correct resistor value could also be found by experimentation. You will notice that an earthed dual spark gap has been placed across "L2" in order to make sure that the voltage levels always stay within the design range.

Don also explains an even more simple version which does not need a Variac, high voltage capacitors or high voltage diodes. Here, a DC output is accepted which means that high-frequency step-down transformer operation can be used. This calls for an air-core transformer which you would wind yourself from heavy duty wire. Mains loads would then be powered by using a standard off-the-shelf inverter. In this version, it is of course, necessary to make the "L1" turns wire length exactly one quarter of the "L2" turns wire length in order to make the two coils resonate together. The operating frequency of each of these coils is imposed on them by the output frequency of the neon-tube driver circuit. That frequency is maintained throughout the entire circuit until it is rectified by the four diodes feeding the low-voltage storage capacitor. The target output voltage will be either just over 12 volts or just over 24 volts, depending on the voltage rating of the inverter which is to be driven by the system. The circuit diagram is:

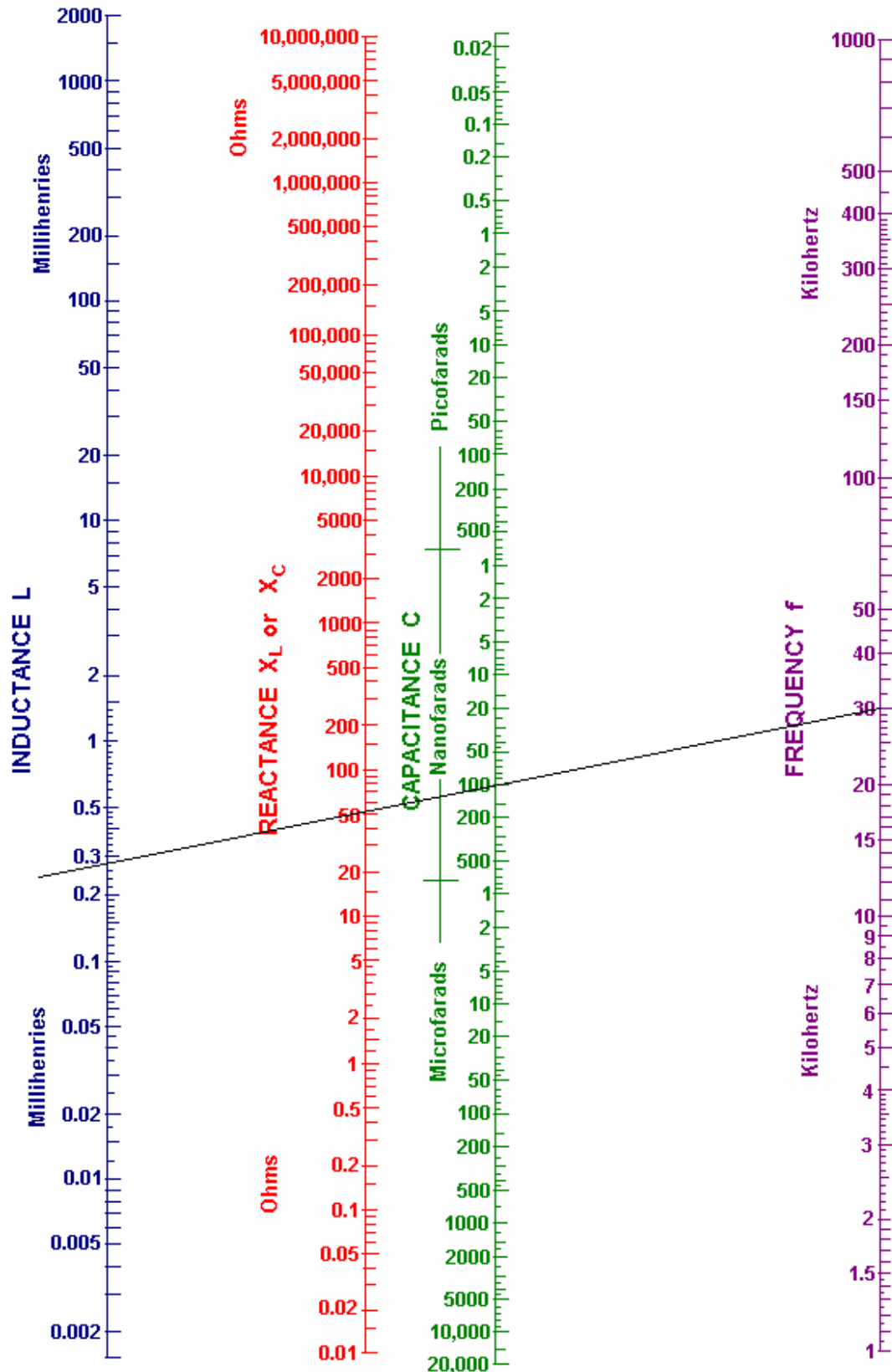


As many people will find the nomograph chart in Don's pdf document very difficult to understand and use, here is an easier version:

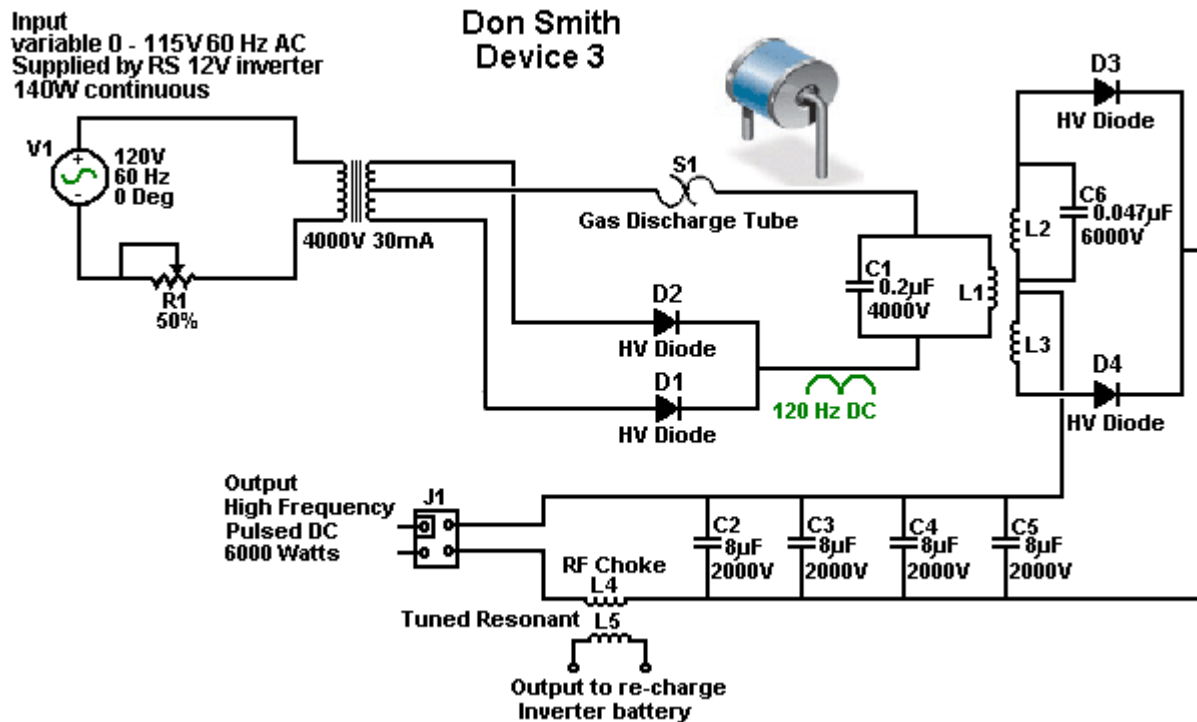


The objective here is to determine the "reactance" or 'AC resistance' in ohms and the way to do that is as follows:

Suppose that your neon-tube driver is running at 30 kHz and you are using a capacitor of 100 nF (which is the same as 0.1 microfarad) and you want to know what is the AC resistance of your capacitor is at that frequency. Also, what coil inductance would have that same AC resistance. Then the procedure for finding that out is as follows:



I have been passed a copy of Don's circuit diagram for this device, and it is shown here:



Don also explains an even more simple version of his main device. This version does not need a Variac (variable voltage transformer) or high voltage capacitors. Here, a DC output is accepted which means that high-frequency step-down transformer operation can be used. This calls on the output side, for an air-core (or ferrite rod core) transformer which you would wind yourself from heavy duty wire. Mains loads would then be powered by using a standard off-the-shelf inverter. In this version, it is of course, very helpful to make the "L1" turns wire length exactly one quarter of the "L2" turns wire length in order to make the two coils automatically resonate together. The operating frequency of each of these coils is imposed on them by the output frequency of the neon-tube driver circuit. That frequency is maintained throughout the entire circuit until it is rectified by the four diodes feeding the low-voltage

As the circuit is capable of picking up additional magnetic pulses, such as those generated by other equipment, nearby lightning strikes, etc. an electronic component called a "varistor" marked "V" in the diagram, is connected across the load. This device acts as a voltage spike suppressor as it short-circuits any voltage above its design voltage, protecting the load from power surges. A Gas-Discharge Tube is an effective alternative to a varistor.

OPPOSING-DIRECTION WINDINGS?

High-frequency step-down transformer

+12V or +24V

Inverter

Neon-tube driver

12V

Spark gap

Varistor

Inverter

MAINS OUTPUT

When considering the “length” of wire in a resonant coil, it is necessary to pay attention to the standing wave created under those conditions. The wave is caused by reflection of the signal when it reaches the end of the wire OR when there is a sudden change in the diameter of the wire as that changes the signal reflection ability at that point in the connection. You should pay attention to Richard Quick’s very clear description of this in the section of his patent which is included later on in this chapter. Also, remember what Don Smith said about locating the peaks of the standing wave by using a hand-held neon lamp.

A Practical Implementation of one of Don Smith's Designs

31 - 26

However, questions from several different readers indicate that a short, reasonably specific description of the steps needed to attempt a replication of a Don Smith device would be helpful. Again, this document must not be considered to be a recommendation that you actually build one of these high-voltage, potentially dangerous devices. This is just information intended to help you understand what I believe is involved in this process.

In broad outline, the following steps are used in the most simple version of the arrangement:

1. The very low frequency and voltage of the local mains supply is discarded in favour of an electrical supply which operates at more than 20,000 Hz (cycles per second) and has a voltage of anything from 350 volts to 10,000 volts. The higher voltages can give greater overall output power, but they involve greater effort in getting the voltage back down again to the level of the local mains voltage in order for standard mains equipment to be used.
2. This high-frequency high voltage is used to create a series of very rapid sparks using a spark gap which is connected to a ground connection. Properly done, the spark frequency is so high that there is no audible sound caused by the sparks. Each spark causes a flow of energy from the local environment into the circuit. This energy is not standard electricity which makes things hot when current flows through them, but instead this energy flow causes things to become cold when the power flows through them, and so it is often called “cold” electricity. It is tricky to use this energy unless all you want to do is light up a series of light bulbs (which incidentally, give out a different quality of light when powered with this energy). Surprisingly, the circuit now contains substantially more power than the amount of power needed to produce the sparks. This is because additional energy flows in from the ground as well as from the local environment. If you have conventional training and have been fed the myth of “closed systems”, then this will seem impossible to you. So, let me ask you the question: if, as can be shown, all of the electricity flowing into the primary winding of a transformer, flows back out of that winding, then where does the massive, continuous flow of electricity coming from the secondary winding come from? None of it comes from the primary circuit and yet millions of electrons flow out of the secondary in a continuous stream which can be supplied indefinitely. So, where do these electrons come from? The answer is ‘from the surrounding local environment which is seething with excess energy’ but your textbooks won’t like that fact as they believe that the transformer circuit is a ‘closed system’ – something which probably can’t be found anywhere in this universe.
3. This high-voltage, high-frequency, high-power energy needs to be converted to the same sort of hot electricity which comes out of a mains wall socket at the local voltage and frequency. This is where skill and understanding come into play. The first step is to lower the voltage and increase the available current with a step-down resonant transformer. This sounds highly technical and complicated, and looking at Don Smith’s expensive Barker & Williamson coil, makes the whole operation appear to be one for rich experimenters only. This is not the case and a working solution can be cheap and easy. It is generally not convenient to get the very high voltage all the way down to convenient levels in a single step, and so, one or more of those resonant transformers can be used to reach the target voltage level. Each step down transformer boosts the available current higher and higher.
4. When a satisfactory voltage has been reached, we need to deal with the very high frequency. The easiest way to deal with it is to use high-speed diodes to convert it to pulsing DC and feed that into a capacitor to create what is essentially, an everlasting battery. Feeding this energy into a capacitor converts it into conventional “hot” electricity and a standard off-the-shelf inverter can be used to give the exact voltage and frequency of the local mains supply. In most of the world, that is 220 volts at 50 cycles per second. In America it is 110 volts at 60 cycles per second. Low-cost inverters generally run on either 12 volts or 24 volts with the more common 12 volt units being cheaper.

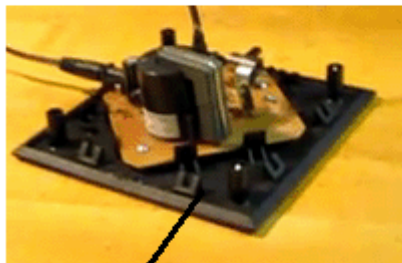
So, let’s take a look at each of these step in more detail and see if we can understand what is involved and what our options are:

1. We want to produce a high-voltage, high-frequency, low-current power source. Don Smith shows a Neon-Sign Transformer module. His module produced a voltage which was higher than was convenient and so he used a variable AC transformer or “Variac” as it is commonly known, to lower

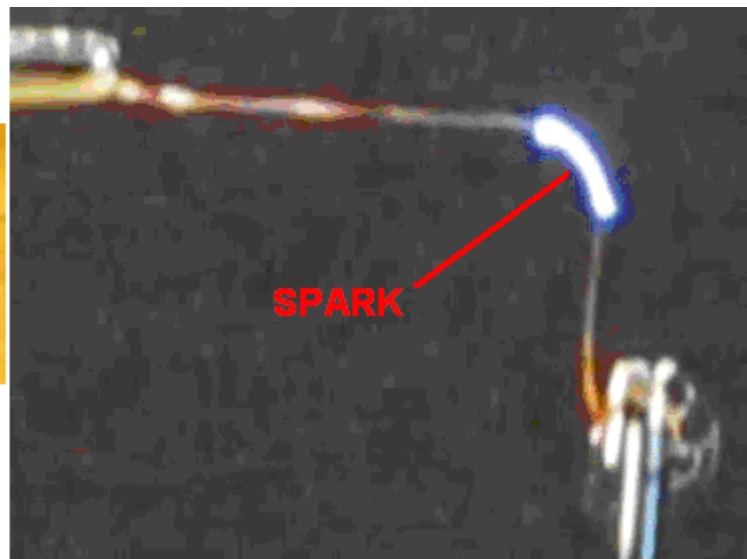
the input voltage and so, lower the output voltage. There is actually no need for a Variac as we can handle the higher voltage or alternatively, use a more suitable Neon-Sign Transformer module.

However, we have a problem with using that technique. In the years since Don bought his module, they have been redesigned to include circuitry which disables the module if any current flows out of it directly to earth, and as that is exactly what we would want to use it for, so most, if not all of the currently available neon-sign transformer modules are not suitable for our needs. However, I'm told that if the module has an earth wire and that earth wire is left unconnected, that it disables the earth-leakage circuitry, allowing the unit to be used in a Don Smith circuit. Personally, I would not recommend that if the module is enclosed in a metal housing.

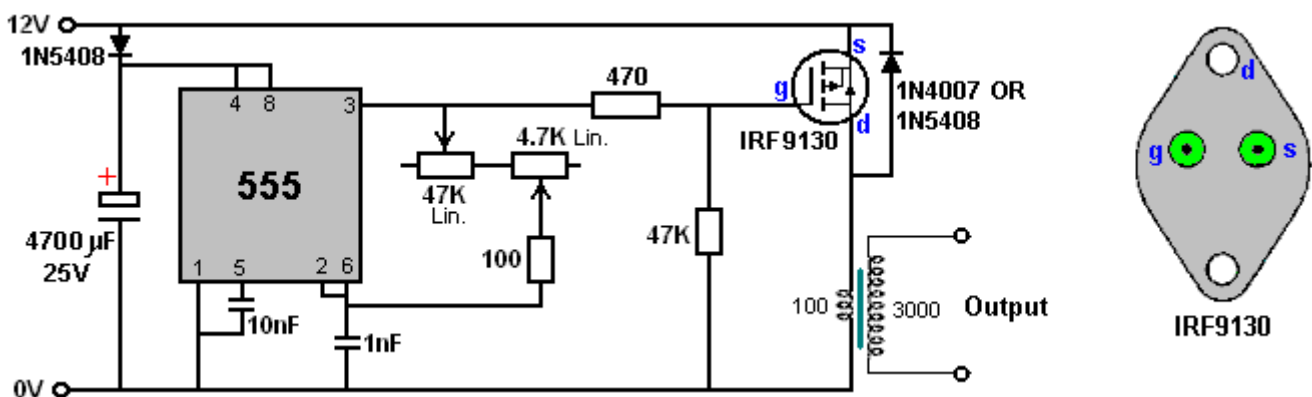
A much cheaper alternative is shown here: http://www.youtube.com/watch?v=RDDRe_4D93Q where a small plasma globe circuit is used to generate a high-frequency spark. It seems highly likely that one of those modules would suit our needs:



MODULE WITHOUT
THE PLASMA GLOBE



An alternative method is to build your own power supply from scratch. Doing that is not particularly difficult and if you do not understand any electronics, then perhaps, reading the beginner's electronics tutorial in chapter 12 (<http://www.free-energy-info.com/Chapter12.pdf>) will fill you in on all of the basics needed for understanding (and probably designing your own) circuits of this type. Here is a variable frequency design for home-construction:



One advantage of this circuit is that the output transformer is driven at the frequency set by the 555 timer and that frequency is not affected by the number of turns in the primary winding, nor it's inductance, wire diameter, or anything else to do with the coil. While this circuit shows the rather expensive IRF9130 transistor, I expect that other P-channel FETs would work satisfactorily in this circuit. The IRF9130 transistor looks like this:

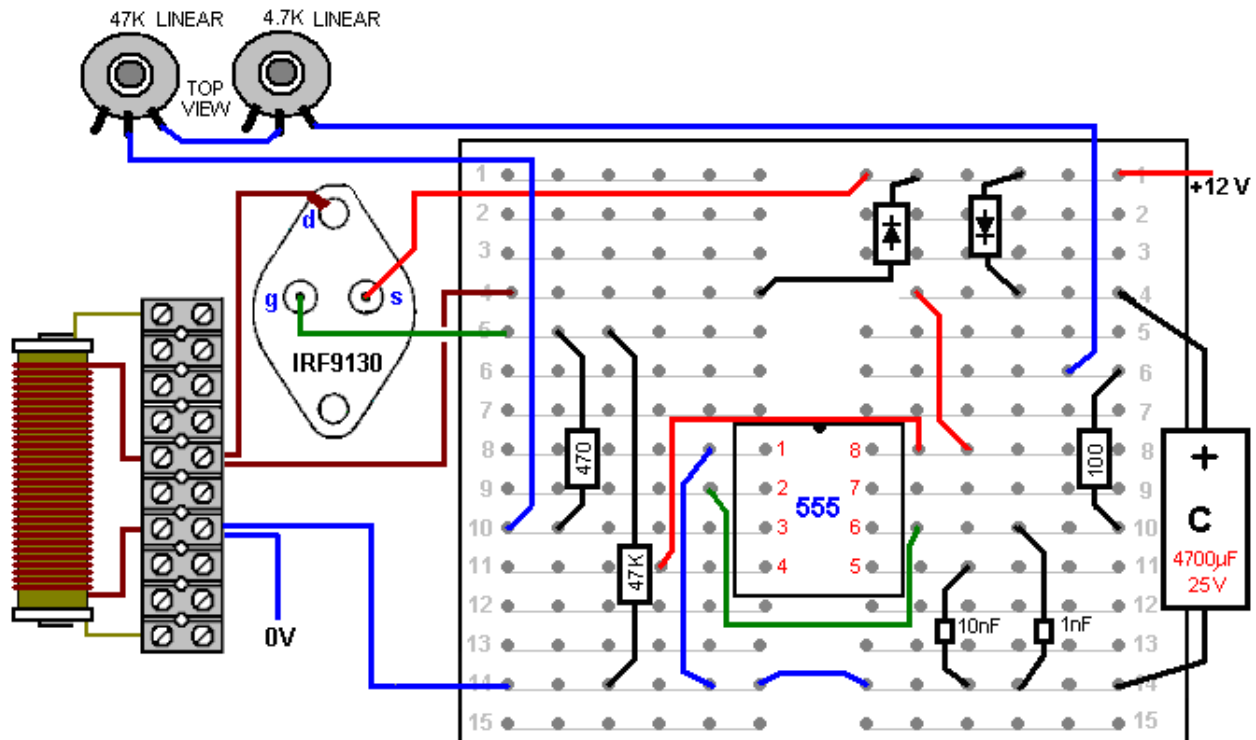


The circuit has a power supply diode and capacitor, ready to receive energy from the output at some later date if that is possible and desired. The 555 circuit is standard, giving a 50% Mark/Space ratio. The 10 nF capacitor is there to maintain the stability of the 555 and the timing section consists of two variable resistors, one fixed resistor and the 1 nF capacitor. This resistor arrangement gives a variable resistance of anything from 100 ohms to 51.8K and that allows a substantial frequency range. The 47K (Linear) variable resistor controls the main tuning and the 4.7K (Linear) variable resistor gives a more easily adjustable frequency for exact tuning. The 100 ohm resistor is there in case both of the variable resistors are set to zero resistance. The output is fed through a 470 ohm resistor to the gate of a very powerful P-channel FET transistor which drives the primary winding of the output transformer.

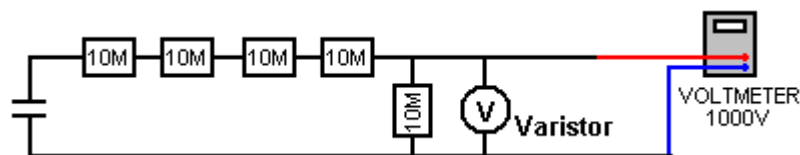
The output transformer can be wound on an insulating spool covering a ferrite rod, giving both good coupling between the windings, and high-frequency operation as well. The turns ratio is set to just 30:1 due to the high number of primary winding turns. With a 12-volt supply, this will give a 360-volt output waveform, and by reducing the primary turns progressively, allows the output voltage to be increased in controlled steps. With 10 turns in the primary, the output voltage should be 3,600 volts and with just 5 turns 7,200 volts. The higher the voltage used, the greater the amount of work needed later on to get the voltage back down to the output level which we want.

Looking at the wire specification table, indicates that quite a small wire diameter could be used for the oscillator output transformer's secondary winding. While this is perfectly true, it is not the whole story. Neon Tube Drivers are very small and the wire in their output windings is very small diameter indeed. Those driver modules are very prone to failure. If the insulation on any one turn of the winding fails and one turn becomes a short-circuit, then that stops the winding from oscillating, and a replacement is needed. As there are no particular size constraints for this project, it might be a good idea to use enamelled copper wire of 0.45 mm or larger in an attempt to avoid this insulation failure hazard. No part of the transformer coil spool should be metal and it would not be any harm to cover each layer of secondary winding with a layer of electrical tape to provide additional insulation between the coil turns in one layer and the turns in the layer on top of it.

A plug-in board layout might be:

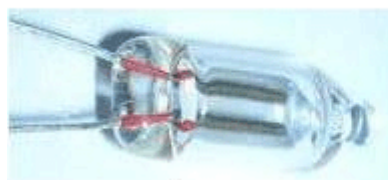


Please remember that you can't just stick your average voltmeter across a 4 kV capacitor (unless you really do want to buy another meter) as they only measure up to about a thousand volts DC. So, if you are using high voltage, then you need to use a resistor-divider pair and measure the voltage on the lower resistor. But what resistor values should you use? If you put a 10 Megohm resistor across your 4 kV charged capacitor, the current flowing through the resistor would be 0.4 milliamps. Sounds tiny, doesn't it? But that 0.4 mA is 1.6 watts which is a good deal more than the wattage which your resistor can handle. Even using this arrangement:



the current will be 0.08 mA and the wattage per resistor will be 64 mW. The meter reading will be about 20% of the capacitor voltage which will give a voltmeter reading of 800 volts. The input resistance of the meter needs to be checked and possibly, allowed for as the resistance in this circuit is so high (see chapter 12). When making a measurement of this type, the capacitor is discharged, the resistor chain and meter attached, and then, and only then, is the circuit powered up, the reading taken, the input power disconnected, the capacitor discharged, and the resistors disconnected. High-voltage circuits are highly dangerous, especially so, where a capacitor is involved. The recommendation to wear thick rubber gloves for this kind of work, is not intended to be humorous. Circuits of this type are liable to generate unexpected high-voltage spikes, and so, it might be a good idea to connect a varistor across the meter to protect it from those spikes. The varistor need to be set to the voltage which you intend to measure and as varistors may not be available above a 300V threshold, two or more may need to be connected in series where just one is shown in the diagram above. The varistor should not have a higher voltage rating than your meter.

2. We now need to use this high voltage to create a strategically positioned spark to a ground connection. When making an earth connection, it is sometimes suggested that connecting to water pipes or radiators is a good idea as they have long lengths of metal piping running under the ground and making excellent contact with it. However, it has become very common for metal piping to be replaced with cheaper plastic piping and so any proposed pipe connection needs a check to ensure that that there is metal piping which runs all the way into the ground.



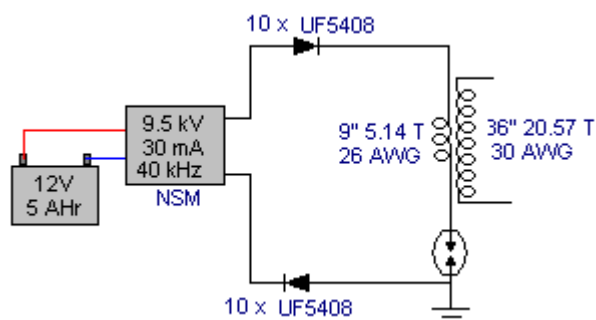
Neon



Gas-Discharge Tube

The spark gaps shown can be commercial high-voltage gas discharge tubes, adjustable home-made spark gaps with stainless steel tips about 1 mm apart, car spark plugs, or standard neon bulbs, although these run rather hot in this application. A 15 mm x 6 mm size neon bulb operates with only 90 or 100 volts across it, it would take a considerable number of them connected in series to create a high voltage spark gap, but it is probably a misconception that the spark gap itself needs a high voltage. Later on in this chapter, there is an example of a very successful system where just one neon bulb is used for the spark gap and an oscillating magnetic field more than a meter wide is created when driven by just an old 2,500 volt neon-sign transformer module. If using a neon bulb for the spark gap, then an experienced developer recommends that a 22K resistor is used in series with the neon in order to extend it's working life very considerably.

This circuit is one way to connect the spark gap and ground connection:



This is an adaption of a circuit arrangement used by the forum member "SLOW-'N-EASY" on the Don Smith topic in the energeticforum. Here, he is using a 'LowGlow' neon transformer intended for use on a bicycle. The diodes are there to protect the high-voltage power supply from any unexpected voltage spikes created later on in the circuit. The spark gap is connected between the primary winding of a step-up transformer and the earth connection. No capacitor is used. Seeing this circuit, we immediately think of Don Smith's large and expensive coils, but this experimenter does not use anything like that. Instead, he winds his transformer on a simple plastic former like this:



Ho Sung International. EI-2820 nylon bobbin. Core is 10 mm x 13 mm x 10 mm high. Top is 18.5 mm x 21.5 mm. Base is 22 mm x 26 mm. Four leads, 15 mm and 20 mm spacing

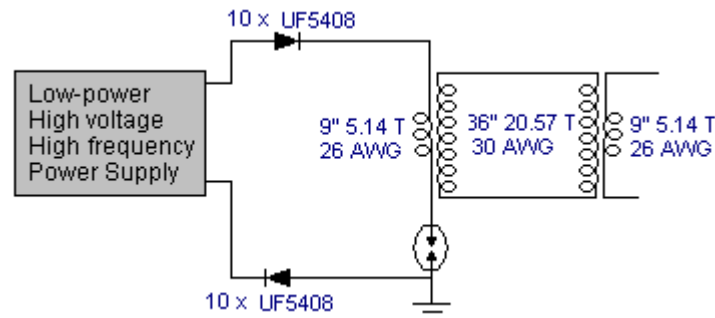
And to make matters 'worse' the primary winding wire is just 9 inches (228.6 mm) long and the secondary just 36 inches (914.4 mm) long, the primary being wound directly on top of the secondary. Not exactly a large or expensive construction and yet one which appears to perform adequately in actual tests.

This is a very compact form of construction, but there is no necessity to use exactly the same former for coils, nor is there anything magic about the nine-inch length of the L1 coil, as it could easily be

any convenient length, say two feet or 0.5 metres, or whatever. The important thing is to make the L2 wire length exactly four times that length, cutting the lengths accurately. It is common practice to match the weight of copper in each coil and so the shorter wire is usually twice the diameter of the longer wire.

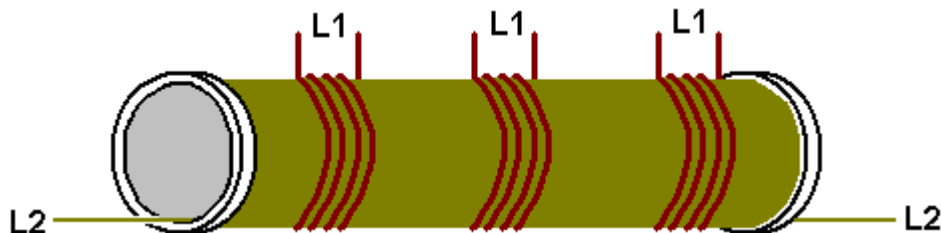
The circuit above, produces a cold electricity output of high voltage and high frequency. The voltage will not be the same as the neon transformer voltage, nor is the frequency the same either. The two coils resonate at their own natural frequency, unaltered by any capacitors.

3. The next step is to get the high voltage down to a more convenient level, perhaps, like this:



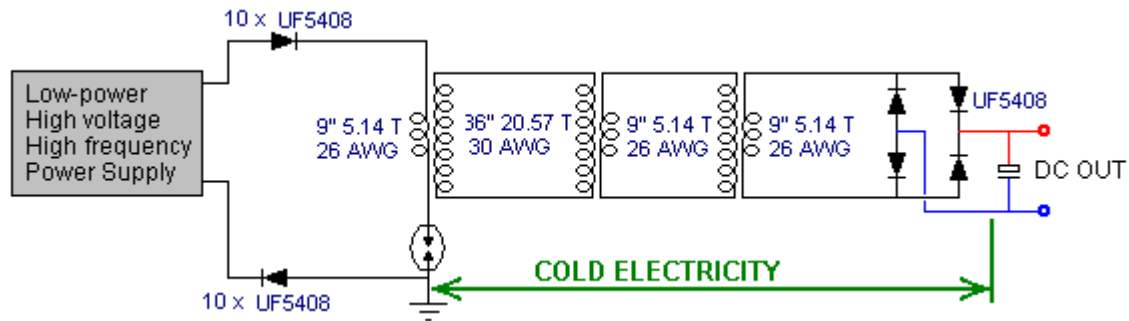
Here, an identical transformer, wound in exactly the same way, is used in reverse, to start the voltage lowering sequence. The wire length ratio is maintained to keep the transformer windings resonant with each other.

Supposing we were to wind the L2 coil of this second transformer in a single straight winding and instead of winding just one L1 winding on top of it, two or more L1 identical windings were placed on top of it – what would happen?:



Now for a comment which will seem heretical to people steeped in the present day (inadequate) level of technology. The power flowing in these transformers is cold electricity which operates in an entirely different way to hot electricity. The coupling between these coils would be inductive if they were carrying hot electricity and in that case, any additional power take-off from additional L1 coils would have to be 'paid' for by additional current draw through the L2 coil. However, with the cold electricity which these coils are actually carrying, the coupling between the coils is magnetic and not inductive and that results in no increase in L2 current, no matter how many L1 coil take-offs there are. Any additional L1 coils will be powered for free. However, the position of the coils relative to each other has an effect on the tuning, so the L1 coil should be in the middle of the L2 coil, which means that any additional L1 coils are going to be slightly off the optimum tuning point.

4. Anyway, following through on just one L1 coil, there is likely to be at least one further step-down transformer needed and eventually, we need conversion to hot electricity:



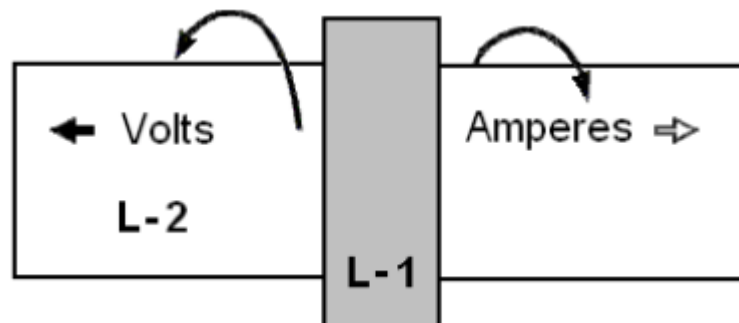
Probably the easiest conversion is by feeding the energy into a capacitor and making it standard DC. The frequency is still very high, so high-speed diodes (such as the 75-nanosecond UF54008) are needed here although the voltage level is now low enough to be no problem. The DC output can be used to power an inverter so that standard mains equipment can be used. It is not necessary to use just one (expensive) large-capacity inverter to power all possible loads as it is cheaper to have several smaller inverters, each powering it's own set of equipment. Most equipment will run satisfactorily on square-wave inverters and that includes a mains unit for powering the input oscillator circuit.

PVC pipe is not a great material when using high-frequency high-voltage signals, and grey PVC pipe is a particularly poor coil former material. The much more expensive acrylic pipe is excellent, but if using PVC, then performance will be better if the PVC pipe is coated with an insulating lacquer (or table tennis balls dissolved in acetone as show on YouTube).

However, there are some other factors which have not been mentioned. For example, if the L1 coil is wound directly on top of the L2 coil, it will have roughly the same diameter and so, the wire being four times longer, will have roughly four times as many turns, giving a step-up or step-down ratio of around 4:1. If, on the other hand, the coil diameters were different, the ratio would be different as the wire lengths are fixed relative to each other. If the L2 coil were half the diameter of the L1 coil, then the turns ratio would be about 8:1 and at one third diameter, 12:1 and at a quarter diameter 16:1 which means that a much greater effect could be had from the same wire length by reducing the L2 coil diameter. However, the magnetic effect produced by a coil is linked to the cross-sectional area of the coil and so a small diameter is not necessarily at great advantage. Also, the length of the L1 coil wire and number of turns in it, affect the DC resistance, and more importantly, the AC impedance which affects the amount of power needed to pulse the coil.

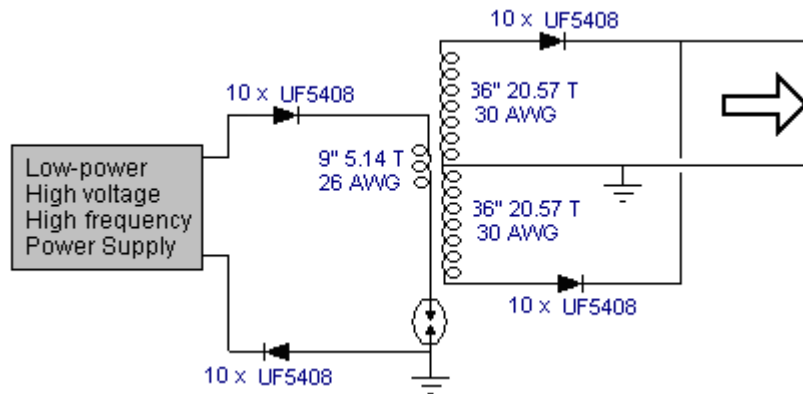
It is also thought that having the same weight of copper in each winding gives an improved performance, but what is not often mentioned is the opinion that the greater the weight of copper, the greater the effect. You will recall that Joseph Newman (chapter 11) uses large amounts of copper wire to produce remarkable effects. So, while 9 inches and 36 inches of wire will work for L1 and L2, there may well be improved performance from longer lengths of wire and/or thicker wires.

We should also not forget that Don Smith pointed out that voltage and current act (out of phase and) in opposite directions along the L2 coil, moving away from the L1 coil:



It has been suggested that a greater and more effective power output can be obtained by splitting the L2 coil underneath the L1 coil position, winding the second part of L2 in the opposite direction and

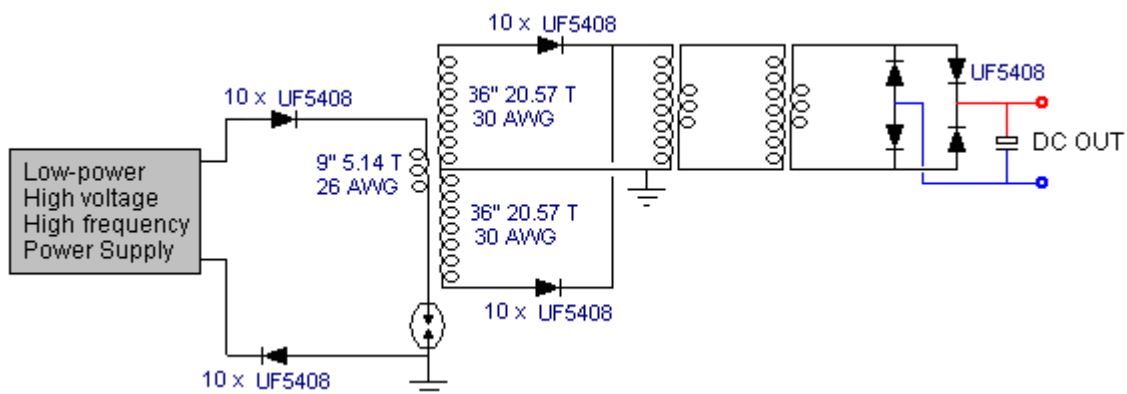
grounding the junction of the two L2 windings. Don doesn't consider it necessary to reverse the direction of winding. The result is an L2 winding which is twice as long as before and arranged like this:



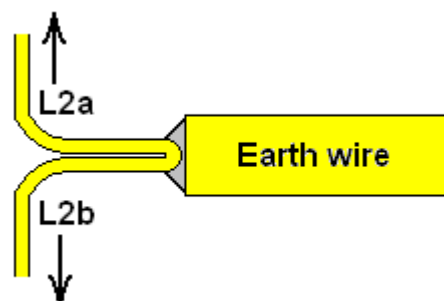
Here, the additional high-voltage diodes allow the two out of phase windings to be connected across each other.

You will notice that this arrangement calls for two separate earth connections, both of which need to be high-quality connections, something like a pipe or rod driven deeply into moist soil or alternatively, a metal plate or similar metal object of substantial surface area, buried deep in moist earth, and a thick copper wire or copper braid used to make the connection. These earthing points need to be fairly far apart, say, ten metres. A single earth connection can't be used as that would effectively short-circuit across the L1/L2 transformer which you really do not want to do.

With this arrangement, the outline circuit becomes:



The thick earth wiring is helpful because in order to avoid the earth wire being included in the resonant wire length, you need a sudden change in wire cross-section:



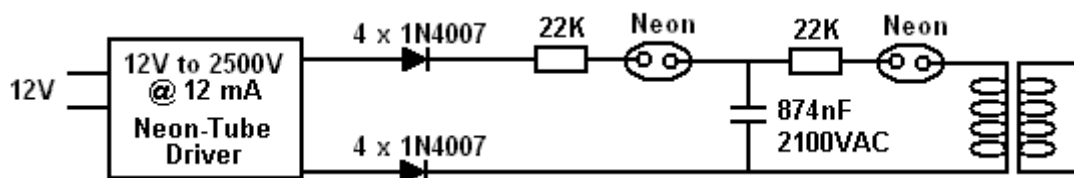
These are just some ideas which might be considered by some experienced developer who may be thinking of investigating Don Smith style circuitry.

To give you some idea of the capacity of some commercially available wires when carrying hot electricity, this table may help:

AWG	SWG	Diameter	Maximum Amps	220V kW	110V kW
1	2	7.01 mm	119	26.18	13.09
3	4	5.89 mm	75	16.50	8.25
4	6	4.88 mm	60	13.20	6.60
6	8	4.06 mm	37	8.14	4.07
8	10	3.25 mm	24	5.28	2.64
10	12	2.64 mm	15	3.30	1.65
12	14	2.03 mm	9.3	2.05	1.02
13	15	1.83 mm	7.4	1.63	801 watts
14	16	1.63 mm	5.9	1.30	650 watts
15	17	1.42 mm	4.7	1.03	515 watts
16	18	1.22 mm	3.7	814 watts	407 watts

It is recommended that the wire have a current carrying capacity of 20% more than the expected actual load, so that it does not get very hot when in use. The wire diameters do not include the insulation, although for solid enamelled copper wire, that can be ignored.

There is a most impressive video and circuit shown at <http://youtu.be/Q3vr6qmOwLw> where a very simple arrangement produces an immediately successful performance for the front end of Don's circuitry. The circuit appears to be:



Here, a simple Neon Sign Transformer module which has no earth connection, is used to produce a 2.5 kV voltage with a frequency of 25 kHz and a maximum output current capacity of 12 mA. There is no difficulty in constructing the equivalent to that power supply unit. The two outputs from the module are converted to DC by a chain of four 1N4007 diodes in series in each of the two outputs (each chain being inside a plastic tube for insulation).

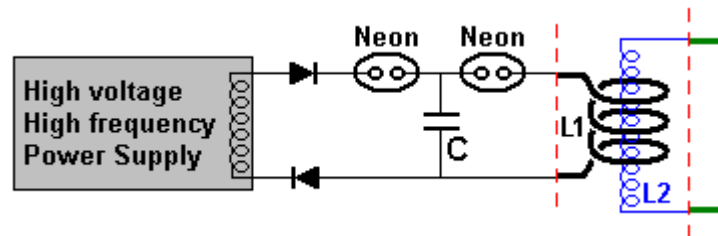
This output is fed through an optional 22K resistor via a neon lamp to a microwave oven capacitor which happens to be 874 nF with a voltage rating of 2,100 volts. You might feel that the voltage rating of the capacitor is too low for the output voltage of the neon sign module, but the neon has a striking voltage of just 90 volts and so the capacitor is not going to reach the output voltage of the power supply. The resistors are solely to extend the life of the neons as the gas inside the tube gets a considerable jolt in the first nanosecond after switch-on. It is unlikely that omitting those resistors would have any significant effect, but then, including them is a trivial matter. The second neon feeds the primary of the resonant transformer which is only shown in notional outline in the diagram above as the developer suggests that the primary acts as a transmitter and that any number of receiving coils can be used as individual secondaries by being tuned to the exact frequency of that resonating primary.



In the video showing this arrangement, the developer demonstrates the fluctuating, high-frequency field which extends for some four feet (1.2 m) around the coil. He also remarks that the single neons in his arrangement could each be replaced with two neons in series. In test which I ran, I found that I needed two neons in series ahead of the capacitor in order to get continuous lighting of the output neon. Also,

one of the diodes needed to be reversed so that one faced towards the input and one away from it. It did not matter which diode was reversed as both configurations worked. Again, please note that this presentation is for information purposes only and it is **NOT** a recommendation that you should actually build one of these devices. Let me stress again that this is a high-voltage device made even more dangerous by the inclusion of a capacitor, and it is quite capable of killing you, so, don't build one. The developer suggests that it is an implementation of the "transmitter" section of Don's Transmitter/multiple-receivers design shown below. However, before looking at that design, there is one question which causes a good deal of discussion on the forums, namely, if the centre-tap of the L2 secondary coil is connected to ground, then should that earth-connection wire length be considered to be part of the quarter length of the L1 coil? To examine this possibility in depth, the following quote from Richard Quick's very clear explanation of resonance in his US patent 7,973,296 of 5th July 2011 is very helpful.

However, the simple answer is that for there to be exact resonance between two lengths of wire (whether or not part, or all of those lengths of wire happen to be wound into a coil), then one length needs to be **exactly** four times as long as the other, and ideally, half the diameter as well. At both ends of both lengths of wire, there needs to be a sudden change in wire diameter and Richard explains why this is. But, leaving that detailed explanation for now, we can use that knowledge to explain the above simplified system in more detail. Here is the circuit again:



One very important point to note is that no earth connection is required and in spite of that, the performance shown on video is very impressive. While an earth connection can feed substantial power into the circuit, not needing one for the front end is an enormous advantage and potentially, opens the way for a truly portable device. Another very important point is the utter simplicity of the arrangement where only cheap, readily available components are used (and not many of those are needed). The resistors for extending the life of the neon bulbs are not shown, but they can be included if desired and the circuit operation is not altered significantly by having them there. If a higher spark voltage is wanted, then two or more neon bulbs can be used in series where these circuit diagrams show just one.

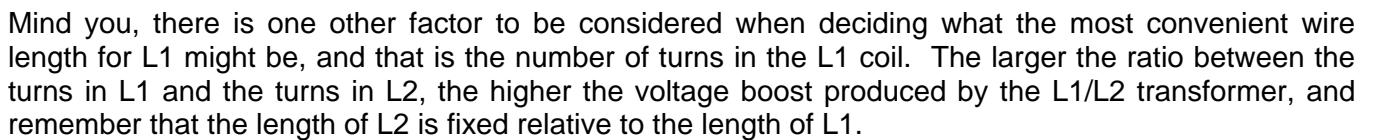
A point to note is that the lower diode is shown reversed when compared to the previous diagram. This is because the power supply shown is any generic power supply which drives a simple output coil which does not have a centre tap. The neon supply of the earlier diagram appears to have two separate outputs which will, presumably, be out of phase with each other as that is common practice for neon-sign driver modules. If you wish, the two diodes shown here could be replaced by a diode bridge of four high-voltage, high-speed diodes.

The wire lengths of L1 and L2 are measured very accurately from where the wire diameter changes suddenly, as indicated by the red dashed lines. The L2 wire length is exactly four times as long as the L1 wire length and the L2 wire diameter is half of the L1 wire diameter.

How long is the L1 wire? Well, how long would you like it to be? It can be whatever length you want and the radius of the L1 coil can be whatever you want it to be. The theory experts will say that the L1 coil should resonate at the frequency of the power feeding it. Well, good for them, I say, so please tell me what frequency that is. It is not going to be the frequency of the power supply as that will be changed by at least one of the neon bulbs. So, what frequency will the neon bulb produce? Not even the manufacturer could tell you that as there is quite a variation between individual bulbs which are supposedly identical.

Actually, it doesn't matter at all, because the L1 coil (and the L2 coil if you measure them accurately) has a resonant frequency all of its own and it will vibrate at that frequency no matter what the frequency feeding it happens to be. A coil resonates in very much the same way that a bell rings when it is struck.

This means that the length of the wire for the L1 coil is the choice of the builder, but once that length is chosen it determines the length of the wire for the L2 coil as that is exactly four times as long, unless the builder decides to use an arrangement which has L2 wound in both the Clockwise and counter-clockwise directions, in which case, each half of the L2 coil will be four times the length of the wire in the L1 coil, like this:

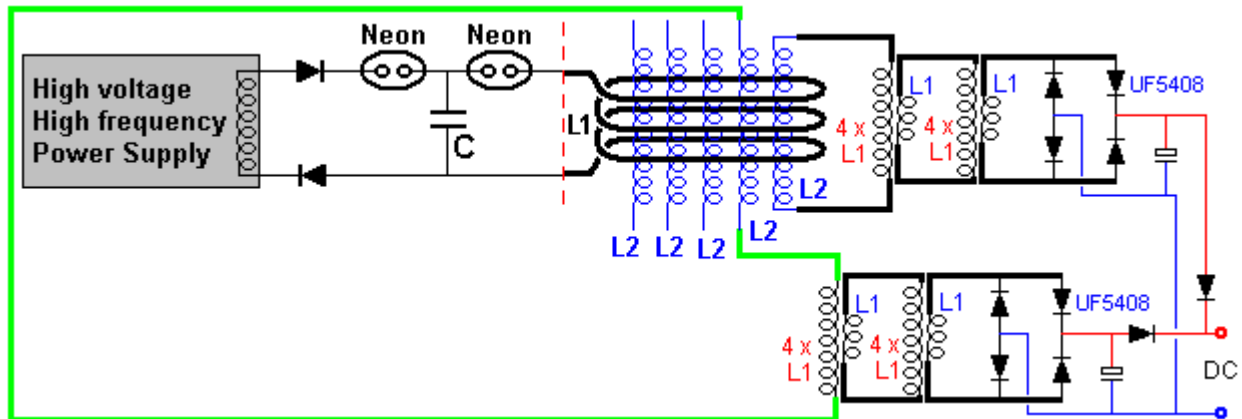


GREAT DANGER HERE !!

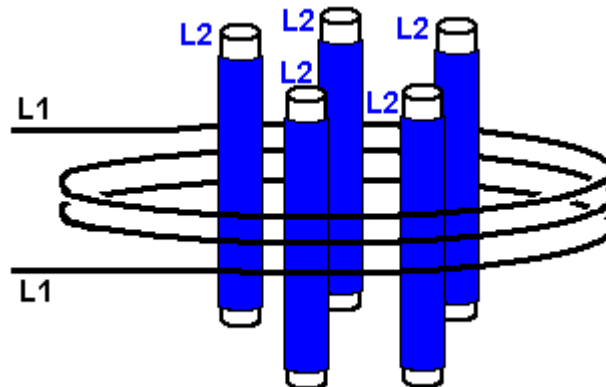
The builder of this circuit put it together in just a few minutes, using components which were to hand, including the microwave oven capacitor marked "C" in the diagrams above. That capacitor is isolated on both sides by the neon bulb spark gaps and so it will have no modifying effect on the resonant frequency of any of the coils in this circuit. But it is vital to understand that the energy stored in that capacitor can, and will, kill you instantly if you were to touch it, so let me stress once again that this information is **NOT** a recommendation that you actually build this circuit. The DC output from the circuit is intended to power a standard inverter, which in turn, would be perfectly capable of powering the high voltage, high frequency input oscillator.

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solely to wire length and no expensive high-voltage capacitors are needed to get every L1/L2 coil pair resonating together. One possible arrangement might be like this:



Where two of the L2 coils are shown connected together to give increased output power. This arrangement uses low-voltage inexpensive components for the output stages and there is no obvious limit to the amount of output power which could be provided. As the circuit operates at high frequency throughout, there is no particular need for additional L2 coils to be placed physically inside the L1 coil:



However, there can be an advantage to this arrangement in that the wire length of the L1 coil is greater, which in turn makes the wire length of each L2 coil greater (being four times longer). This gives greater flexibility when planning the turns ratio of the L1/L2 transformer. The voltage step-up or step-down of that transformer happens to be in the ratio of the turns, in spite of the fact that this is not inductive coupling and so standard transformer technology does not apply.

When you choose the number of turns and coil diameter for L1, that also gives the length of the L2 wire. In order to get the desired output voltage, if perhaps, the step-down ratio is needed to be an amount of 46:1, then you need 46 times the number of L1 turns on the L2 coil. That means that you know both the wire length and number of turns wanted in the L2 coil. But, as each turn will have a length of 3.14159 times the diameter, it follows then that the wanted diameter is the wire length per turn, divided by 3.14159. The wire sits on top of the tube on which it is wound and so has a greater diameter by one wire thickness, so the calculated tube diameter needs to be reduced by one wire diameter. For example, if the length per turn is 162 mm and the wire diameter 0.8 mm, then the tube diameter would be $162 / 3.14159 - 0.8$ which is 50.766 mm (just over two inches).

Now for Richard's explanation of the resonant frequency of any length of wire:

“Quarter-Wave” Resonance; Standing Electromagnetic Waves”

One of the two main types is electrical resonance is referred to here as quarter-wave resonance. This type of resonance depends almost entirely on the length of a wire element. For reasons described below, if a segment or length of wire is one quarter as long as the “voltage waves” which are travelling

through the wire, then a set of “reflected” waves will be added to the emitted waves, in a synchronised alignment which creates stronger “superimposed waves”.

Accordingly, an understanding of the “quarter-wave” phenomenon will help a reader understand how a straightforward and easily-controlled factor (i.e., the length of a wire ribbon which will be used to form a spiral coil) can help create a “quarter-wave” resonant response, which will create the types of electromagnetic pulses and fields referred to as “standing waves”.

The speed at which a voltage impulse is transmitted through a metal wire is extremely fast. It is essentially the same as the speed of light, which travels 300 million meters (186,000 miles) in a single second (that distance would circle the earth more than 7 times).

If wavelength (in meters) is multiplied by frequency (cycles per second), the result will be the speed of light, 300 million meters/second. Therefore, the wavelength of an “alternating current” (AC) voltage, at some particular frequency, will be the speed of light, divided by which frequency.

Therefore, using simple division, if an alternating voltage operates at a frequency of 1 megahertz (MHz), which is a million cycles per second, then the “wavelength” at that frequency will be 300 meters. If the frequency halves become 500 kilohertz, the wavelength becomes twice as long (600 meters); and, if the frequency were to increase to 2 megahertz, the wavelength drops to 150 meters.

It should be noted which the term “cycles” is what scientists call “a dimensionless unit”, which drops out and becomes silent when other physical terms are multiplied or divided.

At AC frequencies of 10 kilohertz or greater, the common references to “alternating current” (AC) voltage begin using a different term, which is “radio-frequency” (RF) voltage. Accordingly, RF voltage is a form (or subset) of AC voltage, which operates at frequencies higher than 10 kilohertz. RF power generators are readily available, and are sold by numerous companies which can be easily located by an Internet search, using the term “RF power generator”. For example, Hotek Technologies Inc. (hotektech.com) sells two RF power generators, called the AG 1024 and AG 1012 models, which can provide output power at frequencies ranging from 20 kHz to 1 MHz; the 1012 model has a power output of 1000 watts, while the 1024 model has a power output of 2000 watts. The output frequency of any such RF power supply can be adjusted and “tuned” across the entire range of operating frequencies, merely by turning knobs or manipulating other controls in a power supply of this type.

In a wire having a fixed and unchanging length, the easiest way to create a “standing wave” is to adjust the RF frequency emitted by a power supply with an adjustable frequency, until the “tuned” frequency creates a wavelength which is 4 times as long as the wire. This principle is well-known to physicists, and it is commonly referred to as “quarter-wave” behaviour, since the length of the wire segment must be one quarter as long as the wavelength. Since it is important to this invention, the principles behind it are illustrated in a series of drawings provided in **Fig.1** to **Fig.4**, all of which are well-known prior art.

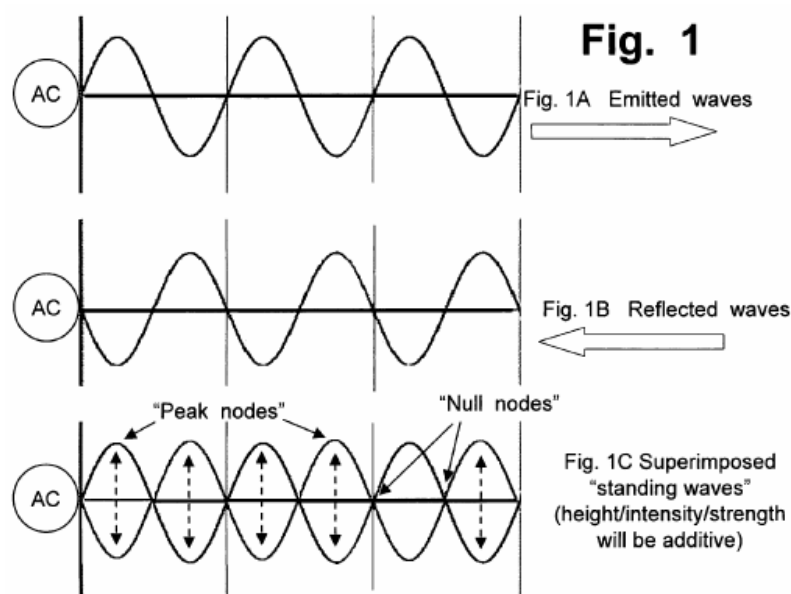


Fig.1A indicates an idealized wavelength of an alternating voltage, depicted by a sine wave which is being sent from an AC power supply (shown by a circle at the left end of a horizontal straight wire) into the “input” end of the wire. The voltage waves travel through the wire towards the right, as indicated by

the block arrow in **Fig.1A**. When the waves reach the end of the wire, they cannot leave the wire (at least, not in a simplified and “ideal” system, which is being assumed and used here to explain the principle of how a simple straight wire can create a standing wave). Therefore, the voltage wave will effectively “bounce” or “reflect” back from the tip of the wire, and the “reflected wave” will begin travelling back through the wire, going in the opposite direction, as indicated by the left-pointing block arrow in **Fig.1B**.

Because of the laws of conservation of energy, the reflection and “return travel” of these types of waves, when they bounce off the tip of a wire, is actually quite good, and rather efficient, as discussed below, provided which the wire tip does not emit sparks, arc discharges, or other forms of “escaping” electrical energy.

Accordingly, **Fig.1A** depicts a set of “emitted waves” travelling towards the right, while **Fig.1B** depicts an idealised set of “reflected waves” travelling toward the left along the same wire.

Fig.1C illustrates what happens when both sets of waves (emitted and reflected) are superimposed on each other. Since the two sets of waves are travelling at exactly the same speed, and since they have exactly the same wavelength, they will create a “standing wave” pattern when they are added together. As can be visualised from **Fig.1C**, there will be a set of locations, along the length of the wire, which can be referred to as “peak nodes”, where the AC voltage reaches it’s maximum.

At a location halfway between a pair of adjacent “peak nodes”, there will be a spot which can be called a “null node”, a “zero node”, a trough or valley node, or similar terms. At each “null node” location, the AC voltage will appear to be not fluctuating at all. Those are the sites, along the length of the wire, where each “positive” hump (created by a sine wave travelling toward the right) will be counter-balanced and offset by a “negative hump” with exactly the same height, travelling at an identical speed toward the left.

As a result, this type of response within a wire creates a “standing wave”. If the instantaneous voltage is measured at a “null node”, it would appear that nothing is happening, in terms of fluctuating voltage. Furthermore, the “null node” will not be moving, along the length of the wire; instead, it will appear to be standing still.

This can be demonstrated, in a coil, by using a “grounded lead” to test for voltages along the length of a coil. If a “grounded lead” coupled to a volt meter is used to touch the surfaces of a series of strands in a non-insulated coil (such as a coil made of thin copper tubing, wrapped around a plastic cylindrical shape, as used in the types of large transformers used by hobbyists to create “Tesla coils” which will emit large and visually impressive electrical arcs), the “test lead” will detect no apparent voltage at a null node, which will occur at some particular strand in the coil. At a different strand of the coil, the “test lead” will detect an alternating voltage which has twice the strength and intensity of the voltage being emitted by the power supply.

If voltage is measured at a “peak node”, the voltage will be doing something which can be called, using vernacular or laymen's terms, “the full-tilt boogie”. The AC voltage levels will be moving back and forth, between: (i) a very high and intense positive voltage, to (ii) an equally intense negative voltage. This is indicated by the “bubble” shapes shown along the wire in **Fig.1C**.

The “bubbles” which are shown in **Fig.1C** can help someone understand how standing waves are created, and how they act in a synchronised manner. However, which drawing fails to show another result which is very important in what actually happens in a standing wave. For purposes of description and analysis at this introductory level, the system can be assumed to be “ideal”, which implies a perfect “mirror-image” reflection of each wave from the right end of the wire. An “ideal” system also implies that no reflections occur at the left hand end of the wire where the power supply is located, and all “reflected” wave activity simply ceases. In real circuits and wires of this type, second and third order reflections do in fact occur, and they are used to further increase the strength and power output of these types of systems; however, those additional factors and “harmonics” should be ignored until after the basic principles of this type of system have been grasped and understood.

In an ideal system, when the reflected waves (which are travelling toward the left, in the wire segments illustrated in **Fig.1**) are “superimposed” on the emitted waves (travelling toward the right), the “peak” positive voltage which will be instantaneously reached, at the highest point of each “bubble” shown in **Fig.1C**, will occur when the positive peak of an emitted wave crosses a mirror-image positive peak of a reflected wave, travelling in the opposite direction. Accordingly, when those two “positive peak” values

are added to each other, the instantaneous positive peak voltage which will occur, in the wire, will actually be twice as intense as the “positive peak” voltage being emitted by the AC power supply.

An instant later, at that exact point on that segment of wire, a negative peak voltage will be created, which will be the sum of (i) the negative peak voltage emitted by the power supply, and (ii) the negative peak voltage of a reflected wave also will pass through, travelling toward the left. At which instant, when those two negative peak voltages are added to each other, the instantaneous negative voltage which will occur, in the wire, will be twice as intense as the “negative peak” voltage being generated by the AC power supply.

A more accurate and representative visual depiction of a “standing wave” in a wire would actually show the heights of the peaks as being twice as tall as the peaks of the emitted voltage waves, and the reflected voltage waves. However, which depiction might confuse people, so it usually is not shown in drawings of “standing waves”.

Accordingly, the instantaneous response in the wire, at a location halfway between two “null nodes”, is doing something which can fairly and properly be called “the full-tilt double double boogie”. The “double double” phrase (note which it contains not just one but two “doubles”) was added to that phrase, for two reasons:

(i) To emphasise the fact that each and every voltage peak (maximum positive, and maximum negative) will be twice as strong, and twice as intense, as the maximum positive and negative peak voltages emitted by the power supply; and,

(ii) to point out that the frequency of the superimposed “bubbles”, shown in **Fig.1C**, is actually twice as fast as the frequency of the AC cycle which is emitted by the power supply, as discussed below.

The “twice the intensity” result is directly comparable to what an observer will see, if a large mirror is placed behind a light bulb in an otherwise dark room. The mirror effectively keeps the room dark, everywhere behind the mirror, so there is no “magical doubling” of the light in the room; which would violate the basic law of conservation of energy. Instead, what the mirror does is to shift light away from the backside of the mirror, and keep that light energy on the reflective side of the mirror. Anyone standing in front of the mirror will see two apparent light bulbs. Both of those light bulbs (the original bulb, and the reflected image) will have the same brightness (if the mirror is perfect). Therefore, the mirror will double the intensity of the light energy reaching the observer.

That same effect, in a circuit, will happen if the end of a wire acts like a mirror. If a wire does not have any components which will cause it to become an active “emission source” (which is the behaviour of transmission antennas and certain other components), in a way which efficiently releases voltage-created energy into the atmosphere, then the basic rules which require conservation of energy will prevent that energy from simply disappearing and ceasing to exist. As a result, even if the end of a wire is not designed to be a perfect reflector, a large portion of the voltage wave will indeed reflect off the wire tip, and travel back through the same wire, in a “second pass”.

To understand adequately, the type and amount of “wave reflection” which occurs at a wire tip, consider what happens if a light bulb is shining in a room which has shiny, glossy white paint on all the walls and ceilings; then, consider how it would look if the same light bulb were located in a room with all of the walls and ceilings painted “matt black”. The total amount of light which would be available, to carry out a task such as reading a newspaper, clearly would be much greater in the white room, because light reflects off white paint, even though white paint does not even begin to approach the type of “reflection quality or clarity” which a mirror creates. The difference in what happens, when light intensity in a room painted matt black is compared to a room painted a glossy white, does not arise from the presence or absence of “reflection quality or clarity”; instead, it is governed by the laws of conservation of energy. When light shines on to a surface which is painted matt black, the light energy is absorbed by the paint, and it literally warms the paint up. In contrast to that, glossy white paint will not absorb light energy, so it reflects the light back out, for a “second pass” through the air which fills a room.

Because of the laws of conservation of energy, and without depending on any “quality of reflectance” characteristic of wire tips, electrical energy cannot simply disappear, when it reaches the end of a wire. Instead, there are only two things which can happen to that energy:

(i) the electrical energy can be emitted into the surroundings, such as by emitting sparks, arcs, or radio-frequency signals which will carry energy; or

(ii) if the energy is not emitted by the tip of the wire, then, by simple necessity and because of the basic law of conservation of energy, it must be reflected back into the wire, and it will be forced to travel back through the wire again.

If a wire has a long and tapered tip, then the reflected wave might become somewhat diffused, and it might lose some portion of the “clarity” of the wave. However, since wavelengths in the frequencies of interest here are hundreds of meters long, the type of tip created by a conventional wire cutter will not create any significant diffusion, in a reflected wave. And, unlike the white-painted walls of a room, there is not a large area which is available, at the tip of a wire, which can create scatter, spread, or diffusion. As a result, the tip of a wire will be a relatively efficient mirror-type reflector, when an AC voltage is “pumped” into one end of the wire.

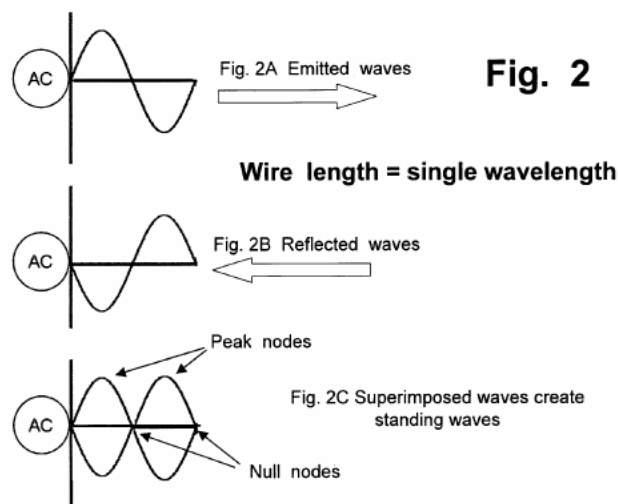
The second factor mentioned above, when the “double-double” boogie phrase was mentioned, relates to a doubling of the frequency of a standing wave. When a standing wave is created in a wire by reflection of an emitted AC voltage wave, the frequency of the standing wave is, quite literally, double the frequency of the emitted wave.

This can be seen, visually, by noting that in the emitted AC voltage, shown in **Fig.1A**, a single complete wavelength contains both a “positive hump” and a “negative hump”. Accordingly, three complete sine waves, divided into three segments by the imaginary vertical lines, are shown in **Fig.1A**.

By contrast, each and every “bubble” shown in **Fig.1C** depicts a complete and total “wavelength”, in a standing wave. Six of those standing wave “bubbles” fit into exactly the same length of wire which holds only 3 emitted wavelengths from the power supply.

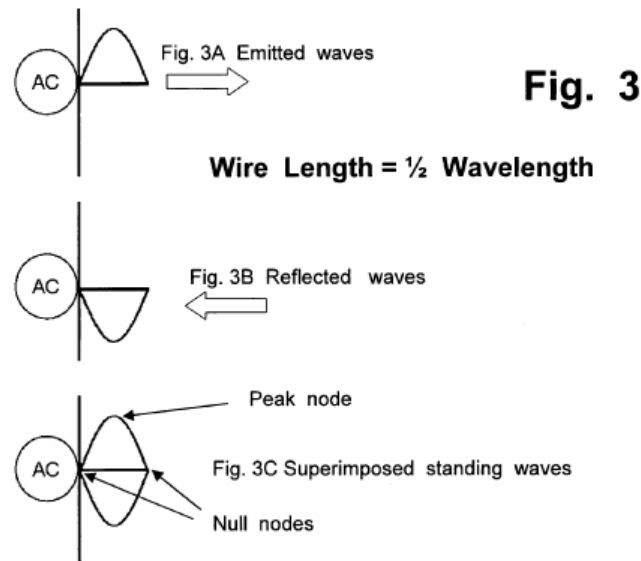
The “frequency doubling” effect of standing waves is important, because AC systems can convey and release energy in a manner which increases, as the frequency of the AC voltage supply increases. To some extent, this is analogous to saying that, if a motor can be run at twice the speed (while still generating the same torque), then the work output of that motor can be twice as great, at the higher speed. That analogy is not entirely accurate, since work output from an electric device which uses AC power depends on “area of the curve” functions which occur when sine waves are involved. Nevertheless, as a general principle, if the frequency of the voltage peaks increases, then power output will also increase, in many types of electric circuit components.

In the three panels of **Fig.1**, the wire length is three times as long as the wavelength of the voltage from the power supply. However, to create standing waves, a wire length does not need to be any particular multiple of the wavelength of an AC voltage. As can be seen by considering **Fig.1C**, the same types of “bubbles” would be created: (i) if the wire length were exactly twice as long as the wavelength; or, (ii) if the wire length were the same length as the wavelength.

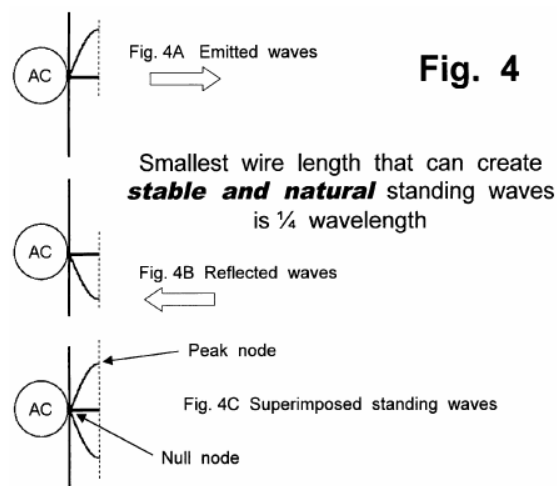


Accordingly, **Fig.2** (which includes **Fig.2A** showing an emitted wave, **Fig.2B** showing a reflected wave, and **Fig.2C** showing the superimposed “bubbles”) shows what happens in a wire segment which has a length which is equal to a single wavelength from an AC voltage at a fixed frequency. A resonant standing wave will be formed, with a frequency which is double the frequency of the input AC voltage. which same result will apply, in a wire having any length which is an exact (integer) multiple (such as

1x, 2x, 3x, etc.) of the wavelength of the AC voltage being pushed (or forced, driven, pumped, etc.) into the wire segment.



Moving to still shorter wires, the same principle also applies to any wire with a length equal to one half of an AC voltage wavelength. As shown in **Fig.3** (which includes **Fig. 3A** showing an emitted wave, **Fig. 3B** showing a reflected wave, and **Fig. 3C** showing the superimposed “bubbles”), if the wire length is one half of the wavelength, a natural and resonant standing wave will still form, with a frequency which is double the frequency of the input AC voltage.



Finally, moving to a still shorter wire, the same principle also applies to any wire which has a length equal to one quarter of an AC voltage wavelength, as shown in **Fig.4A**, **Fig.4B**, and **Fig.4C**. Even though it does not stretch across or cover a complete “bubble”, the standing wave shown in **Fig.4C** is nevertheless a stable, natural, and resonant “standing wave”, with a frequency which is exactly twice the frequency of the input AC voltage.

It is possible to create partially stable and semi-resonant responses, using one eighth, one sixteenth, or shorter lengths of wire, by using additional devices which can remove electrical power from the system, or which can generate effects which are usually called “harmonics”. However, those are not the types of natural and stable responses which can be created by a simple, basic system consisting of nothing more than: (i) a wire having a fixed length and a “reflective” tip; and (ii) an AC power source with a frequency which can be “tuned” until it creates a resonant response in any wire segment having a suitable length.

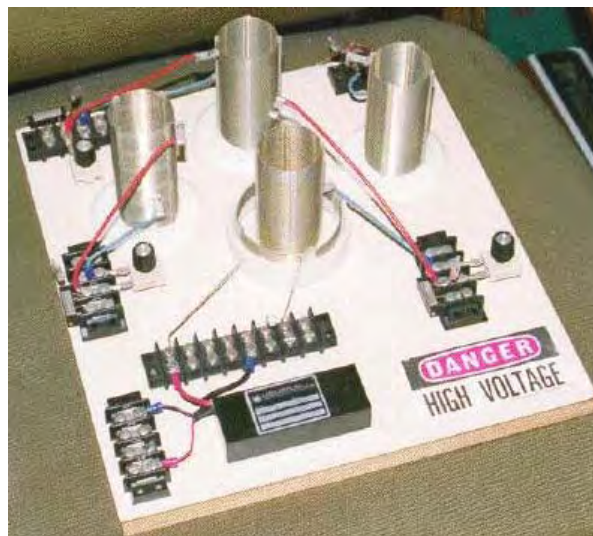
Therefore, since quarter-wave wire lengths are the shortest lengths which can create natural and stable standing waves, the conventional term which is commonly used, to describe what happens when a wire creates a resonant standing-wave response, is a “quarter-wave” response.

In some devices, telescoping components (or other elements which can alter the effective length of a wire-type element) can be used to alter the ability of the element to respond to a fixed wavelength. Many types of antennas use this approach, if they need to process signals which are being transmitted on fixed and known frequencies. However, those examples are not relevant to spiral coil reactors, which will use an approach which involves tuning and adjusting the frequency of the voltage which is being supplied to a reactor, until a resonant response is observed in coils with fixed and unchanging lengths.

It should also be noted that certain types of "tuning" elements (such as capacitors, which can have either fixed or adjustable capacitance levels) can also be coupled electrically to a wire, in a manner which "emulates" adding more length to that wire. This approach can be used to alter (or increase the range of) the frequencies to which a wire circuit will respond resonantly.

So, if we have resonant standing-wave voltages in our L2 coil and some of that signal passes through the wire connecting one end of the coil to the earth, then what will happen? The best way to check it is to test the way which a prototype behaves, however, if I may express an opinion, I would suggest that the signal passing down the earth wire will be absorbed when it reaches the earth and that will prevent the signal being reflected back to the L2 coil to upset it's operation.

The third of Don's designs which we can consider is particularly attractive because almost no home-construction is needed, all of the components being available commercially, and the output power being adaptable to any level which you want. Don particularly likes this circuit because it demonstrates $COP > 1$ so neatly and he remarks that the central transmitter Tesla Coil on its own is sufficient to power a household.



The coil in the centre of the board is a power transmitter made from a Tesla Coil constructed from two Barker & Williamson ready-made coils. Three more of the inner coil are also used as power receivers. The outer, larger diameter coil is a few turns taken from one of their standard coils and organised so that the coil wire length is one quarter of the coil wire length of the inner coil ("L2").

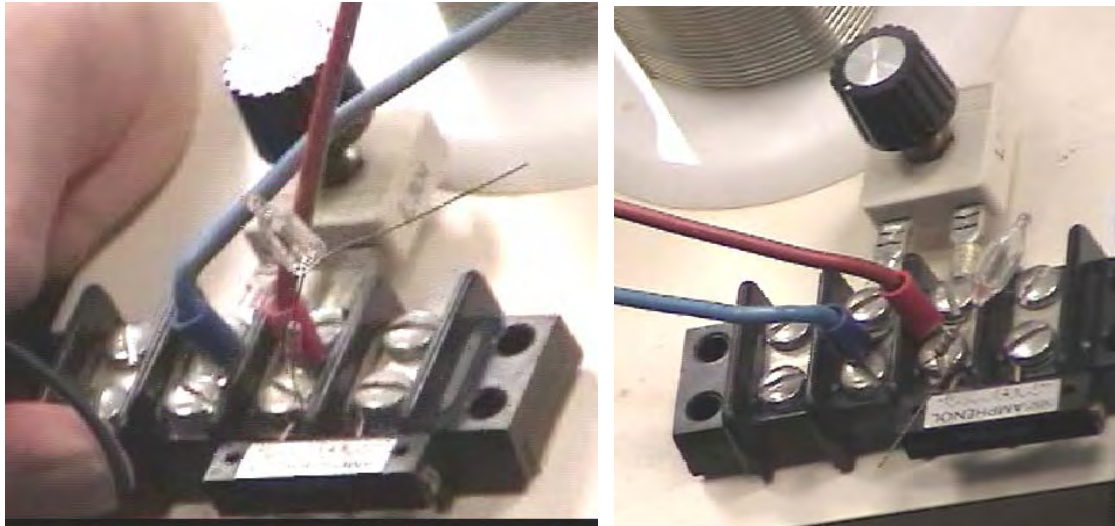
As before, a commercial neon-tube driver module is used to power the "L1" outer coil with high voltage and high frequency. It should be understood that as power is drawn from the local environment each time the power driving the transmitter coil "L1" cycles, that the power available is very much higher at higher frequencies. The power at mains frequency of less than 100 Hz is far, far less than the power available at 35,000 Hz, so if faced with the choice of buying a 25 kHz neon-tube driver module or a 35 kHz module, then the 35 kHz module is likely to give a much better output power at every voltage level.



The "L1" short outer coil is held in a raised position by the section of white plastic pipe in order to position it correctly relative to the smaller diameter "L2" secondary coil.



The secondary coils are constructed using Barker & Williamson's normal method of using slotted strips to hold the tinned, solid copper wire turns in place.



As there are very slight differences in the manufactured coils, each one is tuned to the exact transmitter frequency and a miniature neon is used to show when the tuning has been set correctly.

The key feature of this device is the fact that any number of receiver coils can be placed near the transmitter and each will receive a full electrical pick up from the local environment, without altering the power needed to drive the Tesla Coil transmitter - more and more output without increasing the input power - unlimited COP values, all of which are over 1. The extra power is flowing in from the local environment where there is almost unlimited amounts of excess energy and that inflow is caused by the rapidly vibrating magnetic field generated by the central Tesla Coil. While the additional coils appear to just be scattered around the base board, this is not the case. The YouTube video <http://www.youtube.com/watch?v=TiNEHZRm4z4&feature=related> demonstrates that the pick-up of these coils is affected to a major degree by the distance from the radiating magnetic field. This is to do with the wavelength of the signal driving the Tesla Coil, so the coils shown above are all positioned at exactly the same distance from the Tesla Coil. You still can have as many pick-up coils as you want, but they will be mounted in rings around the Tesla Coil and the coils in each ring will be at the same distance from the Tesla Coil in the centre.

Each of the pick up coils act exactly the same as the "L2" secondary coil of the Tesla Coil transmitter, each picking up the same level of power. Just as with the actual "L2" coil, each will need an output circuit arrangement as described for the previous device. Presumably, the coil outputs could be connected in parallel to increase the output amperage, as they are all resonating at the same frequency and in phase with each other. Each will have its own separate output circuit with a step-down isolation transformer and frequency adjustment as before. If any output is to be a rectified DC output, then no frequency adjustment is needed, just rectifier diodes and a smoothing capacitor following the step-down transformer which will need to be an air core or ferrite core type due to the high frequency. High voltage capacitors are very expensive. The <http://www.richieburnett.co.uk/parts.html> web site shows various ways of making your own high-voltage capacitors and the advantages and disadvantages of each type.

There are two practical points which need to be mentioned. Firstly, as the Don Smith devices shown above feed radio frequency waveforms to coils which transmit those signals, it may be necessary to enclose the device in an earthed metal container in order not to transmit illegal radio signals. Secondly, as it can be difficult to obtain high-voltage high-current diodes, they can be constructed from several lower power diodes. To increase the voltage rating, diodes can be wired in a chain. Suitable diodes are available as repair items for microwave ovens. These typically have about 4,000 volt ratings and can carry a good level of current. As there will be minor manufacturing differences in the diodes, it is good practice to connect a high value resistor (in the 1 to 10 megohm range) across each diode as that ensures that there is a roughly equal voltage drop across each of the diodes:



If the diode rating of these diodes were 4 amps at 4,000 volts, then the chain of five could handle 4 amps at 20,000 volts. The current capacity can be increased by connecting two or more chains in parallel. Most constructors omit the resistors and find that they seem to get satisfactory performance.

The impedance of a coil depends on its size, shape, method of winding, number of turns and core material. It also depends on the frequency of the AC voltage being applied to it. If the core is made up of iron or steel, usually thin layers of iron which are insulated from each other, then it can only handle low frequencies. You can forget about trying to pass 10,000 cycles per second ("Hz") through the coil as the core just can't change its magnetic poles fast enough to cope with that frequency. A core of that type is ok for the very low 50 Hz or 60 Hz frequencies used for mains power, which are kept that low so that electric motors can use it.

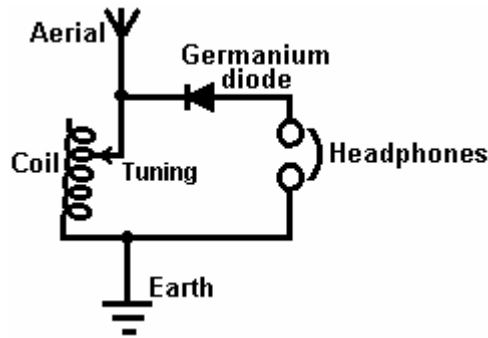
For higher frequencies, ferrite can be used for a core and that is why some portable radios use ferrite-rod aerials, which are a bar of ferrite with a coil wound on it. For higher frequencies (or higher efficiencies) iron dust encapsulated in epoxy resin is used. An alternative is to not use any core material and that is usually referred to as an "air-core" coil. These are not limited in frequency by the core but they have a very much lower inductance for any given number of turns. The efficiency of the coil is called its "Q" (for "Quality") and the higher the Q factor, the better. The resistance of the wire lowers the Q factor.

A coil has inductance, and resistance caused by the wire, and capacitance caused by the turns being near each other. However, having said that, the inductance is normally so much bigger than the other two components that we tend to ignore the other two. Something which may not be immediately obvious is that the impedance to AC current flow through the coil depends on how fast the voltage is changing. If the AC voltage applied to a coil completes one cycle every ten seconds, then the impedance will be much lower than if the voltage cycles a million times per second.

If you had to guess, you would think that the impedance would increase steadily as the AC frequency increased. In other words, a straight-line graph type of change. That is not the case. Due to a feature called resonance, there is one particular frequency at which the impedance of the coil increases massively. This is used in the tuning method for AM radio receivers. In the very early days when electronic components were hard to come by, variable coils were sometimes used for tuning. We still have variable coils today, generally for handling large currents rather than radio signals, and we call them "rheostats" and some look like this:

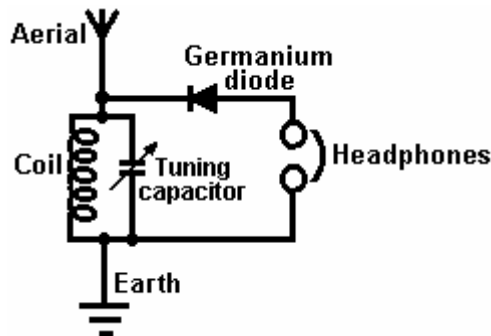


These have a coil of wire wound around a hollow former and a slider can be pushed along a bar, connecting the slider to different winds in the coil depending on its position along the supporting bar. The terminal connections are then made to the slider and to one end of the coil. The position of the slider effectively changes the number of turns of wire in the part of the coil which is being used in the circuit. Changing the number of turns in the coil, changes the resonant frequency of that coil. AC current finds it very, very hard to get through a coil which has the same resonant frequency as the AC current frequency. Because of this, it can be used as a radio signal tuner:



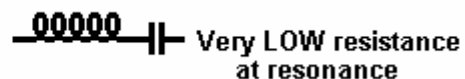
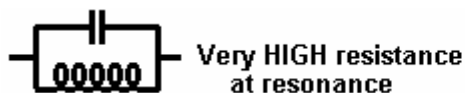
If the coil's resonant frequency is changed to match that of a local radio station by sliding the contact along the coil, then that particular AC signal frequency from the radio transmitter finds it almost impossible to get through the coil and so it (and only it) diverts through the diode and headphones as it flows from the aerial wire to the earth wire and the radio station is heard in the headphones. If there are other radio signals coming down the aerial wire, then, because they are not at the resonant frequency of the coil, they flow freely through the coil and don't go through the headphones.

This system was soon changed when variable capacitors became available as they are cheaper to make and they are more compact. So, instead of using a variable coil for tuning the radio signal, a variable capacitor connected across the tuning coil did the same job:

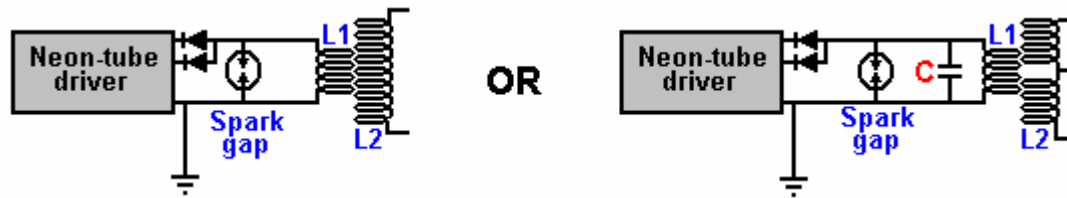


While the circuit diagram above is marked "Tuning capacitor" that is actually quite misleading. Yes, you tune the radio receiver by adjusting the setting of the variable capacitor, **but**, what the capacitor is doing is altering the resonant frequency of the coil/capacitor combination and it is the resonant frequency of that combination which is doing exactly the same job as the variable coil did on it's own.

This draws attention to two very important facts concerning coil/capacitor combinations. When a capacitor is placed across a coil "in parallel" as shown in this radio receiver circuit, then the combination has a very high impedance (resistance to AC current flow) at the resonant frequency. But if the capacitor is placed "in series" with the coil, then there is nearly zero impedance at the resonant frequency of the combination:



This may seem like something which practical people would not bother with, after all, who really cares? However, it is a very practical point indeed. Remember that Don Smith often uses an early version, off-the-shelf neon-tube driver module as an easy way to provide a high-voltage, high-frequency AC current source, typically, 6,000 volts at 30,000 Hz. He then feeds that power into a Tesla Coil which is itself, a power amplifier. The arrangement is like this:



People who try to replicate Don's designs tend to say "I get great sparks at the spark gap until I connect the **L1** coil and then the sparks stop. This circuit can never work because the resistance of the coil is too low".

If the resonant frequency of the **L1** coil does not match the frequency being produced by the neon-tube driver circuit, then the low impedance of the **L1** coil at that frequency, will definitely pull the voltage of the neon-tube driver down to a very low value. But if the **L1** coil has the same resonant frequency as the driver circuit, then the **L1** coil (or the **L1** coil/capacitor combination shown on the right, will have a very high resistance to current flow through it and it will work well with the driver circuit. So, no sparks, means that the coil tuning is off. It is the same as tuning a radio receiver, get the tuning wrong and you don't hear the radio station.

This is very nicely demonstrated using simple torch bulbs and two coils in the YouTube video showing good output for almost no input power: <http://www.youtube.com/watch?v=kQdcwDCBoNY> and while only one resonant pick-up coil is shown, there is the possibility of using many resonant pick-up coils with just the one transmitter.

With a coil (fancy name "inductor" and symbol "L"), AC operation is very different to DC operation. The coil has a DC resistance which can be measured with the ohms range of a multimeter, but that resistance does not apply when AC is being used as the AC current flow is **not** determined by the DC resistance of the coil. Because of this, a second term has to be used for the current-controlling factor of the coil, and the term chosen is "impedance" which is the feature of the coil which "impedes" AC current flow through the coil.

The impedance of a coil depends on it's size, shape, method of winding, number of turns and core material. It also depends on the frequency of the AC voltage being applied to it. If the core is made up of iron or steel, usually thin layers of iron which are insulated from each other, then it can only handle low frequencies. You can forget about trying to pass 10,000 cycles per second ("Hz") through the coil as the core just can't change it's magnetic poles fast enough to cope with that frequency. A core of that type is ok for the very low 50 Hz or 60 Hz frequencies used for mains power, which are kept that low so that electric motors can use it.

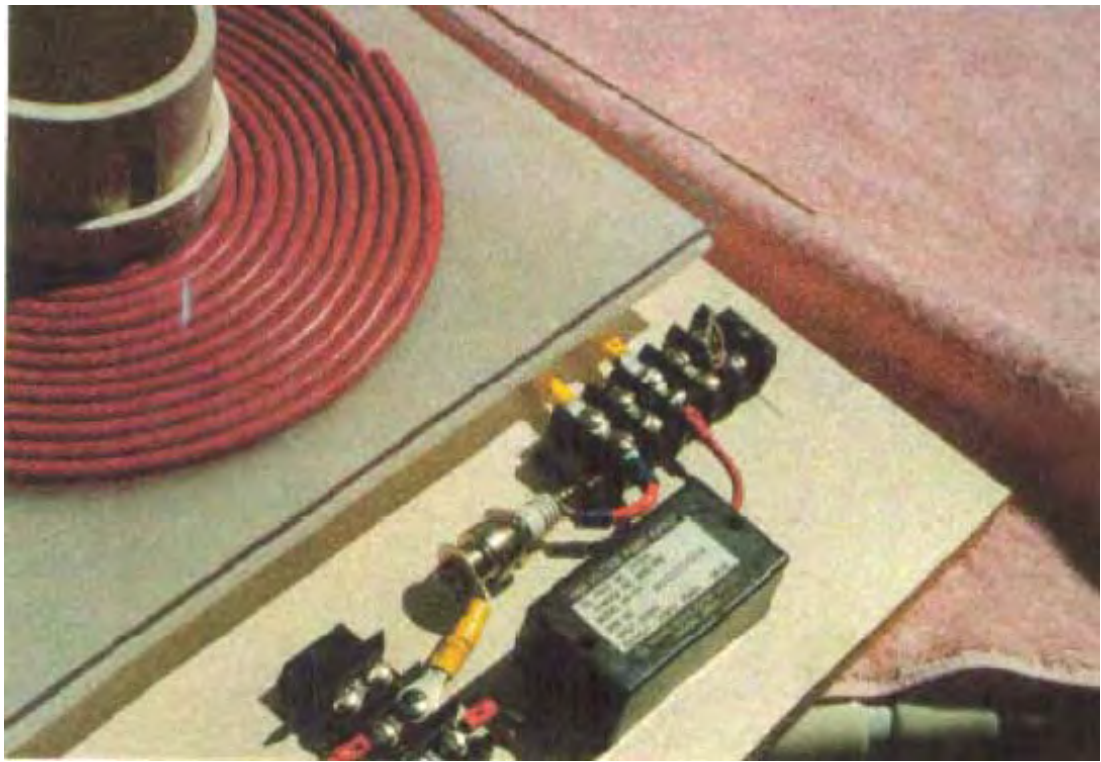
For higher frequencies, ferrite can be used for a core and that is why some portable radios use ferrite-rod aerials, which are a bar of ferrite with a coil wound on it. For higher frequencies (or higher efficiencies) iron dust encapsulated in epoxy resin is used. An alternative is to not use any core material and that is usually referred to as an "air-core" coil. These are not limited in frequency by the core but they have a very much lower inductance for any given number of turns. The efficiency of the coil is called it's "Q" (for "Quality") and the higher the Q factor, the better. The resistance of the wire lowers the Q factor.

Here is a copy of Don Smith's pdf:

RESONANCE ENERGY METHODS

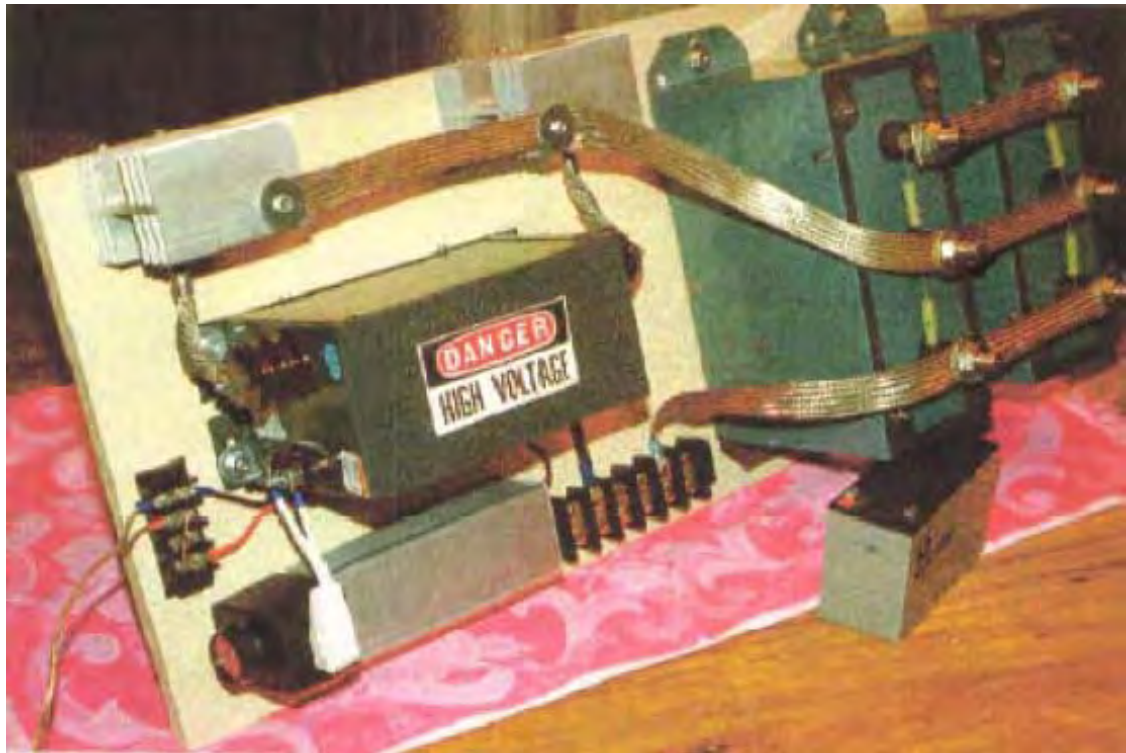
Donald L. Smith
TransWorld Energy, CEO
September 23, 2002

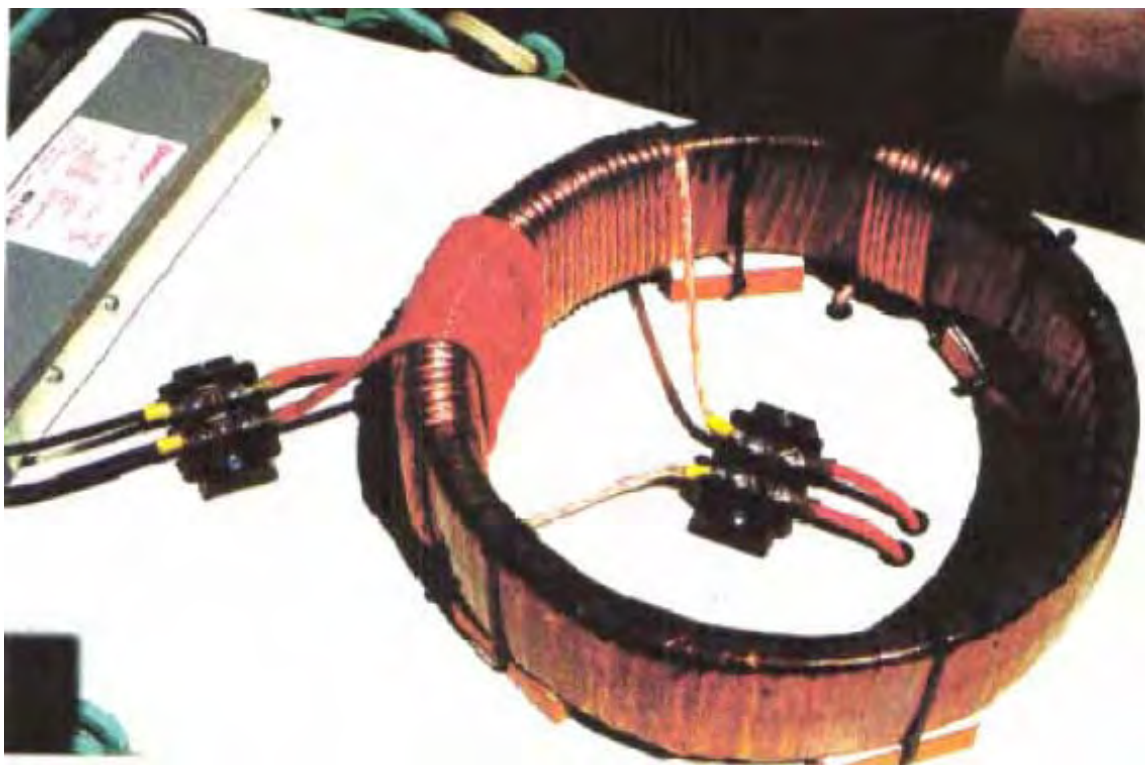
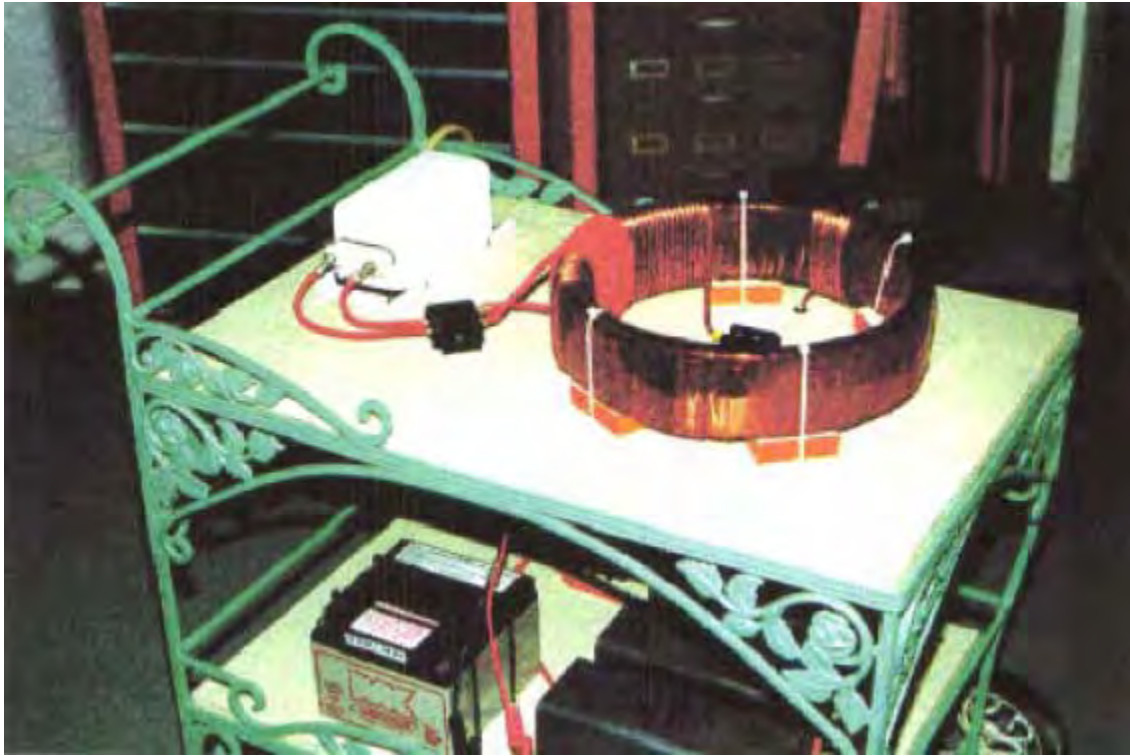
Fax/Phone 281-370-4547 and e-mail donsm1@earthlink.net

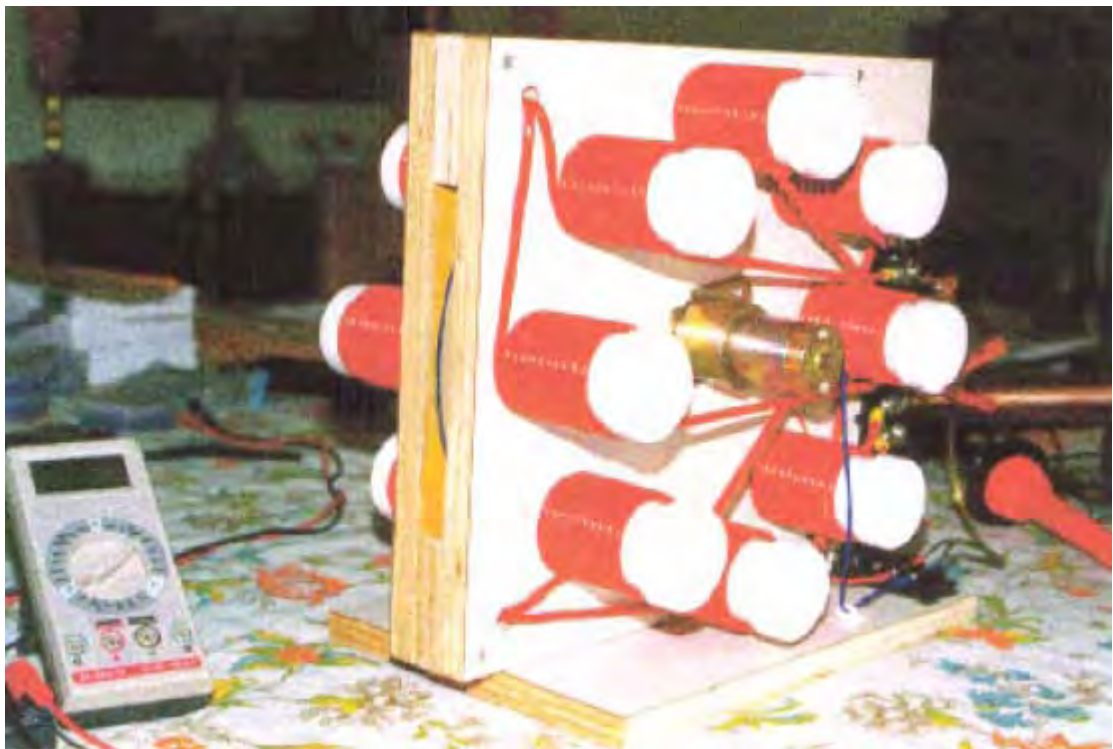
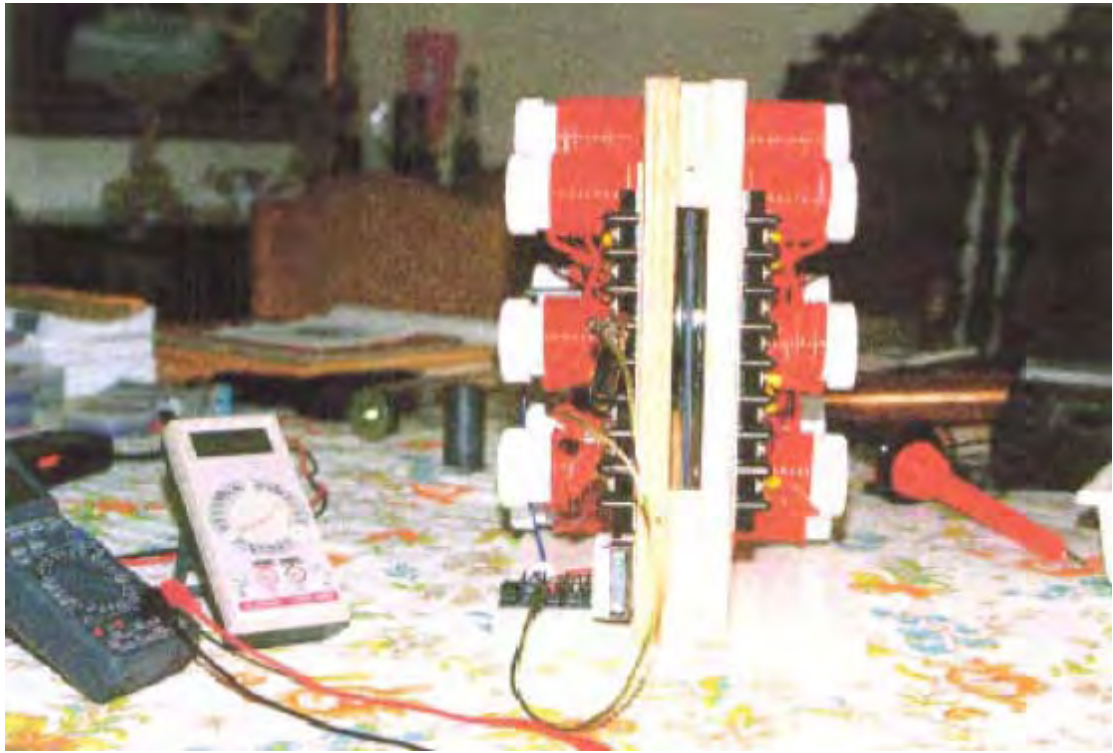


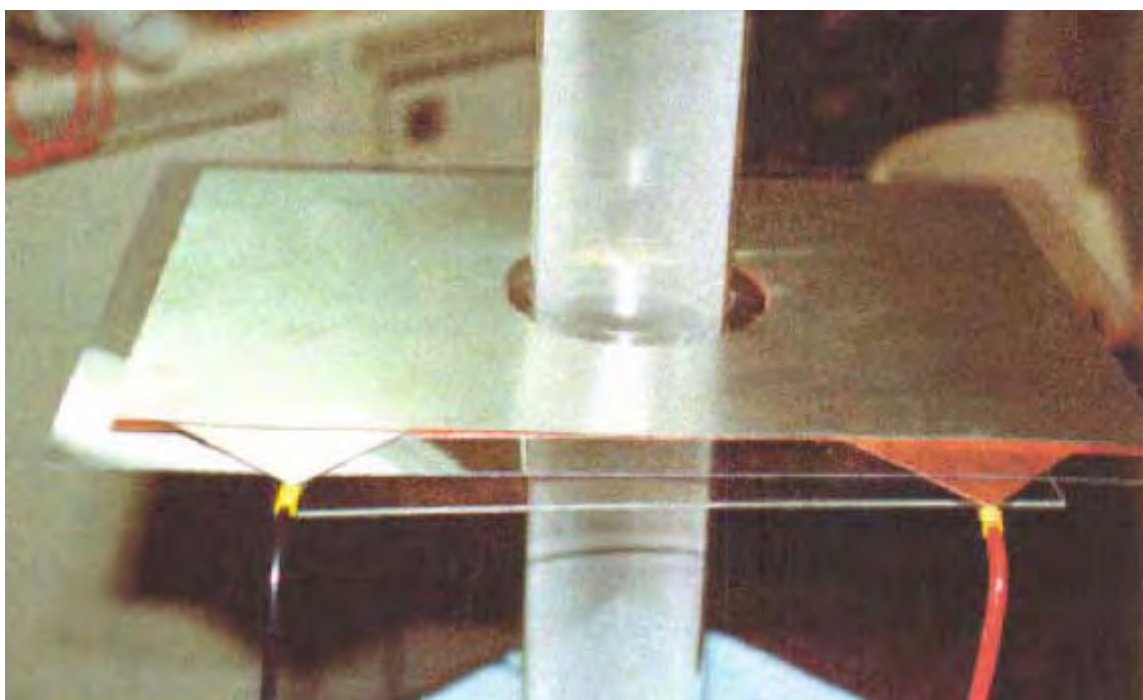


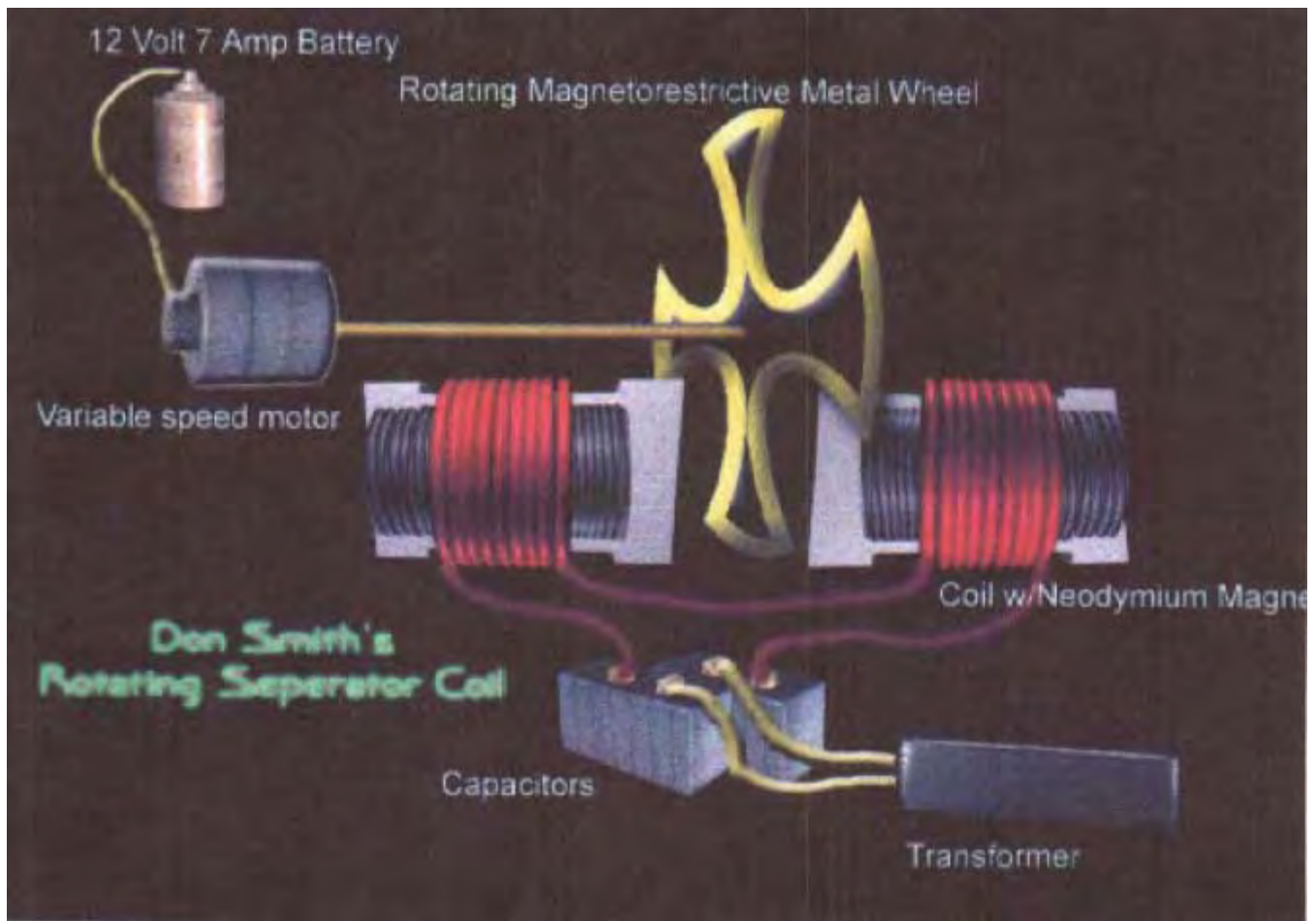












DIPOLE TRANSFORMER GENERATOR DESCRIPTION

TECHNICAL FIELD:

The Invention relates to loaded Dipole Antenna Systems and their Electromagnetic radiation. When used as a transformer with an appropriate energy collector system it becomes a transformer generator. The invention collects and converts energy which, with conventional devices, is radiated and wasted.

BACKGROUND ART:

An International search of Patent Databases for closely related methods did not reveal any prior Art with an Interest in conserving radiated and wasted magnetic waves as useful energy.

DISCLOSURE OF INVENTION:

The Invention is a new and useful departure from transformer generator construction, such that radiated and wasted magnetic energy changes into useful electrical energy. Gauss Meters show that much energy from conventional electromagnetic devices is radiated back into the ambient background and wasted. In the case of conventional transformer generators, a radical change in the physical construction, allows better access to the energy available. It is found that creating a dipole and Inserting capacitor plates at right angle to the current flow,

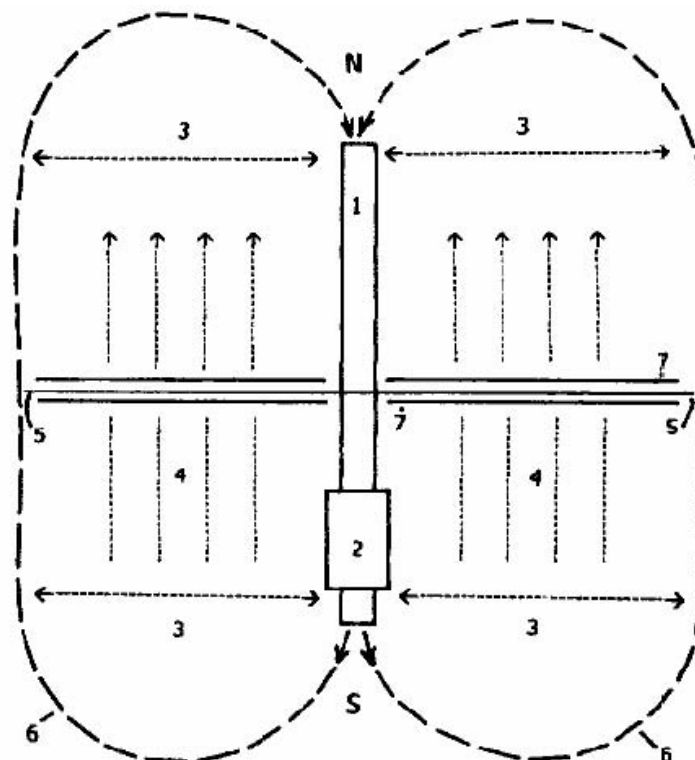
allows magnetic waves to change back to useful electrical (coulombs) energy. Magnetic waves passing through the capacitor plates do not degrade and the full impact of the available energy is accessed. One, or many sets of capacitor plates, may be used as desired. Each set of plates makes an exact copy of the full force and effect of the energy present in the magnetic waves. The originating source is not depleted or degraded as is common in conventional transformers.

BRIEF DESCRIPTION OF THE DRAWINGS:

The Dipole at right angle allows the magnetic flux surrounding it to intercept the capacitor plate, or plates, at right angles. The electrons present are spun in such a way that the electrical component of the electrons is collected by the capacitor plates. Essential parts are the South and North component of an active Dipole. Examples presented here, exist as fully functional prototypes, and were engineer constructed and fully tested for utility by the Inventor. Corresponding parts are utilized in each of the three examples as shown in the Drawings.

DRAWING 1 OF 4: VIEW OF THE METHOD

N = North and S = South of the Dipole



1. North and South component of the Dipole.
2. Resonate High Voltage induction coil.
3. Dipole's electromagnetic wave emission.
4. Heaviside current component.
5. Dielectric separator for the capacitor plates.
6. For purposes of the drawing, a virtual limit of the electromagnetic wave energy.
7. Capacitor plates with dielectric in between.

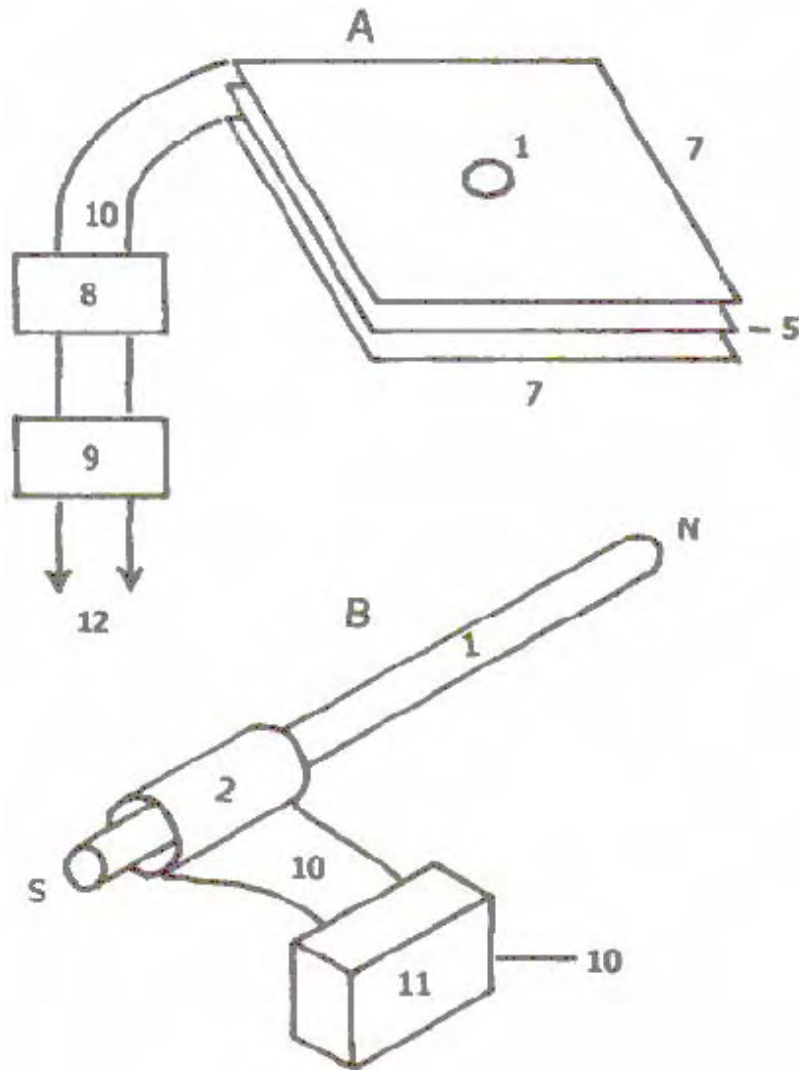


Fig.2-A:

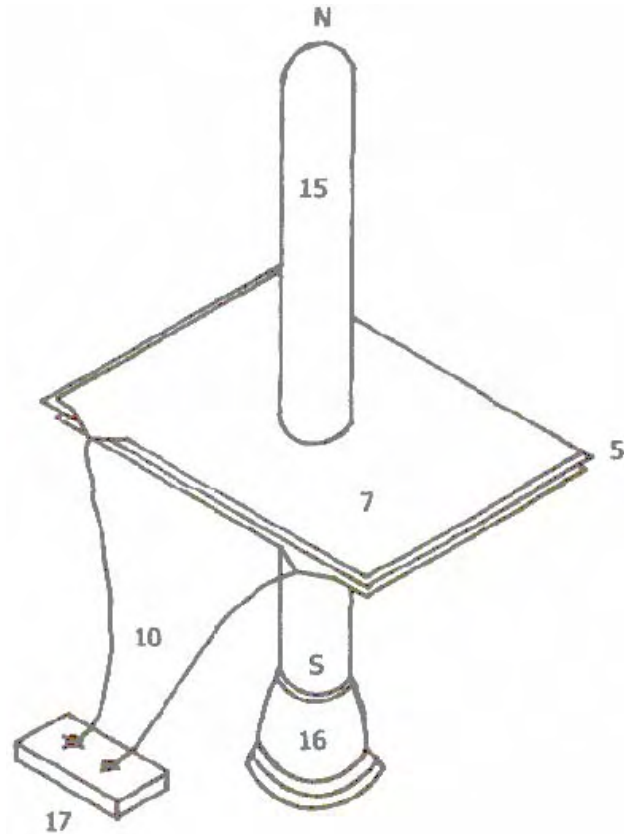
1. Hole for mounting Dipole B-1.
2. Resonate high voltage induction coil.
5. Dielectric separator, a thin sheet of plastic separating the capacitor pl
7. Capacitor plates, upper plate is aluminium and lower plate is copper.
8. Battery system, deep cycle.
9. Inverter. Input: Direct Current, output 120 Volts at 60 cycles per second.
10. Connector wires.
11. Output to point of use being the load

Fig.2-B N = North and S = South component of the Dipole

1. Metal rod, being soft magnetic metal such as iron.
2. Resonate high voltage induction coil.
10. Connector wires.
11. High Voltage input energy source such as a neon tube transformer.

