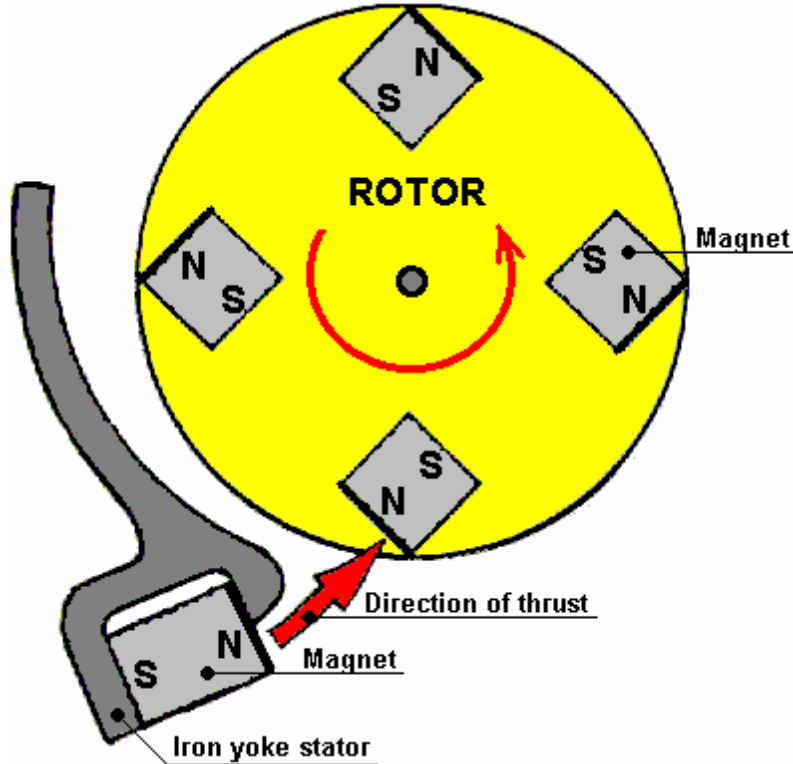


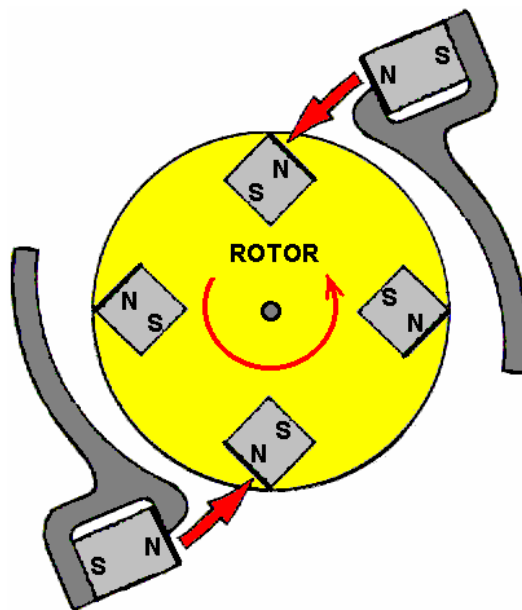
Omissions from Chapter 1:

The Bedini Magnet Motor.

It is not easy to arrange permanent magnets in a pattern which can provide a continuous force in a single direction, as there tends to be a point where the forces of attraction and repulsion balance and produce a position in which the rotor settles down and sticks. There are various ways to avoid this happening. It is possible to modify the magnetic field by diverting it through a soft iron component. An example of this is John Bedini's simple design shown here:



In John's design, the magnetic field of the stator magnet is altered by the iron yoke and this smothers the repulsion which would normally occur between the North pole of the stator magnet and the North pole of each rotor magnet as it gets close to the stator magnet. This arrangement allows the rotor magnets to receive a push as they pass by the stator magnet, producing a repeating thrust to keep the rotor rotating. To increase the power, there does not appear to be any reason why there should not be two stators as shown here:

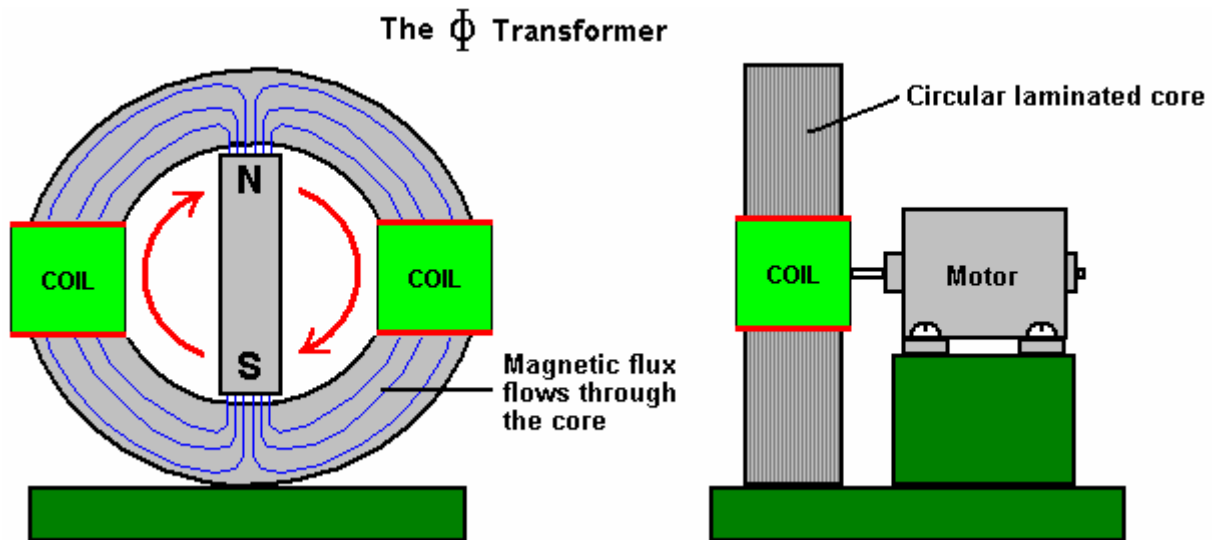


There does not appear to be any reason why several of these rotor/stator assemblies should not be attached to a single shaft to increase the power applied to the shaft and allow an increased level of useful work to be performed

by the device, but this style of magnet motor rotates only slowly and should be considered a "proof of concept" device rather than a serious drive motor.

The "Phi-Transformer"

which looks like a somewhat similar arrangement to the MEG, but it operates in quite a different way:



Here, lines of magnetic flux coming from a permanent magnet are channelled through a laminated yoke which is effectively a circular mains transformer core. The difference is in the fact that instead of electronically driving a coil to alter the flux coming from the permanent magnet, in this system the magnet is rotated by a small motor.