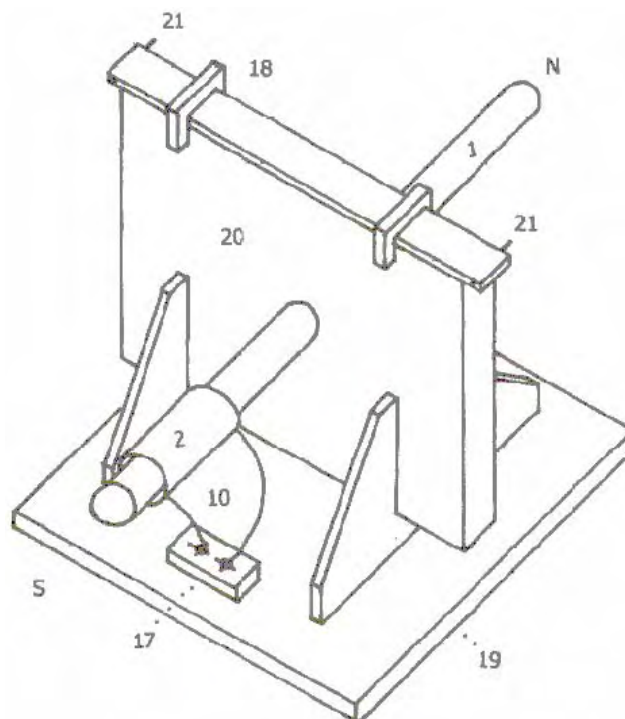
DRAWING 3 OF 4 : Proof of Principle Device, using a Plasma Tube as an active Dipole.

N = North and S = South Components of the active Dipole.



- 5. Dielectric separator of the capacitor plates.
- 7. Upper capacitor plate: upper plate is aluminium and lower plate is copper.
- 10. Connector wires.
- 15. Plasma Tube, 4 feet long and 6 inches in diameter.
- 16. High Voltage Energy source for the active Plasma Dipole.
- 17. Connector block: outlet for testing and use.

DRAWING 4 OF 4: Manufactures Prototype, Constructed and fully tested.



- 1. Metal Dipole rod.
- 2. Resonate High Voltage induction coil.

10. Connector wires.
17. Connector block for Input from high voltage energy source.
18. Clamps for upper edge of capacitor packet.
19. Support Device for The Dipole Transformer Generator.
20. Packet of Capacitor Plates.
21. Output connectors of the capacitor, producing energy into a deep cycle battery which then powers the inverter.

BEST METHOD OF CARRYING OUT THE INVENTION:

The Invention is applicable to any and all electrical energy requirements. The small size and high efficiency makes It an attractive option. It is particularly attractive for remote areas, homes, office buildings, factories, shopping centres, public places, transportation, water systems, electric trains, boats, ships and all things small or great Construction materials are readily available and the skill level required is moderate.

CLAIMS:

1. Radiated magnetic flux from the Dipole, when intercepted by capacitor plates at right angles, changes to useful electrical energy.
2. A Device and method for converting for use, normally wasted electromagnetic energy.
3. The Dipole of the Invention is any resonating substance such as Metal Rods, Coils and Plasma Tubes which have interacting Positive and Negative Components.
4. The Resulting Heaviside current component Is changed to useful electrical energy.

ABSTRACT

An Electromagnetic Dipole Device and Method, wherein, radiated and wasted energy is transformed into useful energy. A Dipole as seen in Antenna Systems is adapted for use with capacitor plates such that the Heaviside Current Component becomes a useful source of electrical energy.

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September 23.2002

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Dear Reader:

TransWorld Energy is dedicated to improving the Human Condition in the Field of Energy which, at the same time, makes possible Healthy Water and increases the food Supply. A never-ending source of energy found throughout the universe is easily accessed with the minimum of effort and cost. The technology for doing this has been around since the 1820s. Selfish special interests have made sure that the technology remains discredited. People who control the Energy Sources control the World.

Extensive research and development by TransWorld and Associates has been progressing for more than 15 years. Numerous successful Energy Producing Devices have been produced and demonstrated throughout the World. Some of these can be viewed by the Web Site located using any major search engine (such as Lycos, Yahoo, Altavista, NorthernLight and more than 2,000 others throughout the World).

The Book which You are viewing has more than 40,000 copies in circulation. It has been translated and distributed in all major languages including Japanese, Arabic, Portuguese, French, Italian, Russian, Chinese, German, Spanish and many more. There are seven editions in circulation. An enormous interest is evident in the subject matter. An average of about fifty e-mails per day are received from the

ends of the Earth (that is about 1,500 per month).

Once the Web Site and the book are viewed, it will become evident that abundant, self- sustainable energy is available everywhere for the taking. This is natural energy which does not harm the environment or those using it. The proper Device for Collecting is all that's required.

The Good News is that the problem is solved and with assistance, an ultimate source of energy which is environmentally benign, abundant throughout the universe and inexpensive to capture, is there for the taking.

Thank You for your consideration

Donald L. Smith, CEO



Electrical Energy Generating System

Description and Function:

The Generation of Electrical Power requires the presence of electrons with various methods of stimulation, yielding magnetic and electrical impulses, collectively resulting in Electrical Energy (Power). In place of the mechanical - coils and magnet system, present in conventional electrical power generation, visible moving parts are replaced by resonate magnetic induction, using radio frequency. Transfer of energy by resonate induction is related to the ratio of the square of the cycles per second.

The Energy System, presented here, operates at millions of cycles per second verses the conventional 60 C.P.S. This tells us that it has a frequency advantage over conventional methods. This same advantage applies to the amount of electrical energy output. Therefore the Device is small in size and produces large amounts of Electrical Energy. The Electrons acquired, are from the surrounding Air and Earth Groundings, being the same source as in conventional methods. This is accomplished by magnetic resonate radio induction.

Applications:

This Electrical System adapts nicely to all Energy Requirements. It is a direct replacement for all existing Energy Systems. This includes such things as Manufacturing, Agricultural, Home Usage, Office Complexes, Shopping Centers, Rail Transportation, Automobiles, Electrical Power Grids, Municipalities, Subdivisions, and Remote Areas. Briefly, the only limiting factor is the imagination.

Economic Possibilities:

No Historical Reference Point exists for a comparison of the Possibilities of this System. One can see from the impacted applications listed above, that the magnitude exceeds any known invention, presently

a part of the Human Experience.

Present and Future Plans:

The Energy System has been in the developmental stage during the past seven years. It is Patent Pending # 08/100,074 with the Patent Office. No prior art exists according to the Patent Office's response. The System is presently being introduced into the World Market.

Useful energy occurs as the result of imbalances in the ambient background energy, which is a transient phenomena. In the electrical field, it is a closed system subject to heat death, which severely limits it's utility. The flip side of the electron, produces magnetic waves which are an open system, not subject to heat death. These waves, being unrestricted, are the universal source of energy when unlimited resonate duplicates from this one source are available. Therefore, the key to unlimited energy, is Magnetic Resonance. In order to understand this, requires putting a stake through the Heart of Antique Physics. Non-linear and Open Systems are universally available in Magnetic Resonance Systems, Explosions of any sort [including Atomic Explosions] and Combustibles of any type. Mechanical equivalents would be levers, pulleys and hydraulics. A highly obvious example is the Piano where the Key impacts the one note giving one sound level, which resonates with it's two side keys providing a much higher sound level. Magnetic Resonance Energy clearly amplifies itself, demonstrating more energy out, than in.

Ohmic resistance does not apply to Magnetic Resonance which travels unrestricted for great distances, therefore multitudes of electrons are disturbed, and their back-spin translates magnetic into usable electric energy. The right angle component which the magnetic flux provides, translates into useful electrical energy. Taken at right angles, the Magnetic Dipole provides an unlimited source of electrical energy. The writer is recognized world-wide for his knowledge and experience. See his Web Site at altenergy-pro.com.

Gravity is a function of spin phenomenon as observed in gravity separation of liquids. When spun, milk and cream separate. Therefore, relative specific gravity is function of mass versus spin. Magnetics and gravity are both spin related. In part, a top levitates when spun. Therefore, spinning magnetic fields are a functional motor source as in flying saucers.

ABSTRACT: Technology of New Energy:

Developments in the understanding of Electricity, along with Materials which were not previously available, allows the construction of Devices which collect energy in large quantities, from the Earth's Ambient Electrical Background. This Energy is naturally occurring, environmentally benign and is available everywhere. It is available wherever and whenever it is required. New Devices use Resonate Magnetic Waves which replicate upon spinning the locally present electrons, providing multiple duplicate copies of the Energy Present. Each electron when spun yields both magnetic and electric waves in equal proportion. The electrical component is a closed system limited by Ohms Law. The magnetic component is an open system not limited and it replicates multiple copies of the energy present.

Special materials and recent developments allow the magnetic energy to reproduce, through resonance, unlimited duplicate copies acquired from the ambient background. These Devices harvest the energy that has been, and is always present universally. Conventional methods consist of coils and magnets systems. Upon moving past each other, the magnetic flux field disturbs electrons which yield electricity, which is collected by the coils system. This is accomplished electronically with the new technology, without any moving parts and the energy is multiplied such that the Device becomes self-sustaining once

it is started. This Technology, already presented Worldwide, will be shown at the Conference.

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"Putting a stake through the Heart" and thus removing the mental block created by antique physics is required. Conditions wherein this becomes necessary are non-linearity, resonance and explosions of any sort. Combustibles of any sort such as gasoline and atomic explosions are good examples wherein more energy out than in, is obvious. You can add to that the non-linearity found in pulleys, hydraulics, steam power and suchlike. Magnetic resonance is a highly obvious source for multiplying energy output. The sound system present in the piano, demonstrates this very clearly. Energy amplification clearly present in the above, demonstrates the silliness attested to by many Physicists.

Ohmic resistance does not apply to magnetic resonance which travels unrestricted for great distances, therefore multitudes of electrons are disturbed, and their back-spin converts from magnetic energy to usable electric energy. These same electrons have been around from the beginning of time and they are undiminished and will remain so until the end of time.

ELECTRICAL ENERGY SYSTEMS PREFACE

Useful Electrical Energy is obtained directly from electron spin induced by incoming magnetic waves, or indirectly through mechanical exchange as in dynamo type devices. Simply put, electron spin converts from magnetic to electrical energy and vice versa. Nature provides grand scale magnetic wave induction throughout the universe, for free. In Electrical Systems, movement is at right angles to the direction of current movement. This explains the rotary movement of the Earth and other related Systems. The rate of Spin for the Earth is known as well as the mass (5.98×10^{24} Kg - "Physics for Scientist and Engineers", by Raymond A. Serway, Saunders College Publishing, 2nd Ed. page 288, Table 14.2), therefore the amount of incoming Electrical Energy which produces this action can be calculated.

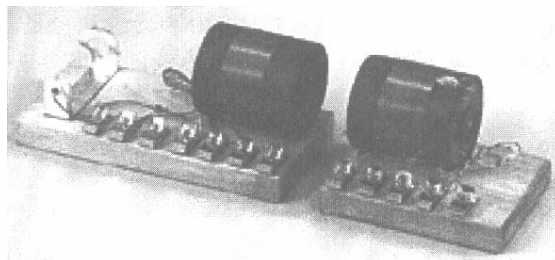
It can be seen quite easily, that the incoming magnetic wave energy is Vast and Continuous. As an accretion mass, the Earth is an Energy Sink, getting its energy from elsewhere, being Cosmic, Galactic and Solar. Conversion of incoming magnetic waves into electrical energy provides an unending, inexpensive and environmentally friendly source available to all. Cosmic and Galactic Energy is available twenty four hours per day. Large amounts of this Energy accumulate in the Earth's radiation belts. This Giant Energy Storage, when properly understood, provides a major source of free unending electrical energy. Each of My Inventions plugs into this vast energy source.

A perverse, Intentional Ignorance on the part of the Establishment, prevents recognition of the importance of the Energy Systems shown here. Any new system which is favourable towards the masses, is considered as disruptive, and therefore not allowed. Those who have the (Gold) Energy Rule (Golden rule) Mandated Destruction of all Humanity is not a consideration.

This Presenter will remove some of the Fog placed with the intention of preventing the recognition of this unending, environmentally clean, electrical energy Source, which is present everywhere throughout

the Universe. The Cost of Harvesting and Using this Free Energy is a function of Human Stupidity.

RESONANCE CIRCUITS DEMO



Used to demonstrate electromagnetic radiation between two UC circuits - one a transmitter and the other a receiver. When the 1.5 volt power transmitter is pulsed, the radiated signal is picked up by the remote receiver circuit which then lights up a 70 volt neon lamp.

With this apparatus, the student quickly understands some basic principles governing wireless communication, broadcasting, etc.

Kit: #10-416

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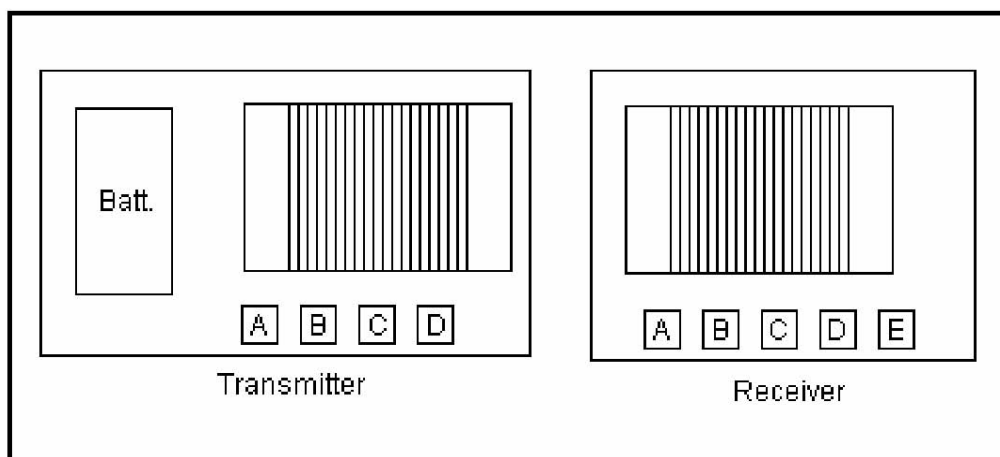


Diagram of transmitter and receiver coils

ULTIMATE ENERGY SOURCES

A human is a speck of dust on Earth, the Solar System is a speck of dust in the Galaxy and in turn, the Galaxy is a speck of dust in the Universe (Cosmos). All of these respectively represent vast ambient energy reservoirs. Awareness of the Sun, opens doors into other energy sources. Electromagnetic Energy which is present everywhere throughout the Universe, is accessed by catalytic activity, directly as in Solar Cells or indirectly as by mechanical means. Resonate, Magnetic Waves (Faraday's "Action at a Distance") allow Energy Activation Transfer to remote points of usage. The method of capture and use of this Energy is optional, and therefore it's cost is a function of Human Stupidity (Free-Energy).

Direct access is more desirable, and technology transfer from Solar Cell-type Devices provides the Catalyst. Enormously high Ambient Energy Levels are not detected by instruments that use the Ambient Background as a Reference Plane. A spoonful of water lifted from the Ocean does not define the Ocean. Incoming magnetic waves are reflected, Deflected or absorbed. Deflected Magnetic Waves spin electrons sideways producing useful Electrical Energy. Absorbed Wave Energy produces heat, therefore a hot interior for the Earth. In Electrical Systems physical movement is in the direction of current flow, frictional drag from inflow current defines gravity. Accretion masses resulting from Energy Sinks, provide all solid entities with their respective gravitational effect.

Increasing the tolerance level for Intellectual Awakening opens Doors of Reality. These doors blink into, and out of existence, and upon recognition, benefit Mankind. Opening some of these Doors, which at the present time are seen through a deep fog, is our purpose. Exploring Unrecognized Energy Sources, which are a Part of the Ambient Background, is another goal. Our Available Instruments do not use reference planes which allow recognition of this energy, as we shall see, vast Energy Sources that totally surround us are available through Technology Transfer. They are inexpensive (Free), fully self-renewable and environmentally benign.

Incoming Magnetic Wave Energy with Faraday's "action at a distance" will be looked at closely. Particle Physics will be left for the Astrophysics. Excited Electrons at point "A" the Sun (including the Galaxy and Cosmos) do not travel to point "B" the Earth, however a corresponding action occurs at point "B". The Electrons being disturbed at the Central Power Plant, in the same manner excite the Electrons at Your House, upon switching into an Earth grounding (known as "flipping the switch"). Correspondingly, there are Four Major Power Sources providing enormous amounts of Ambient Background Magnetic Wave Energy. They are The Cosmic, Galactic, Solar and Earth's Ambient Electromagnetic Backgrounds. The Earth's Electromagnetic Field comes from reflection, deflection and absorption as a result of action at a distance from the above.

Prescription Physics mandates that the Earth's background is of little interest. When we have Considered the evidence herein, it will become obvious that Special Interest's effort at keeping the People ignorant has, until now, largely succeeded.

Information for the entire World is available regarding the Magnetic Flux Background of the Earth's Surface (United State's Geological Survey, Colorado, USA, Office). When examined and properly understood, these Maps yield important information regarding reflection, deflection and absorption of incoming Magnetic Waves, plus action at a distance. When properly understood, these Maps reveal a very large Ambient Electromagnetic Energy Source. This is the Part of the Earth's Energy System that relates to the Bird on the High Voltage Line. When deflected, magnetic flux from electrons changes to electrical flux, providing the Motor System that spins or rotates the Earth. Physical movement by electrical systems is from inflow current movement. What level of current movement is required to spin the Earth? The Earth's Mass is 5.98×10^{24} . From this Information, the Watts of Electricity Required may be calculated! Absorbed microwave flux energy heats from the inside out, therefore a hot interior of the Earth results. Water is strongly diamagnetic, and on windless days, ocean waves provide visible Proof of the overhead incoming magnetic flux. From the information above, the Earth's weight and rate

of spin allows the calculation of the amount of incoming ambient background energy required. As You can see, it is not inconsequential as Prescription Physics mandates.

Astrophysicist are concerned with charged particles that whiz by, once every one hundred years, rather than Wave Phenomenon associated with action at a distance. This highly Active Wave Energy translates into Electrical Energy at point "B". The Galaxy is alive With Energy which is billions of times greater than that of the Sun. Visible Light is a very tiny part of the Electromagnetic Energy Spectrum. Frequencies present in the Galaxy and Cosmos allow Radio Telescope photographs of their existence and magnitude. One such 408 MHz photograph of the Electromagnetic Energy Spectrum shows that the Earth is a tiny speck of dust in this Enormous Ocean of Energy, and can be seen near the left end of the Central High Energy Area.

This Energy extends in all directions. Accretion and formation of Planets, Suns and Galaxies are results of energy sinks and variable sized black holes. Mass retains heat, and is cooked from the inside out by the microwave background energy provided by the Universe. Flux movement into energy sinks, provides the frictional force know as gravity. Spinning mass in the presence of incoming flux amplifies the gravitational effect.

At present, only Solar Energy is recognized. It is inconsistent, flaky and a very small Part of the Magnetic Wave Energy Present. Technology Transfer from Solar Power provides uncomplicated and inexpensive, direct access to the Other Greater Energy Sources. All Electromagnetic Energy harvesting methods include a Catalyst, a Collector and a Pump. Catalysts include sensitization through doping with certain elements, air and earth groundings. Collectors include temporary storage as in Capacitors, Coils and Transformers. The Pump System includes induced movement onward to the point of use. Conventional rotating coils and magnet systems activate electrons present, such that action at a distance can occur, therefore it is an energy activation pump. In Direct Access Systems such as Solar Cells, the same occurs without mechanical action. Direct access occurs when Magnetic Waves impact a catalyst, spinning the local electrons sideways, producing useful electrical energy.

Indirect acquisition of electrical energy by mechanical means is wasteful, troublesome, expensive and degrades the environment. The dynamo is a combination collector and pump of energy which is collected from the Earth's Ambient Energy Background. Generators do not. make electricity, they collect it from the Ambient Background and forward it, as in Faraday's "action at a distance". Energy Conservation Laws relating to these systems, relate to grey areas, and when understood, are excluded because of the existence of External forces, open and non-linear systems as per Einstein. The Knowledge Base just viewed, provides a Direct Understanding of the Requirements for Harvesting of unending, fully renewable, environmentally benign Sources of Electrical Energy.

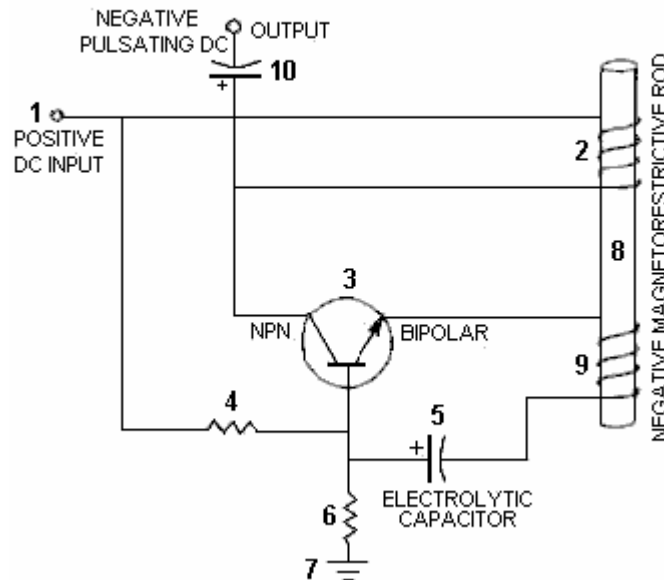
Magnetic Resonance Power System Suggestions for Construction

This is the Basic Sonar Power System which permits submarines to see approximately 50 miles distance. What is not commonly known is that it works better at higher frequencies in the Gigahertz range. Any Device that can radiate 50 miles plus, is producing an enormous electromagnetic disturbance from a small input into a rod of magnetostrictive material. Disturbing the Earth's Ambient Background plus the strong dipole being produced, turns the magnetostrictive rod into a combination of a receiving antenna and a vastly superior output transformer.

The Drawing is only the Key Unit. A power input module and an output inverter circuit (diode bridge plus output transformer) are also required. The metal core and the wire size of the output transformer, plus adjusting the Earth Grounding of the Load, will determine the Amperage.

The Ideal rod material is Terfenol-D (check the internet). However a 1.5" diameter 10" long rod, costs over \$5,000 each. Less expensive alternatives are obvious. When constructing, use PVC tubing with removable caps. Wind the coils on it and insert the experimental rod. Use only magnetostrictive material. When you get it right, you will have exactly what the Doctor ordered:

Magnetic Resonance Power System for Water Systems Donald L. Smith



Magnetostriction oscillators work by magnetic resonance in a rod of magnetostriction material. This rod serves two purposes: It vibrates at the frequency of resonance oscillation, and it becomes the feedback transformer. Frequency is determined by items 4, 5, 6 and 8. The diameter, length and volume of the rod and output windings, determines the output. Item 2 provides feedback into the system. The negative magnetic character of item 8 plus the windings 2, in reaction to the magnetic flux field provided by 9, increases (amplifies or magnifies) the output. Magnetic permeability is the counterpart of negative resistance. Resonating with negative magnetic resistance, it pumps energy from the Earth's ambient background. Magnetic permeability is the ratio of flux density (Earth's B field) to the magnetizing force (H) in oersteds.

Magnetostrictive materials are piezoelectric in character, and have a very high resistance to electrical current flow. Examples are:

1. Permealloy Negative Magnetic Permeability > 80,000
2. Sendust Negative Magnetic Permeability 30,000 -120,000
3. Metglas Negative Magnetic Permeability > 200,000
4. Iron with (34%) Cobalt Magnetic Permeability 13,000
5. New Technology Magnetic Permeability > 1,000,000

ELECTRICAL ENERGY SYSTEMS METHODS

1. **DIRECT** - Faraday's "Action at a Distance" incoming magnetic wave conversion to useful electrical energy. This includes Cosmic, Galactic, Solar and Magnets. Technology Transfer is from Solar Cell Technology.
2. **INDIRECT** - Electron Stimulation-Induced Electron Spin Systems, Electron Avalanche Pumping Systems

Primitive, Indirect Conversion from another form of energy. Coils and Magnet as in Dynamo Systems (Closed Systems). Chemical Systems, Atomic, Pons & Fleischman and etc.

Advanced, Direct Conversion, Magnetic Wave (Open Systems).

Ambient Sources

Air Core Coil Systems

Gaseous Tube Systems,

Solid State Marx Generator Avalanche Type Systems.

Leyden Bottle Capacitor Types inserted in Lakes and other.

Magnet Systems

Electron Beam Antenna Systems

3. TRANSFER MECHANISMS

Solids - as in metal conductors

Gaseous as in radio wave transmission, a form of ionization.

Sensitizing of Systems by use of Trace Doping with Radioactive elements, includes metal surfaces.

Open Systems, non-linear with external forces. Albert Einstein in a direct quote from his biography states that these are excluded from the conservation of energy laws.

Closed Systems Maxwellian Type Systems. Mathematics are predictable requiring deductive reasoning. Ohm's Law is King, and Establishment Intellectuals being comfortable with this, brand all else as a violation of the Laws of Nature by obtaining something for nothing. This is Dishonesty grand mal.

AMBIENT ENERGY SOURCES

<i>Radiation System</i>	<i>Diffusion Method</i>	<i>Magnetic Wave Energy</i>
1. Cosmic	Reflection, Deflection and Absorption	Ultraviolet
2. Galactic	Reflection, Deflection and Absorption	Infrared
3. Solar	Reflection, Deflection and Absorption	Visible Light
4. Earth	Reflection, Deflection, Absorption, Faraday's "Action at a Distance" also, a Composite of all of the above	Earth's Electrical

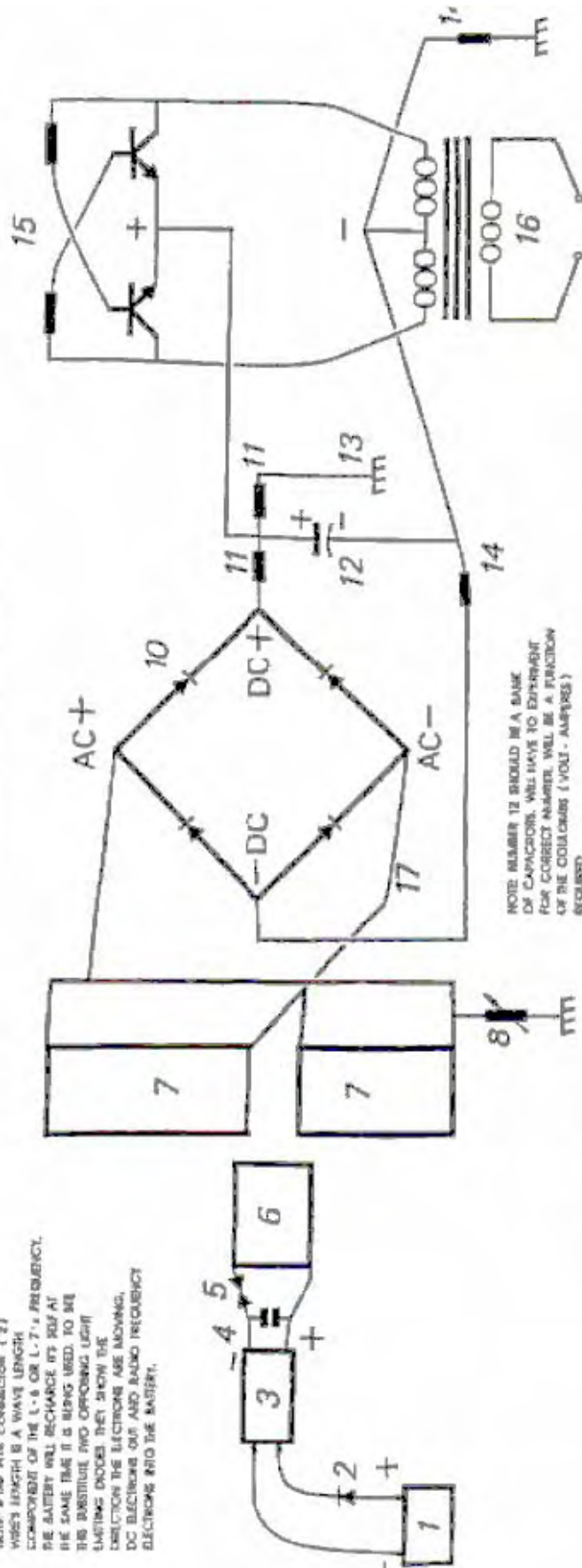
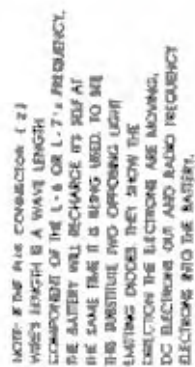
A deep fog pervades the entire Scientific Community with regards to the Significance of the Above Energy Sources. Magnetic Waves convert directly into Electrical Waves (useful electricity). Two sides of the electromagnetic system are always present and never separate. Local electron spin provides (action at a distance) the flip side of the incoming magnetic wave energy.

Enormous amounts of incoming magnetic wave energy becomes a part of the Ambient Background, and as such, cannot be measured directly. Reconstruction from indirect information, allows us to establish the actual energy levels which are present. Instruments provided by the Scientific Community measure only point "A" to "B", and when both are ambient, no potential energy is shown. This is the "bird sitting on the million volt power line and sensing nothing" approach. The Earth's actual ambient background has as it's Energy level multi-billions of Volts, which are conveniently and obviously ignored by the

scientific community. When properly understood, this enormous, never-ending source of environmentally-friendly energy becomes available.

ELECTRICAL ENERGY GENERATING SYSTEM

Patent Pending 08 / 100,074



1. Gelcel 6 or 12 Volt,
2. Diode, Pass. use a Varactor.
3. High Voltage Module, Constituting the L-1 and L-2 Coils.
4. Capacitor, TDK 10.9 Pf., 30 KV.
5. Spark Gap, Small Engine Spark Plug. Gap = .0025 in.
6. Induction Transfer Coil L-3.
7. Induction Receiving Coil L-4.
8. Voltage Control Shunt.
9. Frequency Adjustor, prevents derailing by Diode Bridge
10. Diode Bridge, 200 Nanosecond, R.F., > 100 KV.
11. Voltage Divider Circuit, corrects voltage for next stage.
12. Capacitor, electrolytic, smooths out DC + ripple effect.
13. Earth Ground.
14. Voltage Divider Circuit, corrects voltage for Transformer
15. Inverter Circuit, DC + in and 60 CPS to Transformer
16. Output from Transformer to Load (Work).
17. Center Tap

17 JANUARY, 1977

Electrical Energy System

Don L. Smith, Energy Consultant

At a meeting between J.P. Morgan, Edison and Tesla, Tesla proposed an Electrical Energy System which could be connected directly, without using a meter. Tesla's Idea of "Free Energy" was not compatible with their thinking. Courtesy of Morgan and Edison, from that day forward, a complete and total bastardization of the Idea has been in progress. Agents for Morgan and Friends include the U.S. Patent Office and Academia. Academia's bad habit of incestuous quoting of each other, eliminates them as a possibility in cleaning up the mess. This selective ignorance, permeates throughout the study of electricity.

Many people, otherwise known as "intellectuals", have a total blackout and become jabbering idiots when "free-energy" is mentioned. The term has been amended to say, "something which was never there is being harvested and that this violates the laws of physics". For the selectively ignorant, this seems the way to run. Those who choose Morgan's drum beat, have severely limited the possibilities built into electricity.

This paper will be an exercise in creative understanding, in placing updated knowledge at your disposal. Whether it becomes a useful tool or is selectively ignored is your choice.

Electrons are defined as being the practical source of electrical and magnetic energy. The electron as a particle, was postulated by professor J. Thompson in early 1900's. It is now universally accepted that the electron exists and that it is the source of electricity. When the electron is agitated it produces magnetic and negative electrical energy. Physics as it exists today, cannot explain why the electron remains intact and is not diminished by the energy it releases. This is a part of the built-in ignorance provided by the Morgan and Edison Camp.

One volt worth of electrons, when cycled, yields one volt worth of electricity. This can be repeated continuously forever and it never deplete or diminishes the electrons in question. They simply return to their air and/or earth source, waiting to do the whole thing again and again. Therefore, electrical energy is available, anywhere and everywhere humans go. People who intercede for profit, set the cost of electrical energy. Otherwise, all electrical energy is free, Morgan and Edison be damned.

Improving upon Professor Thompson's postulation, other obvious characteristics can be seen to further define the electron. It has both magnetic and electrical emanations resulting from a right-hand and left-hand spin. Since magnetism and amperage come as one package, this suggests, that electrons in their natural non-ionic state, exist as doublets. When pushed apart by agitation one spins and supplies electricity and the other spins and provides magnetic (amperage) energy. When they reunite, we have Volts x Amperage = Watts. This Idea, until now, has been totally absent from the knowledge base.

The number of times that an electron is cycled, sets the collective energy potential present. The electrical equivalent of $E = mc^2$ is $E = (\text{Volts} \times \text{Amperes}) \times (\text{Cycles Per Second})$. Those who choose, are now free to head for the bushes and make their usual contribution to humanity.

Prior to Tesla, there was a large group of people in Europe, who were building resonant coil systems for medical use. Amperage was dangerous in their coil systems. The Tesla Coil is only the Voltage half of their coil system, as will be demonstrated.

A short list of those (from 1860 onwards) active in resonate high frequency coil systems include; the Curies, Roentgen, Ruhmkoff, Oudin, Hertz, Levassor, Dumont, D'Arsonval and many others.

Peugeot, Panhard-Levassor, Bollee, Renault and others had successful electric automobiles in production using A.C. motors. Various electrically-powered airships, including the Dirigible "France" were in

service.

D'Arsonval, Professor of Experimental Medicine at the College of France, invented the electrocardiograph, oscilloscope, amp and volt meters, thermography and numerous other medical applications of high frequency electricity. As early as 1860, he was building high frequency coil systems, which he used in his experimental work. There is a strong connection between the work of Tesla and the people mentioned above.

Electric vehicles of all sorts, dominated until the 1920s, when the electric starter motor made the internal combustion engine practical. Prior to that, upon cranking, it frequently would break the owner's arm. At that point the use of batteries as a source of power was replaced by oil.

The establishment's carpet has some rather large lumps under it. Coulomb's and Newton's inverse square law is politely ignored and it's opposite is allowed to have only the most abstract status. Without opposites we have no definition.

The source value of a remote flux reading, requires the squaring of the distance, times the remote reading, to obtain the original value. The opposite of this, being the derivations relate to Energy equals Mass times the Velocity constant squared. The electrical equivalent, being Energy equal capacitance times voltage squared and Energy equals induction times amperes squared. Flux lines increase as the law of squares and then activate electron energy which was not previously a part of the sum. The cumulative capacitance and inductance increase as the outer ends of a Tesla coil are approached, and this results in output energy being greater than the input energy present. This Energy is real. It can be safely measured by magnetic flux methods and electrostatic voltmeters, based on the inverse square law

As seen above, flux lines result both from induction-henrys-amperage and capacitance-coulombs-volts, and define electrical energy. The non-linearity of this system does not obey Ohm's law, which is replaced with impedance and reactance for alternating current systems. Impedance is the sum of the system's resistance to AC current flow, and this becomes zero at resonance. In resonant induction systems, a cycles-per-second increase, invokes a second round for the law of squares.

The degree to which flux lines are present, disturbs an equal amount of electrons, upsetting the ambient background energy, resulting in useful electrical energy being obtained. The frequency at which the disturbance occurs, increases the useful energy available, and it obeys the law of squares. Two square-law components, *flux density* and *frequency* are involved. Enter resonance which cancels the resistive effect.

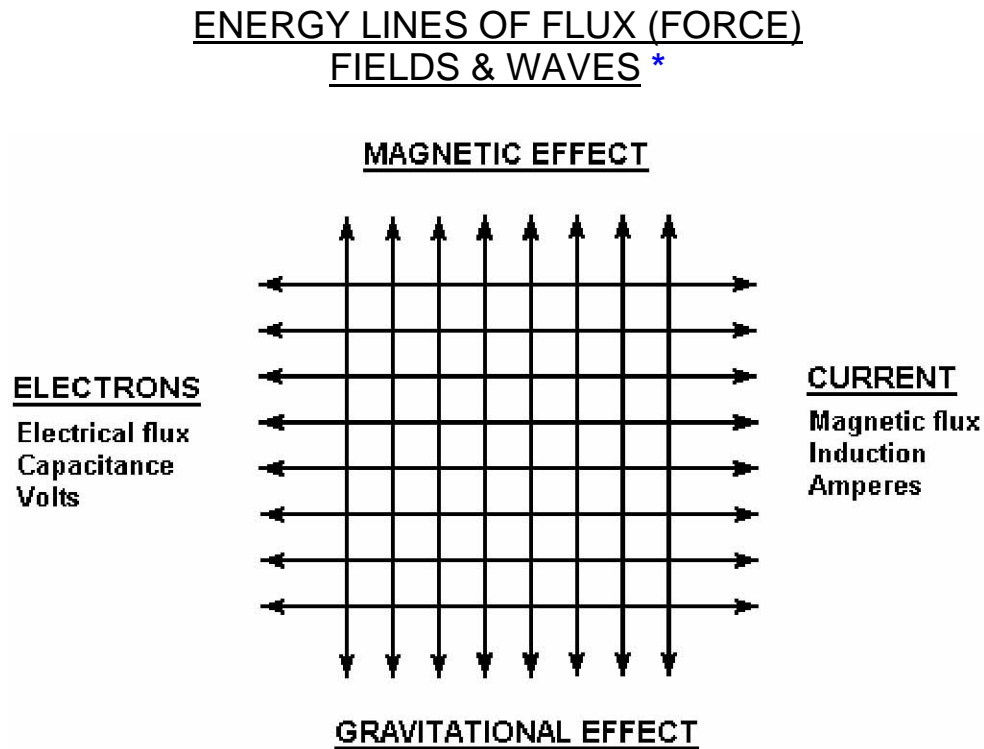
Only the electrical energy which is either above or below the ambient level is useful. For the Central U.S. going east to west, ambient as approximated by electro-static voltmeters and flux methods is 200,000 volts on a solar-quiet day. At night time, the ambient energy level drops to about one half of the daytime value. On a solar-active day, it may reach more than five times that of a solar-quiet day. Ambient background energy at the polar regions, is approximately 500,000 volts on a solar-quiet day. The background energy varies as it relates to the North-South component and the East-West continuum.

This leaves us with an interesting problem. Electrons, when disturbed, first produce magnetic flux and then produce electrical flux when they spin back to their normal position. Therefore any electron movement produces above ambient energy, being over unity.

ELECTRICAL ENERGY WITH ASSOCIATED PHENOMENA

1. Current-amperes results from the unequal distribution of negativity (electrons).

2. Electron spin causes electrical current and magnetic lines of force.
3. Magnetic imbalance causes the gravitational effect. This is evidenced in electric motors by magneto-gravitational displacement of mass, which causes the motor to rotate.

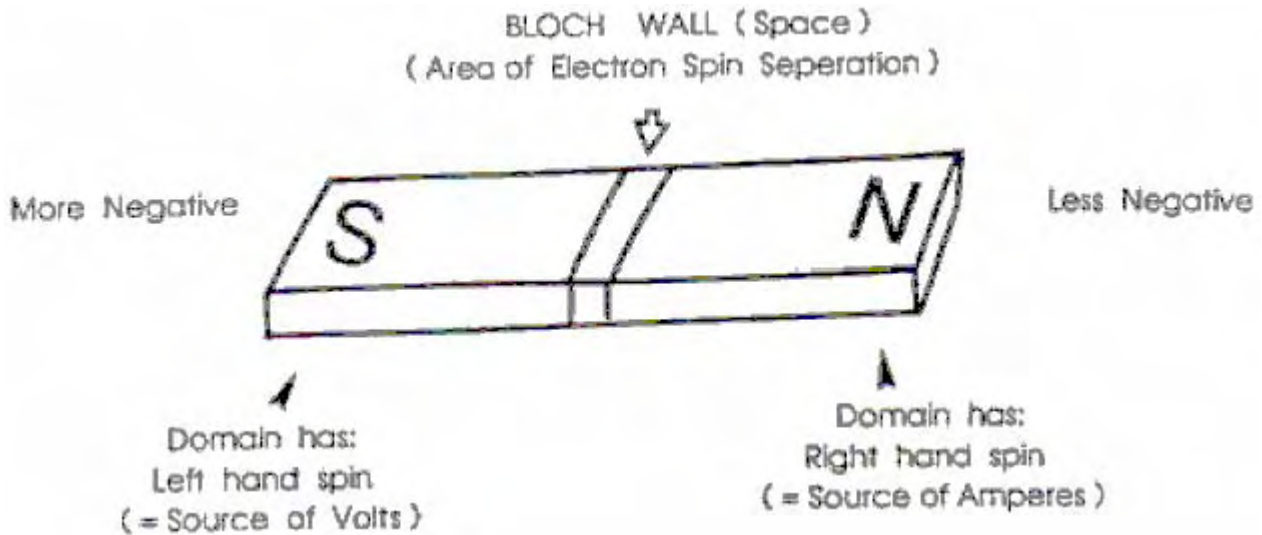


* Below 20,000 Cycles Per Second = **Fields**
Above 20,000 Cycles Per Second = **Waves** (Radio Frequency)

Derivation of Magnetic and Electrical Power

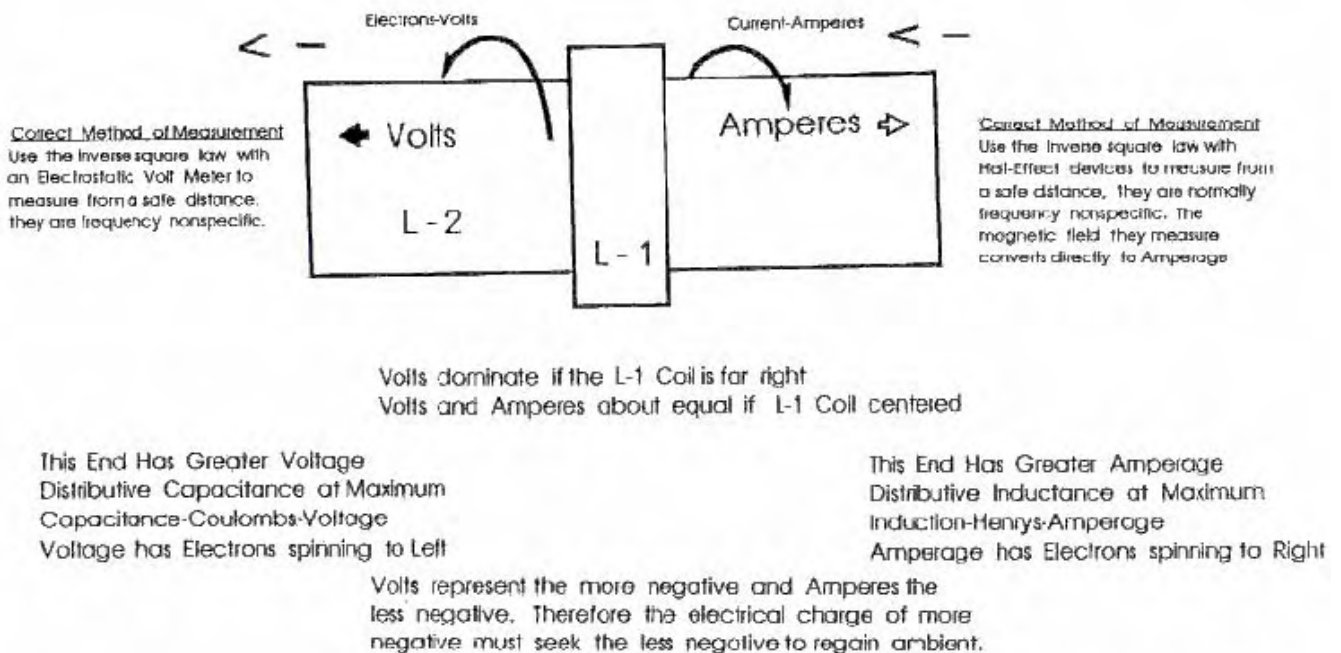
Analogous Relationships:

1. Potential Power is present in a bar magnet as shown:



2. The Source of these Electrons being from the Solar Plasma, are non-ionic and occupy all Free Space. They are commonly obtained from Earth and Air Groundings. They exist in Doublet Pairs, one being more negative than the other. The more negative one has a Left Hand Spin. The less negative one has a Right Hand Spin.
3. Resonate Electrical Coil Systems (Tesla) are Analogous to the System observed in the Bar Magnet (above). The Bloch Wall Area is Located at the base of the L-2 Coil. The Left Spin portion of the coil (Voltage Only) Coil predominates. The Right hand Spin portion of the coil (Magnetic-Amperage) is mostly absent.

Tesla Coil Geometry *



* Contains proprietary information related to Patent Procedure
Geometry - properties of lines, surfaces and solids

Induced Electrical Energy System

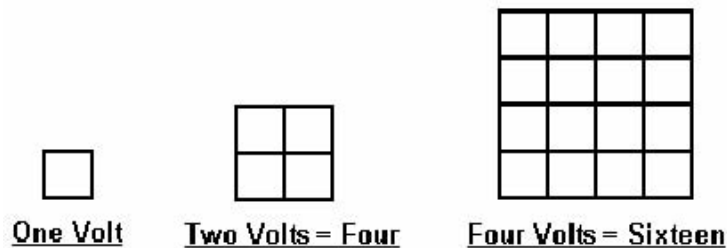
Collection and transfer of energy requires temporary storage, which occurs as capacitors and coils of a resonant circuit are cycled, on and off. The frequency at which the capacitors and coils are pumped, determines the amount of electrical energy that moves onward.

The amount of Energy transferred relates directly to the density of lines of flux present. The Kinetic Energy Formula is helpful in establishing the amount of energy present. This formula squares the velocity times mass. In the case of electrical energy, the intensity of voltage and amperes multiplied by the cycles per second, replace the velocity component.

Note that the "acceleration" of the Voltage "E" and Amperage "I", which increase as non-linear components, then obeys the Law of Squares.

Each unit of increase, causes a squaring of the flux lines present. The amount of energy transfer caused by this increase in flux lines is demonstrated below.

Increase in Flux Lines Present Symbolized



In resonant air-core coil energy transfer, the increase in flux lines present disturbs more electrons than previously, resulting in over-unity energy being present and available.

Energy stored, times the cycles per second, represents the energy being pumped by the system. Capacitors and inductors store electrons temporarily.

Capacitor formula: **$W = 0.5 \times C \times E \times \text{Cycles per second}$** where:

W = energy in Joules (Watt Seconds)

C = capacitance in farads

E = applied potential in volts squared.

Inductor (Coil) formula: **$W = 0.5 \times L \times I \times \text{Cycles per second}$** where:

W = energy in Joules (Watt Seconds)

L = inductance in henrys

I = current in amperes squared

Both one henry, and one farad, equal one volt. The higher the cycles per second, including the squaring of the flux lines, cause a large increase in the amount of energy being produced.

The above combined with a resonant energy induction system (where all electrons are moving in the same direction at the same time), make the next move into over-unity practical.

The dampening process of conventional electrical power generation, has all the available electrons bouncing randomly, mostly cancelling out each other. In that System, the useful energy available is a very small percentage of the energy which is present.

In the resonant induction system, a very high percentage of the energy present is useful. At resonance, (ohms-impedance-Z) becomes zero and all of the energy present is not degraded and becomes available to do useful work. "Ohms" is load or wasted energy, and "amperes" is the rate of that wasting of energy.

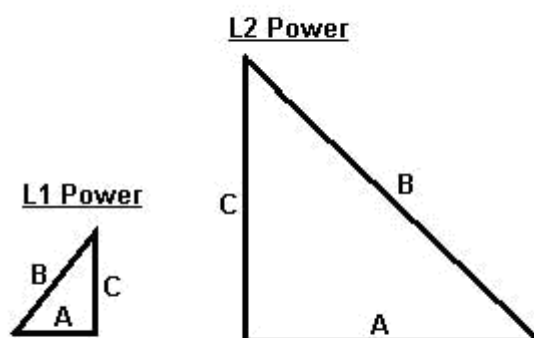
Using the previous information, if we now apply it to an air-core coil, resonant transformer energy system. L-1 and L-2 coils are now present. L-1 has a smaller number of turns and is several times the diameter of L-2. Input from a 12 volt high-voltage laser driver source, produces 8,000 volts with a low level of wasted energy, pushing amperage into, say, 4 turns of coil L-1. Each turn of the L-1 coil then acquires 2,000 volts of resonant potential. Consequently, each turn of L-2 is then exposed to the electric flux of 2,000 volts. Each turn at the bottom end of L-2 acquires 2,000 volts. The flux lines are squared and are additive as the voltage and amperage progresses towards the top end of L-2's large number of turns.

A huge number of additional flux lines which were not previously present become present at the top end of the L-2 coil. These flux lines excite the nearby electrons in it's earth and air and groundings. This high level of excitement above the ambient, causes a large number of electrons which were not previously a part of the energy present, to become available for use. At this point over-unity is present in large amounts.

The "bubble gum between the ears" response to this is: "this must be lots of volts but no amperes". Please recall that amperage is wasted energy, and that until that wasting occurs, there are no amperes. A good way to demonstrate this, would be to let the bubble gum crowd put their hands on the high-voltage end of the device while standing on wet ground (a people zapper). **Note: don't do this.**

This over-unity device produces energy at radio frequencies which range into the megahertz band. This allows the device to be small in size, and yet produce large amounts of energy. A megawatt-sized unit will sit comfortably on a breakfast table. This energy is changed to Direct Current and then switched to produce the desired working frequency AC.

Power Triangle



A: Volts x Amperes (the Available Power)

B: Volts x Ampres x Time (the Used Power)

C: Volts x Amperes x Recative (the Resonant Power)

1. Random movement of electrons in "A" and "B", mostly cancel each other out. This dampening, or wasteful concept of energy, is a source of much pleasure for the establishment.
2. "C" (Volt, Amperes, Reactive "V.A.R."), is the situation where all of the electrons move in the same direction at the same time. This results in near-unity energy output by resonant induction transfer.

3. Resonant induction transfer from one isolated power system, allows other resonant induction systems to duplicate the original source, which in no way diminishes the original source. Air-core coils (isolation-transformers) confirm this when they are a part of one of these functioning systems. A less perfect illustration would be the fact that the number of radio sets tuned to a particular radio transmission, does not alter the power required at the radio transmitter.
4. Resonant induction transfer, disturbs a large number of adjacent electrons which were not a part of the original input power source. The pulsating-pumping effect then draws in the newly available additional electrons into the on-going energy generation system. A near unity energy system of resonant air-core coils and the extra acquired electron-energy source constitute an over-unity system.

Electrical Power Generation / Points of Reference

Useful Electrical Power is Generated when Electrons from Earth and Air Groundings are disturbed by the movement of coils and magnets with reference to each other. The resulting electrical and magnetic energy is then changed to joules [watt-seconds: Volts x Amps x Seconds]. Each forward electron movement results in a magnetic impulse and each return movement causes an electrical impulse. The composite of the electrical energy impulses from these electrons yields useful energy [Power].

Let the above electron movement be represented by a room full of ping pong balls bouncing randomly. Most of the energy present cancels out by random impacts. This is the Classic Under-Unity approach to Electrical Power Generation, sanctioned by the Establishment.

In contrast to that, in the Electrical Energy Generation System presented here, the resonant Electrons are all moving in the same direction at the same time. This allows Near-Unity Electrical Power to Develop. This is the room-temperature equivalent of super conductivity.

The Energy System presented here, consists of a properly-adjusted and functional resonant air-core coil tank. The magnetic energy is stored in the coil system and the Electrical Energy is stored in capacitors. From Maxwell and others, we know that electrical-related energy has an equal amount of magnetic energy associated with it.

"The formula which establishes the Useful Energy of the System":

$$\text{Joules} = 0.5 \times \mathbf{C} \times \mathbf{V}^2 \times (\mathbf{Cycles\ Per\ Second})^2$$

units:

Joules (Volts x Amps x Seconds) Watt Seconds where

C = Capacitance in microfarads

V = Potential in Volts

The transfer of Electrical Power by Resonant Induction is a direct function of the squaring of the cycles per second. For example, square 60 C.P.S. and then square the radio frequency C.P.S.s of the System here presented. Obviously, One Million Cycles per Second transfers more energy than Sixty Cycles per second. The Sanctioned Method of Electrical Power Generation uses the 60 C.P.S. Method. Using 60 C.P.S. and the random scattering of the Electrons System, assures the Establishment of it's desired Under-Unity Goal.

This random bouncing of the Electrons is the Ohms of Ohm's Law and is used to establish the rate of dissipation and/or Load [Work].

In the Resonant Tank Induction Energy Transfer System presented here, Impedance [system resistance] replaces the conventional ohm's usage. At Resonance, impedance becomes zero and the full force and effect of the Energy Transfer occurs. This is superconducting conditions at room temperature. At radio frequency the Electrons do not pass through the conductor as they do at lower frequencies. Instead, these Electrons encircle the conductor and are free of the conductor's resistance.

Let the Establishments Power Generation System be called 'A' and the System presented here be called 'B'.

With "A": Given 60 C.P.S. at 120 Volts using a 10 microfarad Capacitor:

$$\text{Joules} = [0.5 \times 0.000010 \times 120]^2 \times (\text{C.P.S})^2$$

$$(120 \times 120 = 14,400)$$

$$[0.000010 \times 14,400 = 0.144]$$

$$[0.144 \times 0.5 = .072]$$

$$(0.072 \times 3,600 = \mathbf{259.2})$$

Using the Inventor's Resonant Induction System, the Electrical Power available would then be 259.2 Joules [Watt-Seconds]. Using the Establishment's method only permits less than 10 Watt-Seconds of Useful Electrical Energy.

"B". Given One Million Cycles per second at 100,000 Volts, using a 10 microfarad Capacitor.

$$\text{Joules} = [0.5 \times 0.000010 \times 100,000]^2 \times (\text{C.P.S.})^2$$

$$(100,000 \times 100,000 = 10,000,000,000)$$

$$[0.000010 \times 10,000,000,000 = 100,000]$$

$$(100,000 \times 0.5 = 50,000)$$

$$(50,000 \times \text{One Million squared} = \mathbf{50,000,000,000,000,000})$$

The useful Electrical Energy available is greater than 50 Mega Watts. Since the Resonant Electrons are non-impacting, all of the Energy is available for direct usage.

Benefits of the Inventor's System

1. Induction Energy transfer is enhanced by the squaring of the cycles per second produced by the System.
2. Induction Energy transfer is enhanced by the squaring the input voltage and amperage.
3. The increase of the flux lines occurring from the above, disturbing more electrons, causes more electrical energy to become available.

4. Resonant Induction has all of the Electrons moving unimpeded, resulting in superconductor conditions at room temperature.
5. A smaller amount of energy is used to disturb a larger number of Electrons. Electrons not originally a part of the System then contribute their energy, resulting in a net gain in available usable power.
6. The physical size of the System [Device] is small. The Device described in "B" sits comfortable on a breakfast table.
7. A small energy source is used to start the device and that source remains fully charged at all times by the System.

The Evidence Against Under Unity

1. Use of Logarithmic Scales on electrical measurement instruments. Linear measurement works fine where Ohm's Law applies (direct current). In alternating current, ohms are replaced by impedance and the measurements become non-linear.
2. Infinite "Q" at resonance confirms that voltage and amperage is squared, as in the kinetic energy formula. See the formulas of this report.
3. Square waves are clipped infinite "Q"s.
4. Maxwell and others show that magnetic-inductance-amperage and electrical-capacitance-voltage are two sides of the same coin. Magnetic-inductance is directly equal to amperage. Both obey the Law of Squares, which has over-unity built in.
5. Magnetic and electrical flux are present in enormous amounts at the outer ends of an operating Tesla Coil.
6. Ignorance of how to measure and relate magnetic and electrical flux, is the chief weapon of the under-unity gaggle.
7. The Cumulative inductance and capacitance of the Tesla Coil grounds itself out, if not properly utilized. See this report for the temporary energy storage accessible, when properly managed.
8. The Patent Office refers devices related to over-unity to their metering group, which is a sure indication that they are aware and accept the logarithmic measuring devices. This is direct and absolute evidence that they accept the square law as it relates to kinetic energy. This also indicates they are aware that over-unity exists. Since their bureaucratic brain is improperly motivated they continue to badger inventors who are working in the over-unity arena. Their level of intellectual dishonesty is sanctioned by, and is a real part of doing business with, a government which prides itself in being a hooliganistic bureaucracy.

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An Answer to America's Energy Deficit

Donald L. Smith

Energy Consultant

Energy, energy everywhere and not a Joule to Jounce. Conventional wisdom, when properly tuned will appreciate the nature of energy, as here presented. The basic unit of electricity (the electron) upon encountering a moving magnetic field (or wave) spins, giving off an electric impulse. When this impulse collapses, it spins back to its natural position, giving off a magnetic impulse. Therefore, magnetic and electric are two sides of the same coin. When the magnetic side is pulsed, it yields electricity and conversely, pulsing of the electrical side yields a magnetic field. Moving one in relation to the other produces useful energy. When done consecutively, each cycle pushes (current) forward, while pulling electrons into the system... in much the same way as a water pump moves water. These electrons are obtained from Earth and air grounding.

The word "electric" comes from the Latin word electron "amber". When rubbed, amber develops an electrical charge, which can be transferred to a dissimilar substance. During the seventeenth and eighteenth centuries, a great deal of attention was centered on this attribute of amber. Amber was used to differentiate the non-metals. Carbon-related substances and other non-metals, when subjected to friction, give up negative electrical charges. On the other hand, metals when subjected to friction, simply conduct the charge. It is important to note that approximately 70% of the Earth's exposed crustal portions (surface) consist of silicone-related non-metals (electron donors) and become a direct source of electrical energy when properly agitated.

Useful electrical energy can be obtained by grounding into the Earth's non-metal crust and into it's atmosphere as a natural source of electrons. These electrons have accumulated from the solar plasma during the aging of the Earth for more than 4.5 billion years, at a rate exceeding 3.9 exajoules per year. This indicates that the Earth's electrical field contains in excess of 17.6×10^{18} of cumulative exajoules of energy. One exajoule is the approximate energy equivalent of 125 million barrels of oil. The electrical energy in one display of lightning is approximately ten trillion joules. During each 24 hour period, the land portions of Earth's surface yields in excess of 200,000 emissions, which involves more than 2,000 quadrillion watts.

C.F. Gauss (1777-1855) and H.C. Oersted (1777-1851) were each separately trying to define the Earth's electrical field with all external influences removed. These external influences being solar-quiet periods and being remote from the land's surface. The air electricity background which they measured varies with latitude. Their European measurements correspond to approximately the latitude of Washington, D C. They were measuring magnetic field flux as an indicator of negative electron energy active and present. A related family of measurement are now presented. Units of measurement used to define flux fields include Gauss (one unit = 100,000 volts), Oersted (one unit = 50,000 volts), Tesla (one unit = 10,000 Gauss) and Gamma (one unit = 1/10,000 of a Gauss). Much confusion exists in electrical related publications about these units. As presented here they are correct with values taken from their original definitions.

The entire surface of the Earth has been surveyed by aerial magnetometer, in most cases using gamma or nano teslas. One gamma is the magnetic flux equivalent of 10 active volts of electricity. When the data is corrected for flight height it becomes obvious that there are numerous areas where the gamma readings exceed one trillion gammas. Lightning strikes from the ground up are in that energy range. With knowledge of these electron enriched areas, the quality of Earth grounding, becomes enhanced. The correction necessary for land surface data when acquired from aerial magnetometer maps (using Coulomb's law) requires that the remote distance be squared and then multiplied by the remote reading. As an example, if the remote reading is 1,600 gammas and the flight height being 1,000 feet. Take $1,000 \times 1,000 = 1,000,000 \times 1,600$ gammas = 1.6 trillion gammas x 10 volts = 16 trillion volts equivalent for land surface data. Present day methodology requires mechanical energy in exchange for electrical energy. Once obtained, this energy is subject to Ohm's Law. Present Methodology obtains it's electrical energy from it's non-metal and air groundings.

This same energy can be obtained without the wasteful mechanical approach and at a much, much lower cost. Any required amount of electricity is available by resonant induction transfer from the Earth's magnetic and electrical fields. The major difference is in the functioning of Ohm's Law in relation to resonant circuits. In the resonant induction system suggested here, system resistance (Z) becomes zero at resonance.

Therefore, Volts and Amperes are equal (V.A.R.) until work (load) is introduced.

Each cycling of this resonant induction system pulls in additional electrons from the Earth's electrical field, generating electrical energy in any required amount. In this system, a small amount of electrical energy is used to activate and pull a much larger amount of energy into the system.

This electrical advantage corresponds to the pulley and lever of the mechanical world. The electrical system presented here is extremely efficient. Using present methodology as a basis for comparison, with it's 60 cycles per second system. The resonant induction system, cycling at 60 million times per second produces one million times the energy which is produced by the present energy systems. A

single small size unit of the resonant induction system has more usable electrical output than a major conventional unit. The radio frequency energy produced is easily changed to Direct Current, and then to the present 60 cycles per second system in preparation for commercial usage.

The Patent Pending on this system is #08/100,074, "Electrical Energy Generating System", dated 4 February, 1992.

Definitions:

One **Joule** is one watt for one second

One **Watt** is one volt ampere

V.A.R. is Volt Amperes Reactive

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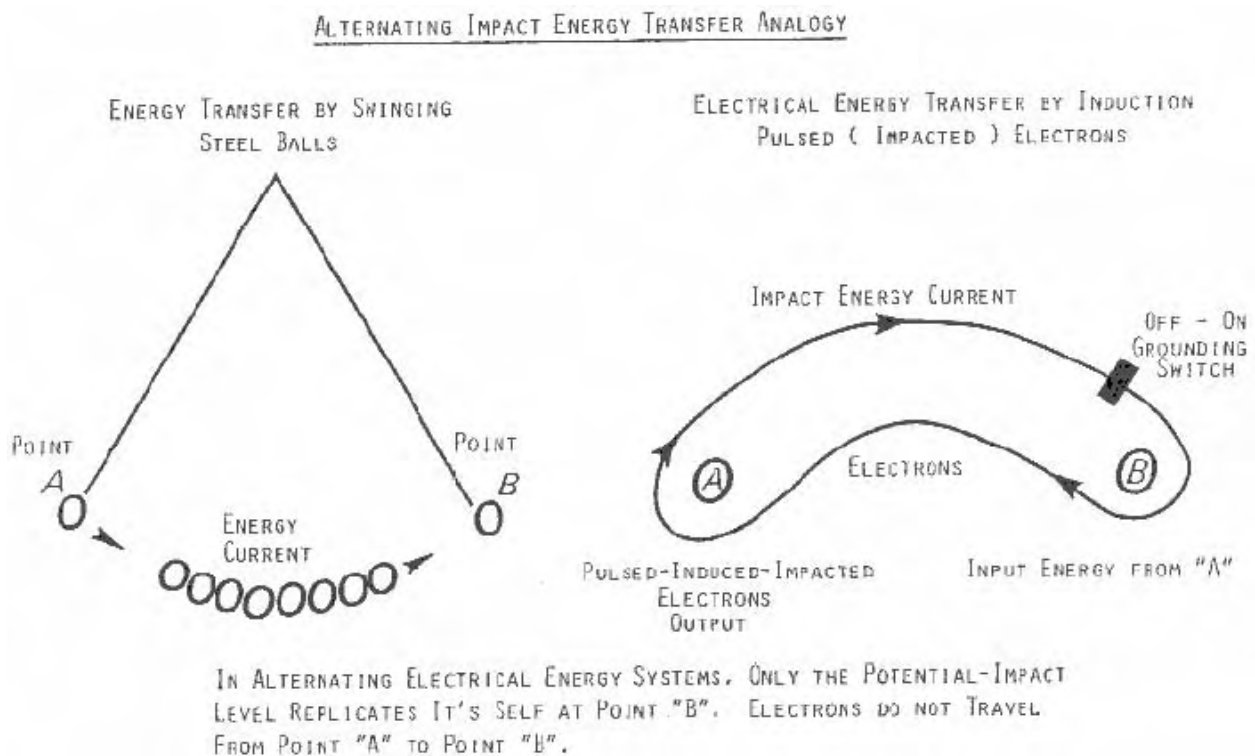
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E.E.S. II, BACKGROUND INFORMATION & CONCEPT

With alternating electrical current, electrons do not move from point "A" to point "B" as commonly envisioned! Electrical potential (oscillating electrons) at point "A", results in harmonic electron activity at point "B", when the grounding switch (circuit) is closed. That is to say, point "B" supplies it's own electrons and mirrors the activity of point "A". Impulsing (turbulence) by magnetic induction causes electrons to be pulled into the system, which then oscillates. When the magnetic field collapses (becomes absent) the electrical potential returns to it's natural background level.

Several major flaws are present in the conventional 60 cycles per second method of electrical power generation and its iron core transformer system. ***This system is handcuffed by the inverse relationship of volts to amperes.*** This represents a stodgy, inflexible inheritance, courtesy of Mr. T.A. Edison and his concept of electrical power generation.

Nikola Tesla stood, almost alone, against Edison and managed to prevail with his Alternating Current system. Without the alternating current system, electronic things in the modern sense would not exist.

This report will be concerned with some of the extensions and benefits of the alternating current electrical system. ***This study will limit its scope to air core coil transformers at radio frequency and upwards. The electrical power produced by this method is inverted to Direct Current and then to Alternating Current as required for popular usage.*** There are several important advantages of this system over conventional power generation.

Start with two coils (separate-apart), one being a reactor coil (L-1) and a second coil (L-2), being the reactant coil. Magnetic field fluxing (off-on of the electrical source) causes inductive reactance of L-1 which replicates by induction in L-2. Pulsing of the magnetic field (from L-1) in the presence of L-2, generates electrical potential. For example, should the L-1 coil have ten turns, with an imposed AC. potential of 1,200 volts. This results in each turn of L-1 acquiring 120 volts of potential. This induced magnetic field, then replicates itself in each turn of the L-2 coil. The L-2 coil may have one or many hundreds of turns. Modern encapsulation techniques makes high frequency and high energy controllable.

Let's take another important step in this air-core transformer process. For purpose of discussion, let the value of inductive reactance at 60 cycles per second, equal one. Each time the frequency is doubled, the effectiveness of induction is squared. At about 20,000 Hz, ***when radio frequency is achieved, the electrons begin spinning free, outside of the inductor and they become increasingly free of the inverse relationship of volt-amperes.*** From this point on, they replicate by the inductive process as V.A.R.. ***That is to say, volts and amperes are equal, until resistance (work) is introduced. Therefore, additional, not previously available electrons become incorporated for a very large net gain in potential. This gain is real !***

The quality of the grounding system determines the effectiveness of this method of producing electricity. A handy reference to locate the negative grounding areas for power generation can be found in the Aeromagnetic Map Studies of the US Geological Survey. They provide an excellent method for locating the best sites for optimum negative grounding areas.

When this method is combined with the induction coil system, already described, it provides an electrical power generating system millions of times more efficient than any known conventional method.

This new system ("E.E.S. II") is uncomplicated, physically small and it is inexpensive to build. The technology required for its construction already exists. Maintenance is near zero, as there are no moving parts. Once operating, this system could last forever.

Small mobile E.E.S. II units are already available as replacements for the batteries used in electric automobiles. Larger E.E.S. II units can be provided as a replacement source of power for hotels, office buildings, subdivisions, electric trains, manufacturing, heavy equipment, ships, and generally speaking, any present day application of electrical power.

Earth Electrical System II, Modular Units

The system consists of three separate modules. Reverse engineering is used in matching the modules to the desired usage.

HIGH VOLTAGE INDUCTION TRANSFORMER MODULE:

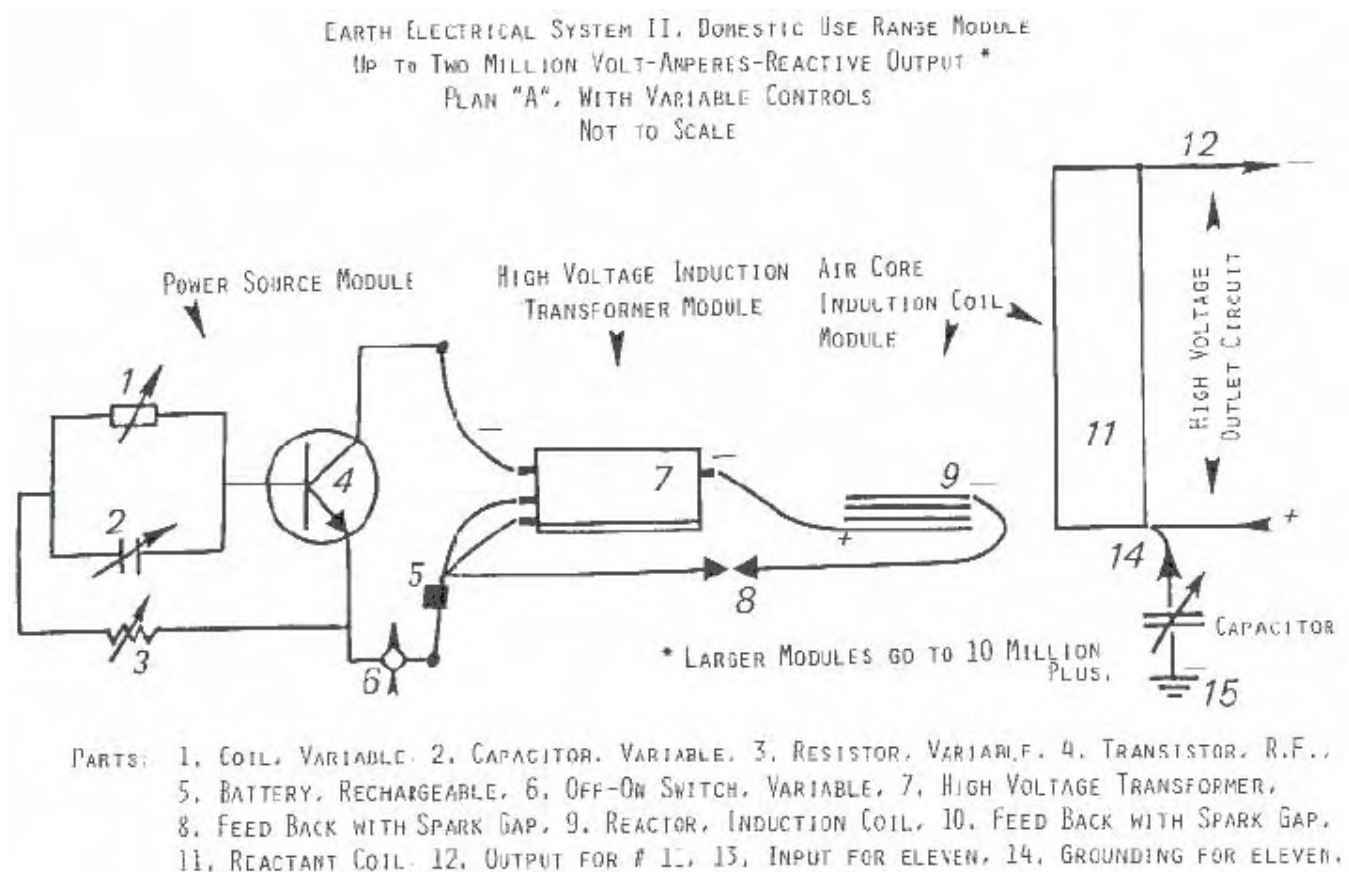
1. Preferably an off-the-shelf-unit similar to a TV flyback and/or automobile ignition type related coil (transformer).
2. Ratio of input to output may be from less than 1:100 to greater than 1:1,000 A voltage tripler may then be used.
3. A connection allowing the high voltage output to pass onward through the induction coil L-1 and then to it's grounding.

AN AIR CORE INDUCTION COIL TRANSFORMER MODULE:

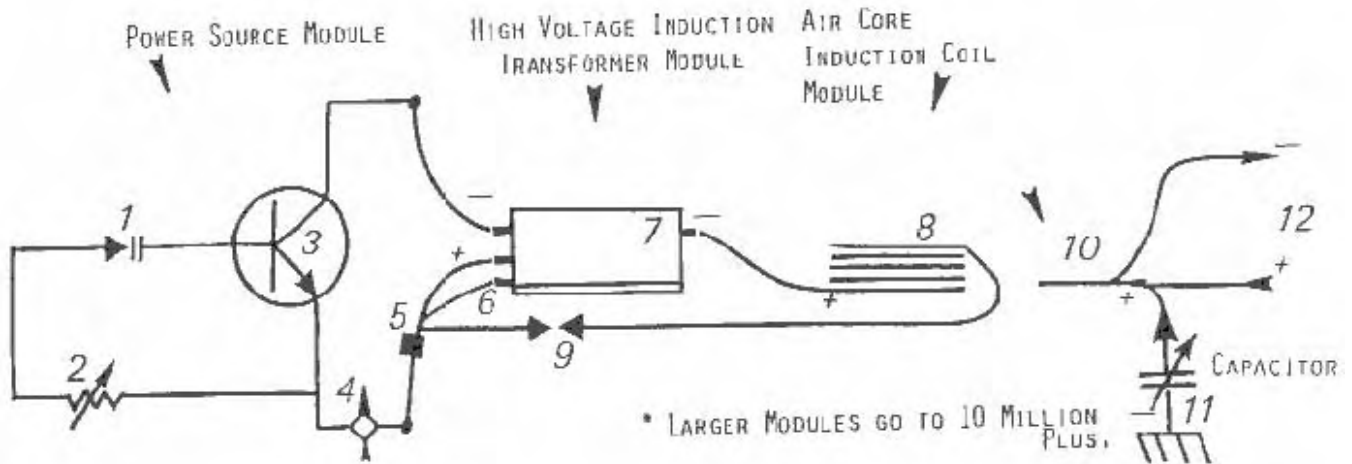
1. There are two coils: the reactor coil L-1 and the reactant coil L-2. L-1 has a high voltage radio frequency capacitor between it and it's grounding.
2. Input into the L-1 inductor is divided by the number of turns in it. The magnetic flux field provided from each turn of L-1 replicates itself as an electrical potential in each turn of L-2.
3. L-2 may have one turn or many hundreds of turns. The net gain depends upon the number of turns in L-2. Output from L-2 is in V.A.R. **With this type of output, volts and amperes are the same until work(resistivity) is introduced.**

THE INVERTER MODULE:

1. Inverts to direct current (D C.)
2. Inverts to alternating current (A C), as desired.
3. Provides customized output of electrical power ready for designated usage



EARTH ELECTRICAL SYSTEM II. DOMESTIC USE RANGE MODULE
UP TO TWO MILLION VOLT-AMPERES-REACTIVE OUTPUT *
PLAN "B", ELECTRICAL AUTOMOBILE ENERGY SOURCE



- PARTS: 1. VARACTOR, RADIO FREQUENCY, 2. RESISTOR, 3. TRANSISTOR, RADIO FREQUENCY, 4. OFF-ON SWITCH, MULTI-POSITION, 5. BATTERY, RECHARGEABLE, 6. TRANSFORMER GROUNDING, 7. HIGH VOLTAGE INDUCTION TRANSFORMER, 8. REACTOR, INDUCTION COIL, 9. FEED BACK WITH SPARK GAP, 10. REACTANT, INDUCTION COIL, 11. GROUNDING FOR # 10, OUT-PUT CIRCUIT, IN VOLT-AMPERES-REACTIVE.

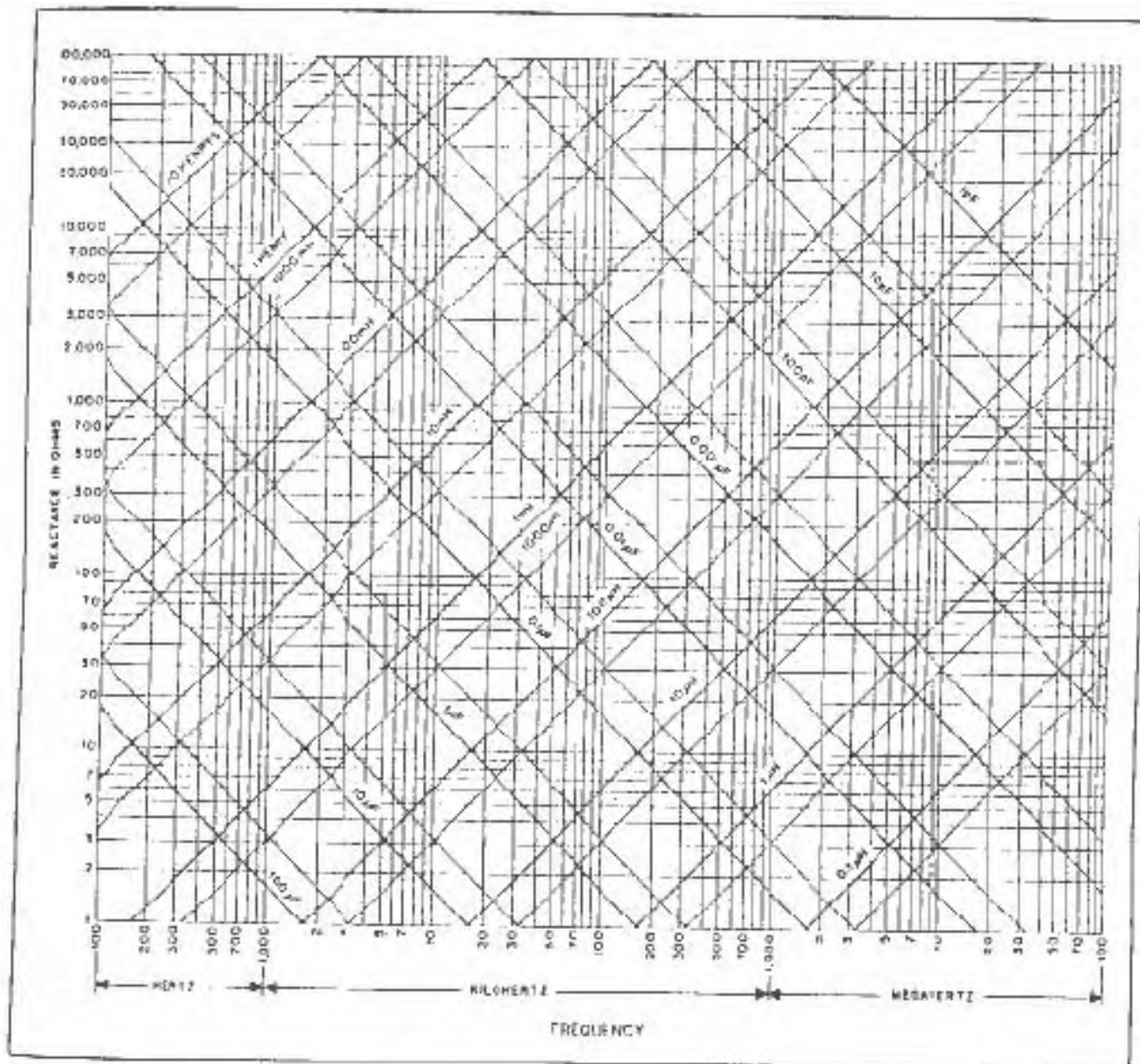


Fig. 44 — Inductive and capacitive reactance vs. frequency. Heavy lines represent multiples of 10, intermediate light lines multiples of five. For example, the light line between 10 μH and 100 μH represents 50 μH ; the light line between 0.1 μF and 1 μF represents 0.5 μF , and so on. Intermediate values can be used within the chart range. For example, the reactance of 10 henrys at 60 Hz can be found by taking the reactance of 1 henry at 600 Hz and dividing by 10 (or the 10 \times times decrease in frequency).

CHART, COURTESY OF A.R.H.L., 1992 Ed.

Speech presented the evening of 23 July, 1994 at the
International Tesla Society Convention at Colorado Springs, Colorado.

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ELECTRICAL ENERGY REFERENCE POINTS

Electrical Energy Generating System
Patent Pending # 08/100.074. 2/4/92

The word "electric" comes from the Latin word electron "amber". When rubbed, amber develops an electrical charge, which can be transferred to a dissimilar substance. During the seventeenth and

eighteenth centuries, a great deal of attention was centered on this attribute of amber. Amber was used to differentiate the non-metals. Carbon-related substances and other non-metals, when subjected to friction, give up negative electrical charges. On the other hand, metals when subjected to friction, simply conduct the charge. It is important to note that approximately 70% of the Earth's exposed crustal portions (surface) consist of silicone related non-metals (electron donors) and therefore becomes a direct source of electrical energy when properly agitated.

Useful electrical energy is obtained by grounding into the Earth's non-metal crust and into it's atmosphere as a natural source of electrons. These electrons have accumulated from the solar plasma during the aging of the Earth for more than 4.5 billion years, at a rate exceeding 3.9 exajoules per year. This indicates that the Earth's electrical field contains in excess of 17.6×10^{18} power of cumulative exajoules of energy. One exajoule is the approximate energy equivalent of 125 million barrels of oil. The electrical energy in one display of lightning is approximately ten trillion joules. During each 24 hour period, the land portions of the Earth's surface yields in excess of 200,000 emissions, which involves more than 2,000 quadrillion watt-seconds of active energy on display.

This physical phenomenon indicates that the Earth's crust is an unending source of electrical energy. The surface area involved is a very small portion of the Earth's crust.

J.C. Maxwell (1891) suggested that an active electron field gives rise to an associated magnetic field. Therefore, both are present with pulsating current. Early studies, involving observation of compass needles by microscopy, revealed that the needle vibrates as with alternating current. More recent studies by A. Nishida and others, confirm that alternating current is common in the Earth's crust.

C.F. Gauss (1777-1855) and H.C. Oersted (1777-1851), both were separately trying to define the Earth's electrical field with all external influences removed. These external influences being solar-quiet periods and being remote from the land's surface. The air electricity background which they measured varies with latitude. Their European measurements correspond to approximately the latitude of Washington, D.C. They were measuring magnetic field flux as an indicator of negative electron energy active and present.

A related family of measurement is now presented. Units of measurement used to define flux fields include Gauss (one unit = 100,000 volts), Oersted (one unit = 50,000 volts), Tesla (one unit = 10,000 Gauss) and Gamma (one unit = 1/10,000 th of a Gauss). Much confusion exists in electrical related publications about these units. As presented here, they are correct with values taken from their original definitions.

The entire surface of the Earth has been surveyed by aerial magnetometer, in most cases using gamma or nano teslas. One gamma is the magnetic flux equivalent of 10 active volts of electricity. When this data is corrected for flight height, it becomes obvious that there are numerous areas where the gamma readings exceed one trillion gammas. Lightning strikes from the ground up are in that energy range. With knowledge of these electron enriched areas, the quality of Earth grounding, becomes enhanced.

The correction necessary for land surface data when acquired from aerial magnetometer maps (using the inverse square law) requires that the remote distance be squared and then multiplied by the remote reading. For example, if the reading is 1,600 gammas and the flight height is 1,000 feet. Take $1,000 \times 1,000 = 1,000,000 \times 1,600 \text{ gammas} = 1.6 \text{ trillion gammas} \times 10 \text{ volts} = 16 \text{ trillion volts equivalent for land surface data.}$

Present day methodology requires mechanical energy to be expended in exchange for electrical energy. Any required amount of electricity is available by resonant induction transfer from the Earth's magnetic and electrical fields. Each cycling of this resonant induction system pulls in additional electrons, generating energy in any required amount. A small amount of electrical energy is used to activate and pull into the system a much larger amount of energy.

ENERGY VERSUS MASS

Steady State Static "Pre-Energy " Mass attracts Mass, Gravity Dominates	Unsteady State Kinetic "Energy" Expanding, Magnetic Energy Dominates Electrons moving apart Pressure decreasing Cooling effect dominates Less scattering of Energy Negative resistance
	Contraction, Electrical Energy Dominates Electrons moving together Pressure increasing Heating effect dominates Scattering of Energy Positive resistance

Functions of active Electrons

Electrons become active when placed inside the critical distance allowed by their negativity.

Active Electrons provide:

1. Electricity
2. Magnetism
3. Gravitational thrust as in Electric Motors
4. The source of Visible Light
5. Its charge is Negative

They move in a closed loop as seen in the Icon for infinity, not in a circle as shown in many books. One half of the loop consist of a magnetic impulse and the return half consist of the electrical impulse. This is seen as the classic sine wave of alternating electrical energy.

A flash of light occurs when two electrons suddenly find they are too close together. Daylight results from the impingement of Electrons in the Earth's atmosphere with the Electrons of the Solar Plasma.

My Concept of the Forces of Nature differs from the conventional. It consist of a weak and a strong force, each being additionally composed of electrical, magnetic and gravitational (fields and waves). Any two of the three constitute the third member; Gravity "B" of the weak force competes with humans on a daily basis. Gravity "A" of the strong force is the force that holds the Solar System and the Universe in place. Energy from the Electrons represent the weak force. Energy inside the Atom represents the strong force "A". Controlled resonant induction of any two of the three, changes into the third and is the motor that runs the Universe. We see this in the electrically-induced magnetic thrust against gravity in electric motors.

Weak force is required to dislodge electrons and strong force (atomic) to dislodge protons. Unless dislodged, these particles are of little value in producing Conventional Electrical Energy.

Therefore, in conventional electrical energy production, the particle of importance is the negative electron. Electrons have a "grudging" relationship with other electrons. They like each other, especially at arms length. Like potentials repel each other, and unlike potentials attract. To demonstrate this,

take two batteries of the same type, but of a different charge level (unequal potentials). Put the plus and minus ends facing the same direction. Then with a volt meter, measure the electrical potential between the two negative ends and then the two positive ends. It is obvious that the "more negative" moves to the "less negative" is the correct concept for electrical energy generation. Electrical Energy flow consist of a higher concentration of electrons moving to an area of lesser concentration.

OHM'S LAW WITH CORRECTIONS:

A major obstruction in reference to the correct function of electrical energy is the establishment's incorrect interpretation of Ohm's Law. The corrected version is:

Volts = Energy Available (Potential)

Ohm = Scattering, dissipation of Energy (Load)

Ampere = the rate of, dissipation / scattering of energy

It is important to note that Ohm and Ampere are after the fact, and are not decisive except for the dissipation factor. High Voltage at low amperage simply means that the High Voltage is still intact for future usage. In no way is the potential diminished by low amperage.

EXAMPLES OF OVERUNITY

Dominos did not exist in England when the Laws of Conservation were originally put in place. Otherwise they might have been very different. For example, let us take a long row of upright dominos, (many thousands) and flip number one. The Energy required to flip the first domino must now be added with that of thousands more in order to have a correct assessment.

The Electron itself is an excellent example of over-unity. The electron provides various forms of energy continuously throughout eternity and is in no way diminished. It simply cycles through the system and is available thereafter.

In Electrical Systems, Electrons active at point "A" are not the same Electrons active at point "B". That is to say, the Electrons activated at the Central Electrical Energy Station are not the ones used at your house. When you ground your system by flipping the wall switch, you use your own electrons. In closed energy systems, electrons communicate with and replicate the activity of the overbalanced potential, when provided with Earth and or Air Groundings.

The number of Radio sets and Television sets running at any one time do not diminish, in any way the electrical output of the source station.

For example, let now use an Air Coil Resonant Induction System for the purpose of flipping some electrons. The flipping device (reactor coil L-1) is pulsed, which then provides a resonant induction pulse. In turn, this flips the electrons present at the (reactant L-2) Coil. The energy input in L-1 is divided by the number of turns present. The induced magnetic pulsing in turn flips the electrons in each turn of L-2. If more turns are present in L-2 than L-1, there is a net gain in the Energy present, as demonstrated by the dominos above. The farads and henrys of the resonant system provide the resonant frequency when pulsed by an external energy system. A system shunt in the resonant circuit sets the containment level for energy potential.

The Induction Process itself provides an excellent example of over-unity. When comparing rate of induction, the cycles per second must be squared and then compared to the square of the second System. Let us then compare the 60 Hz System with my 220 MHz Device. Energy produced at radio frequency has several major advantages over the conventional system. Ohm's Law does not apply to a resonant air-core radio frequency system.

For example: When the system is resonant, the following is true:

EXPECTED RESULTS

$$\frac{\text{Energy Potential as Volts}}{\text{Dissipation}} = \text{Rate of Dissipation}$$

ACTUAL RESULTS

Superconductor Conditions take over

$$\frac{\text{Energy Potential as Volts}}{(\text{Dissipation})^*} = (\text{Rate of Dissipation})^*$$

*** OHMS / DISSIPATION IN AIR-COIL RESONANT INDUCTION SYSTEMS: RESISTIVITY BECOMES ZERO AT RESONANCE**

This is named the V.A.R. (Volt Amperes Reactive) System.

When compared to the Conventional Under-Unity iron-core transformer system, the results are over-unity. It is strange that mechanical advantage as in pulleys, gears, levers and others which correspond to the electrical advantage above mentioned, are not considered over-unity devices.

Let us take a closer look at resonant induction. As an example, let a room full of ping pong balls randomly bouncing at a high speed represent the Conventional method of under-unity energy generation. Suppose that by resonant induction the balls all move in the same direction at the same time. When this occurs a huge amount of energy not previously available is present. The resonant air-core coil system lines up the electrons in such a manner that the energy factor is nearly 100 % , and not the 2% or 3% of Conventional under-unity devices sanctioned by the establishment.

Some other devices where overunity is common would be resonant induction circuits present in conventional radio tubes (high plate voltage), negative-feedback systems found in Op-Amps and possibly others.

SUMMARY

Useful electrical energy is achieved when the electron density at point "A" becomes greater than at point "B", (being the more-negative moving to the less-negative concept). Coils moving through a magnetic field or vice versa causes this imbalance.

The mindset of the professional Electrical Engineer is restricted to non-resonant and iron-core coil resonant systems. Ohm's Law, when applied to resonant air-core induction systems, becomes, system resistivity (impedance, Z). "Z" becomes zero at resonance. Therefore, in this system, volts and amperes are equal until load (resistivity) is introduced. This is called the Volt Ampere Reactive (V.A.R.) System. With impedance being zero, the System grounding is coupled directly into the Earth's immense electrical potential. Efficiency of induction relates to the square of the cycles per second. Compare the ratio of the conventional 60 c.p.s. System and the 220 million plus cycles of my Earth Electrical System II.

Electrons which cycle through this system, after being used, are returned intact to their former state for future usage.

Electron spin causes electrical current and magnetic lines of force

The effect of current, results from the unequal distribution of negativity (electrons).

Magnetic imbalance causes the gravitational effect. This is evidenced in electric motors by magnet-gravitational displacement of mass which causes the motor to rotate.

The System is an extension of present technology.

The System and it's source utilizes magnetometer studies.

This System (Earth Electrical System II. "EES.II") utilizes a fully renewable energy source.

This System utilizes a non-polluting energy source.

This System utilizes an universally available energy source.

Endorsement and Certification of The System can be anticipated by States with pollution problems.

AIR CORE INDUCTION COIL BUILDERS GUIDE

DONALD L. SMITH

Energy Consultant

1. Decide frequency. Considerations are: (economy of size)
 - a. Use radio frequency upward (above 20,000 Hz).
 - b. Use natural frequency (coils have both capacitance and inductance), that is match the wire length of the wire in the coil to the desired frequency.
 - c. Wire length is either one quarter, one half or full wave length.
 - d. To obtain the wire length (in feet) use the following: If using one quarter wave length divide 247 by the desired frequency (megahertz range is desirable). If using one half wave length divide 494 by the desired frequency. If using full wave length divide 998 by the desired frequency.
2. Decide number of turns, ratio of increase in number of turns sets the function. In the case of the L-1 coil, each turn divides the input voltage by the number of turns. In the case of L-2 coil, the resulting voltage in each turn of L-1 is induced into each turn of L-2, adding up with each turn. For example if the input into L-1 from a high voltage, low amperage module is 2,400 volts, and L-1, for example, has 10 turns, then each turn of L-1 will have 240 volts of magnetic induction which transfers 240 volts of electricity to each turn of L-2. L-2 may be one turn or many turns, such as 100 to 500 or more turns. At 100 turns, 24,000 volts would be produced. At 500 turns, 120,000 volts would be produced.
3. Decide the height and diameter of the coil system. The larger the diameter of the coil, the fewer turns are required, and the coil has a lesser height. In the case of L-2 this results in lowering the amplification of the induced voltage from L-1.
4. For example, if 24.7 MHz is the desired frequency output from L-2. One quarter wave length would be 247 divided by 24.7 which equals 10 feet of wire. The number of turns will be the amplification factor. The coil may be wound on standard size P.V.C. or purchased from a supplier. The supplier is normally a ham radio supply source. Once the length is determined and the number of turns decided, move to the next step. For example, let each turn of L-1 have 24 volts and desired output of L-2 be 640 volts. Therefore L-2 needs 26.67 turns. It has been determined that the wire length for one quarter wave length is 10 feet. The number of inches in 10 feet is 120. Using Chart "A" supplied look for next higher number of turns showing (being between 20 and 30 turns with a 2" diameter coil). This tells us to use a 2 inch coil. If ready-made as in the case of Barker and Williamson, 10 Canal Street, Bristol, Penna., 215-788-5581, the coils come in standard sizes of 4, 6 and 10 turns per inch. For higher "Q" use wider spacing of the turns. These coils come in a ready-made length of 10 inches. Select from the coil 30 turns and put input clamps on the base of the coil and at 30 turns. For exact determination of the correct position of the output clamp, use an

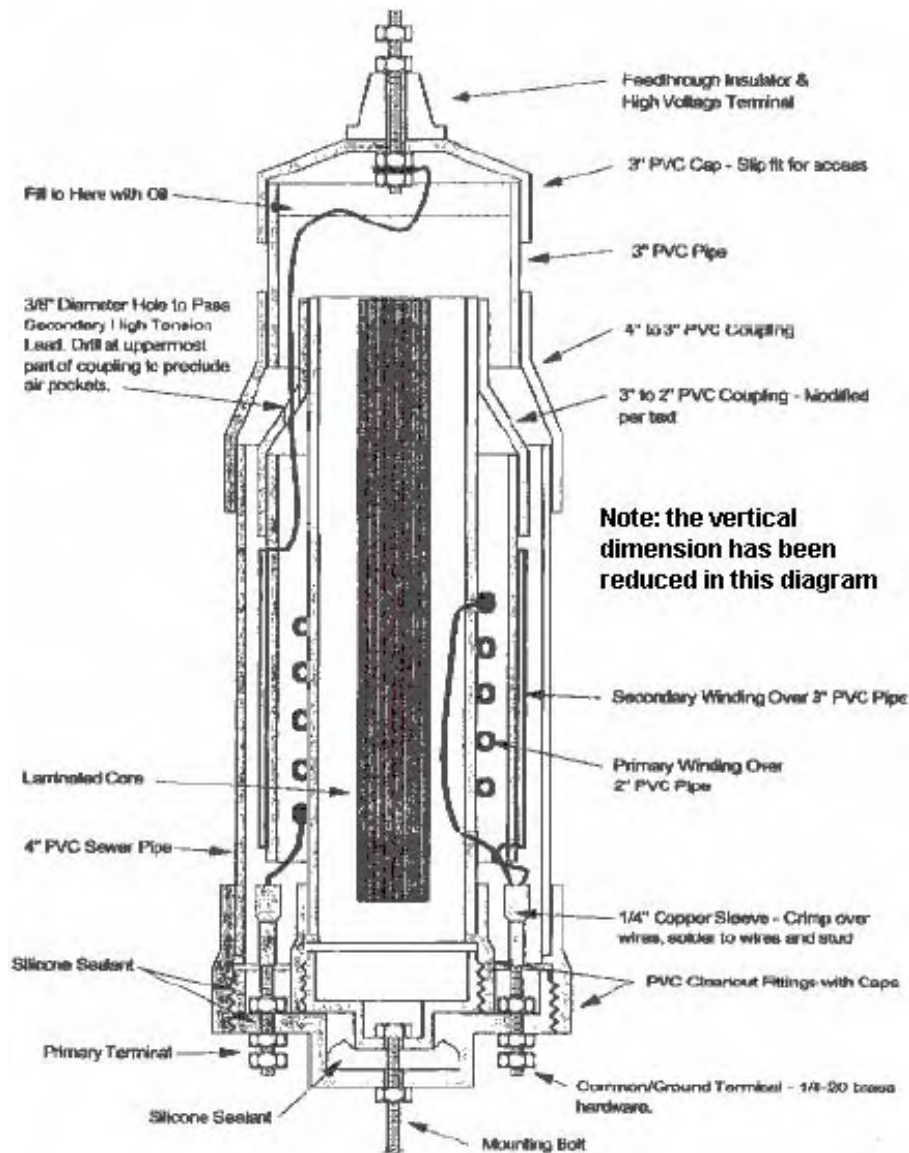
externally grounded voltage probe. The node of maximum intensity, being the natural resonant point. Off the shelf multimeters are not radio frequency responsive. The easiest way to accomplish the above is to get from the hardware store or Radio Shack a voltage detector having a neon bulb system (Radio Shack Cat. No. 272-1100b, NE2-Neon Lamps) will work. With your hand as a ground, move the wire extension of the neon lamp along the coil surface until the neon is brightest. This is the desired point of resonance and it is the optimum connection point.

5. The input power now needs consideration. A 2,400 High Voltage module has been previously selected. This module can be made from a diode bridge or any combination of voltage amplifiers. The one used here is an off-the-shelf type, similar to those used for laser technology.
6. Construction of the input L-1 coil. It has already been decided that there will be 10 turns. The length of the wire here is not critical. Since the L-2 coil is 2-inches in diameter, the next off-the-shelf larger size may be used for L-1. Use a 3 inch diameter off-the-shelf coil which has 10 turns to the inch. Remove (cut) a 10 turn portion from the larger coil. Use an L.C.R. meter and measure the natural farads (capacitance) and henrys (inductance) values of the L-2 coil. Now do the same for the L-1 coil. It will be necessary to put a capacitor across the voltage input of L-1 in order to match the L-1 coil to the L-2 coil. A spark gap across L1 is also required to deal with the return voltage from L-1. A tuneable capacitor of the pad ("trimmer") type for L-1 is desirable.
7. The performance of the L-2 coil can be further enhanced by having an Earth grounding from the base of the coil. The maximum voltage output will be between the base and the top of the L-2 coil. Lesser voltages can be obtained at intermediate points along the length of the L-2 coil.

SUPPLY SOURCES

1. HAM RADIO SUPPLY STORES
 2. COILS, AIR INDUCTOR IN HOUSTON
 3. BAKER AND WILLIAMSON (READY MADE), BRISTOL. PENNA.
- ALSO R.F. DUMMY LOADS AND WATTMETERS.

NOTES



Impulse Transformer Assembly

ELECTRICAL PRINCIPLES: TERMINOLOGY & SAFETY

The use of electricity is so commonplace that most people assume that it will always be available on demand. To fully realize our dependence upon electricity, consider the ways in which electricity is being used each day in the home, on the farm and the ranch. Electricity is doing more to increase work efficiency and promote enjoyable living than any other single factor. The use of electricity has grown to the extent that an increasing portion of the home or business budget, is used in paying for this source of energy.

1. Definition of Electricity

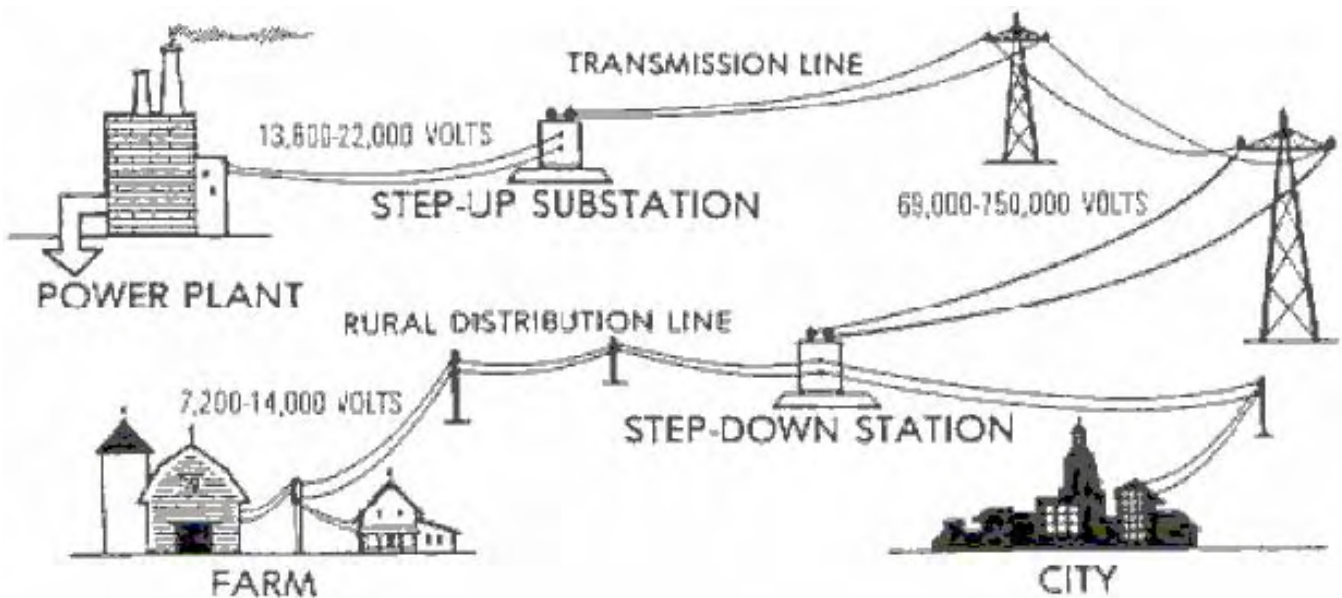
Electricity can be defined in several ways. The layman defines electricity as a source of energy that can be converted to light, heat, or power. Electrical Engineers define electricity as a movement of electrons caused by electrical pressure or voltage. The amount of energy produced depends on the number of electrons in motion.

2. The Manufacture and Distribution of Electricity

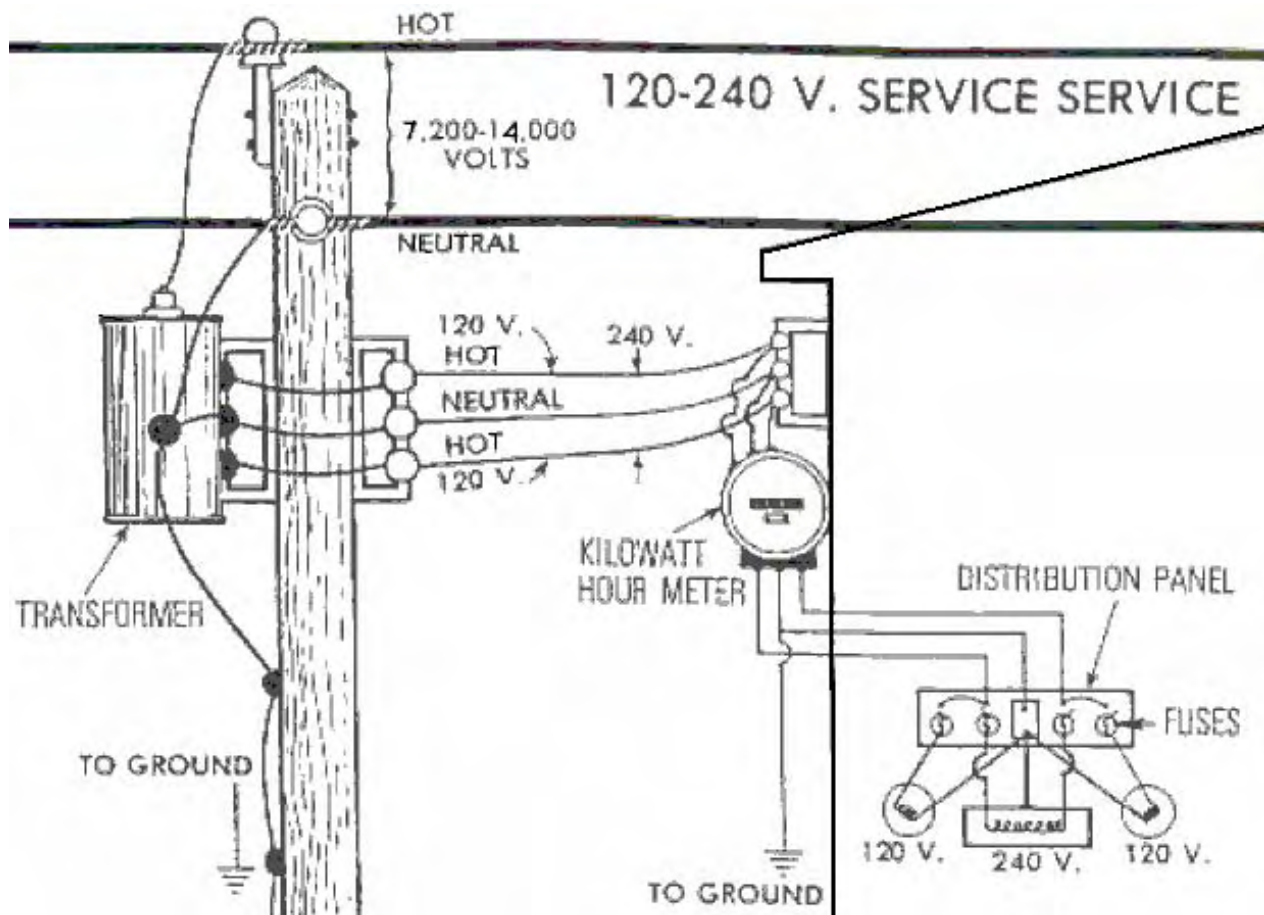
Electricity is produced from generators that are run by water, steam, or internal combustion engines. If water is used as a source of power to turn generators, it is referred to as hydroelectric generation. There are a number of this type located in areas where huge dams have been built across large streams.

Steam is used as a source of power for generating much of today's electricity. Water is heated to a high temperature, and the steam pressure is used to turn turbines which generate electricity. These are referred to as thermal-powered generators. Fuels used to heat the water are coal, natural gas, and/or fuel oil.

Generators at the power plant generate from 13,800 to 22,000 volts of electricity. From the power plant, electricity is carried to a step-up sub-station which, through the use of transformers, increases the voltage from 69,000 to 750,000 volts. This increase in voltage is necessary for the efficient transmission of electricity over long distances. From the step-up sub-station, the electricity is carried on transmission lines to a step-down sub-station which reduces the voltage to 7,200 to 14,000 volts for distribution to rural and city areas.



Transformers at the business or residence reduce the voltage to 120 or 240 volts to supply the meter of the customer:



3. Common Electrical Terms

In order to work safely and efficiently with electricity and have the ability to converse on the subject, the following terms should be understood:

Ampere (Amp) - A measurement in units of the rate of flow of electrical current. This may be compared with the rate of flow of water in gallons per minute.

Example: A 60-watt incandescent lamp on a 120V circuit would pull 1/2 ampere of electricity (60 divided by 120 = 0.5 or 1/2, Formula: $\text{Amperes} = \text{Watts} / \text{Volts}$)

Volt (V) - A unit of measure of electrical pressure. A given electrical pressure (V) causes a given amount of electrical current (Amps) to flow through a load of given resistance. Voltage may be compared to water pressure in pounds per square inch in a water system. Common service voltages are 120 volts for lighting and small appliance circuits and 240 volts for heating, air conditioning, and large equipment circuits.

Watt (W) - A unit of measure of electrical power. When applied to electrical equipment, it is the rate that electrical energy is transformed into some other form of energy such as light. Watts may be compared to the work done by water in washing a car. (Formula: $\text{Volts} \times \text{Amps} = \text{Watts}$)

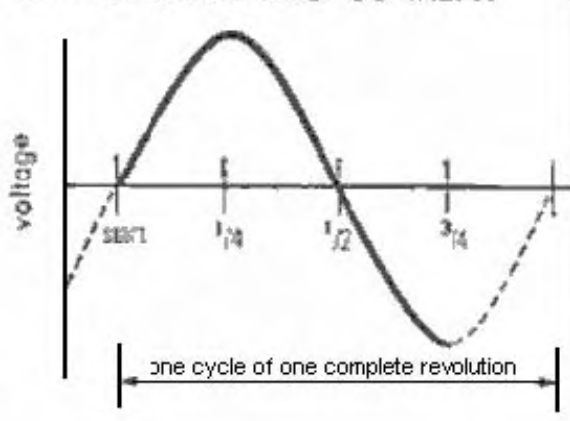
Kilowatt (KW) - A unit of measurement used in computing the amount of electrical energy used. Kilowatts are determined by dividing the number of watts by 1000 as 1 kilowatt = 1,000 watts.

Kilowatt-Hour (KWH) - A measure of electricity in terms of power in kilowatts and time in hours. One KWH is 1000 watts used for one hour.

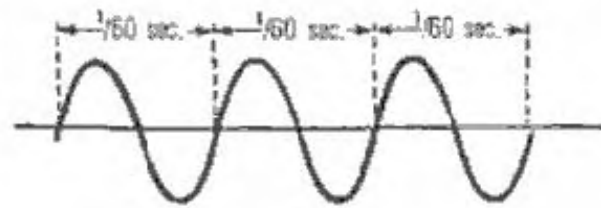
Alternating Current (A.C.) - Electrical current that alternates or changes direction several times per second. The direction current moves depends on the direction in which the voltage forces it.

Cycle - The flow of electricity in one direction, the reverse flow of electricity in the other direction, and the start of the flow back in the other direction. The cycles per second are regulated by the power supplier and are usually 60 in America. Most electric clocks are built to operate on the mains frequency. More or fewer cycles per second would cause mains-operated clocks to gain or lose time. The present practice is to use the term Hertz (Hz) rather than "cycles per second".

**GENERATION
OF ALTERNATING CURRENT**

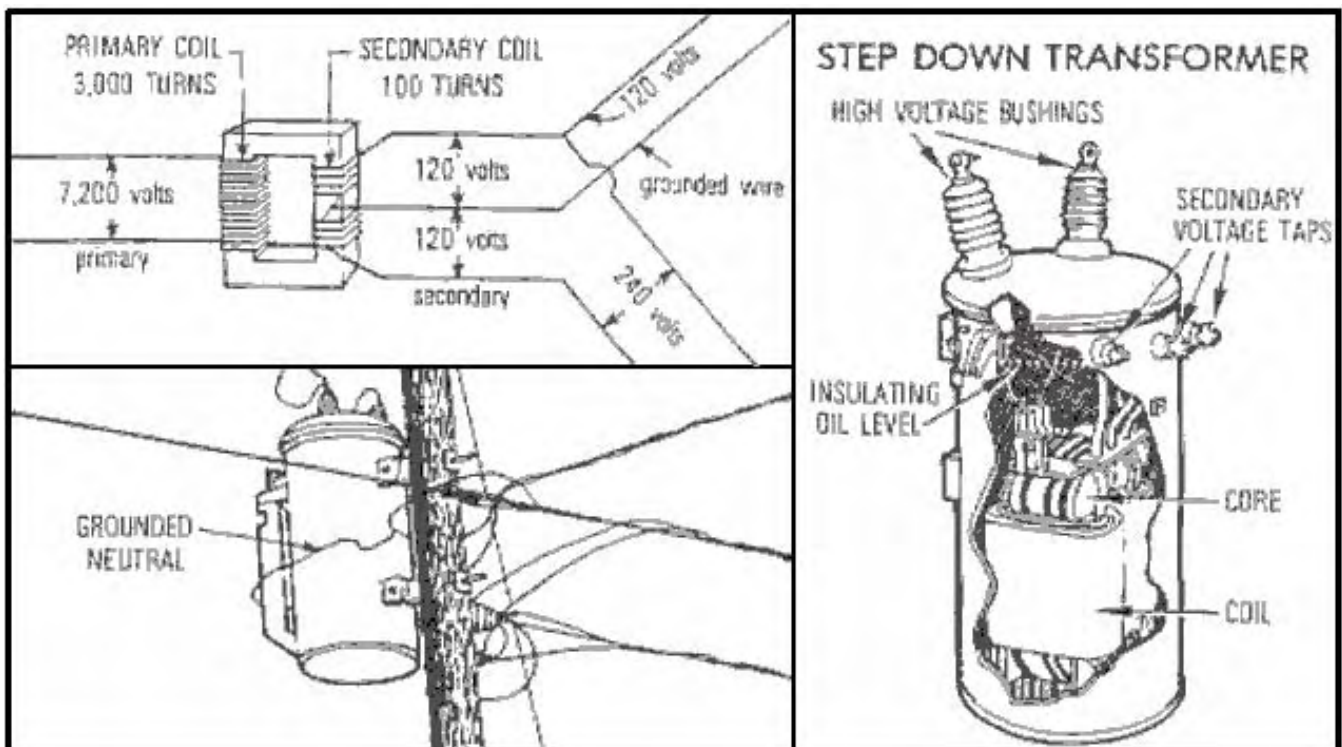


**SINGLE-PHASE
60-Hz ALTERNATING CURRENT**



Direct Current (D.C.) - Electrical current flowing in one direction. Example: electrical circuits in automobiles and tractors.

Transformer - A device used to increase or decrease voltage.



Single Phase - The most common type of electrical service or power available to consumers. One transformer is used between the distribution line and the meter. Usually three wires, two "hot" and one neutral, are installed to provide 120V and 240V single-phase service. Single-phase service may also be supplied with a three-phase service.

Three-Phase - This type of service is designed especially for large electrical loads. It is a more expensive installation due to three wires and three transformers being required. The important advantage of three-phase power is that the total electrical load is divided among the three phases, consequently, the wire and transformers can be smaller. Other advantages exist in the design of three-phase motors.

Short Circuit - A direct connection (before current flows through an appliance) between two "hot" wires, between a "hot" and neutral wire, or between a "hot" wire and ground.

Voltage Drop - A reduction of current between the power supply and the load. Due to resistance, there will be a loss of voltage any time electricity flows through a conductor (wire). Factors that influence voltage drop are size of wire, length of wire, and the number of amps flowing. A drop in voltage may cause a loss of heat, light, or the full power output of a motor. It could cause motor burn-out unless the motor is properly protected (time-delay fuse).

Fuse - A device used to protect circuits from an overload of current.

Circuit Breaker - A device used to protect circuits from an overload of current. May be manually reset.

Time-Delay Fuse - A fuse with the ability to carry an overload of current for a short duration without disengaging the contacts or melting the fuse link.

Horsepower (hp) - A unit of mechanical power equal to 746 watts of electrical power (assuming 74.6% electric motor efficiency). Motors of one horsepower and above are rated at 1000 watts per hp while motors below one horsepower are rated at 1,200 watts per hp.

Conductor - The wire used to carry electricity (typically, copper or aluminum). Copper and aluminum should not be spliced together due to their incompatibility resulting in deterioration and oxidation.

Insulator - A material which will not conduct electricity and is usually made of glass, Bakelite, porcelain, rubber, or thermo-plastic.

"Hot" Wire - A current-carrying conductor under electrical pressure and connected to a fuse or circuit breaker at the distribution panel. (Color Code: usually black or red)

Neutral Wire - A current-carrying conductor not under electrical pressure and connected to the neutral bar at the distribution panel. (Color Code: usually white)

Grounding - The connection of the neutral part of the electrical system to the earth to reduce the possibility of damage from lightning and the connection of electrical equipment housings to the earth to minimize the danger from electrical shock. (Color Code: Can be green or bare wire).

Underwriters' Laboratory (U.L.) - An American national organization which tests all types of wiring materials and electrical devices to insure that they meet minimum standards for safety and quality.

National Electric Code (N.E.C.) - Regulations approved by the National Board of Fire Underwriters primarily for safety in electrical wiring installations. All wiring should meet the requirements of the national as well as the local code.

4. Computing Electrical Energy Use and Cost

If an estimate of cost for electricity used is desired, the name plate data on appliances and equipment and an estimate of operating time may be used. The following formulas should be used for determining watts, amps, volts, watt-hours, kilowatt-hours, and cost.

$$\text{Watts} = \text{Volts} \times \text{Amperes}$$

$$\text{Amperes} = \text{Watts} / \text{Volts}$$

$$\text{Volts} = \text{Watts} / \text{Amperes}$$

$$\text{Watt-Hours} = \text{Watts} \times \text{Hours of operation}$$

$$\text{Kilowatt-Hours} = \text{Watt-Hours} / 1000$$

$$\text{Cost} = \text{Kilowatt-Hours} \times \text{Local Rate per Kilowatt-Hour (or per "Unit")}$$

Example:

Local electricity rate per Kilowatt-Hour: 8 cents

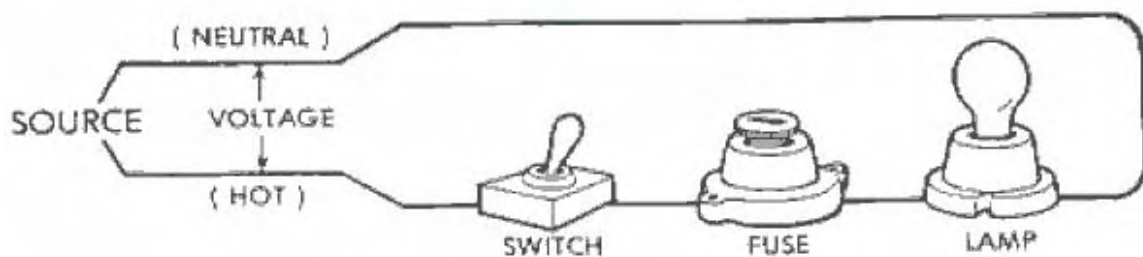
Equipment plate data: 120 Volts 5 Amps

Monthly hours of operation: 10

1. Watts = Volts x Amperes, so Watts = $120 \times 5 = 600$ watts
2. Watt-Hours = $600 \times 10 = 6,000$ watt-hours
3. Kilowatt-Hours = $6,000 / 1,000 = 6$ kilowatt-hours (or 6 Units)
4. Cost = $6 \times 8 = 48$ cents

5. Electrical Circuits

An Electrical Circuit is a completed path through which electricity flows. Insulated conductors (wires) provide the path for the flow of electricity. A water system and an electrical circuit are similar in many respects. Water flows through pipes and is measured in gallons per minute, and electricity flows through conductors and is measured in amperes. A simple circuit is shown here:

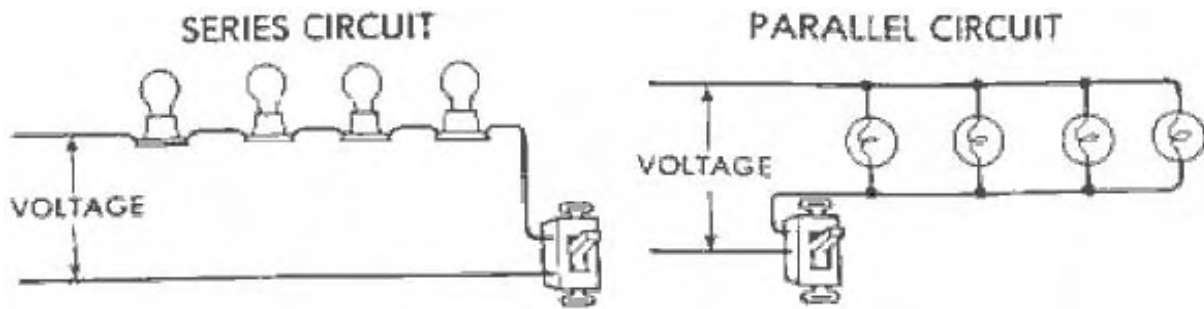


A circuit includes a "hot" wire (red or black) carrying current from the source through a switch, circuit protector (fuse or circuit-breaker), and an appliance. The neutral wire (white) conducts the current from the appliance to the source (ground).