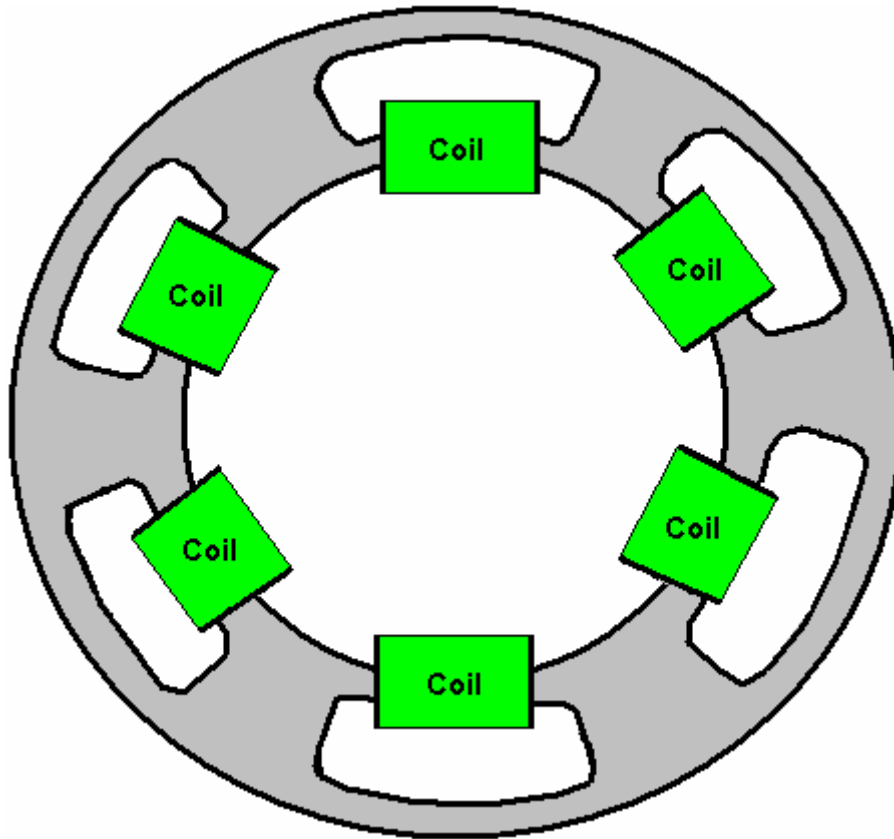
The performance of this device is impressive. The power required to rotate the magnet is not unduly affected by the current drawn from the coils. The flux is channelled through the laminated iron core and in tests an output of 1200 watts for an input of 140 watts has been achieved, and that is a COP of 8.5 which is very respectable, especially for such a simple device.

At <http://jnaudin.free.fr/html/dsgromg2.htm> a generator design by Dave Squires is shown, dated 1999. All attempts to contact Dave Squires have been unsuccessful, so it is not known if the information there is from tests on a device which has actually been built or if it is just a theoretical design, though it is likely that it was not built at that time. The design is almost identical to the Phi Transformer. A central core is produced by casting the shape shown below, using an amorphous iron powder / epoxy mix. However, as the operating frequency is low at only 50 Hz or 60 Hz, there does not seem to be any reason why normal transformer laminations should not be used, in which case six sets of shims shaped like this:

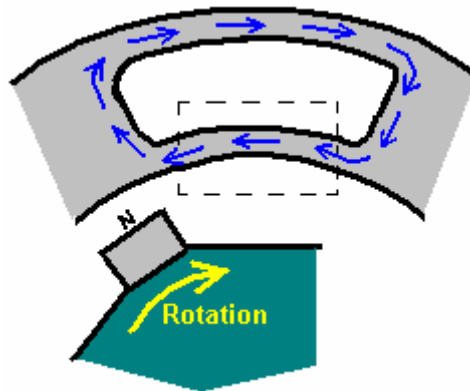


which would make the winding of the coils very much easier as standard bobbins could be slotted into place as the core yoke is being assembled.

However, the complete core is shaped like this with coils placed in the slots:

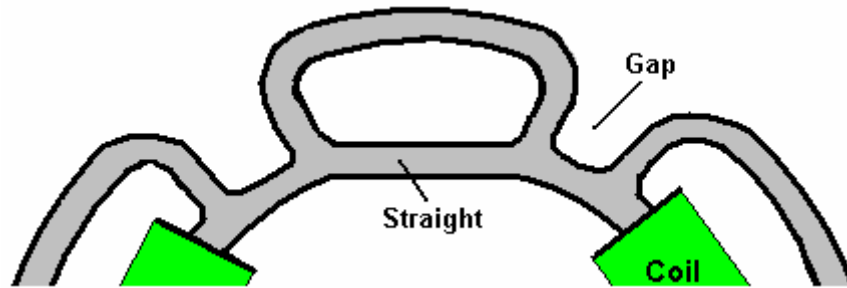


The thinking behind this arrangement is that the “back-EMF” magnetic flux which normally causes Lenz Law opposition to the free rotation of the magnets around the toroid, is diverted around behind the coil and turned so that instead of hindering the rotation, it actually assists it:



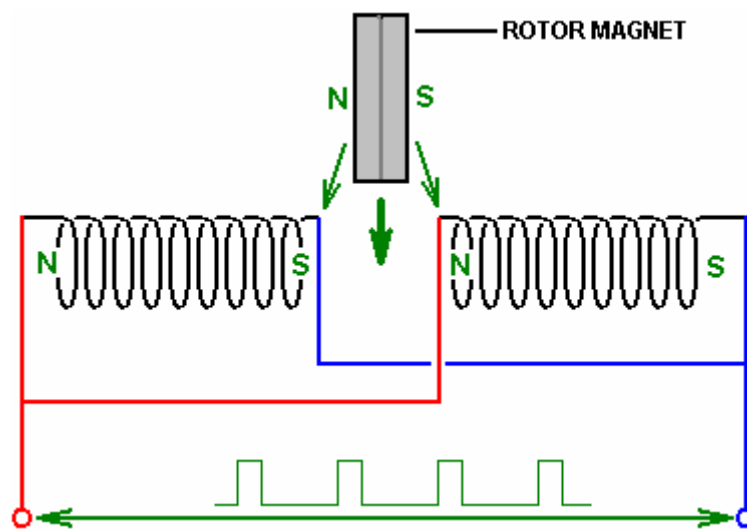
The speed of rotation is quoted as being 1,000 rpm for 50 Hz and 1,200 rpm for 60 Hz. The coil windings are suggested as being 180 turns of AWG 14 (16 SWG) for 120 volts AC, at a supposed current of 100 amps, which is seems unrealistic as the maximum current for that size of wire is quoted as being 5.9 amps. The magnets are 2 inches long, 1 inch deep neodymium set into a circular rotor of 12 inch diameter. There can, of course, be more than one rotor on a single shaft, and the number of turns would be doubled for 240 volts AC output.

The yoke on which the coils are wound is effectively a series of toroids, though admittedly, not exactly circular is shape. An alternative shape which might be considered would be as shown below where the section carrying the magnetic flux for any one coil is more isolated from the other toroids. It is not clear if making the section which passes through the coil, straight rather than curved, so I will leave that detail to people who are expert in magnetics.



This design concept has been tested by one or two people and while magnetic drag was reduced, it did not reach zero.

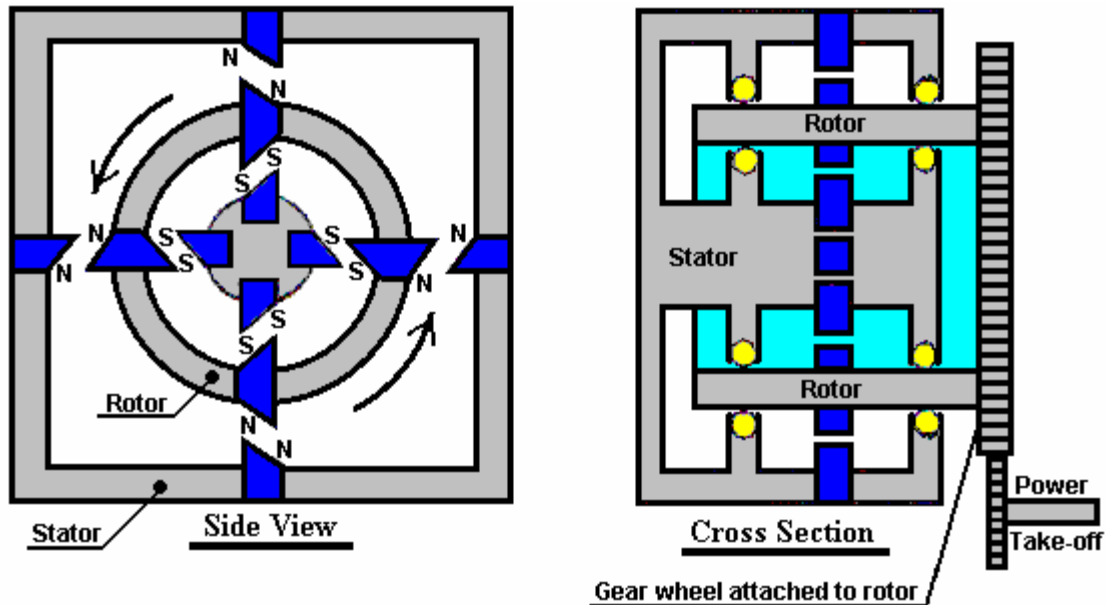
One arrangement suggested by **Garry Stanley** and verified by Stefan Hartman in October 2003 is:



Here, two identical coils are wired in parallel and driven by a pulsed DC voltage. When they are powered up a strong attraction is created between these stationary coils and the permanent magnet fixed to a rotating disc positioned between the coils. This attraction causes the rotor to rotate, moving the magnet into the space between the coils. If nothing were changed, then the magnet would overshoot the centre of the coils and then experience a pull backwards towards the coils. To avoid this, the electrical power is cut as soon as the magnet passes the centre of the coils. This produces a large voltage of the opposite polarity in the coil and that has two beneficial effects. The first effect is that the poles of the coils are reversed and instead of dragging the magnet backwards, the coils actually push the magnet onwards. The second effect is that the voltage pulse can be directed through diodes to pass that "back EMF" power pulse back to charge a battery, regaining some of the electrical power used to drive the rotor.

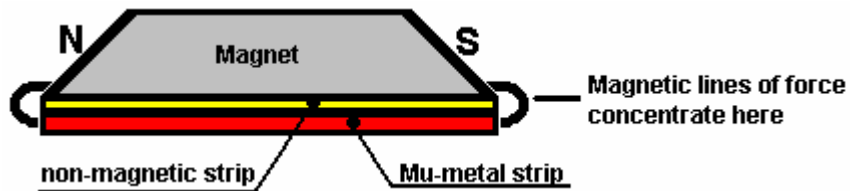
Invention Intelligence (India)

The following design for a permanent magnet motor was published in the April 1977 issue of 'Invention Intelligence' in India:



This design relies on the magnetic field of a magnet being distorted by having the pole faces angled at 45 degrees. In the diagram, the magnets are shown in blue and they are mounted in a non-magnetic stator and rotor material shown in grey. The rotor is mounted on two ball races shown in yellow. The theory is that the repulsing forces of the four North-North outer magnet pairs along with the repulsing forces of the four inner South-South magnet pairs should be continuously greater than the North-South attracting forces, thus giving continuous rotation.

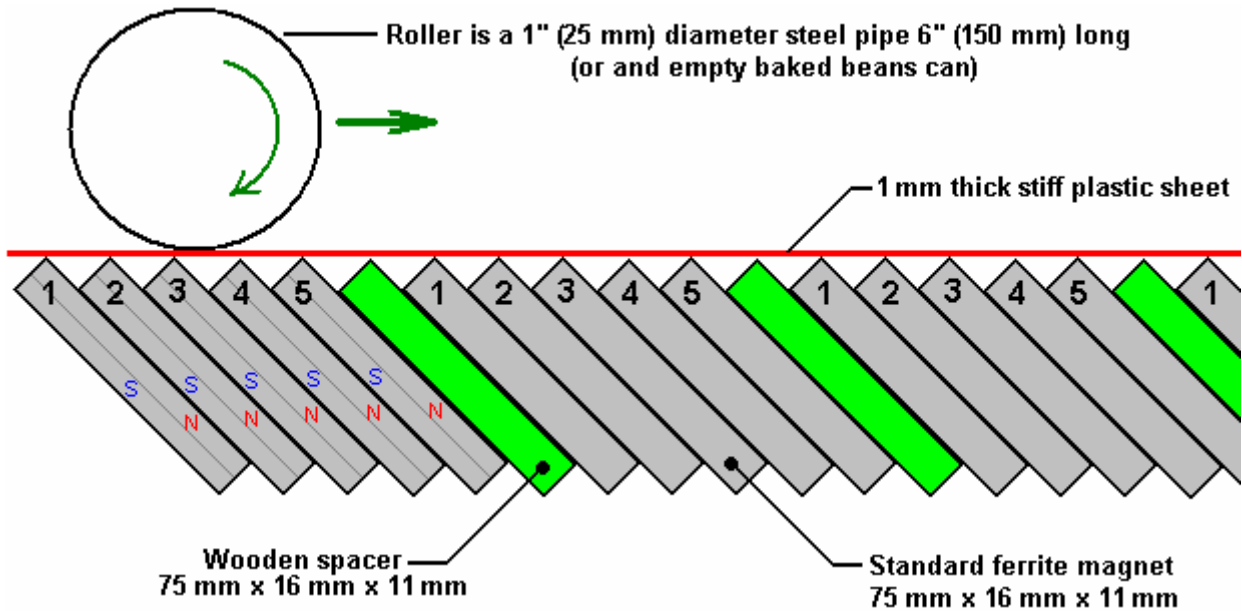
It appears most likely that this design is just a theory and that a working model has never been constructed. However, it is possible that this system might work very well, so the information is presented here for interest and possible experimentation. It might be remarked that making the magnet face have a 45 degree angle may well not skew the magnetic field sufficiently to give a big enough imbalance to provide significant drive power. One way to increase the effect might be to use a mu-metal strip along the back of each magnet. Mu-metal is an expensive material which conducts magnetic lines of force in a phenomenal way and so soaks up any magnetism near it:



To recap: the underlying principle of the power of magnets is that each permanent magnet mentioned here, has two magnetic poles (one "North" and one "South" pole) and these poles being of opposite type and near each other, form a "dipole". This dipole unbalances the quantum environment around the magnet, causing continuous streams of energy to flow out in every direction from the magnet. These streams of energy are not what we see as lines of magnetic force, and to date, nobody has managed to design any piece of equipment which responds to that energy and which can be used to measure it. At this point in time, all we can do to estimate the energy flow is to divert it into a battery and then assess the battery charge by measuring the length of time that the battery can power a load from the energy which it received. This is a very crude method, but it does work.

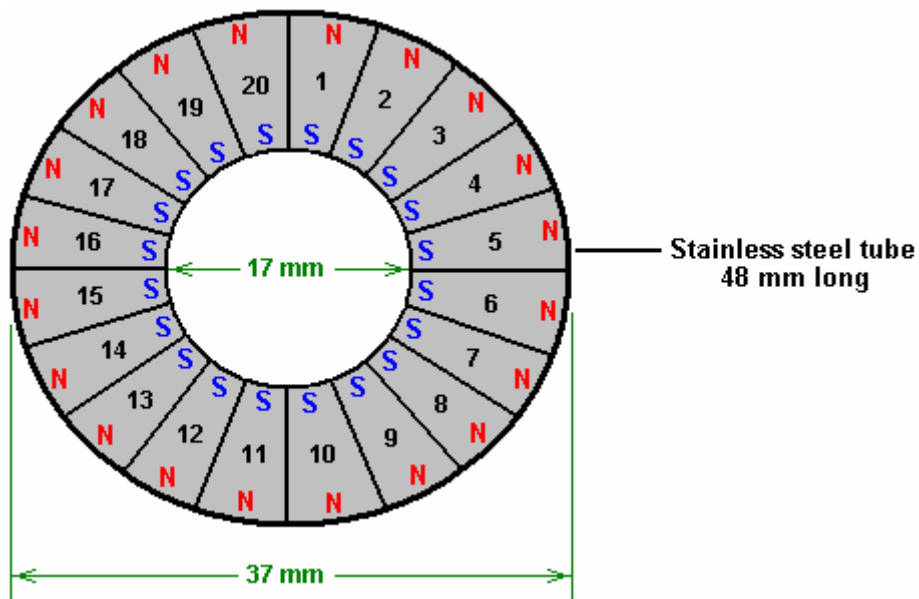
Steele Braden

has experimented very extensively with this arrangement of magnets and it is his experience that each magnet in a set of this kind, affects the field of the following magnet. This effect is progressive and by the fifth magnet, the magnetic push is no longer near enough to the horizontal to be fully effective. This is overcome by putting a non-magnetic wooden spacer between sets of five magnets as shown here:



This gives transport of the rolling ferrous cylinder without any input power being required. There is no limit to the length of the magnetic strip along which the metal cylinder rolls but the cylinder weight of 325 grams is essential for the inertial effect in keeping the cylinder rolling. With just a ferrous roller, the effect is not powerful. The magnets used by Steele for the track are standard ferrite magnets 75 mm long. This length does not show in the side-view diagram above as it runs away into the distance as does the length of the metal cylinder. The cylinder needs to overlap at least three magnets and the rolling effect causes the cylinder to appear to have only one magnetic pole. The magnets have a North pole on one face and a South pole on the opposing face and when they are stacked as shown, they are pulled together by the magnetic effect. Serious experimenters can contact Steele at stebra@value.net.nz for sharing of results or discussing observed effects.

Steele has also experimented with a magnetic roller constructed from twenty wedge-shaped magnets 48 mm long and stacked inside a stainless steel tube. This produces a high-performance roller but getting magnets which are wedge-shaped is not easy nor are they cheap:

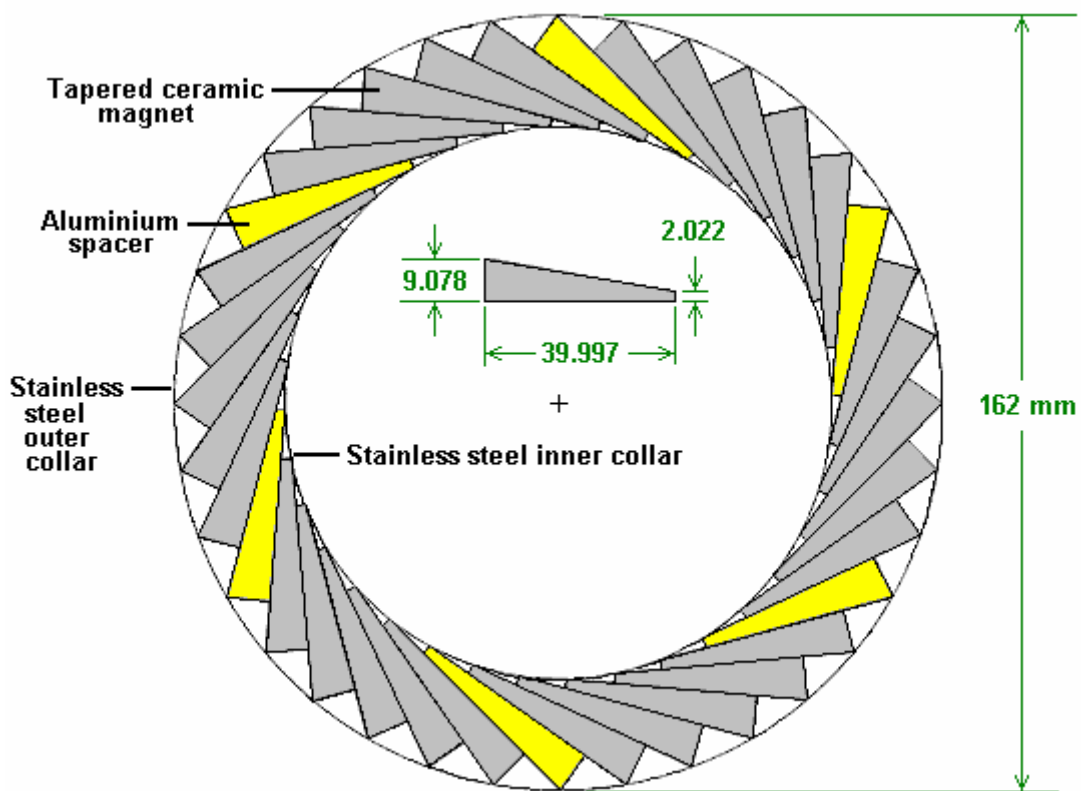


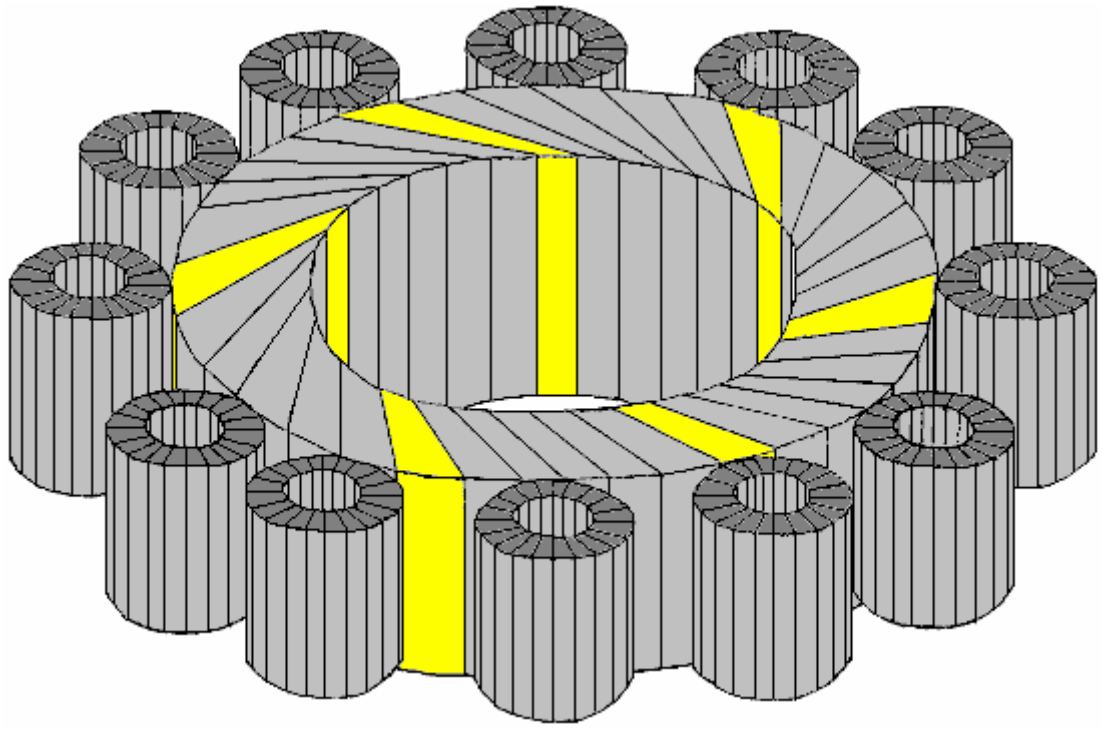
Permanent magnet motors have a Coefficient Of Performance ("COP") of infinity as they produce output power and the user does not have to provide any input power to make them operate. Remember, COP is defined as Output Power divided by the Input Power **which has to be provided by the user** to make the device operate. In the following chapter, we will be considering pulsed systems, where the user has to provide input pulses to make

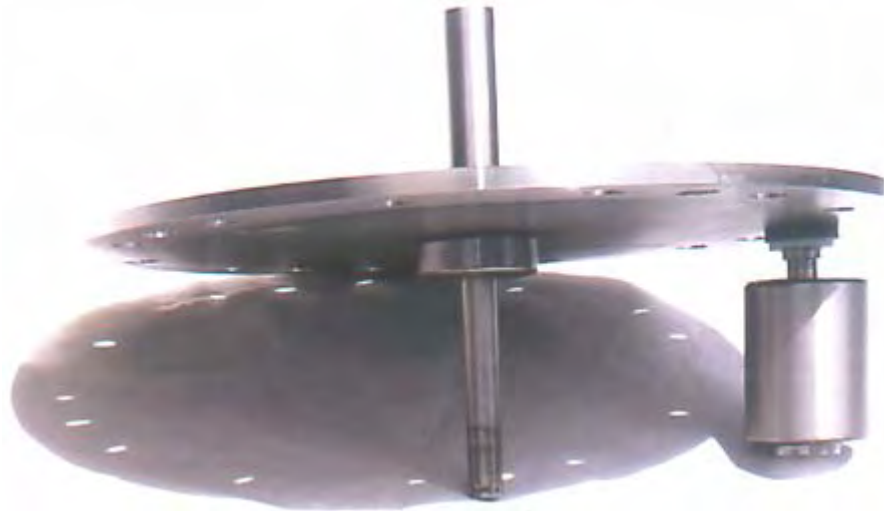
the device operate. This prevents these devices from having a COP of infinity and instead, we are looking for any device which has a COP greater than one. However, any device with $COP > 1$ has the potential of becoming self-powered, and if that can be arranged, then the COP does in fact become infinity by definition, as the user no longer needs to supply any input power.

The examples of permanent magnet motors and motor-generators mentioned above, have generally been of the type where there is a stationary "stator" and a rotating "rotor". It should be understood that the arrangement of magnets on the "stator" do not necessarily have to be stationary. Some motor designs do not have a stator, but instead have two or more rotors. This allows the magnets which would have been on the stator to be in position to provide thrust to the output rotor, and then move out of the way so as not to retard the rotor movement. The Bowman magnet motor is one of this type, though admittedly, it uses one stator magnet to get it started and it has two subsidiary small rotors which carry the magnets which would normally be on a stator. A search on the web will provide the details of many permanent magnet motor designs.

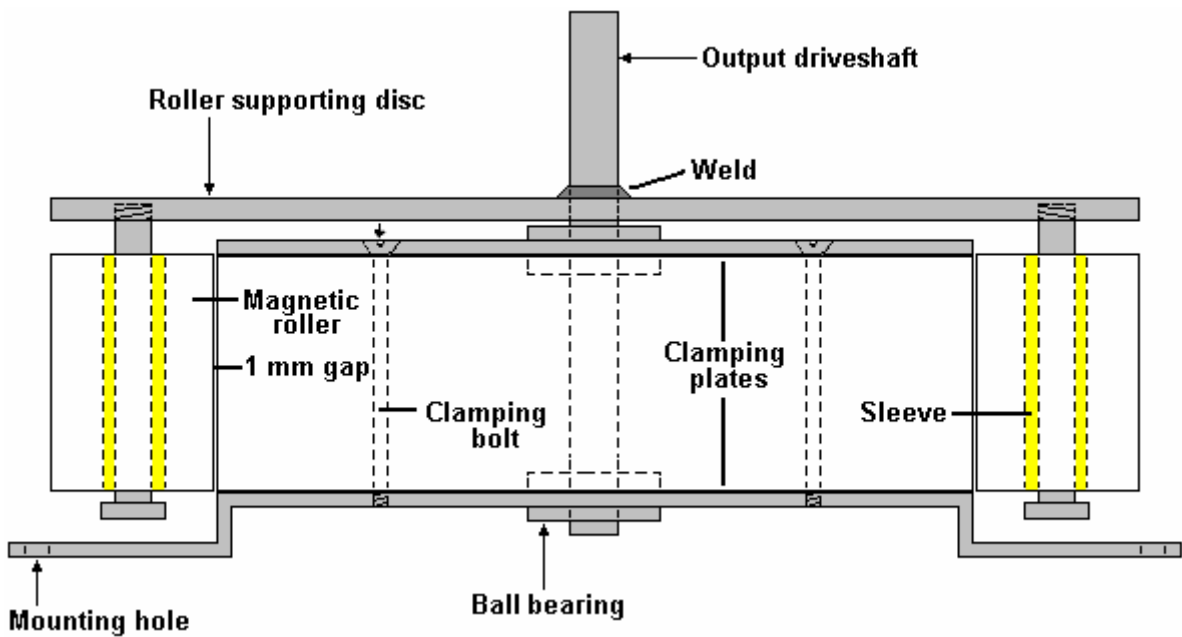
The next step with Steele Braden's system is to arrange the magnetic track so that it forms a continuous circular path, and have more than one roller. It needs to be stressed that to date, this has not been successful and it is still a matter of research and development. To create a compact motor, tapered ceramic magnets have been used. This causes the magnets to fit together closely as shown here:







This arrangement uses twelve of the 37 mm diameter cylindrical rollers, each of which contains twenty tapered magnets as shown in the diagram above. The photograph above shows the rotor plate with one of the twelve rollers attached. The motor housing is as shown here:





The motor is arranged so that the twelve magnetic rollers are bolted to a metal disc welded to the rotor shaft. The rollers run around the magnetic path driving the output shaft. The bolts holding the rollers in place are made to be a loose fit on a sleeve made of a material of a type which has a low rotational friction. At the start, the rollers roll in direct contact with the outer stainless steel sleeve, but as the rotation speed increases, the resulting outward pressure causes the rollers to press outwards on their bearings, creating the 1 mm gap shown in the diagram. In the version shown in the photograph above, the bolts holding the rollers in place are secured by nuts but a preferred arrangement is where the holes in the rotor disc are tapped to take the roller bolts directly.

James Roney

has posted a number of video on his magnetic experiments. One of these is located at http://www.youtube.com/watch?v=H6bE9TzetSA&annotation_id=annotation_234168&feature=iv and shows his method of magnetic shielding which produces a permanent magnet which appears to have only one magnetic pole. This effectively overcomes the back-drag of a stator magnet when a rotor magnet passes by it. James demonstrates the construction which he is using at present, which has a neodymium magnet surrounded by several other materials. He says:

The outer shielding is "flashing material" which is commonly sold in hardware stores in the US. I have no idea of it's exact composition. This simple demonstration, which I first posted on 21st January 2008, shows just how effective one-way shielding is in producing a net gain. Here, you see two specially shielded magnets being moved close together. When the two shielded faces are pushed together there is no magnetic effect but when they are reversed and the opposing two faces are pushed towards each other there is a sizeable magnetic push which moves the stationary magnet away. It is this thrust which is the making a fuel-less permanent magnet motor using any one of a number of different possible designs. My long-awaited video showing the method of magnetic shielding which I use.

However, shielding is just the half of it and the other half is the exact position of the stator and the angle of approach of the incoming magnets. At all times, only like poles are used as the primary pole, which means that the magnets approaching the stator will be two like poles which must be able to pass close by each other. This approach is what I call "the back door" to my stator, where one of the like poles has been heavily shielded. However, if you provide too much shielding on the stator magnet, then the rotor magnet will be attracted to the heavy metal of that shielding and that would cause a braking effect, opposing the rotation of the rotor. To

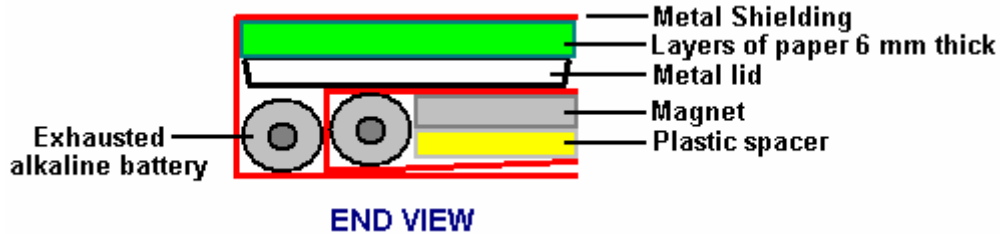
neutralise this effect we can allow some of the “like pole” to pass through the shielding. When the right amount of magnetism passes through the shielding it exactly balances the attraction of the rotor magnet to the metallic shielding of the stator magnet, allowing unhindered movement of the rotor as it passes the stator magnet.