There are two methods for connecting devices in a circuit - "in series" or "in parallel". In a series circuit, all of the current must flow through each device in the circuit. Removing any one of the devices in a series circuit will stop the flow of current. In parallel circuits, the load (lights or appliances) are connected between the two wires of the circuit providing an independent path for the flow of current, and removing a lamp has no effect on the other lamps in the circuit.

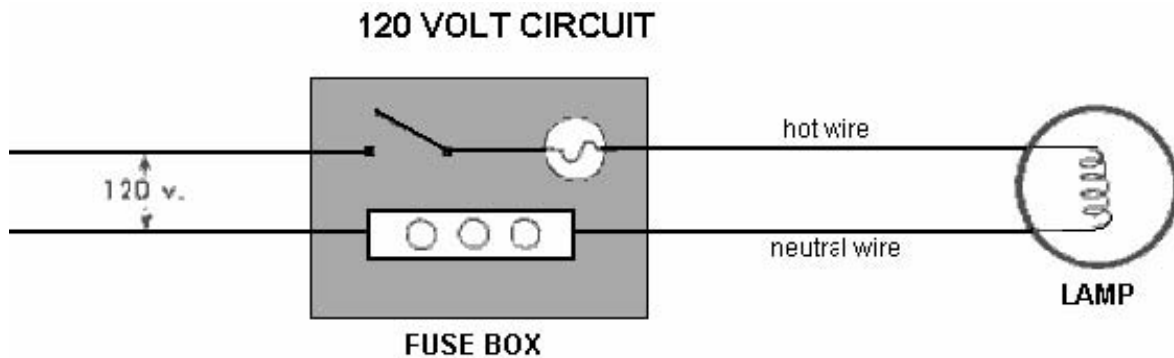
Switches, fuses, and circuit breakers are always connected in series. In most cases, except for some

Christmas tree lights, appliances and lights are connected in parallel.

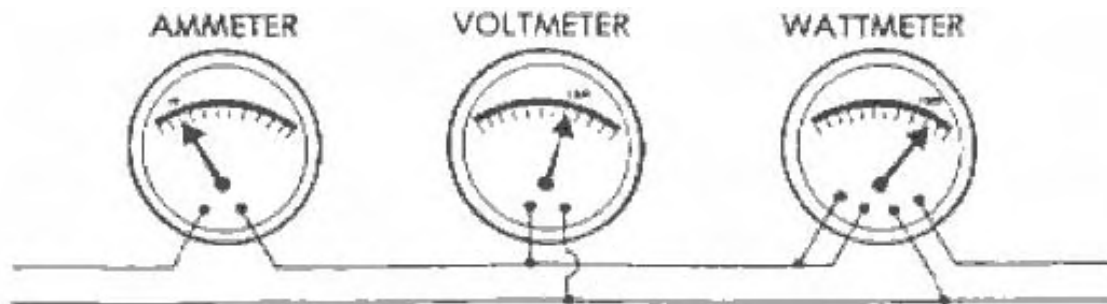


6. 120 Volt and 240 Volt Circuits

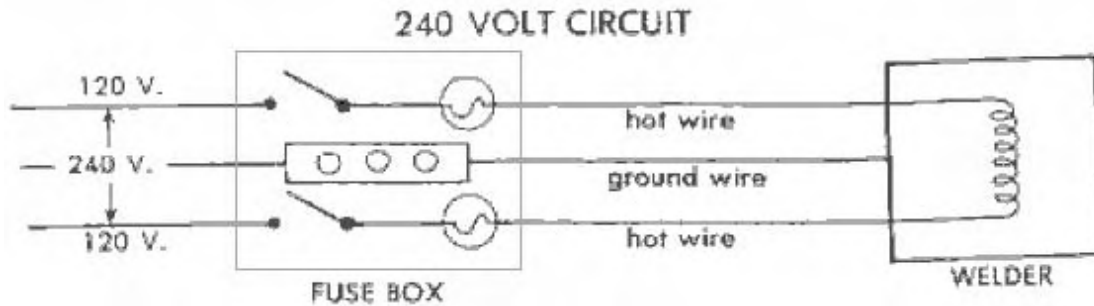
The 120V circuit has one "hot" and one neutral wire, with the switch and circuit protector in the hot line. The neutral wire from the appliance is connected to the neutral bar in the fuse or breaker box. For safety, the neutral wire should never be broken or interrupted with a switch or fuse.



The voltage in a 120V circuit is measured with a voltmeter with one lead on the hot terminal and the other lead on the neutral bar. The number of amperes flowing may be measured with a clamp-on ammeter by encircling the hot or neutral wire with the jaws of the ammeter.



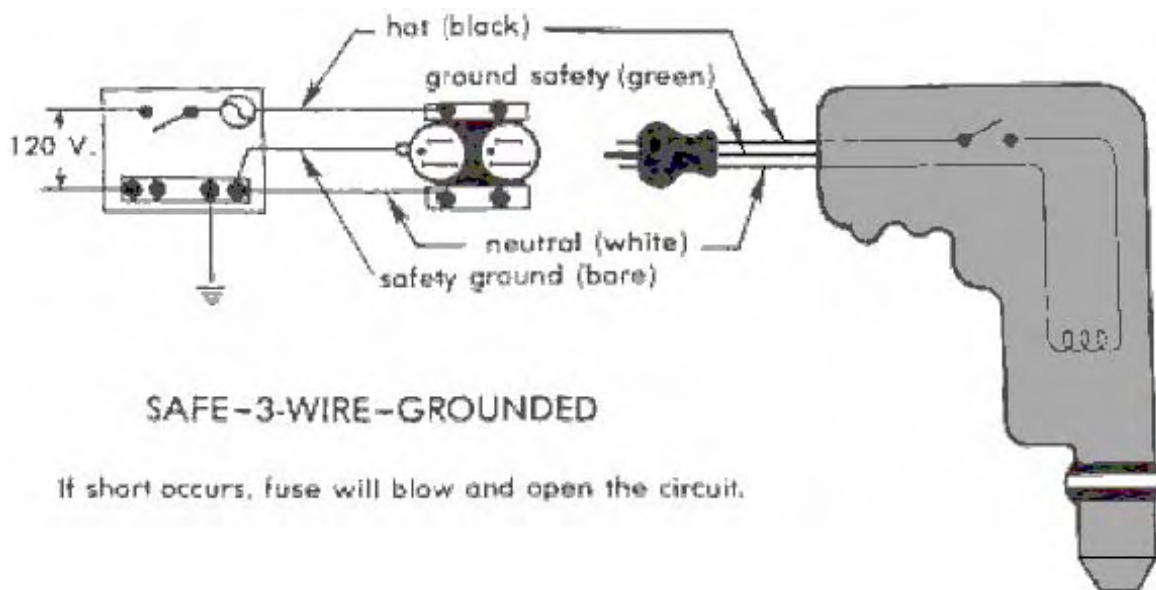
The 240V circuit has two hot wires and one safety-ground wire. Switches and fuses are installed in the hot lines. The two hot wires are necessary for the operation of 240V welders and motors. The safety-ground wire, connected to the metal frame of the equipment or motor and to the neutral bar, does not carry current unless a "short" develops in the motor or welder. If a short should occur, one of the circuit protectors will burn-out or open, thus opening the circuit.



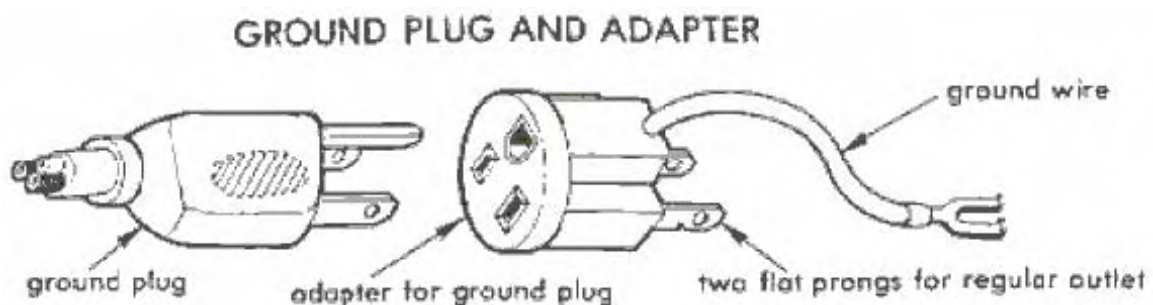
The voltage on a 240V circuit is measured by fastening a lead on the voltmeter to each of the hot wires. Voltage between either hot terminal and the neutral bar will be one-half of the voltage between the two hot wires. The number of amperes flowing can be measured by clamping an ammeter around either of the hot wires.

7. Safety Grounding of Electrical Equipment

Refer back, to the 240V circuit and note the ground wire from the metal frame to the neutral bar. The following illustration shows proper safety grounding when operating a drill in a 120V circuit. The safety-ground wire may be bare, but a three-wire cable is recommended. Safety-ground wire in three-wire cable is usually green in color. A current-carrying neutral wire should never be used for a safety-ground. Likewise, a safety-ground wire should never be used as a current-carrying hot or neutral wire.



Using grounded receptacles and a safety-ground on all circuits will allow the safety-grounding of appliances when they are plugged into the outlet. An adapter must be used to properly ground appliances connected to receptacles which are not safety-grounded. If an adapter is used, the green pigtail wire must be connected to a known ground to give protection from electrical shock should a short-circuit occur.



A test lamp can be used to check a circuit completed between a "hot" wire and a neutral wire. Use the test lamp to check appliances for shorts. With the appliance plugged into an outlet, touch the appliance frame with one lead of the test lamp while the other lead of the test lamp is grounded to a water or gas pipe. If the test light does not burn, reverse the appliance plug and check with the test lamp again. If the light burns, a short exists (the hot wire is touching the frame of the appliance). Unplug the appliance and repair or discard it.

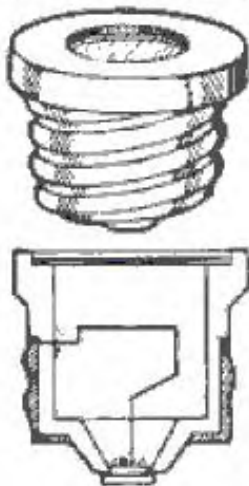
8. Electrical Circuit Protection

Electrical circuits should be protected from an overload of amperes. Too many amperes flowing through an unprotected circuit will generate heat, which will deteriorate or melt the insulation and possibly cause a fire. The number of amperes that a given conductor can safely carry, depends upon the kind and size of wire, type of insulation, length of run in feet, and the type of installation. Charts are available in reference texts giving allowable current-carrying capabilities of various conductors.

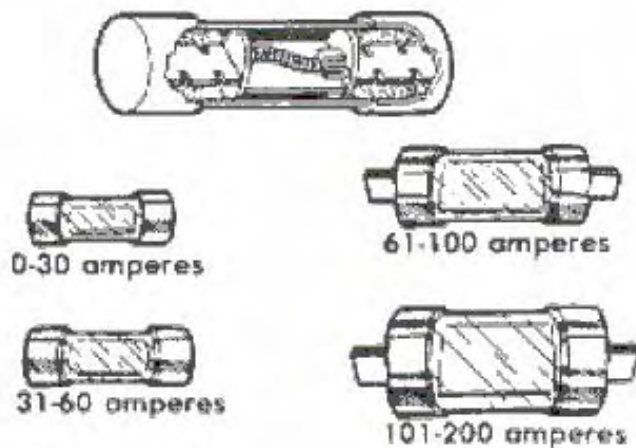
The four types of circuit protection are: common fuses, fusetrans (time-delay), fustats (two- part time-delay), and circuit-breakers. Fuses are of two basic types: plug, and cartridge.

Common fuses contain a link made from a low-temperature melting alloy which is designed to carry current up to the rating of the fuse. Current higher than the amperage rating causes the link to heat above it's melting point. When the fuse "blows", the link melts and opens the circuit.

PLUG TYPE FUSE

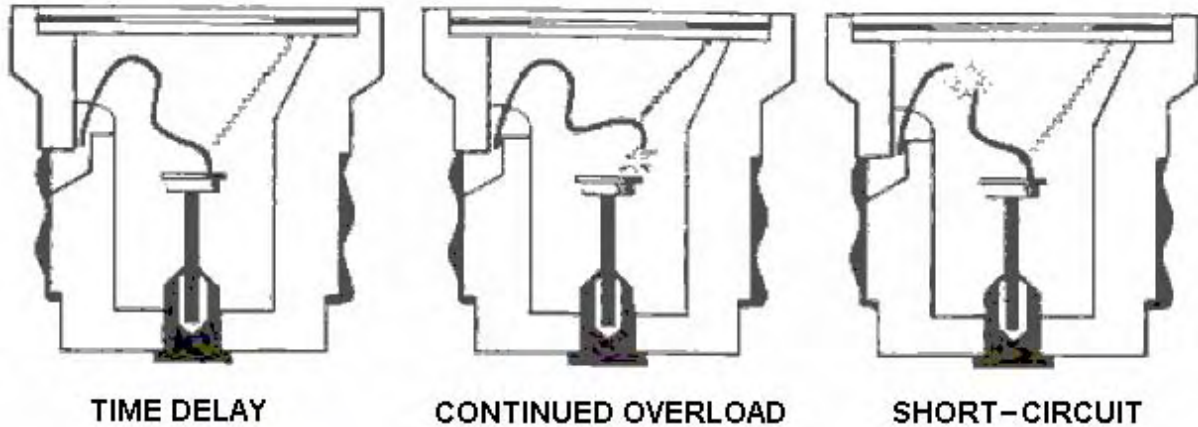


CARTRIDGE TYPE FUSE



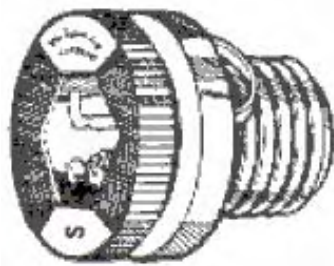
Fusetrans (time-delay fuses) are made to carry a temporary overload, such as the overload caused by the starting of an electric motor. The fuse, however, still provides protection for the circuit, and a short-circuit will melt the fuse link. If a common fuse is used, the fuse link will melt every time an electric motor starts. The use of a larger ampere common fuse will prevent the "blow" resulting from the temporary overload, but will not provide protection for the motor or the circuit.

OPERATING PRINCIPLE OF DELAYED ACTION FUSE

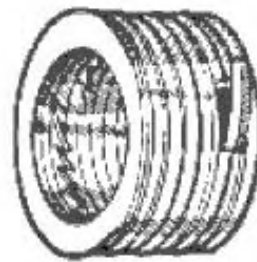


Fustats, non-tamperable fuses of the time-delay type, have a different size base and require a special adapter which is screwed into the standard fuse socket. After the adapter is installed, it cannot be removed. For example, the installation of a 15-ampere adapter allows only the use of 15-ampere or smaller fuse.

FUSTATS



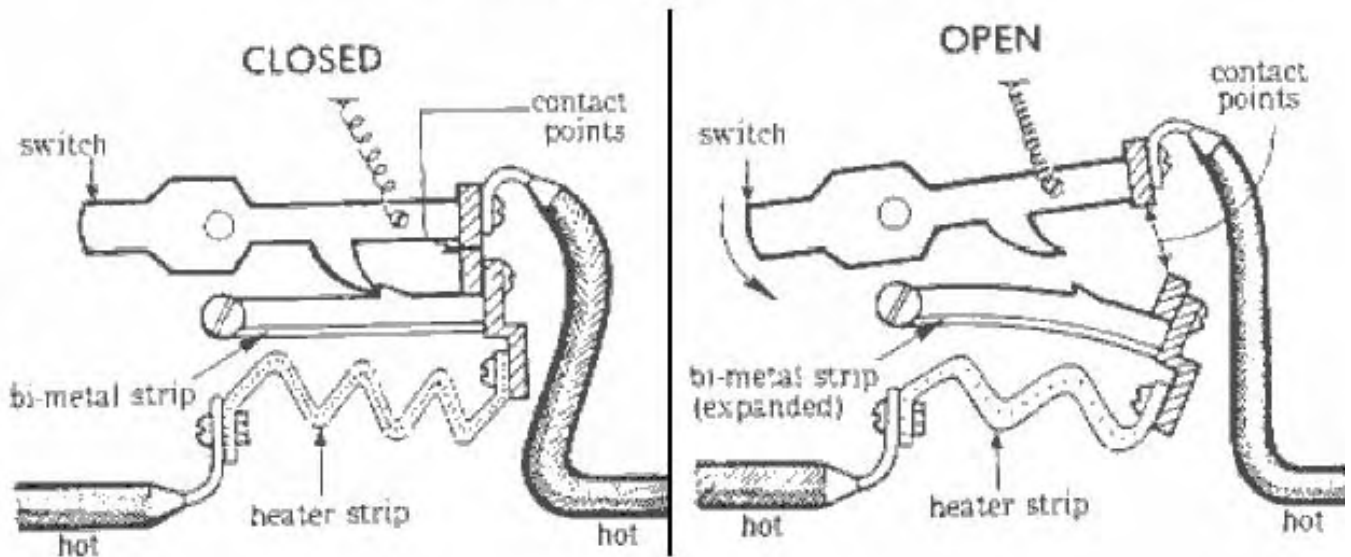
FUSE



ADAPTER

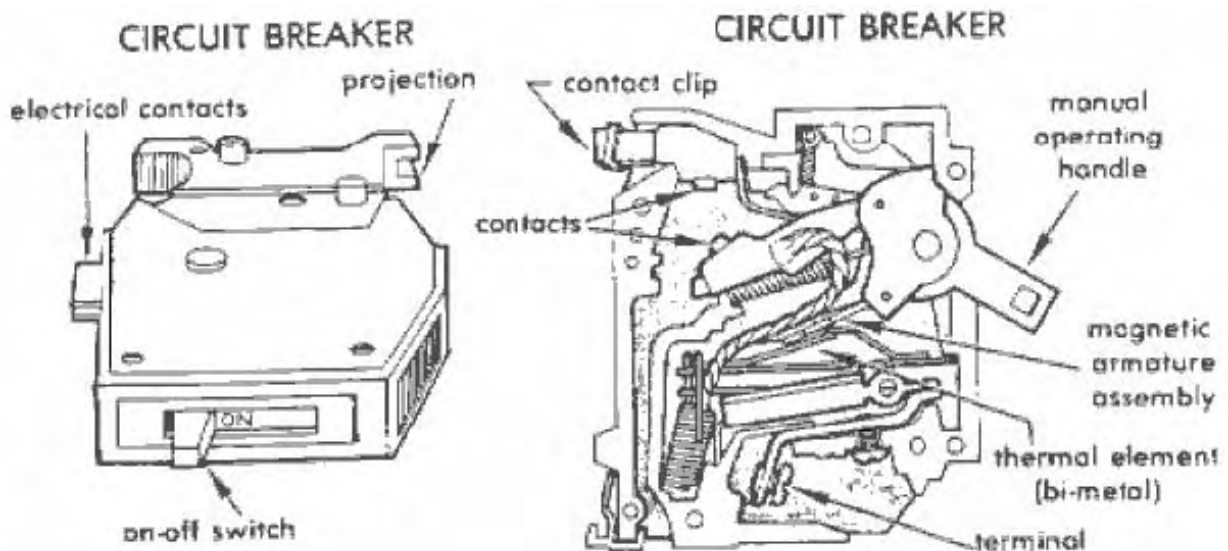
Circuit breakers eliminate the replacement of fuses and are commonly used even though a circuit breaker box costs more than a fuse box. Circuit breakers are of two types, thermal and magnetic. The thermal breaker has two contacts held together by a bi-metal latch. A current overload causes the bi-metallic strip to become heated, the latch releases, and the points spring open. After the bi-metallic strip cools, the switch is reset and service is restored.

CIRCUIT BREAKER OPERATION



The magnetic breaker has contacts that are held together by a latch which is released by the action of an electromagnet. The amount of current flowing through the circuit will determine the size of the electromagnet. This type of circuit-breaker is reset by moving the toggle switch to the "on" position.

The following diagram shows the parts of a circuit breaker.



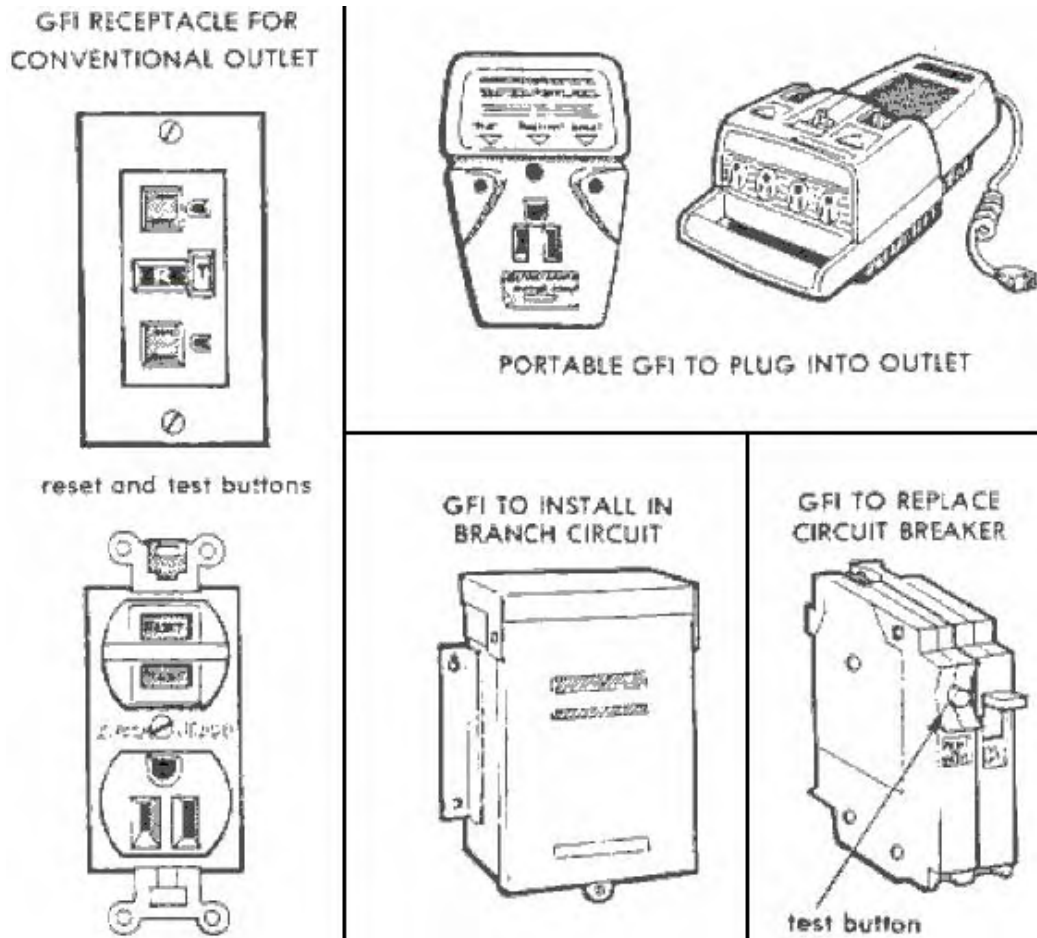
9. No Fault Grounding

Fuses and circuit-breakers are safety devices which limit current (amperage) in a circuit. Their main function is to protect equipment and wiring from overload. Ground fault circuit interrupters (GFI) are designed to protect humans, equipment, and/or electrical systems from injury or damage if electricity flows in an unintended path (a short-circuit).

A GFI is a very sensitive device that functions by comparing the current moving in the "hot" wire with that in the neutral wire. If these two currents are not equal, a fault exists, and current is "leaking" out of the circuit. If the difference in current between the two wires is 5/1000 of an ampere or greater, the GFI will open the circuit, shutting off the power and eliminating any shock hazard.

The National Electrical Code requires GFI's for all 120V, single phase, 15 and 20 amp receptacles installed outdoors, in bathrooms, and in garages for residential buildings. A GFI is required at construction sites and some other applications. After correcting a circuit fault, the GFI may be reset for further use.

A variety of GFI equipment is made for 120 and 240 volt circuits:



REFERENCES:

COOPER, ELMER L., *AGRICULTURAL MECHANICS: FUNDAMENTALS AND APPLICATIONS*. DELMAR PUBLISHERS INC., ALBANY, NEW YORK

ELECTRICAL WIRING - RESIDENTIAL, UTILITY BUILDINGS, SERVICE AREAS, AAVIM, ATHENS, GEORGIA.

Note: This electrical information does not apply directly to areas outside America and local regulations for electrical supply should be checked.

Variations

Some people have experimented with Don Smith's basic ideas and found some interesting things. One of these people is Ukrainian: I. M. Solovey. The translation for his application for a PhD is shown below and thanks is due to Howerd Halay for making this translation:

ELECTRIC POWER GENERATION SYSTEM HIGH FREQUENCY

I. M. Solovey, Candidate Ph.D.

NUBiP of Ukraine "Berezhany Agrotechnical Institute" LS Chervinsky, PhD National University of Life and Environmental Sciences of Ukraine NP Semenov, engineer NUBiP of Ukraine "Berezhany Agrotechnical Institute"

Considered:

Existing scientific views do not have a convincing theoretical basis for the phenomenon of excess energy output. Power supply, Inductance, power, high-frequency measuring range, filter, energy.

Currently, there is a great deal of information about devices, after which "Activation" in whatever working field; in the process of "relaxation" output energy is in excess of input energy used.

For example, in the "production" of thermal energy observed in the oxygen-hydrogen electrolyzers for normal and heavy water (Filimonenko V., 1957, S. Jones, 1989), the electric discharger (Chernetskyy A., 1971), vortex heat generators (Potapov Y., 1992).

In the late 1980s Stanley Meyer patents "Water Fuel Cell" (WFC) that allows the conversion of ordinary tap water into hydrogen and oxygen with far less expenditure of energy than would be required by conventional electrolysis, and in much greater quantity than expected with simple electrolysis. His explanation of the results is based on the resonant electric field effects on water molecules [2].

Later Don Smith built a number of devices based on Tesla's experiments, mostly with high output power. In his articles, he notes that he repeated each of the experiments found in the Tesla books, and this gave him an understanding of "ambient background energy" [3].

Objective. Repeat one of the above methods of obtaining energy. To test whether these devices really work. For this we implemented the circuit of the Don Smith device from his patent of 1994, where the generator can achieve an output of 15 kW (Fig. 1).

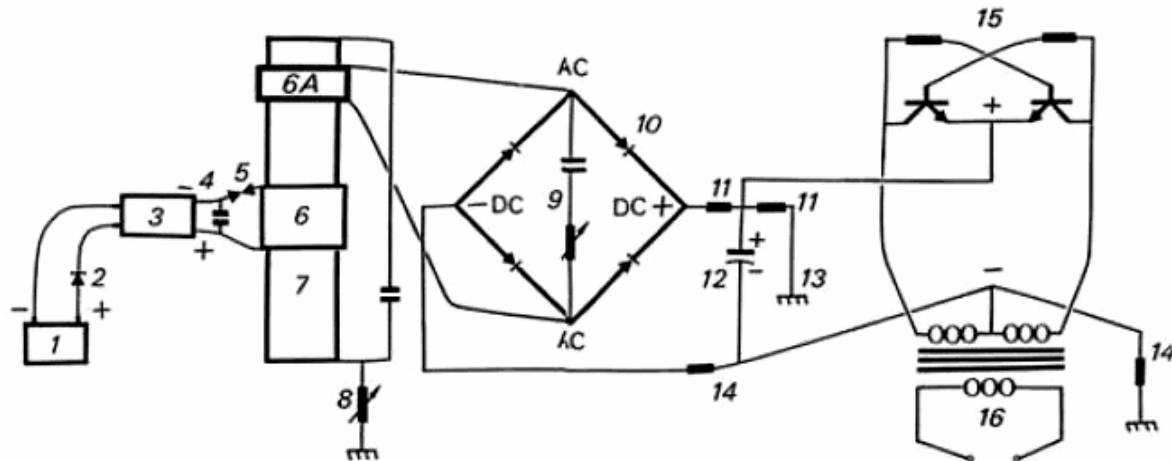


Fig 1. Schematic of electricity generator of Don Smith (according to his patent from 1994)

Basic materials and methods of research.

The main element in the schematic of Fig. 1 is an air-core transformer with the windings numbered 6 (primary), 6A (optional), 7 (secondary).

For the study we prepared Primary L1, secondary L2 and an additional L3 coil according to specifications given in the following table:

Coil Specifications			
Specification	Primary L1	Secondary L2	Additional L3
Coil length, cm	5,5	32	6
Number of turns	8	463	10
Diameter CM	5,5	5,1	5,6
Active resistance, ohms	0,1	4,2	0,1
Copper wire length per winding, M	1,4	69,1	1,8
Wire diameter, mm	2	0,65	1,2

To calculate the electromagnetic parameters of the secondary coil L2 we used a program named "Flyback Tesla calculator".

Calculation results: L2

Coil inductance - 1559.9 uH;

self capacity - 4.61 pF;

Wire Length 73.2 m;

number of turns - 457;

quality factor - 8492;

resonance frequency AC - 1.875 MHz; and ¼ resonance frequency – 1.024 MHz

(Actual Experiment - 1.1 MHz).

The study was conducted according to the schematic in Fig. 2.

Placing of coil windings - as a Tesla transformer: primary on the base of the secondary.

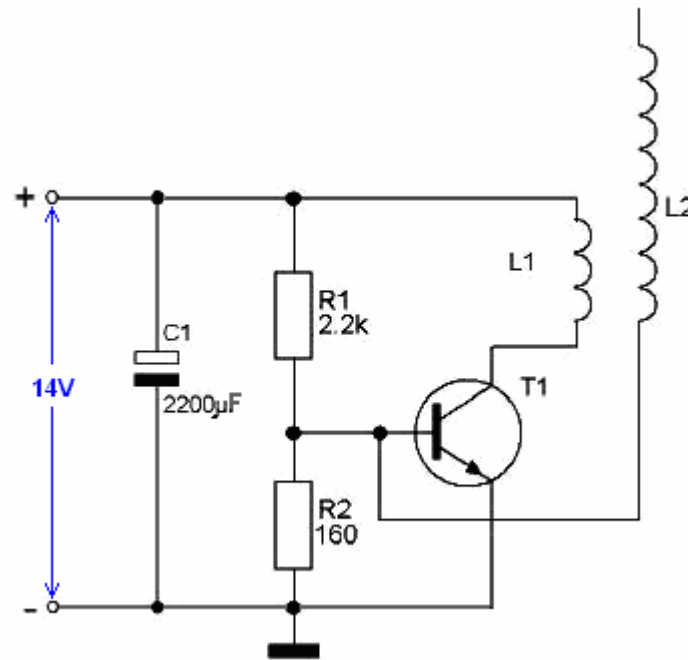


Fig. 2. Schematic of windings L1 and L2

Measurement of current was carried out by a DC ammeter on the PSU. Current consumption in the above schematic is 0.3 A. The value of voltage U_2 at the output ends of the winding L2 is calculated by the formula: $U_2 = U_m / N_1 \cdot N_2 = 14 / 8.463 = 810.25 \text{ V}$

where

U_m is the voltage, 14 V;

N_1 is the number of primary turns and

N_2 is the number of secondary turns (see. Table).

Note. The formula does not take into account the resistance of the transistor's base-emitter pn junction nor that of the connecting conductors.

Experimentally determined values of voltage - largest breakdown in the air gap between the initial winding ends at L2 point of discharge. The magnitude of the voltage was 500-700 Volts. Frequency: 1.1 MHz measured experimentally by the use of a frequency generator.

When connecting the circuit (see. Fig. 2) to the constant power supply, power consumption was $0.3 \times 14 = 4.2 \text{ W}$ and this power can be called a complete network power consumption of 4.7VA. On output of the L2 winding we obtain (at the base of the coil) current of about 0.3 A and a voltage between the two ends of the coil of 700 V which calculates to $0.3 \times 700 = 210 \text{ VAR}$. The study of high-energy parameters of the generator power circuit was conducted in Figs. 3 - 6 where a bulb was used as an active load. The magnitude/intensity of lamp brightness determined the output power measurement. Lamps used were various capacities from 0.3 watts to 21 watts.

Under the schematic of Fig. 3 switching in various incandescent lamps, for example 0.3 W, did not lead to lighting, although consumption of the circuit energy was $14 \times 0.3 = 4.2 \text{ watts}$.

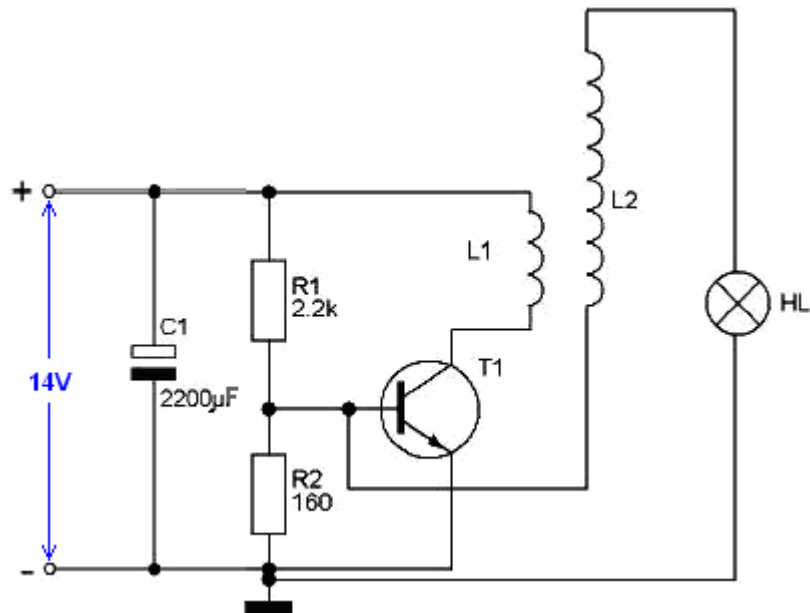


Fig. 3. Circuit of the experiment to determine the active power output of the L2 coil

We placed an extra coil L3, as in Smith's schematic (Fig. 4). Coil L3 was placed in the upper third of the L2 coil. A 6 volt, 3 watt lamp was connected to the additional coil L3 (see Table) and it showed a subtle glow.

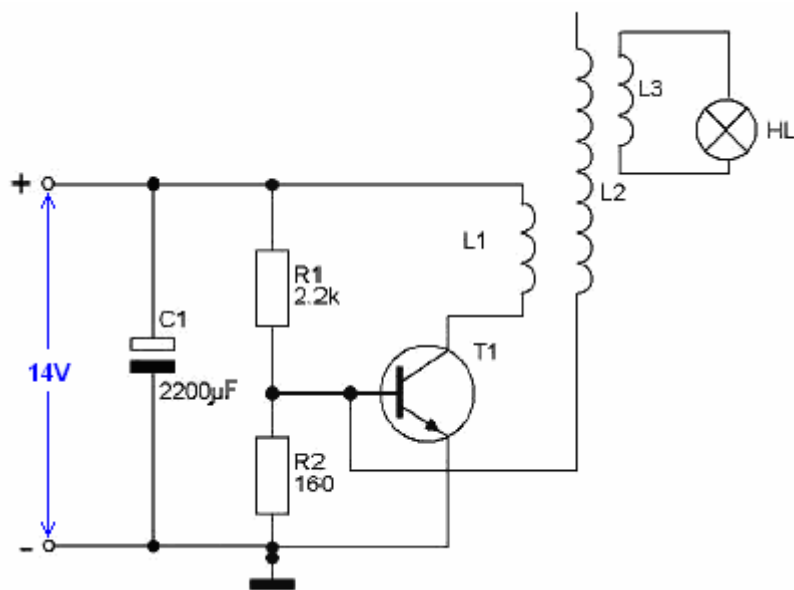


Fig. 4. Inserting various incandescent bulbs through additional winding L3.

When we inserted a capacitor C2 in series with the winding L2 (Fig. 5) We inserted a 12 volt 21 watt lamp to the L3 coil output. The lamp became brightly lit and in 4 to 5 seconds it burned out. The current consumption was a net 1.2 amps.

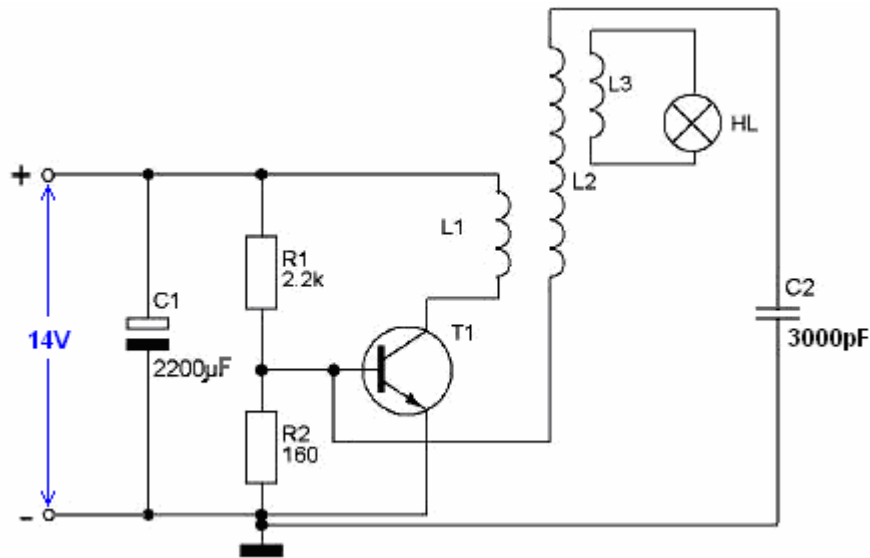


Fig. 5. Switching incandescent bulb(s) through the additional winding L3 when creating L2-C2 path.

An analogous result was obtained when we switched in a tungsten lamp using the schematic in Fig. 6 in a series circuit L2 / C2. A 12 volt 21 watt lamp also burns out in 4 to 5 seconds. The current in the lamp in this configuration was 1.8 - 2.3 Amps.

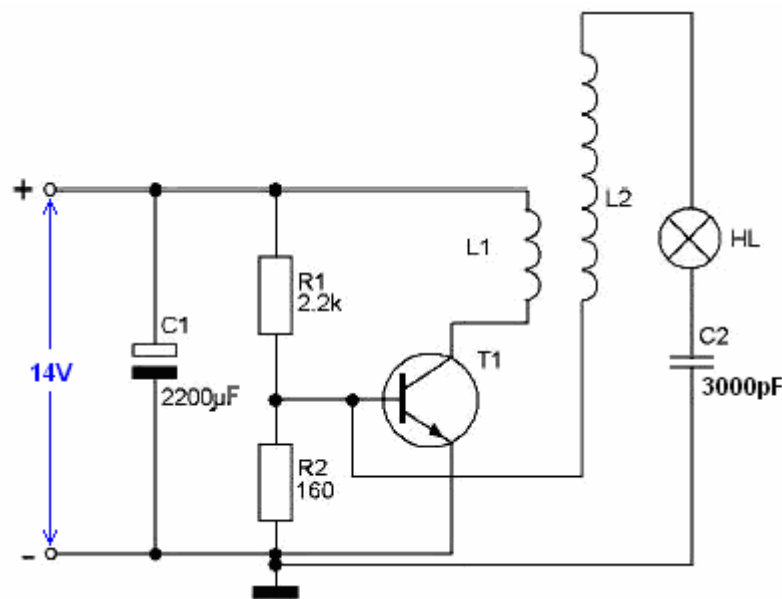


Fig. 6. Schematic: inserting an incandescent lamp in series through L2 and C2.

Conclusions

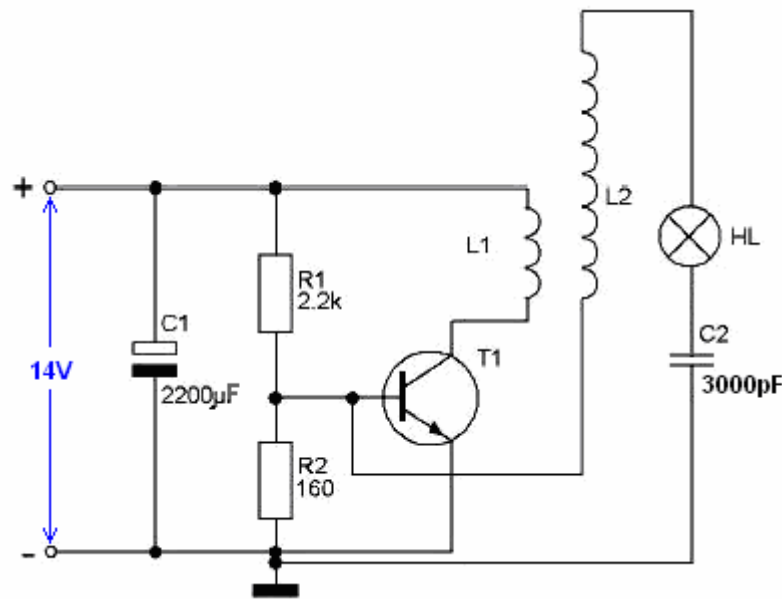
The results of exploratory studies confirm the existing scientific thought that the processes of input and output routing/transmission of electricity using high-voltage high-frequency electromagnetic field (radiation) phenomena require further deep theoretical and experimental studies.

References

1. Kanarev FM Beginning Phys chemistry microcosm / Kanarev FM [8th ed.]. Krasnodar, 2007. - 750 s.
2. Fominsky LP Rotary generators of free heat. DIY Fominsky LP - Cherkasy: "OKO-Plus". 2003. - 342 s.
3. US Patent No. 08/100074 .

The phenomena of appearance of excess energy effects have not found a convincing theoretical explanation from the standpoint of existing scientific views.

The interesting thing about this paper from Solovey is that the input voltage is so low at a mere 14 volts, although, of course, the output voltage is much higher and is at 1.1 Megahertz. Solovey's final diagram Fig.6 is interesting in that his 21 watt 12 volt bulb was destroyed in just a few seconds.

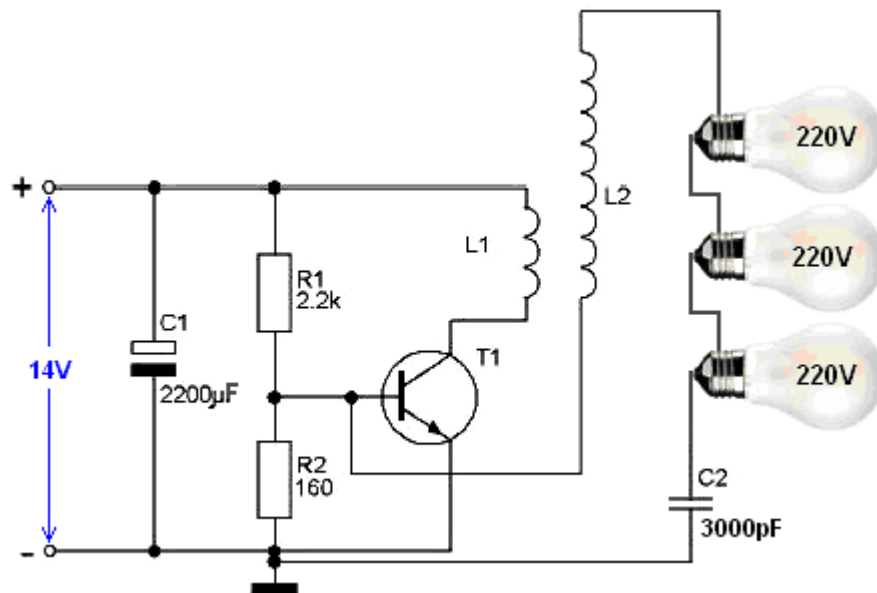


The measurement of current through the bulb was 2.1 amps while the bulb's design current is 1.75 amps. That difference is not enough to have destroyed the bulb so rapidly, so the problem will have been that the bulb wattage was exceeded severely. Earlier, the voltage across the coil "L2" was measured at 700 volts, so there may have been as much as that applied to the twelve volt bulb. If 700 volts were applied to the bulb and a current of 2.1 amps flowed through the bulb, then the dissipated power in the bulb would have been as much as $700 \times 2.1 = 1470$ watts which is 70 times the rating for the bulb and more than a kilowatt! **Please don't be misled by the 14 volt input voltage, this circuit steps up the voltage and it could easily kill you.** It is said that the high frequency of 1.1 MHz makes the output harmless to humans. I have not tested this and you really need to be careful around any high voltage circuit.

A point which Solovey seems to have missed is the fact that the positioning of the L1 primary coil along the length of the L2 secondary coil has a major effect on the output amperage, so, positioning the L1 coil in the middle of the L2 coil should increase the output power considerably.

The lamp used as the load is essentially a resistive load. I don't know enough about the subject, but putting a step-down air-core transformer in place of the bulb should lower the output voltage and increase the available output current considerably. However, a transformer is an inductive load and whether or not that change would completely alter the functioning of the circuit remains to be seen.

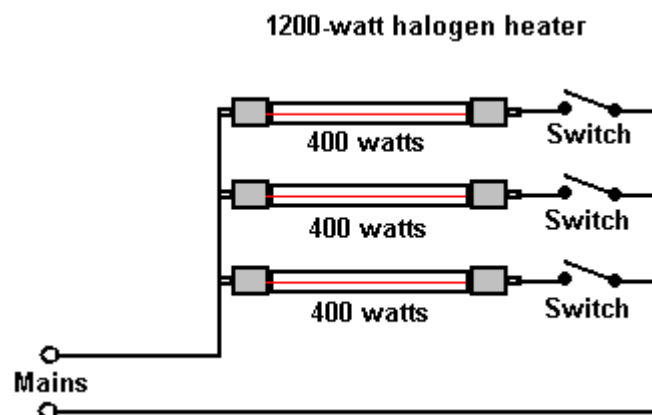
It might be worth testing the following simple circuit if we were to assume that the output voltage is indeed the 700 volts measured by Solovey and that a resistive load is needed. Three 220-volt 100-watt filament bulbs connected in series would appear to be a satisfactory test load:



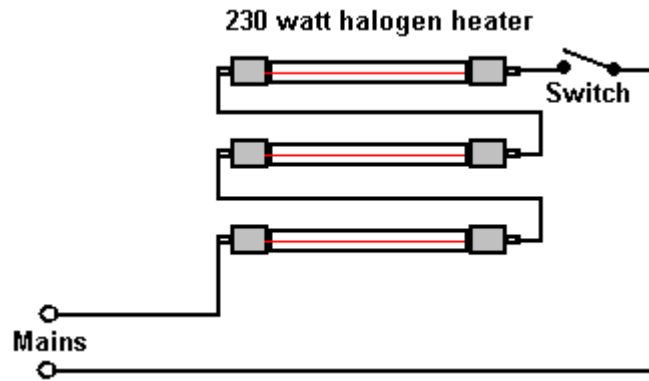
Another possibility would be to take an ordinary cheap halogen heater and re-wire it so that the three 400-watt lamps are in series rather than in parallel:



A standard, low-cost halogen heater consists of three separate 400-watt sections with a switching arrangement which allows one, two or three sections to be powered up:



You can change the wiring inside the heater, so that all three halogen lamps are connected in a chain. As the wires connecting the lamps have push-on 'spade' connectors to allow for both simple manufacturing and easy replacement of a halogen lamp, this can often be done without any soldering. The new arrangement is like this:

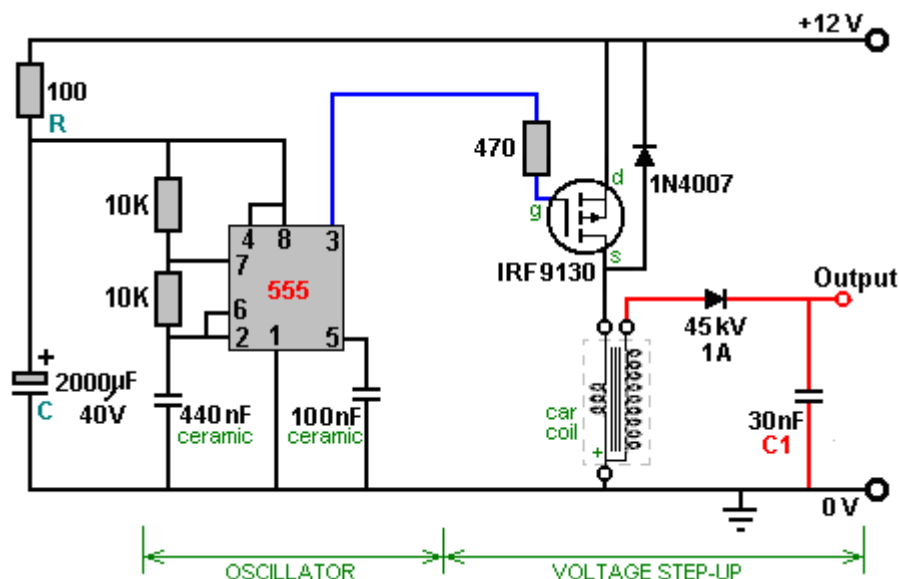


This arrangement 'under-runs' the lamps as each lamp only gets one third of the voltage which it was designed for. If the halogen heater is now connected across 700 volts and the three lamps are similar to each other, then about one third of the 700 volts will be across each bulb. This is only an untested 700 volt suggestion although a heater of this type works well at low power on 220 volts. However, should give a high voltage resistive load as a starting point for experimentation.

Making a Solid-State Tesla Coil.

As some readers may feel that there is some "black magic" about the neon-driver circuit used by Don to drive the Tesla Coil section of his circuitry and that if a suitable unit could not be purchased then the circuit could not be reproduced or tested, it seems reasonable to show how it operates and how it can be constructed from scratch:

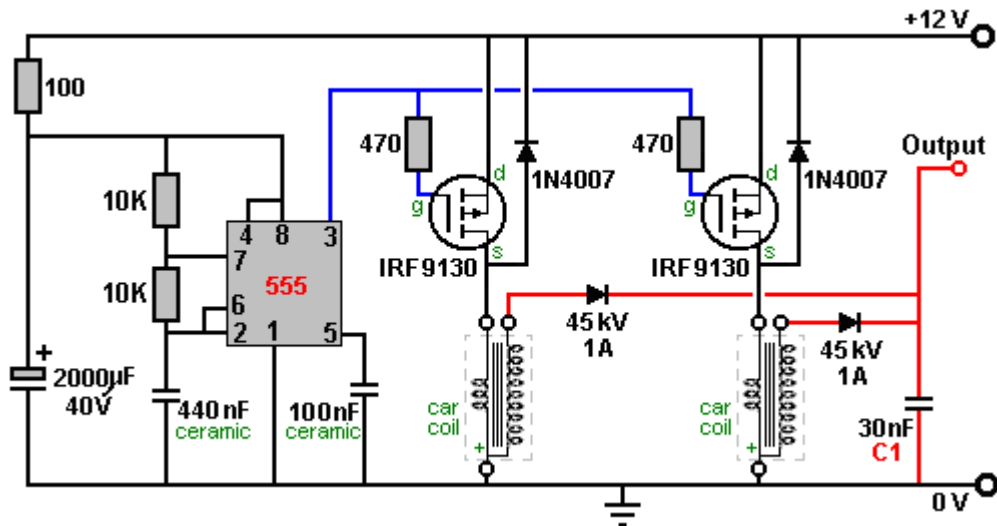
The circuit itself is made up of an oscillator to convert the 12-volt DC supply into a pulsating current which is then stepped up to a high voltage by a transformer. Here is a circuit which has been used for this:



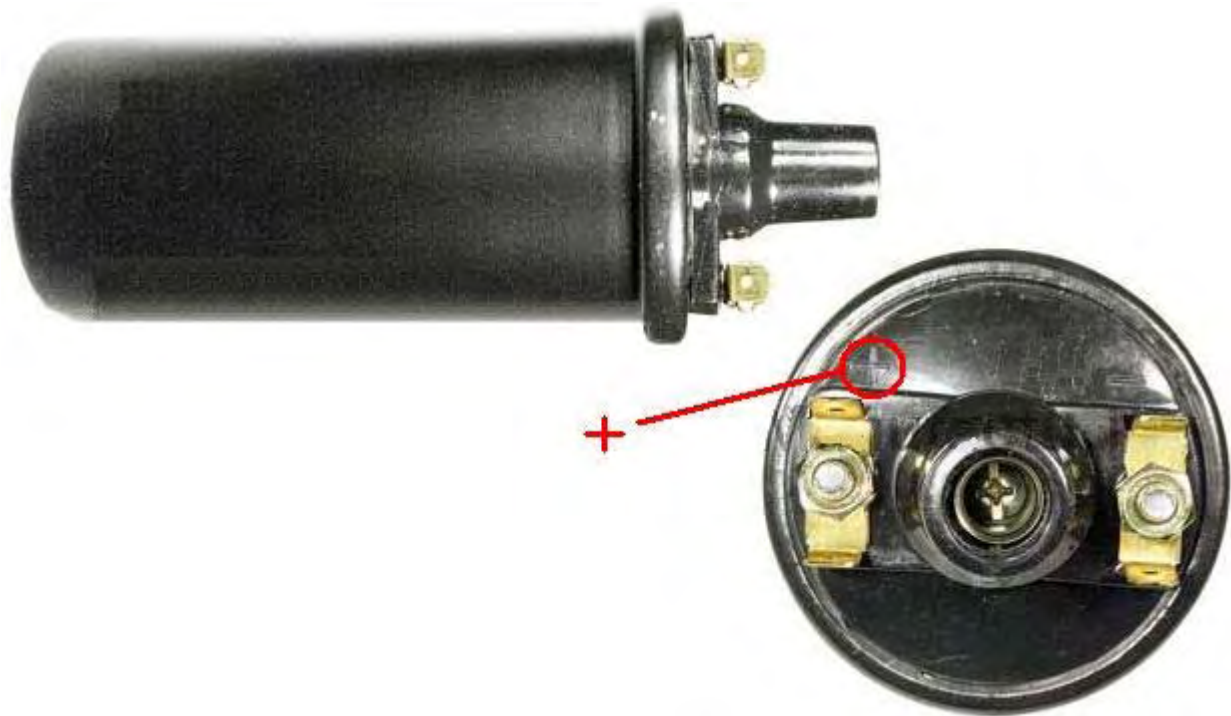
The supply for the 555 timer chip is protected against spikes and dips by the resistor "R" and the capacitor "C". The 555 timer chip acts as an oscillator or "clock" whose speed is governed by the two 10K resistors feeding the 440 nF capacitor. The step-up transformer is an ordinary car coil and the drive power to it is boosted by the IRF9130 FET transistor which is driven by the 555 chip output coming from it's pin 3.

The output from the (Ford Model T) car coil is rectified by the diode, which needs to have a very high voltage rating as the voltage at this point is now very high. The rectified voltage pulses are stored in a

very high-voltage capacitor before being used to drive a Tesla Coil. As a powerful output is wanted, two car coils are used and their outputs combined as shown here:

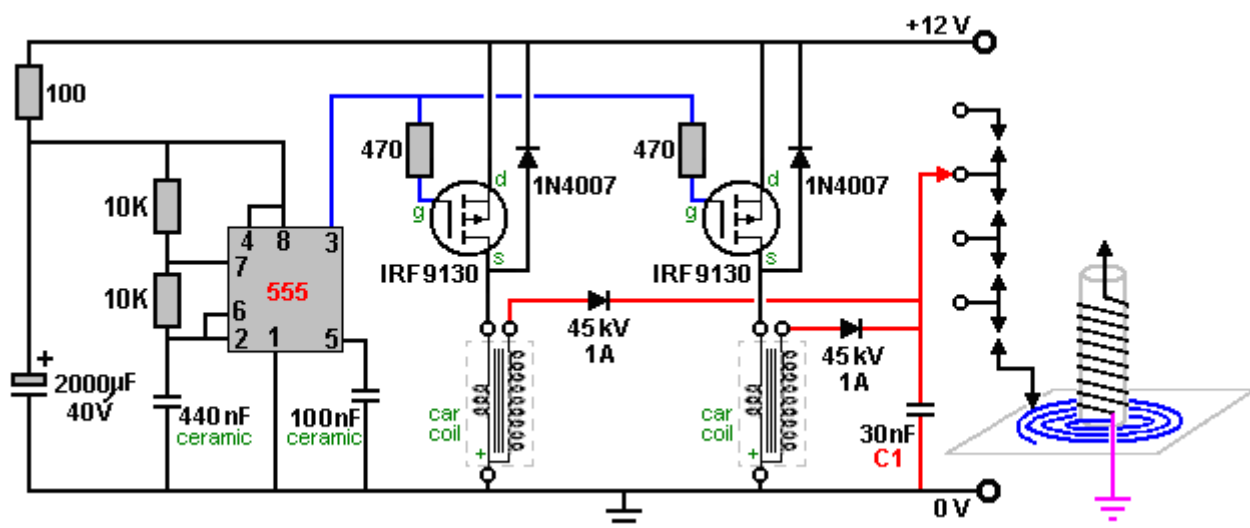


You will notice that the car coil has only three terminals and the terminal marked "+" is the one with the connection common to both of the coils inside the housing. The coil may look like this:



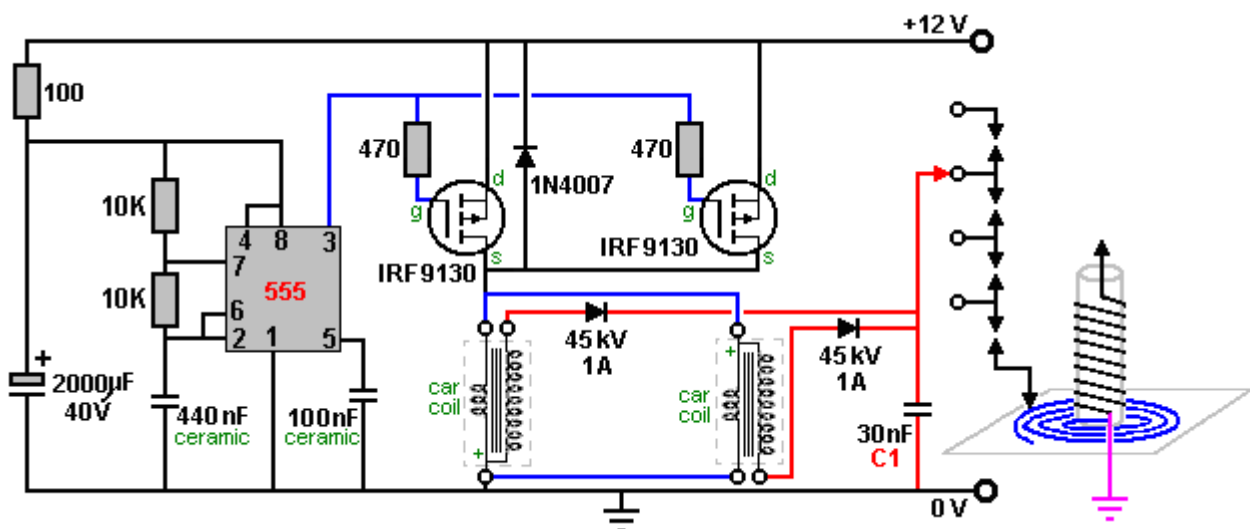
and the "+" is generally marked on the top beside the terminal with the two internal connections running to it. The circuit described so far is very close to that provided by a neon-tube driver circuit and it is certainly capable of driving a Tesla Coil.

There are several different way of constructing a Tesla Coil. It is not unusual to have several spark gaps connected in a chain. This arrangement is called a "series spark gap" because the spark gaps are connected "in series" which is just a technical way of saying "connected in a row". In the chapter on aerial systems, you will see that Hermann Plauson uses that style of spark gap with the very high voltages which he gets from his powerful aerial systems. These multiple spark gaps are much quieter in operation than a single spark gap would be. One of the possible Tesla Coil designs uses a pancake coil as the "L1" coil as that gives even higher gain. The circuit is as shown here:

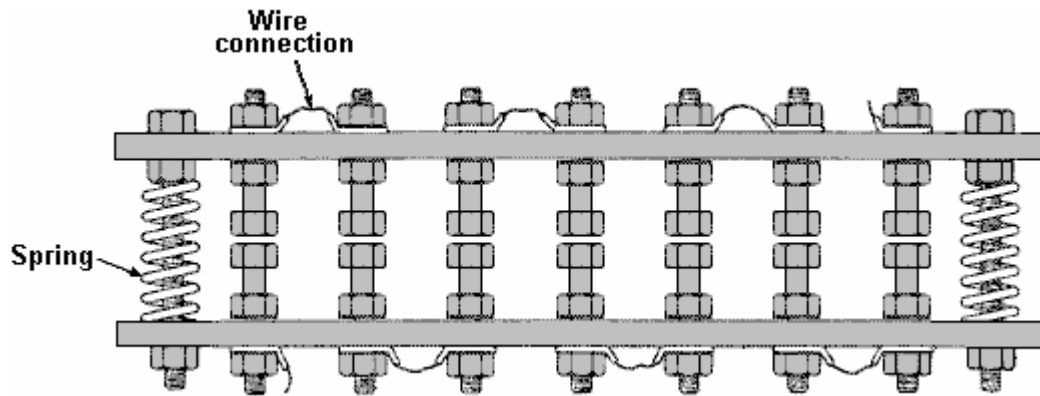


The connection to the pancake coil is by a moveable clamp and the two coils are tuned to resonance by careful and gradual adjustment of that connection, 10 mm at a time (after powering down and discharging the “C1” capacitor).

It has been found recently, that connecting two of these (non-ballast resistor) car coils back to back with the plus and minus connections switched over, that the performance is very much improved. It has been suggested that the small self-capacitance of each coil when connected across the other coil, causes a very much higher frequency of operation, giving much sharper voltage spikes which is a very desirable situation in a circuit of this type. This arrangement might be connected like this:



The series spark gap can be constructed in various ways, including using car spark plugs, gas-discharge tubes or neon lamps. The one shown here uses nuts and bolts projecting through two strips of a stiff, non-conducting material, as that is much easier to adjust than the gaps of several spark plugs:



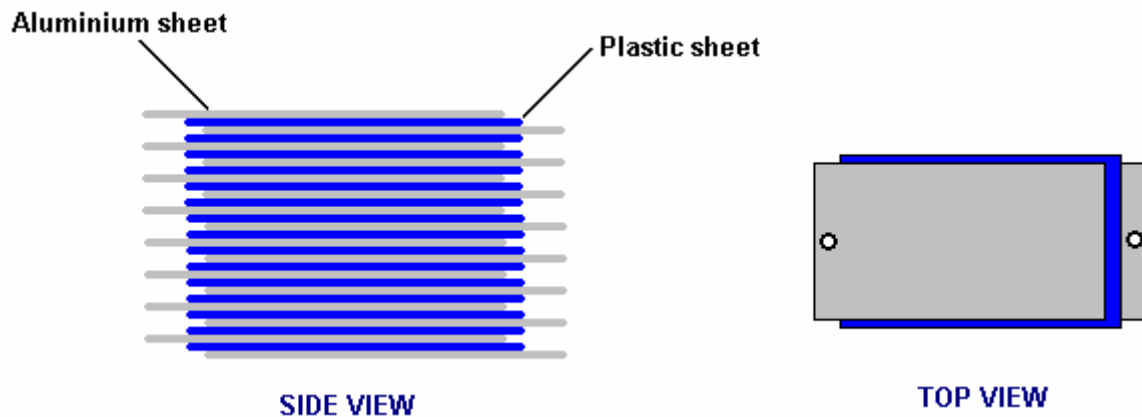
Tightening the bolts which compress the springs moves the bolt heads closer together and reduces all of the spark gaps. The electrical connections can be made to the end tags or to any of the intermediate wire connection straps if fewer spark gaps are required in the chain.

Let me remind you again that this is not a toy and very high voltages will be produced. Also, let me stress again that if you decide to construct anything, then you do so entire on your own responsibility. This document is only provided for information purposes and must not be seen as an encouragement to build any such device nor is any guarantee given that any of the devices described in this ebook will work as described should you decide to attempt to construct a replication prototype of your own. Generally, it takes skill and patience to achieve success with any free-energy device and Don Smith's devices are some of the most difficult, especially since he admits quite freely that he does not disclose all of the details.

The output capacitor marked "C1" in the circuit diagram above has to be able to handle very high voltages. There are various ways of dealing with this. Don dealt with it by getting very expensive capacitors manufactured by a specialist company. Some home-based constructors have had success using glass beer bottles filled with a salt solution. The outside of the bottles are wrapped in aluminium foil to form one of the contacts of the capacitor and bare wires are looped from deep inside each bottle on to the next one, looping from the inside of one bottle to the inside of the next one, and eventually forming the other contact of the capacitor. While that appears to work well, it is not a very convenient thing to carry around. An alternative is just to stand the bare bottles in a container which is lined with foil which forms the second contact of the capacitor.

One method which has been popular in the past is to use two complete rolls of aluminium foil, sometimes called "baking foil", laying them one flat, covering it with one or more layers of plastic cling film and laying the second roll of foil on top of the plastic. The three layers are then rolled up to form the capacitor. Obviously, several of these can be connected together in parallel in order to increase the capacitance of the set. The thicker the plastic, the lower the capacitance but the higher the voltage which can be handled.

The November 1999 issue of Popular Electronics suggests using 33 sheets of the thin aluminium used as a flashing material by house builders. At that time it was supplied in rolls which were ten inches (250 mm) wide, so their design uses 14" (355 mm) lengths of the aluminium. The plastic chosen to separate the plates was polythene sheet 0.062 inch (1.6 mm) thick which is also available from a builders merchants outlet. The plastic is cut to 11 inch (280 mm) by 13 inch (330 mm) and assembly is as follows:

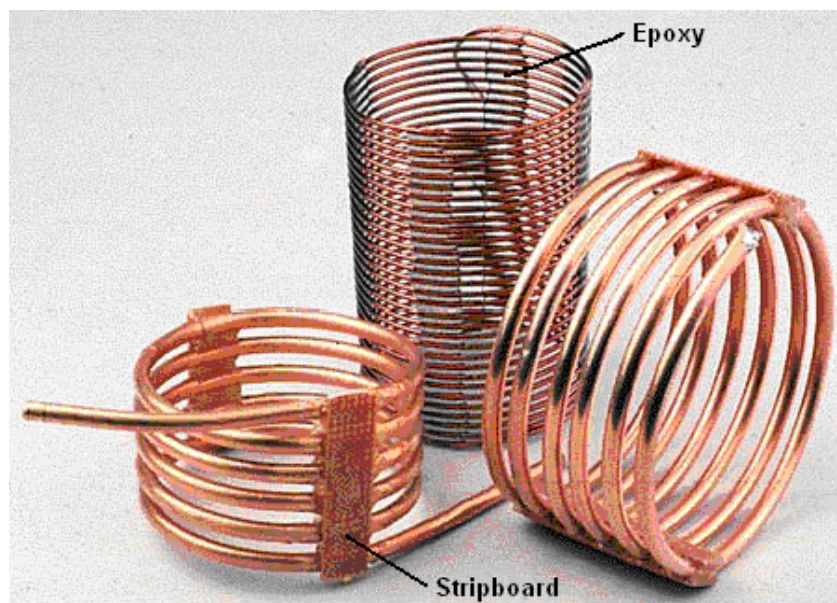


The sandwich stack of sheets is then clamped together between two rigid timber sheets. The tighter that they are clamped, the closer the plates are to each other and the higher the capacitance. The electrical connections are made by running a bolt through the projecting ends of the plates. With two thicknesses of plastic sheet and one of aluminium, there should be room for a washer between each pair of plates at each end and that would improve the clamping and the electrical connection. An alternative is to cut a corner off each plate and position them alternatively so that almost no plate area is ineffective.

As Don Smith has demonstrated in one of his video presentations, Nikola Tesla was perfectly correct when he stated that directing the discharge from a Tesla Coil on to a metal plate (or in Don's case, one of the two metal plates of a two-plate capacitor where a plastic sheet separates the plates just as shown above), produces a very powerful current flow onwards through a good earth connection. Obviously, if an electrical load is positioned between the plates and the earth connection, then the load can be powered to a high level of current, giving a very considerable power gain.

Constructing High-Quality Coils.

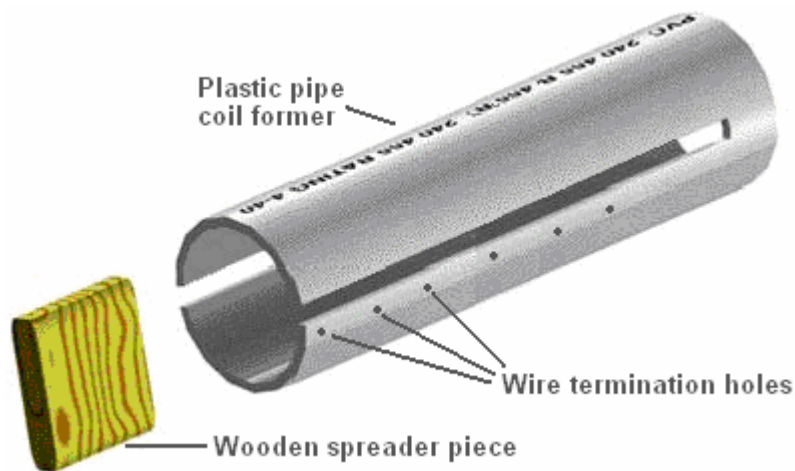
The Barker & Williamson coils used by Don in his constructions are expensive to purchase. Some years ago, in an article in a 1997 issue of the "QST" amateur radio publication, Robert H. Johns shows how similar coils can be constructed without any great difficulty. The Electrodyne Corporation research staff have stated that off-the-shelf solid tinned copper wire produces three times the magnetic field that un-tinned copper does, so perhaps that should be borne in mind when choosing the wire for constructing these coils.



These home-made coils have excellent “Q” Quality factors, some even better than the tinned copper wire coils of Barker & Williamson because the majority of electrical flow is at the surface of the wire and copper is a better conductor of electricity than the silver tinning material.

The inductance of a coil increases if the turns are close together. The capacitance of a coil decreases if the turns are spread out. A good compromise is to space the turns so that there is a gap between the turns of one wire thickness. A common construction method with Tesla Coil builders is to use nylon fishing line or plastic trimmer cord between the turns to create the gap. The method used by Mr Johns allows for even spacing without using any additional material. The key feature is to use a collapsible former and wind the coil on the former, space the turns out evenly and then clamp them in position with strips of epoxy resin, removing the former when the resin has set and cured.

Mr Johns has difficulty with his epoxy being difficult to keep in place, but when mixed with the West System micro fibres, epoxy can be made any consistency and it can be applied as a stiff paste without any loss of it's properties. The epoxy is kept from sticking to the former by placing a strip of electrical tape on each side of the former.



I suggest that the plastic pipe used as the coil former is twice the length of the coil to be wound as that allows a good degree of flexing in the former when the coil is being removed. Before the two slots are cut in the plastic pipe, a wooden spreader piece is cut and it's ends rounded so that it is a push-fit in the pipe. This spreader piece is used to hold the sides of the cut end exactly in position when the wire is being wrapped tightly around the pipe.

Two or more small holes are drilled in the pipe beside where the slots are to be cut. These holes are used to anchor the ends of the wire by passing them through the hole and bending them. Those ends have to be cut off before the finished coil is slid off the former, but they are very useful while the epoxy is being applied and hardening. The pipe slots are cut to a generous width, typically 10 mm or more.

The technique is then to wedge the wooden spreader piece in the slotted end of the pipe. Then anchor the end of the solid copper wire using the first of the drilled holes. The wire, which can be bare or insulated, is then wrapped tightly around the former for the required number of turns, and the other end of the wire secured in one of the other drilled holes. It is common practice to make the turns by rotating the former. When the winding is completed, the turns can be spaced out more evenly if necessary, and then a strip of epoxy paste applied all along one side of the coil. When that has hardened, (or immediately if the epoxy paste is stiff enough), the pipe is turned over and a second epoxy strip applied to the opposite side of the coil. A strip of paxolin board or strip-board can be made part of the epoxy strip. Alternatively, an L-shaped plastic mounting bracket or a plastic mounting bolt can be embedded in the epoxy ready for the coil installation later on.

When the epoxy has hardened, typically 24 hours later, the coil ends are snipped off, the spreader piece is tapped out with a dowel and the sides of the pipe pressed inwards to make it easy to slide the finished coil off the former. Larger diameter coils can be wound with small-diameter copper pipe.

The coil inductance can be calculated from:

Inductance in micro henrys $L = d^2 n^2 / (18d + 40l)$

Where:

d is the coil diameter in inches measured from wire centre to wire centre

n is the number of turns in the coil

l is coil length in inches (1 inch = 25.4 mm)

Using this equation for working out the number of turns for a given inductance in micro henrys:

$$n = \frac{\sqrt{L(18d + 40l)}}{d}$$

Patrick J Kelly

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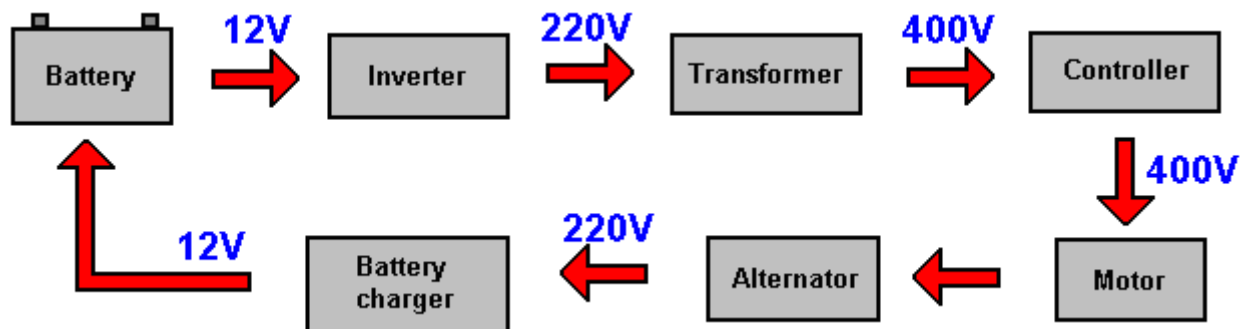
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Chapter 32: A Power Generator Development

Let me make it very clear – this is just a suggested development project. I have never seen a generator of this type in operation. The design is based on the idea that feeding high voltage to an ordinary 3-phase DC motor produces a great increase in torque (turning power) of the motor. This is confirmed by a developer who tried it some years ago and found that doing this did not harm the coils of wire inside the motor but so much torque was produced that it broke the output shaft of the motor.

Generally speaking, the system suggested here is to feed about 400 volts to a 12 volt 3-phase motor. The increased torque of the motor is used to spin an ordinary alternator to generate normal mains equivalent voltage and frequency. Finally, some of the output of the alternator is fed back to provide the input power of the system. If a battery is used to start the system, then that battery is recharged by the feedback even though battery power is only used very briefly at start-up. The overall arrangement is like this:



The most important components of this system are the controller and the motor. You are probably familiar with the most common type of motor which is a single-phase motor, but the more powerful motors used in industry are three-phase motors. There are several varieties of three-phase motors, but the type which we want is a “BLDC” or “Brushless Direct Current” motor. These motors are available with or without built in sensors to indicate the position of the motor as it spins. We want to use any sensorless 3-phase motor and those are the cheapest type of 3-phase motor.

The website www.simple-circuit.com published a program which allows an Arduino Uno R3 board to act as a controller for a brushless, sensorless 3-phase motor. That design is on their website here: <https://simple-circuit.com/arduino-sensorless-bldc-motor-controller-esc/> and it appears to be a very successful design of theirs and it has been offered free since January 2018.

It is not necessary for you to become an expert programmer of an Arduino board as the program used is provided for you. A good instruction video on how to program an Arduino Uno board is shown here: <https://www.youtube.com/watch?v=5OtMqr5hGjE>.

Ideally, we would like the generator to be able to power any of our household items of equipment, that is, washing machine, tumble dryer, vacuum cleaner, fridge, electric fire, air conditioning unit, fan or whatever. To do that, we would like a generator with three kilowatts of electrical output and that suggests a reasonably large motor. A three-phase motor sounds very technical, but it really isn't. It is just a motor which has three sets of drive coils instead of just one drive coil.

One 3-phase motor which appeals to developers is the Samsung washing machine motor as it has 36 coils connected as three sets, each set having twelve windings connected together.

Coils set 1 has coils 1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31 and 34.

Coils set 2 has coils 2, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32 and 35.

Coils set 3 has coils 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33 and 36.

The motor looks like this:



The coils remain stationary as they form the stator of the motor. There is a continuous ring of magnets immediately outside the coils. They are attached to the metal dish-shaped end housing which spins around, being the rotor of the motor.

So, the motor has effectively just three coils in it and it is made to go round by pulsing the coils in order, that is coil 1, then coil 2, then coil 3, then coil 1 again and so on. The more rapidly the coils are pulsed, the faster the motor rotates, and in this system that rotation can be very fast indeed. The suggested motor is available as a replacement part for a washing machine and can be bought quite readily:



Samsung Motor

Genuine spare part



However, two bearings and a drive shaft need to be constructed in order to convert the Samsung motor into a device which can drive an alternator:





Doing that involves precision metalwork and it will probably be necessary to balance the rotor to avoid vibration when it rotates at high speed, typically 3000 revolutions per minute to drive the alternator. This metalwork can be done by a local metal fabricator business if you do not have the necessary equipment or skill to do this work.

For testing purposes it might be more convenient to use a different motor for a “proof of concept” test. One 3-phase motor from China looks particularly suitable as it is low cost and has two bearings on the drive shaft. One motor can be the drive motor and a second identical motor could act as the generator:

DC12V-36V 4000RPM-12600RPM Brushless dc motor BLDC Built-in driver board #Q54 ZX

Condition: **New**

Volume pricing:	1-1	\$20.50 (each)
	2+	\$19.48 (5% off each)

Quantity: More than 10 available / [3 sold](#)

Unit Price: **US \$20.50**

[Buy It Now](#)

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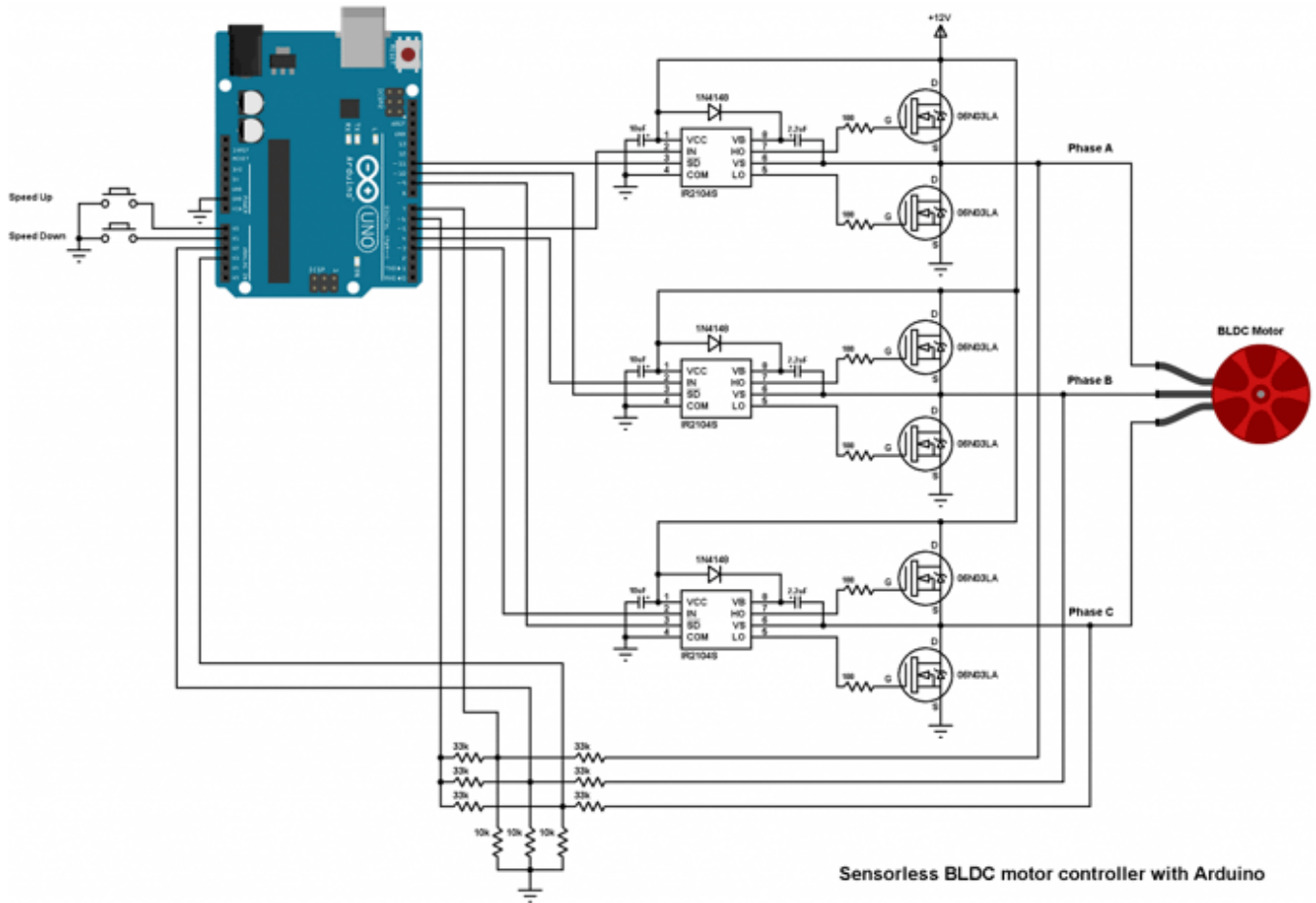
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Free shipping 30-day returns 9 watchers

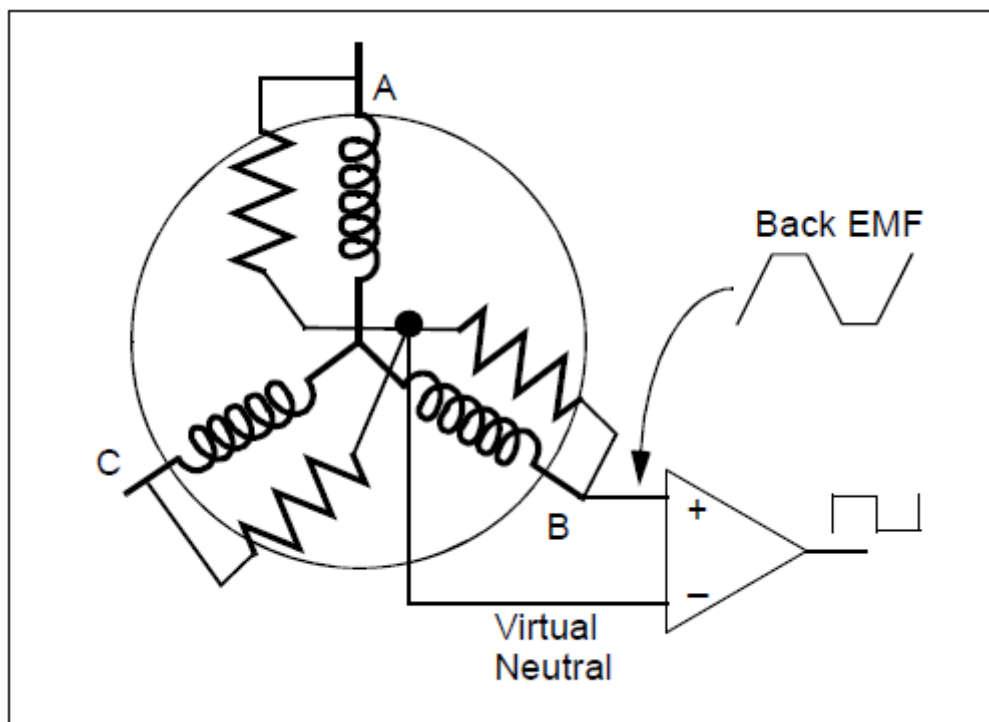
Shipping: **FREE** Economy SpeedPAK from China/Hong Kong/Taiwan | [See details](#)

Aligning and coupling the motor and generator shafts is not difficult and components from model aircraft and radio controlled car shops can be used.

The simple-circuit.com schematic for the motor drive is based on 12 volts throughout:



The challenge for this generator design is to modify this circuit so that the Arduino is run on 12 volts while the motor is run on 400 volts. Because the motor has no sensors, the simple-circuit people use back-EMF voltage feeds from the motor to determine its position during rotation:



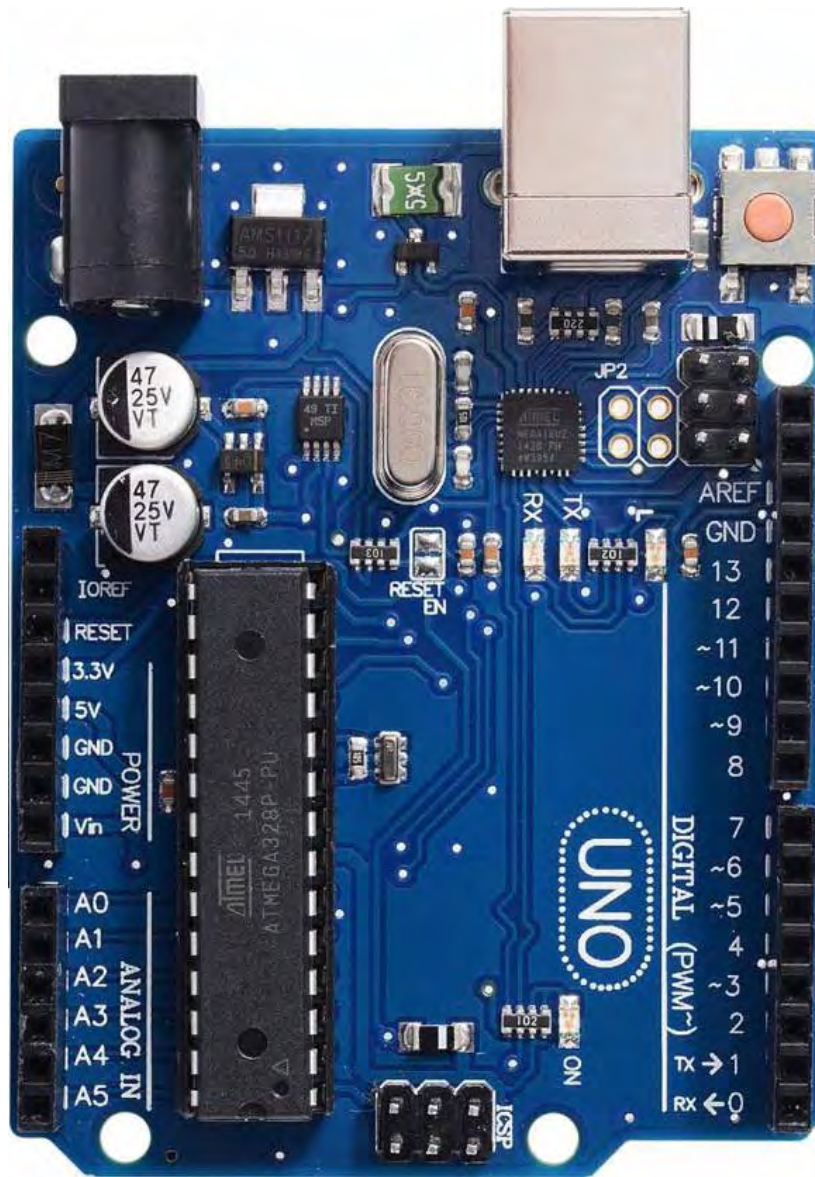
The comparator shown in the diagram is actually inside the Arduino board, but our problem is that we are feeding the motor with 400 volts instead of just 12 volts. So, what voltage will be fed back to the Arduino? Originally, the simple-circuit.com circuit shows a resistor divider pair of 33K / 10K which drops the voltage to about one third before feeding it to the Arduino. But it is the back-EMF which is allegedly being fed back and that is generated by the coils and in a 12 volts system that is likely to be very much in excess of 12 volts and could be in excess of 1000 volts. Pulsing the coils with 400 volts might well not alter the back-EMF by much as the coils are not changed at all. This is the problem and testing is needed using your own motor to determine what is coming back from the motor.

It is suggested that the resistor divider pair of resistors be changed to 1.3M / 10K, or alternatively to 10M / 2.2K. There are cheap Chinese versions of the Arduino board selling for just £5, so it might be a good idea to use one of those for the testing phase of the development. At this point in time we just don't know the answer, so we will have to see what the development testing shows us.

The pulsing of those three coils sets one after the other in sequence, is done by the "controller" unit which is a key component in this design. The controller consists of two parts. The first is an Arduino board which is a general purpose development board - essentially a simple computer which can be programmed from an ordinary PC or laptop. It holds the program in its memory and runs it whenever it is instructed to do so. The second part is an electronics link between the Arduino board and the motor. That link boosts the power fed to the motor using high-power transistors which can feed high currents to the motor, and some other wires which feed information back to the Arduino board to give it full control of what is happening with the motor.

The Arduino code can be downloaded as a text file from: www.free-energy-info.com/Arduino.txt

The Arduino board looks like this:



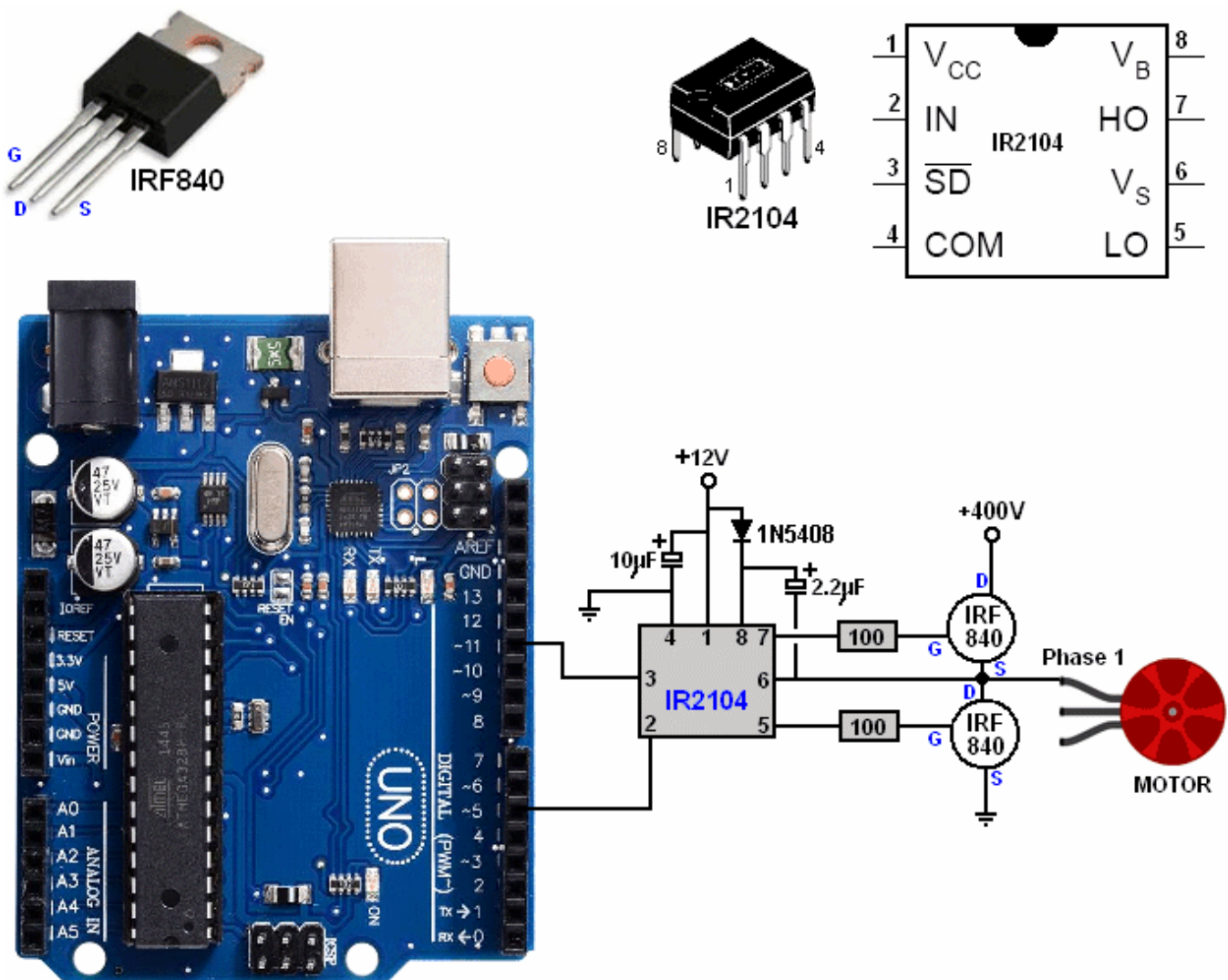
IR2104

The interface between the Arduino Uno board and the motor, needs the following components:

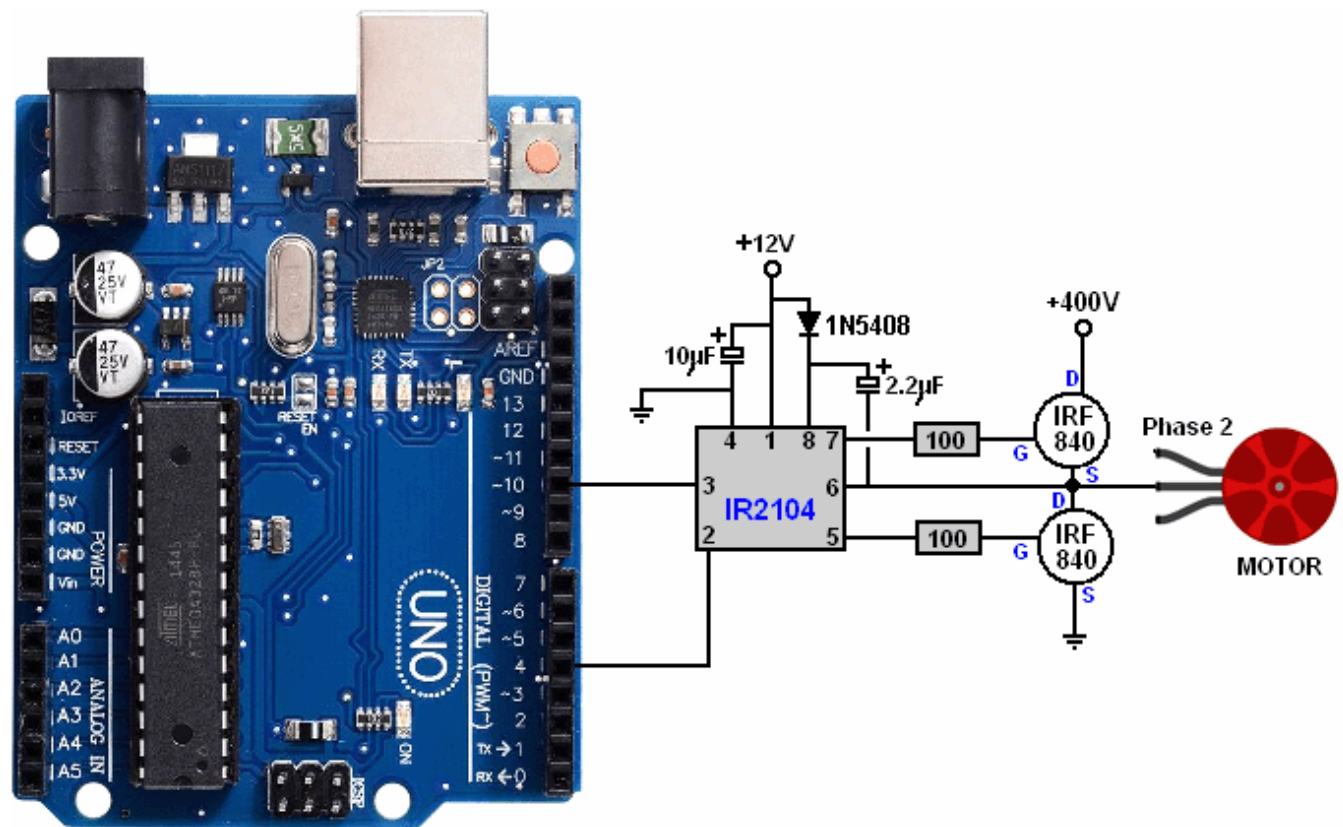
- 6 x IRF840 FET transistors
- 3 x IR2104 DIP gate driver IC
- 3 x 1.3M ohm 0.5 watt resistors
- 3 x 10K ohm 0.5 watt resistors
- 3 x 33K ohm resistors
- 6 x 100 ohm quarter watt resistors
- 3 x IN5408 or UF5408 diodes
- 3 x 10uF 25 volt capacitors.
- 3 x 2.2uF 25 volt capacitors.
- 2 x pushbuttons
- 12V source
- Construction board and connecting wires

These components are connected up like this:

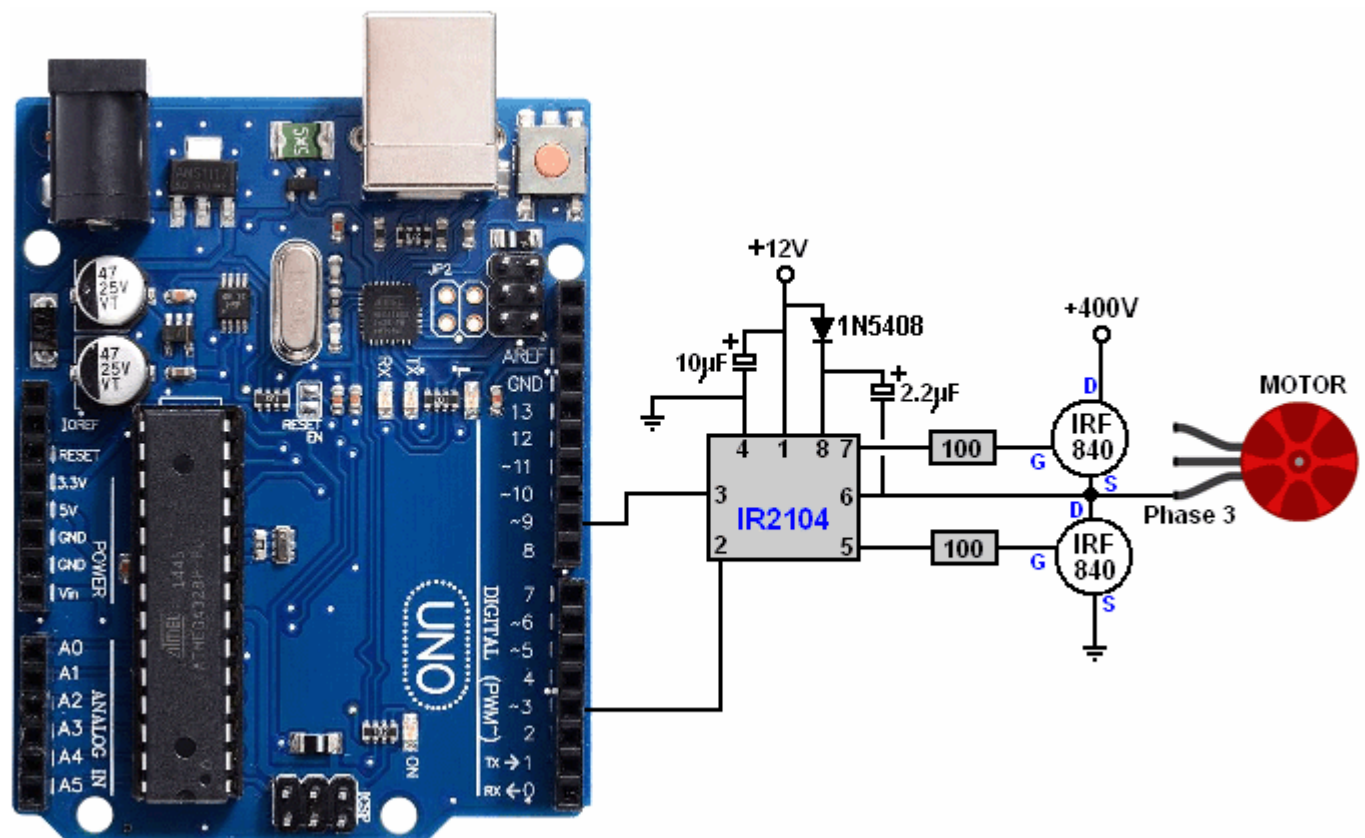
We need to connect this Arduino Uno up to drive one of the three phases of our three-phase motor, so to do that we will use an IR2104 driver chip and an IRF840 Field Effect Transistor ("FET") to feed our 400 volt power supply to the motor at some 14,800 pulses per second. So, the power drive for the first phase is like this:



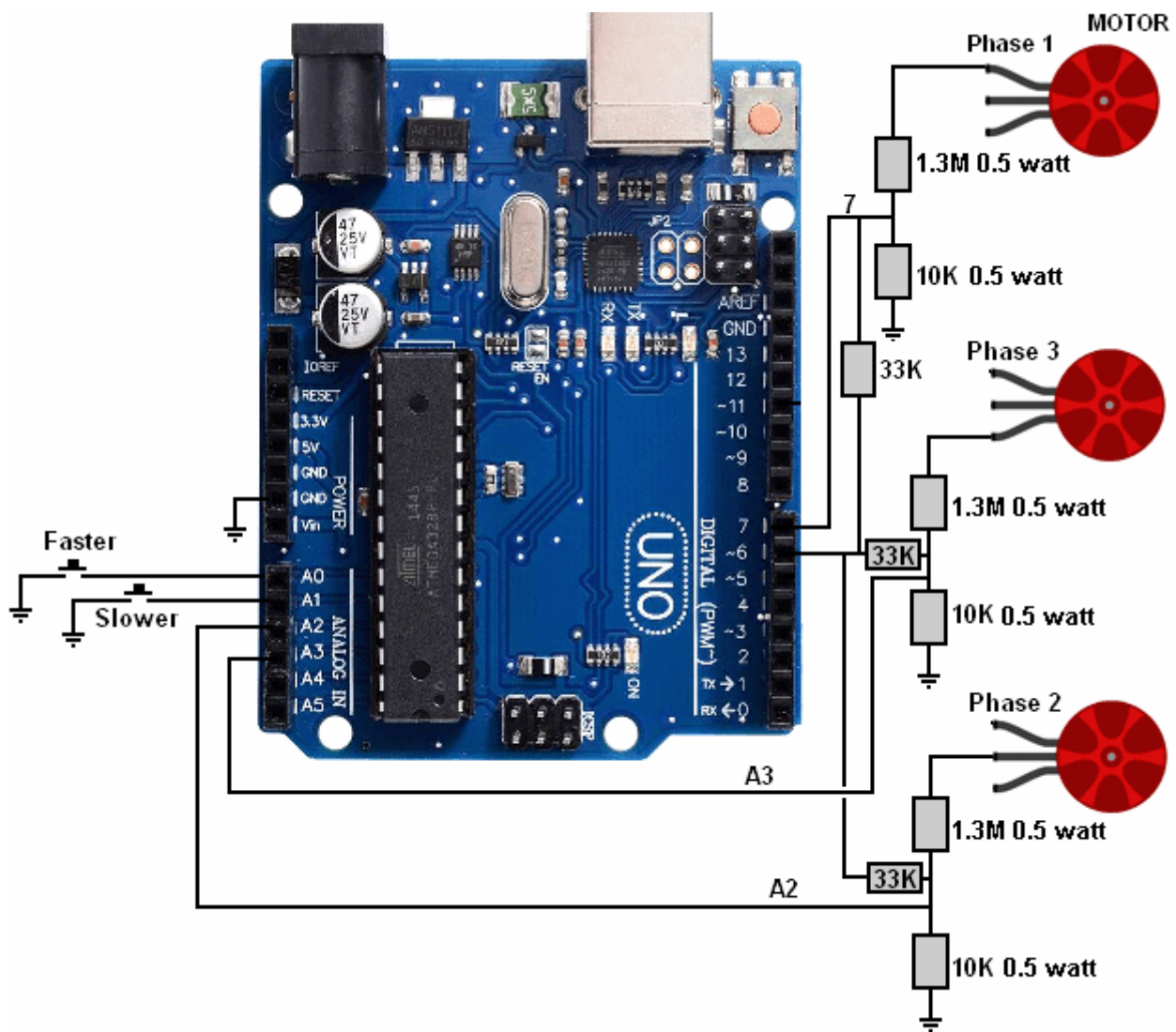
The 1N5408 diode can handle high voltages and so protect the 12 volt section of the circuit from the high voltage section feedback. The power drive for the second phase is:



And the power drive for the third phase is:



But we also need to provide the Arduino board with feedback information to let it know where the motor is in its rotation. That is done by sensing the Phase connections to the motor, and using guessed voltage divider resistor values like this:



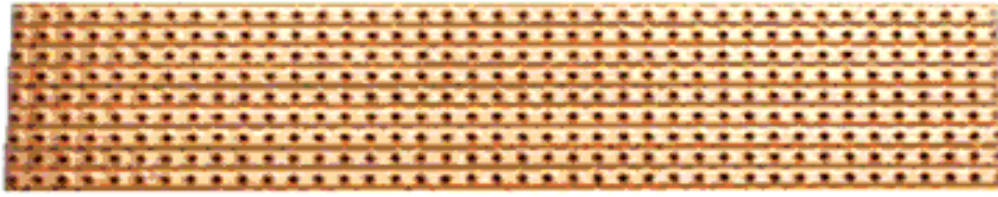
First, a word of warning here. You can get a shock from any voltage above 30 volts. If the voltage is Alternating Current at a frequency under 100 cycles per second (as is supplied by your mains wall socket) then that shock can be serious. The power supply described here is very easy to understand and to make **BUT** if you get a shock from it that shock is very likely to kill you !!

Disclaimer: You are responsible for your own actions. This document is for information purposes only and if you decide to make or experiment with voltages higher than 12 volts, then you and you alone are responsible for your actions and neither the author, the web hosting service nor anyone else is responsible for what you do or for any damage or injury caused by your own actions.

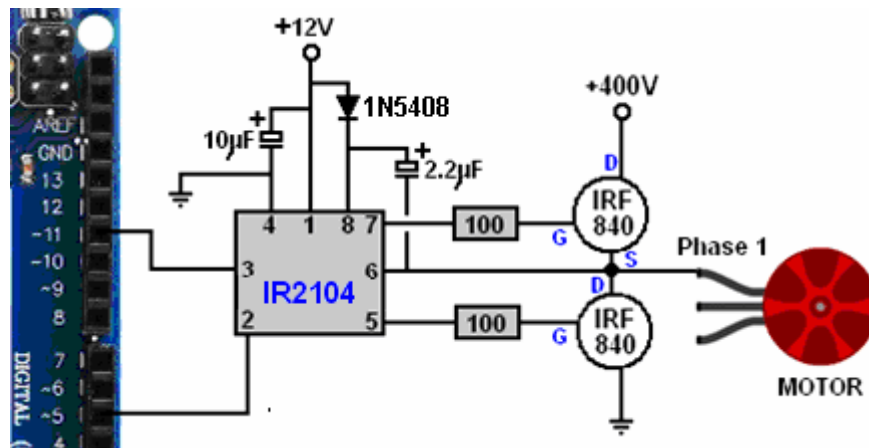
Having said that, please understand that if you are careful and sensible, there is no danger in constructing this power generator in spite of the very high 400 volt input to this power driver circuit. To stay safe, you make all the necessary connections and **insulate** them **before** you apply power.

So, we need to construct an electronics component board to connect the Arduino to the phases of the motor. Please remember that this board will be carrying 400 volts and so you need to enclose the board in a plastic box **before** powering it up.

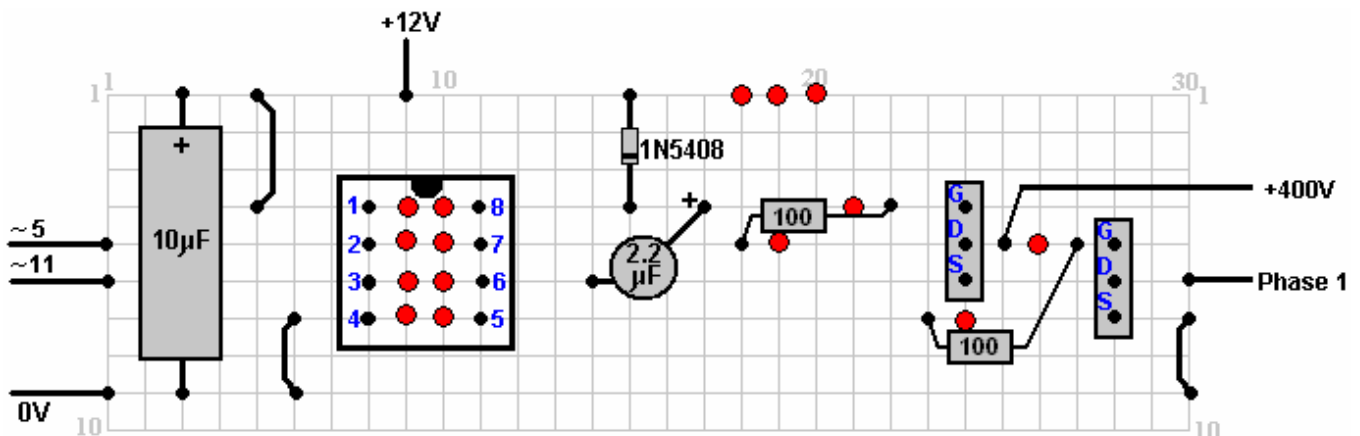
The suggestion for a physical layout for the components is based on using strip board like this:



These boards come in many sizes and are very versatile. However, because the pin spacing of integrated circuit is just 0.1 inches, the solder joints can be very close together and that does not suit a beginner to soldering, so ask a friend for help in soldering unless you are already expert.



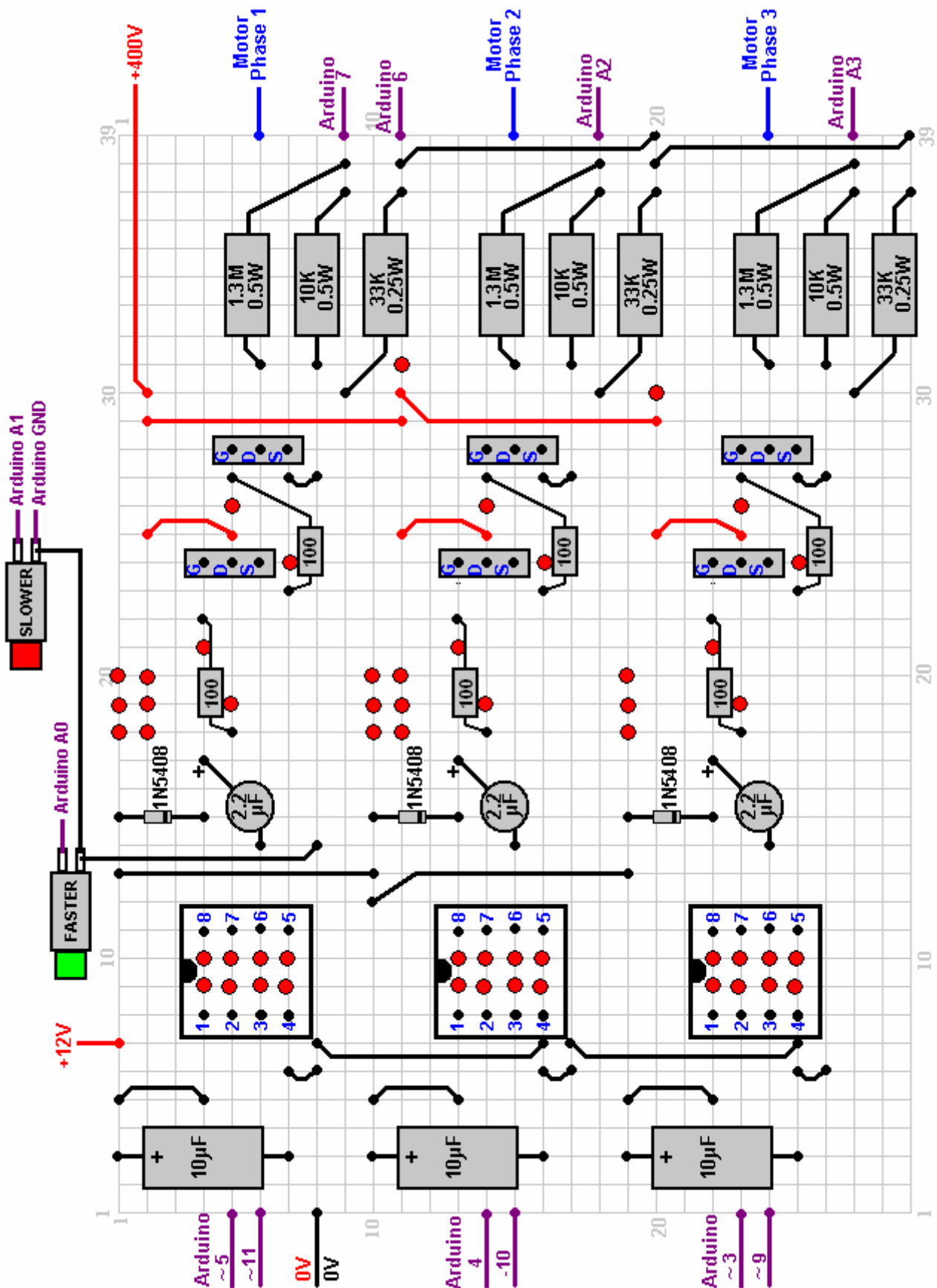
We want to place these components on the board, so perhaps a layout like this might be suitable:



The red circles show where the copper strip on the underside of the board is to be broken. This physical layout has not yet been built and tested, and so is only a suggestion. You can make three separate boards, one for each phase or you can place all three circuits on a single board. Integrated circuits are heat sensitive so I suggest that you use a socket and solder it in place and then plug the chip into the socket when everything is cool. An 8-pin socket looks like this:

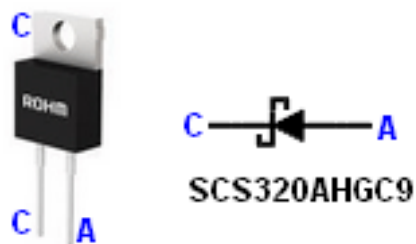


Here is a possible physical layout for the Arduino / Motor interface using a piece of strip board:

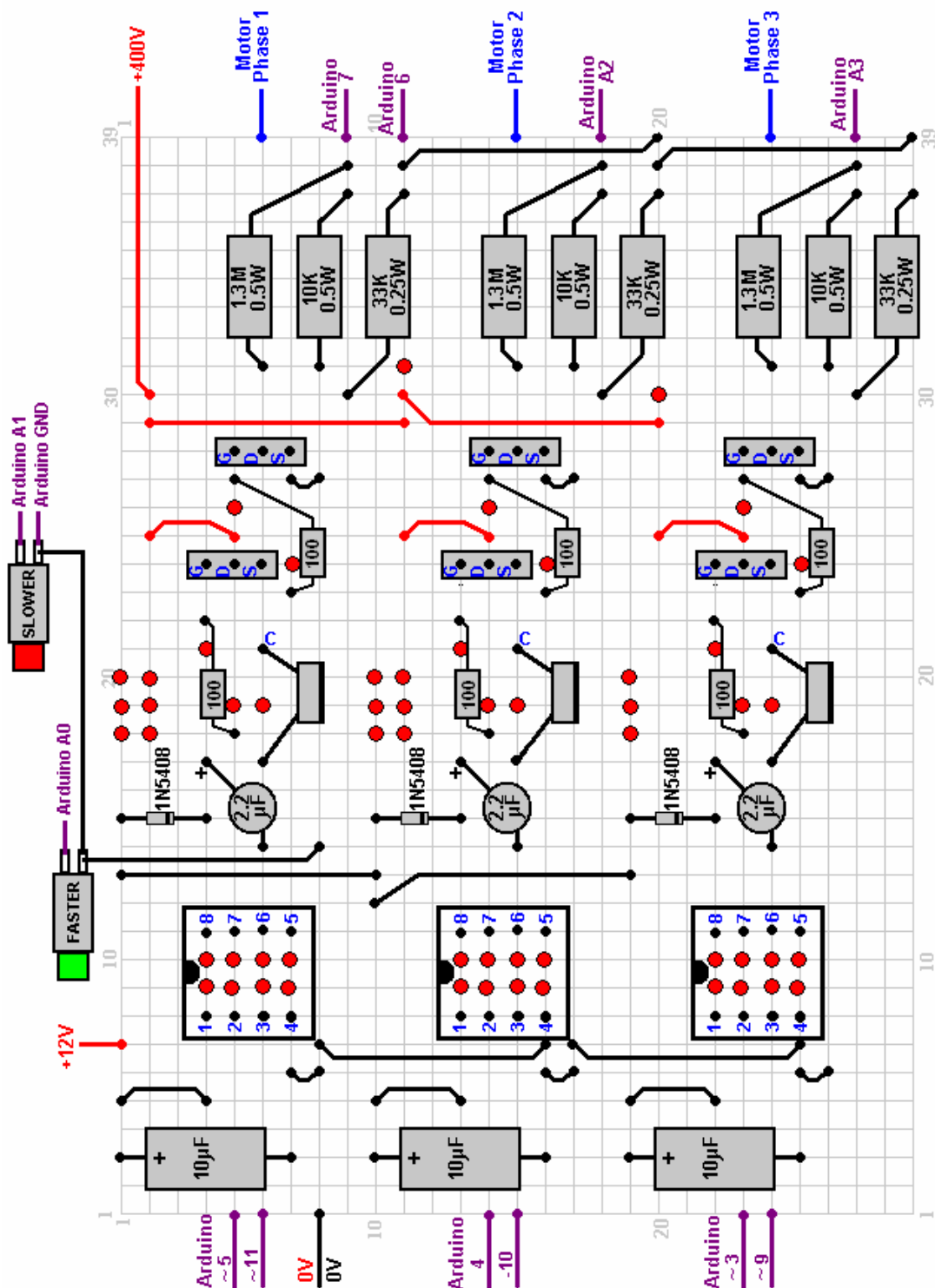


Built in this layout it is likely to damage the Arduino board as there are issues with using 400 volts.

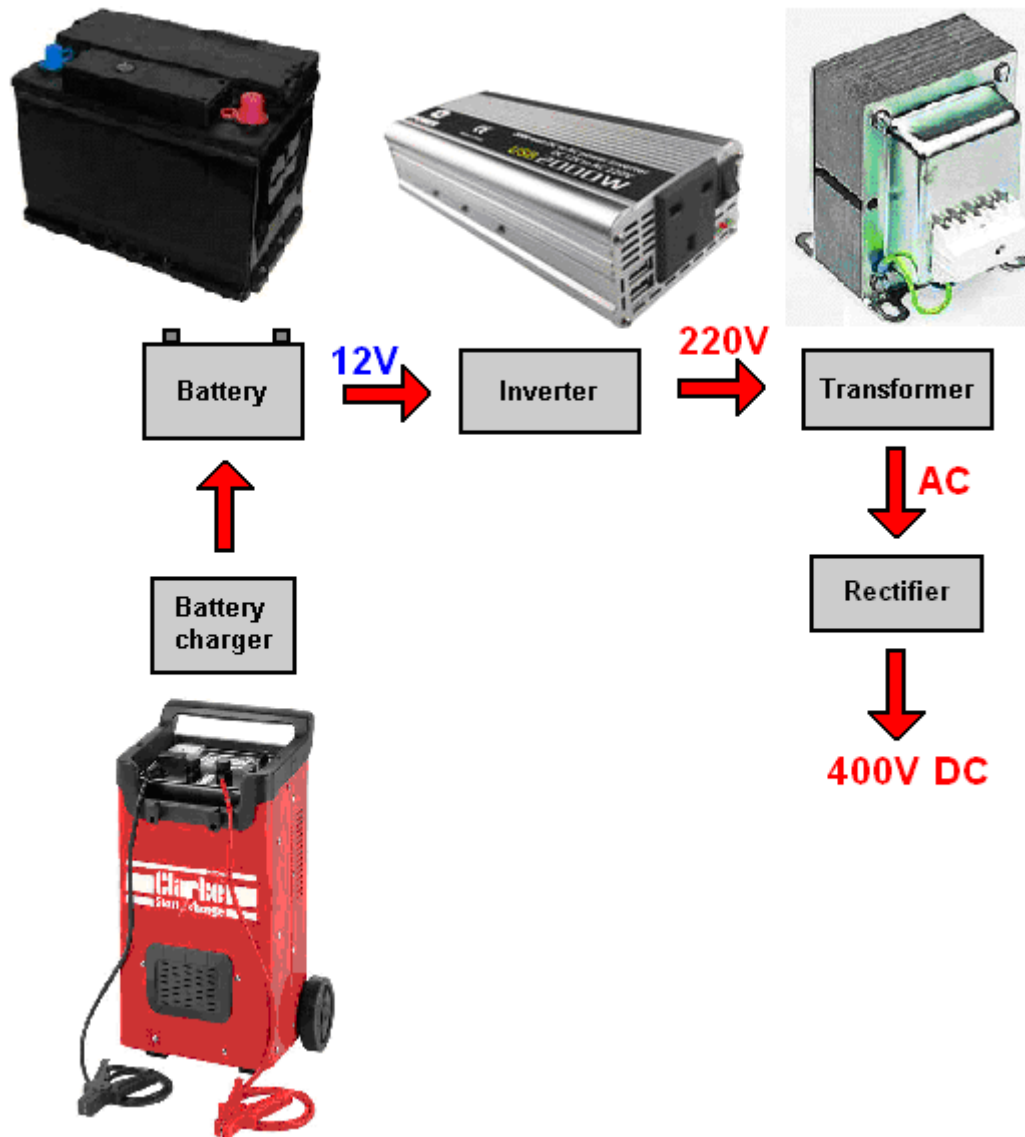
It may be necessary to introduce high voltage fast diodes to protect the circuitry from the high voltage. A diode such as the 650 Volt 8 Amp SCS306AHGC9 diode which looks like this:



This changes the possible physical layout to:



We come now to the difficult part of producing a 400 volt power supply able to supply about 2 amps at that output voltage. This arrangement has been suggested:



The transformer shown here is not at all easy to find as very few people want to produce 400 volts DC from 220 volts AC. One important point here is the “battery charger”. It needs to supply hundreds of watts of electrical power back to the input of the inverter continuously in order to make the system self-powered. Consequently, it needs to be a professional level unit so heavy that it needs wheels and a handle to move it around.

First, there is a car battery and that feeds an inverter like this particular unit which is an European inverter which produces anything from 220 to 240 volts with powers of 2000 watts continuous and 4000 watts peak output. It is also cheap at £25 delivered and it has two handy USB output power sockets as well:



In the absence of a suitable step-up transformer one possibility is to use a “DC chopper” circuit which could take the 12 volts from the car battery and produce a 400 volt 20 kHz output directly in one operation. A DC chopper of that type looks like this:



While a DC chopper power supply is not suitable for all applications, it is felt that this cheap unit costing US \$35 from <https://s.click.aliexpress.com/e/1rHgPQC> would be suitable for this generator project.

However, please understand clearly that your local power company is most unlikely to allow you to connect your generator up to their wiring which goes to your fuse box. Consequently, it is better if you use your new supply of electrical power as if it were an emergency back-up generator. That is, you connect it up to your appliances without connecting it to any external power supply or wall socket.

Let me stress that if you were to construct a generator system like this, you do not connect it to the wiring of the local electricity power supply company. For example, the electrical mains supply wiring will come into your household fuse box or contact breaker box. Do not connect your generator wiring to that same box but instead treat your generator in the same way as an emergency generator, feeding the generator output directly to your washing machine, electric heater, vacuum cleaner or whatever through an extension cable and not through a wall socket.

If you are very keen to have your new generator connected to your fuse box, then be sure to install a “Break-before Make” heavy duty switch to disconnect the outside power supply cable before your generator output is connected to the fuse box. This is important because if a fault occurs in the mains wiring and they turn off the mains power while they fix it, the workmen might get a fatal shock from your generator even though their wiring is supposed to be switched off.

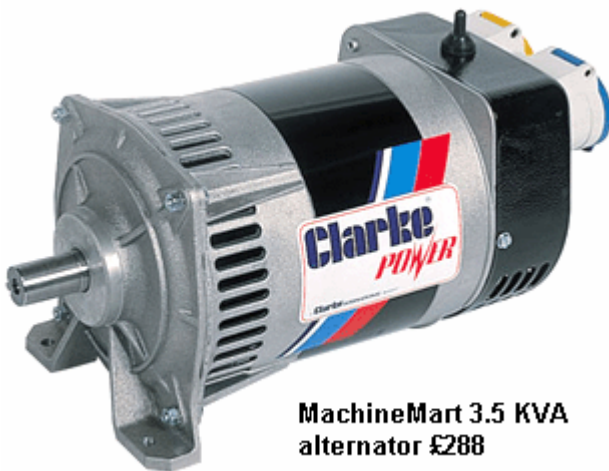
We come now to the alternator which produces the electrical output which is the whole point of the system. All of the components and methods described so far have the objective of spinning the alternator indefinitely in order to provide electrical power for a household.

With a large motor, the system described so far is perfectly capable of driving an alternator of any power level up to ten kilowatts without altering any of the components. So, the size of the alternator which you buy is up to you. Personally, I would consider an output of five kilowatts as being adequate to excessive, but then my electrical needs are probably far lower than yours might be.

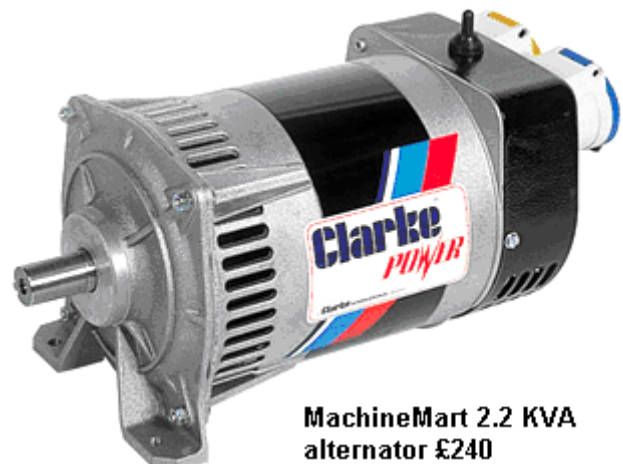
Anyway, in the UK one supplier is MachineMart and they offer three different alternators. They look like this and each needs to be driven at 3000 rpm:



**MachineMart 6.5 KVA
alternator £324
Pulley £15**



**MachineMart 3.5 KVA
alternator £288**



**MachineMart 2.2 KVA
alternator £240**

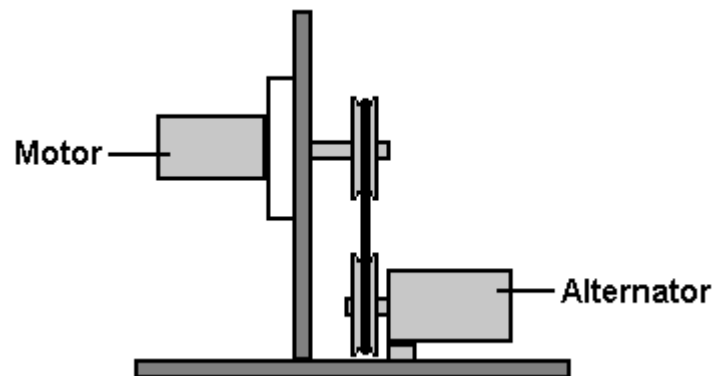


**118mm V-Belt Pulley
24/8mm £15**

Looking at the small price difference between the alternators, there seems to be very little reason not to pick the 6.5 KVA unit even if your expected current is likely to be well below that rating. If you limit the output current to, say, 3 kilowatts, using a fuse or a circuit breaker, then you can install a higher

capacity alternator. That will not increase the load on the motor and as the alternator is always running at less than its design current, the alternator will run cooler.

The final step is to mount the motor unit and alternator unit together so that the motor can drive the alternator to provide the required electrical output. Aligning the shaft of a large motor with the shaft of an alternator is not an easy thing to do unless you are skilled at such work. For the average person it is easier to use a pulley wheel on the motor and a pulley wheel on the alternator, linking them with a belt drive as is done in a car:



Patrick Kelly
www.free-energy-info.com

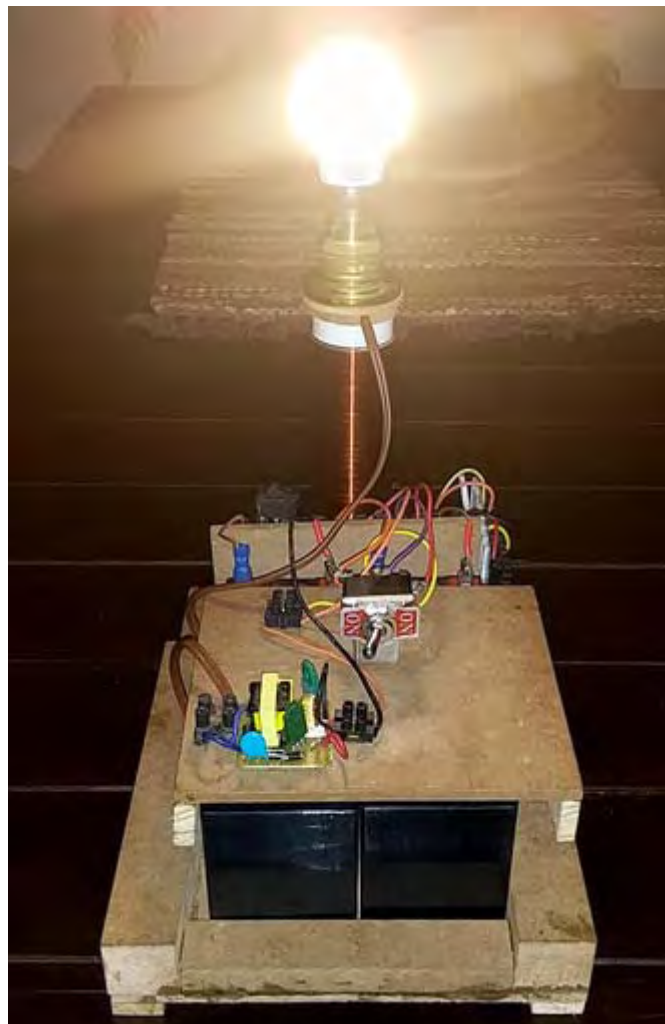
Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 33: The Simplified Perpetual Light

There has already been shown a Perpetual Light system where lighting batteries are recharged when the light is not in use. That design uses a latching relay to swap between two batteries on a continuous basis, but that tends to confuse some people and make the design seem too complicated. So, here is a design from our South African developer friend who shares his work freely and generously. He has daily mains power cuts which average seven hours per day and that brings into play the old saying that “necessity is the mother of invention”.

He has built some of the earlier light design which uses a latching relay and those work very well, this one uses a tiny 12V to 220V inverter and a mains LED bulb:

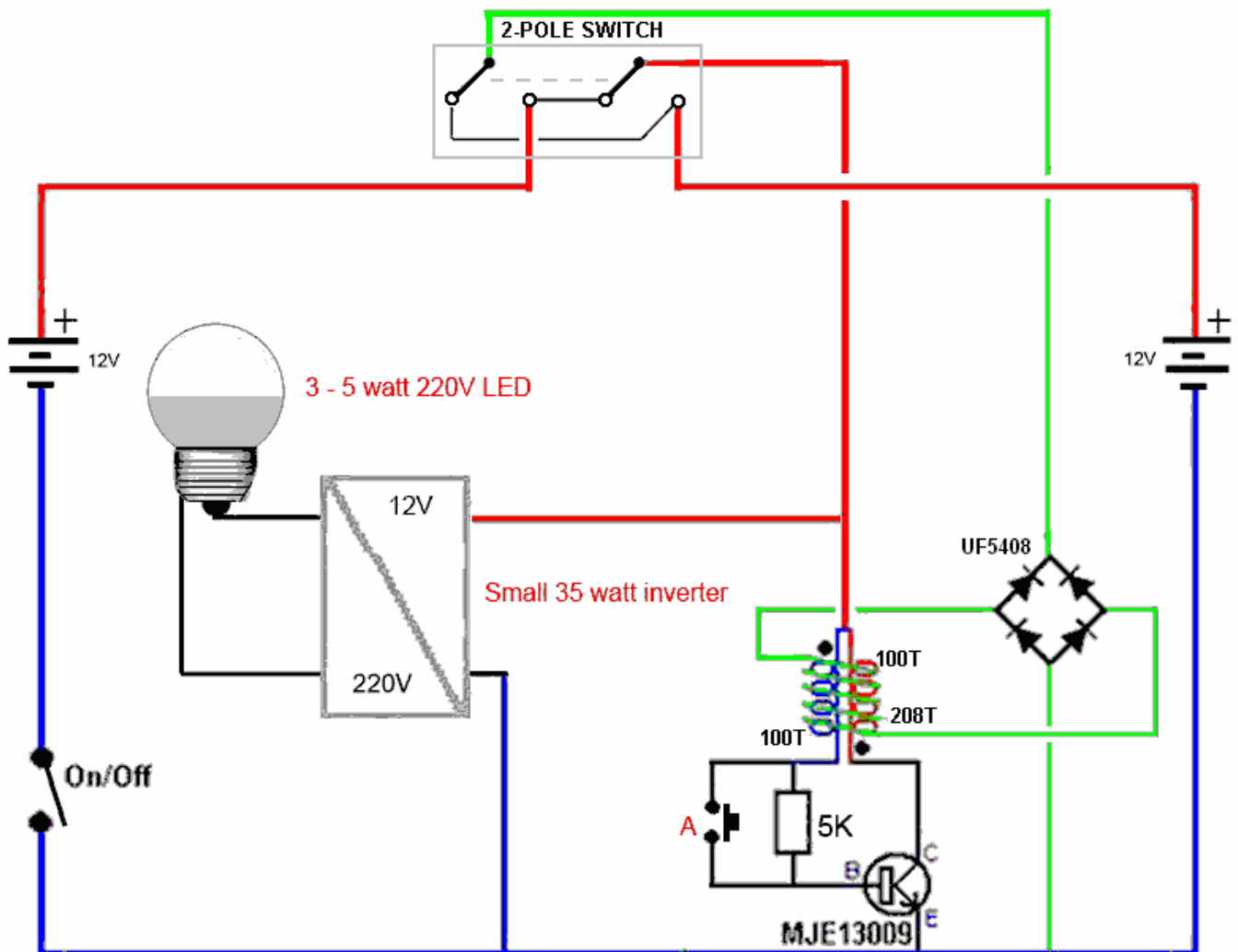


However, looking for an even more simple version has led to the following design which has few components and yet which works very well. It uses the same principle of operation used by Carlos Benitez in his two kilowatt self-powered design, namely the circuit drives both the load to be powered (a light in this case) and at the same time drives a battery charger which charges a second battery which will be ready for use when the driving battery needs recharging. The circuit is switched entirely off

when the light is not in use. The developer has easy access to many discarded 12-volt batteries and so he uses batteries like this:



The heart of the very simple circuit is a bi-filar coil wound on a 40 mm diameter coil former using two strands of 0.71 mm diameter solid enamelled copper wire. Each coil has 100 turns and the two strands of wire are wound side by side. The start of the first winding is connected to the end of the second winding. Then, a third coil of 208 turns is wound on top of that bi-filar coil. The circuit is like this:



For the light, the developer has chosen to use a 220-volt bulb, rated at anything from 3 watts to 5 watts as that is easy to organise and gives really good lighting. Ignoring the coil circuitry, the circuit is extremely simple with a small inverter powered by either of the batteries.

The inverter is very small and very cheap and the developer has found it to be highly reliable. It can be purchased through eBay:



12V to 220V Step UP Power Module 35W DC-AC Boost Inverter Module Dual Channel

Brand new

£1.75

Buy It Now

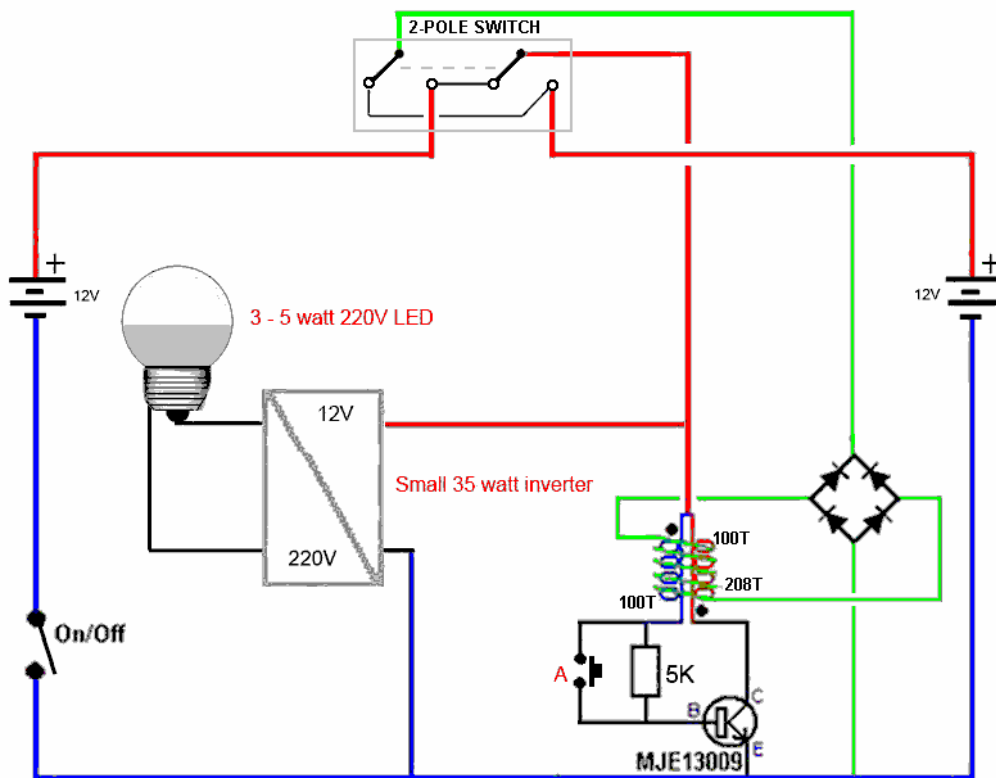
+ £0.50 postage

144 sold

From China

However, although it is so small you need to be **very careful** when setting it up as you could get a serious shock if you are careless. Remember that this tiny board is generating the same voltage and frequency as a 220-volt mains wall socket, so insulate it fully before applying 12-volt power to the circuit.

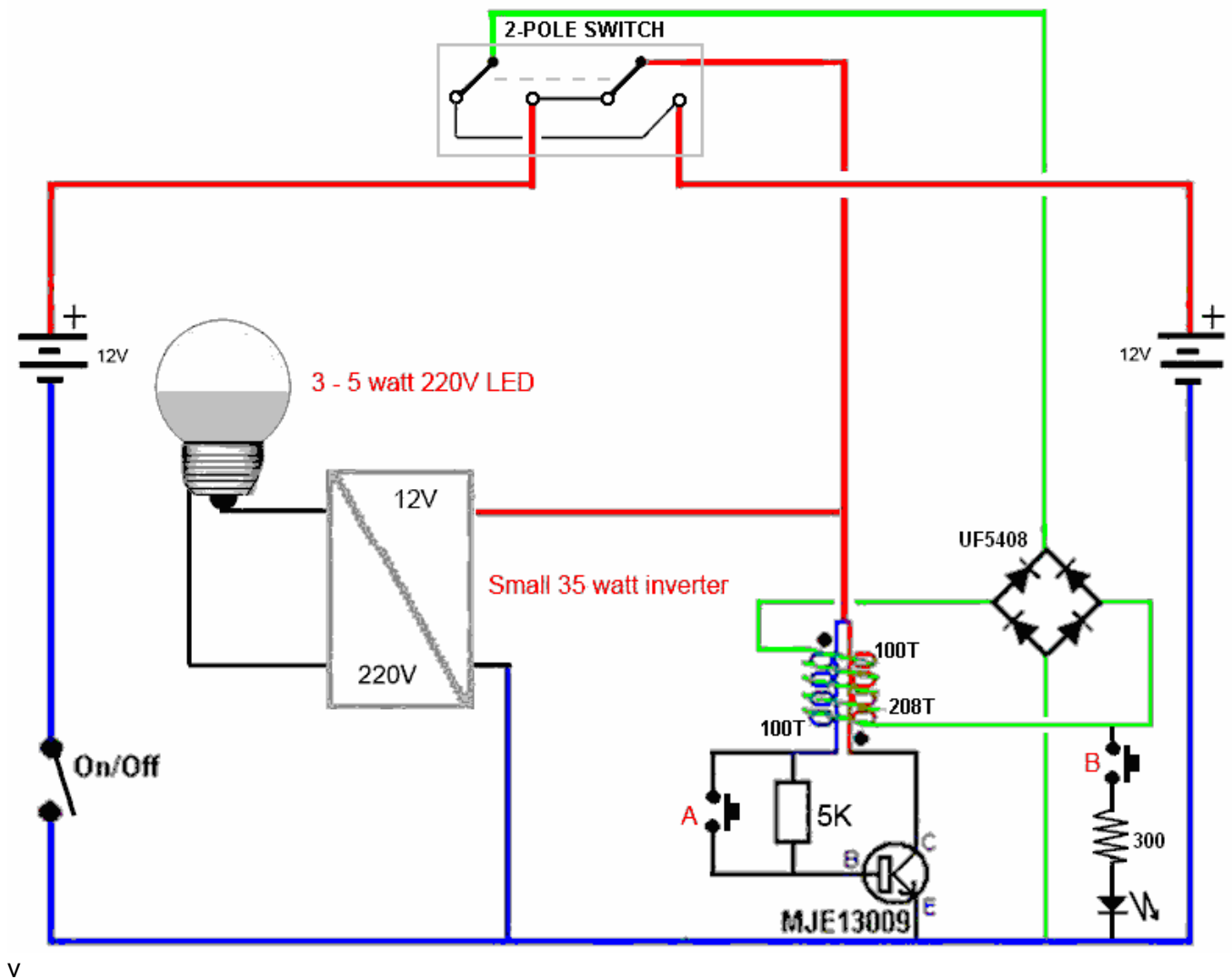
An ordinary 2-pole 2-way toggle switch allows you to switch from one battery to the other. You don't do that until the battery driving the circuit needs to be recharged.



The charging circuit is an ordinary Joule Thief circuit with an extra FLEET-style winding shown in green. The voltage developed in that winding is rectified by the diode bridge and passed to battery which is being recharged. This light is always available and never needs external charging.

The press-button switch marked "A" is included because the MJE13009 transistor is sometimes reluctant to start with its 5K resistor and so a quick tap on the switch always gets it started. If it doesn't start, then the light will work fine but the second battery doesn't get charged. To allow a quick test to

show that the oscillator is actually running, the developer has added a check light to the circuit. The final circuit then looks like this:



Pressing button switch “B” will light the indicator LED if the Joule Thief charging circuit is oscillating and if it isn’t running, then a brief tap on button “A” will get it running as that uses the blue winding directly to feed a large current to the transistor.

As well as generating the 220-volt AC which the bulb needs, the small inverter also acts as a sensor for the state of charge of the battery which is powering the circuit. The inverter starts the light bulb flickering when the battery voltage drops to 12.5 volts. The developer has found that batteries work much better if they are not discharged below 12.5 volts (which is about half charge for a lead-acid battery). So, when the light starts to flicker, the two-pole switch is operated to swap the batteries over.

Again, our thanks are due to the South African developer who shares his working circuits with us.

Patrick J Kelly

www.free-energy-devices.com

www.free-energy-info.com

www.free-energy-info.co.uk

Raymond Kromrey's Electrical Generator

Where the objective is to produce electricity from a rotating magnetic field, there has always been a search for some method of either reducing, or eliminating altogether, the drag on the rotor when electric current is drawn from the coils. One design which claims to have very limited drag caused by current draw is the Kromrey design. The main characteristics of this design are said to be:

1. It has almost constant electrical power output even when the rotor speed is altered by as much as 35%.
2. It can continue to operate with it's electrical output short-circuited, without heating the rotor or causing a braking effect.
3. The production efficiency (electrical output divided by the driving force) is high.
4. The frequency of it's AC output power can be adjusted to that required by the equipment which it powers.
5. The rotor can be spun at any rate from 800 rpm to 1,600 rpm.
6. The simple construction allows manufacturing costs to be about 30% less than other generators.
7. This generator is recommended for supplying power at or above the 1 kilowatt level.

Here is the patent for this device:

Patent US 3,374,376

19th March 1968

Inventor: Raymond Kromrey

ELECTRIC GENERATOR

My present invention relates to an electric generator which converts magnetic energy into electric energy using two components which can rotate relative to each other, i.e. a stator and a rotor, one having electromagnets or permanent magnets which induce a voltage in a winding which forms part of an output circuit mounted on the other component.

Conventional generators of this type use a winding which whose conductors form loops in different axial planes so that opposite parts of each loop pass through the field of each pole pair, twice per revolution. If the loops are open circuit, then no current flows in the winding and no reaction torque is developed, leaving the rotor free to turn at the maximum speed of its driving unit. As soon as the output winding is connected across a load or is short-circuited, the resulting current flow tends to retard the motion of the rotor to an extent which depends on the intensity of the current and this makes it necessary to include compensating speed-regulating devices if it is necessary to maintain a reasonably constant output voltage. Also, the variable reaction torque subjects the rotor and its transmission to considerable mechanical stresses and possible damage.

It is therefore the general object of this invention to provide an electric generator which has none of the above disadvantages. Another object is to provide a generator whose rotor speed varies very little in speed between open circuit operation and current delivery operation. Another objective is to provide a generator whose output voltage is not greatly affected by fluctuations in its rotor speed.

I have found that these objectives can be achieved by rotating an elongated ferromagnetic element, such as a bar-shaped soft-iron armature, and a pair of pole pieces which create an air gap containing a magnetic field. Each of the outer extremities of the armature carries a winding, ideally, these windings

are connected in series, and these coils form part of a power output circuit used to drive a load. As the armature rotates relative to the air gap, the magnetic circuit is intermittently completed and the armature experiences periodic remagnetisations with successive reversals of polarity.

When the output circuit is open, the mechanical energy applied to the rotor (less a small amount needed to overcome the friction of the rotating shaft) is absorbed by the work of magnetisation, which in turn, is dissipated as heat. In actual practice however, the resulting rise in temperature of the armature is hardly noticeable, particularly if the armature is part of the continuously air-cooled rotor assembly. When the output circuit is closed, part of this work is converted into electrical energy as the current flow through the winding opposes the magnetising action of the field and increases the apparent magnetic reluctance of the armature, and so the speed of the generator remains substantially unchanged if the output circuit is open or closed.

As the armature approaches its position of alignment with the gap, the constant magnetic field tends to accelerate the rotation of the armature, aiding the applied driving force. After the armature passes through the gap there is a retarding effect. When the rotor picks up speed, the flywheel effect of its mass overcomes these fluctuations in the applied torque and a smooth rotation is experienced.

In a practical embodiment of this invention, the magnetic flux path includes two axially spaced magnetic fields traversing the rotor axis and substantially at right angles to it. These fields are generated by respective pole pairs co-operating with two axially spaced armatures of the type already described. It is convenient to arrange these two armatures so that they lie in a common axial plane and similarly, the two field-producing pole pairs also lie in a single plane. The armatures should be laminated to minimise eddy currents, so they are made of highly permeable (typically, soft-iron) foils whose principle dimension is perpendicular to the rotor axis. The foils can be held together by rivets or any other suitable method.

If the ferromagnetic elements are part of the rotor, then the output circuit will include the usual current-collecting means, such as slip-rings or commutator segments, depending on whether AC or DC current output is desired. The source of coercive force in the stator includes, advantageously, a pair of oppositely positioned, yoke-shaped magnets of the permanent or electrically energised type, whose extremities constitute the pole pieces mentioned above. If electromagnets are used in the magnetic circuit, then they may be energised by an external source or by direct current from the output circuit of the generator itself.

I have found that the terminal voltage of the output circuit does not vary proportionately to the rotor speed as might be expected, but instead, it drops at a considerably slower rate with decreasing rotor speed. So, in a particular tested unit, this voltage fell to only about half its original value when the rotor speed was dropped to one third. This non-linear relationship between terminal voltage and driving rate produces a substantially constant load current and therefore, electric output over a wide speed range, at least under certain load conditions, inasmuch as the inductive reactance of the winding is proportional to frequency (and consequently, to rotor speed) so as to drop off more rapidly than the terminal voltage, in the event of a speed reduction, with a resulting improvement in the power factor of the load circuit.

If the magnetic circuit contains only a single pole pair per air gap, the flux induced in the rotating armature will change its direction twice per revolution so that each revolution produces one complete cycle of 360 electrical degrees. In general, the number of electrical degrees per revolution will equal 360 times the number of pole pairs, it being apparent that this number ought to be odd since with even numbers it would not be possible to have poles alternating in polarity along the path of the armature and at the same time to have the North and South poles of each pair at diametrically opposite locations. In any case, it is important to dimension the curved facing faces of the pole pairs in such a manner so as to avoid allowing the armature to bridge between adjoining poles, so it is necessary to make the sum of the arcs spanned by these faces (in the plane of rotation) equal to considerably less than 360 degrees electrical.

The invention will now be described in more detail, reference being made to the accompanying drawings in which:

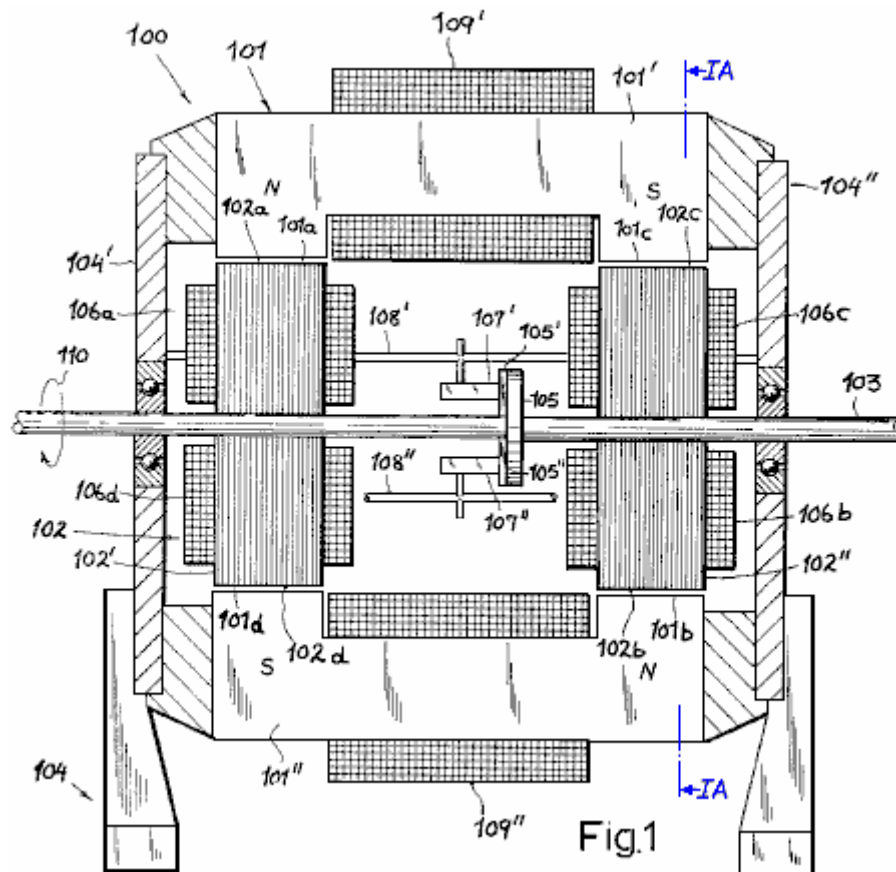


Fig.1 and **Fig.1A**. illustrate a first embodiment of my invention, shown in axial section and in a cross-sectional view taken on line IA - IA of Fig.1 respectively.

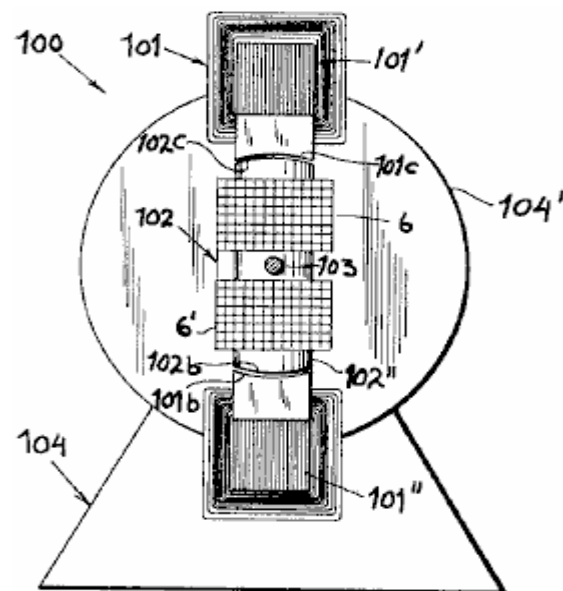


Fig.1A

Fig.2 and **Fig.3** are perspective views illustrating two other embodiments.

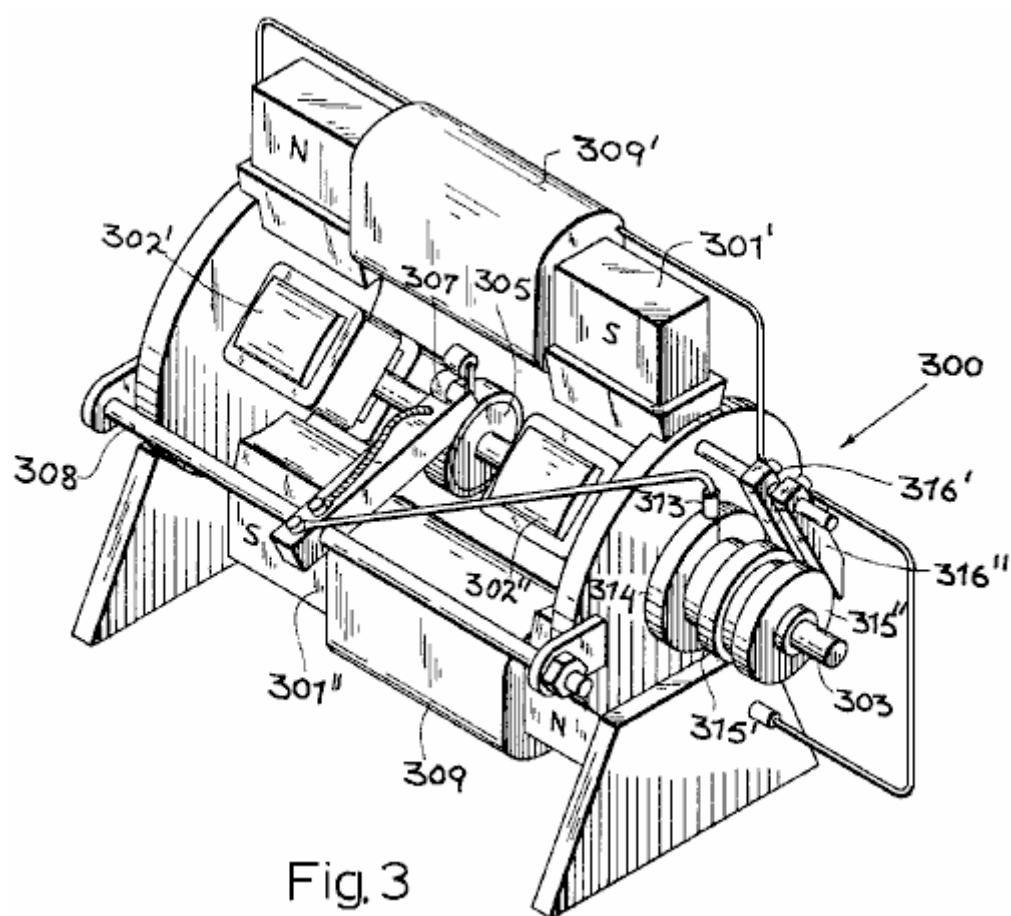
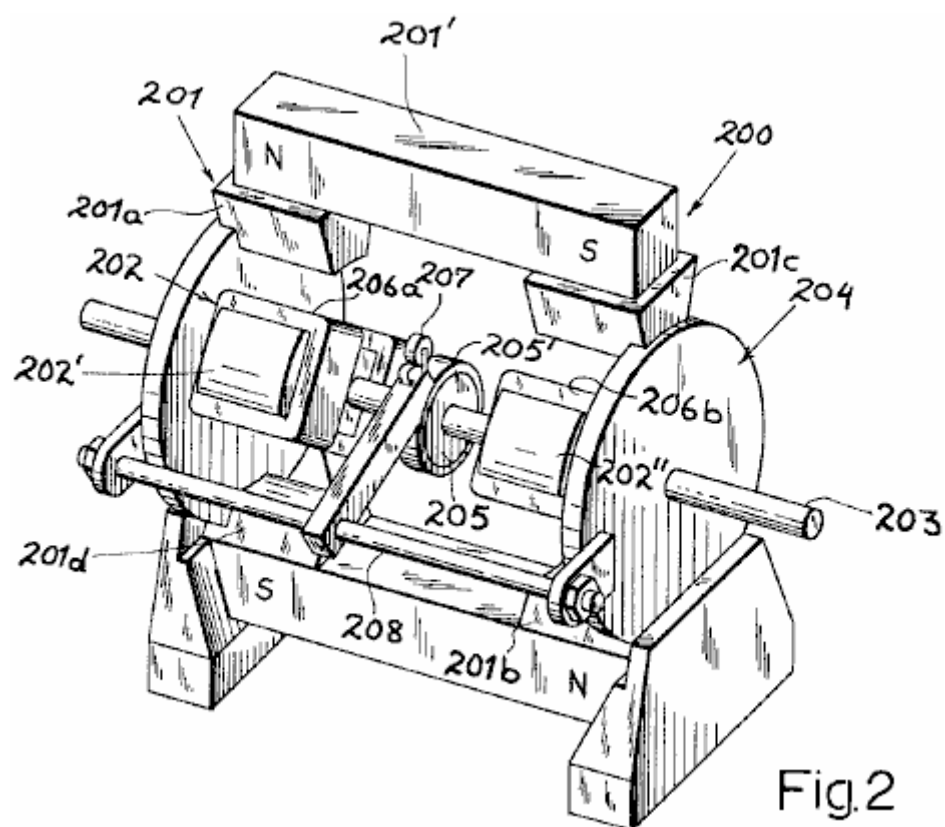


Fig.4 and **Fig.5** illustrate diagrammatically, two output circuit arrangements, one for a DC output and one for an AC output.

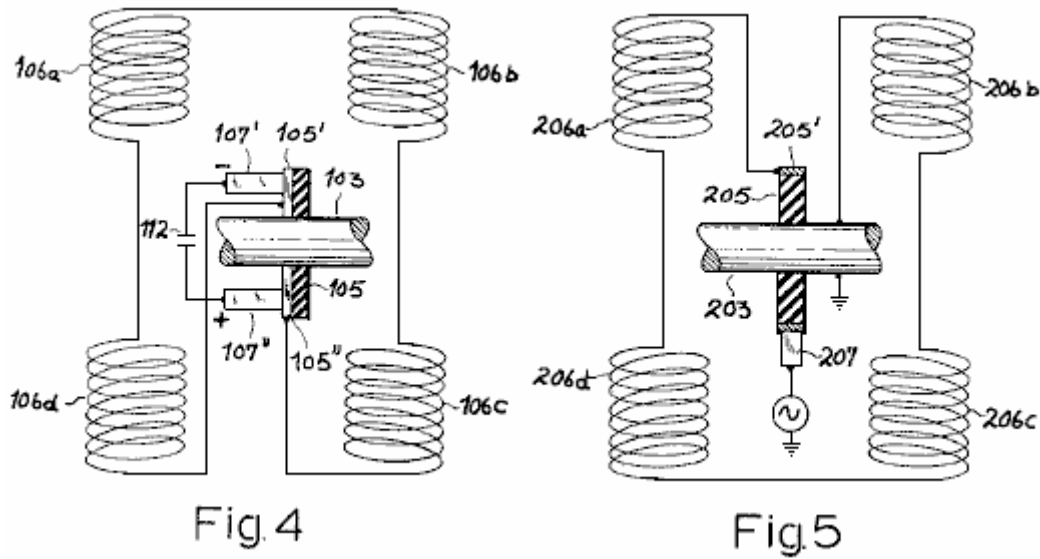
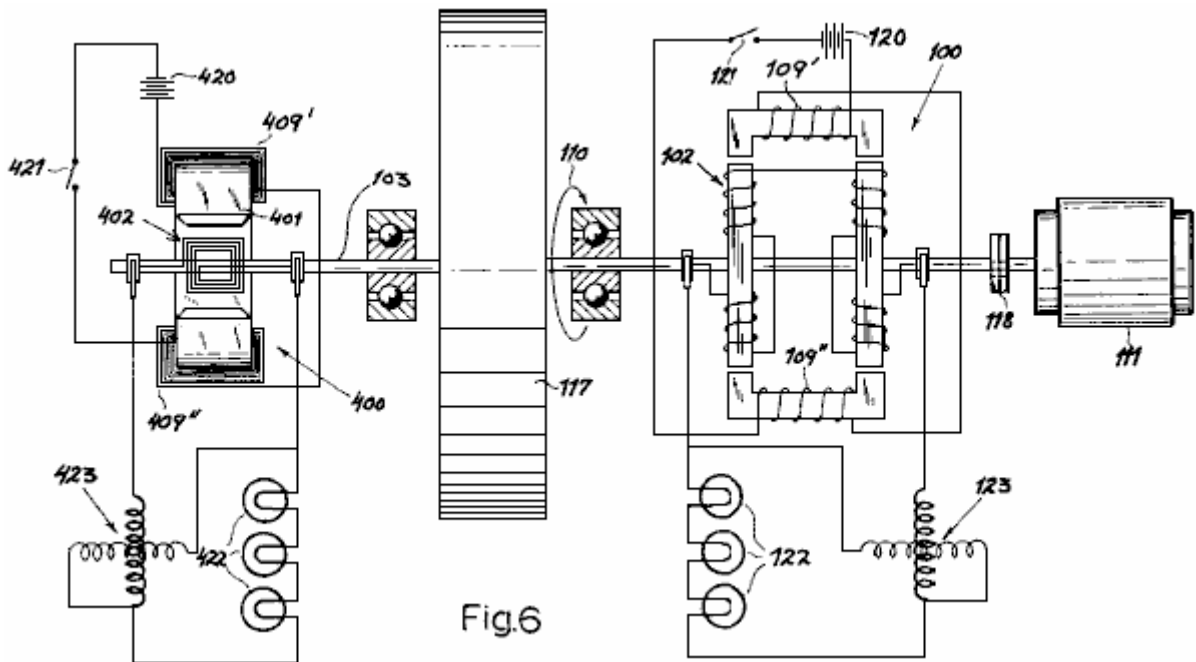
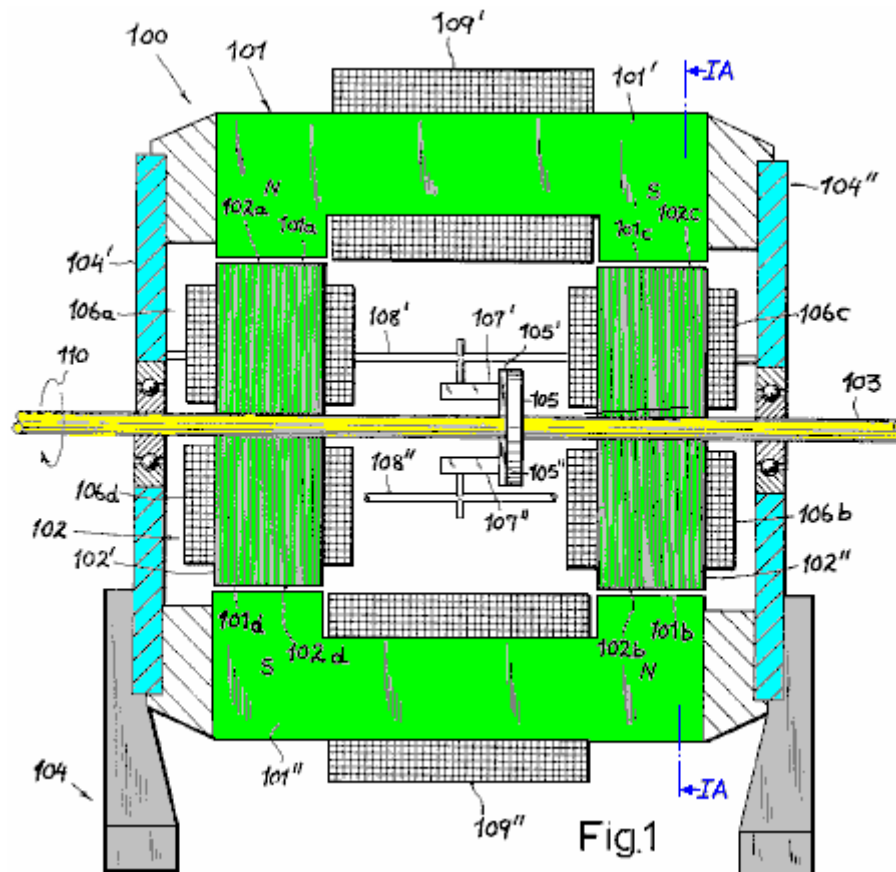


Fig.6 is a somewhat diagrammatic illustration of an arrangement for comparing the outputs of a conventional generator and a generator according to this invention.



The generator **100** shown in **Fig.1** and **Fig.1A** comprises a stator **101** and a rotor **102** which has a pair of laminated armatures **102'** and **102''**, carried on a shaft **103** which is free to rotate in bearings mounted in the end plates **104'** and **104''**, of a generator housing **104** which is made from non-magnetic material (e.g. aluminium) which is rigidly attached to the stator.



Shaft **103** is coupled to a source of driving power indicated diagrammatically by an arrow **110**. The stator **101** includes a pair of yoke-shaped laminated electromagnets **101'** and **101''** whose extremities form two pairs of co-planar pole pieces, designated respectively **101a**, **101b** (North magnetic pole) and **101c**, **101d** (South magnetic pole). The pole pieces have concave faces, facing towards the complimentary convex faces **102a**, **102d** of armature **102'** and **102b**, **102c** of armature **102''**. These faces whose concavities are all centred on the axis of shaft **103**, extend over arcs of approximately 20° to 25° each in the plane of rotation (**Fig.1A**) so that the sum of these arcs adds up to about 90° geometrically and electrically.

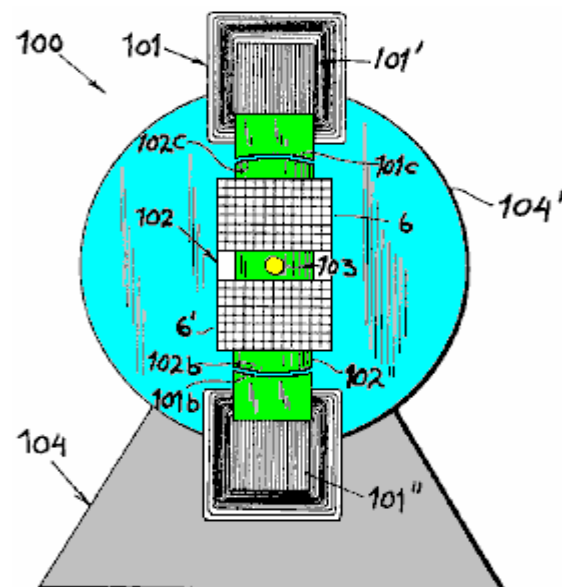


Fig.1A

The stator magnets **101'**, **101''** are surrounded by energising windings **109'**, **109''** which are connected across a suitable source of constant direct current (not shown). Similar windings, each composed of two series-connected coils **106a**, **106d** and **106b**, **106c**, surround the rotor armatures **102'** and **102''**, respectively. These coils form part of an output circuit which further includes a pair of brushes **107'**, **107''** which are carried by arms **108'**, **108''** on housing **104** with mutual insulation brushes **107'**, **107''** co-operate with a pair of commutator segments **105'**, **105''** (see also **Fig.4**) which are supported by a disc of insulating material **105**, mounted on shaft **103**.

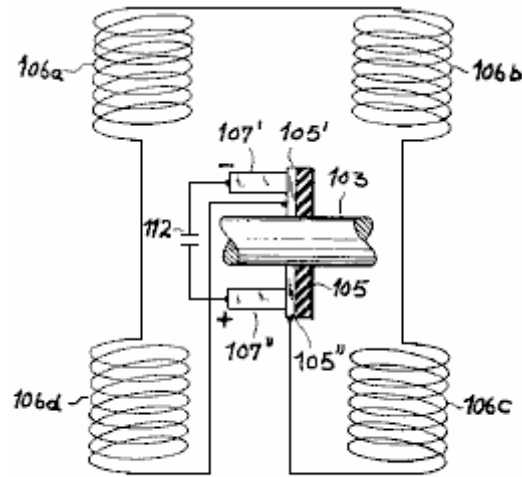


Fig. 4

By virtue of the series-connection of coils **106a-106d** between the segments **105'** and **105''**, as illustrated in **Fig.4**, the alternating voltage induced in these coils gives rise to a rectified output voltage at brushes **107'** and **107''**. The unidirectional current delivered by these brushes to a load (not shown) may be smoothed by conventional means, represented by capacitor **112** in **Fig.4**.

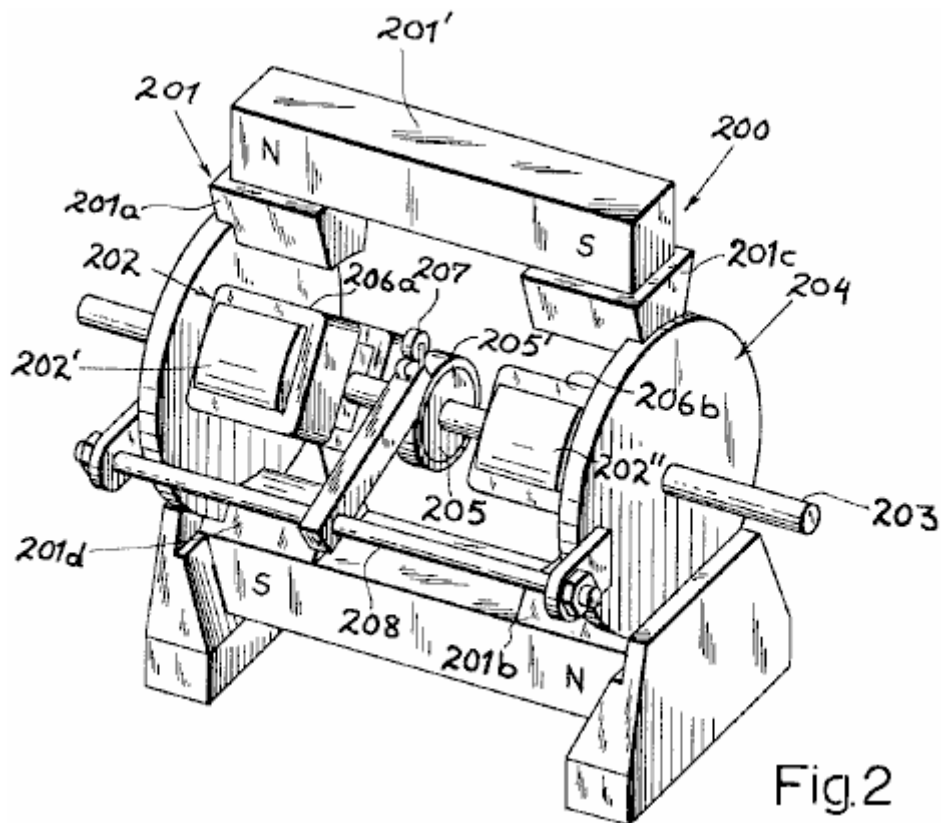


Fig.2

Fig.2, shows a modified generator **200**, whose housing **204**, supports a stator **201** essentially consisting of two permanent bar magnets **201'** and **201''**, extending parallel to the drive shaft **203** (on opposite side of it), each of these magnets being rigid and each having a pair of sole shoes **201a**, **201c** and **201b**, **201d** respectively. Rotor **202** is a pair of laminated armatures **202'** and **202''**, similar to those of the previous embodiment, whose output coils **206a**, **206b**, **206c** and **206d** are serially connected between a slip-ring **205'**, supported on shaft **203** through the intermediary of an insulating disc **205**, and another terminal here represented by the grounded shaft **203** itself. Slip-ring **205'** is contacted by brush **207** on holder **208**, the output of this brush being an alternating current of a frequency determined by the rotor speed.

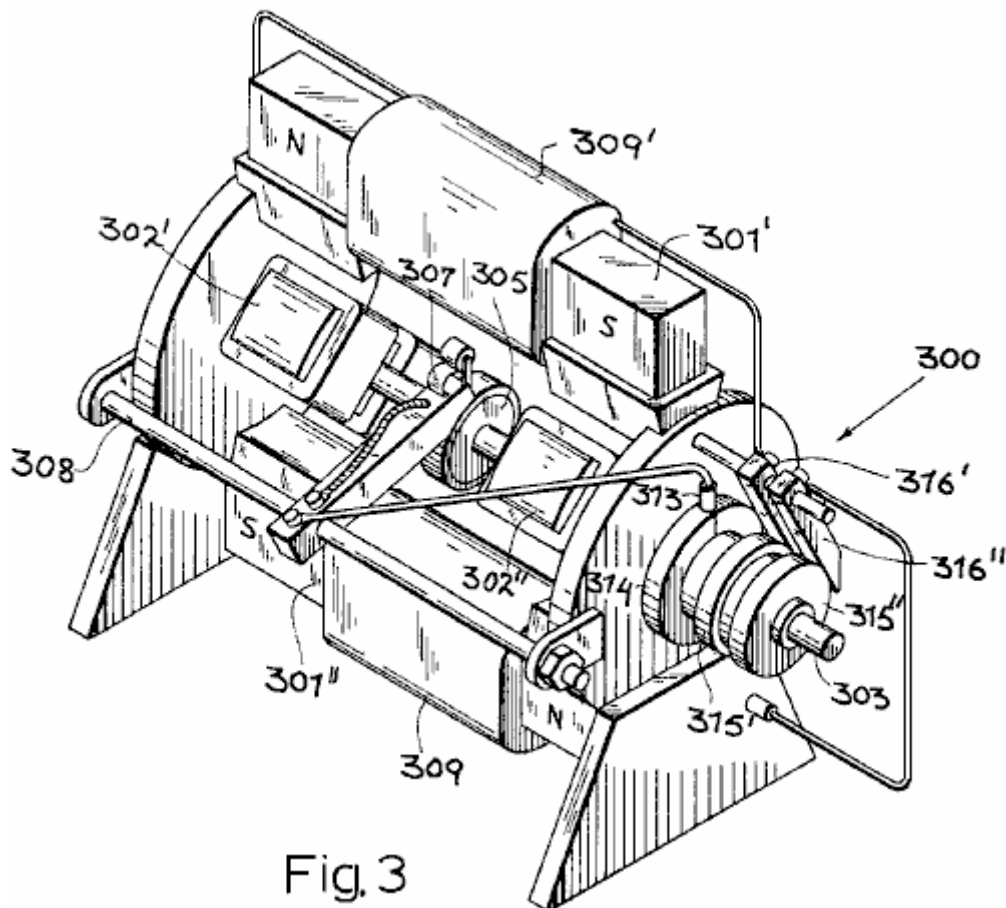


Fig.3

Fig.3 shows a generator **300** which is basically similar to the generator **100** shown in **Fig.1** and **Fig.1A**. It's shaft **303** carries a pair of laminated soft-iron armatures **302'**, **302''** which can rotate in the air gaps of a pair of electromagnets **301'**, **301''** which have windings **309'** and **309''**. The commutator **305** again co-operates with a pair of brushes **307**, only one of which is visible in **Fig.3**. This brush, carried on an arm **308**, is electrically connected to a brush **313** which engages with a slip-ring **314** positioned on an extremity of shaft **303** which also carries two further slip-rings **315'**, **315''** which are in conductive contact with ring **314** but are insulated from the shaft. Two further brushes **316'**, **316''** contact the rings **315'**, **315''** and respectively are connected to windings **309'** and **309''**. The other ends of these windings are connected to an analogous system of brushes and slip-rings on the extremity of the opposite shaft, and arranged so that the two commutator brushes are effectively bridged across the windings **309'** and **309''** in parallel. Therefore, in this embodiment, the stator magnets are energised from the generator output itself, it being understood that the magnets **301'** and **301''** (made, for example, of steel rather than soft iron) will have a residual coercive force sufficient to induce an initial

output voltage. Naturally, the circuits leading from the brushes **307** to the windings **309'**, **309''** may include filtering as described in connection with **Fig.4**.

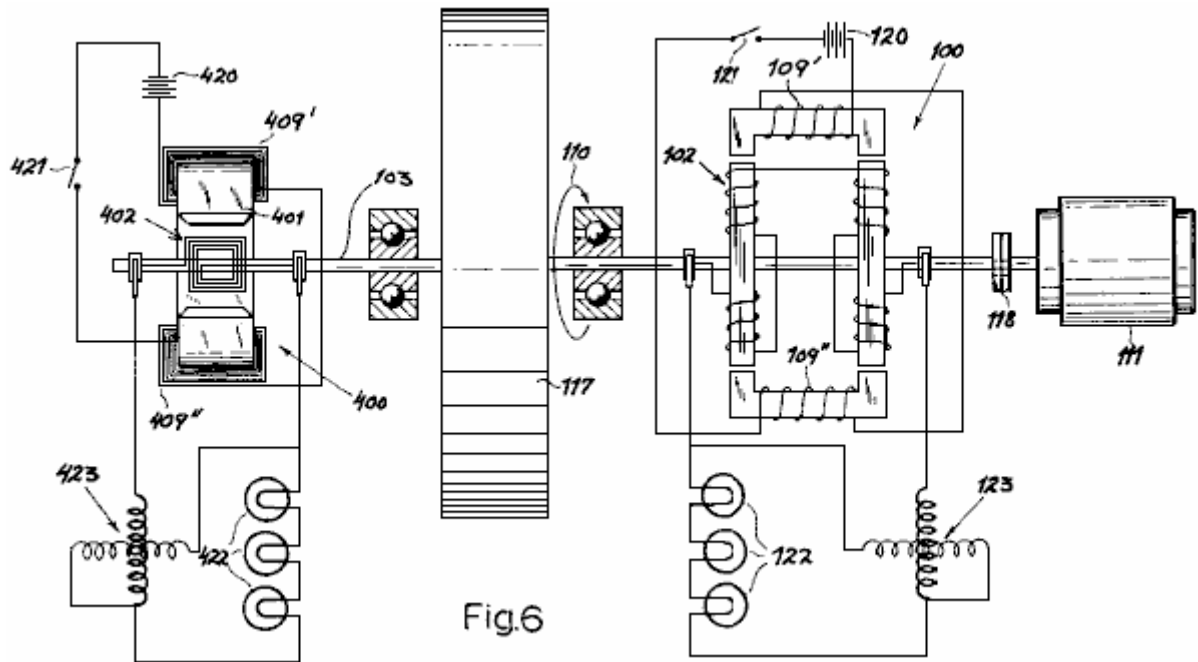


Fig.6 shows a test circuit designed to compare the outputs of a generator of this design, such as the unit **100** of **Fig.1** and **Fig.1A**, with a conventional generator **400** of the type having a looped armature **402** which rotates in the gap of a stator magnet **401** which is fitted with energising windings **409'**, **409''**. The two generators are interconnected by a common shaft **103** which carries a flywheel **117**. This shaft is coupled through a clutch **118** to a drive motor **111** which drives the rotors **402** and **102** of both generators in unison, as indicated by arrow **110**. Two batteries **120** and **420**, in series with switches **121** and **421**, represent the method of supplying direct current to the stator windings **109'**, **109''** and **409'**, **409''** of the two generators.

The rectified output of generator **100** is delivered to a load **122**, shown here as three incandescent lamps connected in series, and with a combined consumption of 500 watts. Generator **400**, provides current into an identical load **422**. Two watt meters **123** and **423** have their voltage and current windings connected respectively in shunt and in series with their associated loads **122** and **422**, to measure the electric power delivered by each generator.

When clutch **118** is engaged, shaft **113** with it's flywheel **117** is brought to an initial driving speed of 1,200 rpm. at which point, the switch **421** in the energising circuit of the conventional generator **400**, is closed. The lamps **422** light immediately and the corresponding wattmeter **423** shows an initial output of 500 watts. However, this output drops immediately as the flywheel **117** is decelerated by the braking effect of the magnetic field on armature **402**.

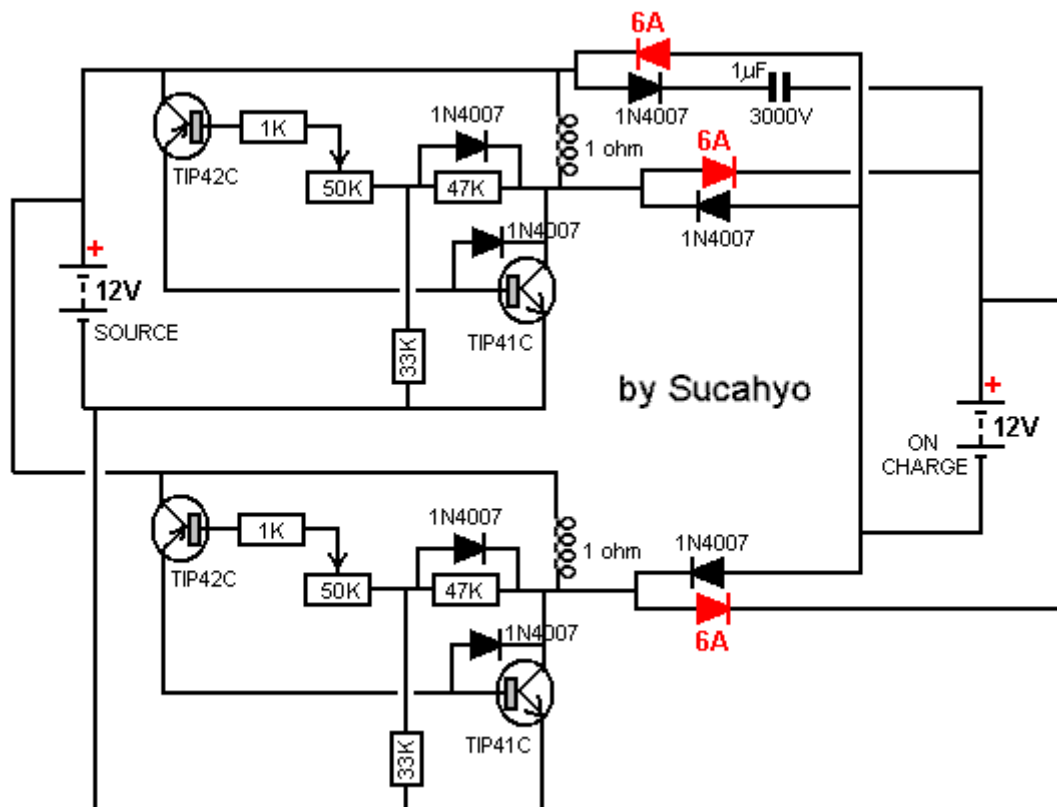
Next, the procedure is repeated but with switch **421** open and switch **121** closed. This energises generator **100** and the lamps **122** light up, wattmeter **123** showing an output of 500 watts, which remains constant for an indefinite period of time , there being no appreciable deceleration of flywheel **117**. When the clutch **118** is released and the rotor speed gradually decreases, the output of generator **100** is still substantially 500 watts at a speed of 900 rpm. and remains as high as 360 watts when the speed dropped further to 600 rpm. In a similar test with a generator of the permanent magnet type, such as the one shown at **200** in **Fig.2**, a substantially constant output was observed over a range of 1600 to 640 rpm.

Simple Free-Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 35: The Upgraded Joule Thief

There are various circuits which I have shown which use the well-known “Joule Thief” circuit as part of the design. These devices have worked well for me. However, in 2014, Sucahyo stated that some people found that pulse-charging batteries for a few times, caused those batteries to then have “surface charge” where the battery voltage rose without there being a corresponding genuine charge inside the battery. That is something which I have never experienced myself but that might be because I didn’t discharge and recharge batteries a sufficient number of times for me to experience the effect. Sucahyo uses this circuit:

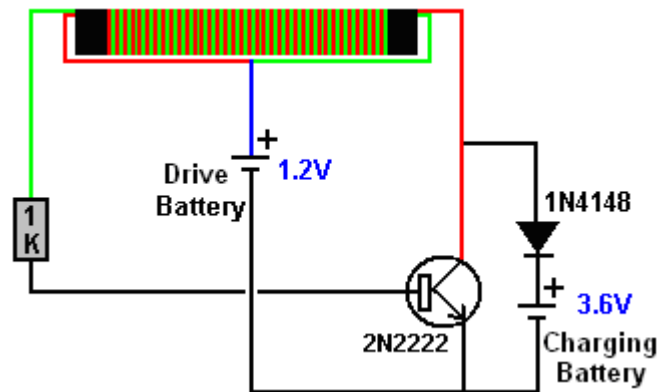


which looks rather complicated with two of the transistors connected upside down and protection diodes connected between transistor collector and base. Sucahyo says that he has used this circuit for four years now without experiencing any surface charge effects.

My preferred form of Joule thief uses a bi-filar coil of 0.335 mm diameter wire wound on a paper cylinder formed around a pencil and only 100 mm (4 inches) long, as that produces a very cheap and lightweight circuit. As I understand it, the Joule Thief produces a rapid stream of high voltage spikes of very short duration. Those spikes cause the local environment to feed static energy into both the circuit and the circuit's load device (typically an LED or a battery).

While I have never experienced surface charge from a Joule Thief circuit, I tested some old Digimax 2850 mAHr test batteries which had been sitting unused for more than a year. These did indeed show

a surface charge effect when load tested. The first test used one battery to drive the circuit and charged three batteries in series using this circuit:



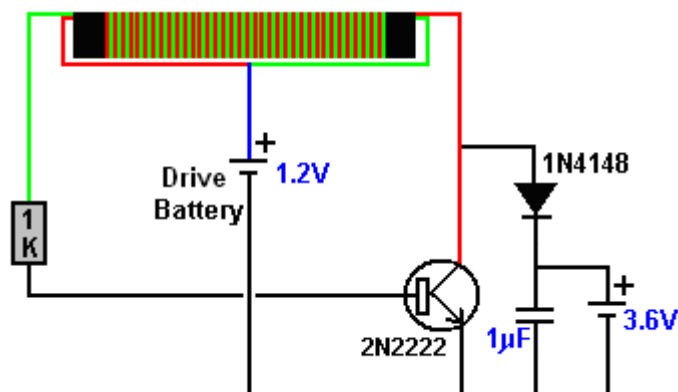
But no matter how long the circuit operated, it would not charge the output battery above 4.0 volts which is 1.33 volts per battery. The load test results were terrible with the voltages at one hourly intervals being 3.93V, 3.89V, 3.84V, 3.82V and 3.79V after only five hours of powering the load. That is ridiculous performance as those batteries managed 22 hours of load powering with the solar panel design.

Perhaps the batteries were damaged. So I overcharged them with a main operated charger, reaching 4.26 volts which is 1.42 volts per battery and the hourly load testing results were 4.21, 4.18, 4.16, 4.15, 4.13, 4.12, 4.10, 4.08, 4.07, 4.07, 4.06, 4.05, 4.03, 4.03, 4.02, 4.01, 4.00 (after 17 hours), 3.99, 3.99, 3.98, 3.97, 3.97, 3.96, 3.96, 3.95 after 25 hours and 3.90 after 33 hours. Clearly, there is nothing wrong with the batteries so the effect must be a factor of the charging.

Feeding static electricity into a capacitor converts it into normal “hot” electricity, but we want a very simple circuit, so the next step was to add in a 100 volt 1 microfarad capacitor which looks like this:



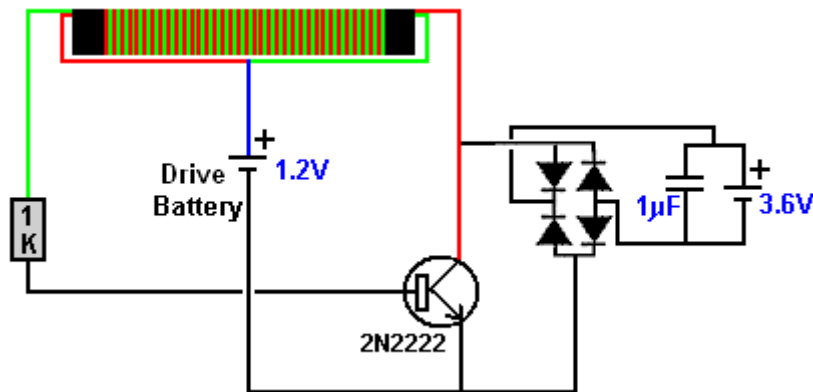
making the circuit:



With the battery on charge removed, the voltage on the capacitor reaches 22 volts. Charging the same batteries with this circuit reached 4.14 volts and produced load results of 4.09, 4.05, 4.01, 3.98, 3.96,

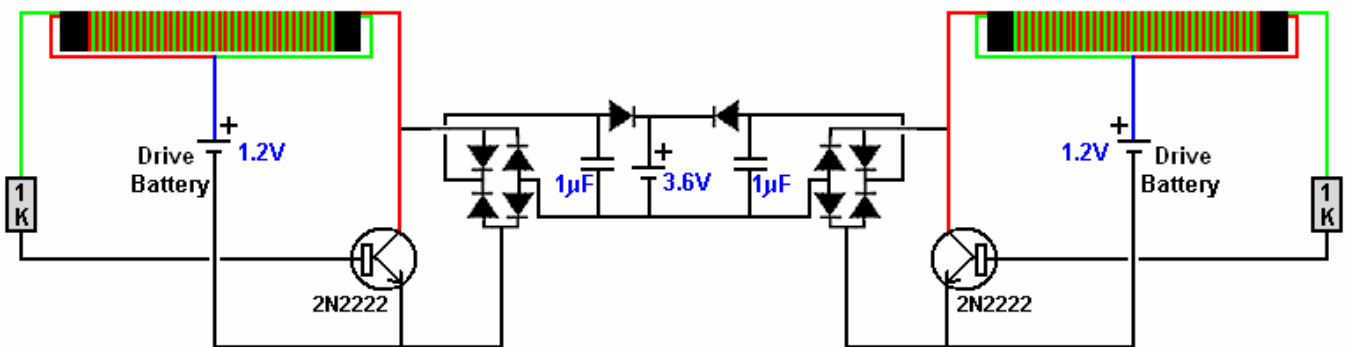
3.93, 3.90, 3.88, 3.85, 3.83, 3.81 and 3.79 volts after 12 hours which is much better than the 5-hour total previously experienced. However, obviously, something better is needed.

The next step is to use a diode bridge of 1N4148 diodes instead of the single diode, giving this circuit:



Without the charging battery connected, this circuit gives 28 volts on the capacitor and the battery charging is good, giving load testing results of 4.18, 4.16, 4.15, 4.13, 4.11, 4.10, 4.08, 4.08, 4.06, 4.05, 4.04, 4.03, 4.02, 4.00, 3.99, 3.98, 3.97, 3.96, 3.95, 3.95, 3.94, 3.94, 3.93, 3.93, and 3.93 volts after powering the load for 24 hours. This seems to be a very satisfactory result for such a minor alteration.

If two 1.2V batteries are used to drive the circuit, without a battery on charge, then the voltage on the capacitor reaches 67 volts, but that is not necessary for charging a 12-volt battery. Although the change is slight, the circuit operation is changed considerably. The capacitor does not discharge instantly and so, for some of the time between the sharp Joule Thief pulses, the capacitor supplies extra charging current to the battery on charge. This does not mean that the battery being charged is charged much faster and you can expect that full charging will take several hours. I have not yet tested it, but I would expect that by using two or more of these circuits simultaneously, should increase the rate of charge;



There is no need to restrict the battery on charge to a nominal 3.6 volts in any of these circuits as a single 1.2 volt drive battery can easily charge a 4.8 volt battery or larger. The value of the capacitor has a considerable effect and I suggest a one microfarad capacitor is a good choice. It has been argued that the two additional diodes on each side of the battery being charged are not necessary, although I have shown them to isolate the two circuits from each other.

Patrick J Kelly

www.free-energy-info.tuks.nl

www.free-energy-info.com

www.free-energy-info.co.uk

Chapter 36 - Useful Free Energy

This is information for people who are not fully familiar with the subject of free energy. What I mean by free-energy is energy to run the devices which you use – TV, computer, air conditioning, cooker, washing machine, fan, etc. – without having to pay for a fuel to generate that power. That sounds mad to people who do not realise that we live in an energy field so powerful that running every powered device on Earth for a thousand years would never even be noticed by that energy field. Yet, that is exactly the way that things are.

There are air-conditioning systems which can easily be bought and which can either heat or cool the air passing through them. These are heat pump systems which draw energy from the local environment as well as from the electrical supply to which they are connected. Their efficiencies range from 250% to around 500% efficient. That is, the heating of the air is two to five times more efficient than using a fan heater or other electrical heater. One of them looks like this:



Fujitsu KM Range ASYG07KMTA

2Kw, 7000Btu Wall Mtd Unit ***

INDOOR ONLY ***

Fujitsu KM range inverter wall mounted split air conditioning system suitable for many different applications. *** INDOOR ONLY

Customer Rating :

£199.00

And the technical information includes the fact that the output from this unit is more than four times the input power (called the “Coefficient Of Performance” or “COP”):

Specification:

	Indoor	ASYG07KMTA
Nominal Capacity (kW)	Cooling	2.00 (0.50-3.00)
	Heating	3.00 (0.50-3.40)
Power Consumption (kW)	Cooling	0.47
	Heating	0.69
EER / COP (Nominal Conditions)		4.30 / 4.38

Split air conditioning units which have an outdoor section as well as an indoor section, are more efficient again, some having a Coefficient Of Performance greater than five, that is, the output power is more than five times greater than the input power **which you have to supply** to make it work.

That is a fine performance, but it will only work if you can provide the electricity which the air conditioner needs. Thanks to a lightning strike and the loss of two power stations, a few days ago, more than a

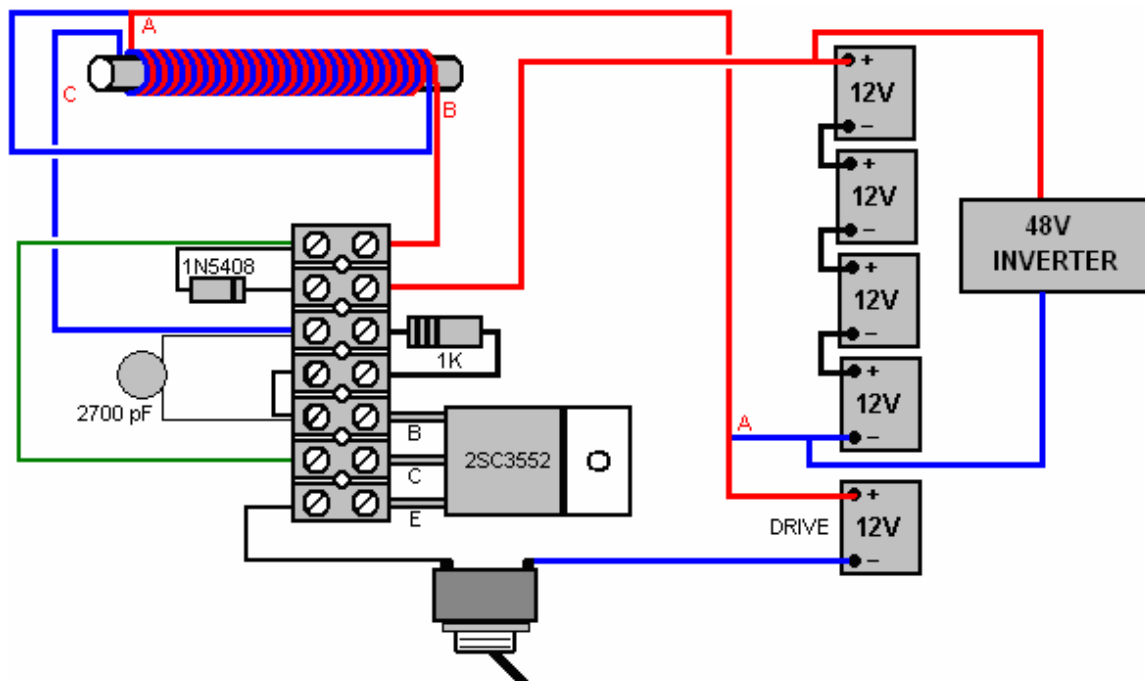
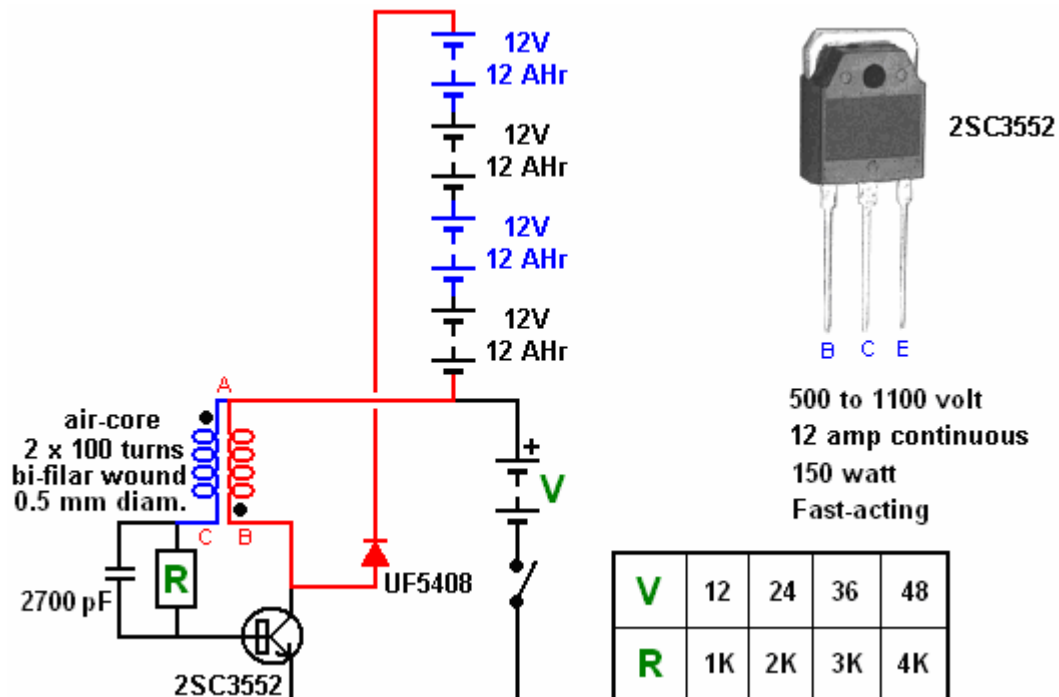
million people in the UK did not have a working electricity supply. It would be nice to have your own electricity supply. Free-energy can provide that. There are two main groups of people who want free energy. The first group are the people who just don't want to pay for electricity. The second group are the people who want to stop the pollution that the present oil-based system is causing. I'm sorry to tell you, but while the incoming energy which ends up as being your electrical supply is indeed free, obtaining a device to make the wanted conversion of the energy is, itself, by no means free. You can convert a gallon of petrol into a powered trip of many miles, but to do that you would probably want a car, and cars are by no means free.

So, even if you have to pay for it, how do you get your own supply of electricity? You can definitely do it and it can be done in several different ways, some of which are well beyond the abilities of the average person to arrange. The most simple is using a battery with an ordinary DC-to-AC converter called an "inverter" to generate the same voltage and frequency as your local electricity supply. This battery and inverter system is a well-known method which has been used for many years and very often, the battery is recharged using solar panels mounted on a roof.

This method has problems quite apart from the cost of buying and installing the solar panels. At the present time (August 2019) the most obvious choice for a battery is a "deep cycle" lead-acid battery which is roughly the same as that used in cars. However, most people are not aware of the practical difficulties with using a lead-acid battery:

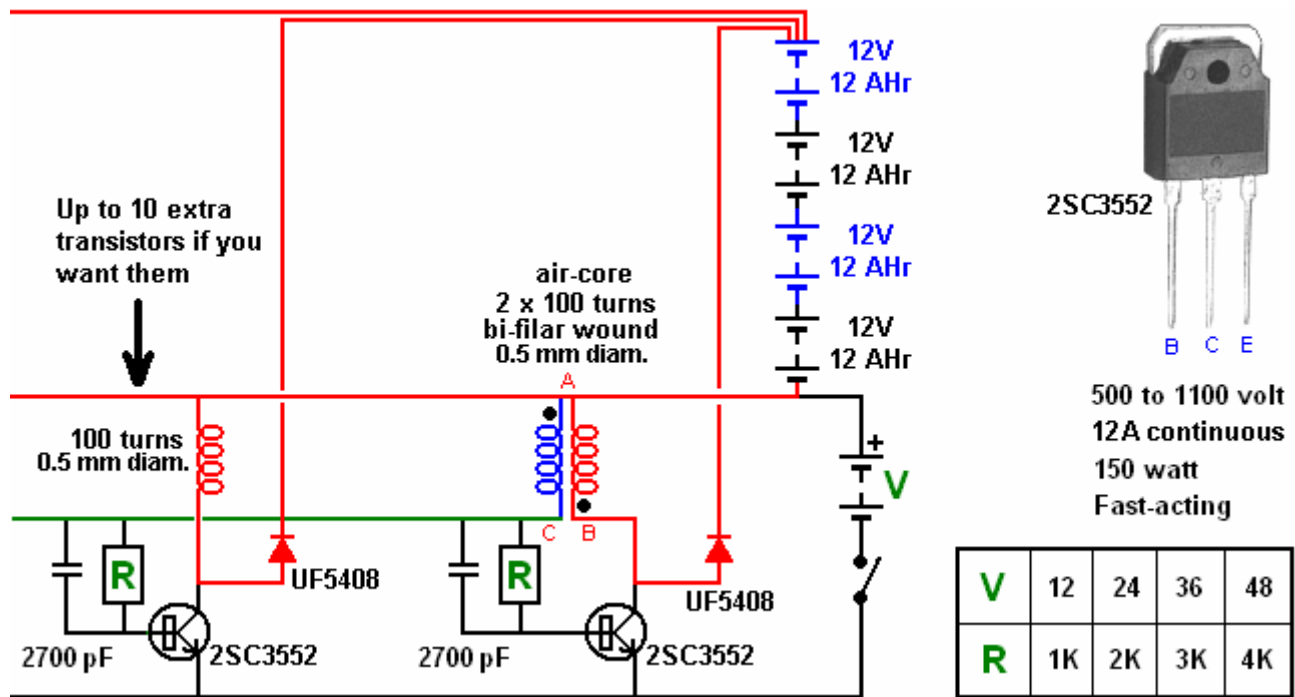
1. The first problem is that a lead-acid battery loses half of the charging current which you feed into it. That means that for every watt of power which you draw from the battery, you have to feed back two watts of recharging power.
2. The next problem is that a battery of that type has a limited operational life, typically, the battery can be charged and discharged 400 to 1000 times at the "C20" rate of current draw and if that rate of current draw is exceeded, then the lifetime of the battery is reduced. The "C20" rate of discharge is one twentieth of the Amp-Hour rating of the battery. So, for a 100 Amp-Hour battery, the battery life will be shortened if more than 5 amps is drawn from it.
3. The third problem is that batteries do not recharge nearly as well if they are also supplying current. That is, a disconnected battery recharges very much better than one which is supplying a load with current.
4. The fourth problem is that most people do not understand how little power can be drawn from a battery compared to the amount of electricity which they actually use from day to day. Take a 100 Amp-Hour battery (costing £60), it's life will be shortened if more than 5 amps is drawn from it and 5 amps at twelve volts is just 60 watts. That is, if properly treated, the 100 Amp-Hour battery cannot power a 100 watt light bulb.
5. The fifth problem is the current draw from a 12-volt battery, needed to produce 220-volt AC mains output. Is substantial, needing thick wires between the battery and the inverter. For a 1 kilowatt mains supply from a 12-volt battery at 100% inverter efficiency, would require a substantial continuous current. One amp gives 12 watts, so 1000 watts will require $1000 / 12 = 83.33$ amps. At 95% inverter efficiency, that is about 88 amps. And that needs an exceptionally thick wire to carry it. Many people want a good deal more than one kilowatt of electrical power. At the C20 rate of battery discharge, you are talking about eighteen 100-Amp-hour batteries. To reduce the current draw from each battery, it is normal to connect four batteries in series to give 48 volts and use a 48-volt inverter. That cuts the individual battery current to 22 amps for each row of four batteries, and so for a C20 current draw, five rows of four batteries in each row would be needed, costing a total of £1200.

This looks like a serious list of problems, and yet solar panel battery charging systems can work well for many years. We can do better than those systems as items 1 and 2 can be dealt with by switching from DC charging to pulsed DC charging as that improves battery life and battery performance. That can be done by having the solar panels charge up a battery which is then used to drive a DC-pulsing circuit which charges the main battery bank. The pulsing circuit can be built quite easily. Here is one from "Alexkor" of Russia (document: www.free-energy-info.com/Chapter6.pdf page 35):



These sketches avoid the need for any significant soldering but if it seems confusing to you, then the Electronics Tutorial here: www.free-energy-info.com/Electronics/Tutorial.pdf might be helpful. For faster charging, the circuit can be expanded by creating additional sections, each with its own transistor. The charging coil is about 1.5 inches (40 mm) in diameter and wound with 100 turns of two strands of wire of about 0.5 mm diameter. That is, the coil is very simple to make with just 200 turns of wire as shown in the sketch and connected that way with the end of one wire attached to the start of the other wire. Quite apart from being easier to wind, that arrangement is a Tesla bi-filar coil which is more effective than a single coil of 200 turns.

The circuit can be expanded to increase the rate of battery charging if you need that:



Anyway, back to the solar panel problems. The obvious one is that solar panels only work in daylight and ideally in direct sunlight. Also, solar panels differ a great deal in quality of performance. The last time I looked, Kyocera panels were the best as they have extra cells which make the panel work well in poor light.

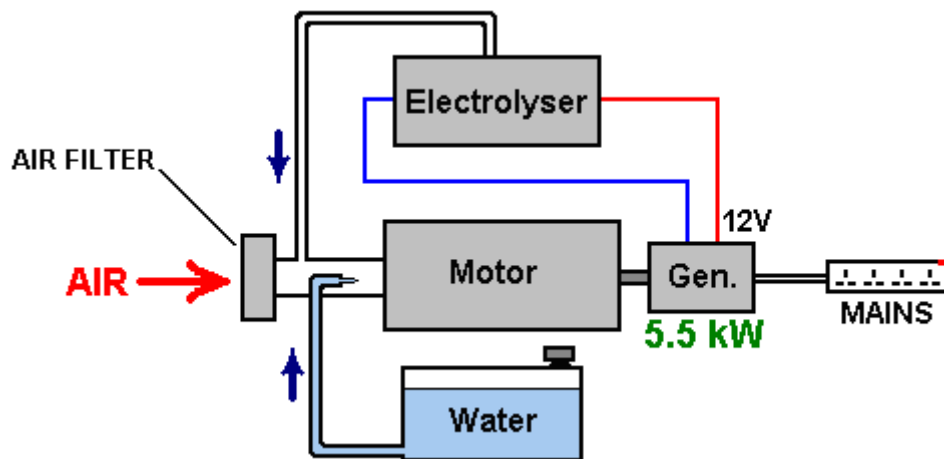
Technically, it is not essential to use one or more solar panels. It is perfectly possible to have your DC pulsing charger charge your battery bank **and** another charging battery and switch the charging batteries over every hour or so, one to drive the charging circuit and one to be recharged at the same time.

Of course, it would be nice to avoid having to use batteries. That is certainly possible. For example, you can use a standard "standby" generator and that can power the household equipment which you want to use. It might look like this:



But, some people say, that it is too noisy and it needs fuel. Well, we can deal with those two problems. First, we can build a sound-reducing enclosure for the generator, one which allows free flow of air to and from the generator. That can be made quite simply by using overlapping timber slats covered in carpet. The air flows easily through the openings between the slats but as sound travels in straight lines it has to bounce off the carpet-covered slats repeatedly and each bounce absorbs part of the sound. So you mount the generator on a sound-absorbing base and put one or two sound-absorbing enclosures around it.

The fuel? Well, you can make the generator operate on a gas mixture called “HHO” which is generated from water using some of the electrical power from the generator. Also, you can add some cold water mist to the air entering the engine and that converts the engine into an internal combustion steam engine. That arrangement has been in use in remote areas for several years now. Details on how to do that can be found in the document www.free-energy-info.com/Chapter10.pdf and it can be done in two different ways. You can either adapt the engine to run directly on HHO or you can bubble the HHO through acetone and use an unmodified generator.



People tend to concentrate on the items of household equipment with the largest current draw. While that is understandable, smaller systems can allow a better quality of life at quite low cost. One man who lives off the grid, recently asked for advice as he wanted to watch TV without the noise of his generator running. That could be accomplished by making his generator charge a battery and then running the TV from the battery while the generator is off. Alternatively, reducing the generator sound would be helpful.

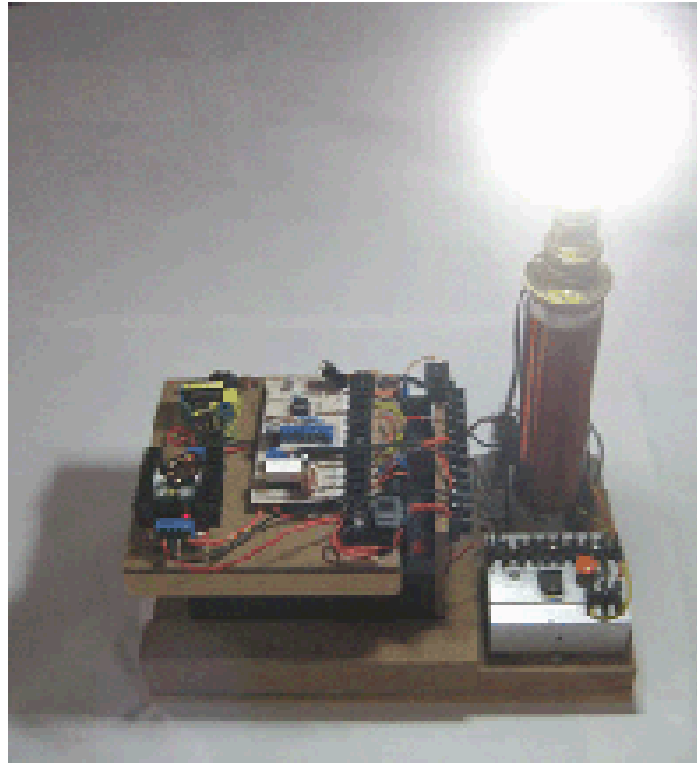
A friend in South Africa has been experiencing power cuts due to local electricity supply problems. There was no indication that the daily power cuts would end soon, so he arranged things to make life easier. He powered his wi-fi equipment from a small rotary generator which he designed and built. The generator is self-powered in spite of looking as if it is driven by a battery while in reality, the battery is just a passive component which is there to act as a voltage level control for the inverter. The generator puts out 150 watts of mains power continuously and needs no fuel to run. It looks like this:



The document on this is www.free-energy-info.com/RotaryGen.pdf.

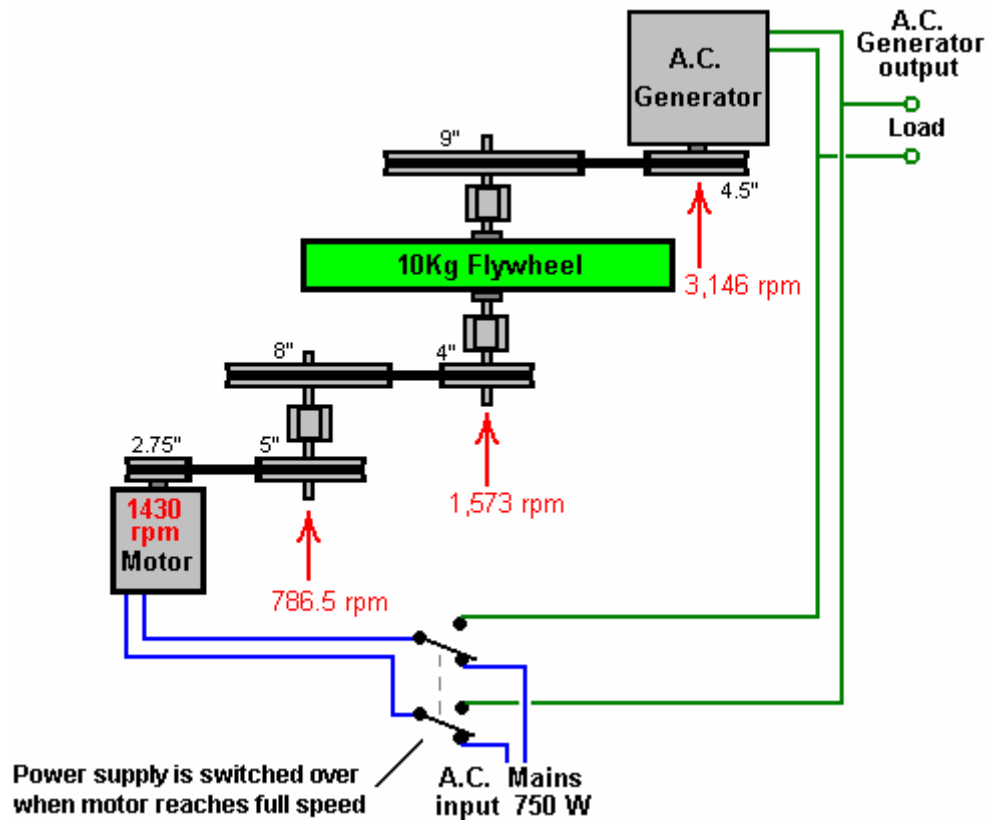
It has been suggested that instead of having a spinning rotor, it should be sufficient to pulse stationary coils with an oscillator circuit. Initial tests indicate that doing that should be perfectly possible, but at this point in time any such solid-state version of the rotary generator has not yet been built, tested and proved to be viable. If it is confirmed, then it is a very attractive option as quite apart from being motionless and quite easy to build, unlike the rotary version which has limited space for coils around the rotor, the solid-state version has no such limitation and so potentially could have any desired level of power output.

The South African developer also constructed self-powering lights for various places around his house (document: www.free-energy-info.com/SChapter33.pdf) and has found them to be perfectly adequate for lighting when the local mains supply has failed again. His particular choice of construction for these lamps is like this:



However, newcomers to the field of free-energy devices, often get confused by the options along with the fact that many people think it funny to show videos of fake free-energy devices. Some, of course, are genuine, for example, Chas Campbell of Australia who built a self-powered flywheel system which both powers itself and other equipment:



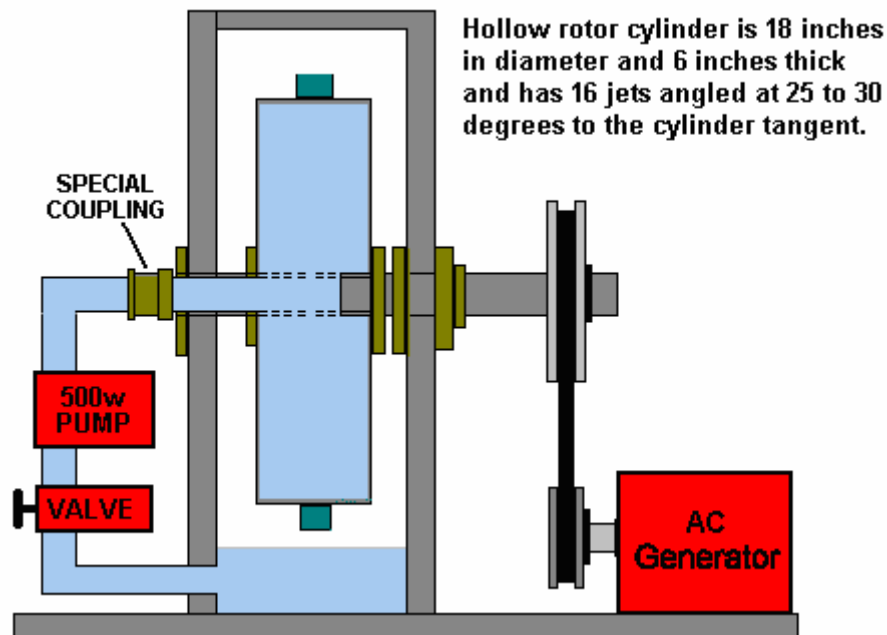


The way that it works is that it is started up by powering the motor with the local mains supply or alternatively using a battery and inverter. Once the motor gets up to speed, Chas switches it over so that the output from the generator then feeds the drive motor and the additional power tools which Chas uses.

It is possible to find companies which offer to sell you a free-energy generator, for example, the Infinity SAV company of South Korea (<https://infinitysav.com/magneticgenerator/>) appears to be perfectly genuine, but then, that is only an impression as I have never had any kind of communication with them. Their main generator is shown as being like this:

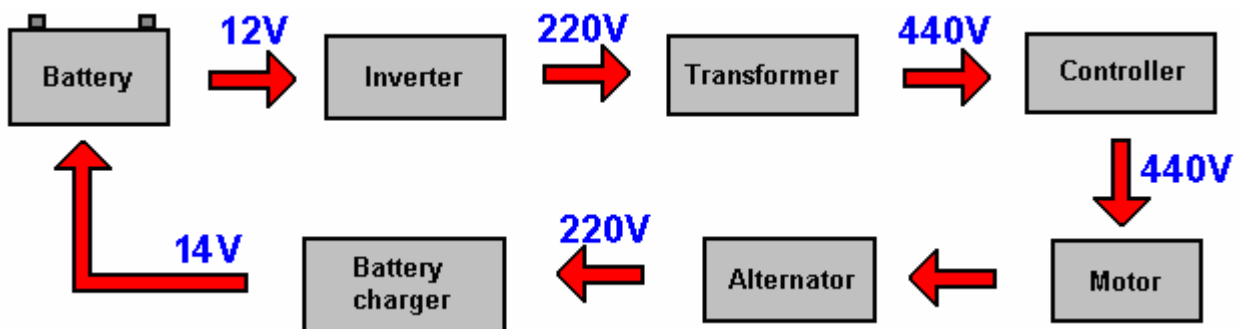


There is also a continuous push to find or develop new high-powered free-energy generator designs. At the present time there are several people working on a hydraulic design from Donnie Watts. So far, there are no reports of success, but then most of the builders are delayed by lack of finance or similar problems:



A common problem is the fact that many people don't understand that when the designer states that a 3-inch (75 mm) diameter pipe is needed, he actually means that. Instead, they think that a 1-inch (25 mm) diameter pipe will do, and it just won't do. It takes **ten** 1-inch pipes to match the capacity of one 3-inch diameter pipe.

Another design of recent interest involves changing the electronic drive to a 3-phase electric motor in order to get more than the usual amount of power from the motor and then using that power to drive a standard electrical generator. While there is no guarantee that the system will work, a team of talented developers are busily investigating the design. The overall principle is to run the 12-volt 3-phase motor on 400 volts with an arrangements which is something like this:



There are various other designs which offer what appeals most to newcomers, namely motionless operation and massively powerful output as well as small physical size. Designs such as those from Don Smith seem irresistible:



These designs do indeed work but it takes an exceptionally skilled electronics expert to ever get one going, so please don't imagine that you can just assemble the stated (very expensive) components in the arrangement described and expect it to burst into life – that is not going to happen as a lot of very expert electronic tuning is needed using unusually specialised equipment.

So, to summarise the actual situation, you can indeed have an energy system of your own, but if it is powerful enough to power all of your household equipment, then it is likely to cost a significant amount of money to construct even if that construction is done by yourself. Perhaps it would be better to call it “low-cost electricity” rather than “free-energy”. If you decide to go ahead and build some project, then let me wish you every success with your project.

Patrick Kelly

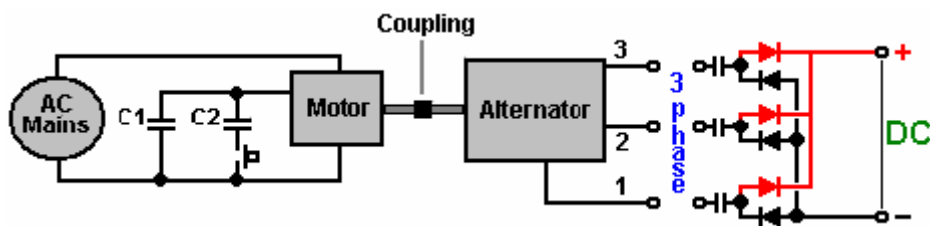
www.free-energy-info.com

www.free-energy-info.tuks.nl

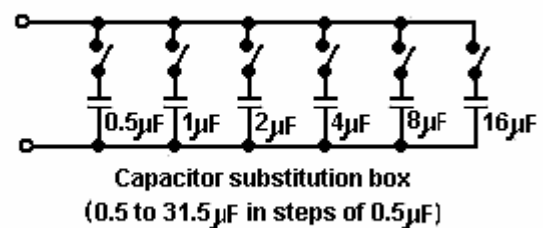
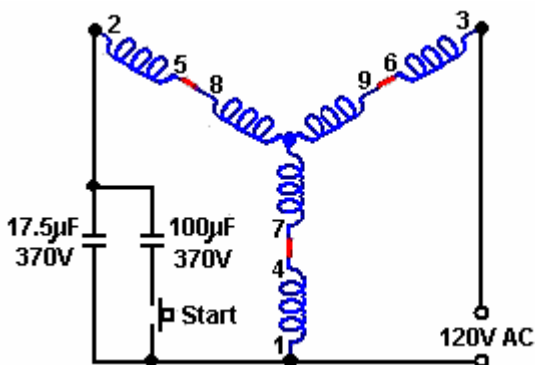
Chapter 37 - The Rotoverter

The Rotoverter is a high-efficiency motor drive system which uses a standard three-phase electric motor. A three-phase motor has got three windings, each of which is powered up sequentially to provide rotation of the output drive shaft. This circuit has been presented as a Public Domain non-copyrightable circuit by Hector Perez Torres.

The Rotoverter has been reproduced by several independent researchers and it produces a substantial power gain when driving devices which need an electrical motor to operate. Typically, the input power requirement is cut to just 10% of the original power needed. For example, it is possible to power a Rotoverter with a solar panel and use it to pump water from a well. However, the greatest interest is in generating an electrical output. One method is shown here:



The output device is an alternator which is driven by a three-phase mains-powered, 3 HP to 7.5 HP motor (both of these devices can be standard 'asynchronous squirrel-cage' motors). The drive motor is operated in a highly non-standard manner. It is a 240V motor with six windings as shown below. These windings are connected in series to make an arrangement which should require 480 volts to drive it, but instead, it is fed with 120 volts of single-phase AC. The input voltage for the motor, should always be a quarter of its rated operational voltage. A virtual third phase is created by using a capacitor which creates a 90-degree phase-shift between the applied voltage and the current. The arrangement needs a different value capacitor when starting compared to when the motor is running normally. The best capacitor size for any particular drive motor has to be determined by experiment.



A capacitor switching box can be very helpful. The capacitors shown above, can produce any value from 0.5 microfarad to 31.5 microfarad, and can be rapidly switched to find the correct resonant value. These values allow combined values of 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5,by selecting the appropriate switches to be ON or OFF. Should you need a value greater than this, then wire a 32 microfarad capacitor in place and connect the substitution box across it to test higher values step by step to find the optimum value of capacitor to use. The capacitors need to be powerful, oil-filled units with a high voltage rating - in other words, large, heavy and expensive.

The power being handled in one of these systems is large and setting one up is not without a certain degree of physical danger. These systems have been set to be self-powered but this is not recommended, presumably because of the possibility of runaway with the output power building up

rapidly and boosting the input power until the motor burns out.

The Yahoo EVGRAY Group at <http://groups.yahoo.com/group/EVGRAY> has many members many of whom are very willing to offer advice and assistance. A unique jargon has built up on this forum, where the motor is not called a motor but is referred to as a “Prime Mover” or “PM” for short, which can cause confusion as “PM” usually stands for “Permanent Magnet”. RotoVerter is abbreviated to “RV” while “DCPMRV” stands for “Direct Current Permanent Magnet RotoVerter” and “trafo” is a non-standard abbreviation for “transformer”. Some of the postings in this Group may be difficult to understand due to their highly technical nature and the extensive use of abbreviations, but help is always available there.

To move to some more practical construction details for this system. The motor (and alternator) considered to be the best for this application is the “Baldor EM3770T” 7.5 horsepower unit. The specification number is 07H002X790, and it is a 230/460 volts 60Hz 3-phase, 19/9.5 amp, 1770 rpm, power factor 0.81, device.

The Baldor web site is www.baldor.com and the following details should be considered carefully before trying any adaption of an expensive motor. The following constructional photographs are presented here by kind permission of Ashweth of the EVGRAY Group.

The end plate of the drive motor needs to be removed and the rotor lifted out. Considerable care is needed when doing this as the rotor is heavy and it must **not** be dragged across the stator windings as doing that would damage them.



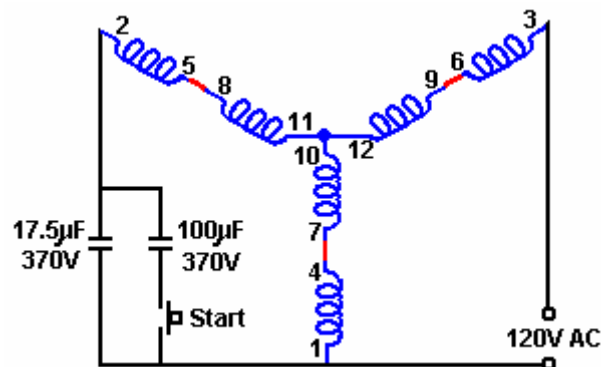
The second end-plate is then removed and placed on the opposite end of the stator housing:



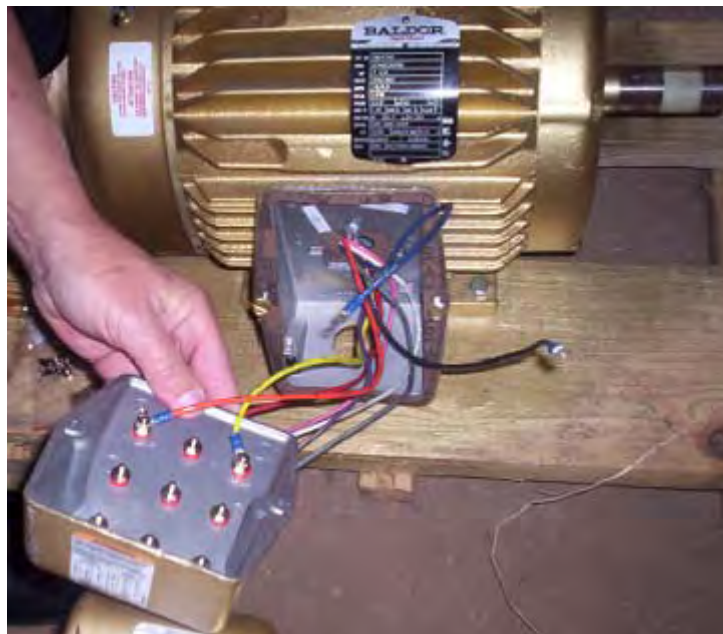
The fan is removed as it is not needed and just causes unnecessary drag, and the rotor is inserted the opposite way round to the way it was removed. That is, the housing is now the other way round relative to the rotor, since the rotor has been turned through 180 degrees before being replaced. The same part of the shaft of the rotor passes through the same end plate as before as the end plates have also been swapped over. The end plates are bolted in position and the rotor shaft spun to confirm that it still rotates as freely as before.

To reduce friction to an absolute minimum, the motor bearings need to be cleaned to an exceptional level. There are various ways of doing this. One of the best is to use a carburettor cleaner spray from your local car accessories shop. Spray inside the bearings to wash out all of the packed grease. The spray evaporates if left for a few minutes. Repeat this until the shaft spins perfectly, then put one (and only one) drop of light oil on each bearing and do not use WD40 as it leaves a residue film. The result should be a shaft which spins absolutely perfectly.

The next step is to connect the windings of the two units. The motor (the "Prime Mover") is wired for 480 volt operation. This is done by connecting winding terminals 4 to 7, 5 to 8 and 6 to 9 as shown below. The diagram shows 120 volts AC as being the power supply. This is because the RotoVerter design makes the motor operate at a much lower input than the motor designers intended. If this motor were operated in the standard way, a 480 volt 3-phase supply would be connected to terminals 1, 2 and 3 and there would be no capacitors in the circuit.

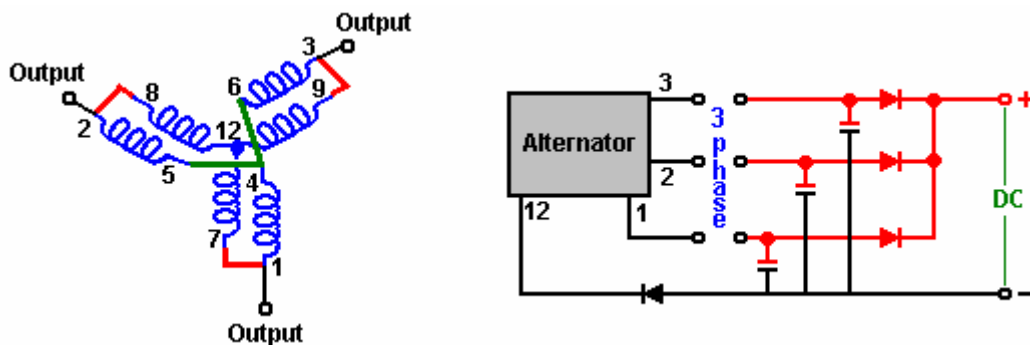


It is suggested that the jumpering of the motor windings is more neatly done by removing the junction box cover and drilling through it to carry the connections outside to external connectors, jumpered neatly to show clearly how the connections have been made for each unit, and to allow easy alterations should it be decided to change the jumpering for any reason.





The same is done for the unit which is to be used as the alternator. To increase the allowable current draw, the unit windings are connected to give the lower voltage with the windings connected in parallel as shown below with terminals 4,5 and 6 strapped together, 1 connected to 7, 2 connected to 8 and 3 connected to 9. This gives a three-phase output on terminals 1, 2 and 3. This can be used as a 3-phase AC output or as three single-phase AC outputs, or as a DC output by wiring it as shown here:



The motor and the alternator are then mounted securely in exact alignment and coupled together. The switching of the direction of the housing on the drive motor allows all of the jumpering to be on the same side of the two units when they are coupled together, facing each other:

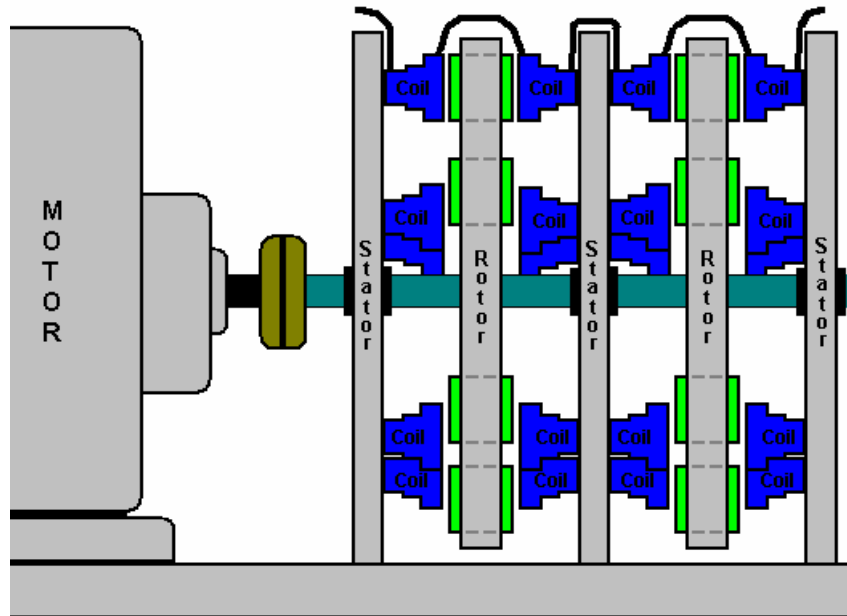


The input drive may be from an inverter driven from a battery charged via a solar panel. The system now needs to be 'tuned' and tested. This involves finding the best 'starting' capacitor which will be switched into the circuit for a few seconds at start-up, and the best 'running' capacitor value.

To summarise: This device takes a low-power 110 Volt AC input and produces a much higher-power electrical output which can be used for powering much greater loads than the input could power. The output power is much higher than the input power. This is free-energy under whatever name you like to

apply to it. One advantage which should be stressed, is that very little in the way of construction is needed, and off-the-shelf motors are used. Also, no knowledge of electronics is needed, which makes this one of the easiest to construct free-energy devices available at the present time. One slight disadvantage is that the tuning of the “Prime Mover” motor depends on its loading and most loads have different levels of power requirement from time to time. A 220 Volt AC motor can also be used if that is the local supply voltage.

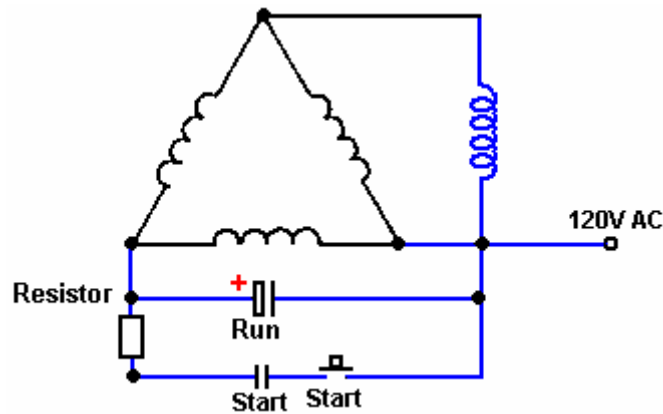
It is not essential to construct the RotoVerter exactly as shown above, although that is the most common form of construction. The Muller Motor can have a 35 kilowatt output when precision-constructed as Bill Muller did. One option therefore, is to use one Baldor motor jumpered as the “Prime Mover” drive motor and have it drive one or more Muller Motor style rotors to generate the output power:



T. J. Chorister in America has used a Rotoverter style circuit for some time now. He uses a 200V 3-phase electric motor driven by a single-phase 120V 60 Hz mains. He says: The hot wire goes direct to one phase, and it also goes through a ‘run’ capacitor to the second phase, also through an inductor to the 3rd phase. You have to experiment with the values of the capacitor and inductor in order to get the smoothest running of the motor. Often you will not even need a switched starting capacitor. Generally, a one-horsepower motor will output about three-quarters of a horsepower. However, the arrangement will be much more efficient than a single phase motor. The neutral is not needed, but be sure to use a ground connected to the frame of the motor.