As soon as the rotor magnet has passed “the back door” of the stator magnet, and moved into the unshielded area, the like poles of the stator magnet and the rotor magnet repel each other, giving the rotor a strong push in it’s direction of rotation. This, of course, is immediately repeated by the next rotor magnet, providing the rotational drive for the motor. The turning force is enormous, even on this small scale, and if scaled up, would have enough power to drive a car or power a home.

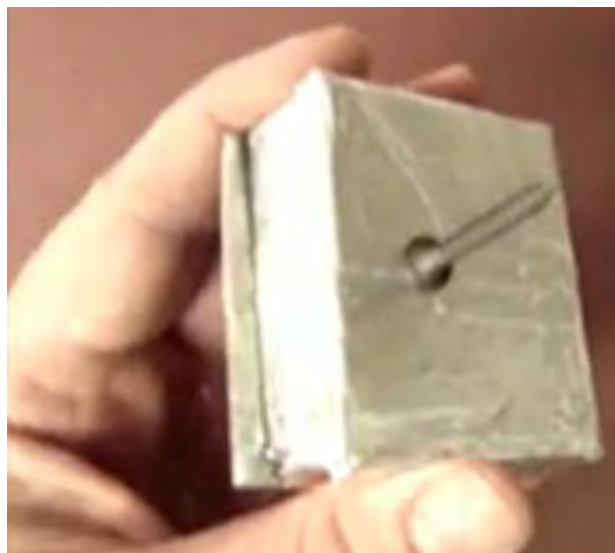
When you take this two-dimensional layout and turn it into a three-dimensional layout (by placing several rotors on the same shaft) you get a tremendous amount of thrust, capable of handling heavy loads and still keep working with the greatest of ease. Best of all, there is only one moving part and it is 99% friction free.

Having the stator long and thin, unlike typical bucket magnets which do not work in this case, this allows for a long 3-inch (75 mm) pass over the stator before the rotor magnet receives its strong push from the stator magnet, spinning the rotor and driving the next rotor magnet across the shielded part of the stator magnet, allowing the process to repeat indefinitely, producing a fuel-less permanent magnet motor.

Our thanks go to James for sharing his design information freely like this. He invites everybody to copy and repost his videos as the web hosting sites, such as YouTube, repeatedly take his videos down. Due to this repeated opposition to this information from James, it is quite possible that by the time you read this, the video pointed to by the above link will no longer be available at that address. The details from his videos are as follows:



The magnet used is a Grade 52 strength neodymium magnet 2” x 1” x 1/4” (50 mm x 25 mm x 6 mm) and it is encased in five different types of material in order to give it modified magnetic characteristics. The completed set of materials is wrapped in the silver aluminium adhesive tape used for ductwork construction and so, looks like this:



In this picture, a steel screw is shown held on one face by the residual magnetic field but that screw falls off the back face as there is not enough magnetism there to hold it in place.

Underneath the tape are two shells made from any thin magnetic metal material. James uses thin flashing metal as that is readily available and is easy to bend into shape. As the objective is to encase the magnet on three sides, the metal is cut and bent like this:



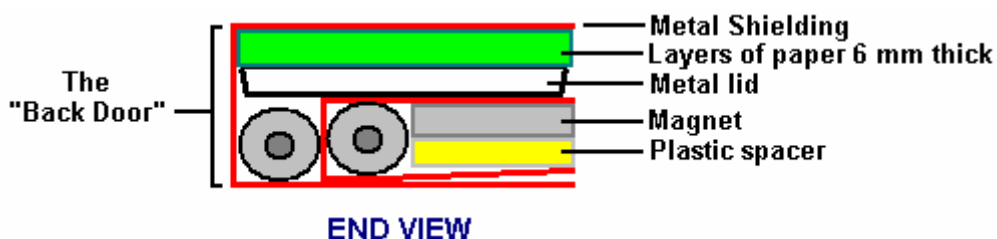
The resulting shape is not unlike a book. There are two of these metal casings, one inside the other. Each of these casings contains an alkaline battery inside it. James stresses that these batteries need to be fully discharged in case a short-circuit develops inside the casing.

The inner casing contains the magnet and the 1/4" (6 mm) plastic spacer supplied with the magnet, making an overall thickness of 1/2" (12 mm), placed up against the alkaline battery which has a 14 mm diameter, which means that the lower face of the inner casing is not quite parallel with the upper face. In the diagram, the metal casing is shown in red.

Outside that metal casing, there is a second alkaline battery and above it, there is a 2" (50 mm) diameter shallow metal cap from a container:



Between the metal cap and the upper metallic case there is a 1/4" (6 mm) layer of sheets of paper as shown here:



James stresses that the spacers made of plastic and paper can be made of almost any non-magnetic material **except** aluminium which has unusual magnetic properties. The shielded magnet can be used in two different ways, either in attraction or repulsion. The repulsion mode is slightly more powerful than the attraction mode, but some permanent magnet motors built using it have found that the magnets lost their magnetisation after some three months of continuous operation. Using the attraction method (where the rotor magnet pole is selected to be opposite to the stator magnetic pole) is nearly as powerful and never causes the magnets to get depleted. James demonstrates the attraction mode in one of his videos:



This view is looking vertically downwards on a horizontally mounted bicycle wheel which has six magnets attached to the rim. The first two magnets are Grade 52 neodymium 1" x 1" x 1/4" (25 mm x 25 mm x 6 mm) with plastic spacers glued to them. The following four magnets are the same but have a 1" diameter 1/4" thick circular neodymium magnet placed on top of them. This magnetic attraction setup is demonstrated to accelerate the wheel from a stationary position.

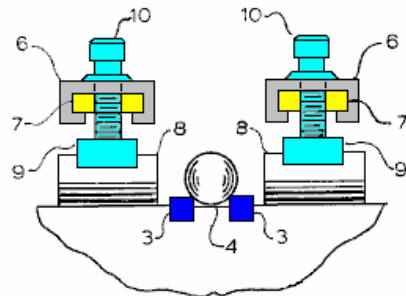
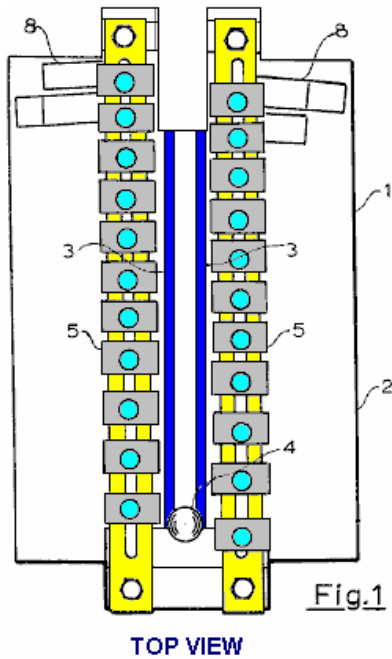
However, in my opinion, this video is not very satisfactory in that it is conceivable that the view is not vertical but horizontal and the rotation taking place due to the weight imbalance of the wheel, as the wheel is restrained immediately after it has stopped instead of allowing time to show that no reverse motion occurs. Also, no information is given as to why the six magnets are not identical, nor why the whole of the rim did not have magnets attached to it, demonstrating continuous rotation.