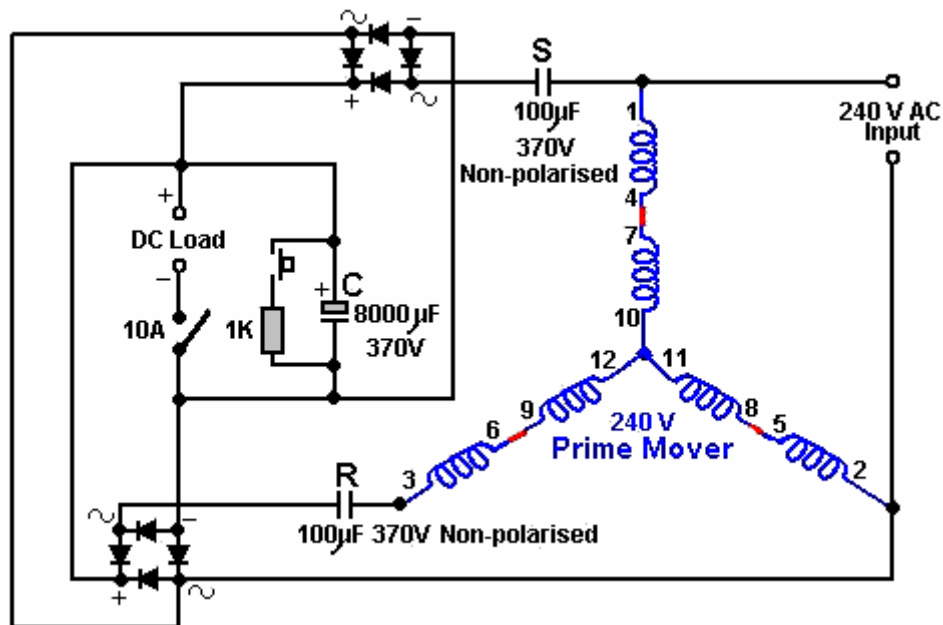
Run capacitors pass about 1-amp for each 22 microfarads of its capacity and so they act as current limiters when in series in an AC circuit. Inductors should have wire which is thick enough to carry the current needed by the motor. I have no guidelines for inductors, so just try it (if you can measure one leg of the motor winding, then that would be about right for the inductor). The inductor value is adjusted by trial and error until you find the value where the motor runs most smoothly.

If a starting capacitor is needed, then just parallel a starting capacitor and switch and connect a bleeder resistor to the run capacitor. The circuit is like this:



Phil Wood

has many years of experience working with all varieties of electric motor, has come up with a very clever circuit variation for the RotoVerter system. His design has a 240 volt Prime Mover motor driven with 240 volt AC. The revised circuit now has automated start-up and it provides an extra DC output which can be used to power additional equipment. His circuit is shown here:



Phil specifies the diode bridges as 20 amp 400 volt and the output capacitor as 4000 to 8000 microfarads 370 volt working. The ON/OFF switch on the DC output should be 10 amp 250 volt AC working. The circuit operates as follows:

The charge capacitor "C" needs to be fully discharged before the motor is started, so the press-button switch is pressed to connect the 1K resistor across the capacitor to discharge it fully. If you prefer, the press-button switch and resistor can be omitted and the switch to the DC load closed before the AC input is applied. The switch must then be opened and the AC connected. The starting capacitor "S" and capacitor "R" both operate at full potential until capacitor "C" begins to charge. As capacitor "C" goes through its charging phase, the resistance to capacitors "R" and "S" increases and their potential capacitance becomes less, automatically following the capacitance curve required for proper AC motor operation at start-up.

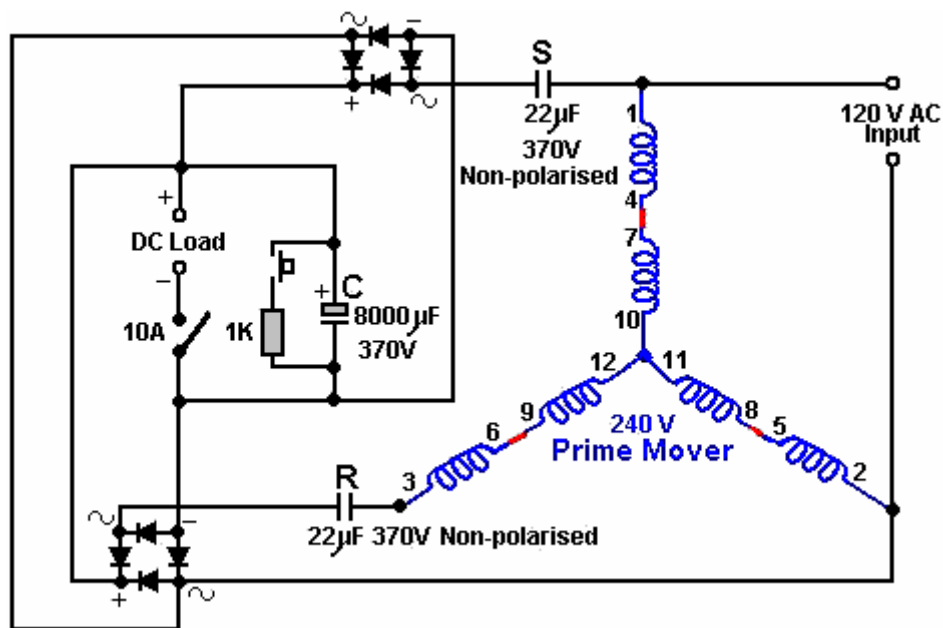
After a few seconds of run time, the output switch is operated, connecting the DC load. By varying the resistance of the DC load, the correct tuning point can be found. At that point, the DC load resistance keeps both of the capacitors "R" and "S" operating at a potentially low capacitance value.

The operation of this circuit is unique, with all of the energy which is normally wasted when the AC motor is starting, being collected in the output capacitor "C". The other bonus is where a DC load is

powered for free while it keeps capacitors “R” and “S” in their optimum operating state. The DC load resistance needs to be adjusted to find the value which allows automatic operation of the circuit. When that value has been found and made a permanent part of the installation, then the switch can be left on when the motor is started (which means that it can be omitted). If the switch is left on through the starting phase, capacitor “C” can be a lower value if the DC load resistance is high enough to allow the capacitor to go through its phase shift.

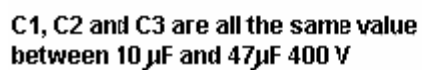
The capacitor values shown above were those found to work well with Phil’s test motor which was a three-winding, 5 horsepower, 240 volt unit. Under test, driving a fan, the motor draws a maximum of 117 watts and a variable speed 600 watt drill was used for the DC load. The motor operates at its full potential with this circuit.

The circuit will need different capacitors for operation with a 120 Volt AC supply. The actual values are best determined by testing with the motor which is to be used, but the following diagram is a realistic starting point:

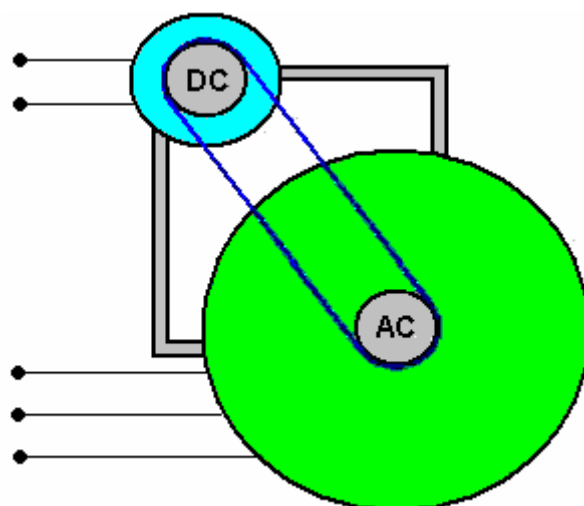


The 120 V AC motor runs very smoothly and quietly drawing only 20 watts of input power.

Advancing the design even further, Phil has now produced an extremely clever design by introducing an additional DC motor/generator coupled to the “Prime Mover” motor. The coupling is nominally mechanical with the two motors physically linked together with a belt and pulleys, but the electrical linking is such that the two motors will synchronise automatically if the mechanical linkage is omitted. I should like to express my thanks to him for sharing this information, diagrams and photographs freely.



This circuit is very clever as the DC motor/generator automatically adjusts the running of the AC motor both at startup and under varying loading. Also, the selection of the capacitors is not so critical and no manual intervention is needed at startup. In addition, the DC motor/generator can be used as an additional source of electricity.



As the loading on the drive motor is quite low due to the very, very high efficiency of the RotoVerter arrangement, it is perfectly feasible to drive the whole system with a low-power inverter run from a battery. If that is done, then it is possible to use two batteries. One is charged by the DC generator while the other is driving the inverter. A timer circuit then switches the batteries over on a regular basis using relay switching.

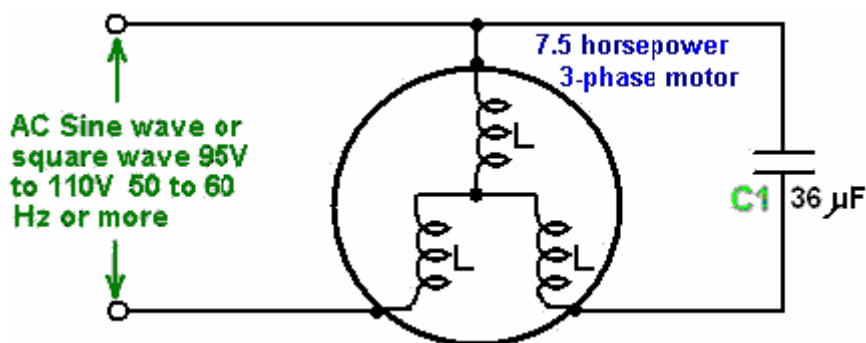
Extra Energy Collection

A very effective additional circuit has been developed by **David Kousoulides**. This circuit allows extra current to be drawn off a RotoVerter while it is running, without increasing the input power needed to drive the RotoVerter. David's circuit can be used with a wide range of systems, but here it is being shown as an addition to the RotoVerter system, raising it's efficiency even higher than before.

As is common with many effective circuits, it is basically very simple looking, and it's apparent operation is easily explained. The objective is to draw additional current from the RotoVerter and use that current to charge one or more batteries, without loading the RotoVerter at all. The current take off is in the form of a rapid series of current pulses which can be heard as a series of faint clicks when fed into the battery.

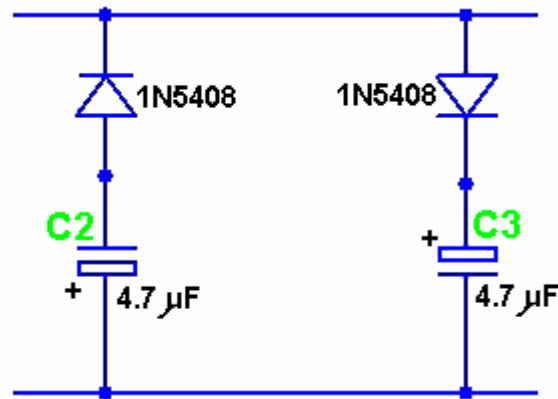
Let us examine the circuit section by section:

First, we start with a standard "off the shelf" 3-phase motor. In this example, the motor is a 7.5 horsepower motor, which when wired in RotoVerter mode, using just a single-phase supply as shown here, only draws a very low amount of power when running, especially if the single-phase supply is about 25% of the voltage rating of the motor:



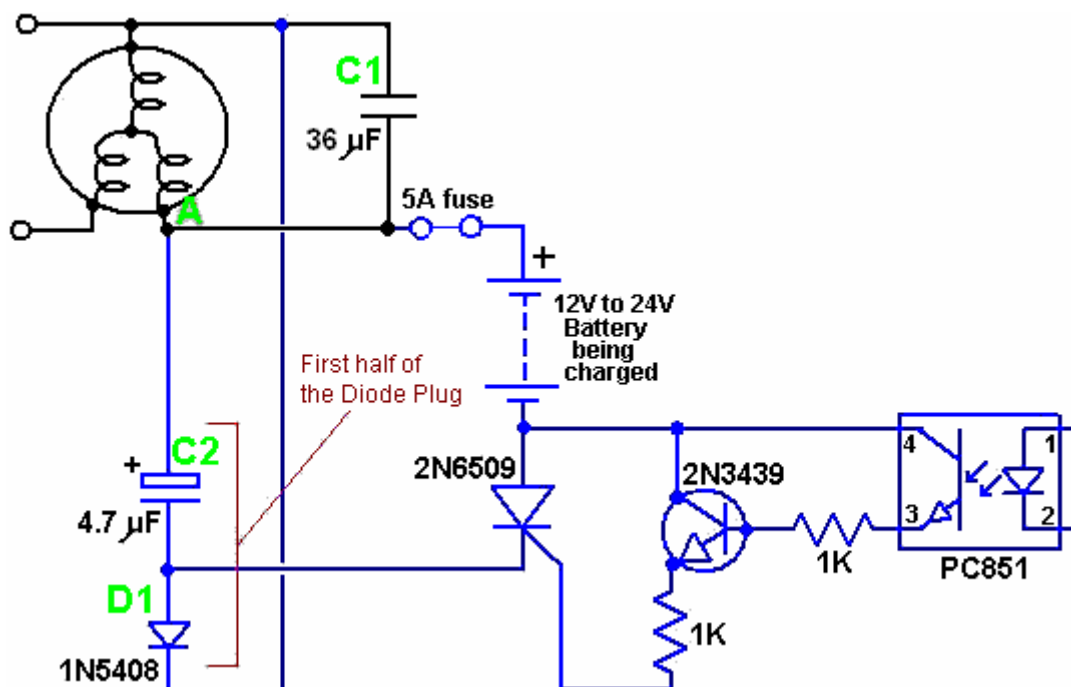
Because the running power draw is so low, it is possible to run this motor from a standard battery-powered inverter, but the current draw at start-up is some 17 amps, so the mains is used to get the motor started and then the motor is switched from the mains to the inverter. The inverter also allows easy measurement of the power input and so makes for easier calculation of the overall power efficiency of the system.

There is a power extraction device called a "diode-plug", which in spite of it's seeming simplicity, is actually much more subtle in it's operation than would appear from a quick glance at the circuit:



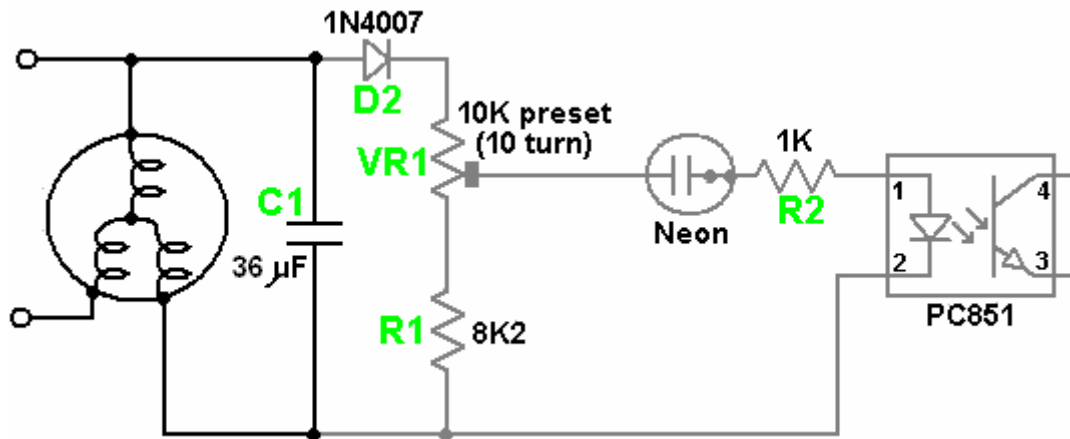
This circuit has been presented as a public-domain non-copyrightable circuit by Hector Perez Torres and it is capable of extracting power from a range of different systems, without affecting those systems or increasing their power draw. In the circuit presented below, just the first half of the diode plug is utilised, though it should perhaps be stressed that it would be perfectly feasible to raise the efficiency of the circuit even further by adding extra components to duplicate the power feed from the battery, drawing on both parts of the diode-plug circuit. For clarity, this is not shown here, but it should be understood that it is a possible, and indeed desirable, extension to the circuitry described here.

When the motor is running, high voltages are developed across the windings of the motor. As only the first half of the diode-plug is being shown here, we will be capturing and using the negative-going voltages. These negative-going pulses are picked up, stored in a capacitor and used to charge a battery using the following circuit:



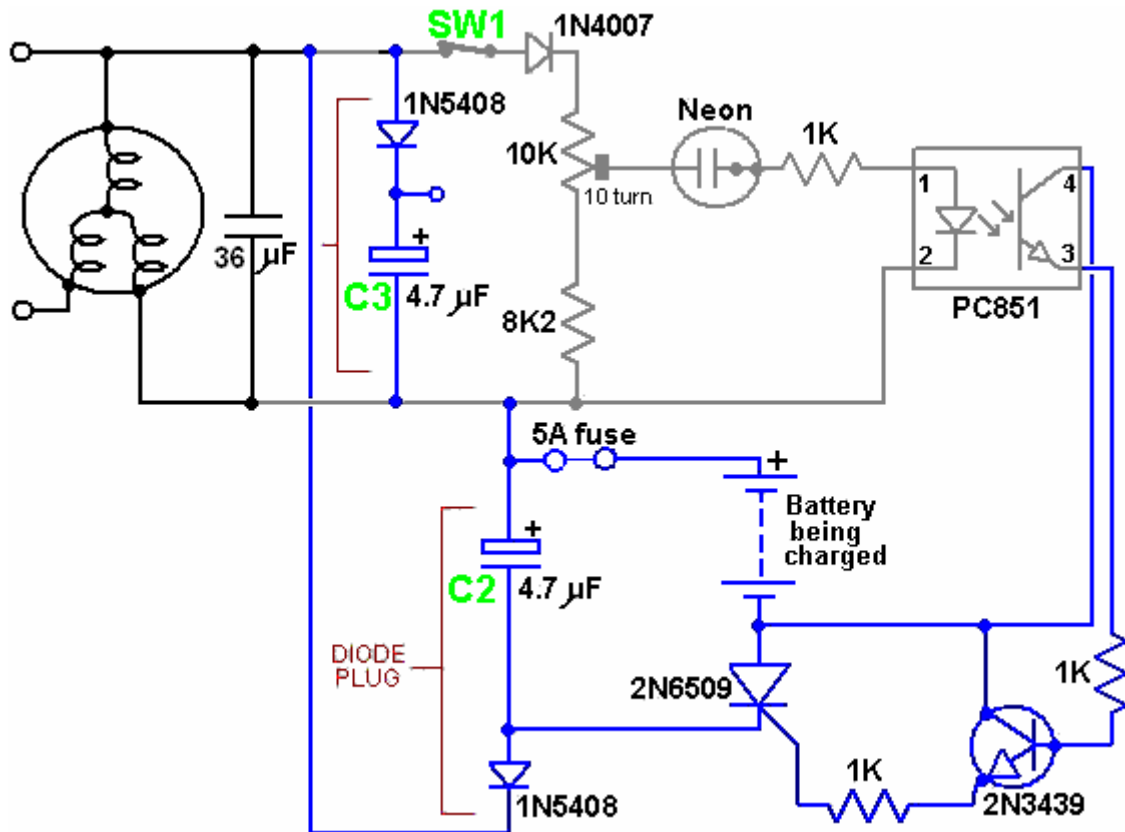
Here we have the same RotoVerter circuit as before, with high voltage being developed across capacitor C1. The battery-charging section is a free-floating circuit connected to point A of the motor. The high-voltage diode D1 is used to feed negative-going pulses to capacitor C2 which causes a large charge to build up in that capacitor. At the appropriate moment, the PC851 opto-isolator is triggered. This feeds a current into the base of the 2N3439 transistor, switching it on and firing the 2N6509 thyristor. This effectively switches capacitor C2 across the battery, which discharges the capacitor into the battery. This feeds a substantial charging power pulse into the battery. As the capacitor voltage drops, the thyristor is starved of current and it turns off automatically. The charging sequence for the capacitor starts again with the next pulse from the windings of the motor.

The only other thing to be arranged is the triggering of the opto-isolator. This should be done at the peak of a positive voltage on the motor windings and has been built like this:



Here, we have the RotoVerter motor as before, with the voltage developed on C1 being used to trigger the opto isolator at the appropriate moment. The voltage on C1 is sensed by the diode D2, the pre-set resistor VR1 and the resistor R1. These place a load of some 18.2K ohms on capacitor C1 as the neon has a very high resistance when not conducting. The ten-turn preset resistor is adjusted to make the neon fire at the peak of the voltage wave coming from the motor. Although the adjustment screw of most preset resistors is fully isolated from the resistor, it is recommended that adjustment of the screw be done using an insulated main-tester type of screwdriver, or a solid plastic trimmer-core adjustment tool.

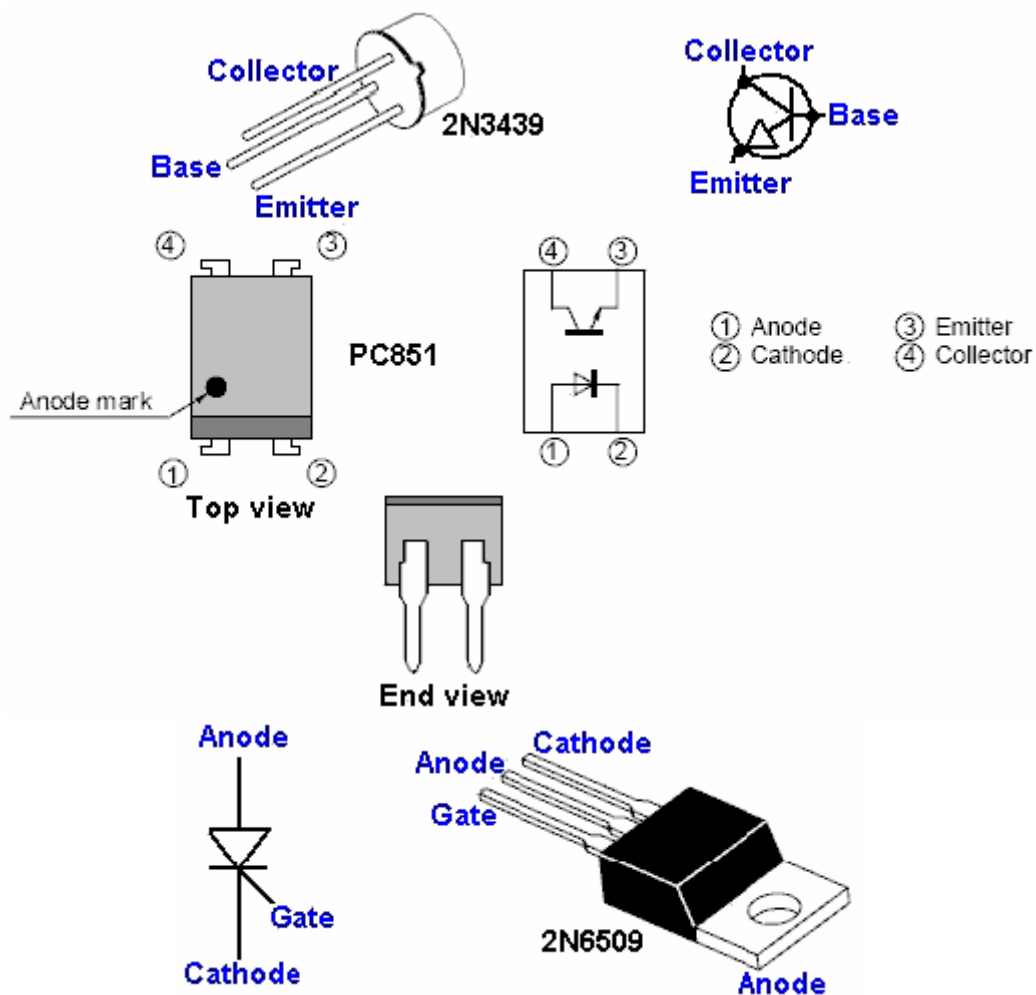
The circuit to test one half of the diode plug is then:



The switch SW1 is included so that the charging section can be switched off at any time and this switch

should not be closed until the motor gets up to speed. All wire connections should be made before power is applied to the circuit. Capacitor C1 which is shown as 36 microfarads, has a value which is optimised for the particular motor being used and will normally be in the range 17 to 24 microfarads for a well-prepared motor. The motor used for this development was retrieved from a scrap yard and was not prepared in any way.

The value of capacitor C2 can be increased by experimenting to find at what value the resonance gets killed and the charging section starts drawing extra current from the supply. It should be noted that many new thyristors (Silicon Controlled Rectifiers or "SCR"s) are faulty when supplied (sometimes as many as half of those supplied can be faulty). It is therefore important to test the thyristor to be used in this circuit before installing it. The circuit shown below can be used for the testing, but it should be stressed that even if the component passes the test, that does not guarantee that it will work reliably in the circuit. For example, while 2N6509 thyristors are generally satisfactory, it has been found that C126D types are not. A thyristor passing the test may still operate unpredictably with false triggers.



Please note that the 2N6509 package has the Anode connected inside the housing to the metal mounting tab.

Components List:

Component	Quantity	Description
1K ohm resistor 0.25 watt	3	Bands: Brown, Black, Red
8.2K ohm resistor 0.25 watt	1	Bands: Gray, Red, Red
10K ohm preset resistor	1	Ten turn version
4.7 mF 440V (or higher) capacitor	1	Polypropylene
36 mF 440V (or higher) capacitor	1	Non-polarised polypropylene
1N5408 diode	1	
1N4007 diode	1	
2N3439 NPN transistor	1	
2N6509 thyristor	1	Several may be needed to get a good one
PC851 opto-isolator	1	
Neon, 6 mm wire-ended, 0.5 mA	1	Radiospares 586-015
5A fuse and fuseholder	1	Any convenient type
30A switch 1-pole 1-throw	1	Toggle type, 120-volt rated
Veroboard or similar	1	Your preferred construction board
4-pin DIL IC socket	1	Black plastic opto-isolator holder (optional)
Wire terminals	4	Ideally two red and two black
Plastic box	1	Injection moulded with screw-down lid
Mounting nuts, bolts and pillars	8	Hardware for 8 insulated pillar mounts
Rubber or plastic feet	4	Any small adhesive feet
Sundry connecting wire	4 m	Various sizes

When using and testing this circuit, it is important that all wires are connected securely in place before the motor is started. This is because high voltages are generated and creating sparks when making connections does not do any of the components any particular good. If the circuit is to be turned off while the motor is still running, then switch SW1 is there for just that purpose.

The operating technique is as follows:

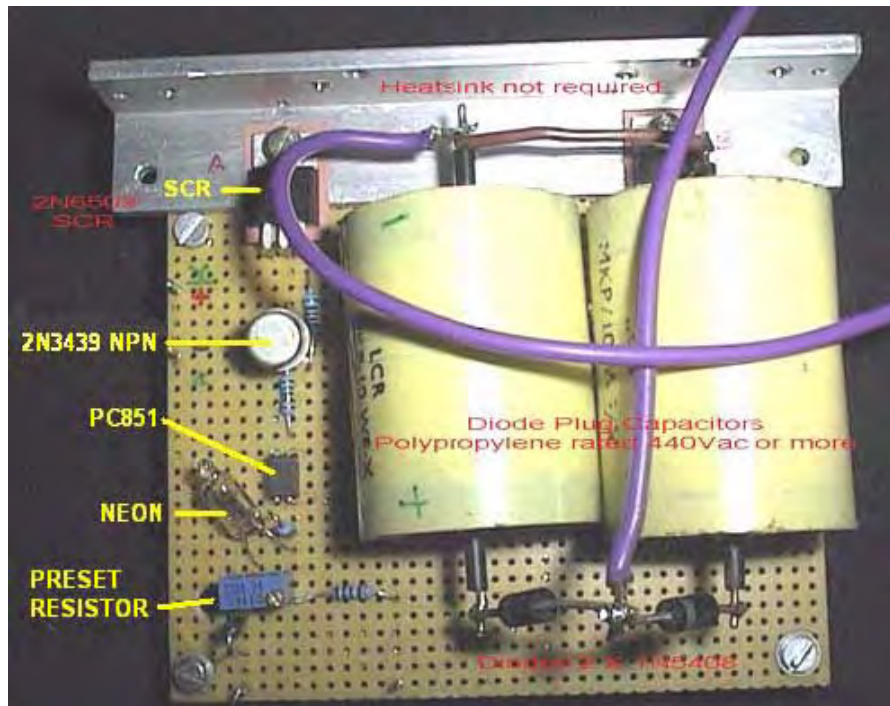
Before starting the motor, adjust the slider of the preset resistor VR1 to the fixed resistor end of its track. This ensures that the charging circuit will not operate as the neon will not fire. Power up the circuit and start adjusting the preset resistor very slowly until the neon starts to flash occasionally. There should be no increased load on the motor and so no extra current drawn from the input supply.

If there is an increase in the load, you will be able to tell by the speed of the motor and the sound it makes. If there is an increase in the load, then back off VR1 and check the circuit construction. If there is no increased load, then continue turning VR1 slowly until a position is reached where the neon remains lit all the time. You should see the voltage across the battery being charged increase without any loading effects on the motor.

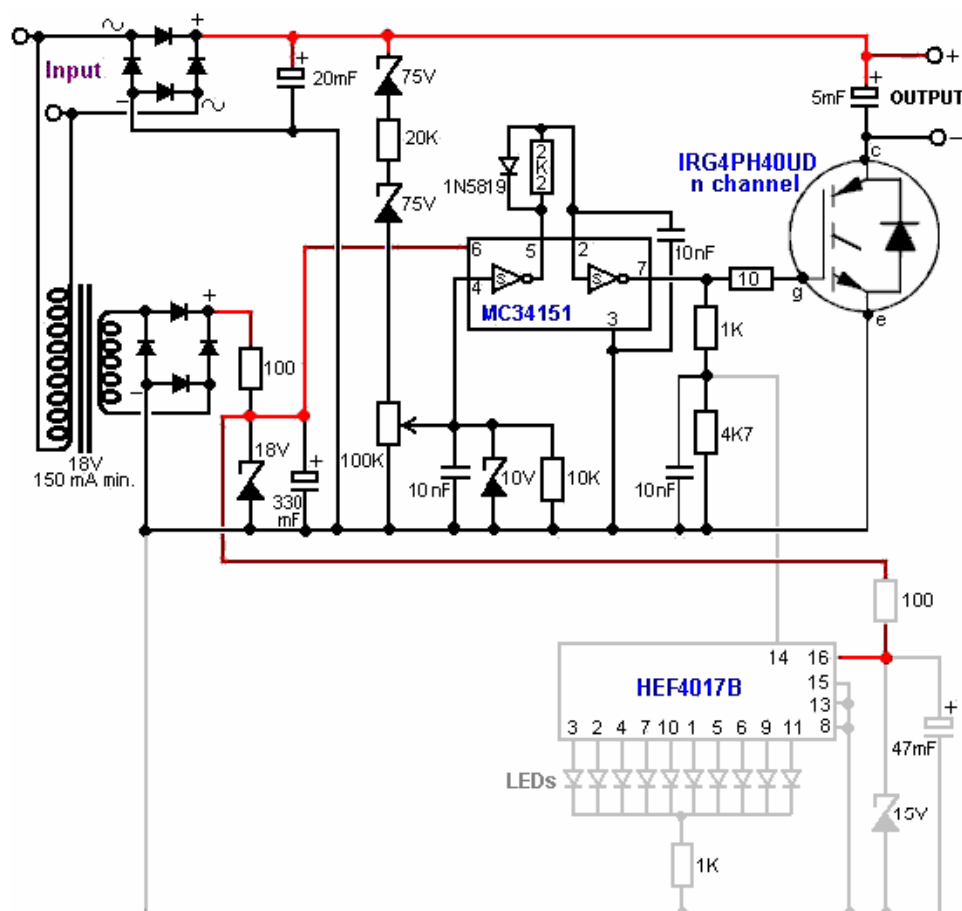
If you use an oscilloscope on this circuit, please remember that there is no “ground” reference voltage and that the circuit is not isolated.

Here is a picture of David's actual board construction. There are various ways for building any circuit. This particular construction method uses plain matrix board to hold the components in position and the bulk of the interconnections are made underneath the board. The charge-collecting capacitor is made here from two separate polypropylene 440 volt capacitors wired in parallel. David has opted to use a separate diode on each capacitor as this has the effect of doubling the current-carrying capacity of a single diode and is a popular technique in pulse charge circuits where sometimes several diodes are wired in parallel.

David has included a heat sink, which he marks as being “not required” but you will notice that there is insulation between the SCR and the heat sink. Mica “washers” available from the suppliers of semiconductors are particularly good for this, as mica is a good insulator and it also conducts heat very well.



Phil Wood has developed a particularly effective method for extracting the excess resonant circulating energy of a RotoVerter Prime Mover. This is the circuit:



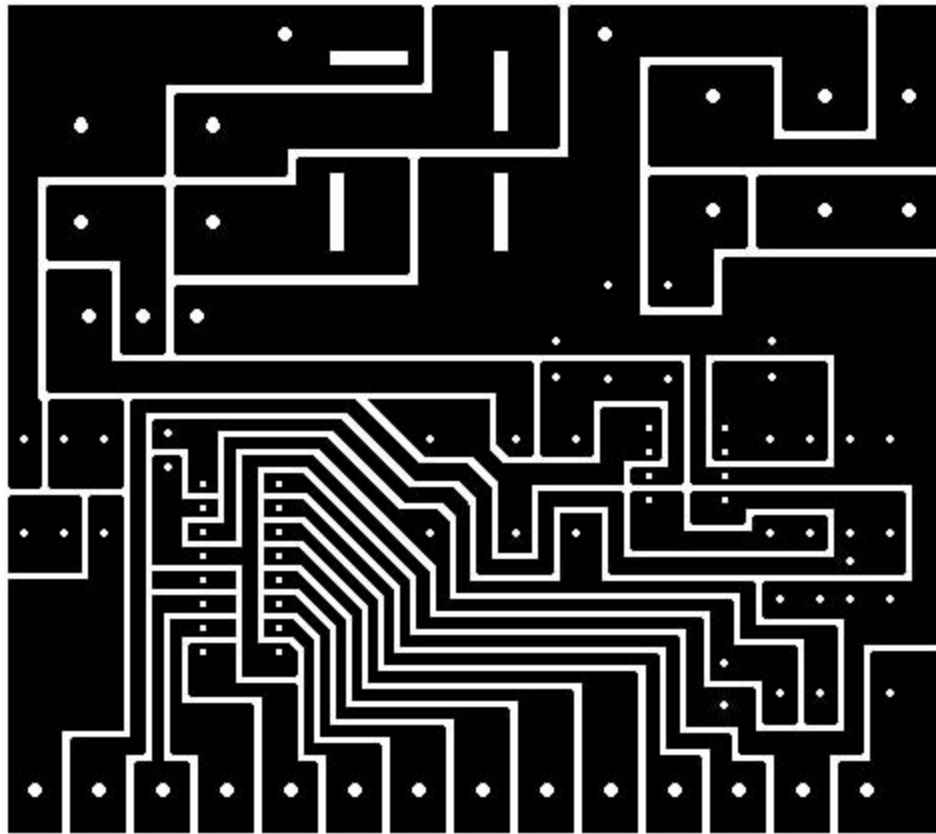
Care needs to be taken when constructing this circuit. For example, the circuit performance is displayed by an HEF4017B 5-stage Johnson counter, but for some lunatic reason, the 4017 designation is also used for a completely different chip of the same size and number of DIL pins, namely the “CMOS high-speed hex flip-flop with Reset”, an action definitely worthy of a stupidity award. Another point to watch out for is that the 1A 1N5819 diode is a very high-speed Schottky barrier component.

The circuit operation is as follows: the input from the Rotovertor motor is stepped-down by a transformer to give an 18-volt (nominal) AC output, which is then rectified by a standard rectifier bridge and the output smoothed by an 18-volt zener diode and a 330mF smoothing capacitor, and used to power the MC34151 chip. This DC power supply line is further dropped and stabilised by a 15-volt zener diode and a 47mF capacitor and used to power the LED display chip HEF4017B.

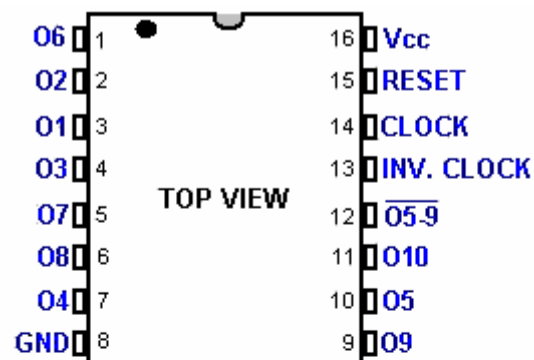
The raw RotoVerter input is also taken direct and rectified by a second 400-volt 35-amp rectifier diode bridge and smoothed by a 20mF capacitor with a high voltage rating. It must be understood that the RotoVerter system is liable to produce considerable power surges from time to time and so this circuit must be capable of handling and benefiting from these surges. This is why the IRG4PH40UD IGBT device was selected (apart from it's very reasonable price) as it robust and can handle high voltages.

The resulting high-voltage DC is taken by the chain of components two 75-volt zener diodes, 20K resistor and the 100K variable resistor. The voltage developed on the slider of this variable resistor is loaded with a 10K resistor and voltage-limited with a 10-volt zener diode, and decoupled with a 10nF capacitor before being passed to the MC34151 high-speed MOSFET dual driver chip. Both of these drivers are used to sharpen up the pulse and drive the IGBT cleanly. The result is an output which is a series of DC pulses. The operation of the circuit can be seen quite clearly, thanks to the HEF4017B display circuit which drives a row of LEDs, triggered by the IGBT gate signal, divided by the 1K / 4.7K voltage divider decoupled by the 10nF capacitor. This display shows clearly when the IGBT is switching correctly - actually, the display circuit is quite a useful device for people who do not own an oscilloscope, not just for this circuit, but a wide range of different circuits.

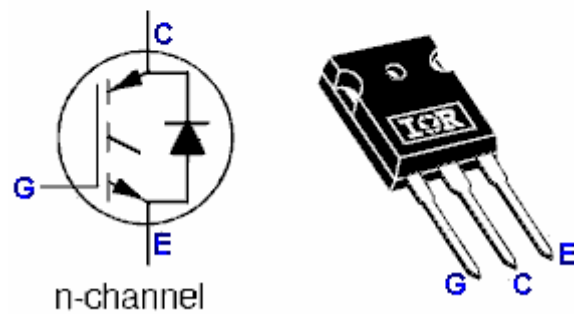
The physical board layout for Phil's circuit is shown here: As you will notice from the notes on Phil's board layout shown above, the first of the 75-volt zener diodes used on the direct RotoVerter power feed, should be replaced with a 30-volt zener if a 120-volt motor is used in this circuit.



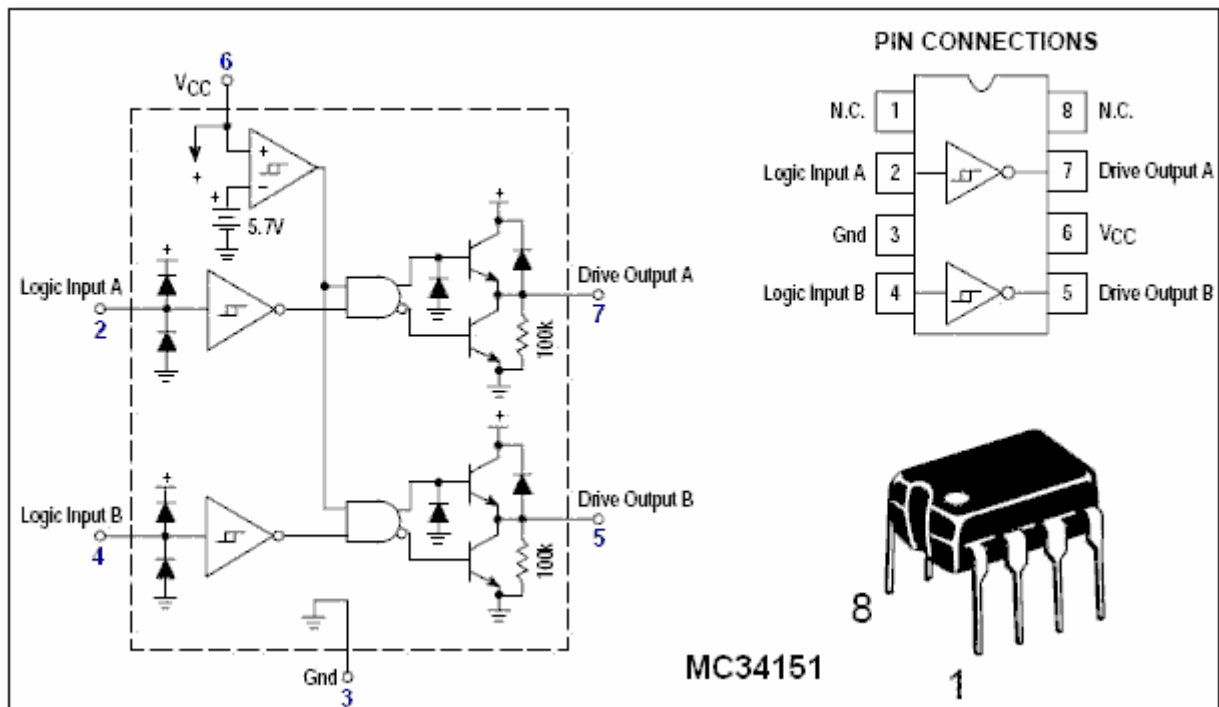
And component packaging is:



HEF4017B



IRG4PH40UD

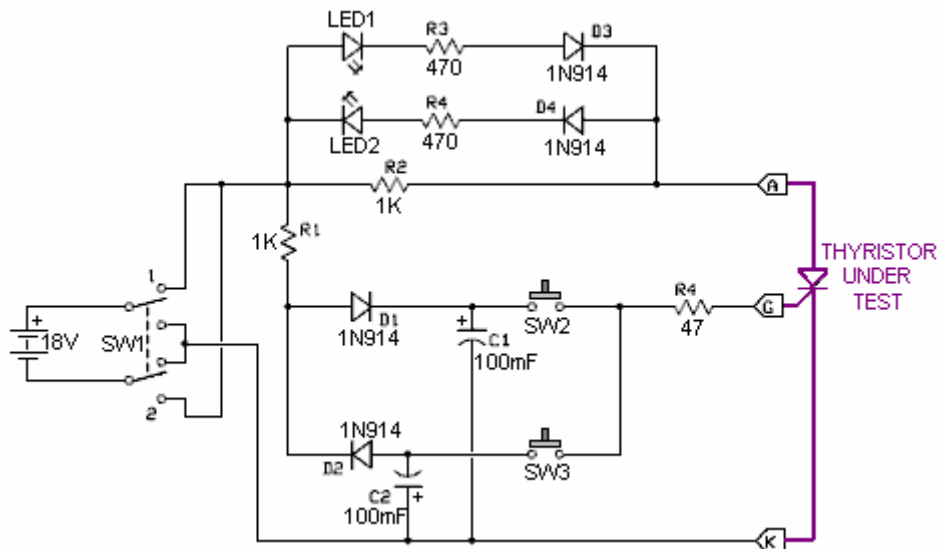


Phil's build of his circuit was implemented like this:



Thyristor testing:

The components needed to construct the thyristor testing circuit shown below can be bought as Kit number 1087 from www.QuasarElectronics.com



The circuit is operated by operating SW1 several times so as to get capacitors C1 and C2 fully charged. LED1 and LED2 should both be off. If either of them light, then the thyristor is faulty.

Next, with SW1 at it's position 1, press switch SW2 briefly. LED1 should light and stay on after SW2 is released. If either of these two things does not happen, then the thyristor is faulty.

With LED1 lit, press SW3 and LED1 should go out. If that does not happen, then the thyristor is faulty.

As mentioned before, even if the thyristor passes these tests it does not guarantee that it will work correctly in any circuit as it may operate intermittently and it may trigger spuriously when it shouldn't.

Component List:

Component	Quantity	Description
10 ohm resistor 0.25 watt	1	Bands: Brown, Black, Black
100 ohm resistor 0.25 watt	2	Bands: Brown, Black, Brown
1K ohm resistor 0.25 watt	2	Bands: Brown, Black, Red
2.2K ohm resistor 0.25 watt	1	Bands: Red, Red, Red
4.7K ohm resistor 0.25 watt	1	Bands: Purple, Yellow, Red
10K ohm resistor 0.25 watt	1	Bands: Brown, Black, Orange
22K ohm resistor 0.25 watt	1	Bands: Red, Red, Orange
10nF capacitor	3	
5mF 440V (or higher) capacitor	1	Polypropylene
20mF 440V (or higher) capacitor	1	Polypropylene
47mF 25V capacitor	1	
330 mF 25V capacitor	1	
1N5819 Schottky barrier diode	1	
10-volt zener diode	1	
15-volt zener diode	1	
18-volt zener diode	1	
75-volt zener diode	2	
400-volt, 40 A rectifier bridge	1	
35-volt 1 A rectifier bridge	1	
MC34151 IC	1	
HEF4017B IC	1	
IRG4PH40UD transistor	1	
LEDs	10	Any type or alternatively, an LED array
100K ohm variable resistor	1	
Plastic knob for variable resistor	1	
240:18 volt mains transformer	1	150 mA or higher rated
10A switch 1-pole 1-throw	1	Toggle type, 120-volt rated
Veroboard or similar	1	Your preferred construction board or pcb
Wire terminals	4	Ideally two red and two black
Plastic box	1	Injection moulded with screw-down lid
Mounting nuts, bolts and pillars	8	Hardware for 8 insulated pillar mounts
Rubber or plastic feet	4	Any small adhesive feet
Sundry connecting wire	4 m	Various sizes

Patrick J. Kelly

www.free-energy-info.com

www.free-energy-devices.com

www.free-energy-info.tuks.nl

Simple Free Energy Devices

There is nothing magic about free-energy and by “free-energy” I mean something which produces output energy without the need for using a fuel which you have to buy.

Chapter 38 – The Tiny Generator

I have already shown the very impressive 150 watt self-powered 110 mm diameter rotor generator designed, built and used daily by the South African developer who has so kindly shared his designs with us. He has continued to advance his designs and test many alternatives. His latest design has a very small rotor of only 48 mm in diameter and only one coil which both drives the rotor and extracts excess energy which charges up to seven 12-volt batteries as well as it's own drive battery. It is a very small and compact generator although the rate of charging is impressive:

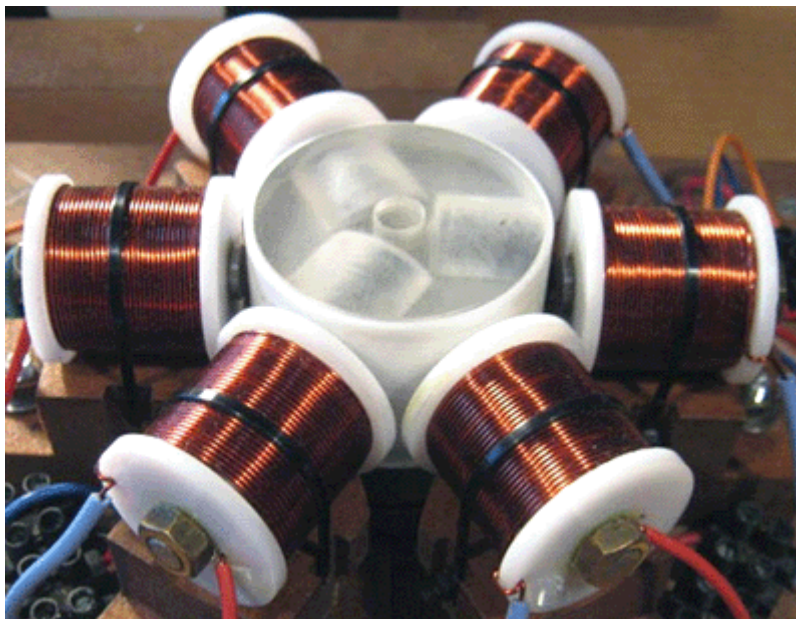


This generator has only one coil because with two coils the operation is so powerful that the rotor is liable to destroy itself. The rotor is made from a thick piece of acrylic plastic cut into a circular disc on a lathe and with three evenly spaced holes of 20 mm diameter drilled in it's side and a length of two-inch diameter plastic pipe around the outside to contain the magnets which are stacked inside the 20 mm holes.

The rotor is mounted on a bearing taken from an old disc drive:



This rotor has been used in earlier projects, initially with six coils:



And then later with two very small coils. However, this implementation uses just one coil and that is one taken from an old doorbell:

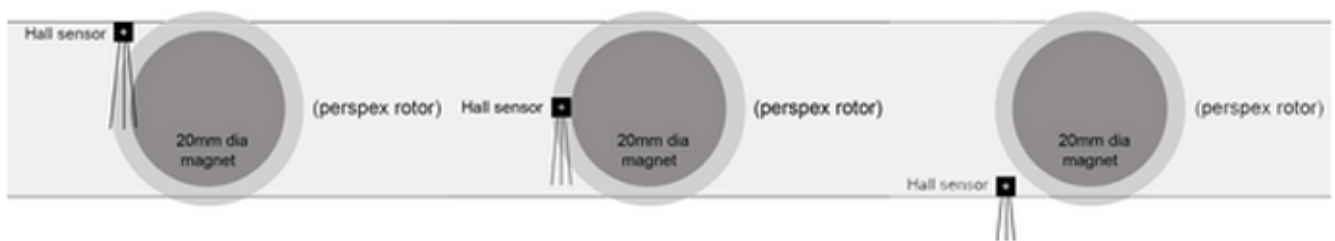
volts, cutting off the IRF840 FET transistor and so starving the coil of current, which in turn creates a magnetic pulse which drive the rotor on it's way.

When the FET switches off, it's drain pin "D" rises to a high voltage of around 600 volts. The three diodes connected in parallel pass that voltage spike across to the three 12-volt batteries causing them to charge very satisfactorily. However, as their charging current also passes through the 12-volt 7 Amp-Hour battery driving the circuit, that battery also gets charged (not as much as the top three batteries as the drive battery is also discharging into the circuit and that sort of an arrangement never charges as well as a battery which is not also discharging). This design is so effective that it produces 600-volt output spikes even if the rotor is just spun by hand.

The IRF840 FET is a 500 volt 32-amp pulse transistor.

The 2SC5353 transistor is a 700-volt, 5-amp pulse, with a low gain of 10, but it really does not need to be a power transistor and was used because it was to hand. Any high gain transistor with reasonable current handling ability should do, perhaps a TIP3055.

As with almost all free-energy devices, the setting up and adjustment makes a major difference. The rotor being so very small, it needs to be made very accurately – usually with a lathe or a 3D printer. The 20 mm diameter holes in the rotor each hold five ferrite magnets size 20 mm in diameter and 3 mm thick. Exactly where the Hall effect sensor is positioned is important, so it is mounted in a way which allows both horizontal and vertical adjustment. Obviously, the sensor must not touch the rotor and surprisingly, the gap between the sensor and the rotor can be anything up to 10 mm as that distance does not seem to make any great difference to performance. By contrast, the horizontal and vertical positioning does make a major difference and the developer describes it this way:

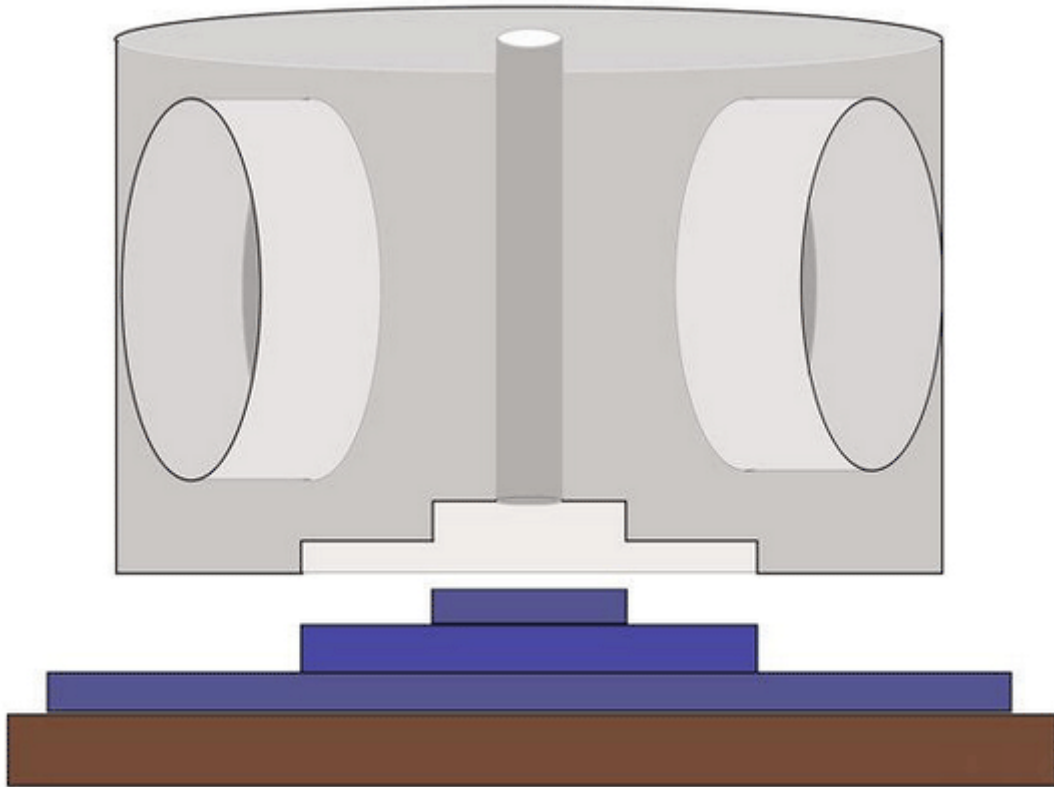


The magnetic effects of the rotor magnets are shown in this diagram. The dark grey region is the full magnet strength and the light grey area shows a reduced magnetic field effect.

The vertical position of the sensor determines both the current draw from the drive battery and the rotational speed of the rotor. At the top or bottom positions, the time of the passage of the magnet past the sensor is the shortest, and therefore the current draw from the drive battery is the least. In the centre position, the passage of the magnet past the sensor is obviously the longest, and this is a tempting position to use because it results in the most impressive raw power. It is not however the best position in most instances.

The light grey circle indicates the region of sensitivity to the magnet, which the sensor exhibits, usually about 5 mm. So the sensor can trigger 5 mm before the magnet arrives and still draws power for 5 mm after it passes by. This is important. Many folk seem to be very concerned about the *radial* position of the sensor and from a scientific point of view it is of course very worthy of close study. However, from a practical consideration, I would advise not to waste too much time on this point. Just use trial and error. Make sure that the Hall Sensor mount is adjustable horizontally as well as vertically, and move the sensor into the position which gives the best results.

The rotor is connected to it's base bearing using a push fit. For that arrangement to work well, the rotor construction has to be very accurate indeed. The arrangement is like this:

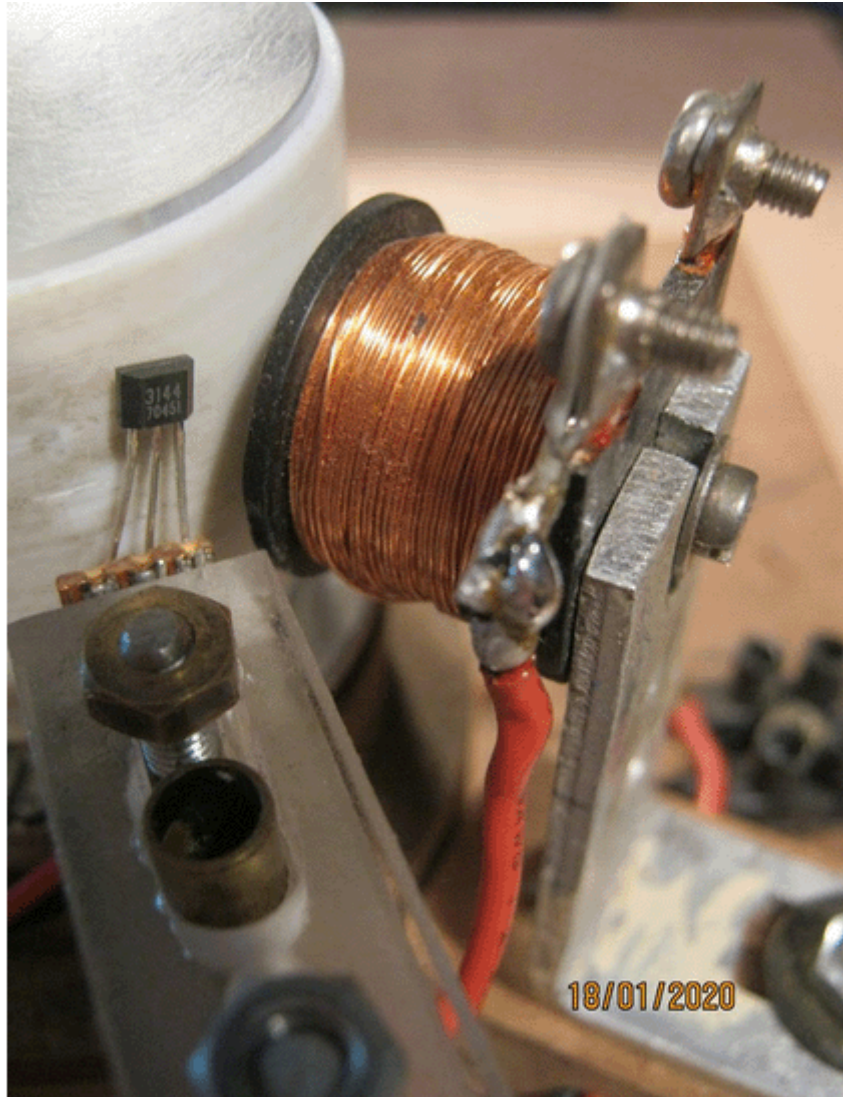


The overall unit is small:



The sensor is positioned about 1.5 mm away from the rotor and the coil is on a solid metal core, which,

since the core has to magnetise and demagnetise very quickly, will be made of iron or it's equivalent (not mild steel which becomes a permanent magnet):



The coil is wound with 0.3 mm diameter wire and the distance between the flanges is 15 mm and the width of the winding is 20 mm and the DC resistance is 10.6 ohms. Although this generator can easily charge seven batteries simultaneously, there is no need to use that many batteries if it does not suit you, you can charge a single 12-volt battery with this generator if you wish. Again, I should like to thank the South African developer for generously sharing his successful designs with us.

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Electronics Tutorial

Introduction

This document is not an in-depth presentation of the subject of electronics. Instead, it is intended to give you sufficient (empirical) knowledge of the subject to be able to understand, design and build simple circuits such as the control circuits used with the 'Free Energy' devices described in the later parts of this eBook.

Disclaimer

This material is provided for information purposes only. Should you decide to attempt construction of some device based on information presented here and injure yourself or any other person, I am not liable in any way. To clarify this; should you construct something in a heavy box and drop it on your toe, I am not liable for any injury you may sustain (you should learn to be more careful). If you attempt to construct some electronic circuit and burn yourself with the soldering iron, I am not liable. Also, I strongly recommend that unless you are expert in electronics, you do not construct any device using, or producing more than 30 Volts - high voltage circuits are extremely dangerous and should be avoided until you gain experience or can obtain the help and supervision of a person experienced in constructing high voltage circuits.

Voltage.

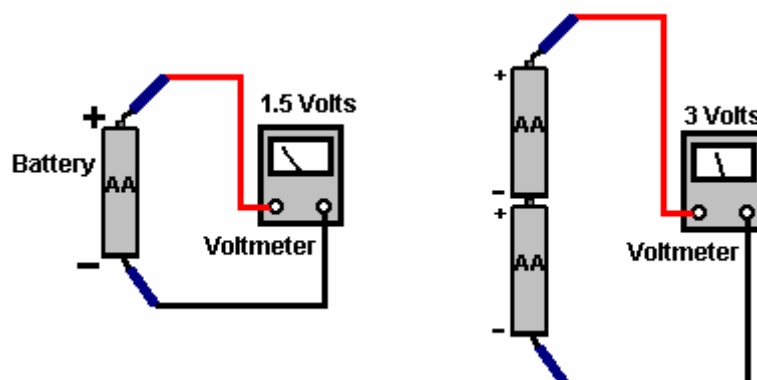
Voltage is the key to understanding electronics. Without voltage, nothing happens in electronics. What is it? Nobody knows. We know how to generate it. We know what it does. We know how to measure it, but nobody knows what it actually is.

It is also called "Electro Motive Force" or "EMF" which is no help whatsoever in knowing *what* it is. That, is roughly equivalent to saying "the thing that pushes is the thing that pushes" - very true but absolutely no help whatsoever. OK, having admitted that we really don't know *what* it is, we can start to say the things we do know about it:

A new battery has a voltage between its terminals. This voltage is said to cause a current to flow through any complete electrical circuit placed across it. The current flowing through the circuit can cause various things to happen such as creating light, creating sound, creating heat, creating magnetism, creating movement, creating sparks, etc., etc.

By using the current caused by a voltage, a device called a 'Voltmeter' can indicate how big the voltage is. The bigger the voltage, the bigger the current and the bigger the display on the voltmeter. The voltmeter can have a numerical display where you read the voltage directly from the display, or it can be an 'analogue' voltmeter where the voltage is shown by the position of a needle on a scale. The size of the voltage is stated in 'Volts' which is a unit of measurement named after the man Volta who introduced voltage to the world (it was always there, we just did not know about it).

Voltages add up if they are connected the same way round, i.e. with the + terminals all facing the same way:



The physical size of the battery usually determines the length of time it can supply any given current - the bigger the battery, the longer it can provide any given current. A battery is constructed from a number of 'cells'. The number of cells in the battery controls the voltage of the battery. For example, an 'AA' size battery (what used to be called a 'penlight' battery) has a single 'cell' and so produces 1.5 Volts when new. The very much larger and heavier 'D' battery also has just one cell and so it also produces 1.5 Volts when new. The difference (apart from the higher cost of the 'D' cell) is that the larger cell can provide a much higher current if both batteries are discharged over the same period of time.

There are several different types of battery construction. A rechargeable NiCad battery has a single cell but its construction method means that it produces about 1.35 Volts when fully charged. In passing, NiCad batteries have a 'memory' characteristic which means that if they are recharged before they are fully discharged, then the next time they are discharged they run out of power at the voltage level it had when the last charging was started. Consequently, it is a good idea to fully discharge a NiCad battery before charging it again.

Car and motorcycle batteries are described as Lead/Acid batteries. This type of construction is not very convenient being large, heavy and potentially corrosive. The big advantages are the ability to provide very high currents and giving 2.0 Volts per cell. These batteries are normally produced as 6 Volt or 12 Volt units. The Amp-Hours for lead/acid car batteries is usually quoted for a 20 hour discharge period, so a fully charged, new, 20 Ahr battery can provide 1 Amp for 20 hours of continuous use. That battery loaded to give 5 Amps, will **not** provide that current for 4 hours but might only last 2 hours, or perhaps a little better. The manufacturers literature should give an indication of the performance, but if it is important, run your own test to see how the battery actually works in practice.

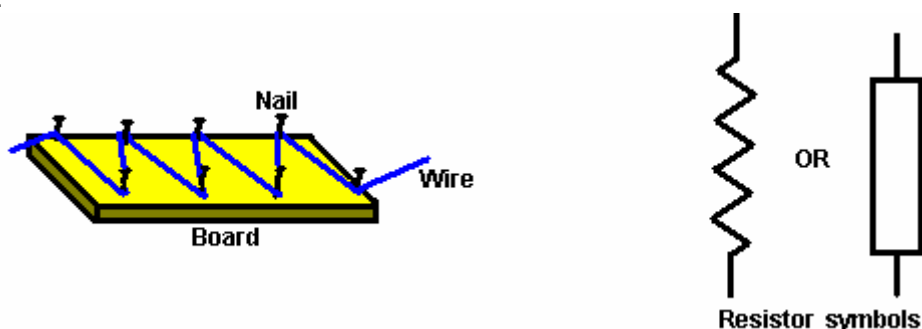
"Mains units" are known in the electronics world as "Power Supply Units" or "PSUs" for short. These convert the mains voltage (220 Volts in UK, 110 Volts in USA) to some convenient low voltage; 12 Volts, 9 Volts, 6 Volts, or whatever is needed. A mains unit can provide several different voltages simultaneously.

Resistance.

Being familiar with Voltage and Resistance is the key to understanding electronic circuitry. Resistance is a measure of how difficult it is for current to flow through something. Some materials such as glass, ceramics, wood and most plastics do not easily carry a current and so are considered to be 'insulators'. That is why you will see power lines hung from their pylons by a series of ceramic discs. Current flows easily through metals, especially along the surface of the metal, so cables are made from metal wires surrounded by a layer of plastic insulation. The higher grade cables have wire cores made up of many small-diameter strands as this increases the surface area of the metal for any given cross-sectional area of the metal core (it also makes the cable more flexible, and generally, more expensive).

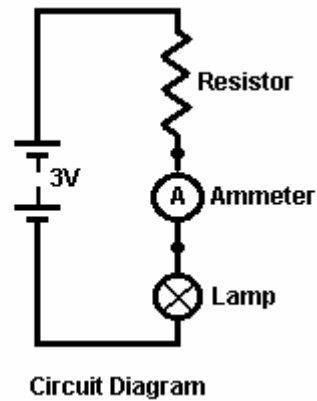
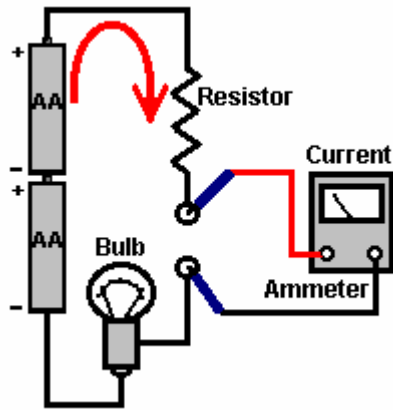
There is a very important, third group of materials, silicon and germanium in particular, which fall between conductors and insulators. Not surprisingly, these are called 'semi-conductors' and the amount of current they can carry depends on the electrical conditions in which they are placed. Much, much more about this later on.

While a metal wire carries current very well, it is not perfect at the job and so has some 'resistance' to current flowing through it. The thicker the wire, the lower the resistance. The shorter the wire, the lower the resistance. The first researchers used this characteristic to control the way circuits operated. Sometimes, as higher resistances were needed, the researcher used to need long lengths of wire which would get tangled up. To control the wire, a board with nails along each side was used and the wire wound backwards and forwards across the board like this:



When drawing a circuit diagram, the researcher would sketch the wire on the board giving a zig-zag line which is still used today to represent a 'resistor' although different methods of construction are now used. An alternative symbol for a resistor is a plain rectangle as shown above.

If a resistor is connected across a battery, a circuit is formed and a current flows around the circuit. The current cannot be seen but that does not mean that it is not there. Current is measured in 'Amps' and the instrument used to display it is an 'ammeter'. If we place an ammeter in the circuit, it will show the current flowing around the circuit. In passing, the ammeter itself, has a small resistance and so putting it in the circuit does reduce the current flow around the circuit very slightly. Also shown is a bulb. If the current flowing around the circuit is sufficiently high and the bulb chosen correctly, then the bulb will light up, showing that current is flowing, while the ammeter will indicate exactly how much current is flowing:



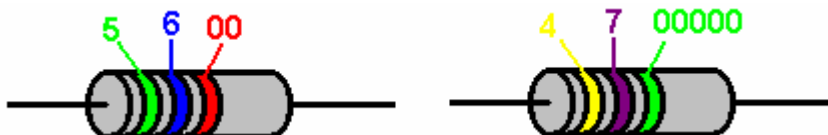
Shown on the right, is the way that this circuit would be shown by an electronics expert (the 'Resistor', 'Ammeter' and 'Lamp' labels would almost certainly not be shown). There are several different styles of drawing circuit diagrams, but they are the same in the basic essentials. One important common feature is that unless there is some very unusual and powerful reason not to do so, every standard style circuit diagram will have the positive voltage line horizontally at the top of the diagram and the negative as a horizontal line at the bottom. These are often referred to as the positive and negative 'rails'. Where possible, the circuit is drawn so that its operation takes place from left to right, i.e. the first action taken by the circuit is on the left and the last action is placed on the right.

Resistors are manufactured in several sizes and varieties. They come in 'fixed' and 'variable' versions. The most commonly used are the 'fixed' carbon 'E12' range. This is a range of values which has 12 resistor values which repeat: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and then: 100, 120, 150, 180, 220, 270, 330, 390, 470, 560, 680, 820 and then: 1000, 1200, 1500, 1800, 2200, 2700, 3300, 3900, 4700, 5600, 6800, 8200, etc. etc. Nowadays, circuits often carry very little power and so the resistors can, and are, made in very small physical sizes. The higher the resistance value of a resistor, the less current will flow through it when a voltage is placed across it. As it can be difficult to see printing on small resistors clustered together on a circuit board and surrounded by other larger components, the resistor values are not written on the resistors, instead, the resistors are colour-coded. The unit of measurement for resistors is the 'ohm' which has a very small size. Most resistors which you encounter will be in the range 100 ohms to 1,000,000 ohms. The higher the resistance of any resistor, the smaller the current which will flow through it.

The colour code used on resistors is:

- 0 Black
- 1 Brown
- 2 Red
- 3 Orange
- 4 Yellow
- 5 Green
- 6 Blue
- 7 Purple (Violet if your colour vision is very good)
- 8 Grey
- 9 White

Each resistor has typically, three colour bands to indicate its value. The first two bands are the numbers and the third band is the number of noughts:



Green: 5
 Blue: 6
 Red: 2 noughts
 Value: 5,600 ohms or 5.6K or 5K6

Yellow: 4
 Purple: 7
 Green: 5 noughts
 Value: 4,700,000 ohms or 4.7M or 4M7

The colour bands are read from left to right and the first band is close to one end of the body of the resistor. There is often a fourth band which indicates the manufacturing tolerance: you can ignore that band.

Examples:

Red, Red, Red: 2 2 00 ohms or 2K2

Yellow, Purple, Orange: 4 7 000 ohms or 47K

Brown, Black, Brown: 1 0 0 ohms or 100R

Orange, Orange, Orange: 3 3 000 ohms or 33K

Brown, Green, Red: 1 5 00 ohms or 1K5

Brown, Green, Black: 1 5 no noughts, or 15 ohms

Blue, Grey, Orange: 6 8 000 ohms or 68K

Brown, Green, Green: 1 5 00000 ohms or 1,500,000 ohms or 1M5

Yellow, Purple, Brown: 4 7 0 ohms

As there are only 12 standard resistor values per decade, there are only 12 sets of the first two colour bands:

10: Brown/Black,

12: Brown/Red,

15: Brown/Green,

18: Brown/Grey

22: Red/Red,

27: Red/Purple

33: Orange/Orange,

















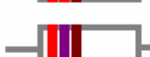



















39: Orange/White

47: Yellow/Purple

56: Green/Blue

68: Blue/Grey

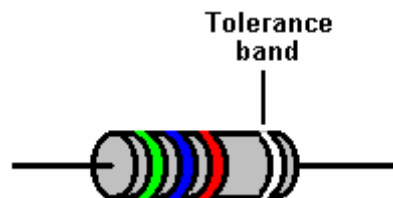
82: Grey/Red

	10		100		1K
	12		120		1.2K
	15		150		1.5K
	18		180		1.8K
	22		220		2.2K
	27		270		2.7K
	33		330		3.3K
	39		390		3.9K
	47		470		4.7K
	56		560		5.6K
	68		680		6.8K
	82		820		8.2K

	10K		100K		1M
	12K		120K		1.2M
	15K		150K		1.5M
	18K		180K		1.8M
	22K		220K		2.2M
	27K		270K		2.7M
	33K		330K		3.3M
	39K		390K		3.9M
	47K		470K		4.7M
	56K		560K		5.6M
	68K		680K		6.8M
	82K		820K		8.2M

Black = 0 or None, Brown = 1, Red = 2, Orange = 3, Yellow = 4, Green = 5, Blue = 6, Purple = 7, Grey = 8, White = 9

The details above give you all the basic information on resistor colour codes but there are a few additional refinements. There is an extra colour band further down the body of the resistor as shown here:



This extra band is used to indicate the manufacturing tolerance of the construction of the resistor. Resistor values are never exact and this rarely has any significant effect on their use in circuits. If some circuit needs very accurate resistor values in it, then buy several resistors of the same nominal value and use an ohm-meter to measure that actual value of each particular resistor and if none are perfect, then use two or more resistors to give the exact value wanted.

The tolerance band has the following codes:

Silver is $\pm 10\%$ (i.e. a 10K resistor of this type should be between 9K and 11K)

Gold $\pm 5\%$ (i.e. a 10K resistor of this type should be between 9.5K and 10.5K)

Red $\pm 2\%$ (i.e. a 10K resistor of this type should be between 9.8K and 10.2K)

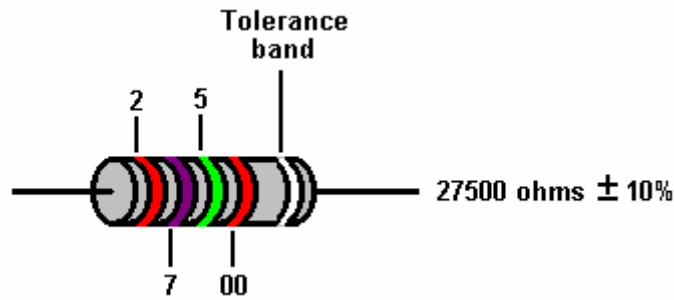
Brown $\pm 1\%$ (i.e. a 10K resistor of this type should be between 9.9K and 10.1K)

Green $\pm 0.5\%$ (i.e. a 10K resistor of this type should be between 9.95K and 10.05K)

Blue $\pm 0.25\%$ (i.e. a 10K resistor of this type should be between 9.975K and 10.025K)

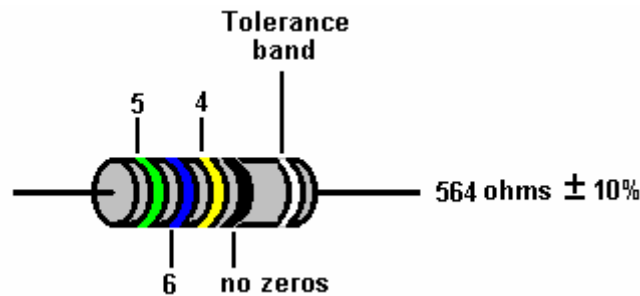
Purple $\pm 0.1\%$ (i.e. a 10K resistor of this type should be between 9.99K and 10.01K)

This type of resistor in the 10% and 5% ranges are the most common as they are the cheapest to buy and so tend to be the most popular. Recently, however, two additions to the coding have been introduced in order to allow for very high specification resistors which the average constructor may never come across. Each of these additions involves one additional colour band. The first additional colour band allows an extra digit in the resistor value, and looks like this:



As before, the colour coding is exactly the same, with the fourth colour band specifying the number of zeros after the digits indicated by the colour bands in front of it. So, in the example shown above, the first band being Red indicates a "2". The second colour band being Purple indicates a "7". The third colour band being Green indicates a "5" and the fourth colour band being Red indicates "2 zeros", so putting those together it produces the value of 27,500 ohms, which can also be written as 27.5 K or more briefly as 27K5.

Another example of this is:

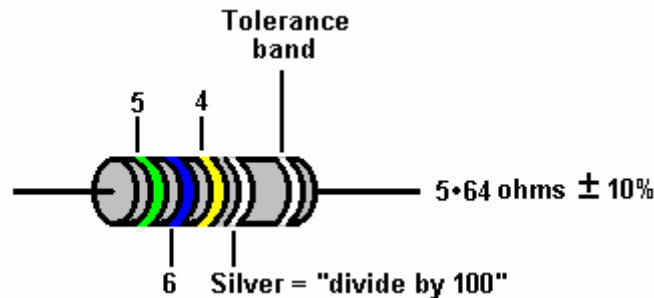


The fourth colour band coding has also been extended to include two other colours:

Gold: meaning "no zeros and divided by 10" so if the band in the example above had been gold, then the value would be 56.4 ohms.

Silver: meaning "no zeros and divided by 100" and if the example band had been silver then the value would have been 5.64 ohms.

So, for example, if the resistor had a fourth colour band which was silver, then the value would be:

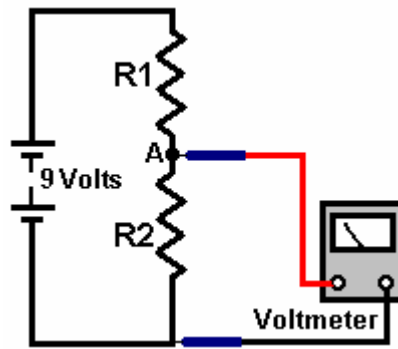


Finally, for very high-quality applications (typically military applications), there can be a sixth colour band positioned outside the tolerance band, and that final colour band states how much the resistance value can be expected to alter with changes in temperature. This is not something which is likely to be of any interest to you, but the codes for that final colour band are:

- Brown: 0.01% of the resistor value for each degree Centigrade change in temperature.
- Red: 0.005% of the resistor value for each degree Centigrade change in temperature.
- Yellow: 0.0025% of the resistor value for each degree Centigrade change in temperature.
- Orange: 0.0015% of the resistor value for each degree Centigrade change in temperature.

To put this in context, the worst of these represents a change of 1% in the resistor value when moving from the temperature of ice to the temperature of boiling water. Is this something which you really care about? I don't.

Leaving the details of identifying individual resistors, we now come to the interesting part: what happens when there are several resistors in a circuit. The important thing is to keep track of the voltages generated within the circuit. These define the currents flowing, the power used and the way in which the circuit will respond to external events. Take this circuit:



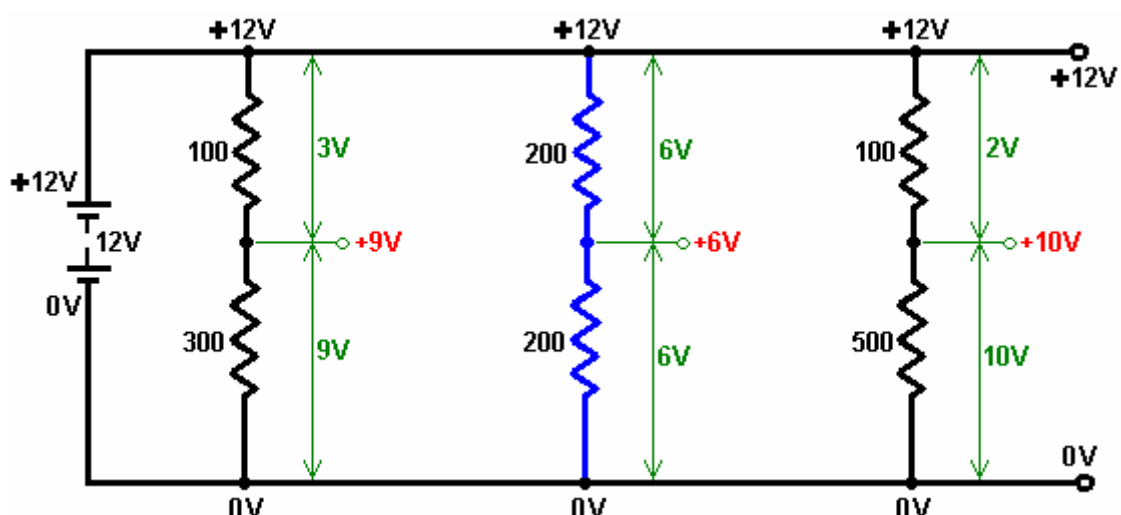
What is the voltage at point 'A'? If you feel like saying "Who cares?" then the answer is "you" if you want to understand how circuits work, because the voltage at point 'A' is vital. For the moment, ignore the effect of the voltmeter used to measure the voltage.

If R1 has the same resistance as R2, then the voltage at 'A' is half the battery voltage, i.e. 4.5 Volts. Half the battery voltage is dropped across R1 and half across R2. It does not matter what the actual resistance of R1 or R2 is, as long as they have exactly the same resistance. The higher the resistance, the less current flows, the longer the battery lasts and the more difficult it is to measure the voltage accurately.

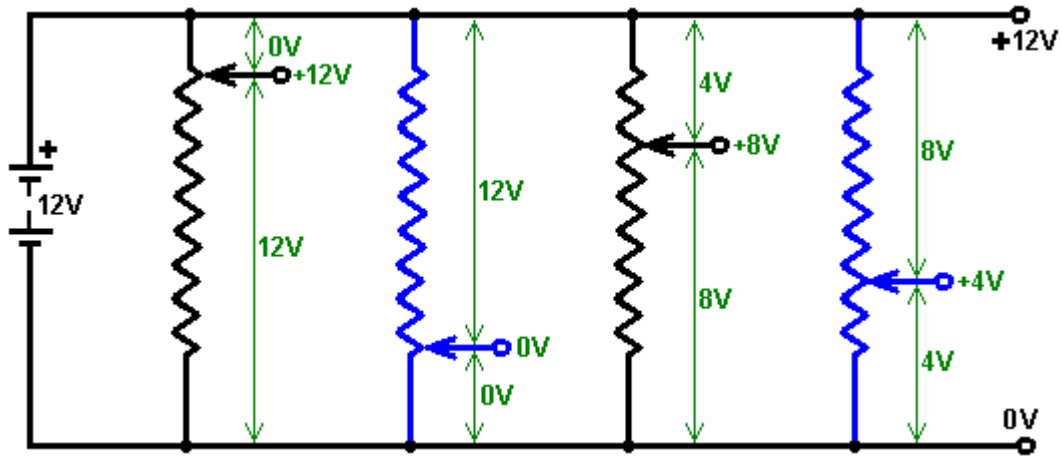
There is no need to do any calculations to determine the voltage at point "A" as it is the ratio of the resistor values which determines the voltage. If you really want to, you can calculate the voltage although it is not necessary. The method for doing this will be shown you shortly. For example, if R1 and R2 each have a value of 50 ohms, then the current flowing through them will be 9 volts / 100 ohms = 0.09 Amps (or 90 milliamps). The voltage drop across R1 will be 50 ohms = Volts / 0.09 amps or Volts = 4.5 volts. Exactly the same calculation shows that the voltage across R2 is exactly 4.5 volts as well. However, the point to be stressed here is that it is the **ratio** of R1 to R2 which controls the voltage at point "A".

If R1 has half as much resistance as R2, then half as much voltage is dropped across it as is dropped across R2, i.e. 3 Volts is dropped across R1, giving point 'A' a voltage of 6 Volts and that is what the voltmeter will show. Again, it does not matter what the actual value of R1 is in ohms, so long as R2 has exactly twice the resistance (shown by a higher number on the resistor).

If R1 has twice as much resistance as R2, then twice as much voltage is dropped across it as is dropped across R2, i.e. 6 Volts is dropped across R1, giving point 'A' a voltage of 3 Volts. Here are some examples with different resistors:

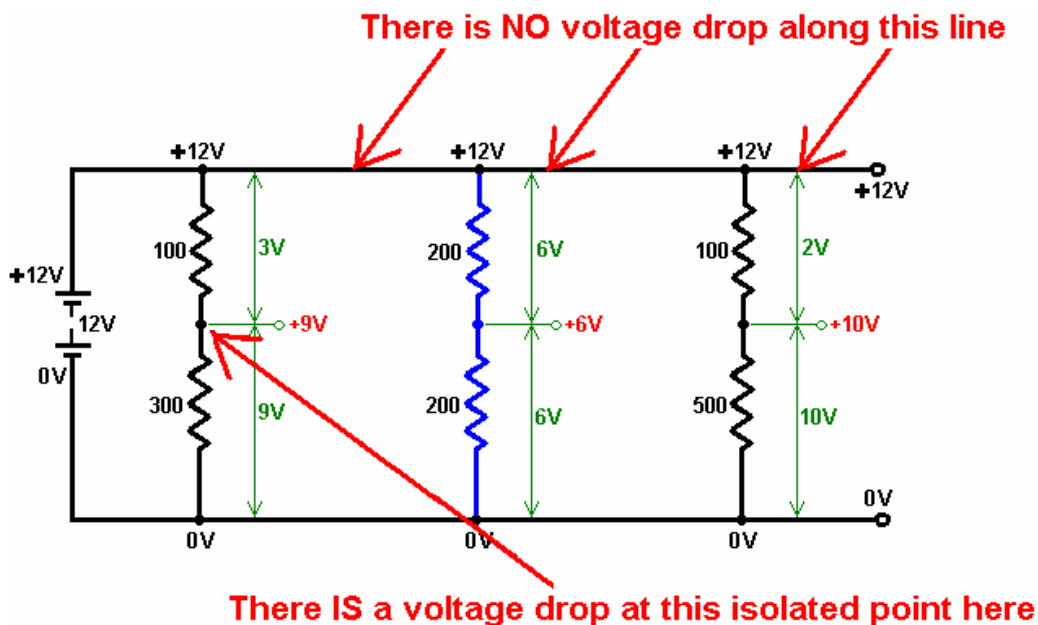


The same division of the supply voltage can be produced by positioning the slider of a variable resistor at different points by rotating the shaft of the device:



This determination of the voltage levels is the key factor to understanding electronic circuitry. The voltage levels control what currents flow and how every circuit will perform, so it is essential to understand what is happening. Stick with this section until you understand it, and if necessary, ask questions about what you find difficult.

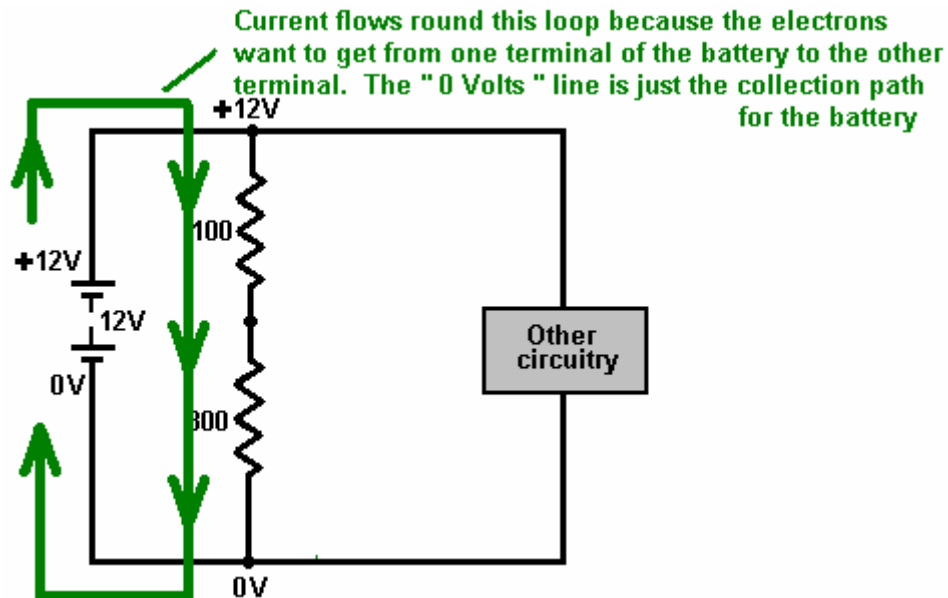
First, please understand that a good battery is an unlimited source of voltage and that voltage does not get “used up” when a resistor or whatever is connected across it:



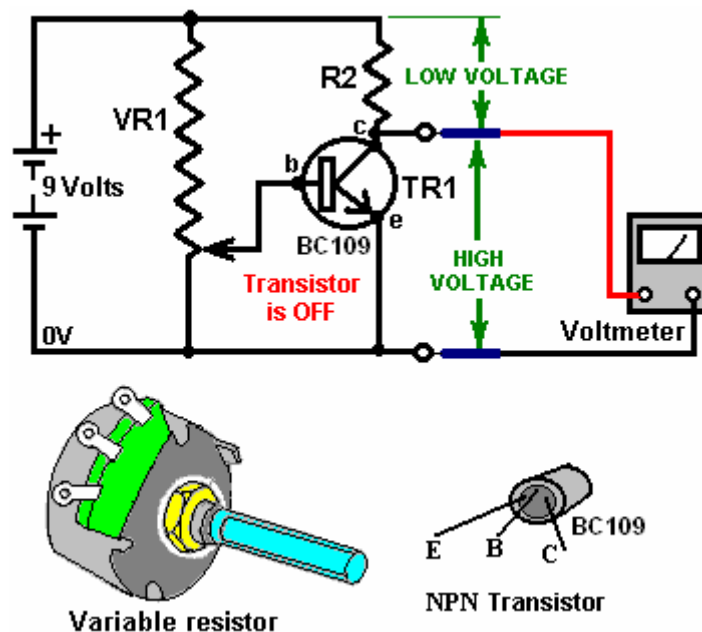
There can be some difficulty in understanding the “0-volt” connection in a circuit. All this means is that it is the return line for current flowing from the battery. Most conventional circuits are connected to both sides of the battery and that allows a current to flow around a closed “circuit” from one terminal of the battery to the other terminal.

It is normal practice to draw a circuit diagram so that the Plus terminal of the battery is at the top and the minus terminal is at the bottom. Many circuit diagrams show the negative line at the bottom connected to the ground or an “earth” connection, which is literally a metal rod driven into the ground to make a good electrical connection to the ground. This is done because the Earth is literally a vast reservoir of negative electricity. However, in reality, most circuits are not connected directly to the Earth in any way. The standard circuit diagram can be visualised as being like a graph of voltage, the higher up the diagram, the higher the voltage.

Anyway, when there is a circuit connected across the battery, the negative or “0V” line just indicates the return path to the battery for the current flow:



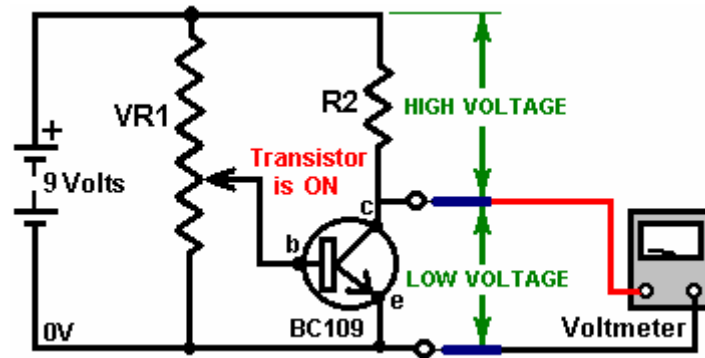
This principle applies immediately to the following circuit:



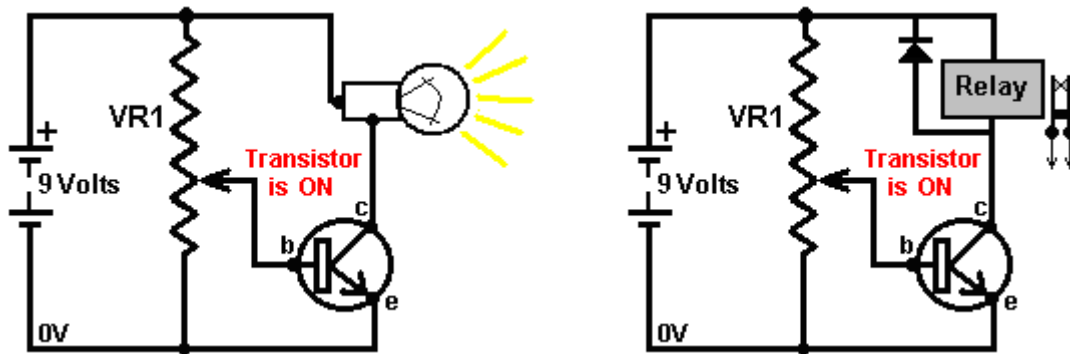
Here we encounter two new components. The first is 'VR1' which is a variable resistor. This device is a resistor which has a slider which can be moved from one end of the resistor to the other. In the circuit above, the variable resistor is connected across the 9 Volt battery so the top of the resistor is at +9 Volts (relative to the battery Minus terminal) and the bottom is at 0 Volts. The voltage on the slider can be adjusted from 0 Volts to 9 Volts by moving it along the resistor by turning the shaft of the component (which normally has a knob attached to it).

The second new device is 'TR1' a transistor. This semiconductor has three connections: a **C**ollector, a **B**ase and an **E**mitter. If the voltage on the base is below 0.7 volts, then the transistor is said to be "OFF" and in that state it has a very high resistance between the collector and the emitter, much higher than the resistance of resistor "R2". The voltage dividing mechanism just discussed means that the voltage at the collector will therefore, be very near to 9 Volts - caused by the **ratio** of the transistor's Collector/Emitter resistance compared to the resistor "R2".

If the voltage on the base of the transistor is raised to 0.7 volts by moving the slider of the variable resistor slowly upwards, then this will feed a small current to the base which then flows out through the emitter, switching the transistor ON causing the resistance between the collector and the emitter to drop instantly to a very low value, much, much lower than the resistance of resistor 'R2'. This means that the voltage at the collector will be very close to 0 Volts. The transistor can therefore be switched on and off just by rotating the shaft of the variable resistor:

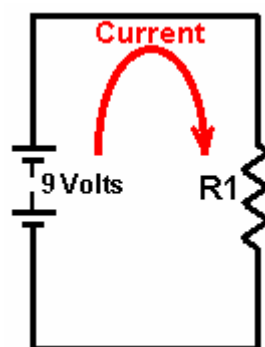


If a bulb is used instead of R2, then it will light when the transistor switches on. If a relay or opto-isolator is used, then a second circuit can be operated:



If a buzzer is substituted for R2, then an audible warning will be sounded when the transistor switches on. If a light-dependent resistor is substituted for VR1, then the transistor will switch on when the light level increases or decreases, depending on how the sensor is connected. If a thermistor is used instead of VR1, then the transistor can be switched on by a rise or fall in temperature. The same goes for sound, wind speed, water speed, vibration level, etc. etc. - more of this later.

We need to examine the resistor circuit in more detail:



We need to be able to calculate what current is flowing around the circuit. If the circuit contains only resistors, then this can be done using "Ohm's Law" which states that "Resistance equals Voltage divided by Current" or, if you prefer:

Ohm's Law (resistive Circuits only).

"Ohms = Volts / Amps" which indicates the units of measurement.

In the circuit above, if the voltage is 9 Volts and the resistor is 100 ohms, then by using Ohm's Law we can calculate the current flowing around the circuit as $100 \text{ Ohms} = 9 \text{ Volts} / \text{Amps}$, or $\text{Amps} = 9 / 100$ which equals 0.09 Amps. To avoid decimal places, the unit of 1 milliamp is used. There are 1000 milliamps in 1 Amp. The

current just calculated would commonly be expressed as 90 milliamps which is written as 90 mA.

In the circuit above, if the voltage is 9 Volts and the resistor is 330 ohms, then by using Ohm's Law we can calculate the current flowing around the circuit as $330 = 9 / \text{Amps}$. Multiplying both sides of the equation by "Amps" gives: $\text{Amps} \times 330 \text{ ohms} = 9 \text{ volts}$. Dividing both sides of the equation by 330 gives: $\text{Amps} = 9 \text{ volts} / 330 \text{ ohms}$ which works out as 0.027 Amps, written as 27 mA.

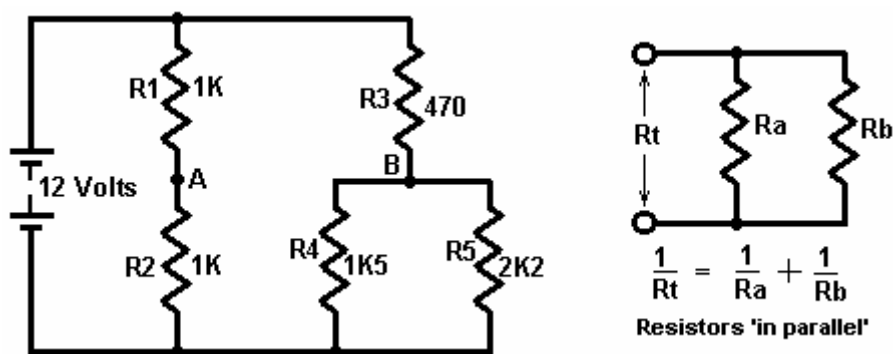
Using Ohm's Law we can calculate what resistor to use to give any required current flow. If the voltage is 12 Volts and the required current is 250 mA then as $\text{Ohms} = \text{Volts} / \text{Amps}$, the resistor needed is given by: $\text{Ohms} = 12 / 0.25 \text{ Amps}$ which equals 48 ohms. The closest standard resistor is 47 ohms (Yellow / Purple / Black).

The final thing to do is to check the wattage of the resistor to make sure that the resistor will not burn out when connected in the proposed circuit. The power calculation is given by:

Watts = Volts x Amps. In the last example, this gives $\text{Watts} = 12 \times 0.25$, which is 3 Watts. This is much larger than most resistors used in circuitry nowadays.

Taking the earlier example, $\text{Watts} = \text{Volts} \times \text{Amps}$, so $\text{Watts} = 9 \times 0.027$ which gives 0.234 Watts. Again, to avoid decimals, a unit of 1 milliwatt is used, where 1000 milliwatts = 1 Watt. So instead of writing 0.234 Watts, it is common to write it as 234 mW.

This method of working out voltages, resistances and wattages applies to any circuit, no matter how awkward they may appear. For example, take the following circuit containing five resistors:



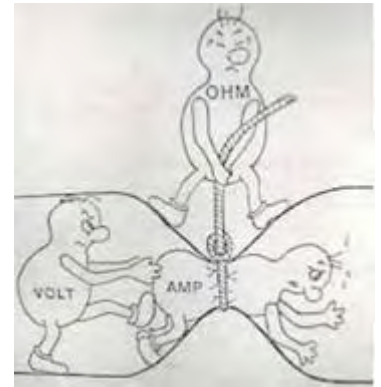
As the current flowing through resistor 'R1' has then to pass through resistor 'R2', they are said to be 'in series' and their resistances are added together when calculating current flows. In the example above, both R1 and R2 are 1K resistors, so together they have a resistance to current flow of 2K (that is, 2,000 ohms).

If two, or more, resistors are connected across each other as shown on the right hand side of the diagram above, they are said to be 'in parallel' and their resistances combine differently. If you want to work out the equation above, for yourself, then choose a voltage across R_t , use Ohm's Law to work out the current through R_a and the current through R_b . Add the currents together (as they are both being drawn from the voltage source) and use Ohm's Law again to work out the value of R_t to confirm that the $1/R_t = 1/R_a + 1/R_b + \dots$ equation is correct.

In the example above, R_4 is 1K5 (1,500 ohms) and R_5 is 2K2 (2,200 ohms) so their combined resistance is given by $1/R_t = 1/1500 + 1/2200$ or $R_t = 892 \text{ ohms}$ (using a simple calculator). Apply a common-sense check to this result: If they had been two 1500 ohm resistors then the combined value would have been 750 ohms. If they had been two 2200 ohm resistors then the combined value would have been 1100 ohms. Our answer must therefore lie between 750 and 1100 ohms. If you came up with an answer of, say, 1620 ohms, then you know straight off that it is wrong and the arithmetic needs to be done again.

So, how about the voltages at points 'A' and 'B' in the circuit? As R_1 and R_2 are equal in value, they will have equal voltage drops across them for any given current. So the voltage at point 'A' will be half the battery voltage, i.e. 6 Volts.

Now, point 'B'. Resistors R_4 and R_5 act the same as a single resistor of 892 ohms, so we can just imagine two resistors in series: R_3 at 470 ohms and R_4+R_5 at 892 ohms. Common-sense rough check: as R_3 is only about half the resistance of R_4+R_5 , it will have about half as much voltage drop across it as the voltage drop across R_4+R_5 , i.e. about 4 Volts across R_3 and about 8 Volts across R_4+R_5 , so the voltage at point 'B' should work out at about 8 Volts.



We can use **Ohm's Law** to calculate the current flowing through point 'B':

Ohms = Volts / Amps, (or **Amps = Volts / Ohms** or **Volts = Ohms x Amps**)

$(470 + 892) = 12 / \text{Amps}$, so

$\text{Amps} = 12 / (470 + 892)$

$\text{Amps} = 12 / 1362$ or

$\text{Amps} = 0.00881 \text{ Amps}$ (8.81 milliamps).

Now that we know the current passing through (R4+R5) we can calculate the exact voltage across them:

$\text{Resistance} = \text{Volts} / \text{Amps}$ so

$892 = \text{Volts} / 0.00881$ or

$\text{Volts} = 892 \times 0.00881$

$\text{Volts} = 7.859 \text{ Volts}$.

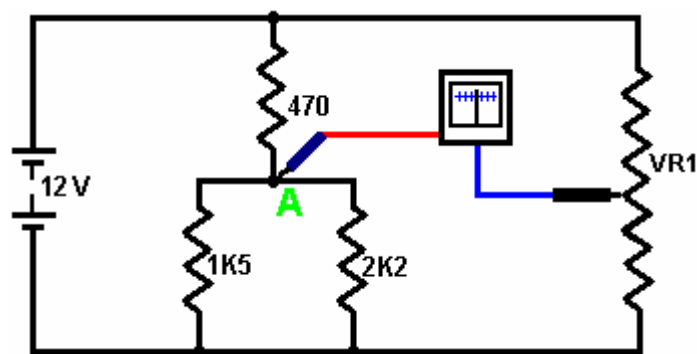
As our common-sense estimate was 8 Volts, we can accept 7.86 Volts as being the accurate voltage at point 'B'.

The Potentiometer.

Just before we leave the subject of resistors and move on to more interesting subjects, we come across the term 'potentiometer'. This term is often shortened to 'pot' and many people use it to describe a variable resistor. I only mention this so that you can understand what they are talking about. A variable resistor is not a potentiometer and really should not be called one. You can skip the rest of this part as it is not at all important, but here is what a potentiometer is:

A fancy name for voltage is 'potential', so a circuit powered by a 12 Volt battery can be described as having a 'potential' of zero volts at the negative side of the battery and a 'potential' of plus twelve volts at the positive side of the battery. Ordinary folks like me would just say 'voltage' instead of 'potential'.

When a voltmeter is used to measure the voltage at any point in a circuit, it alters the circuit by drawing a small amount of current from the circuit. The voltmeter usually has a high internal resistance and so the current is very small, **but** even though it is a small current, it **does** alter the circuit. Consequently, the measurement made is not quite correct. Scientists, in years gone by, overcame the problem with a very neat solution - they measured the voltage without taking **any** current from the circuit - neat huh? They also did it with a very simple arrangement:



They used a sensitive meter to measure the current. This meter is built so that the needle is in a central position if no current is flowing. With a positive current flowing, the needle deflects to the right. With a negative current flowing, the needle moves to the left. They then connected a variable resistor 'VR1' across the same battery which was powering the circuit. The top end of VR1 is at +12 Volts (they called that 'a potential of +12 Volts') and the bottom end of VR1 is at zero volts or 'a potential of zero volts'.

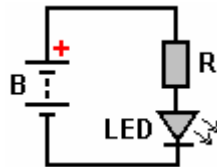
By moving the slider of VR1, any voltage or 'potential' from zero volts to +12 Volts could be selected. To measure the voltage at point 'A' without drawing any current from the circuit, they would connect the meter as shown and adjust the variable resistor until the meter reading was exactly zero.

Since the meter reading is zero, the current flowing through it is also zero and the current taken from the circuit is zero. As no current is being taken from the circuit, the measurement is not affecting the circuit in any way - very clever. The voltage on the slider of VR1 exactly matches the voltage at point 'A', so with a calibrated scale on the variable resistor, the voltage can be read off.

The slick piece of equipment made up from the battery, the variable resistor and the meter was used to measure the 'potential' (voltage) at any point and so was called a 'potentiometer'. So, please humour me by calling a variable resistor a 'variable resistor' and not a 'potentiometer'. As I said before, this is not at all important, and if you want to, you can call a variable resistor a 'heffalump' so long as you know how it works.

Understanding what circuit diagrams mean.

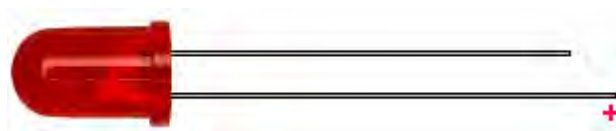
Many people look at a circuit diagram and have no idea what it means, so let's see if we can make the mystery go away. Take this circuit for example:



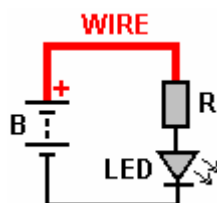
This circuit has three components plus some wire. The symbol "B" represents a battery, or more strictly speaking, a battery made up of a number of cells. Batteries come in many different shapes and sizes. Here are some of them:



The symbol "R" represents a resistor as described above, and the "LED" is a Light-Emitting Diode which probably looks like this:



The longer lead is the Plus. Many LEDs need more than 1.5 volts to light up, and while it is very easy to think of a single AA-size battery as being 1.5 volts, the very common AA-size NiMh batteries are only 1.2 volts. So, let us set up the circuit using a 9V battery and a 330 ohm resistor (Orange, Orange, Brown) to limit the current flowing through the LED. The circuit is:



And this indicates that the Plus of the battery gets connected to the resistor. This can be done using some wire, or the resistor can be connected directly to the battery:



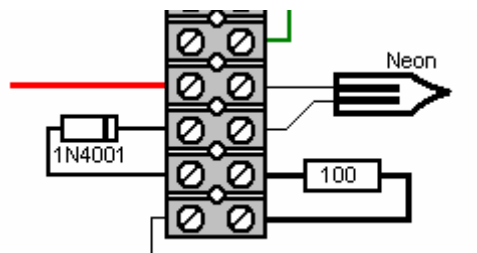
Then the LED gets connected to the other end of the resistor:



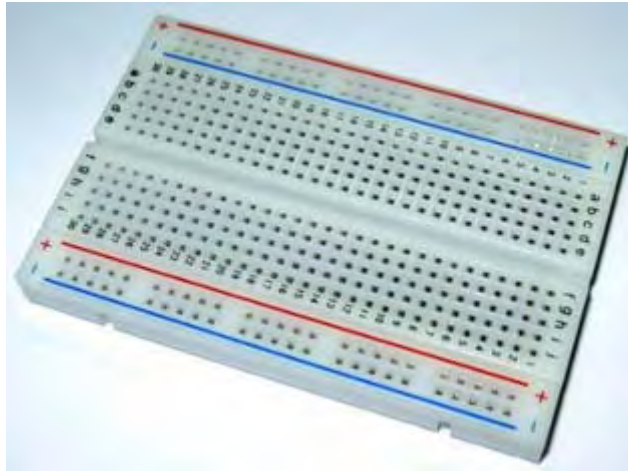
And finally, the other side of the LED is connected to the Minus of the battery:



If the LED is connected the wrong way round, it will not damage anything but the LED will not light up. Poor quality connections can be made by twisting wires together. Better quality connections can be made using screw connectors:



The spacing of the connectors on the strip varies with the power rating of the connectors and there are four or five sizes commonly available, and so it is sometimes necessary to cut the strip and use individual connectors at times. Another option is to use a plug-in board although they are far from perfect. They used to be very good but then integrated circuits came along with their tiny pin spacing and the boards adapted to them by making the holes and the spacing between the holes small enough to suit the integrated circuits. Now, it is no longer possible to plug in quite ordinary components such as the fast UF5408 diode as the diode wires are too large to plug into the tiny holes:

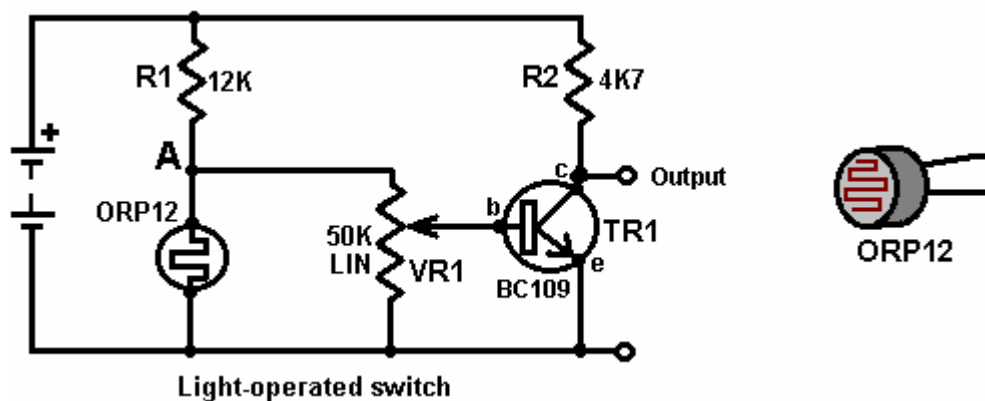


The most effective method of connection is to solder the components together and that is not particularly difficult to do. Veroboard (stripboard) is convenient and there are several other board styles which can be used. When I was very young and almost no components were available, I used drawing pins and soldered components to them, killing the excessive heat using a wet cloth which is very effective in dropping temperature very rapidly. However, no matter what method of connection is used, you just follow along the connecting lines in any diagram to see what components are connected together.

Semiconductors.

This section deals with discrete semiconductors. A later section deals with 'Integrated Circuits' which are large-scale semiconductor devices.

ORP12 Light-dependent resistor. This device has a high resistance in the dark and a low resistance in bright light. It can be placed in a circuit to create a switch which operates with an increase in light level or a decrease in light level:



In this version, the voltage at point 'A' controls the circuit. In darkness, the ORP12 has a resistance ten times greater than that of R1 which is 12,000 ohms. Consequently, the voltage at point 'A' will be high. As the light level increases, the resistance of the ORP12 falls, dragging the voltage at point 'A' downwards. As the variable resistor 'VR1' is connected from point 'A' to the ground rail (the -ve of the battery), its slider can be moved to select any voltage between 0 Volts and the voltage of 'A'. A slider point can be chosen to make the transistor switch off in daylight and on at night. To make the circuit trigger when the light level increases, just swap the positions of R1 and the ORP12.

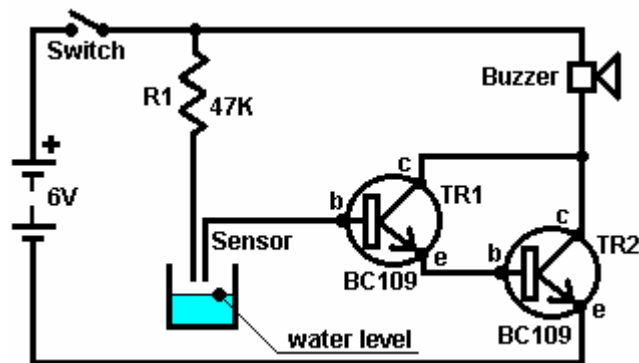
The transistor shown is a BC109 although most transistors will work in this circuit. The BC109 is a cheap, silicon, NPN transistor. It can handle 100mA and 30V and can switch on and off more than a million times per second. It has three connections: the Collector, marked 'c' in the diagram, the Base, marked 'b' in the diagram and the Emitter, marked 'e' in the diagram.

As mentioned before, it has a very high resistance between the collector and the emitter when no current flows into the base. If a small current is fed into the base, the collector/emitter resistance drops to a very low value. The collector current divided by the base current is called the 'gain' of the transistor and is often called 'hfe'. A transistor such as a BC109 or a BC108 has a gain of about 200, though this varies from actual transistor to actual

transistor. A gain of 200 means that a current of 200mA passing through the collector requires a current of 1mA through the base to sustain it. Specific information on the characteristics and connections of semiconductors of all kinds can be obtained free from the excellent website www.alldatasheet.co.kr which provides .pdf information files.

The BC109 transistor shown above is an NPN type. This is indicated by the arrow of the symbol pointing outwards. You can also tell by the collector pointing to the positive rail. There are similar silicon transistors constructed as PNP devices. These have the arrow in the transistor symbol pointing inwards and their collectors get connected, directly or indirectly, to the negative rail. This family of transistors are the earliest transistor designs and are called 'bi-polar' transistors.

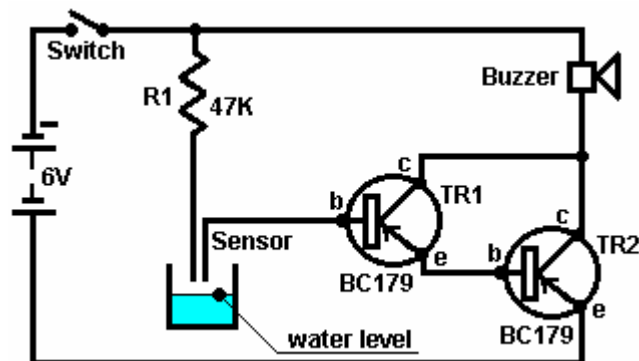
These silicon transistors are so efficiently constructed that they can be connected directly together to give greatly increased gain. This arrangement is called a 'Darlington pair'. If each transistor has a gain of 200, then the pair give a gain of $200 \times 200 = 40,000$. This has the effect that a very, very small current can be used to power a load. The following diagram shows a Darlington pair used in a water-level detector. This type of alarm could be very useful if you are asleep on a boat which starts taking on water.



Here, (when the circuit is switched on), transistor TR1 has so little leakage current that TR2 is starved of base current and is hard off, giving it a high resistance across its collector/emitter junction. This starves the buzzer of voltage and keeps it powered off. The sensor is just two probes fixed in place above the acceptable water level. If the water level rises, the probes get connected via the water. Pure water has a high electrical resistance but this circuit will still work with pure water.

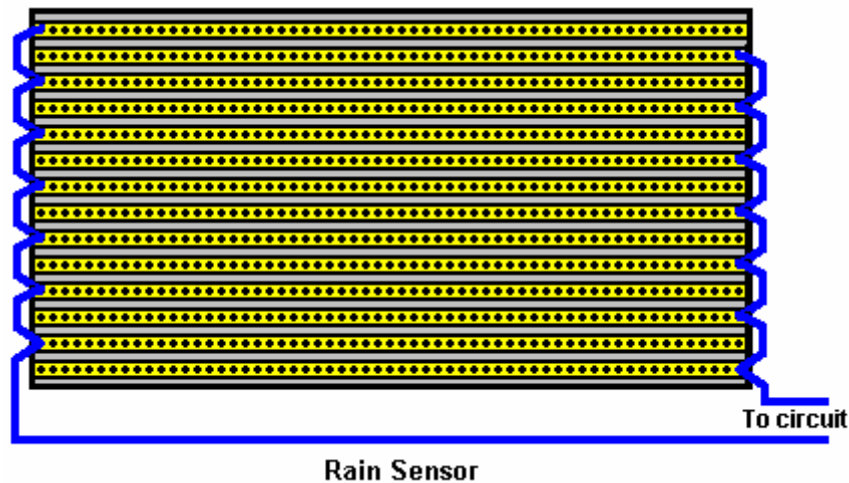
The odds are that in a practical situation, the water will not be particularly clean. The resistor R1 is included to limit the base current of TR1 should the sensor probes be short-circuited. Silicon bi-polar transistors have a base/emitter voltage of about 0.7V when fully switched on. The Darlington pair will have about 1.4V between the base of TR1 and the emitter of TR2, so if the sensor probes are short-circuited together, resistor R1 will have $6 - 1.4 = 4.6\text{V}$ across it. Ohms Law gives us the current through it as $R = V / A$ or $47,000 = 4.6 / A$ or $A = 4.6 / 47,000$ amps. This works out at 0.098mA which with a transistor gain of 40,000 would allow up to 3.9A through the buzzer. As the buzzer takes only 30mA or so, it limits the current passing through it, and TR2 can be considered to be switched hard on with the whole battery voltage across it.

NPN transistors are more common than PNP types but there is almost no practical difference between them. Here is the previous circuit using PNP transistors:



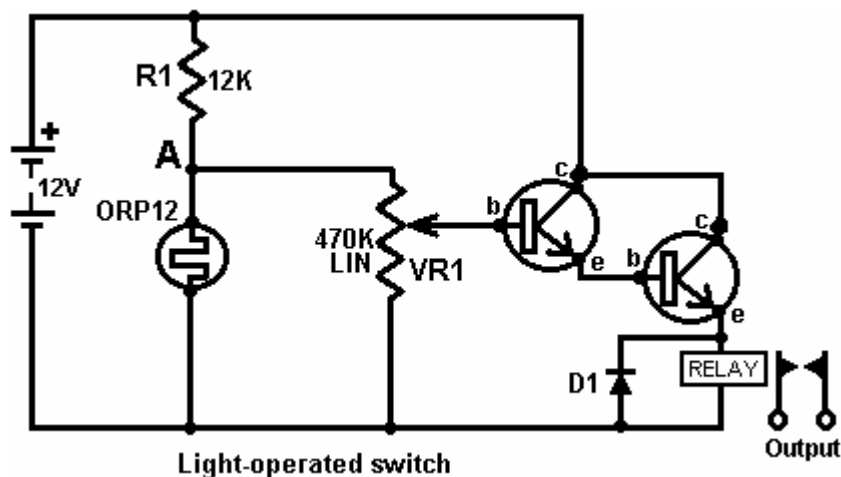
Not a lot of difference. Most of the circuit diagrams shown here use NPN types but not only are these not critical, but there are several ways to design any particular circuit. In general, the semiconductors shown in any circuit are seldom critical. If you can determine the characteristics of any semiconductor shown, any reasonably similar

device can generally be substituted, especially if you have a general understanding of how the circuit works. Either of the two previous circuits can operate as a rain detector. A suitable sensor can easily be made from a piece of strip board with alternate strips connected together to form an interlacing grid:



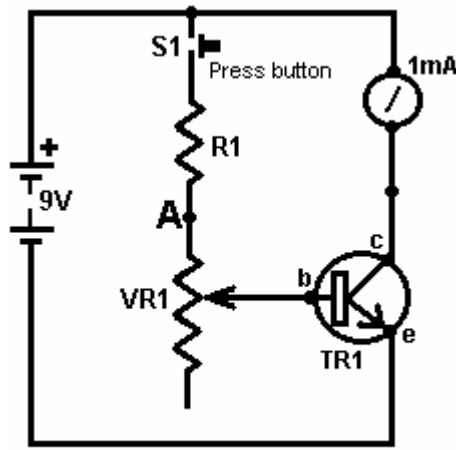
Here, if a raindrop bridges between any two adjacent strips, the circuit will trigger and sound a warning.

The transistors in the circuit above are connected with their emitter(s) connected to the ground rail (the lower battery line shown in any circuit is considered to be “ground” unless it is specifically shown elsewhere). This connection method is called ‘common emitter’. The following circuit uses the transistor connected in ‘emitter follower’ mode. This is where the emitter is left to *follow* the base voltage - it is always 0.7V below it unless the base itself is driven below 0.7V:



This is almost the same as the light-operated circuit shown earlier. In this variation, the transistors are wired so that they work as an ‘emitter-follower’ which follows the voltage at point ‘A’ which rises as the light level drops and the resistance of the ORP12 increases. This causes the voltage across the relay to increase until the relay operates and closes its contacts. A relay is a voltage-operated mechanical switch which will be described in more detail later on.

The disadvantage of the above circuit is that as the light level decreases, the current through the relay increases and it may be a significant amount of current for some considerable time. If it was intended to power the unit with a battery then the battery life would be far shorter than it need be. What we would like, is a circuit which switched rapidly from the Off state to the On state even though the triggering input varied only slowly. There are several ways to achieve this, one of them being to modify the circuit to become a ‘Schmitt Trigger’:



Transistor Tester

With the circuit shown here, the variable resistor is adjusted until a collector current of 1mA is shown on the millimetre and the gain of the transistor is then read off the scale on the variable resistor knob. The circuit is built into a small box containing the battery and with a socket into which the transistor can be plugged. The question then is, what values should be chosen for the resistor R1 and the variable resistor VR1?

Well, we might choose that the minimum gain to be displayed is 10. This would correspond to where the variable resistor slider is taken all the way up to point 'A' in the circuit diagram, effectively taking the variable resistor out of the circuit. If the transistor gain is 10 and the collector current is 1mA, then the base current will be 0.1mA. This current has to flow through the resistor R1 and it has a voltage of (9.0 - 0.7) Volts across it as the base/emitter voltage is 0.7 Volts when the transistor is on. Ohms Law gives us Ohms = Volts / Amps, which for the resistor R1 means Ohms = 8.3 / 0.0001 or 83,000 ohms, or 83K.

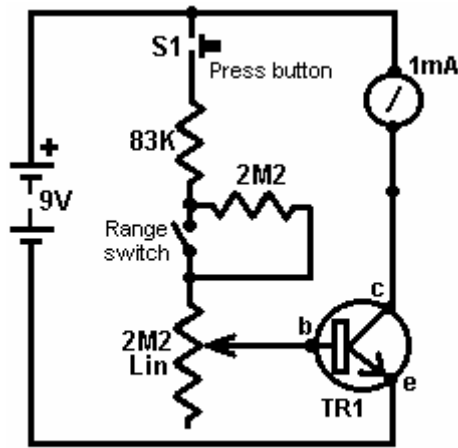
Rule of thumb: 1K provides 1mA if it has 1V across it, so 10K will give 0.1mA if it has 1 Volt across it. With 8.3 Volts across it, it needs to be 8.3 times larger to hold the current down to the required 0.1mA so the resistor should be 83K in size.

As 83K is not a standard size, we need to use two or more standard resistors to give that resistance. Nearest standard size below 83K is 82K, so we can use one 82K resistor and one 1K resistor in series to give the required 83K.

Suppose that we say that we would like to have 500 as the highest gain shown on our tester, then when VR1 is at its maximum value, it and R1 should provide 1/500 of the collector current of 1mA, i.e. 0.002mA or 0.000002 Amps. From Ohms Law again we get $VR1 + R1 = 4,150,000$ ohms or 4M15. Unfortunately, the largest value variable resistor available is 2M2 so the circuit as it stands, will not be able to cope.

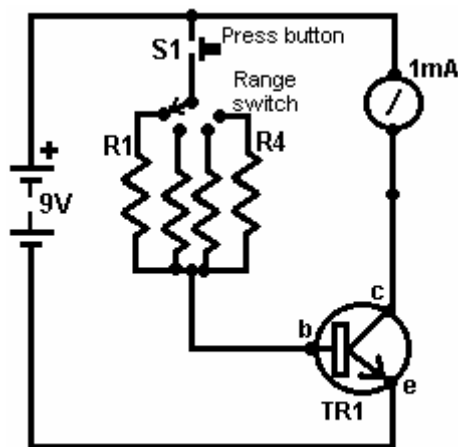
Suppose we were to just use a 2M2 variable resistor for VR1, what transistor gain range could we display? Well Ohms Law ... lets us calculate the base current with 8.3 Volts across (83,000 + 2,200,000) ohms and from that the maximum transistor gain which would be 277.77 (at 1mA). You would buy a 'linear' standard carbon track variable resistor so that the change in resistance is steady as the shaft is rotated. The scale which you would make up would be in even steps and it would run from 10 at the minimum setting, to 278 at the highest setting.

But that is not what we wanted. We wanted to measure up to 500. But they don't make variable resistors big enough, so what can we do? Well, if we wanted, we could lower the battery voltage, which in turn would lower the resistor values. As a 9V battery is very convenient for this kind of circuit, lets not go down that route. We could add extra circuitry to drop the 9V battery voltage down to a lower value. The most simple solution is to add an extra resistor and switch to give two ranges. If we switched in an extra 2M2 resistor above VR1 then the circuit would measure transistor gains from 278 to just over 500 and all we would need to do would be to add a second scale for the VR1 pointer knob to move over. We could, provide extra ranges which overlap and which have more convenient scales to mark. The design is up to you.



Transistor Tester 2

The design covered above is not the only way to measure the transistor gain. A second way, which accepts that it is not so accurate, picks a set base current and measures the collector current as a guide to the gain. In this simple method, one or more resistor values are chosen to give gain ranges, and the milliammeter used to read the corresponding gain:



Transistor Tester 3

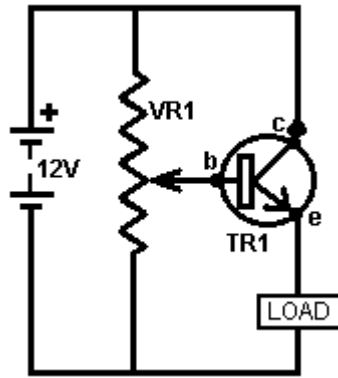
Here, resistor R1 might be chosen to give a collector current of 1mA (which is a full-scale deflection on the meter) when the transistor gain is 100. Resistor R2 might be picked to give a full-scale deflection for a gain of 200, R3 for a gain of 400, R4 for a gain of 600, and so on. Generally speaking, it is not essential to know the exact gain but any reasonable approximation to it is sufficient. You are normally selecting a transistor where you need a gain of 180, so it is not important if the transistor you pick has a gain of 210 or 215 - you are only avoiding transistors with gains below 180.

How do you work out the values of the resistors R1 to R4? Well, you probably won't expect this, but you use Ohms Law. Voltage drop is 8.3 Volts and the base current is given by the full-scale deflection's 1mA divided by the transistor gain for each range, i.e. 1/100 mA for R1, 1/200 mA for R2,... 1/600 mA for R4,...

Emitter Followers

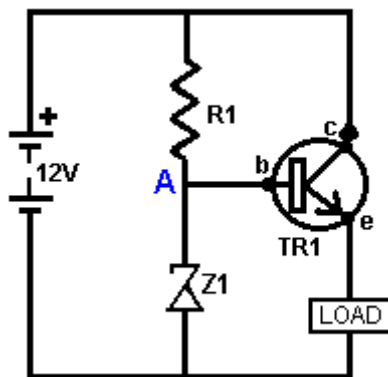
The transistor circuits show so far are known by the technical term "Common Emitter" because the emitters are generally connected to the 'Negative rail' or battery minus line. This method of use is very popular because when the transistor is switched on, all of the supply voltage is supplied to the load. Another common and very useful method is known as the 'Emitter-Follower' circuit where the load is connected to the negative rail instead of the emitter of the transistor. With this arrangement, the voltage at the emitter remains at 0.7 volts below the voltage of the transistor base and 'follows' that voltage no matter how it changes. Generally speaking, the transistor is being used to amplify the current which could be drawn from the point in the circuit where the transistor base is connected.

The circuit arrangement is like this:



If the battery is genuinely 12-volts, then the slider of the variable resistor VR1 can be moved from a voltage of zero volts to a voltage of +12 volts, or any desired value between those two values. That means that the voltage on the base of transistor TR1 can be any of those values. If the voltage on the transistor base is 0.7 volts or higher, then the transistor will conduct current and the voltage across the load will increase until the emitter is 0.7 volts below the base voltage. This means that the voltage across the load can be adjusted to any value from 0 volts to +11.3 volts. This circuit is known as an “Emitter-Follower” circuit.

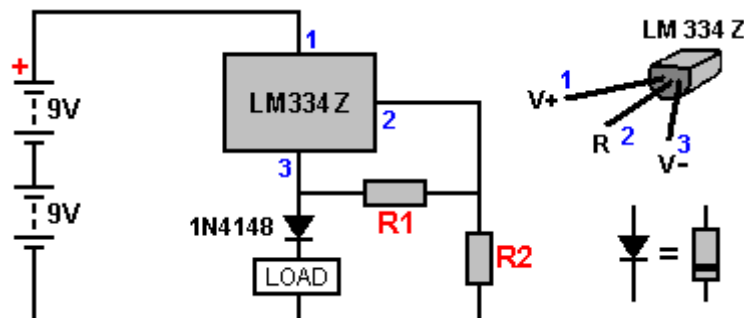
The actual values encountered in ‘real life’ are that a battery marked as 12-volts is very seldom actually at that voltage and a common value is 12.8 volts. I have called the Base-to-Emitter voltage 0.7 volts but in reality, it may be anything from 0.6 volts to 0.75 volts. A common use for this type of circuit is to pass a constant voltage to a circuit, using a zener diode. The circuit is like this:



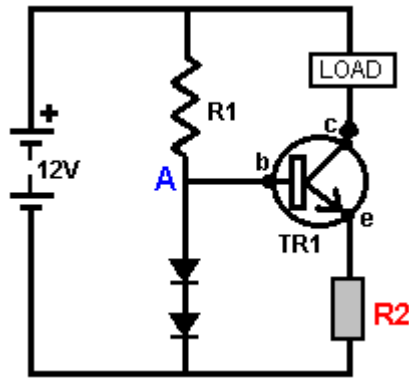
This circuit is supposed to have a fixed voltage at point “A” as the zener diode Z1 is supposed to produce a fixed voltage. That can work reasonably well if the battery voltage is fixed, but if the battery voltage alters either upwards or downwards, the voltage at “A” drifts, which means that the voltage across the load also alters. You will sometimes see this in constant-current circuits.

Constant-Current circuits

The generally recommended way to arrange a constant current flow through some load or other is to use an integrated circuit designed for the job. The arrangement is generally like this:



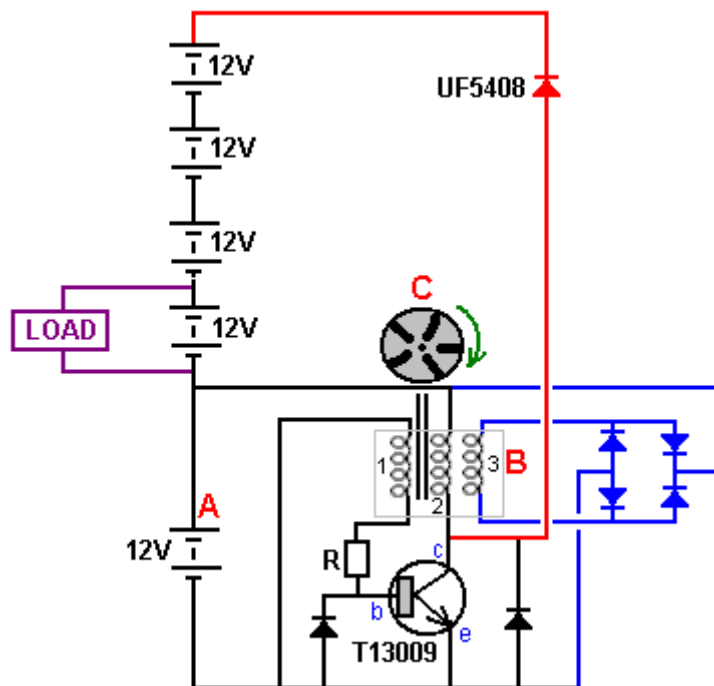
Here, the resistor **R1** controls how much current will flow in the circuit and the resistor **R2** needs to be ten times higher in value than **R1**. One snag is that the LM334Z drops about 4-volts when stabilising the current through the load. That is a lot of voltage sacrificed. An alternative arrangement is:



With this circuit, two ordinary diodes such as the 1N4007, are used to give a steady voltage due to the current flowing through them, supplied by resistor R1. Each diode has a voltage drop across it roughly equal to the voltage drop across the Base/Emitter junction of the transistor TR1. That means that the resistor **R2** will have about the same voltage across it as one of the diodes. It is my experience that the voltage drop across the diodes is not affected much if the battery voltage changes as time goes by. The value of the resistor **R2** is chosen to give the desired current flow through the load. The voltage drop across the transistor Collector/Emitter connections adjusts automatically to keep the current through the load at the constant required value.

Substitute Transistors

A recent question was how to find a substitute transistor for the T13009 transistor in this chapter 21 circuit, as there seemed to be no local supplier for it, and would a 2N2222 transistor do as a substitute?



That is a very reasonable question. So to answer it, we look at the circuit and we see that the Collector of the transistor is going to be pulled upwards until it exceeds the voltage of the battery chain. There are five 12-volt batteries in a chain going upwards from the transistor Emitter and while those batteries have "12 Volts" written on them, they can charge up to nearly 14 volts each. That means that the transistor collector may be dragged up to a voltage of $5 \times 14 = 70$ volts or more if the batteries are going to be charged. So, common sense says that any successful substitute transistor will have to have a voltage rating of at least 70 volts.

If we want to find out the characteristics of a transistor or diode, we can go to the <http://www.alldatasheet.com/> web site, although just Googling the transistor name often gets the needed information very quickly. Anyway, on the web site, the top of the page has an entry section like this:

Part Name	match	<input type="text"/>	Search
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And if you type in T13009 as the part name:



Part Name	match	T13009	Search
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and click on the Search button, then it comes up with this:

T13009 Datasheet, PDF

Shortcut	T13009(1) recommended result.
Match, Like	ST13009 (1)

So you click on the blue ST13009 link and it then comes up with a slightly confusing advertisement display which offers information on some totally unrelated component. However, if you scroll down the page a little you reach a link to the datasheet for the transistor:

Electronic Manufacturer	Part no	Datasheet	
 STMicroelectronics	ST13009		

If you then click on the PDF symbol, you get another screen offering the actual link to the pdf file:

Part No.	ST13009
Download	ST13009 Click to view

Clicking on the link actually provides you with the datasheet which you can store locally to save ever having to go through all that lot again.



ST13009

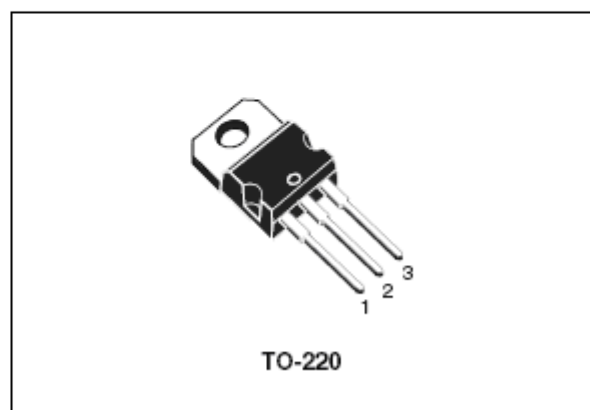
High voltage fast-switching
NPN power transistor

Features

- Low spread of dynamic parameters
- High voltage capability
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed

Applications

- Switch mode power supplies



This is not an FET transistor and so our main interest is in the voltage it can withstand, the continuous current which it can carry, the peak current it can manage when fed sudden pulses, how much power overall it can handle, what DC-current gain (that is amplification) you can expect from it and how fast it can operate.

That sounds a lot but it really is quite simple. However, there is a manufacturing spread on transistors and most other electronic components, and so we are looking for just a ball-park number for these things. That is, you can have five identical-looking transistors in your hand but it is most unlikely that any two of them will actually be identical. However, let's look at this data sheet and see what we find out:

First, the maximum voltage that the transistor can withstand with the base unconnected is 400 volts which is a good deal more than is likely to be reached in our circuit.

Next, the current. The continuous current is stated to be 12 amps and 24 amps if in pulses. That is likely to be more than the circuit needs, as a sustained output of 40 watts from a 12-volt connection is a current of under 4-amps.

Next, the wattage is stated as being 100 watts (a heat sink is definitely needed for that – imagine holding a lit 100 watt light bulb in your hand and think how comfortable that would be). However, in our circuit, the transistor will be off for most of the time and so, wattage is not likely to be a problem.

Next, the switching speed, which is likely to be important in this circuit. The data sheet suggests that about 60 nanoseconds is likely for any T13009 transistor.

And finally, the DC current gain will probably be between 15 and 39 at a current of 5 amps. It is likely to be much better than that at lower currents.

Some people have difficulty visualising how a bipolar transistor works, so let me explain it in a bit more detail. When current is flowing through a bipolar transistor, then the base voltage of that transistor is pretty much fixed. It is a bit like having a large lake with a long horizontal dam wall holding the water in the lake. When the lake water level is below that of the dam, then no water flows over the dam. If the lake level rises, then water spills over the dam. The amount of that water flow is VERY much affected by the depth of water over the dam with even a small increase in depth causing a massive increase in water flow. The same goes for the transistor base and that is why the base current flow is limited by a resistor. Without a resistor, the current flow would very quickly become many amps and burn the transistor out through sheer heating of the base/emitter junction.

The base current flow is like the setting of a valve between the collector and the emitter. If the transistor gain is 200, then 1 mA flowing into the base allows 200 mA to flow between the collector and the emitter, unless there is a load between the collector and the battery – a load which chokes off that current flow, and that is the normal case. For example, if 0.5 mA flows into the base, then a maximum of 100 mA can pass between the collector and emitter. The gain of any transistor depends on the amount of current flowing through the transistor and it varies so much that the only way to specify it properly is to draw a graph of it. Because of that, printed gain figures are given for just one or two currents. Generally, the lower the current, the higher the actual gain, so if a gain is given as 20 at 1 amp and you are only intending to have 100 mA flowing through it, then you can expect a gain much higher than 20. The voltage on the base of a single transistor which is conducting will always be 0.7 volts (or something very close to that depending on how that particular transistor was actually manufactured). That 0.7 volts stays fixed even if the current flowing into the base increases from 0.1 milliamps to 100 milliamps. So back to our T13009 transistor.

Okay, we now know a bit about the T13009 transistor, and the question asked about the 2N2222 transistor, so we look it up on the All Data Sheet web site and we find that the maximum voltage is 40-volts. That rules it out of our circuit where the voltage goes to at least 70-volts and a 2N2222 transistor would die instantly. We then look at the current and see that it has a maximum of 0.8 of an amp which means that it is really not in the ball-park for this circuit.

We know that the TIP3055 (originally packaged as the 2N3055) is very popular with free-energy builders, so we look it up and find out that it can handle voltages up to 60 volts, 90 watts of power and 15 amps of current. While it is a powerful transistor, it looks as if its voltage rating is too low for this circuit.

So, what do we do now? One way is to ask an electronics expert to suggest a suitable alternative. Another way is to look up the transistors offered by your local supplier, which for me is www.esr.co.uk which leads to this table which is one of many and which has far more entries:

Device	Type	VCB VMAX	IC mA Max	PTOT mW Max	HFE MIN IC mA Max
MJ2501	PNP	80	10A	150W	100@5A
MJ2955	PNP	100	15A	150W	5@10A
MJ11015	PNP	120	30A	200W	1k@20A
MJ11016	NPN	120	30A	200W	1k@20A
MJE340	NPN	300	500	20W	30@50
MJE350	PNP	300	500	20W	30@50
MPSA05	NPN	60	500	625	50@100
MPSA13	NPN	30	500	625	5k@10
MPSA42	NPN	300	500	625	40@30

We want an NPN transistor and so the MJ11016 looks possible with a 100 volt capacity, 30 amp current and 200 watt dissipation. It is a Darlington pair in a single case and so will switch on around 1.4 volts as opposed to 0.7 volts on the base, but that should not make any difference in our circuit. With a gain of 1000 a simple carbon variable resistor could be used to control the base current. There are many other transistors to choose from.

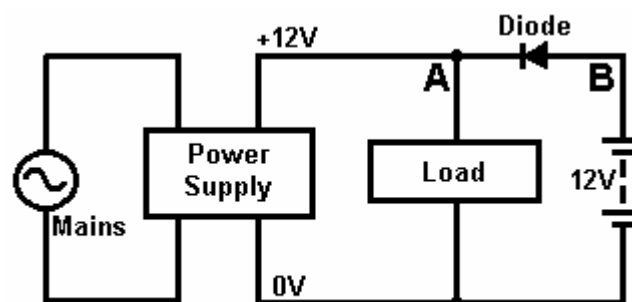
Another way to find a suitable transistor might be to go on eBay and search on "transistor" and see what transistors are popular and how much they cost. An alternative might be to try the circuit with a FET transistor such as the IRF740 which is high voltage, very powerful and not expensive. However, FET transistors trigger on voltage and draw almost no current through their "grid" connection which is the equivalent to a bipolar "base" connection and so some experimentation with the circuit may be needed.

It might also be worthwhile looking to see what transistors were chosen by Alexkor in his 5-battery circuits in chapter 6. If we do that we find the MJE13009 which has an identical specification and so is almost certainly the same as a T13009 transistor and the MJE version is readily available on eBay. Another of his transistors is the 2SC3552 transistor with 500V capability and 150 watt capacity and described as "fast acting".

The Diode

One component which has been shown but not described is the diode or 'rectifier'. This is a device which has a very high resistance to current flowing in one direction and a very low resistance to current flowing in the opposite direction. The base/emitter junction of a transistor is effectively a diode and, at a push, can be used as such. A proper diode is cheap to buy and has far greater voltage and current handling capacities than the base/emitter junction of a transistor.

Diodes are mainly made from one of two materials: germanium and silicon. Germanium diodes are used with very small alternating currents such as radio signals coming from an aerial. This is because a germanium diode needs only 0.2 Volts or so to carry a current while silicon needs 0.6 to 0.7 Volts (same as a silicon transistor base/emitter junction). Germanium diodes (and transistors) are very sensitive to temperature change and so are normally restricted to low power circuits. One very neat application for a silicon diode is as an 'un-interruptible power supply' where mains failure is caught instantly:



Mains Unit Back-up Circuit

In this circuit, the mains voltage drives the Power Supply Unit which generates 12 Volts at point 'A'. This provides current to the Load. The diode has +12 Volts at 'A' and +12 Volts at point 'B' so there is no voltage drop across it and it will not carry current in either direction. This means that the battery is effectively isolated when the mains is

functioning. If the Power Supply Unit output were to rise above its design level of +12 Volts, then the diode would block it from feeding current into the battery.

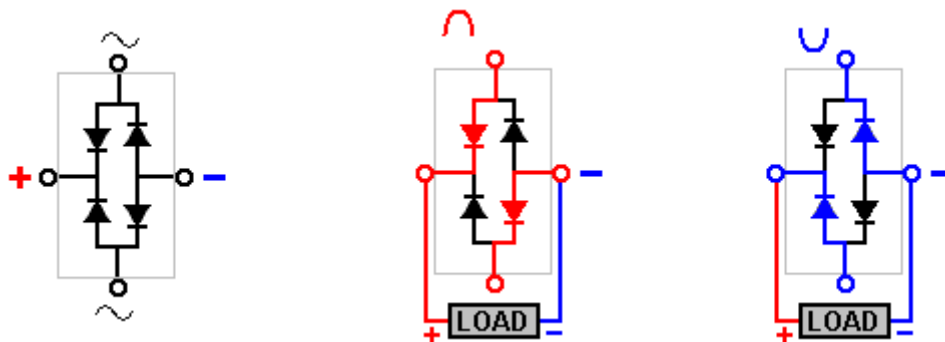
If the mains fails, the Power Supply Unit ('PSU') output will fall to zero. If the battery and diode were not there, the voltage at point 'A' would fall to zero, which would power-down the Load and possibly cause serious problems. For example, if the load were your computer, a mains failure could cause you to lose important data. With a battery back-up of this type, you would have time to save your data and shut your computer down before the battery ran out.

The circuit operates in a very simple fashion. As soon as the voltage at point 'A' drops to 0.7 Volts below the +12 Volts at point 'B', the diode starts feeding current from the battery to the Load. This happens in less than a millionth of a second, so the Load does not lose current. It would be worth adding a warning light and/or a buzzer to show that the mains has failed.

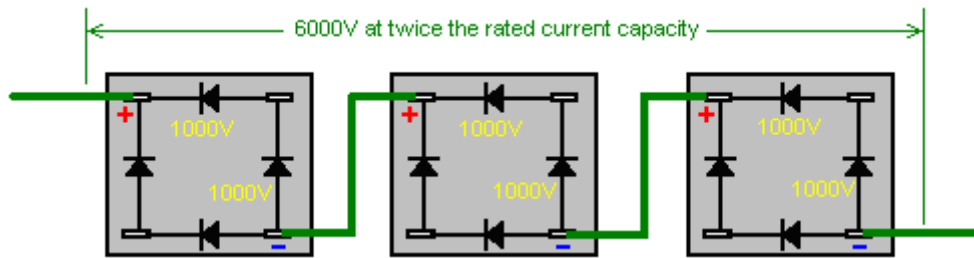
Diodes are also supplied packaged as a diode bridge, with four diodes enclosed inside. Usually intended for power supply rectification, they are not particularly fast-acting diodes, but are cheap and can carry a good deal of current. A common size is with the diodes rated at 1000 volts and able to carry 35 amps. Although there are many package types, a very common package looks like this:



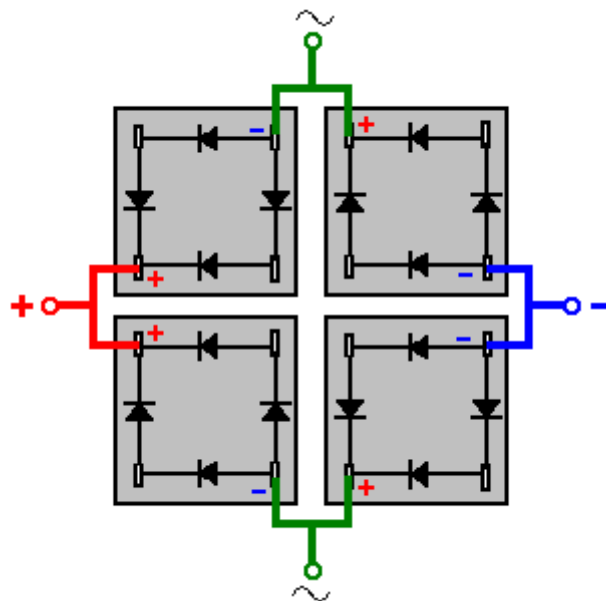
The alternating signal is connected between two opposite corners and the pulsating DC is taken off from the other two terminals. The symbols shown above are normally marked on the flat face which is not seen in this picture. The package has a hole in the centre so that the metal case can be bolted to a heat-sink in order to keep the device reasonably cool when carrying large currents. The connections inside the package are like this:



It is possible to connect the bridge in a different way and use it as a higher voltage double diode arrangement as shown here:

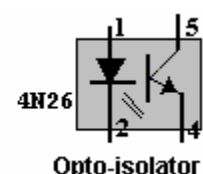


By skipping the alternating current ability and connecting to just the Plus and the Minus terminals, the package provides two pairs of diodes connected in series. This gives twice the voltage handling in both current paths and the rated current handling capacity in both of those two paths which are now connected across each other, which doubles the current handling capacity. The diagram shows how three ordinary, cheap 1000V 35 amp bridges can be connected to give one 70 amp 6000V composite diode. You could, if you wish, raise the specification of a 1000V 35A diode bridge to 2000V 70A by using four of them like this:



Diodes are specified by their voltage handling capacity and their current-carrying capacity and the speed at which they can switch on and off. For power supplies where the frequency is very low, any diode will do, but there are circuits where the switching is needed hundreds of thousand times per second and so the diode specification sheets need to be checked to see what frequency can be handled by any particular diode. Those data sheets can be downloaded free from <http://www.alldatasheet.co.kr/>.

One other thing which needs to be checked for some circuits is the voltage needed to get the diode to switch on. Two common materials used when making diodes are silicon and germanium. Germanium types have a low forward voltage of around 0.2 volts typically which silicon has about a 0.6 volt threshold generally. These voltage figures vary enormously as the current through the diode increases. Circuits which use very low voltages need germanium diodes such as the 1N34.



Light-Emitting Diodes.

There is a widely used variation of the diode which is extremely useful, and that is the Light Emitting Diode or 'LED'. This is a diode which emits light when carrying current. They are available in red, green, blue, yellow or white light versions. Some versions can display more than one colour of light if current is fed through their different electrical connections.

LEDs give a low light level at a current of about 8 or 10 mA and a bright light for currents of 20 to 30 mA. If they are being used with a 12 Volt system, then a series resistor of 1K to 330 ohms is necessary. LEDs are robust

devices, immune to shock and vibration. They come in various diameters and the larger sizes are very much more visible than the tiny ones.

Thyristors (“SCR”s) and Triacs.

Another version of the diode is the Silicon Controlled Rectifier or ‘Thyristor’. This device carries no current until its gate receives an input current. This is just like the operation of a transistor but the SCR once switched on, stays on even though the gate signal is removed. It stays on until the current through the SCR is forced to zero, usually by the voltage across it being removed. SCRs are often used with alternating voltages (described below) and this causes the SCR to switch off if the gate input is removed. SCRs only operate on positive voltages so they miss half of the power available from alternating power supplies. A more advanced version of the SCR is the ‘Triac’ which operates in the same way as an SCR but handles both positive and negative voltages.

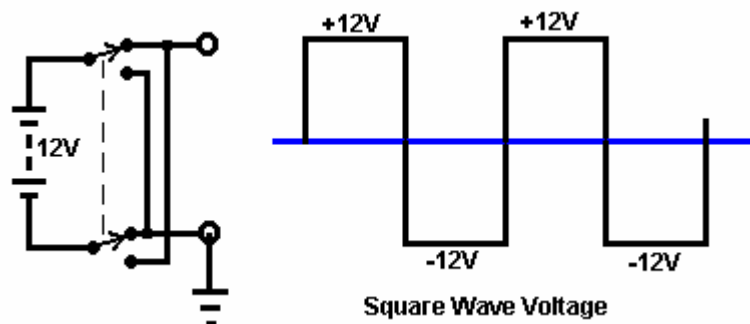
Opto-Isolators.

Another very useful variation on the LED is the Opto-Isolator. This device is a fully enclosed LED and light-sensitive transistor. When the LED is powered up, it switches the transistor on. The big advantage of this device is that the LED can be in a low voltage, low power sensing circuit, while the transistor can be in a completely separate, high voltage, high power circuit. The opto-isolator isolates the two circuits completely from each other. It is a very useful, and very popular, low-cost device.

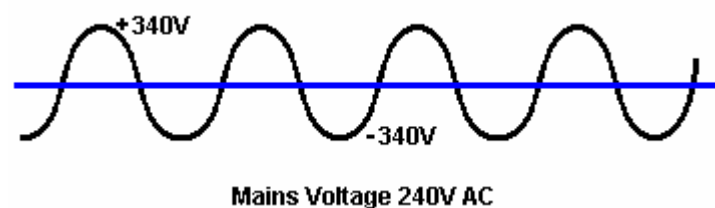
Alternating Current.

A battery provides a constant voltage. This is called a Direct Current or ‘DC’ source of power. When a circuit is connected to a battery, the positive rail is always positive and the negative rail is always negative.

If you connect a battery to a circuit through a double-pole changeover switch as shown here:



When the changeover switch is operated, the battery is effectively turned over or inverted. This circuit is called an ‘inverter’ because it repeatedly inverts the supply voltage. If the switch is operated on a regular, rapid basis, the graph of the output voltage is as shown on the right. This is a ‘square wave’ voltage and is used extensively in electronic equipment. It is called alternating current or ‘AC’ for short. SCRs and Triacs can be used conveniently with supply voltages of this type. Mains voltage is also AC but is rather different:

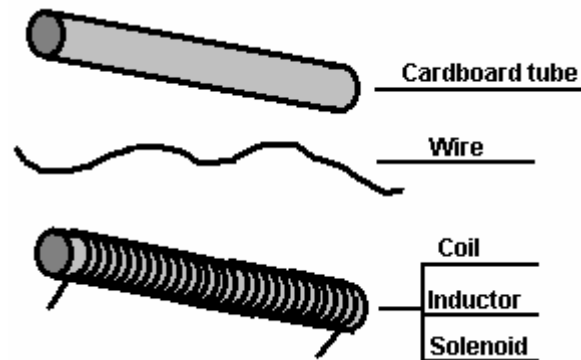


Mains voltage varies continuously in the form of a sine wave. In Britain, the mains voltage is described as ‘240 Volts AC’ and it cycles up and down 50 times per second, i.e. 50 positive peaks and 50 negative peaks in one

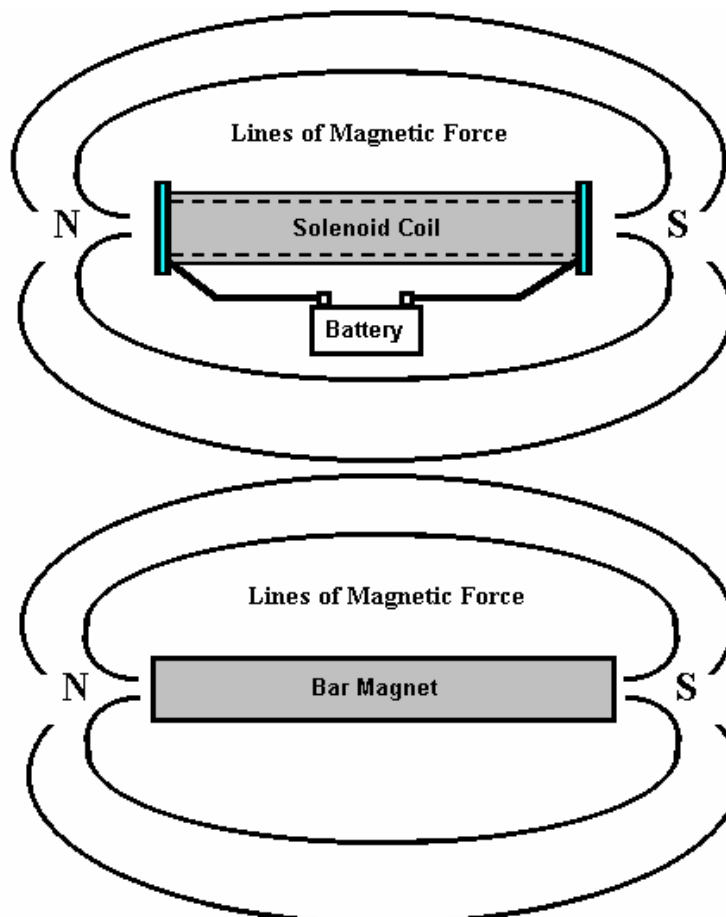
second. It would be reasonable to assume that each voltage peak would be 240 Volts but this is not the case. Even though the supply is described as 240 Volts, it peaks at the square root of 2 times greater than that, i.e. 339.4 Volts. The actual supply voltage is not particularly accurate, so any device intended for mains use should be rated to 360 Volts. In America, the supply voltage is 110 Volts AC and it cycles 60 times per second, peaking at plus and minus 155 Volts. Later on, you will see how one or more diodes can be used to convert AC to DC in a unit which is sold as a 'mains adapter' intended to allow battery operated equipment be operated from the local mains supply.

Coils ("Inductors") and Solenoids.

If you take a cardboard tube, any size, any length, and wind a length of wire around it, you create a very interesting device. It goes by the name of a 'coil' or an 'inductor' or a 'solenoid'.

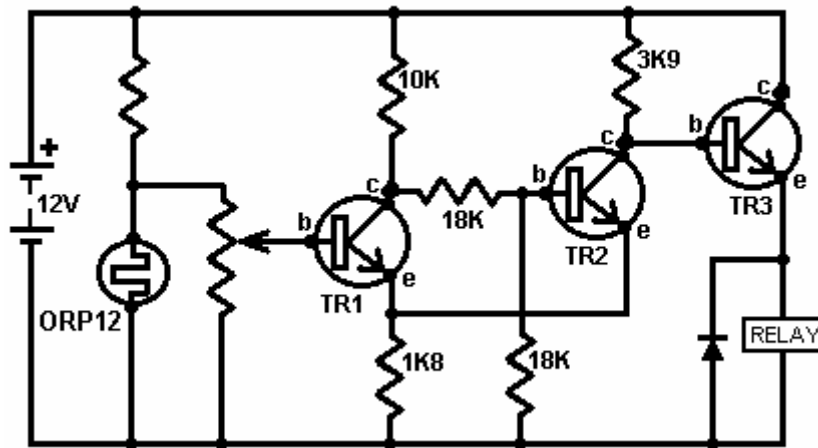


This is a very interesting device with many uses. It forms the heart of a radio receiver, it used to be the main component of telephone exchanges, and most electric motors use several of them. The reason for this is if a current is passed through the wire, the coil acts in exactly the same way as a bar magnet:



The main difference being that when the current is interrupted, the coil stops acting like a magnet, and that can be very useful indeed. If an iron rod is placed inside the coil and the current switched on, the rod gets pushed to one side. Many doorbells use this mechanism to produce a two-note chime. A 'relay' uses this method to close an electrical switch and many circuits use this to switch heavy loads (a thyristor can also be used for this and it has no moving parts).

A coil of wire has one of the most peculiar features of almost any electronic component. When the current through it is altered in any way, the coil opposes the change. Remember the circuit for a light-operated switch using a relay?:

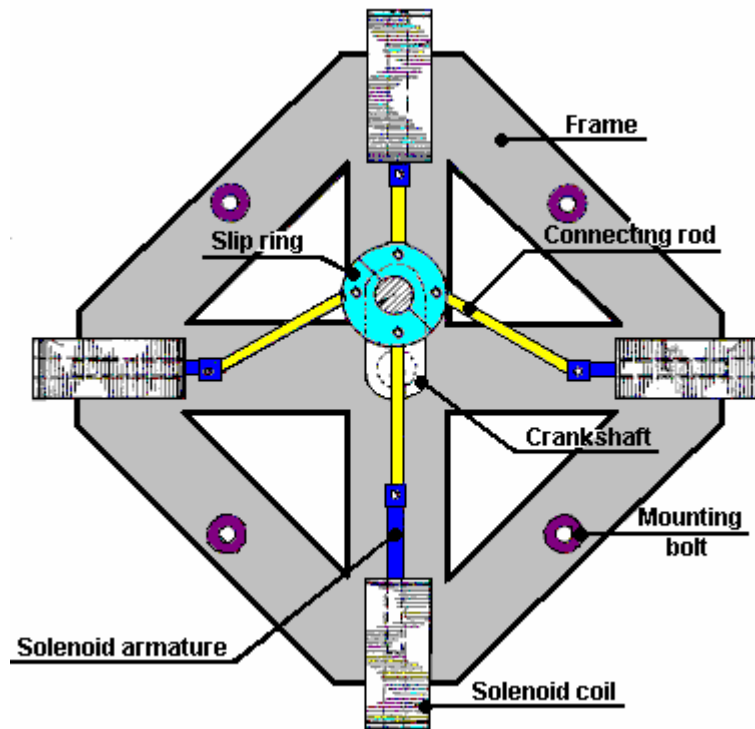


You will notice that the relay (which is mainly a coil of wire), has a diode across it. Neither the relay nor the diode were mentioned in any great detail at that time as they were not that relevant to the circuit being described. The diode is connected so that no current flows through it from the battery positive to the 'ground' line (the battery negative). On the surface, it looks as if it has no use in this circuit. In fact, it is a very important component which protects transistor TR3 from damage.

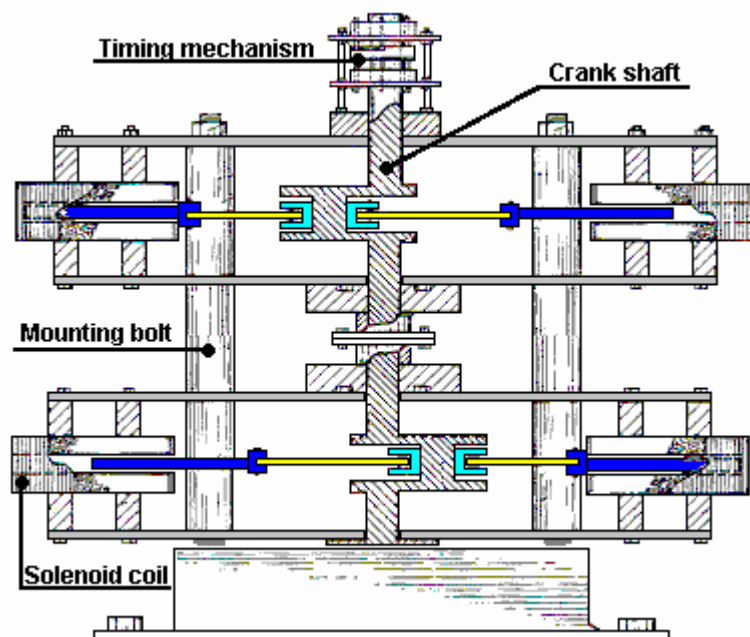
The relay coil carries current when transistor TR3 is on. The emitter of transistor TR3 is up at about +10 Volts. When TR3 switches off, it does so rapidly, pushing the relay connection from +10 Volts to 0 Volts. The relay coil reacts in a most peculiar way when this happens, and instead of the current through the relay coil just stopping, the voltage on the end of the coil connected to the emitter of TR3 keeps moving downwards. If there is no diode across the relay, the emitter voltage is forced to briefly overshoot the negative line of the circuit and gets dragged down many volts below the battery negative line. The collector of TR3 is wired to +12 Volts, so if the emitter gets dragged down to, say, -30 Volts, TR3 gets 42 Volts placed across it. If the transistor can only handle, say, 30 Volts, then it will be damaged by the 42 Volt peak.

The way in which coils operate is weird. But, knowing what is going to happen at the moment of switch-off, we deal with it by putting a diode across the coil of the relay. At switch-on, and when the relay is powered, the diode has no effect, displaying a very high resistance to current flow. At switch-off, when the relay voltage starts to plummet below the battery line, the diode effectively gets turned over into its conducting mode. When the voltage reaches 0.7 Volts below the battery negative line, the diode starts conducting and pins the voltage to that level until the voltage spike generated by the relay coil has dissipated. The more the coil tries to drag the voltage down, the harder the diode conducts, stifling the downward plunge. This restricts the voltage across transistor TR3 to 0.7 Volts more than the battery voltage and so protects it.

Solenoid coils can be very useful. Here is a design for a powerful electric motor patented by the American, Ben Teal, in June 1978 (US patent number 4,093,880). This is a very simple design which you can build for yourself if you want. Ben's original motor was built from wood and almost any convenient material can be used. This is the top view:



And this is the side view:



Ben has used eight solenoids to imitate the way that a car engine works. There is a crankshaft and connecting rods, as in any car engine. The connecting rods are connected to a slip-ring on the crankshaft and the solenoids are given a pulse of current at the appropriate moment to pull the crankshaft round. The crankshaft receives four pulls on every revolution. In the arrangement shown here, two solenoids pull at the same moment.

In the side view above, each layer has four solenoids and you can extend the crankshaft to have as many layers of four solenoids as you wish. The engine power increases with every layer added. Two layers should be quite adequate as it is a powerful motor with just two layers.

An interesting point is that as a solenoid pulse is terminated, its pull is briefly changed to a push due to the weird nature of coils. If the timing of the pulses is just right on this motor, that brief push can be used to increase the power of the motor instead of opposing the motor rotation. This feature is also used in the Adams motor described in the 'Free-Energy' section of this document.

The strength of the magnetic field produced by the solenoid is affected by the number of turns in the coil, the current flowing through the coil and the nature of what is inside the coil 'former' (the tube on which the coil is wound). In passing, there are several fancy ways of winding coils which can also have an effect, but here we will only talk about coils where the turns are wound side by side at right angles to the former.

1. Every turn wound on the coil, increases the magnetic field. The thicker the wire used, the greater the current which will flow in the coil for any voltage placed across the coil. Unfortunately, the thicker the wire, the more space each turn takes up, so the choice of wire is somewhat of a compromise.

2. The power supplied to the coil depends on the voltage placed across it. $\text{Watts} = \text{Volts} \times \text{Amps}$ so the greater the Volts, the greater the power supplied. But we also know from Ohm's Law that $\text{Ohms} = \text{Volts} / \text{Amps}$ which can also be written as $\text{Ohms} \times \text{Amps} = \text{Volts}$. The Ohms in this instance is fixed by the wire chosen and the number of turns, so if we double the Voltage then we double the current.

For example: Suppose the coil resistance is 1 ohm, the Voltage 1 Volt and the Current 1 Amp. Then the power in Watts is $\text{Volts} \times \text{Amps}$ or 1×1 which is 1 Watt.

Now, double the voltage to 2 Volts. The coil resistance is still 1 ohm so the Current is now 2 Amps. The power in Watts is $\text{Volts} \times \text{Amps}$ or 2×2 which is 4 Watts. Doubling the voltage has quadrupled the power.

If the voltage is increased to 3 Volts. The coil resistance is still 1 ohm so the Current is now 3 Amps. The power in Watts is $\text{Volts} \times \text{Amps}$ or 3×3 which is 9 Watts. The power is $\text{Ohms} \times \text{Amps squared}$, or $\text{Watts} = \text{Ohms} \times \text{Amps} \times \text{Amps}$. From this we see that the voltage applied to any coil or solenoid is critical to the power developed by the coil.

3. What the coil is wound on is also of considerable importance. If the coil is wound on a rod of soft iron covered with a layer of paper, then the magnetic effect is increased dramatically. If the rod ends are tapered like a flat screwdriver or filed down to a sharp point, then the magnetic lines of force cluster together when they leave the iron and the magnetic effect is increased further.

If the soft iron core is solid, some energy is lost by currents flowing round in the iron. These currents can be minimised by using thin slivers of metal (called 'laminations') which are insulated from each other. You see this most often in the construction of transformers, where you have two coils wound on a single core. As it is convenient for mass production, transformers are usually wound as two separate coils which are then placed on a figure-of-eight laminated core.

However, while all that information is a useful, gentle introduction to what an inductor is, it does not convey the most important feature of a coil, which is that every coil stores energy when it is connected to a power source and it returns almost all of that energy when disconnected from the power source. The return of the stored energy happens in a very short period of time and that feature can produce powerful systems if you have the expertise to capture and use that power.

For example, it is not unusual for a simple 12-volt system to generate a rapid series of 400-volt pulses which can be used to recondition and charge car batteries. There are many examples of this in chapter 6.

Paul Babcock (www.paulmariobabcock.com) destroyed more than a thousand transistors when developing his magnetic motor system as the return of coil energy is so fast that it produces high current flows, and if the capacitor into which the current return is being fed is of a low capacity, voltages higher than the supply voltage are produced. For the last hundred years or so, this sort of information has been suppressed, so take what is said in standard textbooks as being a mixture of half truths and downright lies.

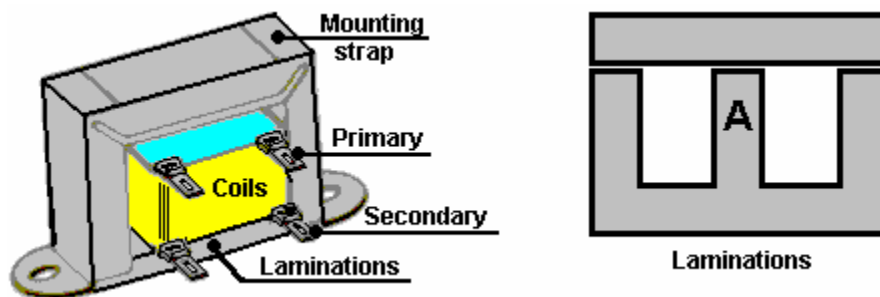
As 'Kone' has demonstrated, if you short-circuit a powered coil, it causes multiple magnetic pulses as the power in the coil oscillates backwards and forwards through the closed circuit containing the coil:



Magnetism is a field which has not been taught or generally researched for many decades. It is not a simple subject. The magnetic strength produced by any coil increases as the number of turns in the coil increases (if the current flowing through the coil remains the same). That means that a coil with many turns can produce a higher magnetic field at a lower current than a high-current coil with few turns. However, other coil characteristics are also altered. The power loss due to the resistance of the wire in the coil increases with increased turns as they need a longer length of wire. That power loss results in the coil heating up when in use. The speed with which the magnetic field develops and decays is slower for a coil with many turns. Surprisingly, because of this, the best coil for many jobs ends up having relatively few turns.

Transformers.

Transformers are used to alter the voltage of any alternating current power source. If the alteration increases the output voltage, then the transformer is called a 'step-up' transformer. If the output voltage is lower than the input voltage then it is called a 'step-down' transformer. If the voltages are the same, it is called an 'isolation' transformer. A common construction looks like this:



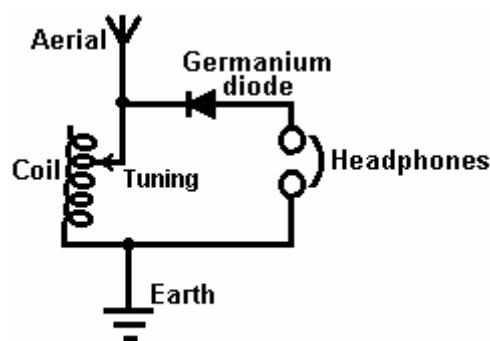
The Coil bobbin sits on the section of the laminations marked 'A' above. The coil is wound on its bobbin former, first one winding and then the second winding. The bobbin is then placed on the central part of the 'E' shaped laminations and then completely surrounded by the laminations when the crossbar is placed on the top. The mounting strap is used to hold the two sets of laminations together and provide mounting lugs for attaching the transformer to a chassis. There are typically, twenty laminations in each set and every lamination is insulated from the adjoining laminations.

If you want to change the voltage of a battery supply, it is possible to build an electronic circuit to generate an alternating voltage and then use a transformer to change that alternating voltage to whatever voltage you want. The most common form of this, is for generating mains voltage from a 12 Volt car battery, so that mains equipment can be run in remote locations, such as boats, caravans, etc. These circuits are called 'inverters' and they are very popular pieces of equipment. The voltage in the secondary coil of any transformer is determined by the ratio of the turns in the primary and secondary windings.

For example; if there is a 10 Volt alternating voltage available and you have a transformer which has 100 turns in the primary coil and 1000 turns in the secondary coil. If you connect the 10 Volts across the primary, there will be 100 Volts generated across the secondary coil.

Instead, if you connect the 10 Volts across the secondary coil, a voltage of 1 Volts will be generated across the primary winding. This is because there is a 10:1 ratio between the two windings. The Law of Conservation of Energy applies to transformers as it does to everything else. The power input to the primary winding will be the same as the power in the secondary winding minus the losses. The losses, in this case, will be a temperature rise of the whole transformer. If the current passed through the transformer is well below its rated capacity, then the losses will be small. The important point is that 10 Volts at 1 Amp into the primary winding will generate 100 Volts in the secondary, but at somewhat less than 0.1 Amps: Power Input is 10 Watts and Power Output is almost 10 Watts. The voltage has been raised to 100 Volts but the potential current draw has been reduced from 1 Amp to 0.1 Amps (100 mA).

In practice, the thickness of the wire used in the windings is very important. If the voltage to be placed across the winding is high, then the wire diameter will be small. Coil windings have fairly low resistances but this is not critical in circuits as coils operate in a peculiar way. Coils have AC 'impedance' in addition to their DC 'resistance'. While Direct Current (from a battery, say) can flow quite easily through a coil with low resistance, Alternating Current may have a hard job getting through the coil due to its high 'impedance'. Sometimes, coils are used to choke off any AC ripple (interference) coming along a DC power cable. When a coil is used for this purpose it is called a 'choke'. Each coil has its own resonant frequency and at that frequency it is very difficult for AC to get through the coil. Crystal set radios work on that principle:



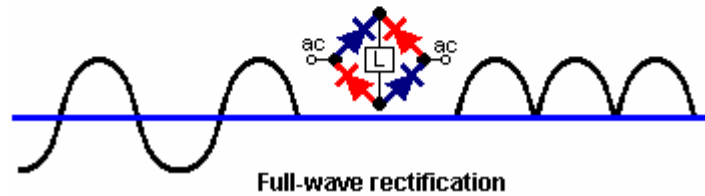
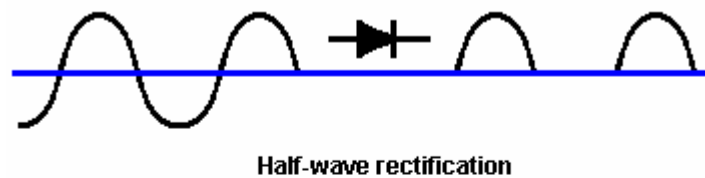
Crystal Set Radio

Here, the aerial picks up every radio station broadcasting in the area. These are all at different frequencies and they all head down the aerial wire, looking for the easiest path to the earth connection. Most of them run through the coil with no problem whatsoever. If the resonant frequency of the coil matches the frequency of one of the radio stations, then that radio signal (and **only** that signal) finds it very hard to get through the coil and looks for an easier path to earth. The next easiest path is through the diode and the headphones, so the signal goes that way. The diode blocks part of the signal which generates the sound of the radio broadcast in the headphones.

This system works very well indeed if there is a good radio signal. A germanium diode is used as the radio signal voltage is very small and a germanium diode operates on 0.2 Volts while a silicon diode needs 0.7 Volts to operate. That difference is significant at these very low voltages. The resonant frequency of the coil depends on the number of turns in the coil. In this design, the coil has a slider which allows the number of turns to be altered and so, different radio stations to be tuned in.

Rectification and Power Supplies.

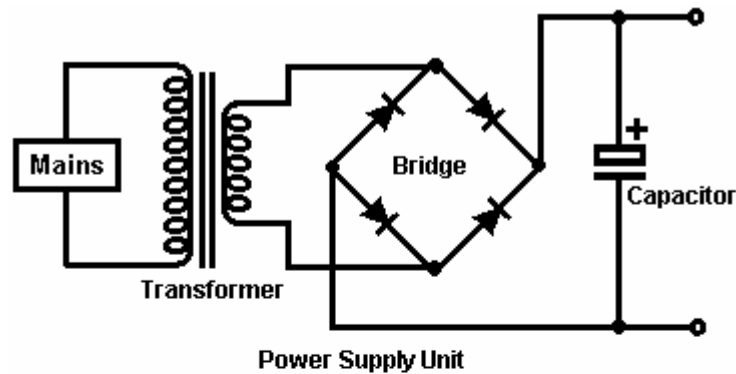
We now have the question of how do we turn an alternating voltage into a constant 'direct' voltage. The crystal radio set operates by chopping off half of the alternating radio signal. If we were to do this to the output from a mains transformer with an output of say, 12 Volts AC, the result is not very satisfactory:



Here, we have the situation shown in the upper diagram. The output consists of isolated pulses at 50 per second. You will notice that there is **no** output power for half of the time. The negative part of the waveform is blocked by the high resistance of the diode while the positive part of the waveform is allowed through by the low resistance of the 'forward-biased' diode. It should be remembered that the diode drops 0.7 Volts when conducting so the output of the half-wave rectified transformer will be 0.7 Volts lower than the transformer's actual output voltage.

If four diodes are used instead of one, they can be arranged as shown in the lower diagram. This arrangement of diodes is called a 'bridge'. Here the positive part of the waveform flows through the upper blue diode, the load 'L' and on through the lower blue diode. The negative part flows through the left hand red diode, the load and then the right hand red diode. This gives a much better output waveform with twice the power available. The output voltage will be 1.4 Volts less than the transformer output voltage as there are two silicon diodes in the supply chain.

The output from even the full-wave rectifier is still unsatisfactory as there is a voltage drop to zero volts 100 times per second. Only a few devices operate well with a power supply like that, an incandescent bulb as used in a car can use this output, but then, it could use the original AC supply without any rectification. We need to improve the output by using a reservoir device to supply current during those moments when the voltage drops to zero. The device we need is a **Capacitor** which used to be called a 'condenser'. The circuit of a mains unit using a capacitor is shown here:

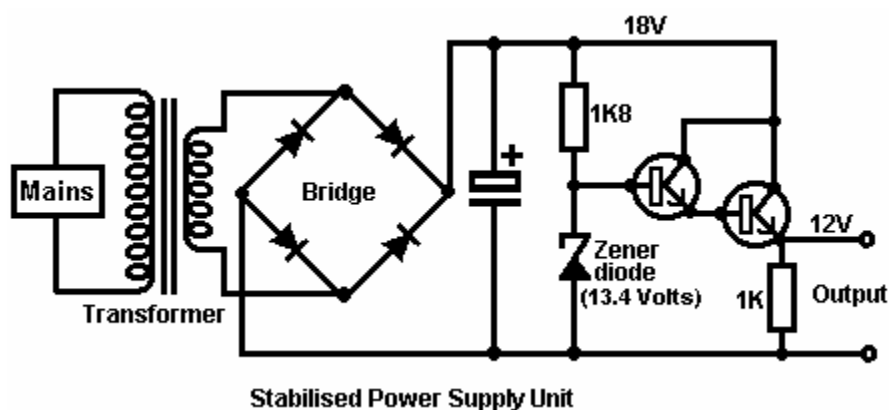


Output Voltage Light load

Output Voltage Heavy load Ripple

This produces a much better result as the capacitor stores some of the peak energy and gives it out when the voltage drops. If the load on the unit is light with not very much current taken from it, the output voltage is quite good. However, if the current drain is increased, the output voltage gets dragged down 100 times per second. This voltage variation is called 'ripple' and if the unit is supplying an audio system or a radio, the ripple may well be heard as an annoying hum. The larger the capacitor for any given current draw, the smaller the ripple.

To improve the situation, it is normal to insert an electronic control circuit to oppose the ripple:



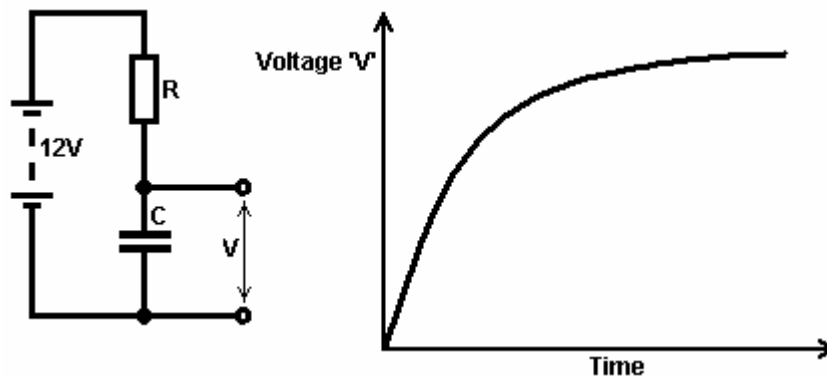
This circuit uses one new component, a new variety of diode called a 'Zener' diode. This device has an almost constant voltage drop across it when its current-blocking direction breaks down. The diode is designed to operate in this state to provide a reference voltage. The circuit merely uses a tiny current from the top of the zener diode to drive the Darlington pair emitter-follower transistors used to provide the output current.

With this circuit, when the output current is increased, the resistance of the transistor pair automatically reduces to provide more current without varying the output voltage. The 1K resistor is included to give the transistors a completed circuit if no external equipment is connected across the output terminals. The zener diode is chosen to give 1.4 Volts more than the required output voltage as the two transistors drop 1.4 Volts when conducting.

You should note that the output transistor is dropping 6 Volts at the full supply current. Watts = Volts x Amps so the power dissipated by the transistor may be quite high. It may well be necessary to mount the transistor on an aluminium plate called a 'heat sink' to keep it from overheating. Some power transistors, such as the 2N3055, do

not have the case isolated from the active parts of the transistor. It is good practice to use a mica gasket between the transistor and the heat-sink as it conducts then heat without making an electrical connection to the metal heat-sink.

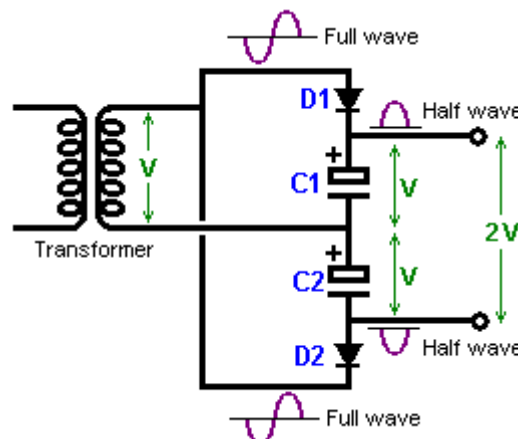
A capacitor, being an electrical reservoir, can be used as part of a timer circuit. If the current flow into it is restricted by passing it through a resistor. The length of time between starting the flow on an empty capacitor, and the voltage across the capacitor reaching some chosen level, will be constant for a high-quality capacitor.



As the voltage increase tails off, it becomes more difficult to measure the difference accurately, so if the capacitor is to be used for generating a time interval, it is normal to use the early part of the graph area where the line is fairly straight and rising fast.

The Voltage Doubler.

It is possible to increase the output voltage of a transformer although this does reduce its ability to supply current at that voltage. The way that this is done is to feed the positive cycles into one storage capacitor and the negative cycles into a second reservoir capacitor. This may sound a little complicated, but in reality, it isn't. A circuit for doing this is shown here:

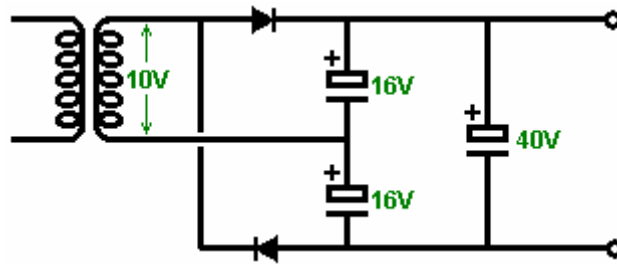


With this circuit, the transformer output is some voltage, say "V" volts of AC current. This output waveform is fed to capacitor "C1" through diode "D1" which lops off the negative part of the cycle. This produces a series of positive half-cycles which charge up capacitor "C1" with a positive voltage of "V".

The other half of the output is fed to capacitor "C2" through diode "D2" which cuts off the positive part of the cycle, causing capacitor "C2" to develop a voltage of -V across it. As the two capacitors are 'in series' and not placed across each other, their voltages add up and produce twice the transformer output voltage.

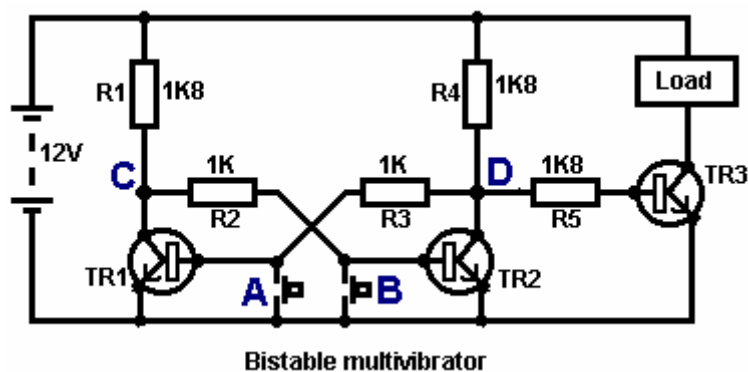
A word of warning here. The transformer is producing an AC waveform and these are marked with the **average** voltage of the waveform, which is usually a sine wave. The peak voltage of a sinewave is 41% greater than this, so if your transformer has an AC output of 10 volts, then the peaks fed to the capacitors will be about 14.1 volts. If there is no current draw from the capacitors (that is, with the load switched off), then each capacitor will charge to this 14.1 volts and the overall output voltage will be 28.2 volts and **not** the 20 volts which you might expect. You need to understand that as this is only a half-wave supply, there will be considerable ripple on the output voltage if the current draw is high.

Using one additional smoothing capacitor and paying attention to the voltage ratings of the capacitors, the 28 volts supply circuit might be like this:



Multivibrators: The Bistable.

The number of electronic circuits which can be built with basic components such as resistors, capacitors, transistors, coils, etc. is limited only by your imagination and needs. Here is a circuit where two transistors operate as a pair:



This circuit has two stable states and so it is called a “bi” “stable” or “bistable” circuit. It is important to understand the operation of this simple and useful circuit.

If press-button switch ‘A’ is pressed, it short-circuits the base/emitter junction of transistor TR1. This prevents any current flowing in the base/emitter junction and so switches TR1 hard off. This makes the voltage at point ‘C’ rise as high as it can. This leaves transistor TR2 powered by R1 and R2 which have 11.3 Volts across them and switches TR2 hard on.

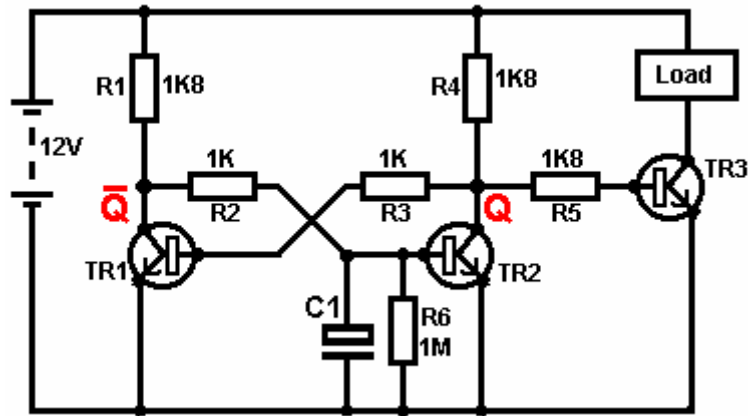
This pulls point ‘D’ down to about 0.1 Volts. This happens in less than a millionth of a second. When the press-button switch ‘A’ is released, transistor TR1 does not switch on again because its base current flows through resistor R3 which is connected to point ‘D’ which is far, far below the 0.7 Volts needed to make TR1 start conducting.

The result is that when press-button ‘A’ is pressed, transistor TR2 switches on and stays on even when press-button ‘A’ is released. This switches transistor TR3 off and starves the Load of current. This is the first ‘stable state’.

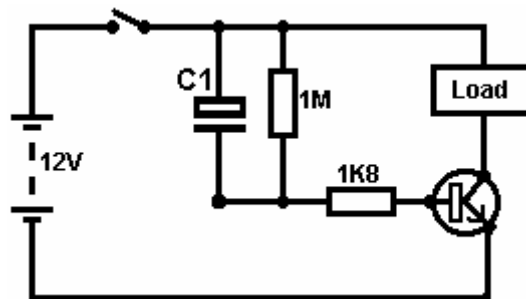
The same thing happens when press-button ‘B’ is pressed. This forces transistor TR2 into its ‘off’ state, raising point ‘D’ to a high voltage, switching transistor TR3 hard on, powering the Load and holding transistor TR1 hard off. This is the second of the two ‘stable states’.

In effect, this circuit ‘remembers’ which press-button was pressed last, so millions of these circuits are used in computers as Random Access Memory (‘RAM’). The voltage at point ‘C’ is the inverse of the voltage at point ‘D’, so if ‘D’ goes high then ‘C’ goes low and if ‘D’ goes low, then ‘C’ goes high. In passing, the output at ‘D’ is often called ‘Q’ and the output at ‘C’ is called ‘Q-bar’ which is shown as the letter Q with a horizontal line drawn above it. This is shown on the next circuit diagram.

A minor variation of this circuit allows a load to be energised when the circuit is powered up:



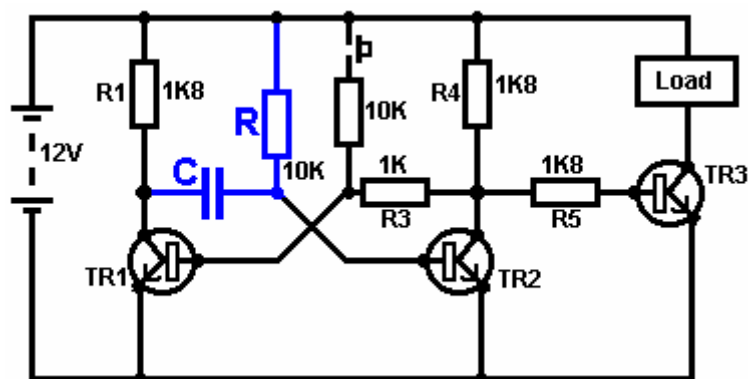
When powered down, the capacitor 'C1' in this circuit is fully discharged through resistor 'R6'. When the 12 Volts supply is connected to the circuit, capacitor C1 does not charge instantly and so holds the base of TR2 down below 0.7 Volts for much longer than it takes for transistor TR1 to switch on (which, in turn, holds TR2 hard off). Mind you, if it is not necessary to have the Load held powered on indefinitely, then an even more simple circuit can do this:



Here, when the switch is closed, both sides of the capacitor C1 are at +12 Volts and this causes the 1K8 resistor to conduct heavily, driving the transistor and powering the load. The capacitor charges rapidly through the transistor and reaches the point at which it can no longer keep the transistor switched on. When the battery is switched off, the 1M resistor discharges the capacitor, ready for the next time the battery is connected.

the Monostable Multivibrator.

The monostable has one stable state and one unstable state. It can be flipped out of its stable state but it will 'flop' back into its stable state. For that reason, it is also known as a 'flip-flop' circuit. It is similar to a bistable circuit, but one of the cross-link resistors has been replaced by a capacitor which can pass current like a resistor, but only for a limited amount of time, after which, the capacitor becomes fully charged and the current flow stops, causing the 'flop' back to the stable state once more.



In this circuit, the 'R' resistor and the 'C' capacitor values determine how long the monostable will be in its unstable state. The circuit operates like this:

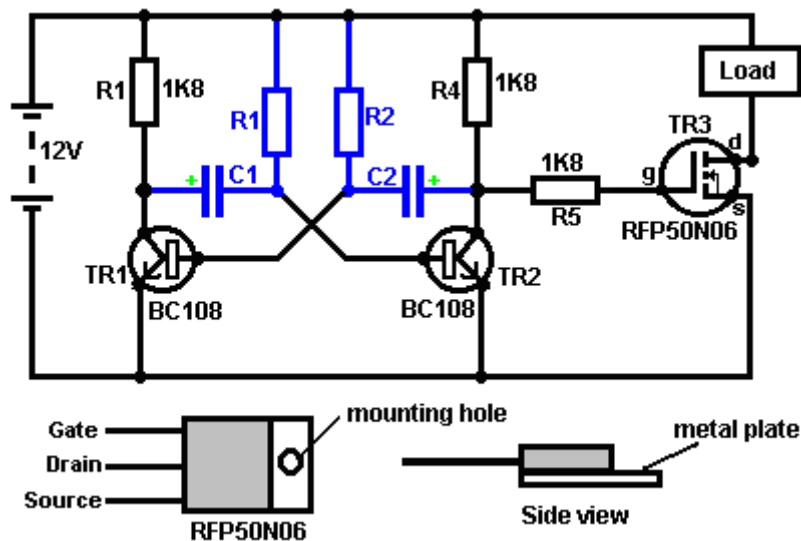
1. In the stable state, transistor TR1 is off. Its collector voltage is high, pushing the left hand side of capacitor 'C' to near +12 Volts. As the right hand side of capacitor 'C' is connected to the base of TR2 which is at 0.7 Volts, the capacitor gets charged to about 11.3 Volts.

2. The press-button switch is operated briefly. This feeds current through its 10K resistor to the base of transistor TR1, switching it hard on. This drops the collector voltage of TR1 to near 0 Volts, taking the left hand side of the capacitor with it.
3. As the voltage across a capacitor can't change instantly, the right hand side of the capacitor drives the base of transistor TR2 down below 0.7 Volts, causing TR2 to switch off.
4. The circuit can't hold TR2 in its 'off' state for ever. The resistor 'R' feeds current into the capacitor, forcing the voltage at the base of TR2 steadily upwards until the voltage reaches 0.7 Volts and transistor TR2 switches on again, forcing TR1 off again (provided that the press-button switch has been released). This is the stable state again. If the press-button switch is held on, then both transistors will be on and the output voltage will still be low. Another output pulse will not be generated until the press-button is let up and pressed again.

This circuit could be used to switch a microwave oven on for any chosen number of seconds, create a delay on your home-built burglar alarm, to give you time to switch it off after walking through your front door, operate a solenoid valve to feed a pre-determined quantity of beverage into a bottle on a production line, or whatever...

The Astable Multivibrator.

The astable circuit is the monostable with a second capacitor added so that neither state is stable. This results in the circuit flopping backwards and forwards continuously:



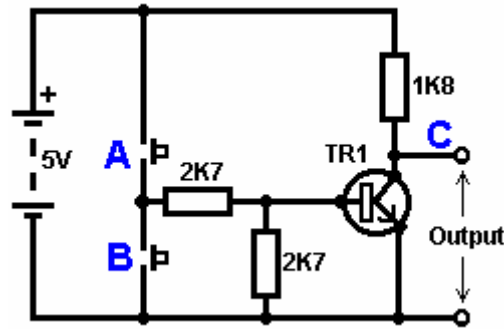
The rate of switching is controlled by the R1/C1 and R2/C2 combinations. The load's ON time to its OFF time is called the 'mark-space' ratio, where the ON period is the 'mark' and the OFF period is the 'space'. If you choose to use electrolytic capacitors which have their own polarity, then the +ve end of each capacitor is connected to the transistor collector.

While it is good to understand how these multivibrator circuits operate and can be built, nowadays there are pre-built circuits encased in a single package which you are much more likely to choose to use. These are called Integrated Circuits or 'ICs' for short. We will be discussing these shortly. Before we do, notice that in the circuit above, transistor TR3 has been changed to a new variety called a **Field Effect Transistor** ('FET'). This type of transistor is newer than the 'bipolar' transistors shown in the earlier circuits. FETs come in two varieties: 'n-channel' which are like NPN transistors and 'p-channel' which are like PNP transistors.

FETs are more difficult to make but have now reached a level of cost and reliability which makes them very useful indeed. They require almost no base current (called 'gate' current with this type of transistor) which means that they have almost no effect on any circuit to which they are attached. Also, many of them can handle large currents and boast major power handling capabilities. Because of this, it is usual to see them packaged with a metal plate mounting, ready to be bolted to an aluminium heat-sink plate to help dissipate the heat generated by the large amount of power flowing through them. The 'RFP50N06' shown above can handle up to 50 Volts and carry up to 60 Amps, which is serious power handling.

Inverters and Truth Tables.

Consider the following circuit:

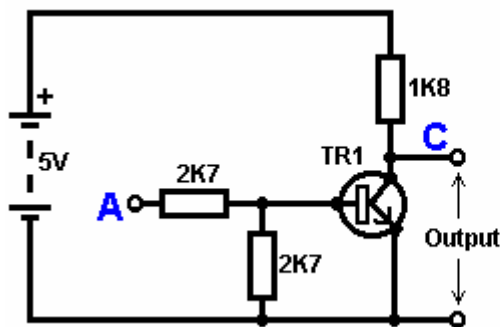


If neither of the press-button switches are operated, the transistor has no base/emitter current flow and so it is off. This places the collector voltage at 'C' near the positive rail (+5 Volts).

If press-button switch 'A' is operated, the base voltage tries to rise to half of the battery voltage but doesn't make it because the transistor base pins it down to 0.7 Volts. This feeds base current to the transistor, switching it hard on and causing the output at 'C' to drop to nearly 0 Volts.

If press-button switch 'B' is operated (don't do this when switch 'A' is closed or you will get a very high 'short-circuit' current flowing directly through the two switches) it has no effect on the output voltage which will stay high.

If we re-draw the circuit like this:



TRUTH TABLE	
Input A	Output C
0	1
1	0

Key:

0 = Less than 0.5 Volts
1 = More than 3.5 Volts

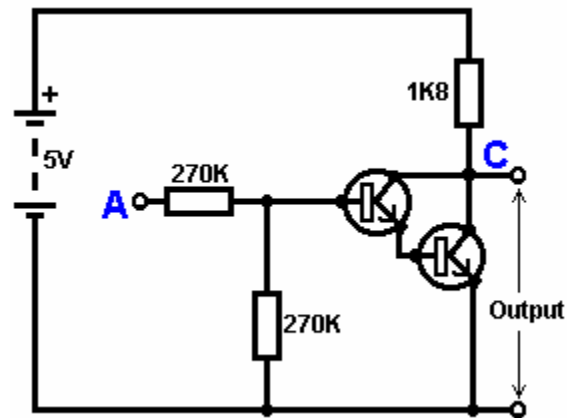
We can see that if the voltage at the input 'A' is taken high, then the output voltage at 'C' will be low. If the voltage at the input 'A' is taken low, then the output voltage at 'C' will be high. A circuit which does this is called an 'Inverter' because it 'inverts' (or 'turns upside down') the input voltage.

We can summarise this operation in a table. Personally, I would call the table an 'Input/Output' table, but for no obvious reason, the standard name is a 'Truth' table. The purpose of this table is to list all of the possible inputs and show the corresponding output for each input.

Another standard, is to substitute '1' for 'High Voltage' and '0' for 'Low Voltage'. You will notice that many items of electrical and electronic equipment have these symbols on the ON / OFF switch. In computer circuitry (hah! you didn't notice that we had moved to computer circuits, did you?), the '0' represents any voltage below 0.5 Volts and the '1' represents any voltage above 3.5 Volts. Many, if not most, computers operate their logic circuits on 5 Volts. This Inverter circuit is a 'logic' circuit.

A criticism of the above circuit is that its input resistance or 'impedance' is not particularly high, and its output impedance is not particularly low. We would like our logic circuits to be able to operate the inputs of eight other logic circuits. The jargon for this is that our circuit should have a 'fan-out' of eight.

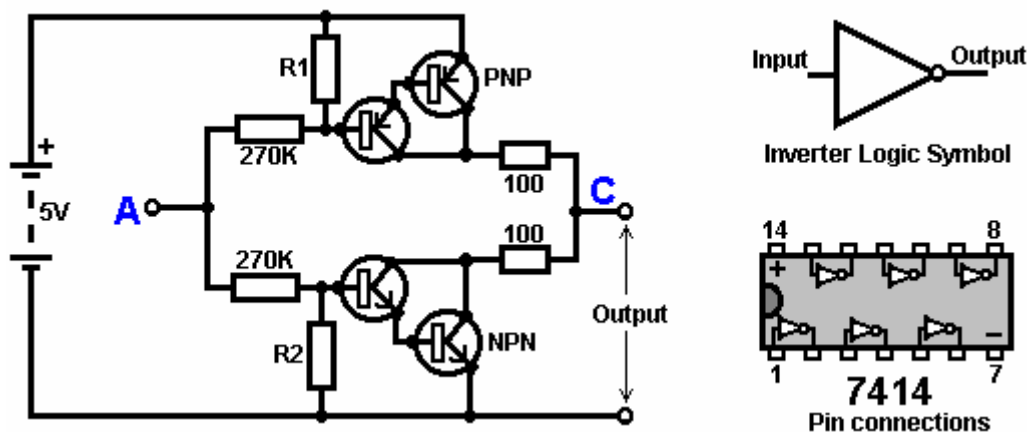
Let's go for a simple modification which will improve the situation:



Here, The input impedance has been increased by a factor of 100 by using a Darlington pair of transistors which need far less base current, and so can have a much higher input resistor.

Unfortunately, the output impedance is still rather high when the transistors are in their OFF state as any current taken from the positive line has to flow through the 1K8 (1800 ohm) resistor. But we need this resistor for when the transistors are in their ON state. We really need to change the 1K8 resistor for some device which has a high resistance at some times and a low resistance at other times. You probably have not heard of these devices, but they are called 'transistors'.

There are several ways to do this. We might choose to use PNP transistors (we normally use NPN types) and connect these in place of the 1K8 resistor. Perhaps we might use a circuit like this:

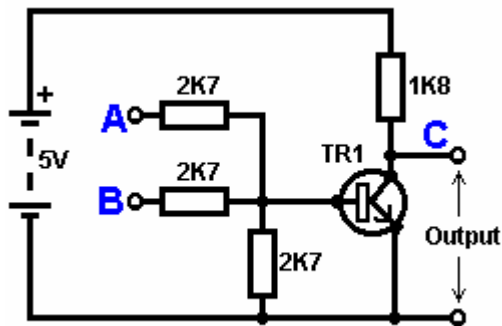


This circuit is starting to look complicated and I don't like complicated circuits. It is not as bad as it looks. The NPN transistors at the bottom are almost the same as the previous circuit. The only difference is that the collector load is now two 100 ohm resistors plus the resistance of the two transistors. If the PNP transistors are OFF when the NPN transistors are ON, then the circuit loading on the NPN transistors will be negligible and the whole of the NPN transistors output will be available for driving external circuits through the lower 100 ohm resistor (a large 'fan-out' for the '0' logic state). To make sure that the PNP transistors are hard off before the NPN transistors start to switch on, the resistor 'R1' needs to be selected carefully.

The PNP transistors are an exact mirror image of the NPN side, so resistor R2 needs to be selected carefully to ensure that the NPN transistors are switched hard OFF before the PNP transistors start to switch ON.

You need not concern yourself unduly with that circuit, because you will almost certainly use an Integrated Circuit rather than building your own circuit from 'discrete' components. An Integrated Circuit containing six complete inverters is the 7414 which is shown above. This comes in a small black case with two rows of 7 pins which make it look a bit like a caterpillar. Because there are two row of pins, the packaging is called "Dual In-Line" or "DIL" for short.

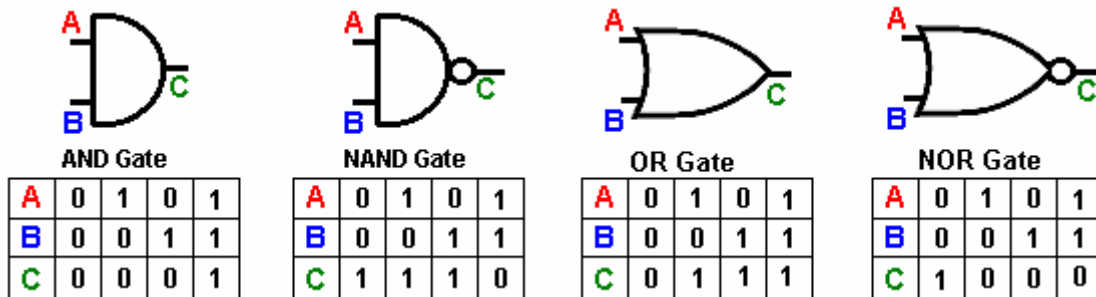
Now, consider the following circuit:



TRUTH TABLE		
Input A	Input B	Output C
0	0	1
0	1	0
1	0	0
1	1	0

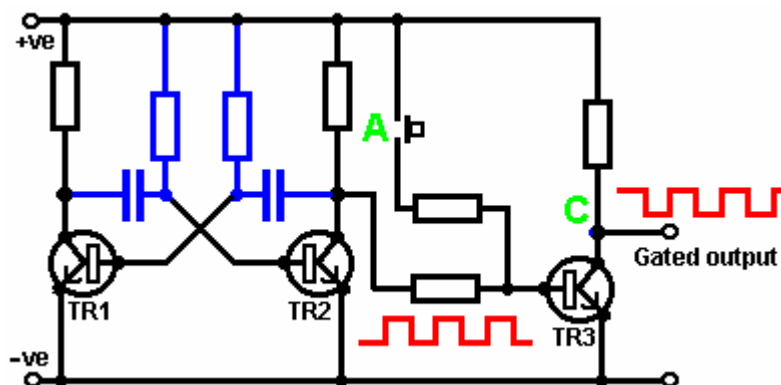
0 = Low voltage 1 = High Voltage

This circuit operates the same way as the Inverter circuit, except that it has two inputs ('A' and 'B'). The output voltage at 'C' will be low if either, 'A' OR 'B' or both, of the inputs is high. The only time that the output is high, is when both Input 'A' and Input 'B' are low. Consequently, the circuit is called an "OR" gate. Strictly speaking, because the output voltage goes Down when the input voltage goes Up, it is called a "Not OR" gate, which gets shortened to a "NOR" gate. In this context, the word "not" means "inverted". If you fed the output 'C' into an inverter circuit, the resulting circuit would be a genuine "OR" gate. The digital circuit symbols for an AND gate, a NAND gate, an OR gate and a NOR gate are:



Gating.

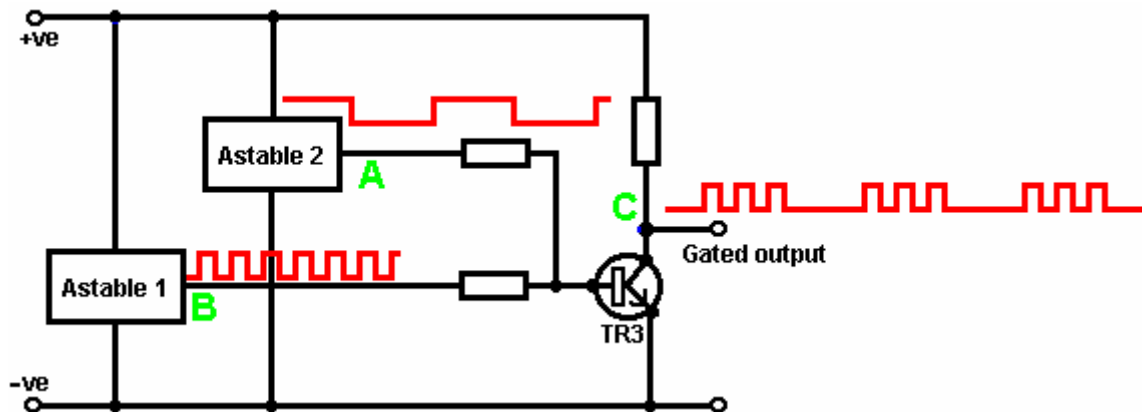
These common chips are usually supplied with 2, 4 or 8 inputs. So, why is it called a "Gate" - isn't it just a double inverter? Well, yes, it **is** a double inverter, but a double inverter acts as a gate which can pass or block an electronic signal. Consider this circuit:



Here, transistors 'TR1' and 'TR2' are connected to form an astable (multivibrator). The astable runs freely, producing the square wave voltage pattern shown in red. Transistor 'TR3' passes this voltage signal on. TR3 inverts the square wave, but this has no practical effect, the output being the same frequency square wave as the signal taken from the collector of TR2.

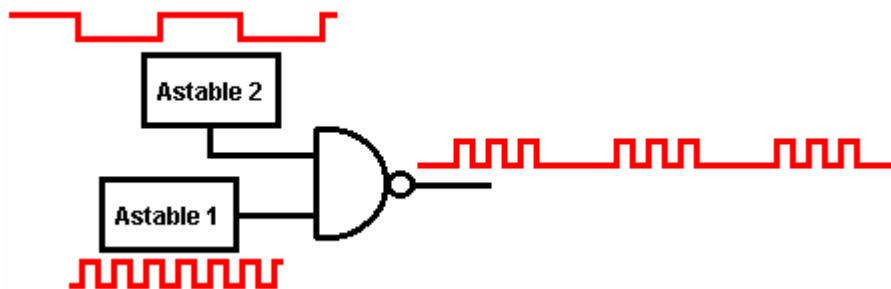
If the press-button switch at point 'A' is operated, a current is fed to the base of TR3 which holds it hard on. The voltage at point 'C' drops to zero and stays there. The square wave signal coming from the collector of TR2 is blocked and does not reach the output point 'C'. It is as if a physical 'gate' has been closed, blocking the signal from reaching point 'C'. As long as the voltage at point 'A' is low, the gate is open. If the voltage at point 'A' goes high, the gate is closed and the output is blocked.

There is no need for a manual switch at point 'A'. Any electronic switching circuit will do:



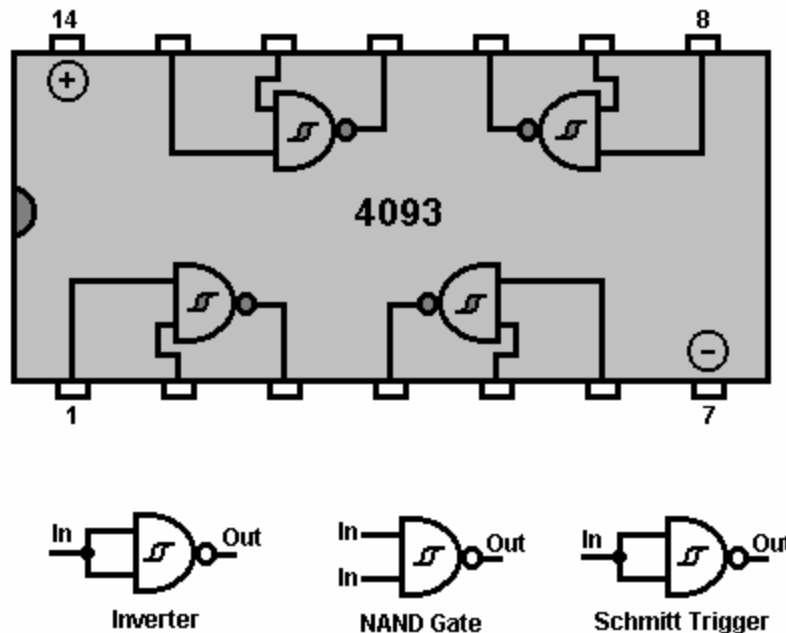
Here, a slow-running astable is substituted for the manual switch. When the output voltage of 'Astable 2' goes high, it switches the gate transistor 'TR3', holding it hard on and blocking the square-wave signal from 'Astable 1'. When the output voltage of 'Astable 2' goes low, it frees transistor 'TR3' and it then passes the 'Astable 1' signal through again. The resulting gated waveform is shown in red at point 'C' and it is bursts of signal, controlled by the running rate of 'Astable 2'. This is the sort of waveform which Stan Meyer found very effective in splitting water into Hydrogen and Oxygen (see Chapter 10).

This circuit could also be drawn as:



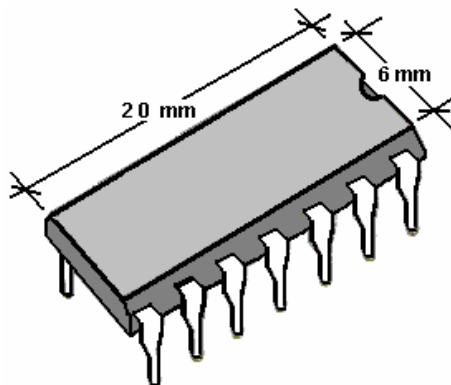
The small circle on the output side of logic devices is to show that they are inverting circuits, in other words, when the input goes up, the output goes down. The two logic devices we have encountered so far have had this circle: the Inverter and the NAND gate.

If you wish, you can use a NAND gate chip which has the circuitry also built as a Schmitt trigger, which as you will recall, has a fast-switching output even with a slowly moving input. With a chip like that, you can get three different functions from the one device:



If the two inputs of a NAND gate are connected together, then the output will always be the opposite of the input, i.e. the gate acts as an inverter. This arrangement also works as a Schmitt Trigger due to the way the NAND gate circuitry is built. There are several packages built with this type of circuitry, the one shown here is the “74132” chip which contains four “dual-input” NAND gates. Gates can have almost any number of inputs but it is rare to need more than two in any given circuit. Another chip with identical pin connections is the **4011** chip (which is not a Schmitt circuit). This ‘quad dual-input’ NAND gate package uses a construction method called “CMOS” which is very easily damaged by static electricity until actually connected into a circuit. CMOS chips can use a wide range of voltages and take very little current. They are cheap and very popular

The number of devices built into an Integrated Circuit is usually limited by the number of pins in the package and one pin is needed for one connection to ‘the outside world’. Packages are made with 6 pins (typically for opto-isolators), 8 pins (many general circuits), 14 pins (many general circuits, mostly computer logic circuits), 16 pins (ditto, but not as common) and then a jump to large numbers of pins for Large Scale devices such as microprocessors, memory chips, etc. The standard IC package is small:



Prototype circuits are often built on ‘strip board’ which is a stiff board with strips of copper running along one face, and punched with a matrix of holes. The strips are used to make the electrical connections and are broken where necessary. This strip board is usually called “Veroboard”:

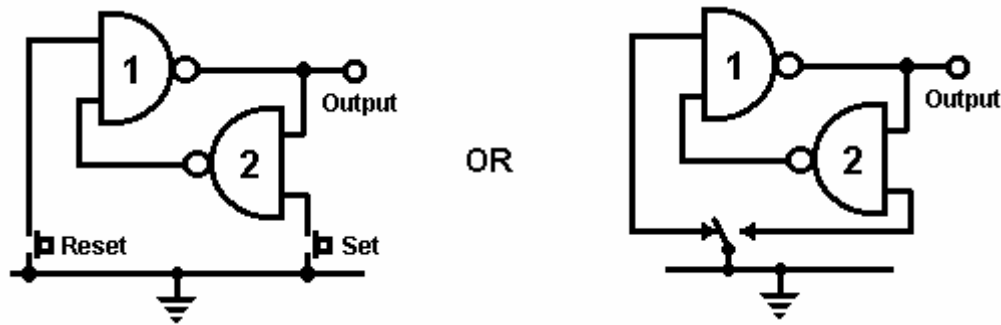


Nowadays, the strip board holes are spaced 2.5 mm (1/10”) apart which means that the gaps between the copper strips is very small indeed. I personally, find it quite difficult to make good solder joints on the strips without the solder bridging between two adjacent strips. Probably, a smaller soldering iron is needed. I need to use an 8x magnifying glass to be sure that no solder bridging remains in place before a new circuit is powered up for the first

time. Small fingers and good eyesight are a decided advantage for circuit board construction. The narrow spacing of the holes is so that the standard IC DIL package will fit directly on the board.

Circuits built using computer circuitry, can experience problems with mechanical switches. An ordinary light switch turns the light on and off. You switch it on and the light comes on. You switch it off and the light goes off. The reason it works so well is that the light bulb takes maybe, a tenth of a second to come on. Computer circuits can switch on and off 100,000 times in that tenth of a second, so some circuits will not work reliably with a mechanical switch. This is because the switch contact bounces when it closes. It may bounce once, twice or several times depending on how the switch is operated. If the switch is being used as an input to a counting circuit, the circuit may count 1, 2 or several switch inputs for one operation of the switch. It is normal to “de-bounce” any mechanical switch. This could be done using a couple of NAND gates connected like this:

The NAND Latch.



Here, the mechanical switch is buffered by a ‘latch’. When the ‘Set’ switch is operated, the output goes low. The unconnected input of gate ‘1’ acts as if it has a High voltage on it (due to the way the NAND gate circuit was built). The other input is held low by the output of gate ‘2’. This pushes the output of gate ‘1’ high, which in turn, holds the output of gate ‘2’ low. This is the first stable state.

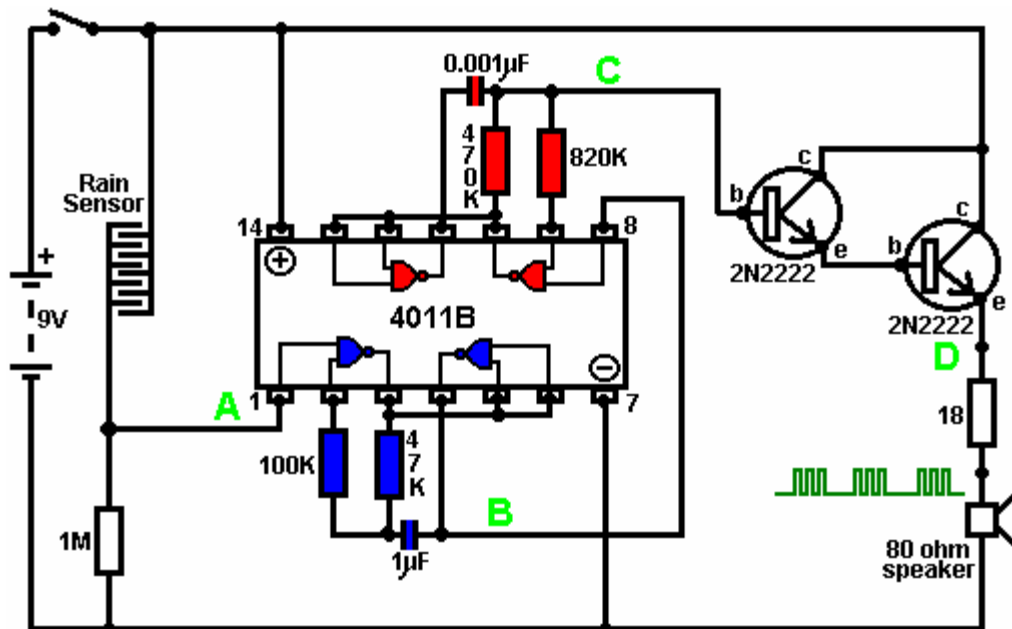
When the ‘Set’ switch is operated, the output of gate ‘2’ is driven high. Now, both inputs of gate ‘1’ are high which causes its output to go low. This in turn, drives one input of gate ‘2’ low, which holds the output of gate ‘2’ high. This is the second stable state.

To summarise: pressing the ‘Set’ switch any number of times, causes the output to go low, once and only once. The output will stay low until the ‘Reset’ switch is operated once, twice or any number of times, at which point the output will go high and stay there.

This circuit uses just half of one cheap NAND gate chip to create a bistable multivibrator which is physically very small and light.

Gate Circuits.

NAND Gates can be used as the heart of many electronic circuits apart from the logic circuits for which the package was designed. Here is a NAND gate version of the rain alarm described earlier. The ‘4011B’ chip is a CMOS device which has a very high input impedance and can operate at convenient battery voltages (3 to 15 Volts):



This circuit is comprised of a rain sensor, two astable multivibrators and a power-driver feeding a loudspeaker:

1. The rain sensor is a wired-up strip board or similar grid of interlaced conductors, forming a voltage-divider across the battery rails.

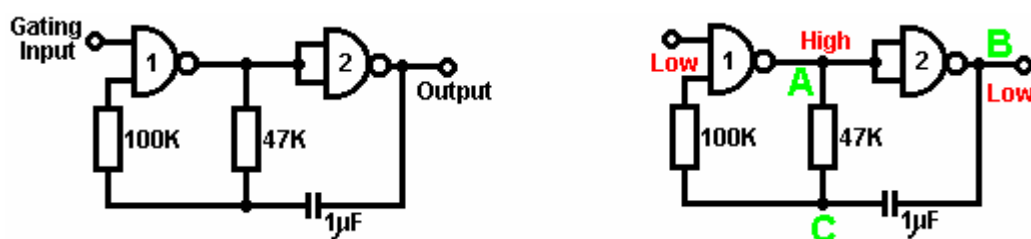
2. The output voltage from this, at point 'A' in the circuit diagram, is normally low as the strip board is open-circuit when dry. This holds the first NAND gate locked in the OFF state, preventing the first astable from oscillating. This first astable is colour-coded blue in the diagram. Its frequency (the pitch of the note it produces) is governed by the values of the 47K resistor and the 1 microfarad capacitor. Reducing the value of either of these will raise the frequency (note pitch). If rain falls on the sensor, the voltage at point 'A' goes high letting the astable run freely. If the voltage at 'A' does not rise sufficiently when it rains, increase the value of the 1M resistor.

3. The output of the first astable is a low voltage when the sensor is dry. It is taken from point 'B' and passed to the gating input of the second astable, holding it in its OFF state. The speed of the second astable is controlled by the value of the 470K resistor and the 0.001 microfarad capacitor. Reducing the value of either of these will raise the pitch of the note produced by the astable. The rate at which this astable operates is very much higher than the first astable.

When it rains, the voltage at point 'A' rises, letting the first astable oscillate. As it does so, it turns the second astable on and off in a steady rhythmic pattern. This feeds repeated bursts of high speed oscillations from the second astable to point 'C' in the diagram.

4. The Darlington-pair emitter-follower transistors cause the voltage at point 'D' to follow the voltage pattern at point 'C' (but 1.4 Volts lower voltage due to the 0.7 Volts base/emitter voltage drop for each transistor). The high gain of the two transistors ensures that the output of the second oscillator is not loaded unduly. These power-driver transistors place the output voltage across an eighty ohm loudspeaker, padded with a resistor to raise the overall resistance of the combination. The voltage pattern produced is shown at point 'D' and is an attention-grabbing sound.

So, why does this circuit oscillate?:

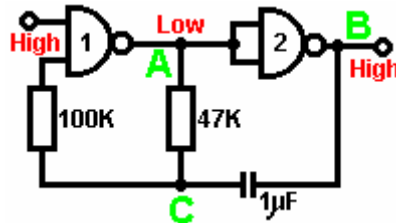


The circuit will not oscillate if the gating input is low, so assume it to be high. Take the moment when the output of gate 2 is low. For this to happen, the inputs of gate 2 have to be high. As the output of gate 1 is wired directly to the inputs of gate 2, it must be high, and for that to be true, at least one of its inputs must be low. This situation is

shown on the right.

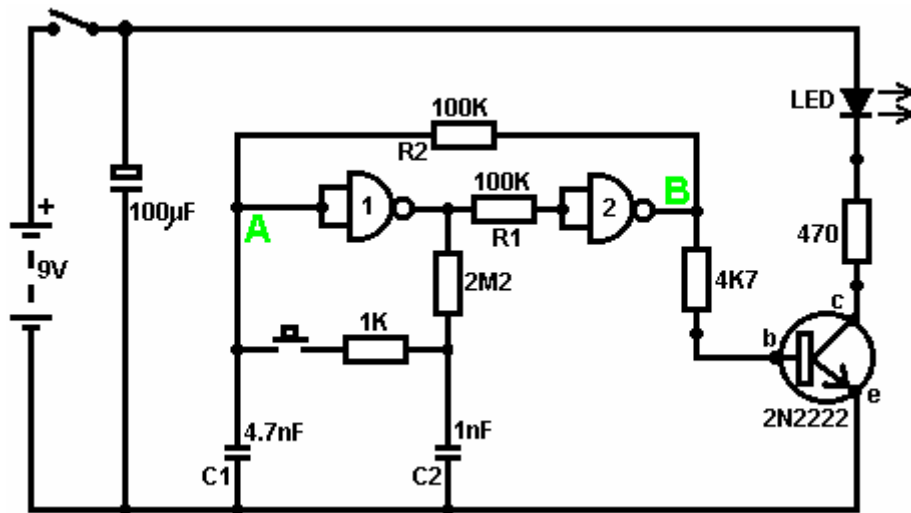
There is now a full voltage drop between point 'A' and point 'B'. The 47K resistor and the capacitor are in series across this voltage drop, so the capacitor starts to charge up, progressively raising the voltage at point 'C'. The lower the value of the resistor, the faster the voltage rises. The larger the value of the capacitor, the slower the voltage rises.

When the voltage at point 'C' rises sufficiently, the 100K resistor raises the input voltage of gate 1 far enough to cause it to change state. This creates the following situation:



Now, the voltage across 'A' to 'B' is reversed and the voltage at point 'C' starts to fall, its rate governed by the size of the 47K resistor and the 1 microfarad capacitor. When the voltage at point 'C' falls low enough, it takes the input of gate 1 low enough (via the 100K resistor) to cause gate 1 to switch state again. This takes the circuit to the initial state discussed. This is why the circuit oscillates continuously until the gating input of gate 1 is taken low to block the oscillation.

Now, here is a NAND gate circuit for a sequential on/off switch:



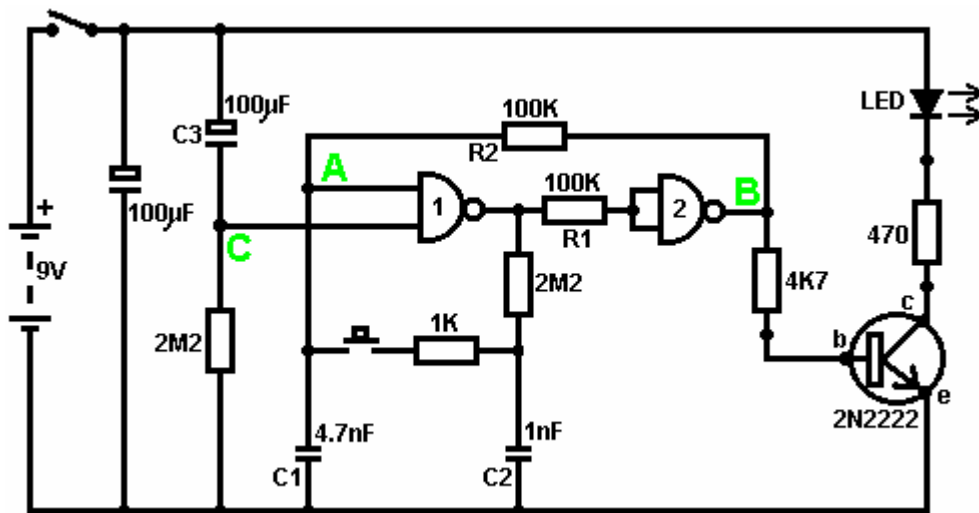
This circuit turns the Light Emitting Diode on and off repeatedly with each operation of the press-button switch. When the on/off switch is closed, capacitor 'C1' holds the voltage at point 'A' low. This drives the output of gate 1 high, which moves the inputs of gate 2 high via the 100K resistor 'R1'. This drives the voltage at point 'B' low, turning the transistor off, which makes the LED stay in its off state. The low voltage at point 'B' is fed back via the 100K resistor 'R2' to point 'A', keeping it low. This is the first stable state.

As the output of gate 1 is high, capacitor 'C2' charges up to that voltage via the 2M2 resistor. If the press-button switch is operated briefly, the high voltage of 'C2' raises the voltage of point 'A', causing gate 1 to change state, and consequently, gate 2 to change state also. Again, the high voltage at point 'B' is fed back to point 'A' via the 100K resistor 'R2', keeping it high, maintaining the situation. This is the second stable state. In this state, point 'B' has a high voltage and this feeds the base of the transistor via the 4.7K resistor, turning it on and lighting the LED.

In this second state, the output of gate 1 is low, so capacitor 'C2' discharges rapidly to a low voltage. If the press-button switch is operated again, the low voltage of 'C2' drives point 'A' low again, causing the circuit to revert to its original stable state.

We could, if we wished, modify the circuit so that it would operate for three or four minutes after switch-on but then stop operating until the circuit was turned off and on again. This is accomplished by gating one of the gates instead of just using both as inverters. If we gated the second gate, then the LED would be left permanently on,

so we will modify the first gate circuit:



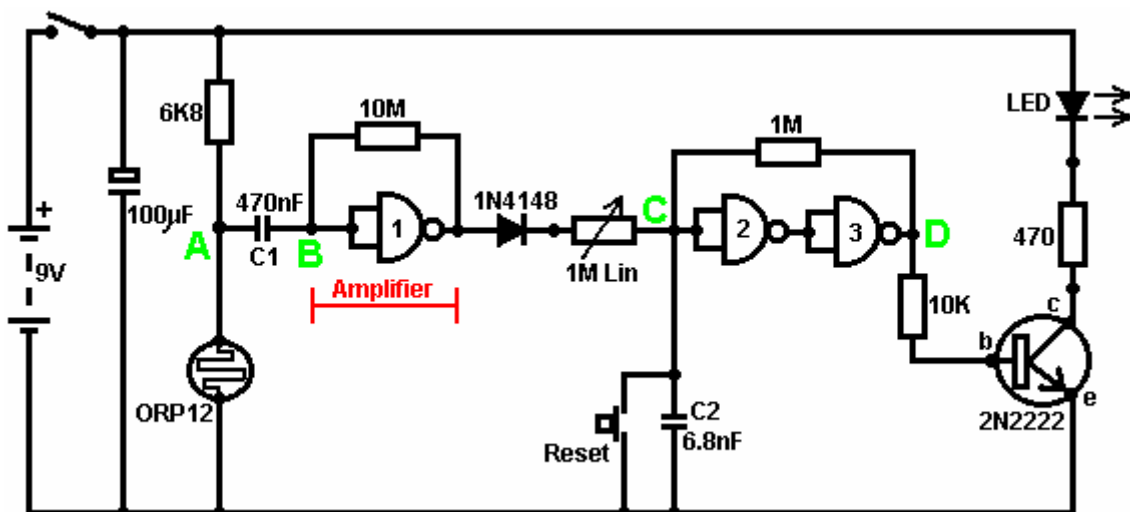
This circuit operates exactly the same way as the previous circuit if, and only if, the voltage at point 'C' is high. With the voltage at point 'C' high, gate 1 is free to react to the voltage at point 'A' as before. If the voltage at point 'C' is low, it locks the output of gate 1 at the high level, forcing the output of gate 2 to the low level and holding the LED off.

When the circuit is first powered up, the new 100 microfarad capacitor 'C3' is fully discharged, which pulls the voltage at point 'C' to nearly + 9 Volts. This allows gate 1 to operate freely, and the LED can be toggled on and off as before. As time passes, the charge on capacitor 'C3' builds up, fed by the 2M2 resistor. This causes the voltage at point 'C' to fall steadily. The rate of fall is governed by the size of the capacitor and the size of the resistor. The larger the resistor, the slower the fall. The larger the capacitor, the slower the fall. The values shown are about as large as are practical, due to the current 'leakage' of 'C3'.

After three or four minutes, the voltage at point 'C' gets driven low enough to operate gate 1 and prevent further operation of the circuit. This type of circuit could be part of a competitive game where the contestants have a limited time to complete some task.

The NAND Gate as an Amplifier.

Gates can also be used as amplifiers although they are not intended to be used that way and there are far better integrated circuits from which to build amplifiers. The following circuit shows how this can be done:



This circuit operates when there is a sudden change in light level. The previous light-level switching circuit was designed to trigger at some particular level of increasing or decreasing level of lighting. This is a shadow-detecting circuit which could be used to detect somebody walking past a light in a corridor or some similar situation.

The voltage level at point 'A' takes up some value depending on the light level. We are not particularly interested

in this voltage level since it is blocked from the following circuitry by capacitor 'C1'. Point 'B' does not get a voltage pulse unless there is a sudden change of voltage at point 'A', i.e. there is a sudden change in light level reaching the light-dependent resistor ORP12.

The first gate amplifies this pulse by some fifty times. The gate is effectively abused, and forced to operate as an amplifier by the 10M resistor connecting its output to its input. At switch-on, the output of gate 1 tries to go low. As its voltage drops, it starts to take its own inputs down via the resistor. Pushing the voltage on the inputs down, starts to raise the output voltage, which starts to raise the input voltage, which starts to lower the output voltage, which The result is that both the inputs and the output take up some intermediate voltage (which the chip designers did not intend). This intermediate voltage level is easily upset by an external pulse such as that produced by the ORP12 through capacitor 'C1'. When this pulse arrives, an amplified version of the pulse causes a voltage fluctuation at the output of gate 1.

This voltage change is passed through the diode and variable resistor to the input of gate 2. Gates 2 and 3 are wired together as a makeshift Schmitt trigger in that the output voltage at point 'D' is fed back to point 'C' via a high value resistor. This helps to make their change of state more rapid and decisive. These two gates are used to pass a full change of state to the output stage transistor. The variable resistor is adjusted so that gate 2 is just about to change state and is easily triggered by the pulse from amplifier gate 1. The output is shown as an LED but it can be anything you choose. It could be a relay used to switch on some electrical device, a solenoid used to open a door, a counter to keep track of the number of people using a passageway, etc. etc. Please note that an operational amplifier chip (which will be described later) is a far better choice of IC for a circuit of this type. A gate amplifier is shown here only to show another way that a gate can be utilised.

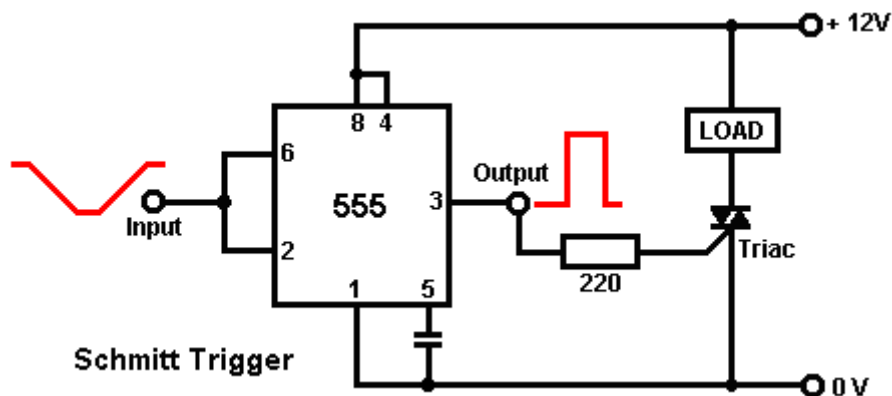
The NE555 Timer Chip.

There is an exceptionally useful chip designated by the number 555. This chip is designed to be used in oscillator and timer circuits. Its use is so widespread that the chip price is very low for its capability. It can operate with voltages from 5 Volts to 18 Volts and its output can handle 200 mA. It takes 1 mA when its output is low and 10 mA when its output is high. It comes in an 8-pin Dual-In-Line package and there is a 14-pin package version which contains two separate 555 circuits. The pin connections are:

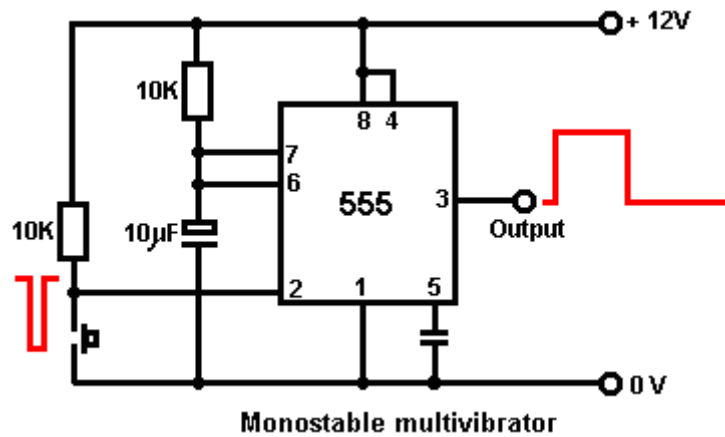


This device can operate as a monostable or astable multivibrator, a Schmitt trigger or an inverting buffer (low current input, high current output).

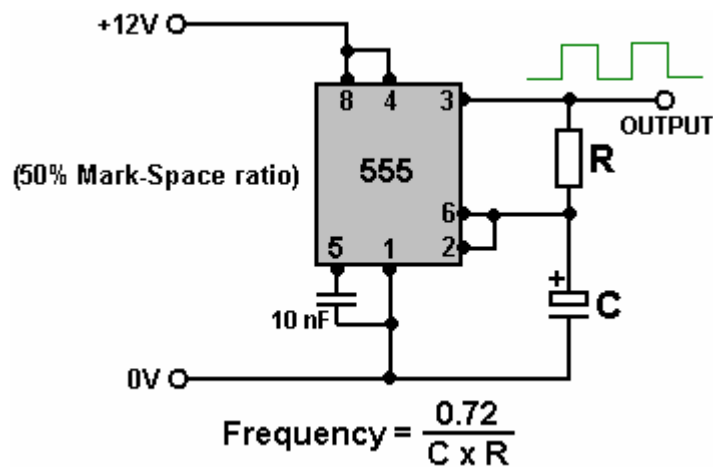
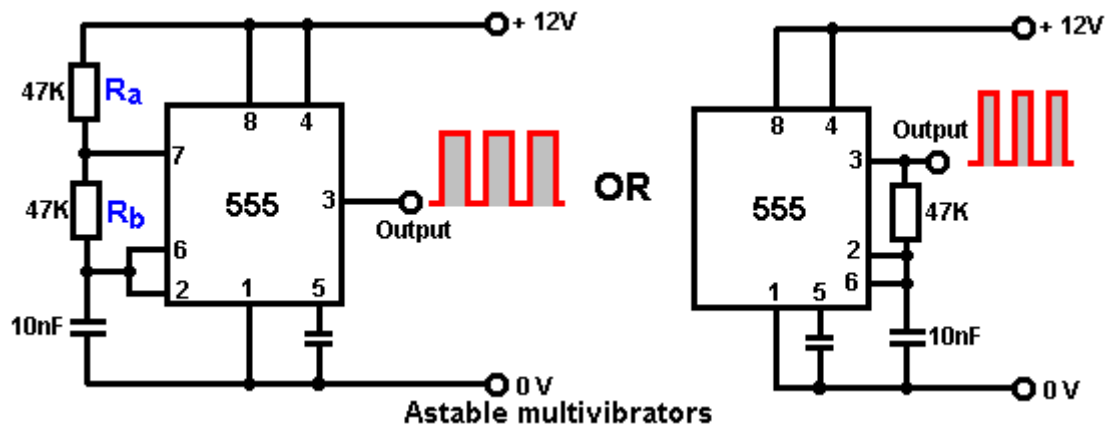
Here it is wired as a Schmitt trigger, and for variation, it is shown triggering a triac which will then stay on until the circuit is powered down (an SCR could be used just as well with this DC circuit):



And here, a monostable:



And here are two astables, the second of which has fixed, equal mark/space ratio and the first a high output voltage time determined by $R_a + R_b$ and a low voltage output time determined by R_b (2:1 in this case):

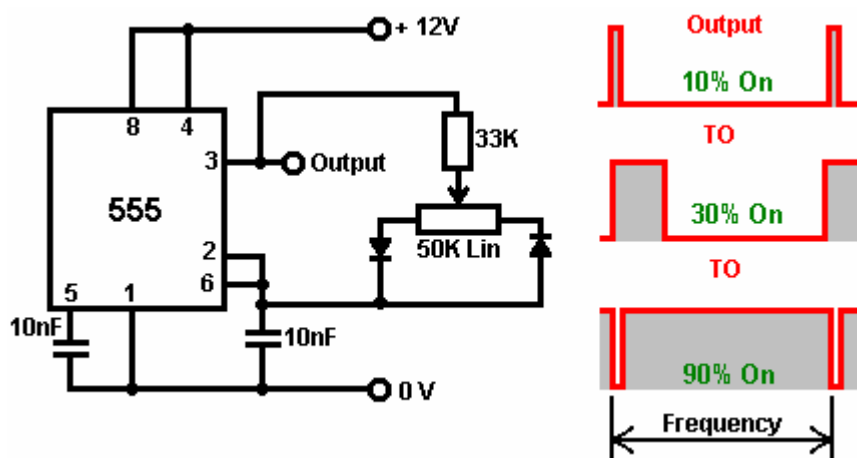


Astable Frequencies

	100	470	1K	4.7K	10K	47K	100K	470K	1M
0.1 μ F	72,000 Hz	15,319 Hz	7,200 Hz	1,532 Hz	720 Hz	153 Hz	72 Hz	15 Hz	7.2 Hz
0.47 μ F	15,319 Hz	3,259 Hz	1,532 Hz	326 Hz	153 Hz	33 Hz	15 Hz	3.3 Hz	1.5 Hz
1.0 μ F	7,200 Hz	1,532 Hz	720 Hz	153 Hz	72 Hz	15 Hz	7.2 Hz	1.5 Hz	1.4 secs
2.2 μ F	3,272 Hz	696 Hz	327 Hz	70 Hz	33 Hz	7 Hz	3.3 Hz	1.4 secs	3 secs
4.7 μ F	1,532 Hz	326 Hz	153 Hz	33 Hz	15 Hz	3.3 Hz	1.5 Hz	3 secs	6.7 secs
10 μ F	720 Hz	153 Hz	72 Hz	15 Hz	7.2 Hz	1.5 Hz	1.4 secs	6.7 secs	14 secs
22 μ F	327 Hz	70 Hz	33 Hz	7 Hz	3.3 Hz	1.4 secs	3 secs	14 secs	30 secs
47 μ F	153 Hz	33 Hz	15 Hz	3.3 Hz	1.5 Hz	3 secs	6.7 secs	30 secs	65 secs
100 μ F	72 Hz	15 Hz	7.2 Hz	1.5 Hz	1.4 secs	6.7 secs	14 secs	65 secs	139 secs
220 μ F	33 Hz	7 Hz	3.3 Hz	1.4 secs	3 secs	14 secs	30 secs	139 secs	307 secs
470 μ F	15 Hz	3.3 Hz	1.5 Hz	3 secs	6.7 secs	30 secs	65 secs	307 secs	614 secs
1,000 μ F	7.2 Hz	1.5 Hz	1.4 secs	6.7 secs	14 secs	65 secs	139 secs	614 secs	
2,200 μ F	3.3 Hz	1.4 secs	3 secs	14 secs	30 secs	139 secs	307 secs		
4,700 μ F	1.5 Hz	3.3 secs	6.7 secs	30 secs	65 secs	307 secs	614 secs		
10,000 μ F	1.4 secs	6.7 secs	14 secs	65 secs	139 secs	614 secs			

Note: The high leakage of large value electrolytic capacitors prevents them being used with high value resistors in timing circuits. Instead, use a smaller capacitor and follow the timing circuit with a “divide-by-N” chip to give accurately timed long periods. Not all 555 chips have a manufacturing quality sufficient for them to operate reliably above 20,000 Hz, so for the higher frequencies the chip needs to be selected after testing its actual performance.