It might be remarked that a wheel of this type is probably a little light for a magnetic rotor as there is considerable advantage in having sufficient rotor weight to generate the momentum needed to carry the rotor past any magnetic sticking point. It can also be remarked that the wheel really needs to be balanced by having an equivalent set of six magnets on the opposite side of the wheel rim, and that placing additional shielded stator magnets at an odd number of positions around the wheel would give a steady powering of the rotor even with only two sets of six rim magnets on the rotor.

Emil Hartman and Howard Johnson

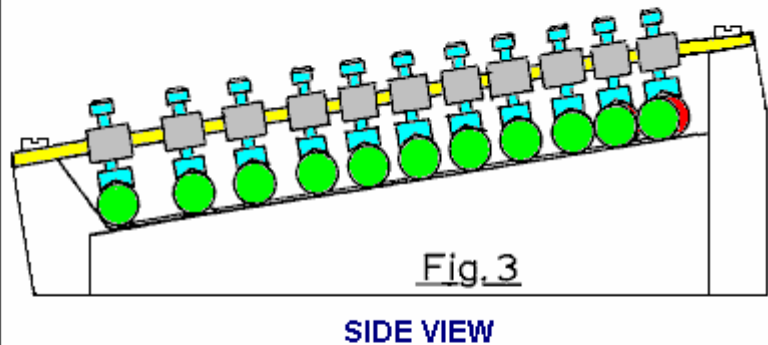
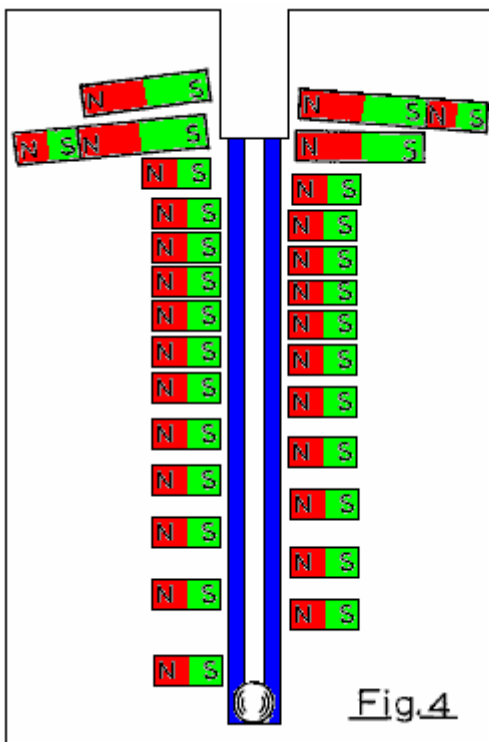
Both Emil Hartman and Howard Johnson have been granted US Patents on arrangements of permanent magnets which produce a directional push along a straight path. Emil, in July 1980 (Patent 4,215,330) and Howard in October 1989 (Patent 4,877,983) and in March 1995 (Patent 5,402,021). Each of these patents show very different methods of producing the magnetic push and each method has been proven by prototypes constructed by the inventors.

In brief outline, Emil Hartman's design drives a ferromagnetic sphere, such as a steel ball bearing, up a slope against gravity. The arrangement is like this:



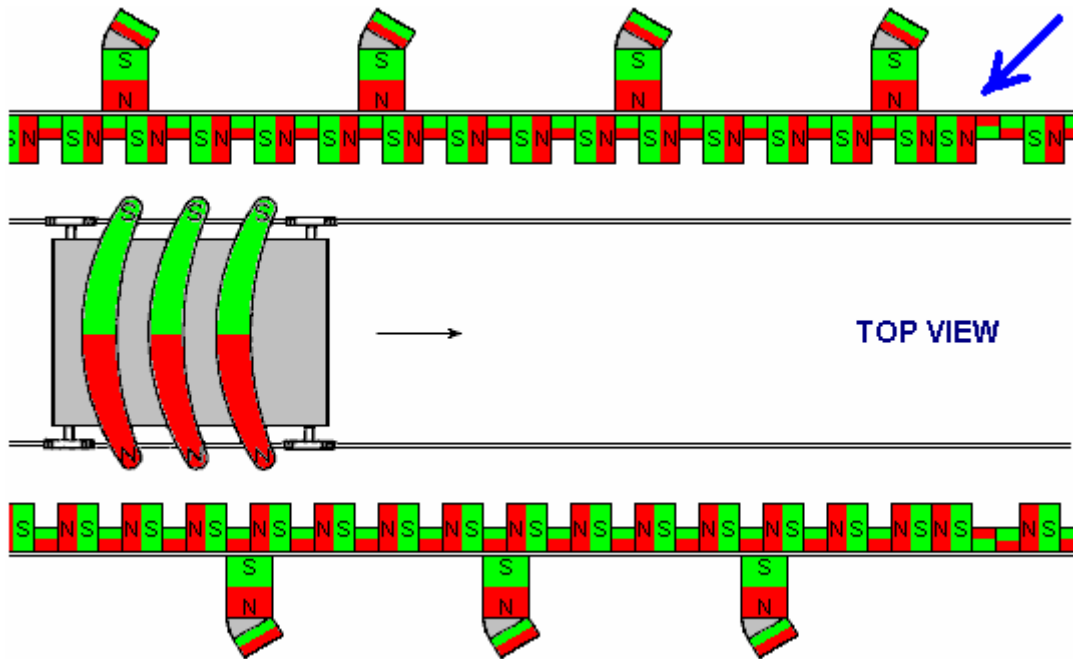
Here, the metal ball rolls along a path between two guiding strips shown in blue in the diagram above. The magnets which provide the pulling force on the ball are not seen in the top view as their clamping mechanism (marked 5 in Fig.1 and 6 in Fig.2) hides them from view. They can be seen on the right in Fig.2 where they are marked with the number 8. Interestingly, this device is put forward as an automated conveyor or as a toy, but as the metal ball is raised into the air as well as being moved along the track, the device immediately lends itself to the feed for a gravity wheel constructed in the style of an overshot water-wheel. Also, horror or horrors, this looks like one of the hated "perpetual motion" devices which people who are steeped in conventional physics are too frightened to accept.

A key feature of this arrangement is the spacing and the orientation of the permanent magnets as shown here:



Notice that the magnets are staggered with those on the right being opposite the gaps between those on the left. Emil opted to use circular bar-shaped magnets with the poles on the circular end faces. The clamping arrangement allows for very precise adjustment of the magnet positions and this will be used when finding the optimum performance. If you wish to examine the full patent, then it can be downloaded free from the website <http://www.freepatentsonline.com>

The more recent of Howard Johnson's linear-track magnetic patents (Patent US 5,402,021) shows a complicated arrangement of magnets. These look symmetrical to a quick glance, but this is not the case with the projecting 'spin accelerator' magnet assemblies being staggered, the poles being swapped on opposite sides and an unusual dividing group marked with a blue arrow in this diagram:



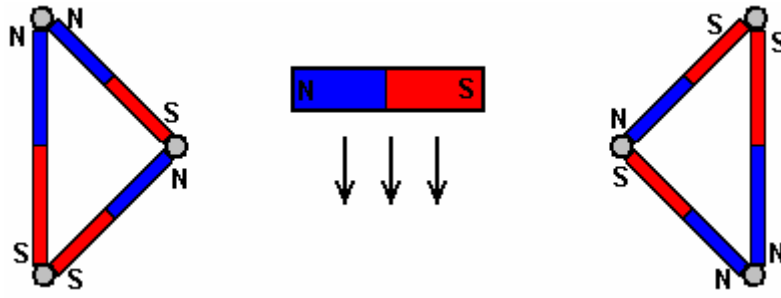
In the centre of the gap between these two sets of magnets, there is a track for a miniature rail vehicle to run along and that vehicle has curved "Alnico 8" magnets mounted on it, the spacing between those magnets being the same as the spacing of the main magnets and their pole directions match those of the short "gap" magnets. The gap between the tips of the curved magnets and the magnetic walls is 0.5" to 1.25" (12 mm to 32 mm) and the prototype vehicles were boosted down the track covering 2 feet (600 mm) in one second.