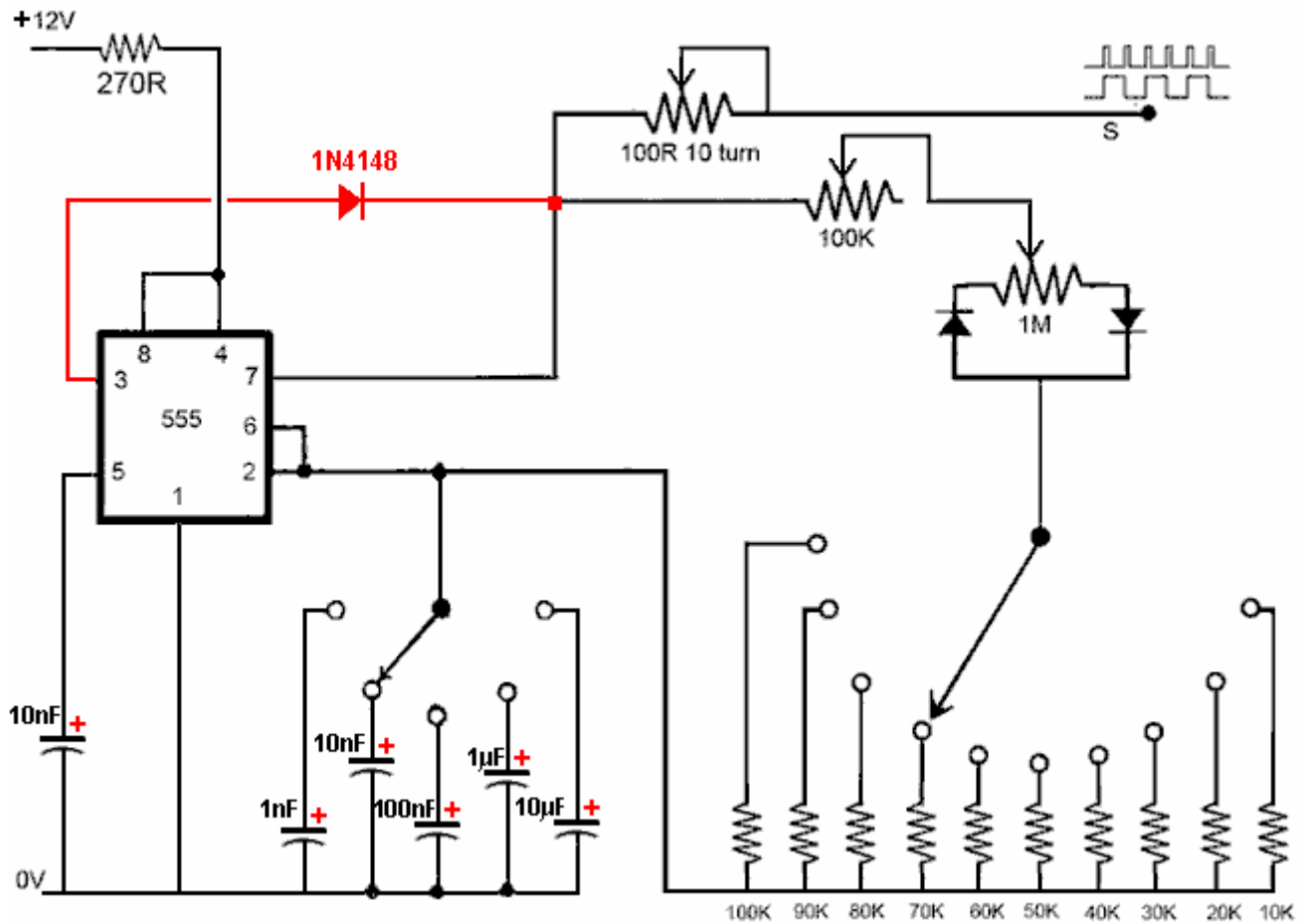
We can also wire the 555 to give a variable mark/space ratio while holding the frequency of the oscillation fixed:



The output waveform changes drastically as the variable resistor is adjusted, but the frequency (or pitch of the note) of the output is supposed to stay unaltered. However, many builders report that this circuit does not do what it is supposed to do and that adjusting the Mark/Space ratio does indeed alter the frequency.

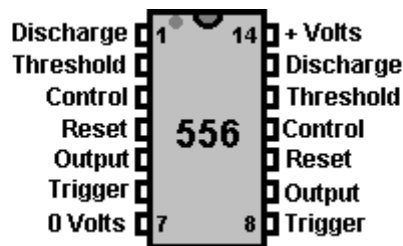
However, my South African developer friend has produced a circuit which does indeed to the job properly and this

is his arrangement:



The diode marked in red **must** be a 1N4148 diode. The waveform produced is a clean rectangle no matter what Mark/Space ratio is selected.

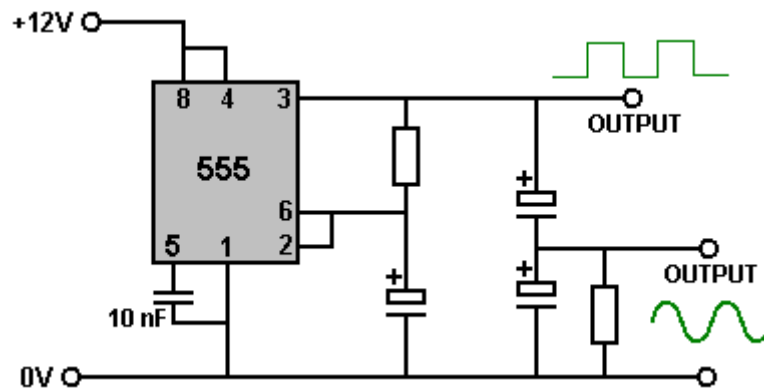
Two of the NE555 circuits can be bought in a single 14-pin DIL package which is designated 'NE556':



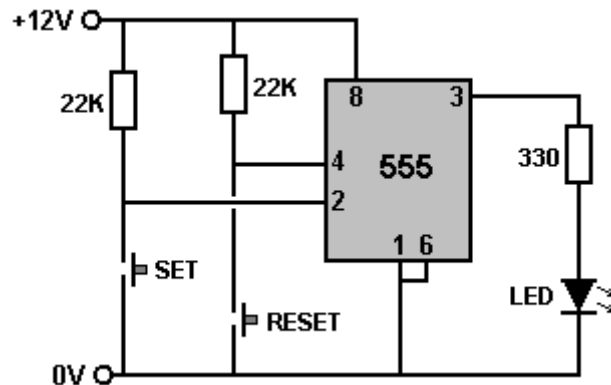
555 8-pin	555 No.1	555 No.2
2	6	8
3	5	9
4	4	10
5	3	11
6	2	12
7	1	13

There are many additional circuit types which can be created with the 555 chip. If you wish to explore the possibilities, I suggest that you download the free pdf "50 555 Projects" from the web site: <http://www.talkingelectronics.com/projects/50%20-%20555%20Circuits/50%20-%20555%20Circuits.html>.

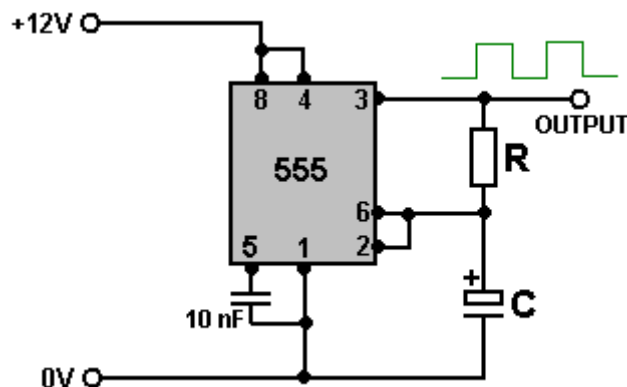
The 555 chip can also produce a sine wave output:



Or, if you wish, a bi-stable multivibrator:



All right, suppose that we want to design and build a circuit to do the same as Bob Beck's pulser circuit mentioned in chapter 11. The requirements are to produce a square wave output pulsing four times per second using a 27 volt power supply, the circuit being powered by three small PP3 size batteries. An obvious choice for the circuit seems to be a 555 timer chip which is small, robust and cheap and a suitable circuit would appear to be:



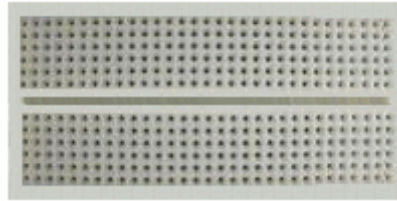
This leaves us with choosing a value for the capacitor and the resistor. We need to pay attention to the fact that the circuit will be running on 27 volts and while the capacitor will not charge up to anything like that voltage, we still will pick one which will survive 27V. Looking on the local eBay shows that a pack of ten capacitors of 1 microfarad rated at 50V can be bought for just £1 including postage, so take that as the value for "C". Looking at the 555 table of frequencies above shows:

Astable Frequencies

	100	470	1K	4.7K	10K	47K	100K	470K	1M
0.1 μ F	72,000 Hz	15,319 Hz	7,200 Hz	1,532 Hz	720 Hz	153 Hz	72 Hz	15 Hz	7.2 Hz
0.47 μ F	15,319 Hz	3,259 Hz	1,532 Hz	326 Hz	153 Hz	33 Hz	15 Hz	3.3 Hz	1.5 Hz
1.0 μ F	7,200 Hz	1,532 Hz	720 Hz	153 Hz	72 Hz	15 Hz	7.2 Hz	1.5 Hz	1.4 secs

Which indicates that to get the circuit switching four times per second (4 Hz) the resistor “R” will need to be somewhere between 100K and 470K. With my capacitor, 120K is about right.

While the switching frequency does not have to be exact, let's aim at getting it correct. Most reasonably priced components have a tolerance of around 10% so we need to select our resistor/capacitor combination for the exact values of the actual components which we will use. For this, it is worth building the circuit on a solder-less ‘breadboard’, so looking on eBay again we find that a suitable small plug-in board can be bought and delivered for £3. It looks like this :



These type of boards allow ICs to be plugged in spanning the central divide, leaving up to five extra connections on every pin. Short lengths of solid-core wire can be used to connect between any two socket holes. This will allow us to plug in one of our capacitors and find what resistor (or what two resistors) make the circuit switch forty times in ten seconds.

However, if we go to <http://www.alldatasheet.co.kr/> and download the data pdf for the NE555 chip, we find that the maximum 555 chip voltage is quite limited:

DC AND AC ELECTRICAL CHARACTERISTICS

$T_A = 25^\circ\text{C}$, $V_{CC} = +5\text{V}$ to $+15$ unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	SE555			NE555/SE555C			UNIT
			Min	Typ	Max	Min	Typ	Max	
V_{CC}	Supply voltage		4.5		18	4.5		16	V
I_{CC}	Supply current (low state) ¹	$V_{CC}=5\text{V}$, $R_L=\infty$		3	5		3	6	mA
		$V_{CC}=15\text{V}$, $R_L=\infty$		10	12		10	15	mA

This means that the chip is liable to burn out instantly if it is fed more than 16 volts. As we need to run our circuit on 27V this is a problem. As the 27V is being provided by three separate batteries, we could supply the 555 chip from just one of the batteries and run it on 9V which would be ok from the point of view of the chip as the table above shows that it can operate correctly with a supply voltage as low as 4.5 volts. The disadvantage of that arrangement is that one of the batteries will run down more quickly than the others and it would be nice to avoid that.

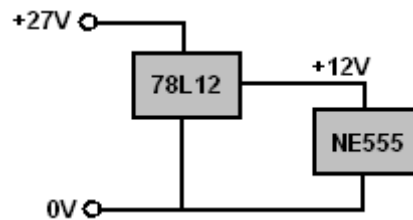
The table also shows that the current draw just to keep the 555 running can be anything from 6 to 15 milliamps. That is not a large current but the PP3 batteries have been chosen for their small size, allowing the whole circuit to be strapped to a person's wrist. A quick search on the internet shows that cheap PP3 batteries have a capacity of 400 milliamp-hours and the very expensive alkaline types 565 milliamp-hours. These ratings are the “C20” values, based on the battery being discharged at a constant current over a period of twenty hours, which would be ten days of use if Bob Beck's two hours per day protocol is followed.

This means that the ‘cheap’ batteries should not be discharged at more than one twentieth of their 400 mAHr rating, which is 20 mA. The expensive alkaline batteries should be able to be discharged at 28 mA for twenty hours.

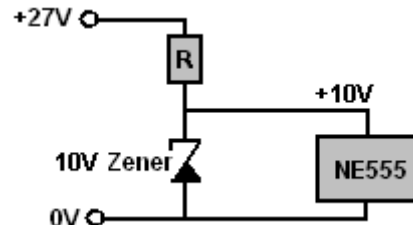
Our current draw is made up of two parts. The first part is supplying the circuit with the current which it needs to run. The second part is the current flowing through the body of the user. This second part is limited by the 820 ohm resistor in the output line which limits that part of the current to a maximum of 33 milliamps (Ohm's Law: Amps = Volts /Resistance). This neglects the body resistance and assumes that the output control variable resistor is set to minimum resistance, which is unlikely.

Checking these values shows that the 555 chip is liable to draw as much current as the circuit supplies through the output electrodes. However, let's go ahead with the circuit, after all, we might decide to use rechargeable PP3 batteries which would overcome the need to buy new batteries every few days.

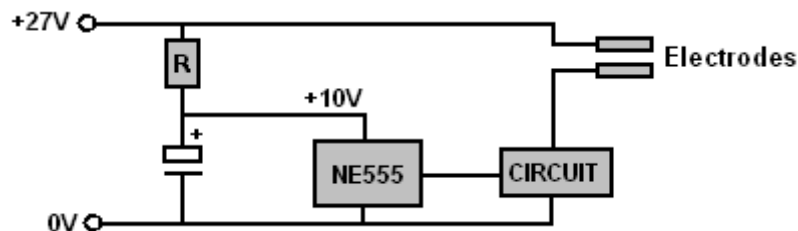
The first essential requirement is to provide the 555 chip with a voltage of, say, 10 volts when it is running in the completed circuit. That could be done with one of the voltage-stabiliser integrated circuits:



That is not a particularly expensive option, but those chips draw a current in order to provide the voltage stabilisation and an absolutely steady voltage is not needed by the 555 chip. Alternatively, we could use a resistor and a 10V zener diode:



But that method does waste some current flowing through the zener in order to provide the wanted voltage. The most simple method is to use a resistor and a capacitor:



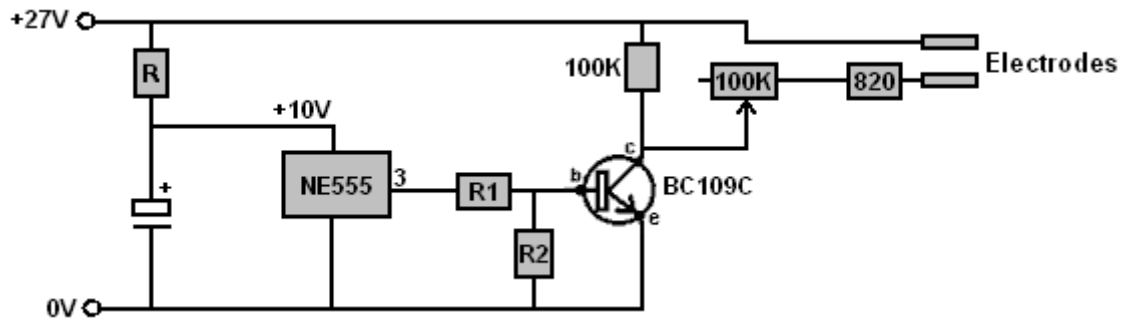
Considerable care is needed when selecting the resistor value "R". If the value is too low, then the voltage passed to the 555 chip will be too high and the chip will burn out. When selecting the resistor "R", start with a higher value than expected and then substitute slightly lower value resistors while monitoring the voltage across the capacitor to make sure that it stays low enough. The resistor value can be assessed using Ohm's Law. Assuming a current of about 6 mA, the voltage drop across the resistor being $(27 - 10) = 17$ volts, then a resistor of about 2.83K (as $\text{Ohms} = \text{Volts} / \text{Amps}$) which suggests that starting with a 4.7K resistor is likely to be ok, and then picking each lower standard resistor in turn until a satisfactory voltage across the capacitor is reached.

The capacitor could be 12V or 15V rated, but if one rated at a higher voltage is used, then if it is accidentally connected across the full 27V it will not be harmed in any way. The larger the capacitance, the better, say 220 microfarads which can be got for a few pence on eBay. If you want to play safe, you could connect a 12V zener diode across the capacitor. It will not draw any current under normal working conditions, but if anything should cause the voltage on the capacitor to rise, then it will fire up and hold the voltage down to a safe 12V level. I would be inclined to see the zener as being unnecessary, but the choice is always yours.

So what resistor power rating is needed? Well, if the resistor turns out to be a 2.7K and the capacitor voltage ends up as 9.5 volts, then the average voltage across the resistor is 17.5V which makes the current through it 6.48 mA and as $\text{Watts} = \text{Volts} \times \text{Amps}$, the power rating needs to be 113 milliwatts, so the typical quarter-watt (250 mW) resistor should be perfectly ok. If two (nearly equal value) resistors in parallel are used to get some intermediate value of "R" then that increases the overall resistor wattage.

The output of the 555 chip is then used to drive the remainder of the circuit which operates at 27V. A BC109C transistor costs only a few pence, can handle the voltage and has a minimum gain of 200 although the gain can be anything up to 800 and a BC109 can handle the current quite easily. If you need to find out any of these things, then download a datasheet for the transistor from the internet.

The output of the 555 timer is on pin 3 and it can easily supply 200 mA which is far, far more current than we would ever need for this circuit. We can feed the 555 square-wave output to the 27V electrodes using a transistor:



As the transistor is made of silicon, the switch-on voltage is when the base voltage is about 0.7 volts above the emitter voltage. That means that when the transistor is switched on, the top of resistor "R1" will be at around 10 volts and the bottom of "R1" will be at about 0.7 volts, which means that the voltage across "R1" will be $(10 - 0.7) = 9.3$ Volts. When that voltage is present across "R1" we want it to feed sufficient current to the transistor to switch it on fully. The transistor supplies a 100K resistor (which will carry 0.27 mA when 27 volts is across it) and the electrodes which will have a minimum resistance of 820 ohms across them (causing a current of 33 mA through them). So, the transistor might have to supply about 33 mA maximum. The BC109C transistor has a minimum gain of 200 so the current flowing into the base needs to be $33 / 200 = 0.165$ mA and the resistor which will carry that current when it has 9.3 volts across it is 56.3K. A somewhat smaller resistor will suit.

A commonsense check that the resistor calculation is correct is:

A 1K resistor carries 1 mA per volt and so will carry 9.3 mA with 9.3 volts across it.

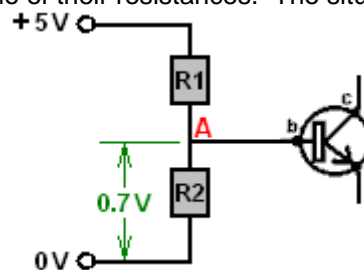
A 10K resistor will carry one tenth of that amount, or 0.93 mA with 9.3 volts across it.

A 100K resistor will carry one tenth of that again, or 0.093 mA with 9.3 volts across it.

This indicates that for a current of 0.165 mA which is about twice the 100K current, a resistor of about half of 100K should be about the right value, so 56.3K looks correct.

Considering that the gain of 200 is the minimum and three or four times that is typical, we could perhaps choose to use a 47K resistor for "R1"

As the electrode current is likely to be considerably less than 33 mA and as the BC109C gain is likely to be very high, it could be quite difficult to get the transistor to switch off as it can operate on very tiny amounts of input current. To get it to switch on and off cleanly when the 555 output voltage is say, about 5 volts, (at which point the NE555 voltage will be changing very rapidly), "R2" is included. With it in place, the output voltage of the NE555 is divided between "R1" and "R2" in the ratio of their resistances. The situation we want is:

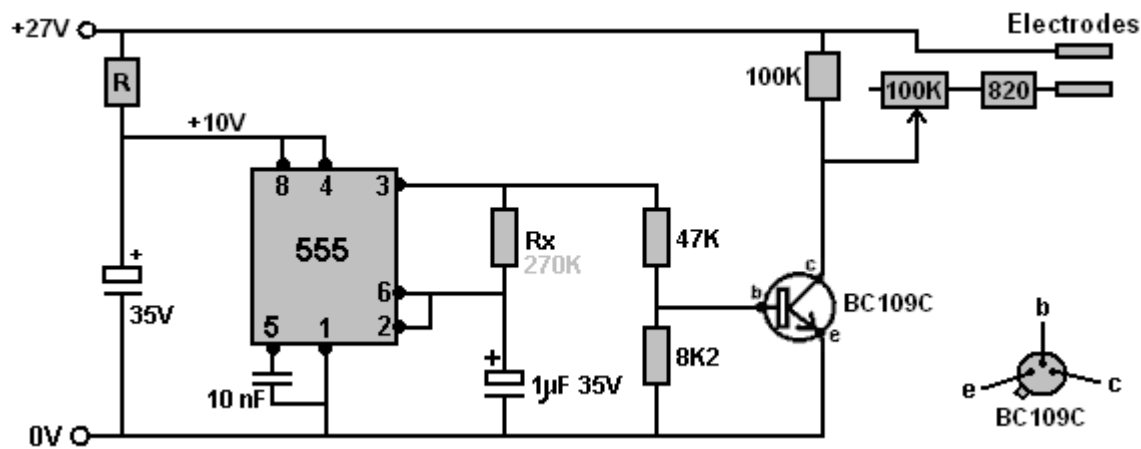


When The transistor is not switched on, it draws almost no current and so looks like a very high value resistor to the circuit. This allows the "R1" and "R2" resistors to act as a voltage-divider pair. This causes the voltage at point "A" to be determined by the ratio of "R1" to "R2" and the transistor can be ignored provided that the voltage at point "A" is below 0.7 volts. If the voltage at that point rises to 0.7 volts then the situation changes dramatically and Ohm's Law no longer holds as the transistor is not a passive resistor but instead, is an active semi-conductor device. If the voltage at point "A" tries to rise further it can't because the transistor base clamps it solidly there by appearing to be an ever lower resistor between the base and the emitter of the transistor. So for higher input voltages, resistor "R2" might as well not be there for all the difference it makes.

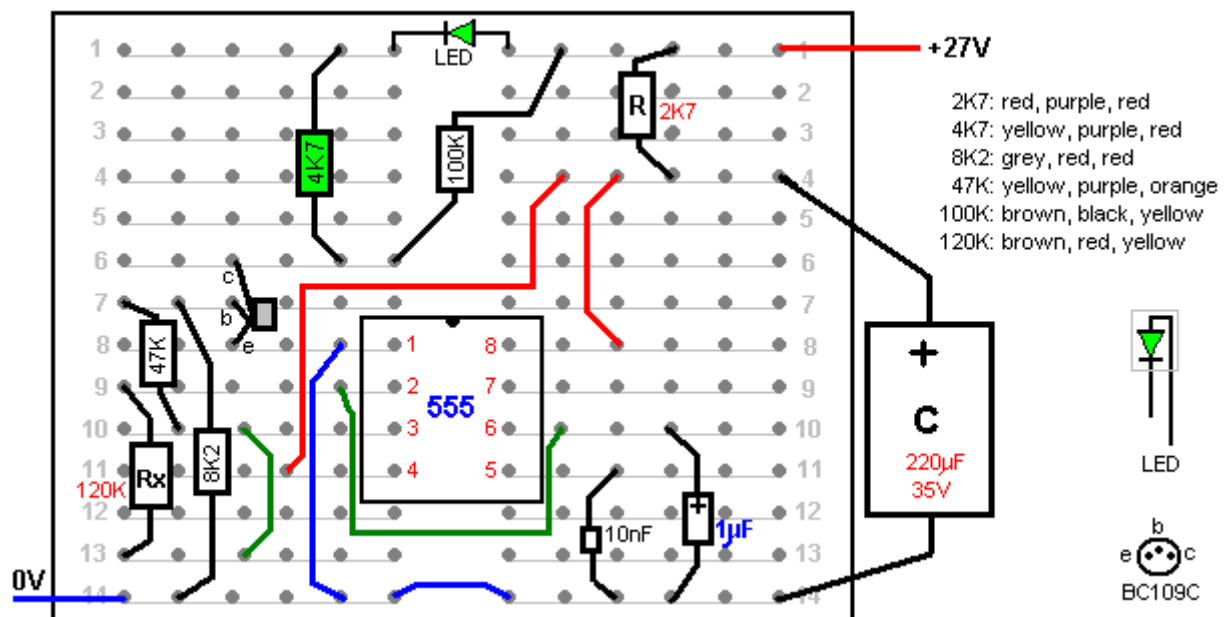
So, what value do we need for "R2" in order for the voltage at point "A" to be 0.7V when pin 3 of the NE555 reaches 5V? Well, that part of the circuit is acting in a resistive fashion and so Ohm's Law can be used. The resistor "R1" is 47K and has 4.3 volts across it, which means that the current through it must be 0.915 mA. That means that "R2" has 0.7V across it and 0.915 mA flowing through it which means that it has a value of 7.65K. A standard 8.2K or 6.8K resistor could be used as there is nothing dramatically important about the 5V switching point. If you were fussed about getting exactly 7.65K (and you shouldn't be), then you can get that value by combining two standard resistors, either in series or in parallel.

A common sense method of working out the value of “R2” is to use the fact that as the same current flows through them (no matter what that current happens to be), then the ratio of the voltage will be the same as the ratio of the resistors. That is: $0.7V / 4.3V = “R2” / 47K$ or $“R2” = 47K \times 0.7 / 4.3$ which is 7.65K.

We have now reached the point where we can determine the resistor value needed to provide a reasonable voltage for the NE555 timer chip, the circuit being:



The “Rx” value is going to be fairly close to 270K so you can use that value when testing to find a suitable value for “R” (2.2K in my case). The capacitor across the NE555 chip should be as large a capacitance as is convenient, bearing in mind that the entire circuit, batteries, etc. is to fit into a small case to be strapped to a wrist. One way that the components could be positioned on the plug-board is:

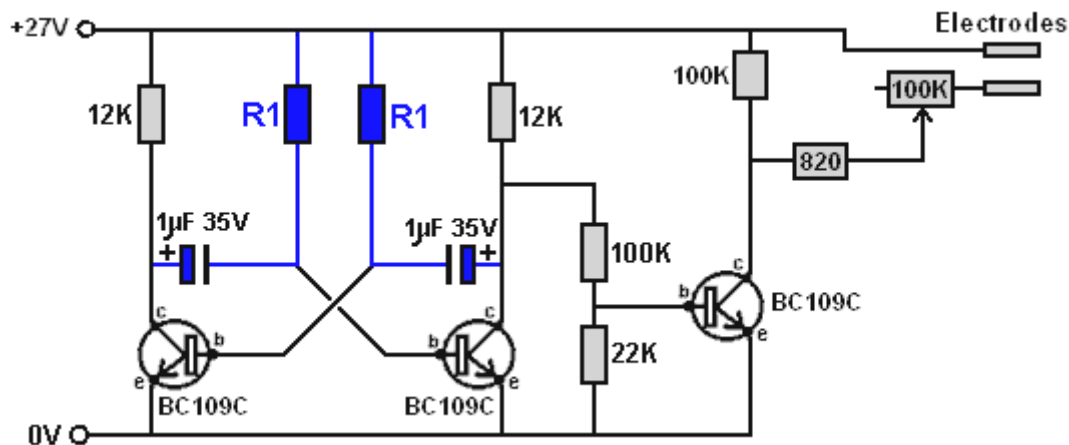


Remember that when trying various resistors for “R” you need to start high at about 4.7K and the resulting voltage on the capacitor shows the voltage drop across your first resistor choice and so, the actual current being drawn by your particular NE555 chip. That calculated current will allow you to calculate the resistor value needed to give 10 volts or so, allowing your next resistor to be tested to be almost exact in value.

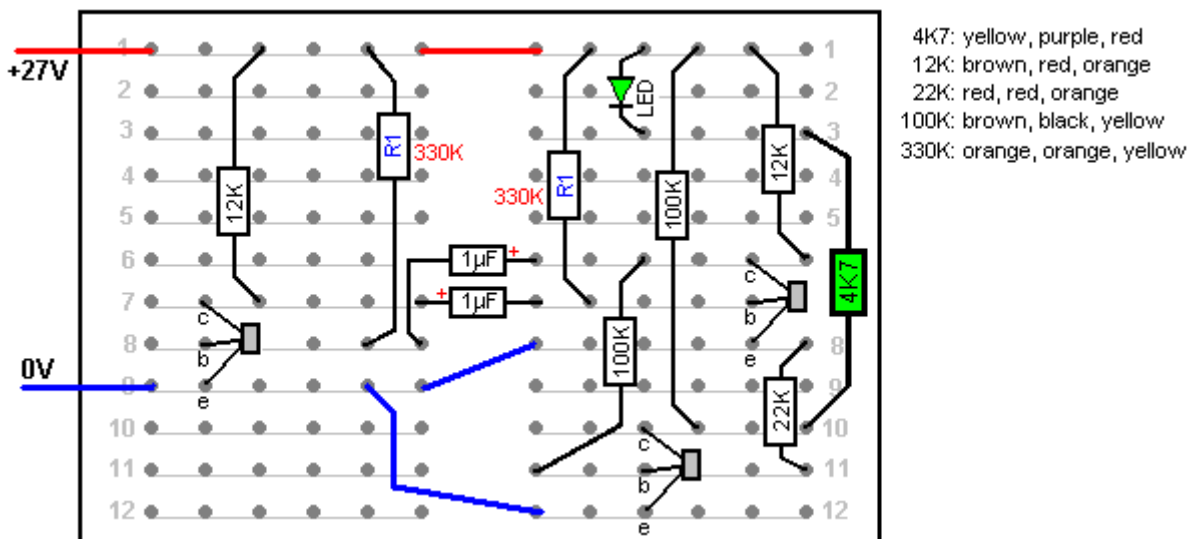
For checking the frequency produced by the circuit, any ordinary LED can be used as a temporary measure. It can be connected across the 100K ‘load’ resistor between the transistor collector and the +27V positive supply line. A current-limiting resistor is essential to stop the LED burning out instantly. If we allow a current of 5 mA to flow through the LED then since the current-limiting resistor has some 26.3 volts across it, then it’s value will be about 5.4K (1K would give 26 mA, 2K would give 13 mA, 3K would give 9 mA, 4K would give 6.5 mA) and so a 4.7K resistor works well. This LED and resistor are shown in the layout above. Please remember that if your BC109C transistor has a metal case, then that case is normally connected internally to the collector and so, care must be taken that the case does not short-circuit to anything else.

If it is considered important to maximise battery life by reducing the current draw to a minimum, then perhaps using an astable circuit might be a good choice. In common with most electronic circuits, there are many different

ways to design a suitable circuit to do the required job. The BC109C transistor can handle the 27V and so we might aim at a current draw for the circuit of just 3 mA. If 2 mA were to flow through the astable transistors when they are switched on, then with 27V across them, the resistors would be 13.5K which is not a standard value. We might select 12K to give a 2.25 mA current, or 15K to give 1.8 mA. Either should be satisfactory. The circuit might then be:

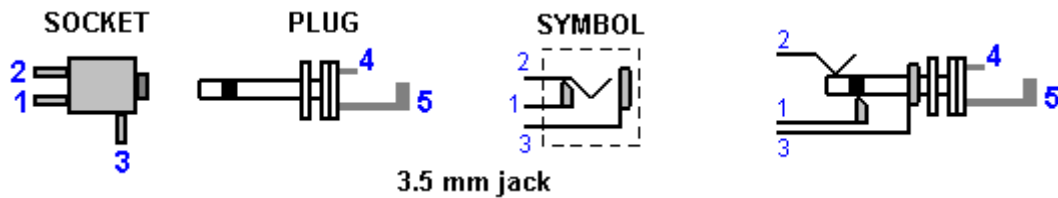


As the voltage swing feeding the output transistor has now risen from 10V to 27V the voltage-divider resistors can now increase in value by 2.7 times, giving around 127K and 22.1K for these resistors. However, the situation is not the same as for the NE555 chip which can supply at least 200 mA at the voltage-high output level. Instead, the transistor becomes such a high resistance that it can be ignored, but the 12K remains in the path which supplies the base current for the output transistor and it will in fact, add to the upper resistor of the voltage-divider pair. So while a 100K resistor is shown, it is effectively 112K due to that extra 12K resistor between it and the +27V supply line. The astable transistors will be switching fast at the point where the output transistor changes state, so the output square wave should be good quality. The BC109C transistor can switch on and off a hundred million times per second, so it's performance in this circuit should be very good. A test breadboard layout might be:



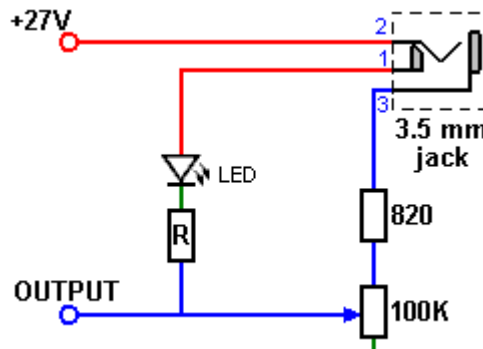
We now need to choose the timing components. For an even 50% duty cycle where each transistor is ON for half the time and OFF for half the time, the two timing capacitors can be the same size and then the two timing resistors will have the same value, in my case, 330K but it depends on the actual capacitors used.

Bob Beck's design calls for the LED display to be running when the unit is switched on and then be disconnected when the electrodes are plugged into a 3.5 mm socket mounted on the case containing the circuit. The switched socket looks like this:

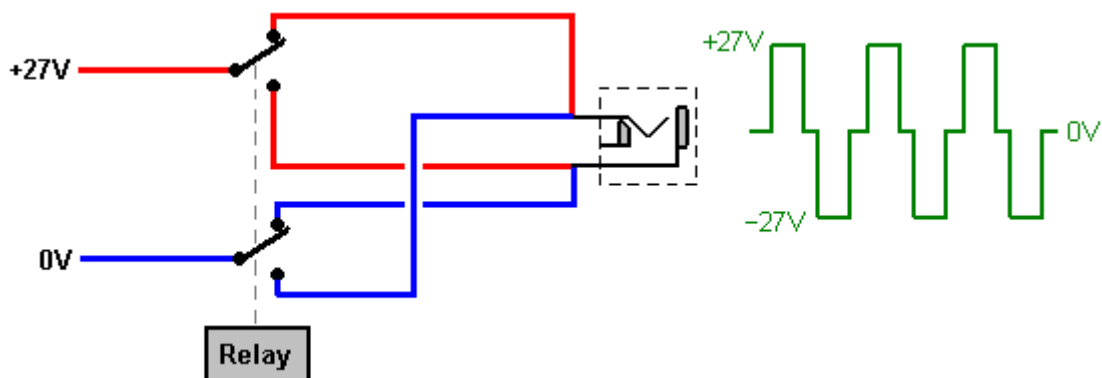


When the plug is not inserted into the socket, pin 1 connects to pin 2 and pin 3 is not connected to anything. When the plug is inserted, then pin 1 is isolated, pin 2 is connected to plug pin 4 and pin 3 is connected to plug pin 5.

The Beck circuit is connected to the output socket like this:

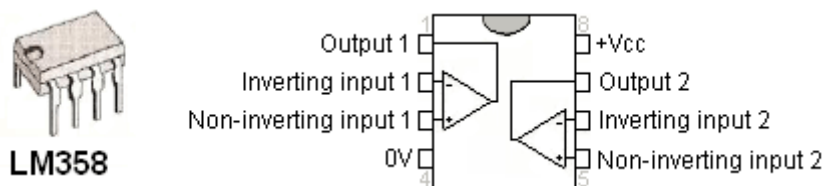


This arrangement will give a 27V 4Hz square wave output through the jack socket. But, Bob Beck's original circuit did not do that. Instead, it was like this:



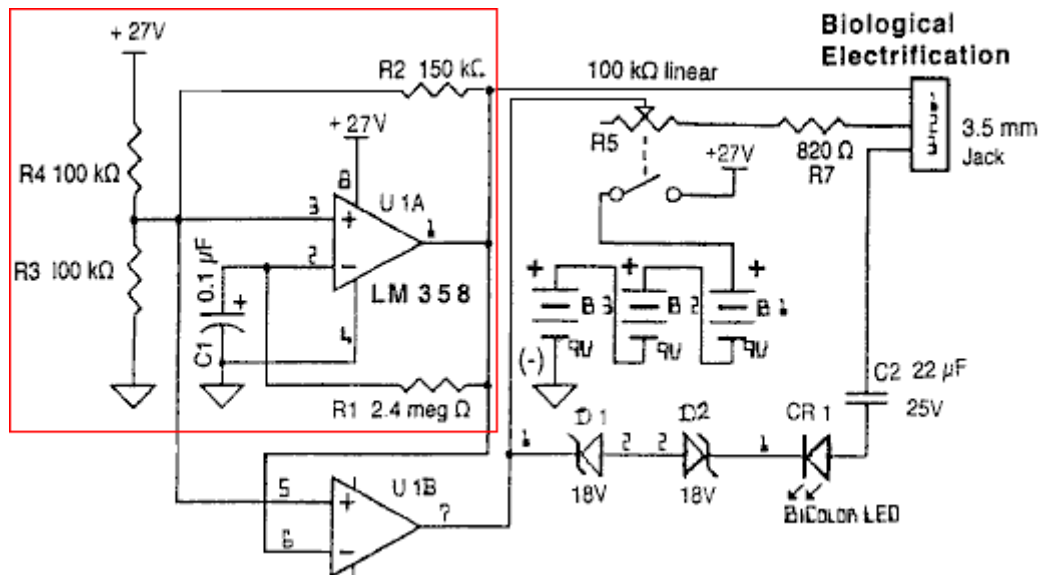
Here, a relay operates two change-over switch contacts which are used to reverse the battery bank contacts four times per second. That is different from just producing a positive-going square wave voltage between the two output terminals. If you were to consider a resistor connected across the output socket, then with the relay switching, the direction of the current reverses four times per second, but with the square wave, while it starts and stops four times per second, the direction of the current is always the same and there is no reversal of direction.

As Bob wanted to avoid using a relay which clicks four times per second all the way through the two-hour treatment described in chapter 11 and in the "Take Back Your Power" pdf on the <http://www.free-energy-info.tuks.nl/> web site, he redesigned the circuit using the very impressive LM358/A integrated circuit:



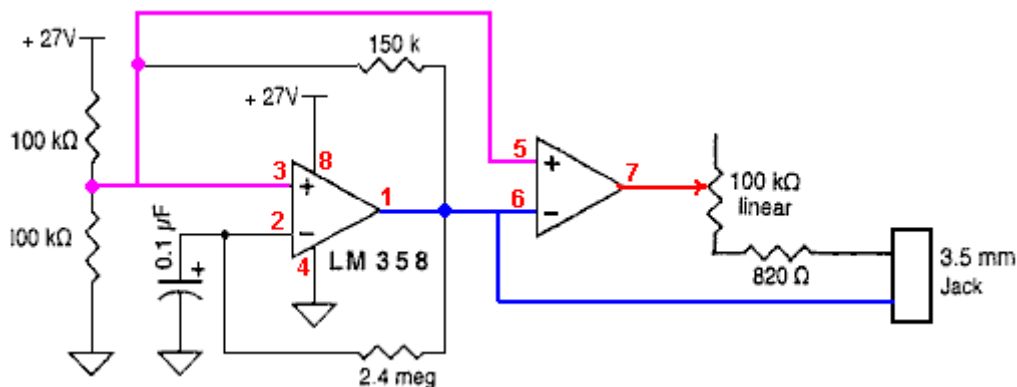
This chip draws only half of one milliamp, has two very high-gain operational amplifiers and can operate with a wide range of supply voltages. It is also inexpensive.

Bob displays the circuit as:



Bob states that the first section acts as a 4Hz square-wave signal generator, the frequency being controlled by the 2.4M resistor "R1" and the 100nF capacitor "C1". The data sheet for the LM358 states that the output voltage swing is between zero volts and 1.5V less than the supply voltage "Vcc" (which is +27V in this case). That implies that, as would be expected, the pin 1 output voltage from the first stage will switch sharply from 0V to +25.5V and sharply back again, four times per second.

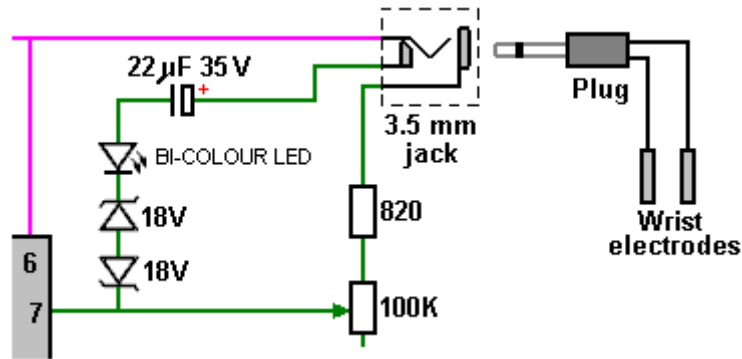
It is difficult to follow the circuit as it is drawn, so it might be a little easier to follow when drawn like this:



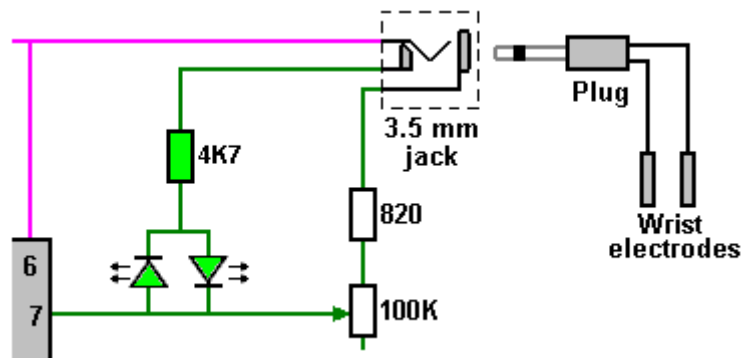
The output from the first amplifier inside the LM358 package is on pin 1 and it can supply a large amount of current (if a large current is ever needed). That output goes straight to one of the jack socket connections. It also goes to the pin 6 input of the second amplifier inside the chip and that causes the high-power output of that amplifier on pin 7 to be the opposite of the pin 1 voltage. When pin 1 goes high to +25.5 volts, then pin 7 goes low, to about zero volts. That output is also fed to the other jack socket connection, placing 25.5 volts across the electrodes when they are plugged in to the jack socket.

When the oscillator circuitry connected to the first amplifier causes the voltage on pin 1 to go low, then the output on pin 7 inverts it and so it goes to +25.5 volts. You will notice that while the overall voltage of 25.5 volts is applied again to the jack socket, the polarity is now reversed, achieving what the relay circuit does (although 1.5 volts is lost in the process). This is a neat solution.

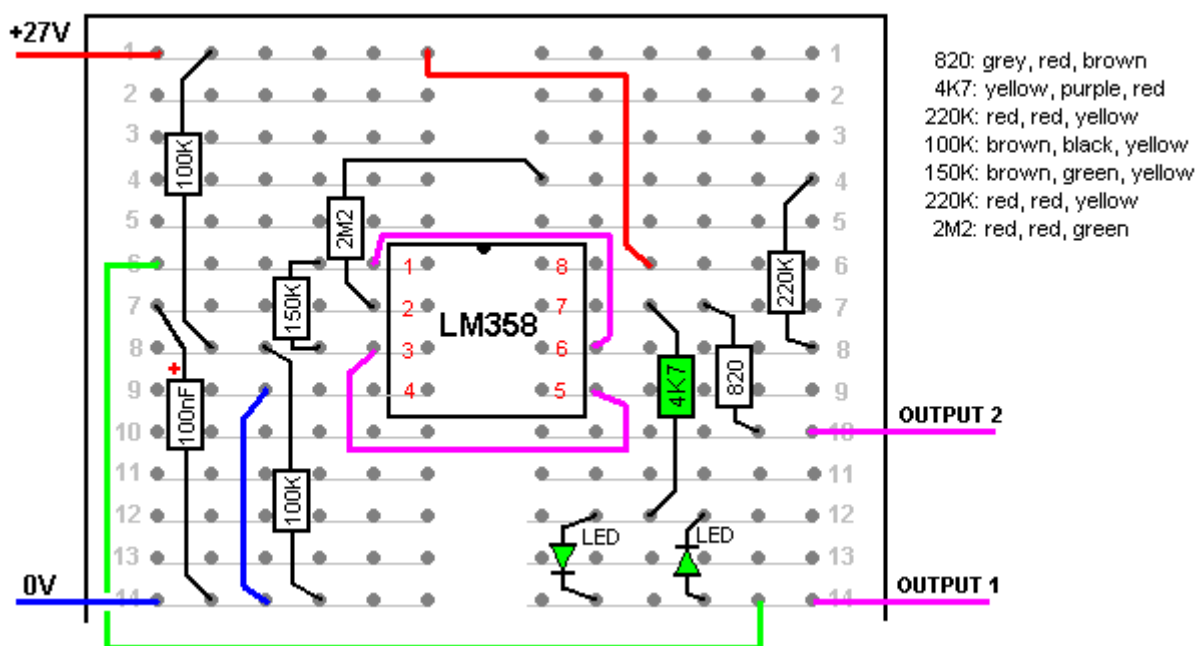
Bob uses a two-colour LED to confirm that the circuit is working correctly before the electrodes are plugged in. He chooses to do it this way:



The two 18V zener diodes drop off 18.7 of the 25.5 volts as one will be forward biased dropping 0.7 volts and the other reversed biased, dropping off 18 volts. That leaves a 7V drop for the LED, which is a bit excessive, so Bob says that he uses a capacitor to limit the current. As there is already an 820 ohm resistor in the LED current path through the socket, the capacitor is not needed. The variable resistor need to be set to it's minimum resistance by rotating it's shaft fully clockwise so that it does not affect the LED brightness as the zeners also show when the battery voltage has dropped as there will no longer be sufficient voltage to light the LED brightly, indicating that the batteries need to be replaced (or recharged if they are rechargeable batteries). When testing the circuit, an alternative to the two zeners is to use a 4.7K resistor and if a bi-colour LED is not to hand, then two ordinary LEDs can be used back to back like this:

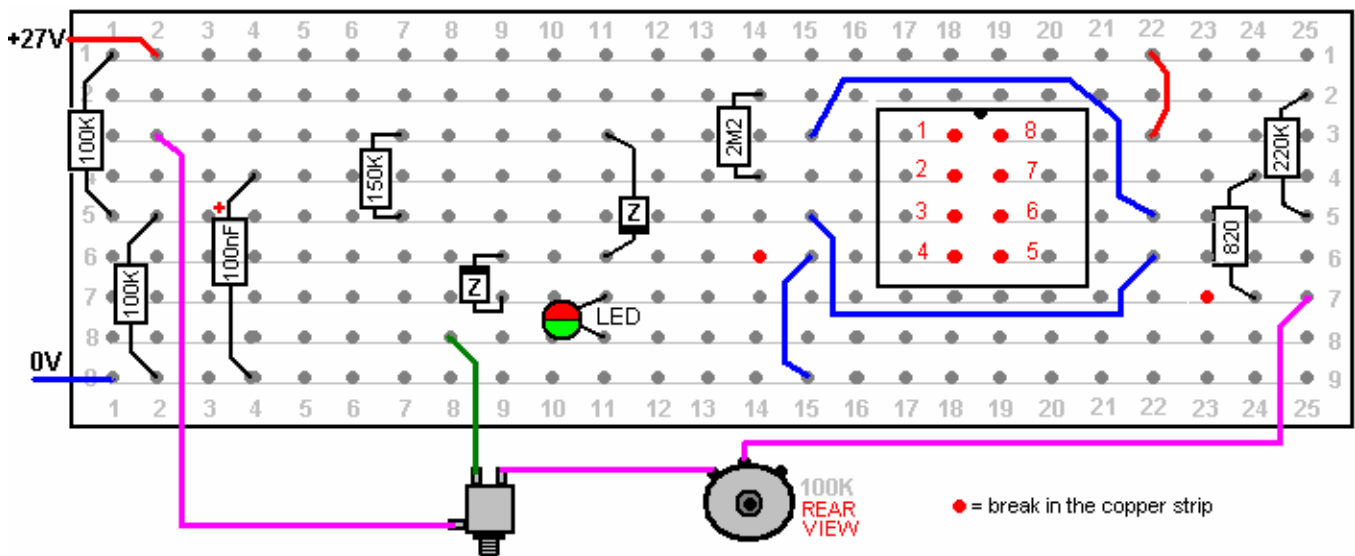


With this arrangement, the two LEDs flash alternately. In any circuit, a capacitor with a higher voltage rating can always be used if the capacitance values are the same. The Beck external circuit is completed through the body of the user, so there is just one electrode connected to each side of the output jack socket. A possible plug-board layout is:



The 4.7K resistor and LEDs are only on the board for testing purposes and when the circuit is built in permanent form, then the LED chain connects to pin 1 of the jack socket so that the LEDs are disconnected during the two hours of daily treatment recommended when using the device.

One stripboard layout using the standard 9-strip 25-hole board and incorporating the two 18V zener diodes for voltage sensing is:



When using a Beck device, it is very important to pay attention to the precautions which Bob sets out. These are in his "Take Back Your Power" pdf document: <http://www.free-energy-info.tuks.nl/Beck.pdf> which includes the following, which, while it refers to treatment to deal with HIV, presumably applies to all treatments with his device:

EXPANDED INSTRUCTIONS FOR EXPERIMENTAL / THEORETICAL HIV BLOOD NEUTRALIZATION

HYPOTHETICAL PROTOCOLS FOR EXPERIMENTAL SESSIONS

Revision March 20, 1997. Copyright 8 1991/1997 Robert C. Beck

PRECAUTIONS: Do NOT use wrist to wrist current flow with subjects who have cardiac pacemakers. Any applied electrical signals may Interfere with 'demand' type heart pacers and cause malfunction. Single wrist locations should be acceptable. Do NOT use on pregnant women, while driving or using hazardous machinery.

Users MUST avoid Ingesting anything containing medicinal herbs, foreign or domestic, or potentially toxic medication. nicotine, alcohol, recreational drugs. laxatives, tonics. and certain vitamins etc., for one week before starting because blood electrification can cause electroporation which makes cell membranes pervious to small quantities of normally harmless-chemicals in plasma. The effect is the same as extreme overdosing which might be lethal. See *Electroporation: a General Phenomenon for Manipulating Cells and Tissues*; J.C. Weaver, Journal of Cellular Biochemistry 51:426-435 (1993). Effects can mimic increasing dosages many fold. Both the magnetic pulsar and blood purifier cause electroporation.

Do NOT place electrode pads over skin lesions, abrasions, new scars, cuts, eruptions, or sunburn. Do NOT advance output amplitude to uncomfortable levels. All subjects will vary. Do NOT fall asleep while using. The magnetic pulser should be safe to use anywhere on body or head.

Avoid ingesting alcohol 24 hours before using. Drink an 8 oz. glass of distilled water 15 minutes before and immediately following each session end drink at least four additional glasses daily for flushing during 'neutralization' and for one week thereafter. This is imperative. Ignoring this can cause systemic damage from unflushed toxic wastes. When absolutely essential drugs *must* be ingested, do so a few minutes *after* electrification then wait 24 hours before next session.

If subject feels sluggish, faint, dizzy, headachy, light-headed or giddy, nauseous. bloated or has flu-like symptoms or rashes after exposures, reduce pulsing per session and/or shorten applications of electrification. Drink more water-preferably ozonized -to speed waste oxidation and disposal. Use extreme caution when treating patients with impaired kidney or liver function. Start slowly at first like about 20 minutes per day to reduce detoxification problems.

To avoid shock liability, use batteries only. Do NOT use any line-connected power supply, transformer, charger, battery eliminator, etc. with blood clearing device. However line supplies are OK with well-insulated magnetic pulse generators (strobe lights).

Health professionals: Avoid nicotine addicts, vegans, and other unconsciously motivated death-wishers and their covert agendas of 'defeat the healer'. Tobacco, the most addictive (42 times more addictive than heroin) and deadly substance of abuse known, disrupts normal cardiovascular function. True vegetarian diets are missing essential amino acids absolutely necessary for the successful rebuilding of AIDS-ravaged tissues. Secondary gains (sympathy / martyrdom, work avoidance, free benefits, financial assistance, etc.) play large roles with many AIDS patients. "Recovery guilt" as friends are dying has even precipitated suicide attempts masked as 'accidents'. Avoid such entanglements, since many have unconscious death wishes.

SUPERIOR ELECTRODES: Excellent, convenient and vastly superior electrodes, reusable indefinitely can be made by butt-soldering lead wires to ends of 1" long by 3/32" dia. blanks cut from type 316 stainless steel rods available from welding supply stores (Cameron Welding Supply, 11061 Dale Ave., Stanton, CA 90680). Use 'Stay Clean' flux before soldering (zinc chloride/hydrochloric acid). Shrink-insulate TWO tight layers of tubing over soldered joints to prevent flexing/breaking and lead/copper ions from migrating. Wrap three or four turns of 100% cotton flannel around rods. Spiral-wrap with strong thread starting from wire side to end, tightly pinch cloth over the rod's end so as to leave no metal exposed by wrapping 6 or 7 turns of thread TIGHTLY just off end of rod, then spiral wrap back to start and tie tightly with four knots then cut off excess cloth at end close to pinch -wraps. Treat end windings and knots with clear fingernail polish or Fray Check® (fabric & sewing supply stores) to prevent ravelling. Soak in a strong solution of sea salt (not table salt) containing a little wetting agent like Kodak Photo Flow, ethylene glycol, or 409 kitchen cleaner. Add a few drops of household bleach, silver colloid, etc., for disinfectant. Store solution for reuse. Tape soaking-wet electrodes tightly over pulse sites with paper masking or Transpore™ tape or with 1 inch wide stretch elastic bands with tabs of Velcro® at ends to fasten. Electrodes should closely conform *precisely* along blood vessels, not skewing ever so slightly over adjacent flesh. This insures better electrical conductivity paths to circulating blood and insures very low internal impedance. (~2000W). Rinse and blot-dry electrodes and skin after each use. NEVER allow bare metal to touch skin as this will cause burns manifested as small red craters that heal slowly. The objective is to get maximum current into blood vessels, not leak it over to adjacent tissue. Therefore never use any electrode wider than about 1/8 inch (3 mm).

ELECTRODE PLACEMENTS: Locate *maximum* pulse position (*NOT* to be confused with acupuncture, reflexology, Chapman, etc. points) on feet or wrists by feeling for maximum pulse on inside of ankle about 1 inch below and to rear of ankle bone, then test along top centre of instep. Place electrode on whichever pulse site on that foot that feels strongest. Scrub skin over chosen sites with mild soap and water or alcohol swab. Wipe dry. Position the electrodes lengthwise along each left and right wrists blood vessel. Note: with subjects having perfectly healthy hearts and not wearing pacers, it is convenient to use left wrist to right wrist exactly over ulnar arterial pulse paths instead of on feet. Recent (Dec. 1995) research suggests that placing both electrodes over different arteries on the same wrist works very well (see pg. 7), avoids any current through heart, and is much more convenient and just as effective. An 8" long, 1" wide elastic stretch-band with two 1.5" lengths of 3/4" wide Velcro® sewn to ends of opposite sides makes an excellent wrist band for holding electrodes snugly in place. With electrode cable unplugged, turn switch ON and advance amplitude control to *maximum*. Push momentary SW. 2 'Test' switch and see that the red and green light emitting diodes flash alternately. This verifies that polarity is reversing about 4 times per second (frequency is *NOT* critical) and that batteries are still good. When LED's don't light replace all three 9V batteries. Zener diodes will extinguish the LEDs when the three 9V battery's initial 27V drops below 18V after extended use. Never use any electrode larger than 1.125" (28 mm) long by 1/8" wide to avoid wasting current through surrounding tissue. Confine exactly over blood vessels only. Apply drops of salt water to each electrode's cotton cover ~every 20 minutes to combat evaporation and insure optimum current flow. Later devices are solid-state, use only three batteries and no relays, and are much smaller.

Now rotate amplitude control to *minimum* (counter-clockwise) and plug in electrode cable. Subject now advances dial slowly until he feels a "thumping" and tingling. Turn as high as tolerable but don't advance amplitude to where it is ever uncomfortable. Adjust voltage periodically as he adapts or acclimates to current level after several minutes. If subject perspires, skin resistance may decrease because of moisture, so setting to a lower voltage for comfort is indicated. Otherwise it is normal to feel progressively less sensation with time. You may notice little or no sensation at full amplitude immediately, but feeling will begin building up to maximum after several minutes at which time amplitude must be decreased. Typical adapted electrode-to-electrode impedance is on the order of 2000W. Typical comfortable input (to skin) is about 3 mA, and maximum tolerable input (full amplitude) is about 7 mA but this 'reserve' margin although harmless is unnecessary and can be uncomfortable. Current flowing through blood is very much lower than this *external* input because of series resistance through skin, tissue and blood vessel walls, but 50 to 100 µA through blood is essential.

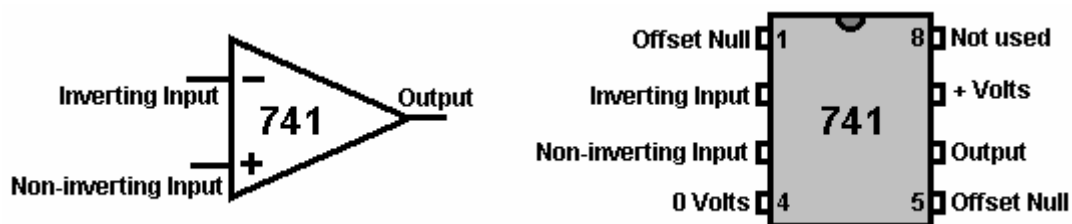
Apply blood neutralizer for about 2 hours daily for ~2 months. Use judgment here. The limiting factor is

detoxification. Carefully monitor subject's reactions (discomfort, catarrh, skin eruptions, weeping exudates, rashes, boils, carbuncles, coated tongue, etc.). With very heavy infections, go slower so as not to overload body's toxic disposal capability. With circulation-impaired diabetics, etc., you may wish to *extend* session times. Again, **have subject drink lots of water**. Recent changes in theoretical protocol being currently tested suggest following up the three weeks of treatments with a 24 hours per day (around the clock) continuous electrification of blood for two days to deal a knockout blow to the remaining HIV's 1.2 day life cycle. (A. Perelson; Los Alamos Biophysics Group, Mar. 16, 1996 "Science" Journal.) Remember to remoisten electrodes regularly. If you absolutely **must** ingest prescription drugs, do so immediately **after** turning off instrument and allow 24 hours before next treatment to let concentrations in blood plasma decay to lower levels.

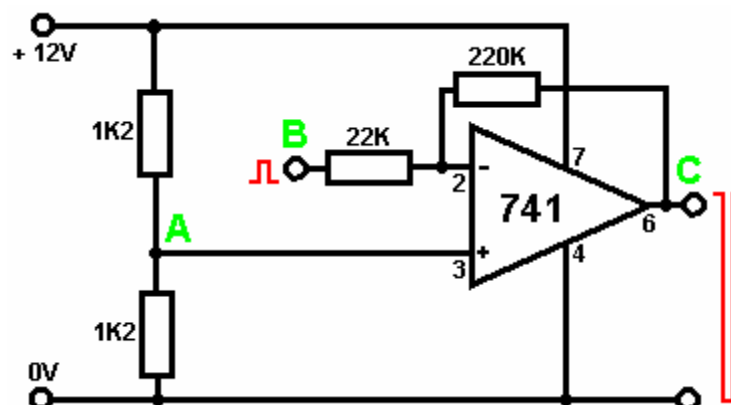
Remember, if subjects ever feel sleepy, sluggish, listless, nauseous, faint, bloated, or headachy, or have flu-like reactions they may be neglecting sufficient water intake for flushing toxins. We interpret this as detoxification plus endorphin release due to electrification. Let them rest and stabilize for about 45 minutes before driving if indicated. If this detoxing becomes oppressive, treat every *second* day. Treating at least 21 times should 'fractionate' both juvenile and maturing HIV to overlap maximum neutralization sensitivity windows and interrupt 'budding' occurring during HIV cells' development cycles. Treatments are claimed to safely neutralize many other viruses, fungi, bacteria, parasites, and microbes in blood. See patents US 5,091,152 US 5,139,684 US 5,188,738 US 5,328,451 and others as well as numerous valid medical studies which are presently little known or suppressed. Also, ingesting a few oz. of about 5 parts per million of silver colloid solution daily can give subjects a 'second intact immune system' and minimise or eliminate opportunistic infections during recovery phase. This miracle substance is pre-1938 technology, and unlike ozone is considered immune from FDA harassment. Silver colloid can *easily* be made at home electrolytically in minutes and in any desired quantities and parts per million strength for under 14 cents per gallon plus cost of water. It is ridiculous to purchase it for high prices. Colloid has no side effects, and is known to rapidly eliminate or prevent hundreds of diseases. Silver colloids won't produce drug resistant strains as will all other known antibiotics. No reasonable amount can overdose or injure users either topically, by ingestion, or medical professional injection.

The 741 Operational Amplifier.

An important and very useful group of Integrated Circuits is the "Operational Amplifier" or "op-amp" group. These devices have a very high gain, an 'inverting' input and a 'non-inverting' input. There are many op-amps but we will look at just one popular type called the "741" which has an 'open-loop' gain of 100,000 times. All operational amplifiers work in the same way in theory. The way they operate in a circuit is controlled by the external components attached to them. They can operate as inverting amplifier, a non-inverting amplifier (i.e. a 'buffer'), a comparator, an astable multivibrator, and various other things. The symbol and connections for a 741 op-amp are:



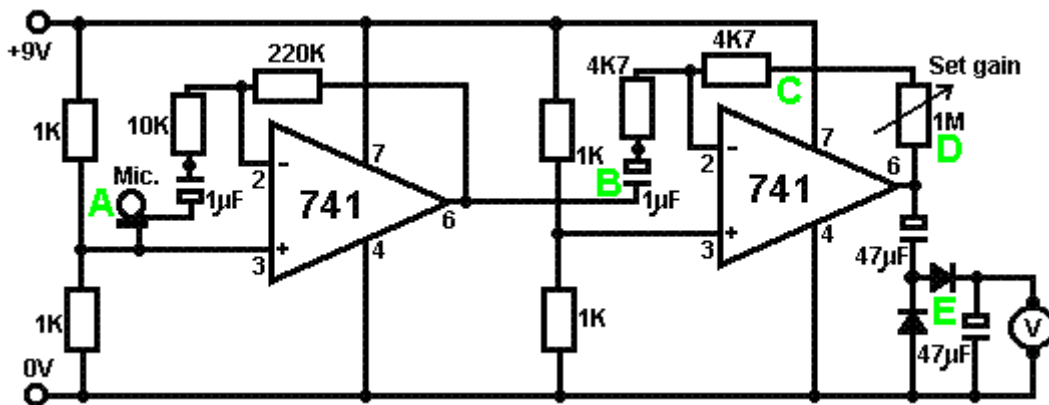
We can connect the 741 chip to act as an amplifier with any set gain level that we choose:



Here, the gain is set by the ratio of the 220K resistor to the 22K resistor. This circuit has a gain of 10 times, so the input signal at point 'B' will generate an output signal at point 'C' which is ten times larger, **provided** that the output signal does not approach the battery voltage. If it does, then clipping will occur with the top and the bottom of the output waveform chopped off at about a volt away from the battery voltage levels, approximately 1 Volt and +11 Volts in this example.

Operational amplifiers are generally designed to operate from a dual power supply. In the above example, the supply would be created by using two 6 Volts batteries instead of one 12 Volt battery. To avoid the inconvenience of this, a mid-point voltage is generated at point 'A' by using two equal resistors in series across the battery. This gives a central voltage of +6 Volts which is fed to the IC.

This circuit can be used in many applications. Here is a circuit for a meter to measure sound intensity:



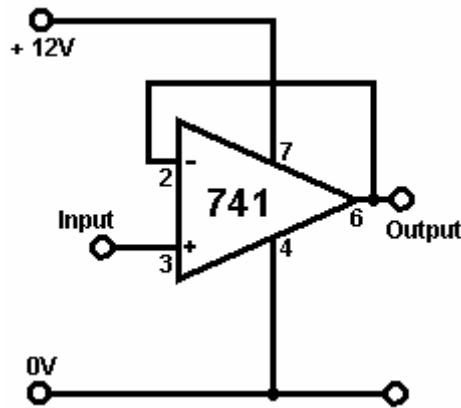
This circuit is two copies of the previous circuit. Each 741 chip has a reference voltage of half the supply voltage created by a voltage-divider pair of 1K resistors. This voltage is fed to pin 3 of the chip, which is the non-inverting input.

At point 'A', a microphone or small loudspeaker is used to generate a signal voltage when sound reaches it. This voltage is fed to the 741 op-amp via a 1 microfarad blocking capacitor. This passes the audio signal through while blocking the +4.5 Volts DC on pin 3. The first 741 has a gain of 22, set by the 10K and 220K resistors ($220/10 = 22$).

Point 'B' then receives an audio signal 22 times larger than the signal produced by the microphone. This signal is still quite small, so the second 741 boosts it further. The gain of the second 741 is variable and depends on the resistance set on the 1M variable resistor. If the variable resistor is set to zero ohms, then the gain of the second 741 will be controlled by the 4K7 resistor at point 'C' alone and so will be 1 ($4.7/4.7 = 1$). If the variable resistor is set to its maximum value, then the gain of the second 741 will be some 214 ($1,004,700/4,700 = 213.8$).

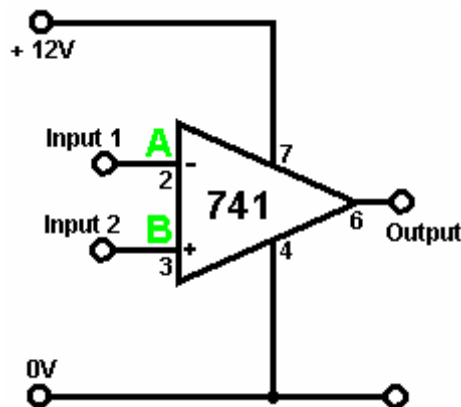
The two op-amps together have a combined gain which ranges from 22 to 4702. The amplified audio signal arrives at point 'D' and it can be adjusted to a respectable value. This alternating voltage is now rectified via the diodes at point 'E' and it builds up a DC voltage across the 47 microfarad capacitor there. This voltage is displayed on a voltmeter. The result is that the voltmeter shows a reading directly proportional to the sound level reaching the microphone.

The 741 can be wired as a **buffer**. This is the equivalent of an emitter-follower circuit when using transistors. The set up for the 741 is:



Difficult circuit - huh! Are you sure you can afford all the extra components? This circuit utilises the full gain of the 741 chip. The output follows the input waveform exactly. The input requires almost no current, so the circuit is described as having a 'high input impedance'. The output can drive a serious load such as a relay, so the circuit is described as having a 'low output impedance'.

The 741 chip can be wired to act as a comparator. This is the circuit:



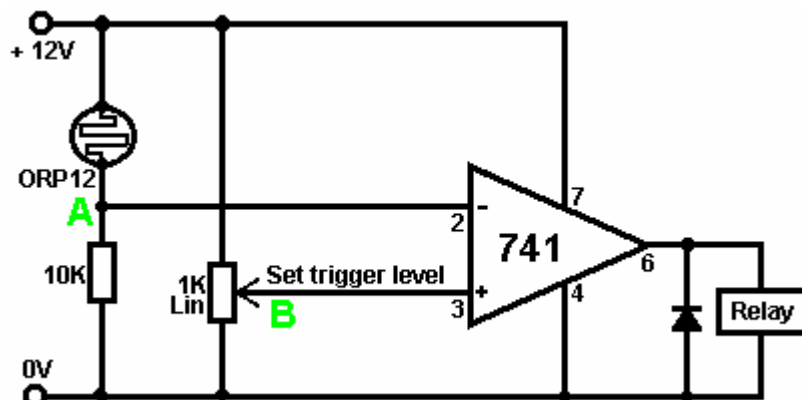
Are you sure you are up to such a difficult circuit? Bit complicated - huh! This is the basic operational form for an operational amplifier.

If the voltage at point 'A' is higher than the voltage at point 'B' then the output goes as low as it can go, say 1 or 2 volts.

If the voltage at point 'A' is lower than the voltage at point 'B' then the output goes as high as it can go, say 10 volts or so.

Having seen how transistor circuits work, you should be able to understand why the 741 chip circuitry (which is a transistor circuit inside the 741 package) needs some voltage inside the supply rails to provide an efficient high-current output drive.

Here is a 741 version of the light-operated switch:

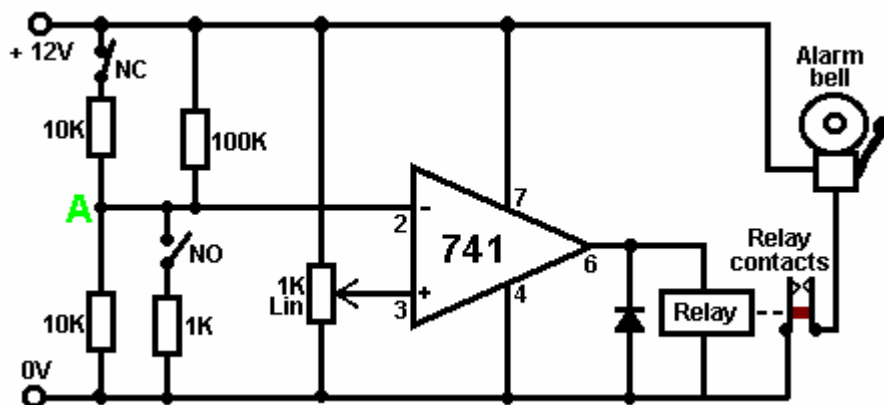


This circuit is set up as evening falls. We want the relay to have minimum voltage across it in daylight, so the voltage at point 'A' needs to be higher than the voltage at point 'B'. As the 1K variable resistor is across the supply voltage, its slider can be set to any voltage between 0 Volts and +12 Volts. To make this easy to do, we choose a 'linear' variable resistor as the logarithmic variety would be hard to adjust in this application. With the 'linear' version, each 1 degree of rotation of the resistor shaft causes the same change in resistance, anywhere along the range. This is not the case for the logarithmic variety.

Anyhow, we adjust the variable resistor downwards until the relay voltage drops to a minimum. When the light level has fallen to the level at which we wish the circuit to trigger, we adjust the variable resistor to make the relay click on. The 741 chip has a very rapid output voltage swing when the input voltages swap over, so the relay switching will be decisive. The switching can be made even more positive by adding a resistor between the output and point 'B'. This acts like a Schmitt trigger when switching occurs by providing some additional positive feedback, lifting the voltage at point 'B'.

If you wish the circuit to trigger on a rising light level, just swap the positions of the 10K resistor and the ORP12 light-dependent resistor. The same circuit will operate as a temperature sensing circuit by substituting a 'thermistor' (which is a temperature-dependent resistor) for the ORP12.

If we would like the circuit to act as a burglar alarm, we could use the same circuit like this:



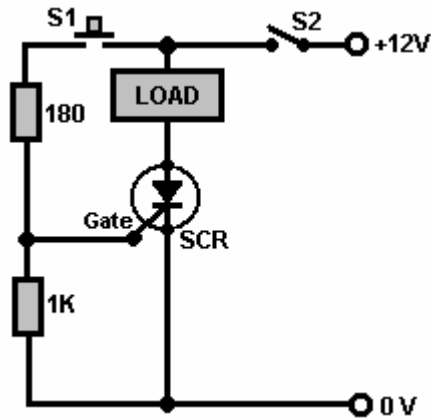
The circuit is still controlled by the voltage at point 'A'. Under normal circumstances, this voltage will be near +6 Volts (produced by the two 10K resistors and the 100K resistor). The upper switch marked 'NC' for 'Normally Closed', represents a chain of, say, magnetic switches attached to doors and windows. If any of these are opened, then the voltage at point 'A' will be dictated by the lower 10K resistor in series with the 100K resistor. This will cause the voltage at 'A' to fall instantly to a low value, triggering the circuit.

The 'NO' switch ('Normally Open') represents one or more pressure-operated switches under carpets or rugs and/or switches which get brushed when doors are swung open, etc. These switches are wired in parallel across each other and if any of them is closed for even a millionth of a second, the voltage at point 'A' will be pulled down by the 1K resistor and the circuit will be triggered.

The circuit can be latched on in any one of a variety of ways. One relay contact can be used to hold the relay on or hold the voltage at 'A' low. A transistor can be wired across the relay to hold the circuit on, etc. etc. If this is done, the circuit will remain in its triggered state until the supply voltage is interrupted. You might prefer to use a 555 chip to limit the length of time the alarm sounds to three minutes or so.

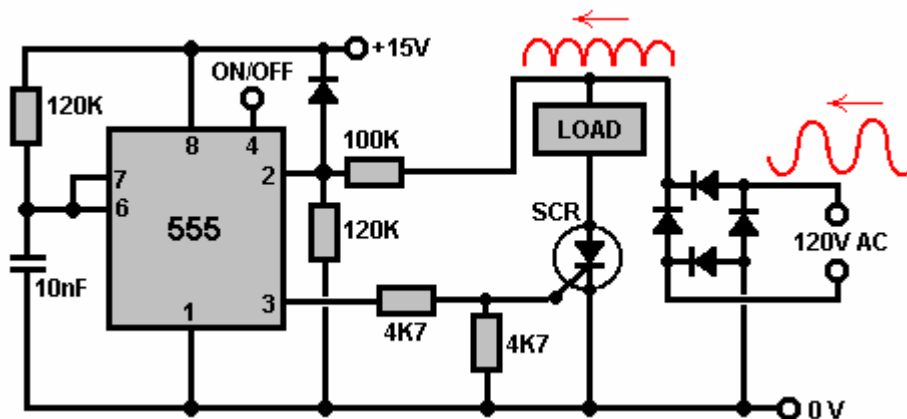
The SCR and Triac.

An alternative to using a relay or semiconductor latch is to use a **Silicon Controlled Rectifier** usually referred to as an 'SCR' or 'Thyristor'. This device is normally "off" with a very high resistance to current flow. If it is switched on by applying a voltage to its Gate connection, it stays continuously on until some external device stops current flowing through it. The following circuit shows how it operates:



When the voltage is first applied to the circuit by closing switch S2, the SCR is in its OFF state so no current is supplied to the load. If the press-button switch S1 is pressed, a current is fed into the Gate of the SCR, turning it ON. When switch S1 is allowed to open, the SCR remains in its ON state and it will stay that way until the current through it is cut off. Opening switch S2 cuts off the current to the load and the SCR returns to its OFF state. A very valid question would be: "Why have an SCR at all and just turn the load on and off with switch S2?". The answer is that switch S1 might be the under-carpet pressure pad of a burglar-alarm and it might be operated some hours after switch S2 was closed to activate the alarm system. Stepping off the pressure pad does not stop the alarm sounding.

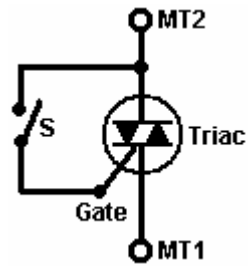
While this sort of DC latching action is useful, it is more common for an SCR to be used in an AC circuit. For example, take the circuit shown here:



The 120 volt AC supply coming in from the right hand side, is converted to positive-going sine-wave pulses by the diode bridge. This pulsing voltage is applied to the Load/SCR path. If the voltage at pin 3 of the 555 chip is low, then the SCR will remain OFF and no current will be fed to the load device. If the voltage on pin 3 goes high **and** the voltage applied to the Load/SCR chain is high, then the SCR will be switched ON, powering the load until the pulsing voltage drops to its zero level again some 1/120 of a second later.

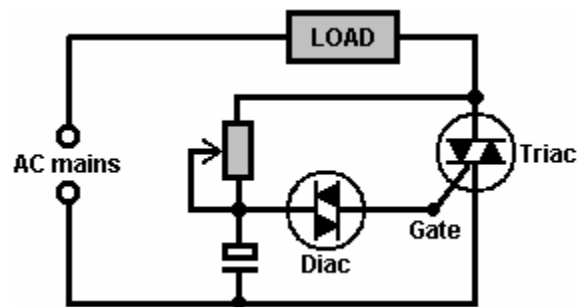
The 555 chip is connected to form a monostable multivibrator and the timing components (the 120K resistor and the 10nF capacitor) cause it to output a 1 millisecond pulse which is long enough to trigger the SCR into its ON state, but short enough to have finished before the mains pulse reaches its zero-voltage level again. The 555 chip is triggered by the rising mains voltage being passed to its pin 2 through the voltage-divider 100K and 120K pair of resistors, and that synchronises it with the AC waveform. Pin 4 of the 555 chip can be used to switch the load power on and off.

In the circuit shown above, the diode bridge is needed to convert the incoming AC waveform to pulsing DC as shown in red in the diagram, as the SCR can only handle current flowing in one direction. The AC load equipment works just as well with the pulsing DC as with a full blown AC waveform. A better semiconductor construction is the 'Triac' which acts like two SCR devices back-to-back in a single package. It is shown like this in circuit diagrams:



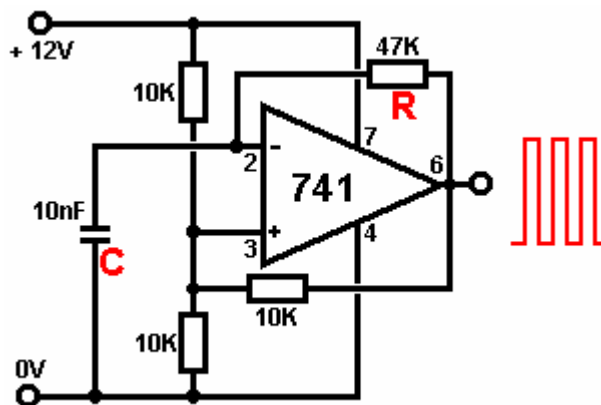
There are three connections to the device: Main Terminal 1, Main Terminal 2 and the Gate. When switch 'S' shown in the diagram is closed, the triac conducts on both positive and negative voltages applied to its MT1 and MT2 terminals. When the switch is open, the device does not conduct at all.

If the external circuit containing switch 'S' is placed inside the device as a permanently closed circuit, then the device becomes a 'Diac' which can be used to trigger a Triac and give a very neat circuit for controlling the power to an item of AC mains equipment as shown here:



Here, the variable resistor/capacitor pair controls the point on the AC waveform that the Triac is triggered and so controls how much of each sinewave cycle is passed to the mains equipment, and so it controls the average power passed to the equipment. A very common use for a circuit of this type is the 'dimmer-switch' used with household lighting.

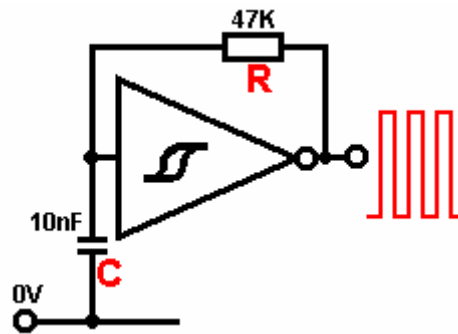
To return now to the 741 chip. The 741 can also be used as an **astable multivibrator**. The circuit is:



The rate of oscillation of this circuit is governed by the Resistor marked 'R' in the diagram and the capacitor marked 'C'. The larger the resistor, the lower the rate of oscillation, the larger the capacitor, the lower the rate of oscillation.

When the output goes high, capacitor 'C' charges up until the voltage on it exceeds the mid-rail voltage on pin 3, at which time the 741 output goes low. The capacitor now discharges through resistor 'R' until the voltage on it drops below the voltage on pin 3, at which time the output goes high again. The 10K resistor connecting the output to pin 3 provides some positive feedback which makes the 741 act quite like a Schmitt trigger, sharpening up the switching.

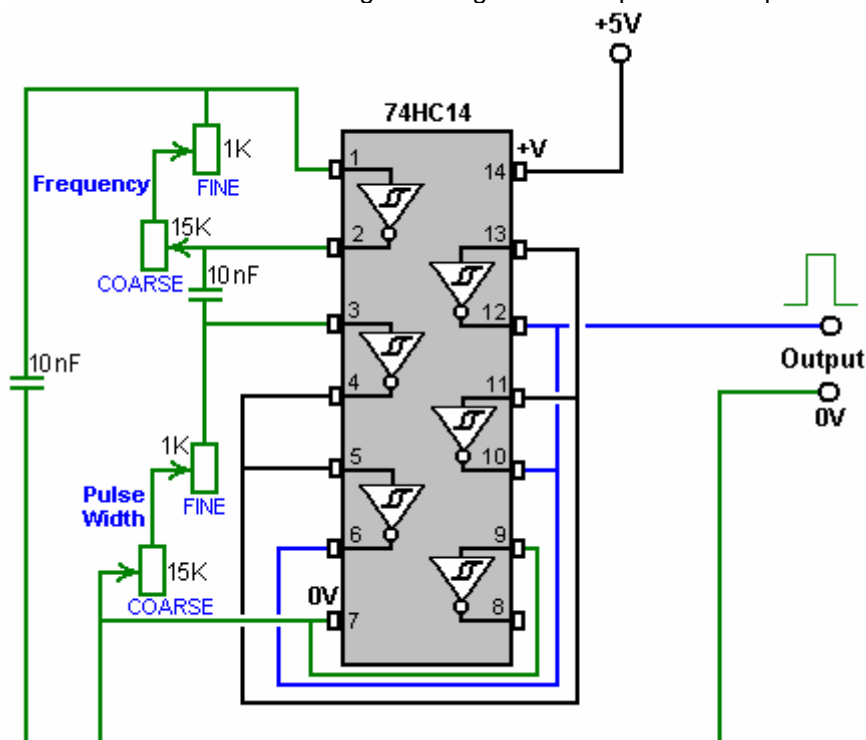
The same arrangement of resistor and capacitor applied to a Schmitt inverter or Schmitt NAND gate causes exactly the same oscillation:



If you would like to see additional ways of using 741 and 555 chips, I can recommend the excellent book "Elementary Electronics" by Mel Sladdin and Alan Johnson ISBN 0 340 51373 X.

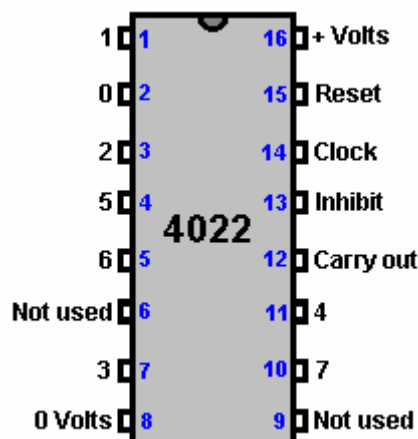
A Hex Inverter Signal Generator.

Here is a very well tested and highly thought of, low-cost oscillator circuit, using a 74HC14 Schmitt inverter chip (or the 40106B higher voltage CMOS chip). It allows fine tuning control of the frequency and the pulse width produced. Three of the inverters are connected together to give a more powerful output current drive:



The 4022 Divide-by-Eight Chip.

One very useful CMOS integrated circuit is the '4022' chip which is a 16-pin 'divide by 8' chip with built-in decoding. The connections are:



If pin 14 is provided with the output from some variety of astable multivibrator, on the first pulse, this chip sets the "0" output on pin 2 to High while the other outputs are Low. On the next pulse, the "0" output goes Low and the "1" output on pin 1 goes High. On the next pulse, output "1" goes Low and the "2" output on pin 3, goes High. And so on until on the eighth pulse, output "7" on pin 10 goes Low and output "0" goes high again.

The chip can also divide by lower numbers:

For 'Divide by 7' operation, connect pin 10 to pin 15 (this resets the output to '0')

For 'Divide by 6' operation, connect pin 5 to pin 15

For 'Divide by 5' operation, connect pin 4 to pin 15

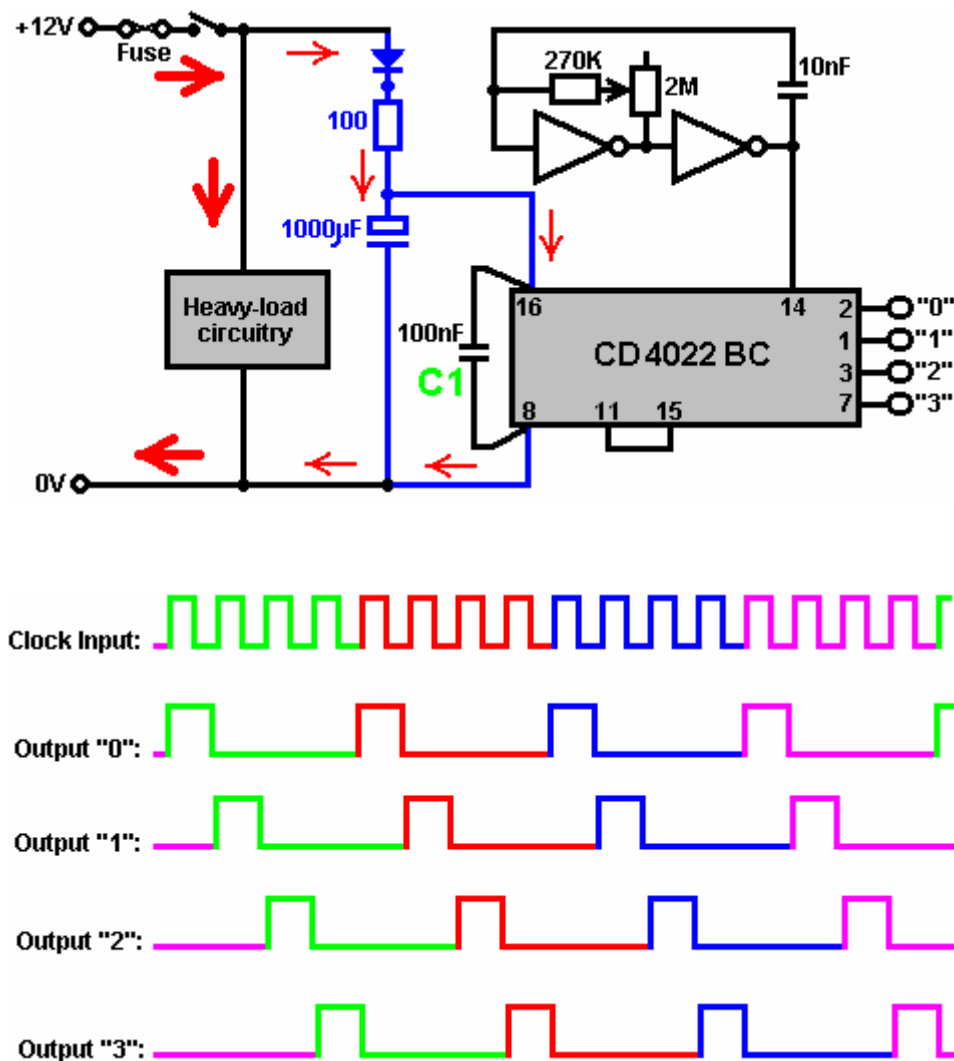
For 'Divide by 4' operation, connect pin 11 to pin 15

For 'Divide by 3' operation, connect pin 7 to pin 15

For 'Divide by 2' operation, connect pin 3 to pin 15

If you want a 'Divide by 1' circuit, I suggest you cut down on the amount of alcohol you drink.

Here is an illustration of a 'Divide by 4' setup:



There are a number of things to notice in the above diagram. Firstly, the practical arrangements for circuitry have not been stressed before. If the circuitry has a pulsing circuit drawing heavy current, as shown by the thick red arrows, then it should be physically connected to the battery and any low-current circuitry should be further away from the battery. The supply from the battery should have a fuse or circuit breaker and a switch in the line before anything else is connected, so that if any component develops a fault and goes short-circuit, the fuse will blow and prevent any significant problems.

Secondly, it is a good idea to provide the other circuitry with a smoothed power supply as shown by the blue components in the diagram. This minimises the effect if the battery voltage gets pulled down by the pulsing of the

high-current circuitry. The diode (silicon, 1 Amp, 50 V) stops the heavy current circuit drawing current from the large smoothing capacitor. The 100 ohm resistor limits the current into the large capacitor on switch-on and provides a little more smoothing. This circuitry is called “de-coupling” as it de-couples the low current circuitry from the high current circuitry.

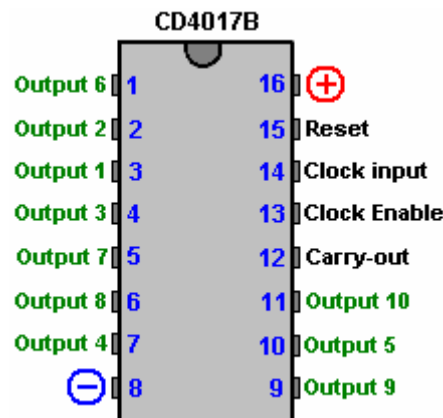
Thirdly, notice capacitor “C1” which is wired physically as close to the power supply pins of the integrated circuit as is possible. If a spike is superimposed on the battery supply, then this capacitor soaks it up and prevents it damaging or triggering the integrated circuit. A spike could be caused by a very strong magnetic pulse nearby as that can induce an extra voltage in the battery wires.

The lower part of the diagram shows the output voltages produced as the clock pulses reach pin 14 of the chip. The positive-going part of the clock signal triggers the change in state of the outputs. If necessary, a positive-going pulse on the reset pin, pin 15, causes output “0” to go high and the other outputs to go low.

The 4017 Divide-by-Ten Chip.

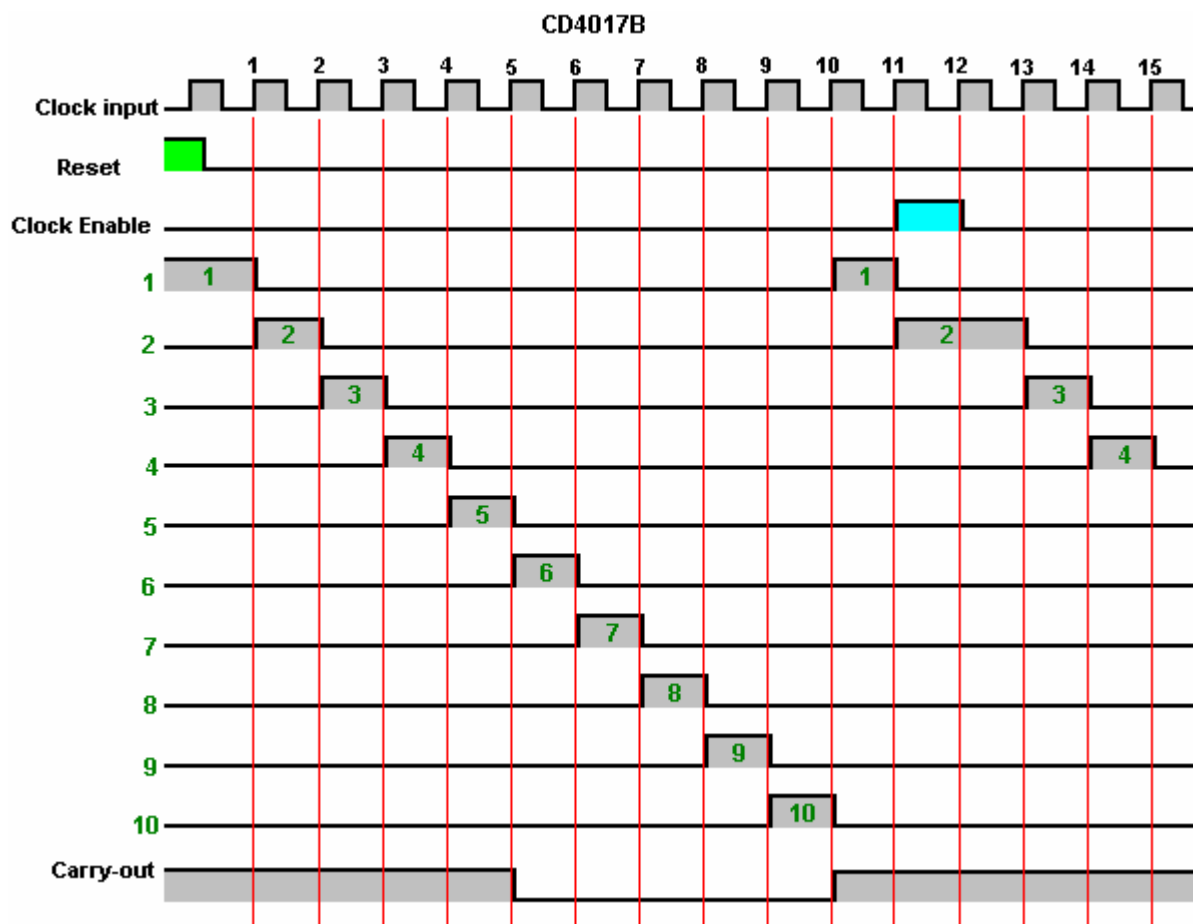
Now, to take this output sequencing a little further. For example, the Charles Flynn magnet motor shown in Chapter 1 needs coils to be powered up, one after the other and only one should be on at any one time. This calls for a circuit which has a large number of outputs. The CD4022BC chip gives up to eight outputs one after the other. The CD4017B chip gives up to ten outputs one after the other but there is no need to be limited by these numbers as more than one chip can be used. If you find this section difficult to understand, then just skip past to the next section as it is not important for you to understand these larger circuits.

The pin connections for the divide-by-ten CD4017B chip is shown here:



While this shows outputs 1 to 10, the manufacturers and some people who draw circuits, prefer to label the outputs as “0 to 9” which correspond to digital displays. In our style of operation, it is easier to think of the ten outputs as being from 1 to 10.

You will notice that there are two pin labels which we have not come across before, namely, the “Carry-out” pin and the “Clock Enable” pin. These allow us to use several of these chips in a row to give a much larger “divide-by” number. The “Clock Enable” pin can be used to block the clock input. The operation is like this:



In this example, the sequence is started by the Reset pin being given a high voltage as shown by the green shading. This pushes the output pin 1 to a high voltage and all of the other outputs to a low voltage and holds those voltages as long as the reset voltage is high.

When the Reset voltage drops, the next rising edge of the clock pulse (marked "1" in the diagram) causes the output 1 to go low and output 2 to go high. Each of the successive clock pulses "2" to "9" moves the high voltage steadily along the outputs until output pin 10 is high.

The next clock pulse rising edge (marked "10" in the diagram) starts the sequence again with output 10 going low and output 1 going high again. If nothing changes, then that sequence of output voltage changes will continue indefinitely.

However, in the diagram above, the Clock Enable pin voltage is driven high on clock pulse "11". Output 2 has just gone high and would have gone low when the rising edge of clock pulse "12" occurred, but in this case, the Clock Enable feature blocks the clock pulse and prevents it reaching the rest of the circuitry. This causes the output 2 voltage to stay high as long as the Clock Enable remains high. In this example, the Clock Enable voltage stays high for just one clock pulse, causing the output 2 voltage to be high for twice it's usual length, and then the sequence continues as before.

A Divide-by-Twenty-five Circuit.

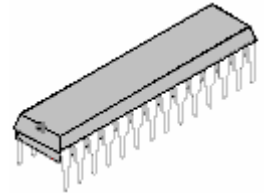
Here is one way to get a large "divide-by" number. This example is divide-by-25 because there is only one 'intermediate stage' but there can be any number and each additional one adds another eight outputs to the total:

single chip, and which is called a "PIC controller".

This new type of chip is not expensive, is easy to use, and can be changed to perform a different task in just a few seconds. It can perform timing tasks. It can act as a multivibrator. It can act as a "Divide-by-N" chip. It is a very impressive chip which is very useful. The reason that I mention it here is because it is at the heart of the fastest working Tesla Switch research forum around (the "energetic forum" group). The chip is something you need to know about as it will certainly take over more and more circuit applications in the coming years.

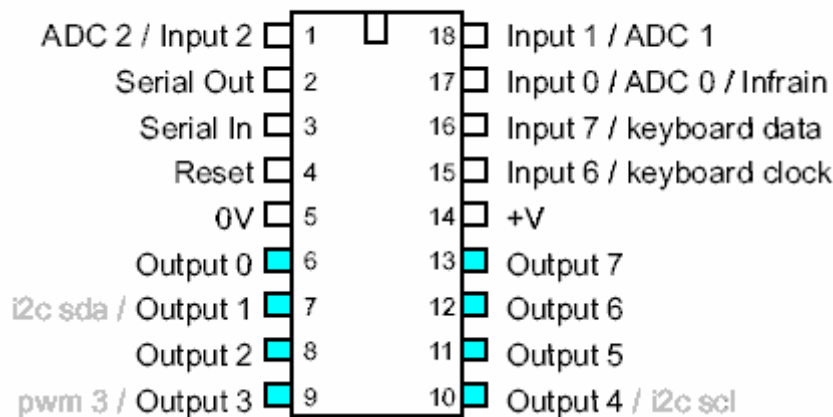
There is a whole family of these processor chips, but I will select just one for this description, and that will be the one being used by the "energetic forum" members, and I have to thank Jeff Wilson for his help in describing this circuitry, the programming and the methods which he uses.

First, however, some information on this new design of chip and the methods used with it. The one used by Jeff is called the "PICAXE-18X" and it looks like the chip shown here. From which you can see, it looks just like any other chip, although with eighteen pins. The powerful performance comes from the way that it operates. You are probably familiar with the "555" chip and understand that it operates by changing the voltage on just one of its pins (pin 3) the output pin, from a low voltage to a high voltage. The PIC chip can do that as well, but even better still, it has more than one output pin and it can alter the voltage on any of those pins to either a high or a low voltage and it can do that in any order and with any timing that you choose. This makes it a very versatile chip indeed and one which is very well suited to be the central controller for a Tesla Switch test environment.



The chip is used by wiring it into a circuit in the same sort of way that a 555 chip would be used, except that the PIC has its own internal timing clock and can operate in intervals of one thousandth of a second, that is, one millisecond.

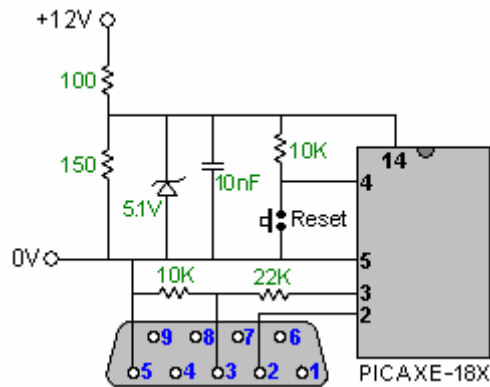
PICAXE-18X



The top eight pins are for making the chip work. The next two are for providing the chip with electrical power. The bottom eight pins are separate outputs, any one of which can operate switches, timers, etc., just as the output from a 555 chip can. Having been named by computer people, instead of the eight output pins being numbered from 1 to 8 as any rational person would do, they have numbered them from 0 to 7.

The voltage on those output pins will be either High or Low. PIC switching can be used with a wide range of different free-energy designs. The PIC chip is generally supplied with a socket, a connecting cable and a program for feeding instructions into the chip. The feed is generally from an ordinary PC. The programming instructions are very simple and anyone can learn how to use them in just a few minutes.

So let's look at a circuit which has been used by Jeff when he tests prototype circuitry. The first part of the circuit is for connecting the standard PC socket to the PIC chip and it looks like this:



A standard 9-pin computer socket has its pin 2 connected to the PIC's pin 2, pin 3 connected to the PIC's pin 3 via a 10K / 22K voltage divider resistor pair (which lowers the incoming signal voltage), and pin 5 is connected to the PIC's pin 5. That is all that's needed to feed information into the PIC chip.

The chip is supplied from a 12-volt battery but as it needs a 5-volt supply, the 100 / 150 ohm (2 watt) resistor pair is used to drop the 12 volts down to about 7 volts and then the 5.1-volt zener diode clamps the voltage at 5.1 volts, which is just what the chip needs. The tiny 10 nF (0.01 microfarad) capacitor is there to trap any voltage spikes should any be picked up from some outside influence. Finally, the press-button switch used to short between pins 4 and 5 is used to wipe out the program inside the PIC, ready for a new program to be loaded.

The actual programming is not difficult and the feed into the chip is handled by the program supplied with the chip and which is run on your home computer. Let's take an example. Suppose we want the output on pin 10 to act as a clock signal. The people who made the chip expect that pin to be called "Output 4" in the program. Please don't ask me why it isn't called "10" in the program as I have no answer for you other than "it takes all sorts of people to make a world".

All right, suppose we want to produce an output signal like a 555 chip running at 50 Hz. We choose one of our output pins, say, the physical pin 10, that being the bottom right hand pin on the chip. As you can see from the pin diagram of the chip shown above, pin 10 is called "Output 4" in a set of commands, or just "4" to save typing. The program might be:

```
Main:
  high 4
  pause 10
  low 4
  pause 10
goto Main
```

Wow - really difficult stuff !! Only a genius could manage to program! Well, we'll see if we can struggle along with this "difficult" stuff.

The "Main:" at the start is a "label" which can be jumped to and that is done by the "goto Main" command which sends the chip back to repeat the commands in the loop indefinitely (or until the chip is powered down).

The second line "high 4" tells the chip to put the maximum possible voltage on the "Output 4" which is the physical pin 10 of the chip. The chip does this immediately, with no time delay.

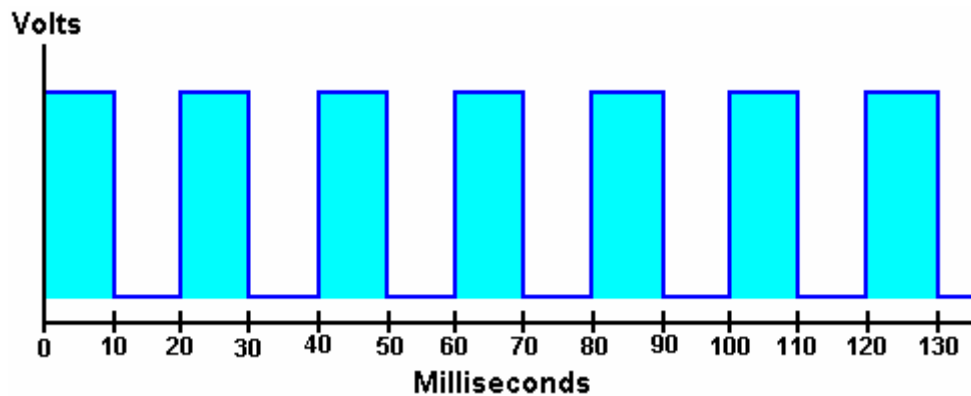
If we want the output to give a 50 Hz output signal, then the voltage on our chosen output pin will have to go high, pause, go low, pause and go high again, 50 times each second. As there are 1,000 milliseconds in one second, and the chip's clock runs with 1 millisecond ticks, then we need our complete cycle of "up, pause, down, pause" to happen 50 times in those 1,000 clock ticks. That is, once every 20 ticks, so each delay will be 10 clock ticks long.

The third line "pause 10" tells the chip to sit on its hands and do nothing for the next 10 ticks of its internal clock (which ticks 1,000 times per second).

The fourth line "low 4" tells the chip to lower the output voltage on its "Output 4" (pin 10 in real life) to its minimum value.

The fifth line "pause 10" tells the chip to wait for 10 milliseconds before doing anything else.

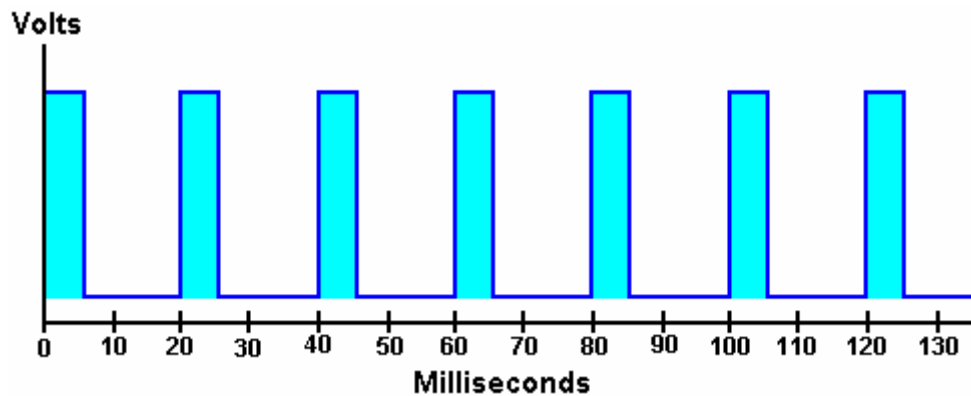
The last line "goto Main" tells the computer to go back to the label "Main:" and continue with whatever instructions follow that label. This puts the chip into an 'infinite loop' which will make it generate that output waveform continuously. The output will look like this:



This gives an even waveform, that is, one with a Mark/Space ratio of 50:50 or a Duty Cycle of 50%. If we want the same rate of pulsing but a Duty Cycle of just 25% then the program would be:

```
Main:
  high 4
  pause 5
  low 4
  pause 15
goto Main
```

which produces this waveform:

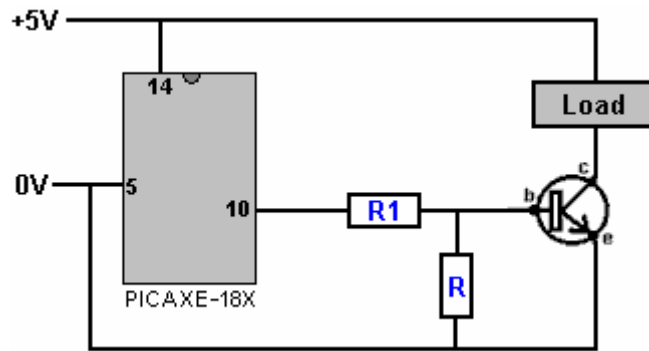


If you wanted "Output 7" (physical pin 13) to do the reverse of this at the same time - that is, when Output 4 goes high we want Output 7 to go low, and vice versa, then, for a 20% Duty Cycle the program would be:

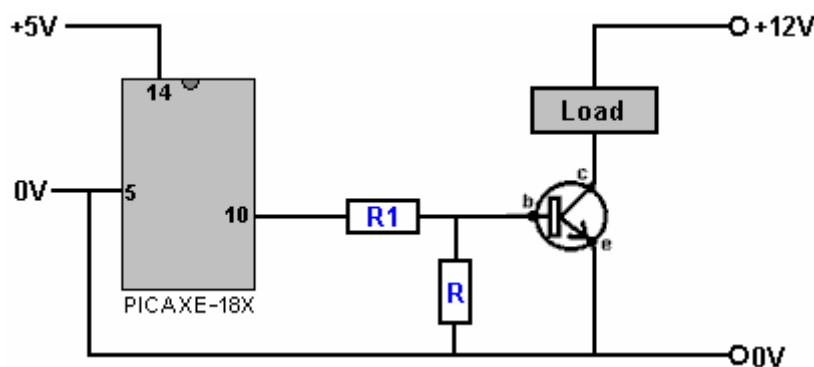
```
Main:
  high 4
  low 7
  pause 4
  low 4
  high 7
  pause 16
goto Main
```

These output voltages are then used in exactly the same way as the output voltages on pin 3 of a 555 chip, or any of the outputs of NAND gates, Hall-effect sensor chips, Schmitt triggers, or whatever. If the device to be powered requires very little current, then the easiest method is to connect the load directly to the output pin.

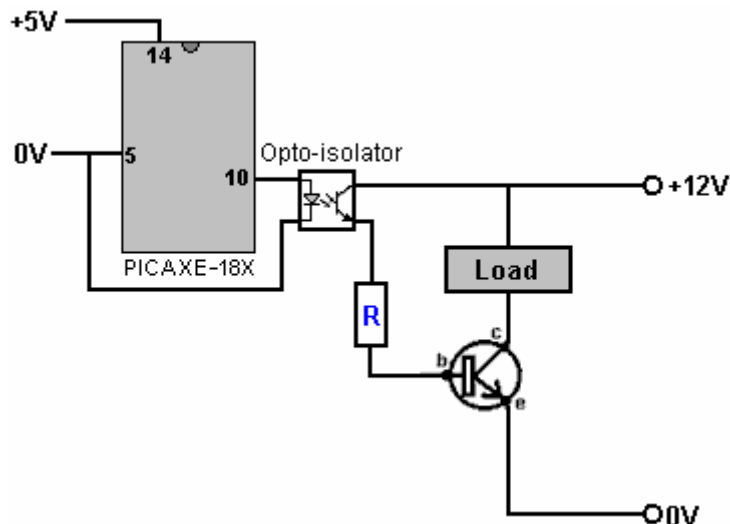
If, as is most often the case, the device to be powered needs a large current to make it work, then the output voltage is used to power a transistor, perhaps like this:



Here, the resistor "R1" limits the current fed into the base of the transistor when pin 10 goes high, but allowing enough current for the transistor to switch on fully, powering the load. The resistor "R" makes sure that the transistor switches off fully when the output on pin 10 goes low. The circuit as shown restricts the load to some piece of equipment which can operate on just five volts, so an alternative circuit could be:

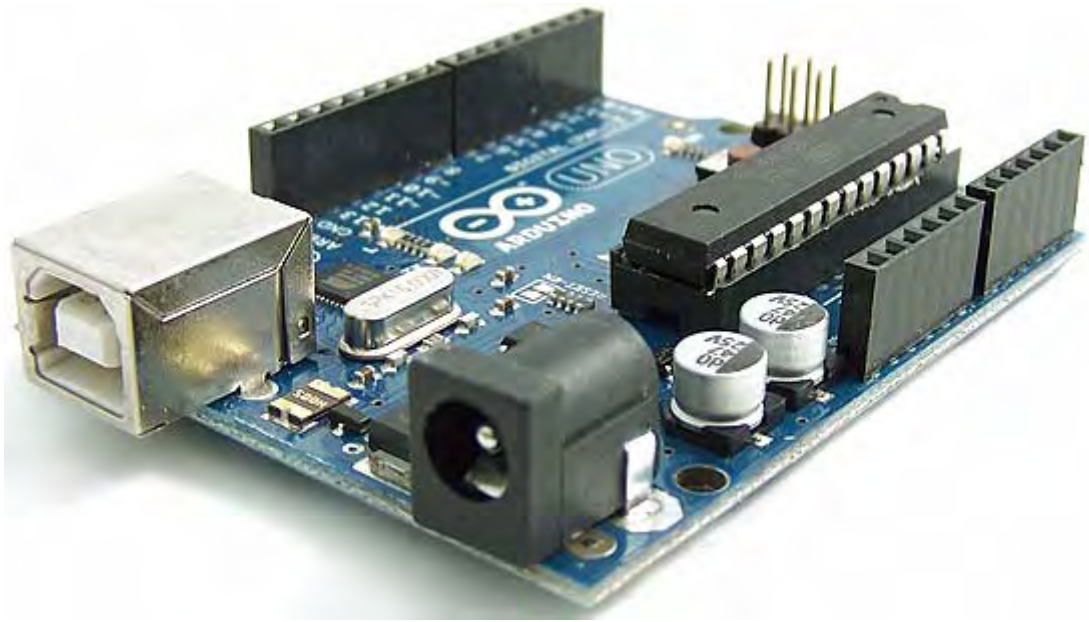


This allows whatever voltage the load needs to be applied to the load, while the PIC chip remains running on its normal 5-volt supply. However, the equipment to be powered may not be able to have a common zero voltage connection with the PIC. To deal with this, an optical isolation chip can be used like this:



Here a high output voltage on pin 10 of the PIC chip lights up the LED inside the opto-isolator chip, causing a major drop in the resistance between the other two pins. This causes a current controlled by the resistor "R" to be fed into the base of the transistor, switching it on and powering the load.

Recently, a very popular programmable chip has been introduced. It is called the "Arduino" and it is fast and versatile and very popular with experimenters. There is an extensive set of English-language Video tutorials on the Arduino chip, the first in the series by Jeremy Blum is http://www.youtube.com/watch?v=fCxA9_kg6s. The board looks like this:



Capacitors.

We have avoided mentioning capacitors in any detail as it has not been necessary for understanding the circuitry covered so far. Capacitors come in many sizes, types and makes. Their size is stated in 'Farads' but as the Farad is a very large unit, you are unlikely to encounter a capacitor marked in anything larger than a microfarad, which is a millionth of a Farad. The symbol for a microfarad is μF where 'mu' is the letter of the Greek alphabet. This is a pain for normal text production as Greek letters do not occur in your average font. Some circuit diagrams give up on 'mu' and just write it as uF which looks like μF slightly mis-printed where the descender of the mu has not printed.

Anyway, very large capacitors which you may encounter range from 5,000 microfarads to maybe as much as 20,000 microfarads. Large capacitors range from 10 microfarads to 5000 microfarads. Medium sized capacitors run from 0.1 microfarad to about 5 microfarads and small capacitors are those below 0.1 microfarad.

1000 nanofarads ('nF') = 1 microfarad.

1000 picofarads ('pF') = 1 nanofarad

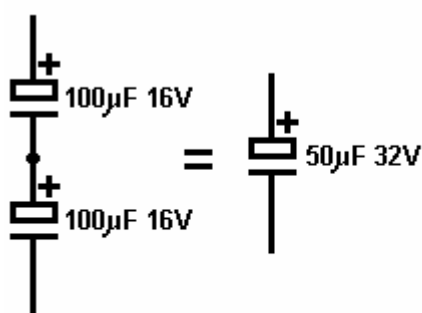
So:

0.01 microfarad can be written as 10nF

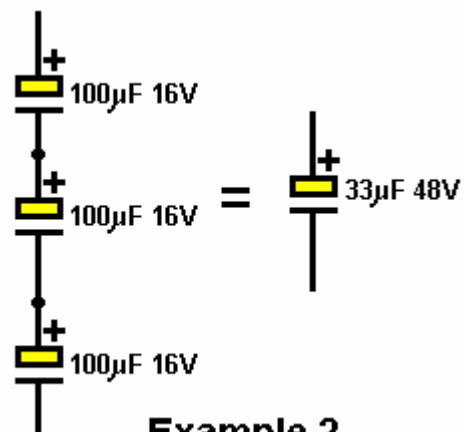
0.1 microfarad can be written as 100nF

0.1nF can be written as 100pF

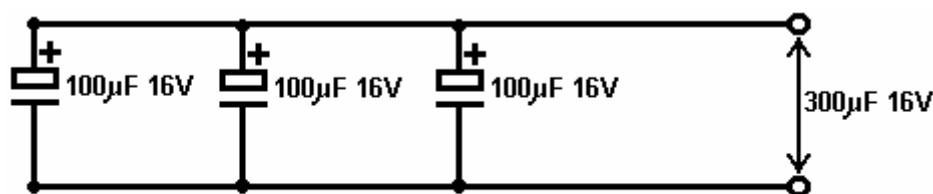
Capacitors larger than 1 microfarad tend to be 'polarised'. In other words, the capacitor has a '+' connector and a '-' connector, and it does matter which way round you connect it. The larger capacitors have a voltage rating and this should **not** be exceeded as the capacitor can be damaged and possibly even totally destroyed. Capacitors can be added together, but surprisingly, they add in the reverse way to resistors:



Example 1



Example 2



Example 3

If two capacitors are wired in series, as shown in Example 1 above, the overall capacity is reduced while the voltage rating increases. The reduction in capacitance is given by:

$$1/C_t = 1/C_1 + 1/C_2 + 1/C_3 + \dots$$

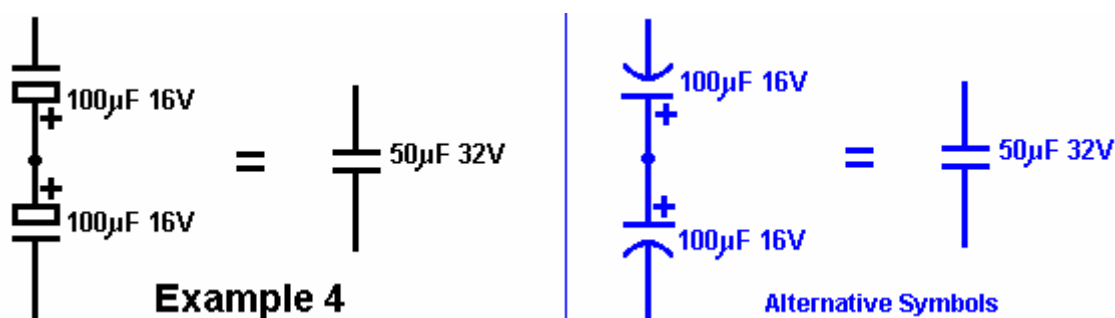
In Example 1, then, $1/\text{total capacitance} = 1/100 + 1/100$ or $1/C_t = 2/100$ or $1/C_t = 1/50$ so the overall capacitance reduces from 100 microfarads to 50 microfarads. The advantage in wiring the capacitors like this is that the voltage rating has now increased to 32V (16V across each of the capacitors).

In Example 2, the overall capacitance has reduced to a third of 100 microfarads but the voltage rating has tripled.

In Example 3, the capacitors are wired in parallel. The voltage rating is unchanged but the overall capacitance is now the sum of the three capacitors, namely 300 microfarads.

There is no need for the capacitors to have similar values, there are merely shown that way in the examples to make the arithmetic easier and not distract you from the ways in which the capacitors interact together.

Occasionally, a circuit needs a large capacitor which is not polarised. This can be provided by placing two polarised capacitors back-to-back like this:



Example 4

Alternative Symbols

When the capacitors are connected this way, it does not matter which end of the pair is connected to the positive side of the circuit and which to the negative side.

Large capacitors usually have their capacitance and voltage printed on the outside of the capacitor, but small capacitors are usually far too tiny for that to be an option. So, a code very much like that used for resistors is used for small capacitors. The code is a 2-digit code for capacitors up to 100 picofarads and for higher values it is a 3-digit code where the first two digits are the numerical value of the capacitor in picofarads and the third digit is the number of zeros following the two digits. One thousand picofarads (pF) is one nanofarad (nF) and one thousand nanofarads is one microfarad. These are some common values:

Value	Code	Value	Code
10 pF	10	2.2 nF	222
22 pF	22	4.7 nF	472
47 pF	47	10 nF	103
100 pF	101	22 nF	223
220 pF	221	47 nF	473
470 pF	471	100 nF	104
1 nF	102	220 nF	224

The time has come for a serious warning: High voltages are very, very dangerous. Do not become so familiar with them that you treat them casually. **High voltages can kill you.** Capacitors are capable of building up high voltages and some good makes can hold the charge for several days.

In particular, do **not** try to make adjustments to, or take parts from, the inside of a TV set. A black and white TV set uses 18,000 Volts on the magnetic coils used to create the moving picture on the tube. A capacitor inside the set may well have that voltage on it three days after the set was last used. Don't fool around inside a TV set, it could kill you quick, or if you are really unlucky, it could injure you for life. A colour TV set uses 27,000 Volts to operate the coils inside it and that will fry you in jig time if you touch it.

Also, please don't think that you are safe if you don't quite touch it; 27,000 volts can jump across a gap to your hand. If you try to discharge a TV capacitor using a metal screwdriver with a wooden handle, please ensure that your medical insurance is up to date before you do it. You can receive a hefty shock through the screwdriver handle.

Voltages up to 24 Volts should be quite safe. **However**, some circuits will generate very high voltages even though the battery driving the circuit is low voltage. A standard off-the-shelf inverter circuit produces 240 Volts AC from a 12 Volt battery. Just because the battery is only 12 Volts does **not** mean that the circuit is not dangerous. Circuits which have inductors in them can produce high voltages, especially if they contain large capacitors. The voltage which produces the spark in your car engine is very high and it comes from the 12-volt car battery. You know enough about this by now, so **pay attention!**

The more advanced stuff:

You do not need to bother with this section if you are just starting out with some basic switching circuits of the type already described in this tutorial, so please feel free to skip this section and move on to the "Prototype Construction" section which you will find immediately useful.

This section is a lightweight introduction to Alternating Current circuits and pulsed DC circuits. Let me stress again that I am mainly self-taught and so this is just a general introduction based on my present understanding.

AC Power Factors.

Alternating Current, generally called "AC" is called that because the voltage of this type of power supply is not a constant value. A car battery, for instance, is DC and has a fairly constant voltage usually about 12.8 volts when in it's fully charged state. If you connect a voltmeter across a car battery and watch it, the voltage reading will not change. Minute after minute it says exactly the same because it is a DC source.

If you connect an AC voltmeter across an AC power supply, it too will give a steady reading, but it is telling a lie. The voltage is changing all the time in spite of that steady meter reading. What the meter is doing is **assuming** that the AC waveform is a sine wave like this:



and based on that assumption, it displays a voltage reading which is called the "Root Mean Square" or "RMS" value. The main difficulty with a sine wave is that the voltage is below zero volts for exactly the same length of time as it is above zero volts, so if you average it, the result is zero volts, which is not a satisfactory result because you can get a shock from it and so it can't be zero volts, no matter what the arithmetical average is.

To get over this problem, the voltage is measured thousands of times per second and the results squared (that is, the value is multiplied by itself) and then those values are averaged. This has the advantage that when the voltage is say, minus 10 volts and you square it, the answer is plus 100 volts. In fact, all of the answers will be positive, which means that you can add them together, average them and get a sensible result. However, you end up with a value which is far too high because you squared every measurement, and so you need to take the square root of that average (or "mean") value, and that is where the fancy sounding "Root Mean Square" name comes from – you are taking the (square) root of the (average or) mean value of the squared measurements.

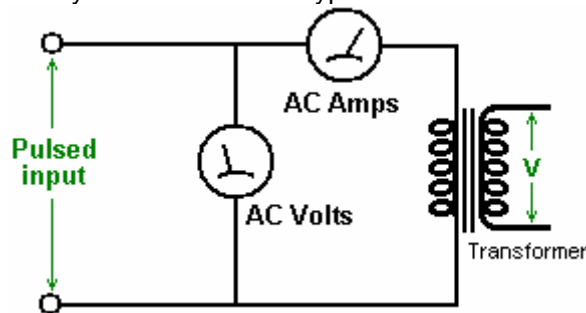
With a sine wave like this, the voltage peaks are 41.4% higher than the RMS value which everyone talks about. This means that if you feed 100 volts AC through a rectifier bridge of four diodes and feed it into a capacitor the

capacitor voltage will **not** be 100 volts DC but instead it will be 141.4 volts DC and you need to remember that when choosing the voltage rating of the capacitor. In that instance I would suggest a capacitor which is made to operate with voltages up to 200 volts.

You probably already knew all of that, but it may not have occurred to you that if you use a standard AC voltmeter on a waveform which is **not** a sine wave, that the reading on the meter is most unlikely to be correct or anywhere near correct. So, please don't merrily connect an AC voltmeter across a circuit which is producing sharp voltage spikes like, for instance, one of John Bedini's battery pulsing circuits, and think that the meter reading means anything (other than meaning that you don't understand what you are doing).

You will, hopefully, have learned that power in watts is determined by multiplying the current in amps by the voltage in volts. For example, 10 amps of current flowing out of a 12 volt power supply, represents 120 watts of power. Unfortunately, that only holds true for circuits which are operating on DC, or AC circuits which have only resistors in them. The situation changes for AC circuits which have non-resistive components in them.

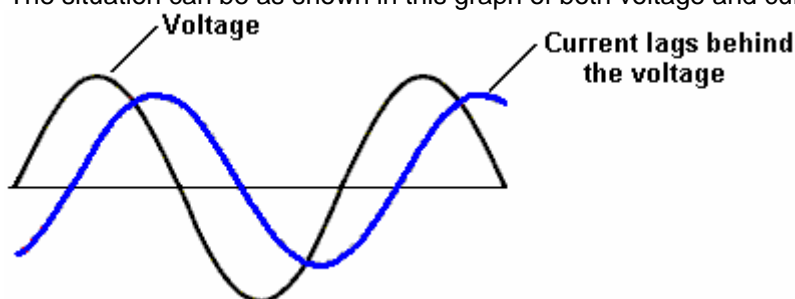
The circuits of this type which you are likely to come across are circuits which have coils in them, and you need to think about what you are doing when you deal with these types of circuit. For example, consider this circuit:



This is the output section of a prototype which you have just built. The input to the prototype is DC and measures at 12 volts, 2 amps (which is 24 watts). Your AC voltmeter on the output reads 15 volts and your AC ammeter reads 2.5 amps and you are delighted because $15 \times 2.5 = 37.5$ which looks much bigger than the 24 watts of input power. **But**, just before you go rushing off to announce on YouTube that you have made a prototype with $COP = 1.56$ or 156% efficient, you need to consider the real facts.

This is an AC circuit and unless your prototype is producing a perfect sine wave, then the AC voltmeter reading will be meaningless. It is just possible that your AC ammeter is one of the few types that can accurately measure the current no matter what sort of waveform is fed to it, but it is distinctly possible that it will be a digital meter which assesses current by measuring the AC voltage across a resistor in series with the output, and if that is the case, it will probably be assuming a sine wave. The odds are that both readings are wrong, but let's take the case where we have great meters which are reading the values perfectly correctly. Then the output will be 37.5 watts, won't it? Well, actually, no it won't. The reason for this is that the circuit is feeding the transformer winding which is a coil and coils don't work like that.

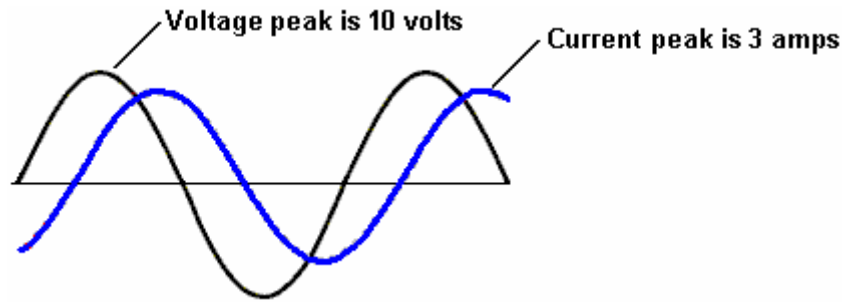
The problem is that, unlike a resistor, when you apply a voltage across a coil the coil starts absorbing energy and feeding it into the magnetic field around the coil, so there is a delay before the current reaches its maximum value. With DC, this generally doesn't matter very much, but with AC where the voltage is changing continuously, it matters a great deal. The situation can be as shown in this graph of both voltage and current:



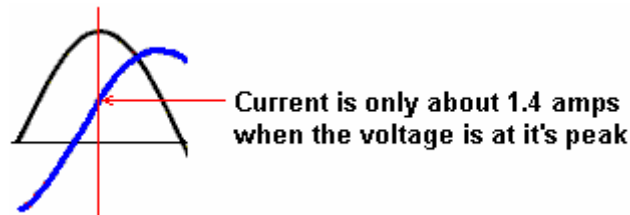
At first, this does not look like any great problem, but it has a very significant effect on the actual power in watts. To get the 37.5 watts output which we were talking about earlier, we multiplied the average voltage level by the average current level. But these two values do not occur at the same time and that has a major effect.

As this can be a little difficult to see, let's take the peak values rather than the averages as they are easier to see. Let's say that in our example graph that the voltage peak is 10 volts and the current peak is 3 amps. If this were

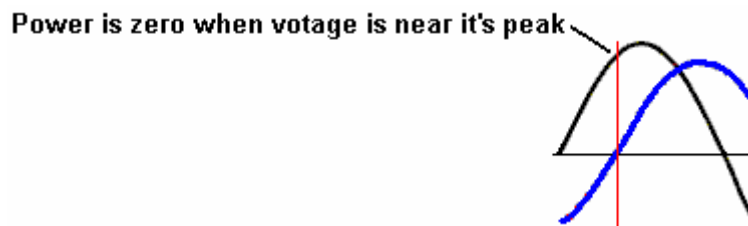
DC we would multiply them together and say that the power was 30 watts. But with AC, this does not work due to the timing difference:



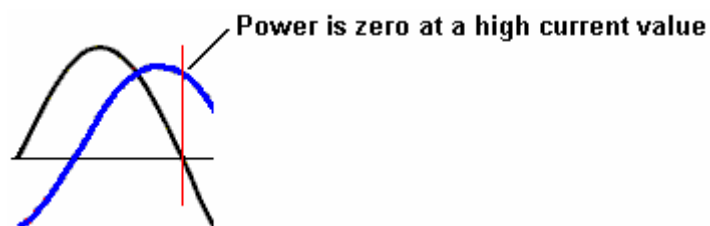
When the voltage is peaking, the current is nowhere near its peak value of 3 amps:



As a result of this, instead of getting our expected peak power at the top of the voltage peak, the actual power in watts is very much lower – less than half of what we were expecting. Not so good, but it gets worse when you look at the situation more closely. Take a look at what the voltage is when the current crosses the zero line, that is, when the current is zero. The output power is zero when the current is zero but this occurs when the voltage is at a very high value:

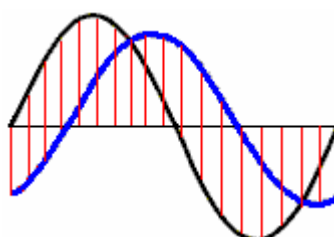


The same goes for when the voltage is zero. When the voltage is zero, then the power is also zero, and you will notice that this occurs when the current is at a high value:



The power is **not** the average current multiplied by the average voltage if there is a coil involved in the circuit – it will be less than that by an amount known as the “power factor” and I’ll leave you to work out why it is called that.

So, how do you determine what the power is? It is done by sampling the voltage and current many times per second and averaging those combined results:



Both the voltage and the current are sampled at the times indicated by the vertical red lines and those figures are used to calculate the actual power level. In this example, only a few samplings are shown, but in practice, a very large number of samples will be taken. The piece of equipment which does this is known as a wattmeter as it measures watts of power. The sampling can be done by windings inside the instrument, resulting in an instrument which can be damaged by overloading without the needle being anywhere near full deflection, or it can be done by digital sampling and mathematical integration. Most digital sampling versions of these meters only operate at high frequencies, typically over 400,000 cycles per second. Both varieties of wattmeter can handle any waveform and not just sine waves.

The power company supplying your home measures the current and assumes that the full voltage is present all of the time that the current is being drawn. If you are powering a powerful electric motor from the mains, then this current lag will cost you money as the power company does not take it into account. It is possible to correct the situation by connecting one or more suitable capacitors across the motor to minimise the power loss.

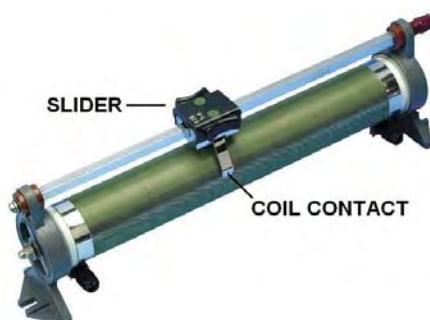
With a coil (fancy name “inductor” symbol “L”), AC operation is very different to DC operation. The coil has a DC resistance which can be measured with the ohms range of a multimeter, but that resistance does not apply when AC is being used as the AC current flow is **not** determined by the DC resistance of the coil alone. Because of this, a second term has to be used for the current-controlling factor of the coil, and the term chosen is “impedance”. The wire in any coil has a resistance and that opposes current flow through the coil irrespective of whether the voltage applied to the coil is DC or AC. The capacitance between the neighbouring turns of wire in a coil, introduces a feature of the coil which “impedes” AC current flow through the coil and the amount of that impedance depends on the frequency of the AC voltage being applied to the coil.

The impedance of a coil depends on it's size, shape, method of winding, number of turns and core material. If the core is made up of iron or steel, (usually thin layers of iron which are insulated from each other), then it can only handle low frequencies. You can forget about trying to pass 10,000 cycles per second (“Hz”) through the coil as the core just can't change it's magnetisation fast enough to cope with that frequency. A core of that type is ok for the very low 50 Hz or 60 Hz frequencies used for mains power, which are kept that low so that electric motors can use it directly.

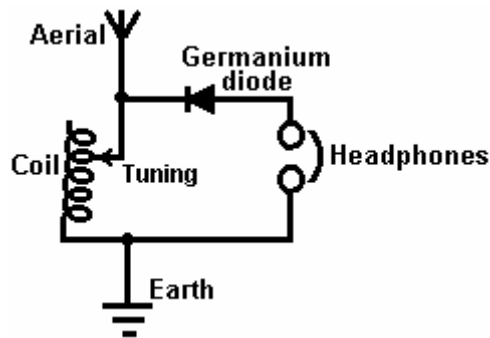
For higher frequencies, ferrite can be used for a core and that is why some portable radios use ferrite-rod aerials, which are a bar of ferrite with a coil wound on it. For higher frequencies (or higher efficiencies) iron dust encapsulated in epoxy resin is used. An alternative is to not use any core material and that is referred to as an air-core coil. These are not limited in frequency by the core but they have a very much lower inductance for any given number of turns. The efficiency of the coil is called it's “Q” (for “Quality”) and the higher the Q factor, the better. The resistance of the wire lowers the Q factor.

A coil has inductance, and resistance caused by the wire, and capacitance caused by the turns being near each other. However, having said that, the inductance is normally so much bigger than the other two components that we tend to ignore the other two. Something which may not be immediately obvious is that the impedance to AC current flow through the coil depends on how fast the voltage is changing. If the AC voltage applied to a coil completes one cycle every ten seconds, then the impedance will be much lower than if the voltage cycles a million times per second.

If you had to guess, you would think that the impedance would increase steadily as the AC frequency increased. In other words, a straight-line graph type of change. That is not the case. Due to a feature called resonance, there is one particular frequency at which the impedance of the coil increases massively. This is used in the tuning method for AM radio receivers. In the very early days when electronic components were hard to come by, variable coils were sometimes used for tuning. We still have variable coils today, generally for handling large currents rather than radio signals, and we call them “rheostats” and some look like this:

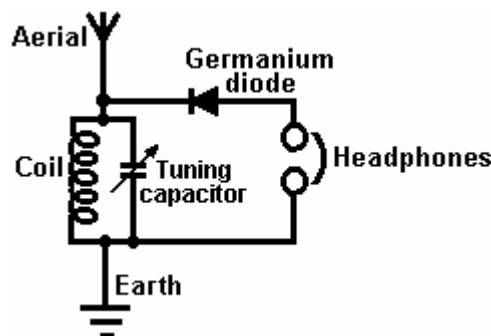


These have a coil of wire wound around a hollow former and a slider can be pushed along a bar, connecting the slider to different winds in the coil depending on it's position along the supporting bar. The coil connections are then to the slider and to one end of the coil. The position of the slider effectively changes the number of turns of wire in the part of the coil which is in the circuit. Changing the number of turns in the coil, changes the resonant frequency of that coil. AC current finds it very, very hard to get through a coil which has the same resonant frequency as the AC current frequency. Because of this, it can be used as a radio signal tuner:



If the coil's resonant frequency is changed to match that of a local radio station by sliding the contact along the coil, then that particular AC signal frequency from the radio transmitter finds it almost impossible to get through the coil and so it (and only it) diverts through the diode and headphones as it flows from the aerial wire to the earth wire and the radio station is heard in the headphones. If there are other radio signals coming down the aerial wire, then, because they are not at the resonant frequency of the coil, they flow freely through the coil and don't go through the headphones.

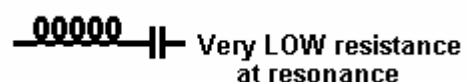
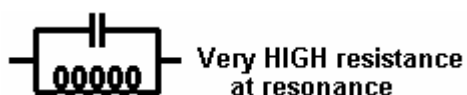
This system was soon changed when variable capacitors became available as they are cheaper and more compact. So, instead of using a variable coil for tuning the radio signal, a variable capacitor connected across the tuning coil did the same job:



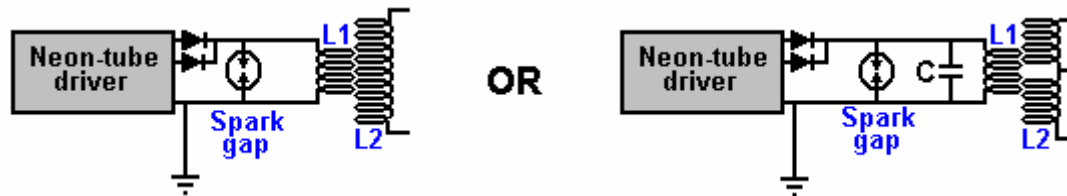
Resonance.

While the circuit diagram above is marked "Tuning capacitor" that is actually quite misleading. Yes, you tune the radio receiver by adjusting the setting of the variable capacitor, **but**, what the capacitor is doing is altering the resonant frequency of the coil/capacitor combination and it is the resonant frequency of that combination which is doing exactly the same job as the variable coil did on it's own.

This draws attention to two very important facts concerning coil/capacitor combinations. When a capacitor is placed across a coil "in parallel" as shown in this radio receiver circuit, then the combination has a very high impedance (resistance to AC current flow) at the resonant frequency. But if the capacitor is placed "in series" with the coil, then there is nearly zero impedance at the resonant frequency of the combination:



This may seem like something which practical people would not bother with, after all, who really cares? However, it is a very practical point indeed. In Chapter 3, some of the very high-power devices produced by Don Smith are described. Typically, he uses an off-the-shelf neon-tube driver module as an easy way to provide a high-voltage, high-frequency AC current source, typically, 6,000 volts at 30,000 Hz. He then feeds that power into a Tesla Coil which is itself, a power amplifier. The arrangement is like this:



People who try to replicate Don's designs tend to say "I get great sparks at the spark gap until I connect the **L1** coil and then the sparks stop. This circuit can never work because the resistance of the coil is too low".

If the resonant frequency of the **L1** coil does not match the frequency being produced by the neon-tube driver circuit, then the low impedance of the **L1** coil will definitely pull the voltage of the neon-tube driver down to a very low value. But if the **L1** coil has the same resonant frequency as the driver circuit, then the **L1** coil (or the **L1** coil/capacitor combination shown on the right, will have a very high resistance to current flow through it and it will work well with the driver circuit. So, no sparks, means that the coil tuning is off. It is the same as tuning a radio receiver, get the tuning wrong and you don't hear the radio station.

Choosing components which are not specified.

Some people find it difficult to select a suitable component where the exact component is not specified or where an alternative has to be selected, so perhaps a few general pointers might be helpful. The reason why component values are omitted may well be because a very wide range of alternative values can be used and if one particular is specified, the newcomers to electronics feel that they **have** to use that one value or the circuit will not work, (which is almost never the case). For example, I have been asked if a capacitor rated at 25V could be used instead of the same value capacitor rated at 16V shown in the circuit, to which the answer is 'yes, most definitely'. The lower voltage rating is adequate and the component cheaper to buy, but if one of a higher voltage rating is available, then it can be used.

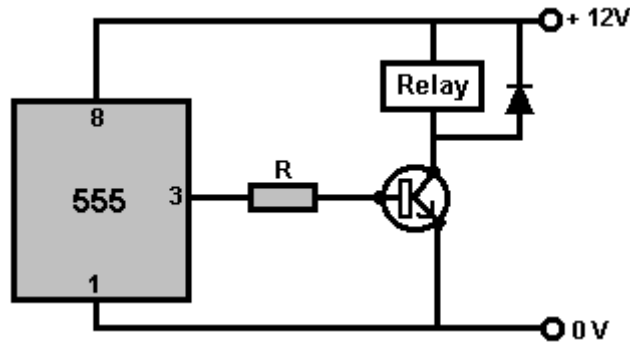
With **capacitors**, you need to consider the physical size and wire connections, the capacitance, the voltage rating, and the leakage. The cost and size of a capacitor is directly related to it's voltage rating, and once the voltage rating exceeds that normally used, the price shoots up rapidly as the sales volume reduces rapidly, which in turn, discourages further sales. This sometimes causes circuit builders to connect chains of cheaper capacitors together to make a smaller-capacity high-voltage capacitor. In the case of Tesla Coil builders, they then may connect several of these chains in parallel to boost the capacitance.

If the voltage rating is exceeded (usually by a very large amount), the capacitor will be damaged and become either a short-circuit, or more likely, an open circuit. Either way, it will never work as a capacitor again. In a household circuit, where the capacitor is being used as part of the power supply to the circuit, the voltage rating does not need to be much higher than the supply voltage, with say, 16V being used for a 12V circuit. You could use a capacitor rated at 25V, 40V, 63V, 100V or 400V and it would work perfectly well, but it will be much larger and have cost much more. But, if you have one sitting around and not being used, there is no reason why you should not use it rather than paying to buy another one.

If the capacitor is being used in a timing circuit where a high-value resistor is feeding current to it, then the leakage current of the capacitor becomes very important. Electrolytic capacitors are seldom suitable for such an application as they have a small, unpredictable leakage current which will vary with the age of the capacitor. For accurate timing with a capacitor, ceramic, polypropylene, mylar or tantalum should be used.

The voltage rating for an electrolytic capacitor is for DC, so if you use it for limiting current in an AC power supply, that is, where the current flows through the capacitor rather than the capacitor being placed across the supply and is acting to combat ripple, then great care is needed. The capacitor will heat up due to the power flowing through it, and it is possible for an electrolytic capacitor used in that way to rupture or 'explode' due to the electrolyte boiling. Instead, you need to use the very much more expensive oil-filled can capacitors (as shown near the end of chapter 10). That style of usage is unusual for home constructors.

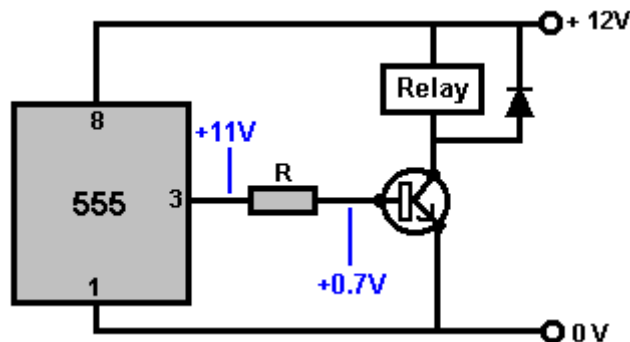
With bi-polar **transistors**, you need to use commonsense. Suppose a 555 timer chip is required to power a transistor which controls a relay:



For the moment, we will ignore the fact that the 555 could drive the relay directly without the need for a transistor. let's say that the relay draws a current of 30 mA when connected to a 12V supply. Therefore, the transistor needs to be able to handle a current of 30 mA. Any small switching transistor such as the BC109 or 2N2222 can easily handle that current. The transistor also needs to be able to handle 12 volts. If in doubt, look up the characteristics of your choice of transistor at <http://www.alldatasheet.co.kr/> by entering the transistor name 'BC109' or whatever in the entry box at the top of the screen and clicking on the button to the right of it. Eventually, it will let you download a pdf document specifying the transistor, and that will show you the voltages which the transistor can handle. Both of the above transistors can handle far more than 12V.

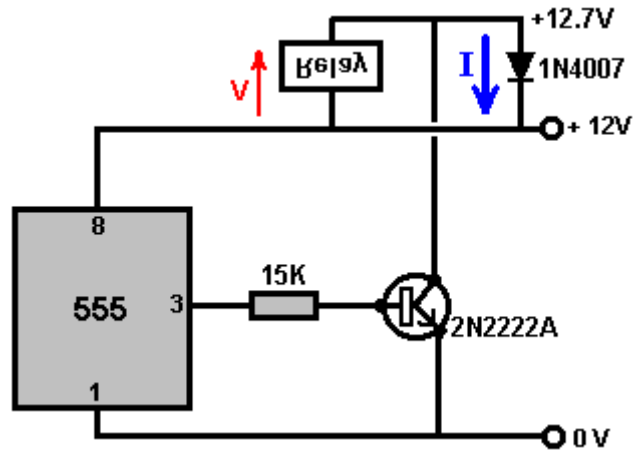
The next question is, 'can the transistor switch fast enough to work in this circuit?' and the data sheet will show that they can switch on and off a million times per second. As the relay can only switch on and off a few times per second, the transistor can easily operate fast enough to handle the switching.

Next, we need to know what size of resistor would be suitable. The data sheet will also show the DC current gain of the transistor. This is usually marked as "hfe" and for these transistors is likely to be a minimum of, say, 200. This means that the current flowing into the base of the transistor needs to be one two-hundredth of the relay's 30 mA which is 0.15 mA. The resistor will have about +11 volts at pin 3 of the 555 timer and around +0.7 volts at the base of the transistor when it is switched fully on. That means that the resistor will have about 10.3 volts across it when the relay is switched on:



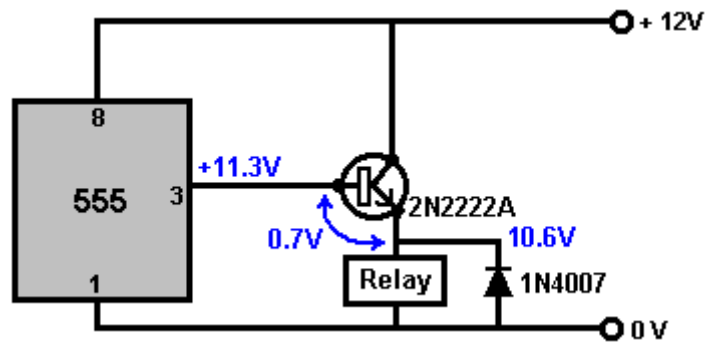
So, what size of resistor will have 0.15 mA flowing through it when there is a 10.3-volt drop across it? We know that a 1K resistor passes 1mA per volt and so would pass 10.3 mA with 10.3 volts across it. That is far more than we need. A 10K resistor would pass 1.03 mA which is still far too much but certainly could be used. As it is a resistor, we can use Ohm's Law: $R = V / A$ (Ohms equals Volts over Amps), or $R = 10.3 / 0.00015$ which is 68K. So, any resistor between 68K and perhaps 15K should work well.

The diode is there to protect the transistor from excessive voltage caused by the coil of the relay. When a coil is switched off suddenly, it generates a reverse voltage which can be hundreds of volts, pulling the collector of the transistor far above the +12V power supply line. When that starts to happen, it effectively reverses the diode direction, allowing it to conduct and short-circuit that big voltage spike:



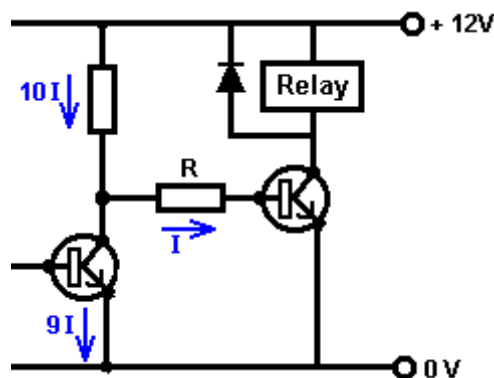
Due to the short-circuiting, the voltage can't get any higher and the current through the diode is not large, so most diodes such as the popular and cheap 1N4001 or 1N4007 types can be used.

When a transistor is connected like that and switched on, it is effectively a short-circuit between its collector and emitter, and that places the full 12 volts across the relay, powering it very solidly. This connection method is called a "common-emitter" circuit because all of the transistors used have their emitters all wired in common to the 0V line. An alternative arrangement is the "emitter-follower" circuit:



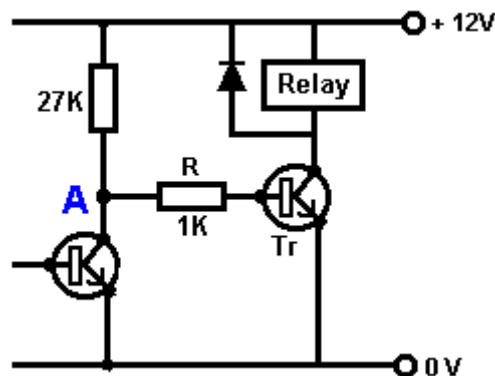
With this circuit arrangement, the emitter of the transistor "follows" the voltage on pin 3 of the 555 timer. It is always a constant voltage below it, typically about 0.7 volts. The output of the 555 timer has a maximum of about 0.7V below the supply voltage, and so its maximum value is about 11.3V in this circuit. The transistor drops that by a further 0.7V, which means that the relay only gets about 10.6V across it instead of the full 12V of the supply, which means that it should be a 10-volt relay rather than a 12-volts relay.

Those are the easy cases because the 555 timer can supply at least 200 mA through its output pin, while keeping the output voltage steady. That is not the case with simple transistor circuits. Take a situation like this:



For audio work - microphone pre-amplifiers and the like – the rule of thumb is that the current flowing through the first transistor should be at least ten times the current required by the base of the second transistor in order not to drag down and distort the audio waveform.

Relay switching is not so critical but the same general principle applies and attention needs to be paid to the collector resistor of the preceding transistor. For example, if the current flowing through the preceding transistor is small, say, 0.5 mA and the output transistor needs 1.5 mA flowing into its base, then there can be a problem. In this circuit, for example:



Here, the voltage at point "A" goes high because the first transistor switches off and so becomes the same as a resistor of 1Meg or more. Normally, that resistance is so much greater than the 27K of its resistor, that the voltage at point "A" would be nearly +12V, but if you were to connect the resistor "R" of just 1K in value, then the situation is changed completely. The base of "Tr" can't rise above 0.7V. The first transistor can be ignored due to its very high resistance. That leaves a voltage-divider pair of resistors, the 27K and the 1K, with 11.3 volts across them, stopping the voltage at point "A" from rising above 1.13V instead of the original 12V and transistor "Tr" will only get 0.43 mA instead of the 1.5 mA which was wanted. The transistor "Tr" has effectively a 28K resistor feeding it current from the +12V rail.

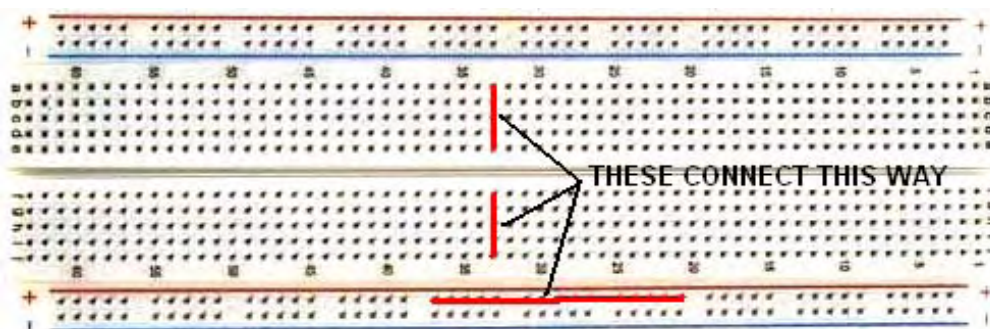
One solution would be to raise the current through the first transistor by using a resistor a good deal smaller than the present 27K. Another option is to lower the input current requirement of transistor "Tr" by making it a Darlington pair or by using a transistor with a much higher gain.

Constructing Prototypes.

The main options for building a prototype circuit are:

1. A (plug-in) breadboard
2. Electrical screw connector strips.
3. Stripboard
4. A printed circuit board.

1. The typical breadboard unit consists of a matrix of clip holes wired in strips, into which component leads can be pushed to make a circuit. In my opinion, they are best avoided as it takes quite some effort to implement any significant circuit using them, some components do not fit well in the sockets which are small enough to take DIL IC packages, and when you do get a circuit working well on the breadboard, there is no guarantee that it will work well when you attempt to move it to a permanent soldered board:

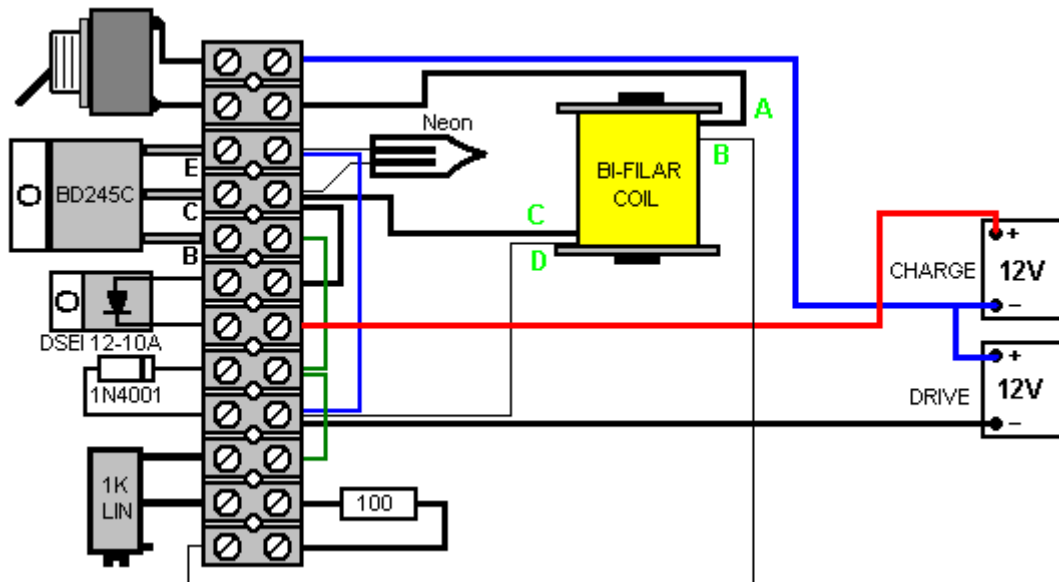


While a plastic board of this type looks as if it should be quick and easy to use, I have never found it to be so ever since the boards were scaled down in size to take the closely-spaced pins of integrated circuits ("chips"). It is generally difficult to lay the components out in the same pattern as the circuit diagram, and if they are not, then it becomes slow to follow the circuit through on the breadboard layout.

2. The local hardware shop has cheap screw connectors which can be very effective. These come in several sizes and the smaller ones are very convenient for constructing transistor circuitry. They look like this:

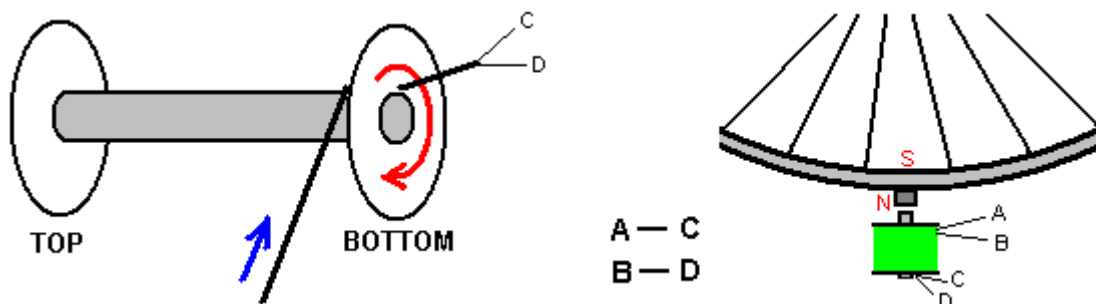


Circuits can be assembled very easily, using these connectors and an example might be one of the John Bedini battery pulsing circuits which might have a layout like this:



I have built this circuit using this style of construction and it was very successful indeed, being very quick and easy to construct and it proved to be very tough and effective over a long period of use. The plastic strip has a hole between each connector strip and that allows you to bolt the strip to a base board on which you mount other components, in this case, the pulsing coil and the rotor with the magnets attached. Each connection block can take two or three wires. The wires need to have the insulation removed and the wires scraped clean and shiny if they are not already in that state. If more than one multi-strand wire is being put into one side of a connector, then it is usually best to twist the wires together before tightening the clamping screw. If you want, you can give the twisted wires a thin coat of solder, but this has to be done neatly to avoid producing a joint which is too large to fit into the connector. One connector can be cut out of the strip quite easily, using a pair of scissors or a craft knife. Single connectors can join two wires very effectively without the need to solder them.

While the wire trigger switch is shown as a thin line in the diagram above, it is suggested that it is more convenient to use wires of identical diameter, and if it is not clear which is the beginning and end of a single wire, then, an ohmmeter may be used to identify the ends. It is suggested that the cables are stretched out in a long length and then twisted together using an electric drill. I have found that doing that is not very good because the cable near the drill is twisted much more strongly than the rest of the wire. Also, it needs a considerable distance outside to lay out a sufficient length of wire. If you really want to twist the wires together (it is not immediately obvious why you would want to do that), then use two coils of wire and twist them together for a short length by turning the reels over as a pair, then wind the twisted length on to a third spool or temporary holder. This method does not need for you to set long cables (which tangle and catch on things very easily) and it gives uniformly twisted wires which can be prepared when sitting in a small workspace. The coil of 850 turns is wound like this:



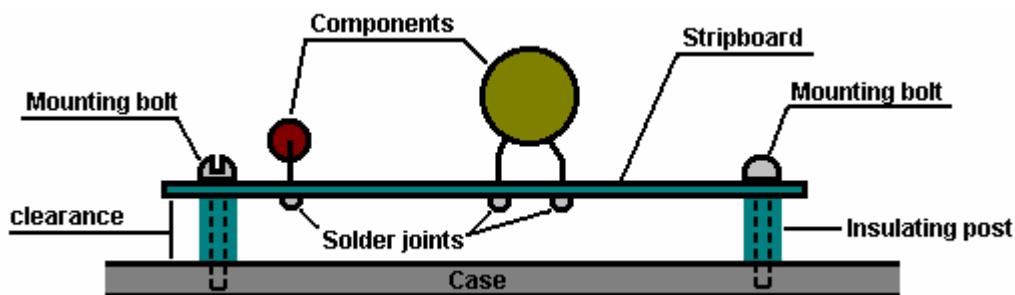
The first strand of the coil starts at point "C" at the base of the coil and finishes at point "A" at the top of the coil. This is the coil which drives the motor with point "A" connected to the Plus of the drive battery. The second strand starts at point "D" at the base of the coil and finishes at point "B" with point "B" connected to the transistor's base resistor. This arrangement generates a magnetic North field at the top of the coil and that pushes against the rotor's permanent magnet's North pole which is the one facing the coil. With the implementation which I used to charge a car battery, the wheel rotation was gentle, giving perhaps 200 to 300 pulses per minute to the battery. The speed of the wheel reduced as the battery charge increased and so a glance at the wheel showed the charge state of the battery. It is recommended that the coil core be made up from lengths of 1.5 millimetre diameter copper coated welding rod, but as copper is highly conductive electrically, I prefer to coat each rod with enamel paint to block sideways eddy currents which waste power.

3. Stripboard, usually called 'Veroboard' even if it is not made by Vero, is a quick and satisfactory method, although you have to make very tiny solder joints. Please be aware that the fumes from the burning resin when soldering are most definitely not good for your health and should be avoided by making sure that the ventilation is adequate.

4. A printed circuit board is feasible for a one-off prototype and making one will increase your production skills, so it is also a reasonable option if you have the etching and drilling equipment to hand. Buying all of the necessary equipment if you do not have any, can cost a fair amount, but the skills gained are significant and the finished boards look very professional.

There are several other methods of construction, and many varieties of construction board and stripboard. Simple stripboard will be used in the following descriptions, although the method does apply to many different styles of construction.

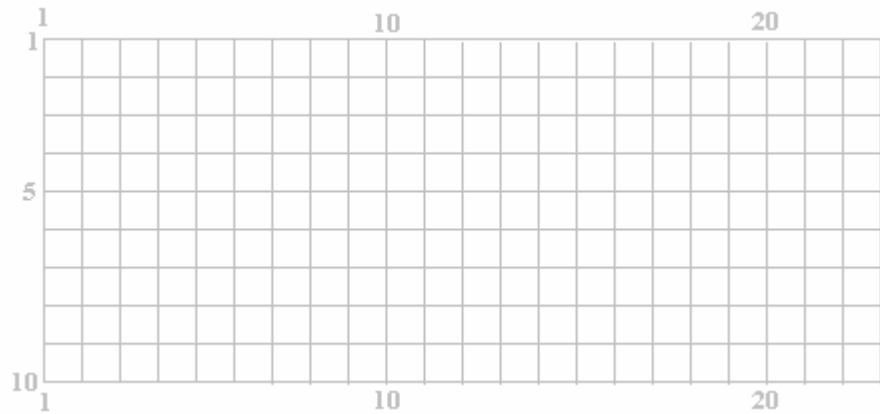
The first step is to produce a layout for the components on the board. When designing the layout provision should be made for drilling holes to allow the completed board to be bolted to its case using bolts and insulating pillars to keep the soldered joints clear of all other surfaces.



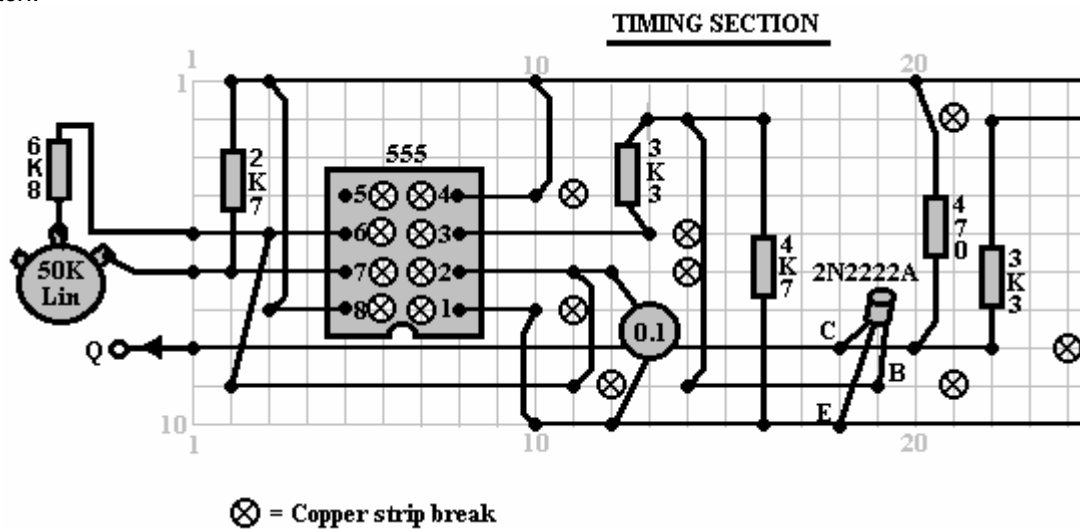
The circuit diagram of the circuit to be built is the starting point. You might wish to draw a light grid of lines to represent the matrix of holes in the strip board. This helps to visualise the run of the copper strips and the sketch can be made to show the exact number of holes available on the piece of strip board to be used. The strip board looks like this:



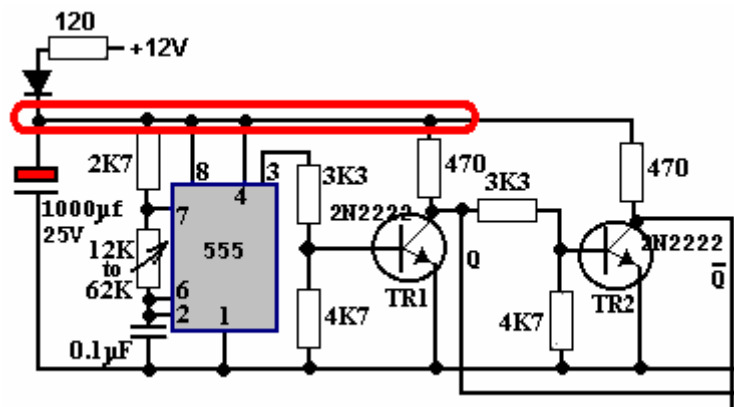
So you might wish to produce a layout sketch re-usable drawing like this:



where the horizontal strips are numbered and the vertical lines of holes are also numbered. In this sketch, where the lines cross, represents a hole in the board. The sketch of a possible physical layout can then be prepared and it might look like this when seen from the top although the copper strips on the underside of the board are shown in the sketch:



It is very important when producing a sketch like this, that the copper strips making up the circuit are not accidentally used to connect components further along the board, without breaking the copper strip between the two sections of the board. It helps to mark a copy of the circuit diagram when you are sketching a possible physical layout on the strip board. It might be done like this:

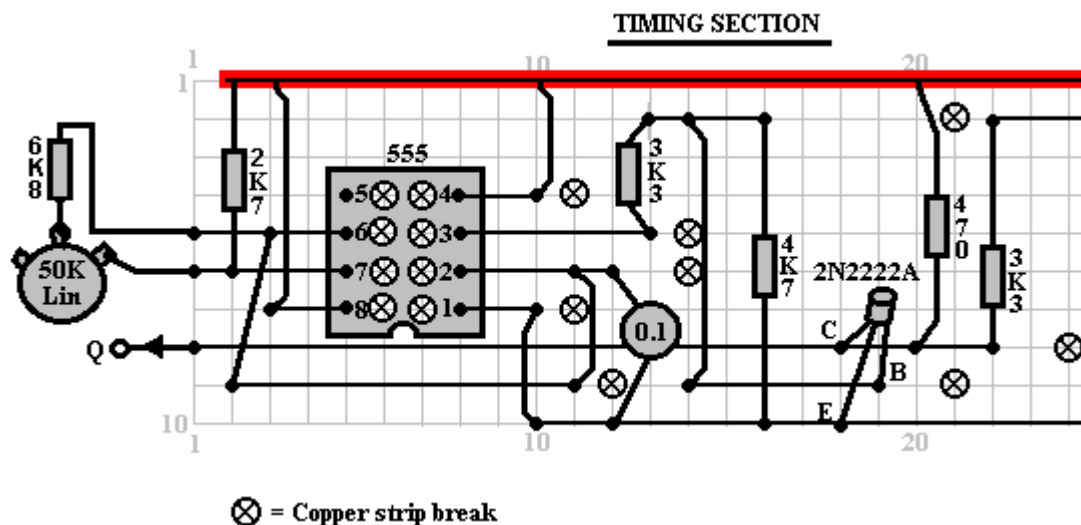


Here, the components just below the diode are ringed to show that they have been marked on the layout sketch and, if necessary, the copper strip broken to isolate the components. A component worth mentioning in passing, is the capacitor marked with red in the circuit diagram. This is a decoupling capacitor, fed from the 12V battery via a resistor and a diode (a diode is not normally used in this part of the circuit).

The decoupling is to provide the 555 chip and drivers with a supply which is reasonably isolated from the heavy current-draw circuit not shown in this small section of the circuit diagram. The pulsating heavy current draw of the rest of the circuit is capable of pulling the battery voltage down slightly many times per second. This creates a voltage ripple on the positive supply line from the battery and to smother the ripple, the resistor and diode are used to feed a large reservoir capacitor which smoothes out the ripple.

The circuit itself is not beyond criticism. Transistor 'TR2' and its associated components are redundant since pin 3 of the 555 chip already supplies the required signal (and with higher drive capacity) so the second output line should be taken directly from pin 3 of the 555 chip. This snippet of circuit is only shown here as an example of marking up a circuit diagram when making a components layout sketch.

As the layout sketch is produced, the circuit diagram should be marked off with a highlighting pen to make sure that every part of the circuit diagram has been successfully copied to the sketch. In the example below, not all of the highlighted strip is shown, since it runs off the small section of the board being shown here:



Many electronic components can be damaged by the high temperatures they are subjected to when being soldered in place. I personally prefer to use a pair of long-nosed pliers to grip the component leads on the upper side of the board while making the solder joint on the underside of the board. The heat running up the component lead then gets diverted into the large volume of metal in the pair of pliers and the component is protected from excessive heat. On the same principle, I always use a DIL socket when soldering a circuit board, that way, the heat has dissipated fully before the IC is plugged into the socket. It also has the advantage that the IC can be replaced without any difficulty should it become damaged.

If you are using CMOS integrated circuits in any construction, you need to avoid static electricity. Very high levels of voltage build up on your clothes through brushing against objects. This voltage is in the thousands of volts range. It can supply so little current that it does not bother you and you probably do not notice it. CMOS devices operate on such low amounts of current that they can very easily be damaged by your static electricity. Computer hardware professionals wear an earthing lead strapped to their wrists when handling CMOS circuitry. There is no need for you to go that far. CMOS devices are supplied with their leads embedded in a conducting material. Leave them in the material until you are ready to plug them into the circuit and then only hold the plastic body of the case and do not touch any of the pins. Once in place in the circuit, the circuit components will prevent the build up of static charges on the chip.

Soldering is an easily-acquired skill. Multi-cored solder is used for electronic circuit soldering. This solder wire has flux resin contained within it and when melted on a metal surface, the flux removes the oxide layer on the metal, allowing a proper electrical joint to be made. Consequently, it is important that the solder is placed on the joint area and the soldering iron placed on it when it is already in position. If this is done, the flux can clean the joint area and the joint will be good. If the solder is placed on the soldering iron and then the iron moved to the joint, the flux will have burnt away before the joint area is reached and the resulting joint will not be good.

A good solder joint will have a smooth shiny surface and pulling any wire going into the joint will have no effect as the wire is now solidly incorporated into the joint. Making a good solder joint takes about half a second and certainly not more than one second. You want to remove the soldering iron from the joint before an excessive

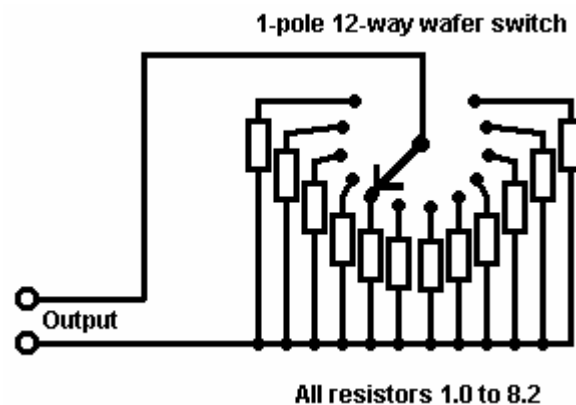
amount of heat is run into the joint. It is recommended that a good mechanical joint be made before soldering when connecting a wire to some form of terminal (this is often not possible).

The technique which I use is to stand the solder up on the workbench and bend the end so that it is sloping downwards towards me. The lead of the component to be soldered is placed in the hole in the strip board and gripped just above the board with long-nosed pliers. The board is turned upside down and the left thumb used to clamp the board against the pliers. The board and pliers are then moved underneath the solder and positioned so that the solder lies on the copper strip, touching the component lead. The right hand is now used to place the soldering iron briefly on the solder. This melts the solder on the joint, allowing the flux to clean the area and producing a good joint. After the joint is made, the board is still held with the pliers until the joint has cooled down.

Test Equipment.

When developing new circuitry, it may be convenient to try different values of resistor in some position in the circuit (the resistor value may be dependent on the gain of a transistor or the actual resistance of an ORP12, or some such other situation). For this, it is very convenient to have a resistor-substitution box which allows you to select any standard resistor at the turn of a switch.

These are not readily available on the market. In years gone by, it was possible to buy custom wafer switches, where the number of wafers could be built up to whatever switch size was required, but these do not seem to be available any more. A slightly less convenient method of construction is to use four of these, selected by a second wafer switch:



In the above diagram, all of the resistors in one range (100 ohms to 820 ohms, 1K to 8K2, 10K to 82K or 100K to 820K) are wired to a single 12-way switch. The output wires then have any of these standard resistors across them, depending on the setting of the switch. A second switch can then be used to select several of these groups, while still using the same output wires. When boxed, it might look like this:



It can also be useful to have a versatile signal generator. You can easily construct your own with variable frequency, variable mark/space ratio and optional variable gating. If you do, you might as well make it with a low output impedance so that it can drive devices under test directly rather than having to provide additional buffering. It might look like this:



The really essential item of equipment is a multimeter. These come in many shapes, sizes and varieties and the cost varies enormously. The reliability also varies a great deal. The most reliable and the cheapest is the analogue type which does not use a battery (other than for the occasional measurement of resistance). Although these types are looked down upon nowadays, they are 100% reliable:

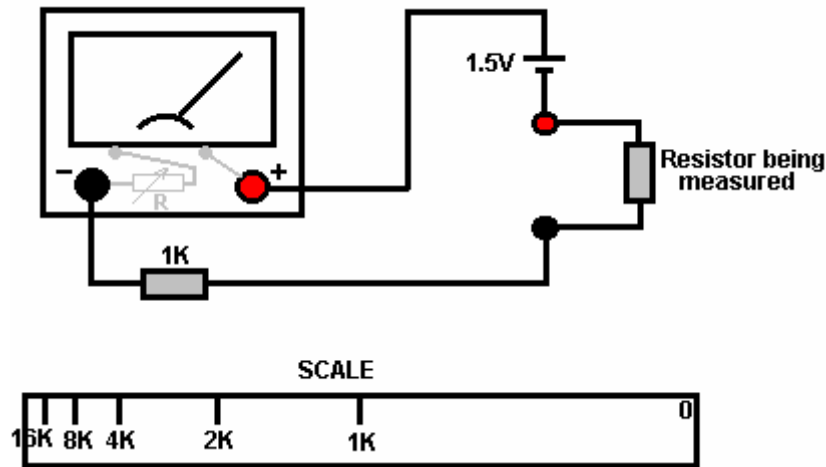


The meter shown above is rated at 2,000 ohms per volt, so connecting it to a circuit to make a measurement on the 10V range is the same as connecting a 20K resistor to the circuit. The big brother of this style of equipment is about five times larger and has 30,000 ohms per volt performance, so connecting it on a 10V range is the same as connecting a 300K resistor to the circuit being measured. This one is battery driven, so if you get one of these, may I suggest that you check its accuracy on a regular basis:



The really excellent non-battery (ex-professional) Avo meter multimeters are still available through eBay at affordable prices. These have 30,000 ohms per volt performance and are robust and accurate, having been built to very high standards.

A multimeter uses a 1.5V battery to measure resistance. Ohm's Law is used as the working principle and the operation is:



The meter shown in the diagram has a small resistance of its own. This has a small variable resistor added to it. This variable resistor will have a small knob mounted on the face of the multimeter, or it will be a thumbwheel knob projecting slightly from the right hand side of the multimeter case. The 1.5V battery will be positioned inside the multimeter case as is the 1K resistor. To use the resistance ranges, the multimeter probes are touched firmly together to form a short-circuit and the variable resistor adjusted so that the meter points to zero.

For the purpose of this discussion, let us assume that the internal resistance of the meter, when correctly adjusted, is exactly 1K. If the resistor under test is exactly 1K in value, then the current through the meter will be halved and the meter will show a needle deflection half way across the scale. If the resistor under test is 2K, then the current will be one third and the scale marking will be at the 1/3 position from the left. If the resistor is 4K, then there will be one fifth ($1K + 4K = 5K$) of the full-scale current and the 4K mark will be 20% from the left hand side of the scale.

Two things to notice: firstly, the scale has to read from right to left which can take some getting used to, and secondly, the scale is not linear, with the markings getting closer and closer together and consequently, more difficult to mark and read, the higher the value of the resistor being measured. The bunching up of the scale markings is why the more expensive multimeters tend to have more than one range.

A mains-operated oscilloscope is an excellent piece of equipment to own but they are expensive when new. It is possible to pick one up at a reasonable price second-hand via eBay. An oscilloscope is by no means an essential item of equipment. One of its most useful features is the ability to measure the frequency, and display the shape of a waveform. Most waveforms are of known shape so the frequency is the major unknown. The following meter is not expensive and it displays the frequency of a signal on a digital readout:



So, when you are deciding what multimeter to buy, consider the following points:

1. How reliable is it? If you are opting for a battery driven unit, what happens to the accuracy if the battery starts to run down. Does it display a warning that the battery needs to be replaced? Mains-operated digital multimeters are brilliant but are a problem if you want to make measurements away from the mains.
2. What DC voltage ranges does it have? If you are intending to work mainly with 12V circuits, it is inconvenient for the ranges to be 9V and 30V as successive ranges. Digital meters do not have this problem but the question then is, how accurate are they going to be in day to day use?
3. Transistor testing options you can ignore - you are better off making your own dedicated unit to check transistors if you think you will ever need to do this - you probably won't.
4. Measuring current can be very useful so see what ranges are offered.
5. Measuring capacitance is very useful, especially since many capacitors are not well marked to indicate their value.
6. Measuring the frequency of a waveform could be a significant bonus but the question is; are you every likely to need it?
7. Measuring resistance is very useful. Every meter has it. There is no need to be over fancy on measurement ranges as you usually only need to know the approximate answer - is it a 1K resistor or a 10K resistor?

Look around and see what is available, how much it costs and what appeals to you. It might not be a bad idea to buy a really cheap multimeter and use it for a while to see if it has any shortcomings which are a nuisance, and if so, what improvements you personally want from a more expensive meter.

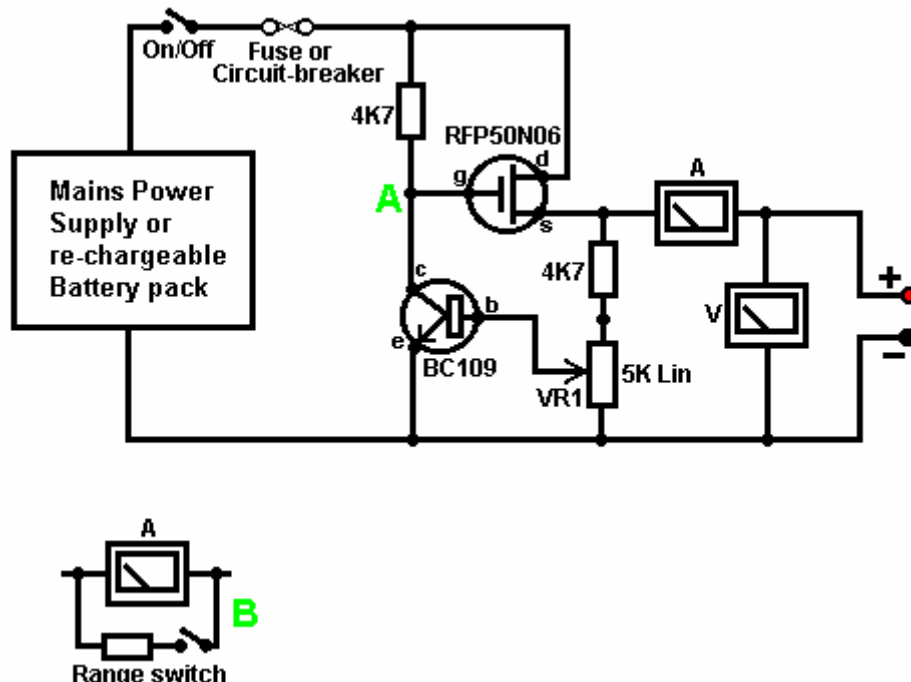
The 'Bench' Power Supply.

It might be worth getting a fancy bench power supply which allows you to set any voltage you want and which displays the current being drawn by your development circuit:



However, there is no need to spend money on a fancy unit when you can build an excellent unit of your own with voltage stabilisation, adjustable output, metered current, etc. etc. Personally, if developing a circuit to be used with a battery, I believe you are better off powering the development from a battery, that way the characteristics of the battery are included in any tests which you carry out.

If you wish, you can construct a very convenient development test bed power supply system. This has the advantage that you can make it in the most convenient style for your own use. You can also make the protection ultra-sensitive and build in additional circuitry such as transistor tester and resistor substitution box to produce an integrated test bed. You could perhaps use a circuit like this:



Here, the power is supplied by a pack of re-chargeable Ni-Cad batteries or possibly, a mains unit with voltage stabilisation. As in all actual circuits, the next thing in the circuit is **always** an on/off switch so that the power source can be disconnected immediately should any problem arise. Next, as always, comes a fuse or circuit breaker, so that should the problem be serious, it can disconnect the circuit faster than you can react. If you wish, you can build your own super-accurate adjustable circuit breaker to use in this position.

The two transistors and three resistors form an adjustable, stabilised output. The FET transistor has a high output power handling capacity and a very low input power requirement and so is good for controlling the output voltage.

Resistor 'VR1' is padded with the 4K7 resistor solely to reduce the voltage across the variable resistor. VR1 is adjusted to control the output voltage. If the current draw is increased and the output voltage is pulled down slightly, then the voltage on the base of the BC109 transistor is reduced. This starts to turn the transistor off, raising the voltage at point 'A', which in turn, raises the output voltage, opposing the variation caused by the load.

The output is monitored, firstly by a large milliammeter to show the current draw and secondly, on the output side of the milliammeter, a voltmeter. This allows very close monitoring of the power supplied to the prototype, especially if the milliammeter is placed alongside the prototype. You can build this circuit into a wide flat box which provides a working surface beside the milliammeter.

At point 'B' in the above diagram, a method for altering the current range of the milliammeter by placing a 'shunt' resistor across it. When the switch is closed, some current flows through the resistor and some through the milliammeter. This resistor has a very low value, so you are better off making it yourself. Let's say we wish to double the range of the meter. Solder the switch across the meter and for the resistor use a length of enamelled copper wire wound around a small former. Put a load on the output so that the meter shows a full-scale deflection. Close the switch. If the current displayed is exactly half of what it was, if not, switch off, remove some wire to lower the reading or add some wire to raise the reading and repeat the test until exactly half the current is displayed. The lower the value of the shunt resistor, the more current flows through it and the less through the meter, which then gives a lower reading.

Please note: it is very important to have a fuse or circuit breaker in the power being delivered to your test circuit. Any error in building the prototype can cause a major current to be drawn from the supply and **this can be dangerous**. Remember, you can't see the current. Even if you have a meter on the current being delivered, you may not notice the high reading. The first sign of trouble may be smoke! You can easily fry the circuit you are building if you do not have a safety cut-off, so use a fuse or other device which limits the current to twice what you are expecting the circuit to draw.

So, after all that, what equipment do you really need? You need a small soldering iron and multicore solder, a pair of long-nosed pliers and a multimeter. One other thing is some tool to cut wires and remove the insulation prior to soldering. Personal preferences vary. Some people prefer one of the many custom tools, some people use a knife, I personally use a pair of straight nail scissors. You pick whatever you are comfortable with.

Not exactly a vast array of essential equipment. The other items mentioned are not by any means essential so I suggest that you start by keeping things simple and use a minimum of gear.

If you are not familiar with electronics, I suggest that you get a copy of the Maplin catalogue, either from one of their shops or via the <http://www.maplin.co.uk> web site. Go through it carefully as it will show you what components are available, how much they cost and often, how they are used. The specifications of almost any semiconductor can be found free at <http://www.alldatasheet.co.kr> in the form of an Adobe Acrobat document.

Finally, because it is not important, all of the circuitry shown so far has indicated current flowing from the + of a battery to the - terminal. The discovery of voltage was made by Volta but he had no way of knowing which way the current was flowing, so he guessed. He had a 50 - 50 chance of getting it right but he was not lucky and got it wrong. Electrical current is actually a flow of electrons, and these flow from the battery minus to the battery plus. So, who cares? Almost nobody, as it has no practical effect on any of the circuitry. Some useful websites:

<http://www.esr.co.uk> for components
<http://www.maplin.co.uk> for components
<http://www.alldatasheet.co.kr> for semiconductor specifications
<http://www.cricklewoodelectronics.com> for components
<http://www.greenweld.co.uk> for components

The Oscilloscope.

If you do decide that you are going to research new equipment, design and possibly invent new devices, then an oscilloscope is useful. Let me stress again that this is not an essential item of equipment and most certainly is not needed until you are quite familiar with constructing prototypes. It is quite easy to misread the settings of an oscilloscope and the methods of operation take some getting used to. The low-cost book "How to Use Oscilloscopes and Other Test Equipment" by R.A. Penfold, ISBN 0 85934 212 3 might well be helpful when starting to use a 'scope.

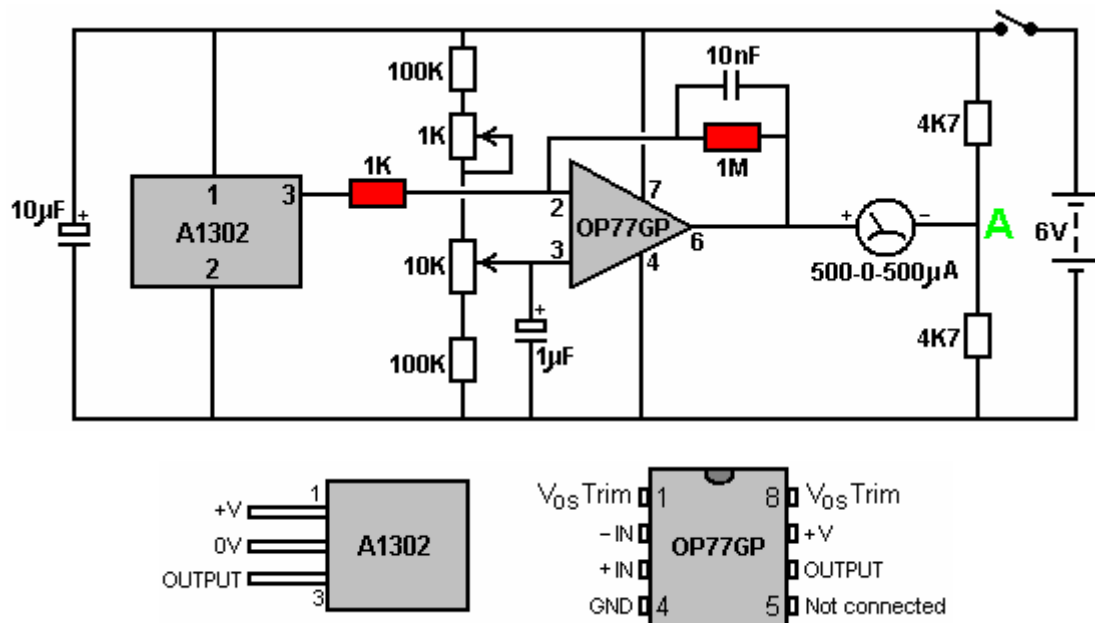
It is possible to get an oscilloscope at reasonable cost by buying second-hand through eBay. The best scopes are 'dual trace' which means that they can display the input waveform and the output waveform on screen at the same time. This is a very useful feature, but because it is, the scope which have that facility sell at higher prices.

The higher the frequency which the scope can handle, the more useful it is, but again, the higher the selling price. Not all scopes are supplied with (the essential) 'test probes', so it might be necessary to buy them separately if the seller wants to keep his. Getting the manual for the scope is also a decided plus. A low cost scope might look like this:



Measuring Magnetic Field Strength.

People who experiment with permanent magnets, can make use of an instrument which displays the strength of a magnetic field. Professionally made devices to do this tend to be well outside the purchasing power of the average experimenter who will already have spent money on materials for his prototypes. Here is a design for a simple and cheap circuit, powered by four AA dry cell batteries, and utilising a Hall-effect semiconductor as the sensor:



This design uses an OP77GP operational amplifier chip to boost the output signal from the A1302 chip which is a Hall-effect device. The gain of the DC-connected operational amplifier is set by the ratio of the 1K and 1M fixed resistors shown shaded in the circuit diagram, giving a gain of 1,000.

The circuit operation is simple. The six-volt battery charges the 10 microfarad capacitor which helps iron out any supply line fluctuations caused by varying current draw by the circuit. The 10K variable resistor is used to set the

output meter display to zero when the Hall-effect device is not near any magnet. The 1K variable resistor is there to make fine tuning adjustments easier.

When the A1302 chip encounters a magnetic field, the voltage on it's output pin 3 changes. This change is magnified a thousand times by the OP77GP amplifier. It's output on pin 6 is connected to one side of the display meter and the other side of the meter is connected to point "A". The voltage on point "A" is about half the battery voltage. It would be exactly half the voltage if the two 4.7K resistors were exactly the same value. This is rather unlikely as there is a manufacturing tolerance, typically around 10% of the nominal value of the resistor. The exact value of the voltage on point "A" is matched by the OP77GP tuning and so the meter reads zero until a magnetic field is encountered. When that happens, the meter deflection is directly proportional to the strength of the magnetic field.

The Weird Stuff.

You don't need to know the following information, so please feel free to skip it and move on to something else.

The presentation shown above is based on the conventional view of electronics and electrical power as taught in schools and colleges. This information and concepts works well for designing and building circuits, but that does not mean that it is wholly correct. Unfortunately, the world is not as simple as is generally made out.

For example, it is said that current is a flow of electrons passing through the wires of a circuit at the speed of light. While it is true that some electrons do actually flow through the metal of the wires, the small percentage of electrons which actually do that, do it quite slowly as they have to negotiate their way through the lattice of the molecules of metal making up the body of the wires.

In spite of this, when the On/Off switch of a circuit is flipped on, the circuit powers up immediately, no matter how long the wires are. The reason for this is that electrical current flows along the wires at very high speed indeed, but it flows rapidly **along** the outside of the wires, not rapidly **through** the wires. One thousandth of a second after switching on a circuit, the electrons flowing through the wires have hardly got started, while the current flowing along the outside of the wires has gone all around the circuit and back:



The above sketch does not show the proportions correctly, as the current flow spiralling along the outside of the wire should be hundreds of thousands of times longer than shown, which is not practical in a diagram.

The actual path taken by current flow makes the surface of the wire of particular importance, and the insulation material is also of great importance. In years gone by, wire manufacturers used to anneal (cool down) copper wires in air. This created a layer of cupric oxide on the outer surface of copper wires, and that layer gave the wire different characteristics than copper wire has today. William Barbat in his patent application claims that the cupric oxide layer can be utilised in making devices with greater power output than the power input from the user.

Unfortunately, the world is not quite as simple as that, as power flowing in a circuit has at least two components. The electrical current which we measure with ammeters is as described above and is sometimes referred to as "hot" electricity as when it flows through components, it tends to heat them up. But there is another component referred to as "cold" electricity, so named because it tends to cool components down when it flows through them. For example, if the output wires of Floyd Sweet's VTA device were short circuited together, frost would form on the device due to the heavy flow of "cold" electricity, and getting a "shock" from it could give you frostbite instead of a burn.

"Cold" electricity is not something new, it has always been there as it is just one aspect of "electricity". It has not been investigated much by conventional science because none of the instruments used to measure "hot" electricity, react to "cold" electricity at all. (Actually, "hot" electricity, "cold" electricity and magnetism are all features of a single entity which should really be called "electromagnetism").

Now the spooky bit: "cold" electricity does not flow along or through the wire at all. Instead, it flows in the space around the wire, possibly riding on the magnetic field caused by the "hot" current. Thomas Henry Moray is famous for building a device which captured "cold" electricity and produced a massive power output capable of powering a whole host of ordinary electrical pieces of equipment. In his many public demonstrations before he was intimidated into silence and his equipment smashed, he invited members of the audience to bring a piece of ordinary glass with them. Then, when his circuit was powering a row of lights, he would cut one of the wires and

insert the piece of glass between the cut ends of the wires. This had no noticeable effect on his circuit, with the power flowing happily through the glass and on through his circuit, powering the lights just as before. That does not happen with "hot" electricity, but as the "cold" electricity is not flowing through or along the surface of the wire, a break in the wire is not a major obstacle to it.

We still do not know very much about "cold" electricity. Edwin Gray snr. demonstrated light bulbs powered by "cold" electricity being submerged in water. Not only did the bulbs continue to operate unaffected by the water, but Edwin often put his hand in the water along with the lit bulb, suffering no ill effects from doing so. Neither of those two effects are possible with conventional electricity, so please **don't** try them to check it out.

Another interesting item is the water-powered car system produced by an American man Nathren Armour. His system, (among other things) involves feeding extra electrical power to the spark plugs. One thing which has always puzzled him is that the engine will not run with just one wire going to the spark plug cap. He has to have a second wire running from his extra power supply to the body of the plug where it screws into the engine block. Take that wire away and the engine stops. Put it back again and the engine runs. But according to conventional electrics, that wire cannot possibly be needed, because the engine block is grounded and the power supply output is grounded, so in theory, there is no voltage difference between the ends of the wire, therefore no current can flow along the wire, hence the wire is not needed and has no function. Well, that is true for "hot" electricity, but it seems possible that the Nathren Armour system is using "cold" electricity as well as "hot" electricity and the "cold" electricity needs the extra wire as a flow guide to the spark plug.

Enough about that for now. Let's go one step further into the "weirdness" of the actual world. If, three hundred years ago, you had described X-rays, gamma rays, nuclear energy and TV signals to the average well-educated person, you would have run a considerable risk of being locked up as being mad. If you do it today, your listener would probably just be bored as he already knows all this and accepts it as a matter of fact (which it is). Please bear that in mind when you read the following information. If it seems strange and far-fetched, that is only because conventional science today is lagging badly behind and still teaching things which have been conclusively proven to be wrong decades ago.

If you lived in a desert and every day a company drove in with a lorry-load of sand and sold it to you for a large amount of money, what would you think about that? Not a very good deal for you, is it? What's that you say, you would never do that? But you already do, because you don't realise that the sand is all around you ready for the taking at next to no cost at all. Several people have tried to publicise the fact, but the sand company has immediately silenced them by one means or another. The company does not want to lose the business of selling you the sand and definitely doesn't want you to start picking it up for yourself for free.

Well... to be perfectly fair, it is not actually sand, it is energy, and it is all around us, free for the taking. Sound a bit like X-rays did three hundred years ago? Doesn't mean that it is not true. It is perfectly true. The design of all computers made today is based on the equations of Quantum Mechanics, and while those equations are not yet perfect, they are easily good enough for practical purposes. The snag is that the world seen at the level of the quantum is not much like the world we think that we see around us and which we think that we understand fully. Examining the world at the quantum level shows that we live in a seething mass of incredible energy. Einstein is famous for stating that Mass equals a very large amount of Energy, a fact that is shown clearly when an atomic bomb is detonated. Put in different words, a small amount of matter is the equivalent of a very large amount of energy. Actually, Energy and Matter are two different aspects of a single thing (which could reasonably be called "Mass-Energy").

At the quantum level, it can be seen that particles of matter pop into existence and drop out again into energy on a continuous basis, everywhere in the whole of the universe. The whole universe is seething with energy. That energy doesn't bother us any more than water bothers a fish, as we evolved in this sea of energy and we just don't notice it. It doesn't harm us, but if we wanted, and knew how, we could use as much of that energy as we wanted for ever and ever. The amount of that energy is unbelievable. It has been calculated that one cubic centimetre anywhere in the universe contains enough energy to create all of the matter we can see in the whole of the universe. Think how many cubic centimetres there are in the Earth ... the Solar System ... our Galaxy ... If every person on Earth were to run their vehicles, power their homes, fly their planes, etc. etc. for the next million years, it would not make the slightest dent in the energy contained in one cubic millimetre of the universe. This is not a theory, it is a fact. (Would you like to buy a big pile of sand? - I've got a load just over here...). This big energy field has gone under different names over the years. A popular name at the present time is the "Zero-Point Energy Field" and it is responsible for everything that happens in the universe. It powers life itself. It balances out in equilibrium everywhere, which is one reason which makes it hard to realise that it is all around us.

Tom Bearden is an American man with very considerable abilities and considerable in-depth knowledge of how the world actually operates. His statements are generally based on laboratory-proven criteria backed up by his high level of mathematical skills which give him an additional grasp of things. He explains how electricity actually works in circuits, and it is nothing like the system taught in schools and colleges. We think that when we attach a

battery to an electrical circuit, the battery forces a current through the wires of the circuit. Sorry Chief - it is actually nothing like that at all. The power in the circuit comes directly from the Zero-Point Energy Field and has very little to do with the battery at all. We tend to think of "using up" power, but that is just not possible. Energy cannot be destroyed or "used up" the most you can do to it is to change it from one form to another. It will perform "work" (power equipment, generate heat, generate cold...) when it changes from one form to another, but if you reverse the process and convert it back to its original form, it will perform another lot of "work" during the conversion and end up back in exactly the same state as it started out from, in spite of having performed two lots of "work" during the operation.

A battery does **not** provide energy to power a circuit. Instead, what happens is that the chemical action inside the battery causes negative charges to gather at the "minus" terminal of the battery and positive charges to gather together at the "plus" terminal of the battery. These two close-together "poles" of the battery are called a "dipole" (two opposite poles near each other) and they have an effect on the Zero-Point Energy Field which is everywhere. The "Plus" pole of the battery causes a massive cluster of Zero-Point Energy Field negative charges to cluster around it. In the same way, the "Minus" pole of the battery causes a massive gathering of ZPE ("Zero-Point Energy") positive charges to gather around it. Not only do these charges gather around the poles of the battery, but an imbalance in the energy field is created and the ZPE charges continue to arrive at the poles and they radiate out in every direction in a continuous stream of incredible energy.

So, there is your shiny new battery sitting there, not connected to anything and yet it causes massive energy streams to radiate out from its terminals in every direction. We don't notice it, because the energy flows freely through us and we can't feel it and none of our conventional instruments, such as voltmeters, ammeters, oscilloscopes, etc. react to it at all.

The situation changes immediately if we connect a circuit to the battery. The circuit provides a flow path for the ZPE energy to flow along, and a significant amount of energy flows near the wires of the circuit, actually powering the circuit for a split second until it reaches the battery "pole" at the far end of the circuit. When it gets there it promptly wipes out the pole, destroying it completely. The ZPE field calms down and the energy flow ceases. But our trusty battery immediately does it all again, using its chemical energy to create the "dipole" once more, and the imbalance of the ZPE field starts again. It is because the battery has to use its chemical energy all the time, creating and re-creating, and re-creating its "dipole" that it runs down and eventually ceases to be able to create the dipole any more - result: no more power in the circuit.

Sorry to spoil the illusion, but the battery never did power the circuit itself, it merely acted as channelling device for the Zero-Point Energy Field. In passing, Direct Current ("DC") is actually not a continuous current at all, but instead it is a stream of DC pulses at an incredibly high frequency - way higher than we can measure at present. The speed of the pulses is so great that it looks continuous to us, a bit like the individual still pictures which are the frames of a movie, appear to be a moving image to us if they are played one after the other at a rate of 25 per second - it looks like continuous movement to us, but in reality, it is a rapid series of still pictures.

The way that a battery "dipole" works on the Zero-Point Energy Field is rather like the way that a magnifying glass acts on sunlight. The rays of the sun get concentrated into a point, focused by the lens. You can start a fire with the lens, and it would be easy to think that the lens started the fire, when in actual fact, it is the rays of the sun that started the fire and the lens just influenced a local area of the large "field" of sunlight, raising the temperature at just one point.

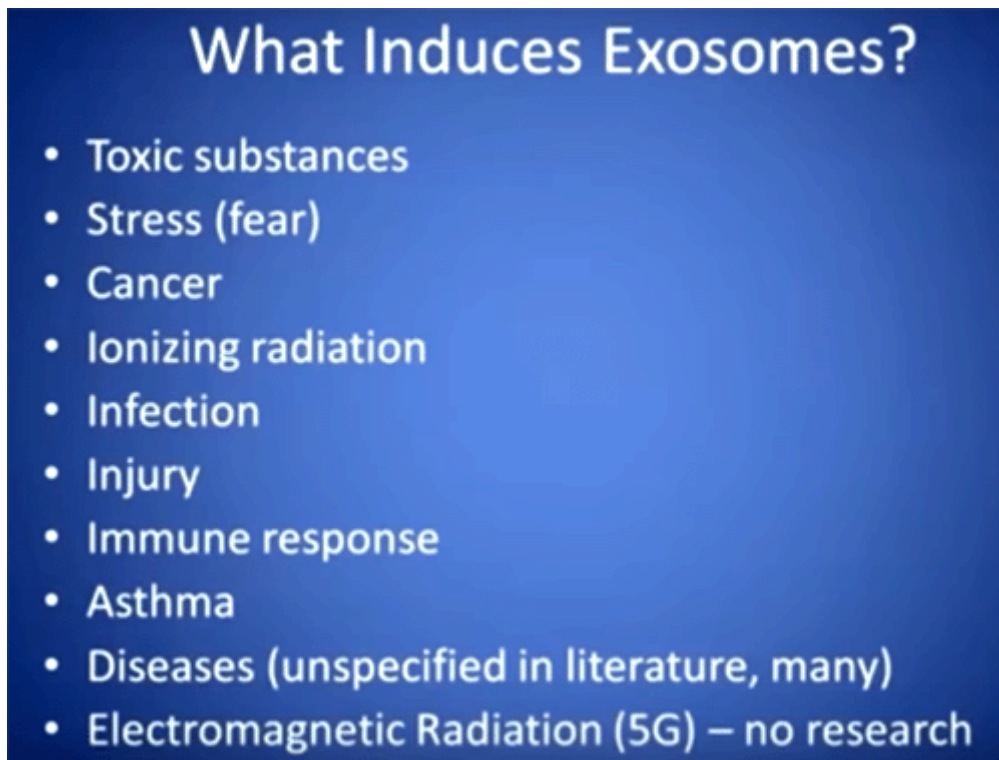
While we tend to think of a "dipole" being generated by a battery, the same effect is also created by a magnet, whether an electromagnet or a permanent magnet - remember that electricity and magnetism are two faces of the same entity. It is possible, but not easy, to capture the energy streaming out from the interference with the ZPE field caused by the poles of a magnet. For example, Hans Coler managed to do this with a completely passive device which, when set up correctly, could produce electrical power, hour after hour from apparently "nothing" (well, actually, the ZPE field). Roy Meyers also did it with his patented array of magnets and zinc plates - completely passive, with no moving parts at all, no battery and no circuitry.

The Current Health Scare

At the present time, in the year 2020, there is considerable concern about a new virus. Let's get some facts straight before we go any further. No virus has ever caused any kind of disease. All human viruses are benign and are generated inside your own body on a regular basis in order to clear away damaged tissue. Have you ever had an injury which caused a swelling? Do you remember how the swelling went down after a few days? That reduction of the swelling was done for you by a virus generated inside your own body for the express purpose of cleaning up the swelling and getting you back into full health again. Your body can generate thousands of different types of virus to help you stay healthy. A virus is the same as an "exosome" in every respect.

Another little-known fact is that you can't "catch" a virus from somebody else. Shock, horror !! So what is all the hype about? Why are we being told to wash our hands over and over again every day? Well, I'm sorry to say, this scare-mongering publicity is a raft of deliberate lies intended to frighten you and make you willing to give up your rights and start living in a police state, ideally under a one-world government which does not care about your best interests. These charming people want to vaccinate you, but what they want to inject into you is highly harmful to you. Vaccines are engineered in a laboratory and the objective is not to cure you of anything (except perhaps your life). The proposed vaccination for the fake Covid-19 virus is to have nano-bots in it, that is, it will contain harmful electronics which tags you with an ID like an animal.

Dr Andrew Kaufman is an experienced virologist who has studied the present health scare in depth and he explains the facts in considerable detail at <https://www.youtube.com/watch?v=wMg6Ydtel6A>. His considered conclusion is that the present test for covid-19 infection is likely to show a positive result and be wrong at least four times out of every five tests. He says that the causes of the supposed virus can be:



What Induces Exosomes?

- Toxic substances
- Stress (fear)
- Cancer
- Ionizing radiation
- Infection
- Injury
- Immune response
- Asthma
- Diseases (unspecified in literature, many)
- Electromagnetic Radiation (5G) – no research

He points out that the current hoax started with 198 people getting poisoned at a food market in China. Of those 198 bodies, just 7 were tested and because of the poisoning each of those bodies had it's own self-generated exosomes, none of which had anything to do with Covid-19. A test was then generated to detect any of those many exosomes. The test does NOT detect Covid-19, just a range of normal exosomes which are found in every person. For that reason, perfectly normal, healthy people with no symptoms can test positive for this terrible, totally fictional "virus" which nobody has ever seen.

But what about all these deaths? There aren't any, or if there are, then they are extremely minor as the death count in 2020 is about the same as for the same period in 2019. Doctors are told to put "tested positive for Covid-19" on all death certificates. That is so that the fiction of a pandemic can be bolstered in the media. The test will always be positive if the person is afraid of a pandemic, and the media keeps trying to stir up panic around the world.

Who is doing this and why? Who, is a group of psychopaths who want to bring in a "Hunger Games" style of life where they rule and everybody else lives in abject slavery. They why is because they are few and we are many and they are afraid of us. They can suppress and even kill us using the fifth generation transmission towers. That sounds far fetched doesn't it, however it is exactly correct because the transmission waves of that new service run at sixty gigahertz which is a frequency which disrupts oxygen in the air. It breaks oxygen molecules into separate oxygen atoms which human lungs cannot absorb properly. Consequently, humans can die of suffocation while standing in the open air.

Some people have become aware of this and oppose the introduction of these dangerous signal towers. A major aim of the present pandemic hoax is to get everybody under house arrest so that these obnoxious towers can be installed with nobody around to see it happening.

Dana Ashley makes a strong case for these new transmitters being a major contributor to people becoming "ill". Her video at:

<https://worldtruth.tv/did-the-5g-rollout-in-wuhan-damage-the-innate-cellular-defense-cells-of-the-population-putting-the-people-at-risk-of-complications-and-death-from-coronavirus/>

is definitely worth watching.

The podcast at <https://www.crow777radio.com/free-episodes/> episode 203 and it's extension 230.5.1 give medical details from an experienced expert who also states categorically that you cannot catch a virus from anybody else and no virus has ever caused an illness of any kind.

A book which took ten years to compile states all of the relevant facts about the present situation is available from Amazon. It is entitled "What Really Makes You Ill? Why Everything You Thought You Knew About Disease Is Wrong" by Dawn Lester and David Parker. This book shows repeatedly that "medical science" is riddled with errors, misconceptions and mistaken results and in spite of it's many "authorative" pronouncements, is wholly wrong most of the time and it's vaccinations and inoculations are just dangerous poisons which just don't work at all and instead, damage patients.

Present medical "science" sees a burning house with fire-fighters clustered around it, and concludes that house fires are caused by fire-fighters, so we need to find a poison which kills fire-fighters !! Personally, I will stay away from all injections as they are just poisons which will never help you in any way.

Just in case you haven't got the message:

Covid-19 is a hoax – it has never existed and it never will !!

If it did exist it would not matter as it is harmless !!

The number of people who have died from Covid-19 is ZERO !!

The same number of people have died in 2020 as in the same period of 2019 and not a single person has ever died of Covid-19.

So, where have these scary figures come from?

They are generated by people calling almost all deaths from other causes “Covid-19 deaths”. Worse still, in the UK they estimate the number of deaths from Covid-19 in the past week and add those figures in to the total of other deaths and announce them as Covid-19 deaths, but then a week later when the actual reporting reaches them, they add those figures in for a second time !!!!

But, you say, the BBC says ...

Yes, indeed, the BBC and all the other mainstream media tells this big fat lie and pumps up the fear. But why?

Because the mainstream media is owned by and working for the so-called “one percent” who own 99% of the world’s wealth. Don’t believe me? Then remember that the BBC announcer Jane Standley reported that World Trade Centre “Building 7” had collapsed unexpectedly, while the actual building could still be seen standing intact behind her:





Later, that unexpected collapse took place. So, how did the BBC have advance notice of that collapse? Please stop thinking that newspapers and television actually tell you the truth – they don't.

So, what is going on, why are they doing this?

Viruses are generated inside your body as part of regular maintenance. They have developed a test for a wide range of normal viruses and that allows anybody to test “positive for Covid-19” – why do you think that perfectly healthy people with none of the ‘symptoms’ test positive – come on, get real here.

They are now doing this to work rapidly towards a “Hunger Games” type of society where the top “one percent” controls the whole world, all of whom have had damaging material injected into them as a supposed medical remedy and all of whom are poor due to a deliberately crashed economy.

This “social distancing” rubbish is to oppose opposition gatherings and to create an acceptance of pointless house arrest. The empty streets allows them to erect fifth generation transmission towers without opposition and those towers are a weapon which will be used against us.

TABLE OF WIRE SIZES:

The wire sizes specified for use in some designs are American Wire Gauge so a comparison table showing the UK 'Standard Wire Gauge' (with lengths on a 500 gram reel of enamelled copper wire), and the 'American Wire Gauge' is given here:

AWG	Dia mm	Area sq. mm	SWG	Dia mm	Area sq. mm	Max Amps	Ohms / metre	Metres Per 500g	Max Hz
1	7.35	42.40	2	7.01	38.60	119			325
2	6.54	33.60	3	6.40	32.18	94			410
3	5.88	27.15	4	5.89	27.27	75			500
4	5.19	21.20	6	4.88	18.68	60			650
5	4.62	16.80	7	4.47	15.70	47			810
6	4.11	13.30	8	4.06	12.97	37			1,100
7	3.67	10.60	9	3.66	10.51	30			1,300
8	3.26	8.35	10	3.25	8.30	24			1,650
9	2.91	6.62	11	2.95	6.82	19			2,050
10	2.59	5.27	12	2.64	5.48	15	0.0042		2,600
11	2.30	4.15	13	2.34	4.29	12	0.0047		3,200
12	2.05	3.31	14	2.03	3.49	9.3	0.0053	17.5 m	4,150
13	1.83	2.63	15	1.83	2.63	7.4	0.0068		5,300
14	1.63	2.08	16	1.63	2.08	5.9	0.0083	27 m	6,700
15	1.45	1.65	17	1.42	1.59	4.7	0.0135		8,250
16	1.29	1.31	18	1.219	1.17	3.7	0.0148	48 m	11 kHz
17	1.15	1.04				2.9	0.0214		13 kHz
18	1.024	0.823	19	1.016	0.811	2.3	0.027		17 kHz
19	0.912	0.653	20	0.914	0.657	1.8	0.026	85 m	21 kHz
20	0.812	0.519	21	0.813	0.519	1.5	0.036		27 kHz
21	0.723	0.412	22	0.711	0.397	1.2	0.043	140 m	33 kHz
22	0.644	0.325	23	0.610	0.292	0.92	0.056		42 kHz
23	0.573	0.259	24	0.559	0.245	0.729	0.070	225 m	53 kHz
24	0.511	0.205	25	0.508	0.203	0.577	0.087		68 kHz
25	0.455	0.163	26	0.457	0.164	0.457	0.105	340 m	85 kHz
26	0.405	0.128	27	0.417	0.136	0.361	0.130		107 kHz
27	0.361	0.102	28	0.376	0.111	0.288	0.155	500 m	130 kHz
28	0.321	0.0804	30	0.315	0.0779	0.226	0.221	700 m	170 kHz
29	0.286	0.0646	32	0.274	0.0591	0.182	0.292	950 m	210 kHz
30	0.255	0.0503	33	0.254	0.0506	0.142	0.347	1125 m	270 kHz
31	0.226	0.0401	34	0.234	0.0428	0.113	0.402	1300 m	340 kHz
32	0.203	0.0324	36	0.193	0.0293	0.091	0.589	1900 m	430 kHz
33	0.180	0.0255	37	0.173	0.0234	0.072	0.767	2450 m	540 kHz
34	0.160	0.0201	38	0.152	0.0182	0.056	0.945	3000 m	690 kHz
35	0.142	0.0159	39	0.132	0.0137	0.044	1.212	3700 m	870 kHz

Patrick Kelly

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The Current Health Scare

On the second of May 2020 David Icke was deleted from the mainstream platforms such as YouTube and Facebook. This is very important because it shows that what he said in his interview disturbed the Deep State people so much that they showed themselves up by their reaction. So, what was it that David said which bothered them? He said:

1. Referring to the Deep State people he said "I'm more powerful than they are" .
2. "They own the mainstream media, they own Silicon Valley, they own the corporations, they own the banking system, and yet one interview with one man has this supposedly all powerful group running around like someone just shouted "fire" and showing by their actions that they know the consequences for them unless they stop that one man being heard".
3. They have to control the perception of the majority of people and so they say that there is this deadly virus and so we must stay indoors – "my God we are all going to die!" And that lie causes a vast number of people to concede their freedom, sit in a house under house arrest, being told what to do by a handful of people. The other perception is "I can see that something is not right here, but what are the consequences for me if I take this on and challenge it?" Those two perceptions are the reason that it is happening. When you break down the number of people in each country who are causing this to happen is tiny. It is perception and fear of consequences which are making this possible, and they are destroying the independent livelihoods of billions of people.
4. We are now living in a global version of Nazi Germany. No, they don't have the jackboots. No they don't have a silly moustache, but the structure is the same – a tiny number of people dictating to everyone else.
5. This group of people have convinced many that there is a fake virus and that they are in danger, so giving up their freedoms is essential to their survival.
6. So where is the Deep State trying to take the world? I have been describing this as "The Hunger Games Society", not just now with this fake pandemic and lockdown but I have been saying it for many years now. They want a pyramid structure with their very few people at the top and below them, the rest of humanity in dependency, in deprivation and poverty and dependent on the top few people for means of survival. Also, they want a Police/Military State to enforce their will on the rest of humanity and preventing the rest of humanity challenging the top few people.
7. I have been saying for years that this pyramid society would be controlled by technology. So we are talking about a fascist-communist global Technocracy. To make this possible you have to destroy the independent livelihood of vast numbers of the population, because while they are running their businesses and employing people and operating independently, making money and paying employees, you are not going to be able to put everybody into poverty and dependency on the few at the top. This fake pandemic has been employed for many reasons but profoundly in there is the aim to have a lockdown long enough to destroy most small businesses which will not survive the lockdown, and that effect is irreversible.
8. They will have new waves of fake viruses to force this new society on people and to use as an excuse to vaccinate everybody.
9. So how can they pull off this fake global pandemic? Well, consider a multinational company, how it has a headquarters with links out to subsidiary companies in different countries. The Deep State is similar except that it's headquarters is hidden and operates in the shadows, but it too has links out to other countries, not to companies but to secret organisations in almost every country. But the headquarters dictates to every subsidiary network of the cult in every country, and the objective of every network in each country is to control the government, the administration, the intelligence service, the military, the big corporations, the media (controlling perception by controlling the information broadcast), the medical systems, etc. but all under the same central agenda.

10. There are two main mass perception manipulation strategies used by this Deep State cult. The first is **Problem – Reaction – Solution** where they covertly create a problem and get the mass media to tell the public the version of that problem which you want them to believe and you want the public to say in a state of fear, anxiety or outrage “something must be done, what are they going to do about it?” and then the people who created the problem presents a solution blaming somebody else for creating the problem in the first place.

There is another version of that which is **No Problem – Reaction – Solution** where you don't need a real problem but instead you need the **perception** of a problem. Weapons of Mass Destruction in Iraq justifying the invasion of Iraq, also, Human-caused Climate Change which when you examine the facts is absolutely unsupportable. And then we come to the global pandemic. Here, there appears to be a response from every government in every country, but the Deep State does not see any borders because each country is controlled by the Deep State network in that country, following the orders of the central Deep State command centre.

11. The blueprint for this planned society is China where they have had a prolonged, vicious dictatorship for many years. China is a Technocracy and they have millions of face-recognition cameras in Chinese cities. This fake pandemic has caused the West to become China. And where did this pandemic start? – China.
12. Wuhan is famous for extraordinary levels of toxic air and in consequence of that, it has enormous levels of respiratory disease from breathing the stuff in. One hundred and ninety eight people died and they took fluid from the lungs of seven of them, collecting a random mixture of genetic material from those sick people. No virus was ever separated from that genetic material. Instead, a test was produced which detected any component of that grand mix of genetic material and it is called a test for “covid-19”. The reality is that the test just detects genetic material which is normally found in most people. They can't use a real bio-weapon because they would have no control over it and it would kill people whom they need to run the police state – fake figures are much better because they can control those.
13. Doctors are being pressurised into putting “covid-19” on death certificates no matter what the cause of death actually was. Extra hospitals have been built or cobbled together but those are just for show and they are empty. In America, Medicare payments to a hospital for a patient who dies of some well-known disease are \$4,600 but if “covid-19” is put on the death certificate then the payment rises to \$13,000 and if the death certificate also says “put on a ventilator” then the payment rises to \$39,000 and that arrangement is a major incentive to report deaths as being from covid-19 even though covid-19 does not exist.
14. The World Health Organisation, which is funded mainly by Bill Gates now that the US government has stopped funding them, has come out and said China has shown the way to deal with this virus – we need to have a severe lockdown to stifle the virus.
15. Old people and the ‘vulnerable’ (people with other illnesses) are more susceptible to the fake virus because they have a much higher level of actual real illnesses than young people “so we must have a lockdown to protect our old people” (and destroy the livelihoods of millions) !! And because they could not produce enough dead bodies, they resorted to faked computer models saying, well, people are not dying now but death is coming down the line so we need to act now, and when those predicted deaths did not happen (surprise, surprise) they will say “those deaths did not happen BECAUSE of the lockdown” !!
16. They are now saying that people who tested positive to this mix of common biological material (not covid-19 !) did not become immune to it, and that is because they want to inject everyone with Bill Gates’ highly damaging “vaccine”.
17. Hospitals are empty because operations, consultations and all contact has been cancelled because of the virus scare. Hospital staff have been laid off. Extra people will die due to lack of care. A man who went around a British hospital with a camera and showed that it was empty was jailed for doing that.

18. A “vaccine” will be produced in impossibly short a time, probably only weeks when normally it would take years. Of course as no covid-19 virus has been isolated, both a test and a genuine vaccine are impossible, but as the objective is to inject whatever material they want into almost every human on the planet, there is no actual time constraint other than trying to avoid making it obvious that there never was a covid-19 virus.
19. Some people have claimed that David Icke says that 5G causes covid-19. That is completely wrong as David states categorically that covid-19 does NOT exist. Instead, David states that 5G at it's 60 gigahertz frequency interferes with oxygen molecules, making oxygen unable to operate correctly with human lungs. That produces oxygen starvation which has symptoms similar to the supposed symptoms of the fake covid-19 virus. The present lockdown is being used to allow rapid installation of new 5G transmitters without interference by the public. In the future, 5G will be used to introduce “a newly mutated covid-19 virus” scam with a future full lockdown.
20. Another objective of the Deep State is to get humans separated from each other and instead become linked to machines such as smart phones and Personal Assistants. The idea is to achieve a psychological link between humans and machines, later leading to humans becoming part of a technological cloud. A lockdown with face masks blocks off human facial expressions and tends to separate people from each other and that is reinforced with pub closures as pubs are social places.
21. The proposed “vaccine” will contain ill-health producing components along with nanotechnology robots which will multiply inside the body and work against the human who received the vaccine. This is what the recent transgender push is all about. Their objective is that modified humans will have no need for procreation.
22. The question is what can we do about it? This hinges on the human population as a whole. If you do things on the basis of “what are the consequences for me personally if I do that?” then you will never do anything other than act as a slave to the few at the top of the pyramid. Instead, we need to choose to do what is right no matter what the consequences are.

This video can now be viewed here <https://banned.video/watch?id=5eaf94333bf48800246c2f6a> on the new uncensored platform.

Also, American Jerry Day made the following presentation:



It is April 2020 and I'm going to guess that when you see this, your life will have been changed in some way by the Corona virus. I'm not calling it a pandemic because in a pandemic millions would die all

over the world. So far, in terms of deaths, we have had an average 'flu season with a few spikes in places where they have a lot of frequencies, air pollution, poor sanitation, an elderly population and incompetent public officials.

The medical crisis may be bad where you live, but it is nothing compared to the economic destruction which we have all allowed to happen. All over the world the cost has already been estimated to be between \$6 trillion and \$20 trillion I would say, and it is rising, and economic damage from businesses closing, jobs lost, supply chains disrupted, food production and supply severely crippled, transportation pared down to a minimum and medical industry chaos where they can't seem to get a reliable test for the disease, month after month after month.

It is a world-class fiasco where our nation's medical officials gather behind a podium to tell us all how to respond to the on-going crisis and none of our medical officials are wearing a mask – how is that for “social distancing”?

You probably know that the way that our economy is measured is by Gross Domestic Product (“GDP”) – how much we produce and how much we exchange with the products and services which we create. When we are told to go home, not work, close our businesses, this is like a bullet to the head of the GDP. And this was not just one country, this was global. When annual GDP goes down, or goes up by less than 2%, that indicates a recession. The GDP must be a solid positive number year to year to balance taxes, debt, crime and natural disasters and the normal fluxes of commerce.

It has been conservatively projected that the pandemic lockdown will take US GDP down by twenty to forty percent annually. It will be a miracle if a recession is all we get. The many countries on which we rely on will have their GDP downturns worse than ours. Usually when one country suffers a disaster, other countries come to its aid. This is the first time in recent history when essentially all developed countries have suffered an economic disaster at the same time. Ladies and gentlemen; we are going to hurt.

So, here is the lesson which we have learned. Our society and economy were badly damaged, but not by the disease. It was by the reckless, corrupt, hysterical and ill-informed policies which were shoved down our throat by media, Big Pharma, and a scattering of power-crazed politicians. Social isolation, masks, shutdowns, slamming commerce to a halt globally in barely a week in late March, this is by any kind of definition the black-swan event which certain financial advisors have been predicting for years because our global economy was so fragile before the corona virus dog-and-pony show.

The financial analysts have been waiting for a leaf to fall and cause an economic avalanche. Well the lockdown is an avalanche all by itself. But the destruction will not be limited to the speculative financial markets, but crippling almost everything the financial markets depend on to stay solvent and functioning as well as crippling the markets where you and I get our toilet paper, bread and rice. So it is clear that corona virus (which is the equivalent to an average 'flu season) is a minor contributor to the global economic catastrophe which will result from the lockdown of people, government, business and trade which all have economic consequences far beyond that of the disease itself.

But ironically, what has caused massive damage to our global economy, was us. It was our belief in the hype and hysteria and our compliance with the ridiculous and unnecessary dictates coming from people who seem to know nothing about either medicine or economics. Mayors, Governors and Presidential advisors and the President himself told us to do things which we knew would cause damage to ourselves and our communities. Many of us knew that these impulsive precautions and shutdowns were not necessary, and yet the general public without any noticeable hesitation went into full compliance, went home, isolated ourselves, sabotaged our own livelihoods, stopped providing goods and services for others, dismantled our critical supply lines of food, goods, medicine - everything.

It was not just that there was a disease, or a lot of bad ideas about how to react to that disease. It was our obedience, our compliance that did most of the damage. What you and I did, will cause on the global level, poverty, suicides, famine, and extended crisis for nearly all of us, because many businesses cannot afford to close for many weeks or months. For many of them, they have permanently lost their suppliers, defaulted on their credit or their rents. Lost their employees or their customers. Farmers have thrown away millions of pounds of food because restaurants were closed,

and grocery stores were running out of everything we need because the restaurant food could not be redirected to the grocery stores in time. Too much food over here and not enough food over there, massive waste, inefficiency, mismanagement on a world-wide scale, complete idiocy in policy. You and I supported these policies as if our politicians knew what they were doing. We did this to ourselves.

We listened to career public servants who have no business commanding people around – in fact, no authority to do so. Their job is to give us information and let us find our own solutions. But oh no, we need central planners – at least that's what the central planners tell us. They had to become little dictators, threatening to shut off our utilities if we did not close our businesses. Threatening to arrest us if we did not self-quarantine for no apparent reason. Telling us to report each other to them if someone did not obey the commands of our stooge officials who literally led us off a cliff in their ignorance and ego-driven zeal.

We failed ourselves by listening to fools talking to us like we were fools. We must not let that happen to us again. We have to use our common sense. We have to find our own local solutions. We have to tune out from the ivory tower gang. We have to be responsible for ourselves, our families, our neighbours, and the last thing we need is to shut down civilisation, shut down society, shut down the economic engine on which we all depend to eat, live and survive.

I don't care what kind of pandemic we are having, society as we know it, as we need it, cannot sustain commercial lockdowns – there are too many of us to feed, too many of us who rely on the supply chains for too many things. The disruptions are catastrophic for some, deadly for others. There will be a death toll on the lockdown, especially in poor countries from famine, suicides, violence. By letting this happen we are bringing calamity on ourselves. Commercial society is like a bicycle, if you stop moving you fall over, you don't just stop and then start off again some time later. You have to understand that global commercial systems as complex as we have today, it is absolute lunacy for some poorly informed politician to step up to a microphone and call on everyone to stop what they are doing and go home.

Most of us can easily exercise better judgement than our politicians have shown us, especially when it comes to our own special local circumstances, our own families and friends – things our politicians know nothing about. They have no idea what we need or what we can do to solve our immediate problems, as long as stores are kept open and people are not prevented from gathering, helping each other, serving each other and taking action rather than sitting around alone in our own homes while the world disintegrates around us. Society is a massively complex thing. We all rely on each other, we rely on what we do for each other every day. Every job matters. Every supply line matters. Every store, office and business matters. There is no such thing as a non-essential job or business. That is someone's job or business and they need it to survive.

If you try to flip a switch and pause all of that for a month or two, you cause damage. The only way to stop a freight train quickly is for the train to hit another train – it causes damage. We have damaged society at the very foundations – we are shattering the massive civic engine which fills all of our complex needs as they arise in real time, day by day.

I think by now we have all realised that our civilisation is more fragile than we thought. We cannot allow our politicians, bureaucrats and global chess players to mess with us in these ways. There are many people who went home from work, locked their doors, thought of the people who would need the things which they would be making – the food, the products, the services which they could have provided. They knew that. They knew that by not working, by closing their businesses they would be hurting people. You may be one of those people who could have made things easier for others by staying on the job. But we were told that there was a big, bad disease by a bunch of public officials who thought that over-reacting would be better for their careers. What about our careers? And many of the businesses which we depend on will never be able to reopen.

A quarantine is a drastic measure. A quarantine should only be used when there is an immediate local life and death situation. Quarantining people who are not sick, makes no sense whatsoever. Most of the people who went into quarantine did not have the slightest chance of catching or transmitting any disease. We will study for years to figure out how we fell for this. Entire towns were quarantined when there was not even one sick person in the town. There could not be a better demonstration of herd insanity. But even if people are sick, there was a much bigger disease which was causing much

greater harm – the disease of following nonsensical orders, the disease of believing lies and hysteria, the disease of giving up our ability to help ourselves. The disease of relying on people who have no ability to help us, telling us what to do. The disease of not thinking for ourselves. All right, we made a mistake, but have we learned anything from this? Are we going to go out and try to rebuild what we had, try to repair the damage, and tell everyone who tries to stop us that they will not be allowed to do that?

In a crisis it is not the politicians we should be serving – it is the people around us, and we should do that in any way that we find that will work. Maybe we'll get the 'flu – we've had the 'flu before and we will have it again. Life goes on, or at least we can try to make life go on. You can't suspend life until there is no more risk – that is not how it works. If you want to quarantine yourself, then go ahead and do that. But do not interfere with people who are more courageous and positive than you. Do not preach to people who are wearing masks and social distancing. Just go home and lie down while the rest of us try to pull things back together in whatever way we can, hopefully without any interference. Your Governor can't rebuild your business or salvage your job. As usual, that will be on us.

We may be able to salvage our economy, supply lines, our standard of living, or we may not. But either way, we are doomed if we don't get back to work or if we let anything like this happen again.

This video can be downloaded from www.yourstrawman.com/JerryDay.mp4

The Overall Picture

You and I have been lied to for all of our lives. We were raised in a culture which is based on lies. We have been told that “there is no such thing as a free meal” which is complete rubbish. I have documented more than 150 different designs which produce more output power than the input power needed to make them operate. We have been lied to about who we are, where we live and what is going on around us.

You were born into a war zone – right into the middle of a battlefield and the propaganda lies of one side make it hard for us to understand clearly what is going on. So let’s start from the beginning.

1. At the beginning of time God existed, and only God, nothing else and nobody else.
2. God chose to create many angelic beings. One of those angelic beings was exceptional, very powerful and exceptionally beautiful. We know this being by the name Satan although he has other names.
3. God created the Earth for these angelic beings.
4. The being Satan decided that he was at least as powerful as God the Creator and he convinced one third of the other angelic beings that he was right and they staged a rebellion, wanting to depose God and set up Satan as overall ruler. That action caused the destruction of the Earth and God exiled that rebellious group to the Earth (which they can no longer leave).
5. God the Creator then reconstructed the Earth in it’s present form with land, seas, air and sky with the Sun to “rule the day” and the Moon to “rule the night”. Both of these are described as “great lights”.
6. God the Creator then created a man and a woman as a pair of humans who would have offspring which would spread out and fill the world. God also created animals, fish and insects.
7. Satan is the most powerful being on Earth and unless God intervenes, what Satan says goes. For that reason Satan is described as “the ruler of the world”.
8. God has an agenda for world history. Much of that agenda has been accomplished before you were born. The most staggering event in that time has been the birth, death and resurrection of Jesus Christ which occurred about two thousand years ago. You can find the details in the “New Testament” section of the Bible, perhaps starting with the gospel of John, part of which says “God so loved the world that he gave his only son so that whoever believes in him should not perish but have everlasting life” If that is not clear enough, then we are also told “if you confess with your mouth the Lord Jesus and believe in your heart that God has raised him from the dead, you shall be saved”
9. But remember that you were born into a battle zone with God the Creator on one side and Satan the ruler of this world on the other side. Satan specialises in propaganda deception and lies and one of his favourite techniques is “but did God really say that?” Satan denies everything that God says – here are a few examples:
 - A. God said that he created the Earth and two great lights, one to rule the day and one to rule the night. But no says Satan, there is only one light, the Sun and the Moon only reflects sunlight. So, who do you believe, God or Satan? Well, check it out for yourself. Sunlight heats, moonlight cools. Put a thermometer in sunlight and then in shade and you will see that the area in sunlight is warmer than the shade. Do the same with moonlight and you find that it is warmer in the shade than in the moonlight. Moonlight comes from the Moon and is nothing like sunlight.

- B.** God talks about the four corners of the world. But no, says Satan, the Earth is a sphere and so has no corners. People who have investigated the subject state that the Earth is not spherical and does not rotate. Further, astronomers have noted that it is possible to see stars through the unlit part of the Moon and so the Moon is not a solid piece of rock. They also remark that the Moon is sometimes eclipsed when both the Sun and the Moon are visible in the sky and so eclipses of the Moon could not possibly be caused by the shadow of the Earth as Satan says.
- C.** God said that he created mankind – a male and a female. But no says Satan, there are lots of different genders and you must teach your children that. Satan also denies that God created mankind, claiming that life evolved on earth without God. So, if you have dogs you need to be careful as your dogs may give birth to a giraffe, a camel, a snake or perhaps a porpoise!
- D.** God said that in the last days the stars will fall on to the Earth. But no says Satan, the Sun is much larger than Earth and the other stars are all bigger than the Sun, so they couldn't possibly fall on the Earth which is much smaller. People who have studied the matter state that the Sun is much smaller than the Earth and is less than 4000 miles away and all the stars are less than 6000 miles away – that doesn't quite agree with Satan's claim that the Sun some 93,000,000 miles away.
- 10.** God's agenda for Earth and humanity has some way to run yet. First, there has to be a hazardous time with wars and rumours of wars, causing people to be afraid, pandemics, droughts, famine, etc. These are the result of Satan's rule on Earth for thousands of years
- 11.** Then there has to come a man who appears to have all the answers and who can cause peace through his skilful organisation. This is the Antichrist who introduces a period of great trial and difficulty, his number one target being the people who have Jesus Christ as their Saviour and who don't fall for his lies. He will murder many Christians and try to kill every last one of them.
- 12.** That time is completed at the last moment when Jesus Christ returns to Earth and deals with Satan once and for all, ushering in permanent peace and prosperity on Earth.

We don't have to sit still and just wait for these things to occur. God has given us instructions which we know as The Ten Commandments. These are widely known and they are ignored by most people.

Do I Disrespect God? Do You?

If, like me, you have attended a church service on a Sunday, then, like me, you have disrespected God by doing that.

Why? Because God commanded us to keep Saturday as a day of rest and worship and in order to oppose God in every possible way, Satan has managed to get people working on a Saturday and instead, have Sunday as a holiday, even though it is the first working day of the week.

This change from Saturday to Sunday was done by the Catholic Church at the Council of Laodicea (around AD 363) and it is an obvious act of rebellion against God.

How about working on a Saturday? Did you ever do that? I certainly did (through ignorance) and that too is following Satan's desire and not following God's command.

God never changes. God's requirements never change. God's commandments never change. In the first few pages of the Bible, God defines what He means by "a day", namely night time followed by day time. God also sets out ten commandments for his followers to keep. Eight of them say what you must not do and two of them specify what you must do if you want to follow God. Four relate to your relationship with God and six relate to your dealings with other humans.

The Ten Commandments

- 1.** You shall have no other gods before me.

2. You shall not make any graven image, or any likeness of any thing that is in heaven above, or that is in the earth beneath, or that is in the water under the earth. You shall not bow down to them, nor serve them.
 3. You shall not take the name of the LORD your God in vain; for the LORD will not hold him guiltless who takes his name in vain.
 4. Remember the Sabbath day, to keep it holy. Six days you shall labour, and do all your work but the seventh day is the Sabbath of the LORD your God: in it you shall not do any work. For in six days the LORD made heaven and earth, the sea, and all that is in them, and rested the seventh day: wherefore the LORD blessed the Sabbath day, and hallowed it.
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5. Honour your father and your mother.
6. You shall not kill.
7. You shall not commit adultery.
8. You shall not steal.
9. You shall not bear false witness against your neighbour.
10. You shall not covet any thing that is your neighbour's.

These do not need any great explanation or expansion as they are very clear and direct, although the order appears most significant. The third commandment may be considered to be about using unsuitable language and while I am most definitely in favour of that, I actually think that it is referring to claiming to be a Christian while not following God's commandments.

The fourth commandment is the crunch. As I understand it, all of Christ's followers need to keep the Sabbath, (that is, the period of time between sunset on Friday to the sunset on Saturday) as a day of rest and worship. If you want to worship at a church at that time then I wish you every success in finding such a church as they are few and far between.

Each week we are faced with a decision which we cannot avoid. We have three main options:

1. We can disobey God's command and not honour God on the Sabbath.
2. We can do what Satan wants and go to church on Sunday (which is between midnight on Saturday and midnight on Sunday).
3. We can do what God commands and make the Sabbath a day of rest and worship and deny Satan's desire for churchgoing on Sundays.

That is your choice and mine to make every seven days.

The change from Sabbath worship to Sunday services was made by the Roman Catholic Church:

In Stephen Keenan's "A Doctrinal Catechism" page 174 it states:

Question: Have you any other way of proving that the Church has power to institute festivals of precept?

Answer: Had she not such power, she could not have done that in which all modern religionists agree with her – she could not have substituted the observance of Sunday, the first day of the week, for the observance of Saturday the seventh day, a change for which there is no scriptural authority ...

Essentially, if we keep the Sabbath then we do what God commands, but if we observe Sunday then we do what Satan wants.

If you want more detail on these things, then perhaps the web site <https://www.tomorrowworld.org/booklets> might be helpful.