In the diagram above, all of the North magnetic poles are colour coded red and the South magnetic poles green and these colours are relied on where there is not enough room to mark the magnets clearly with the "N" or "S" letters. Howard remarks that having sets of permanent magnets positioned so closely together, actually strengthens the magnetic effect and so is helpful. The smaller magnets placed between the main magnets do not exceed half of the length of those main magnets and so there is an indentation gap between the main magnets and that gap extends at least half way down the length of the main magnets as shown above.

All of the inventors who produce a working linear track device such as these, have great difficulty in modifying the design to produce a continuous circular movement. It is not at all clear why the Howard Johnson design shown above should not have the magnetic walls curved into a large circle and the curved magnets mounted on a non-magnetic gantry arm or disc instead of a vehicle. However, as this has not been done, there is presumably some very good reason why a conversion to circular motion does not work.

Graham Clarke

While the magnetic strips shown above seem quite complicated, there are easier ways of doing this. One very good one is from Graham Clarke who uses a pair of triangles made from magnets and steel ball bearings:



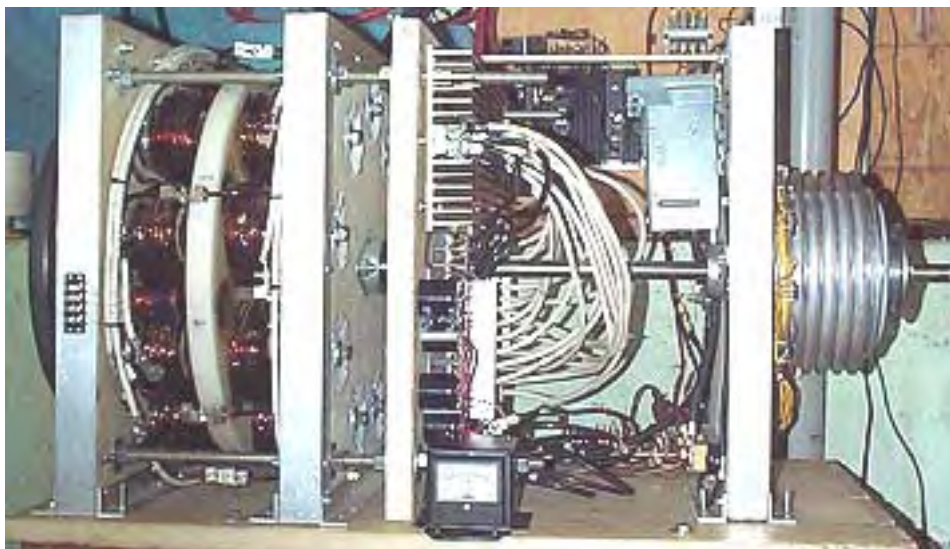
You can see a video of this arrangement in action at <http://www.fdp.nu/triforcegate/default.asp> and you will notice that there is a gap of about half the length of the rolling magnet on both sides. If the gap is too small, then the magnetic lines of force do not fully support the action and a degree of braking occurs as can be seen in the video at <http://www.youtube.com/watch?v=9INRjAI084k>. The ball bearings need to have a diameter about 50% greater than the width of the magnets in the triangles.

You will notice in the second video that the rolling action is quite successful while the Lego rotor arrangement has drag problems. You will also notice that the gap between the triangles and the magnet for the rolling test is about three times greater than for the Lego rotor test. Seeing the action of the rotor, suggests that there should be at least six triangles, spaced further out and that the rotor itself should have greater weight.

Omissions from Chapter 2:

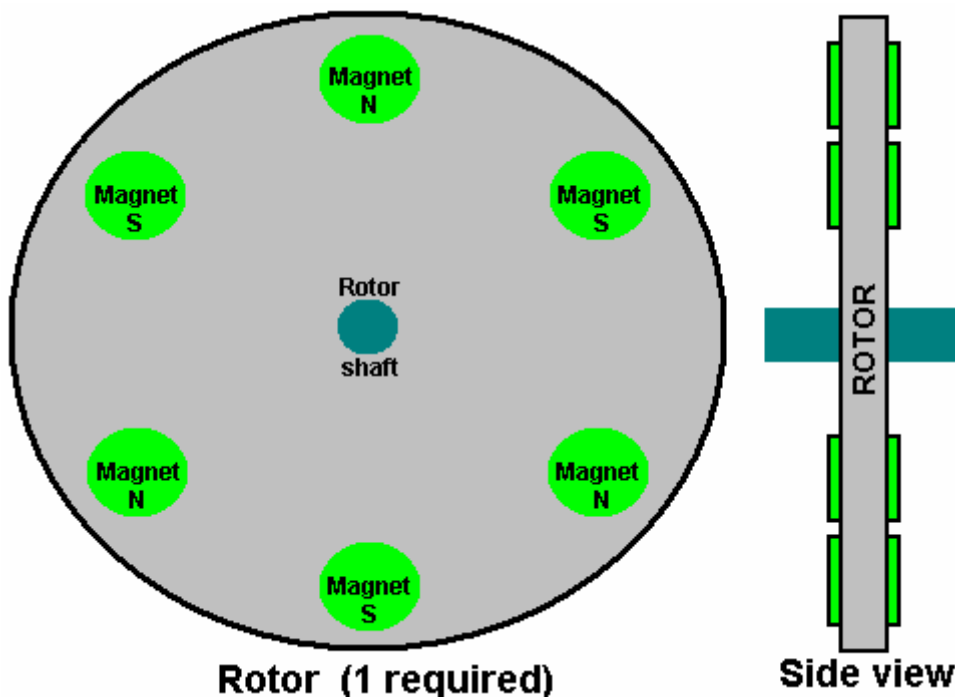
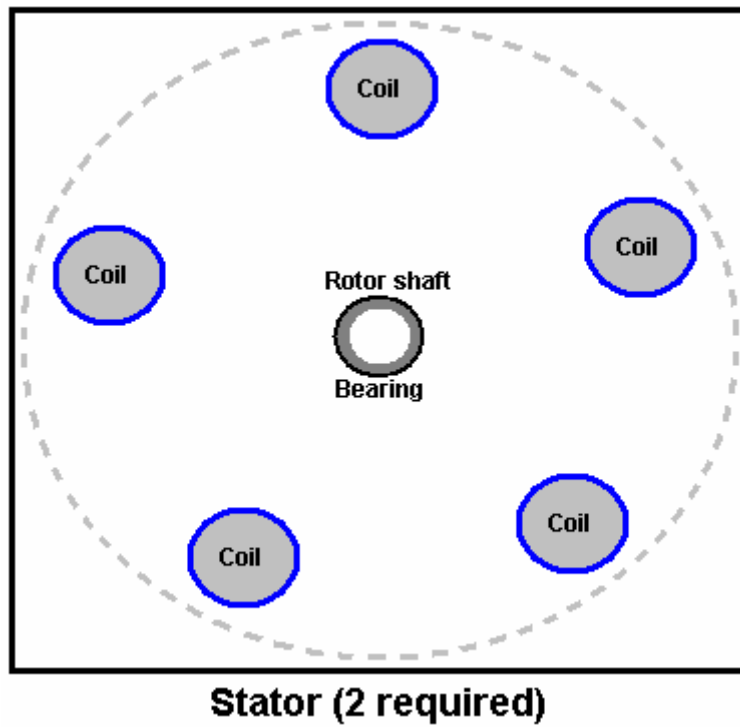
The Muller Motor

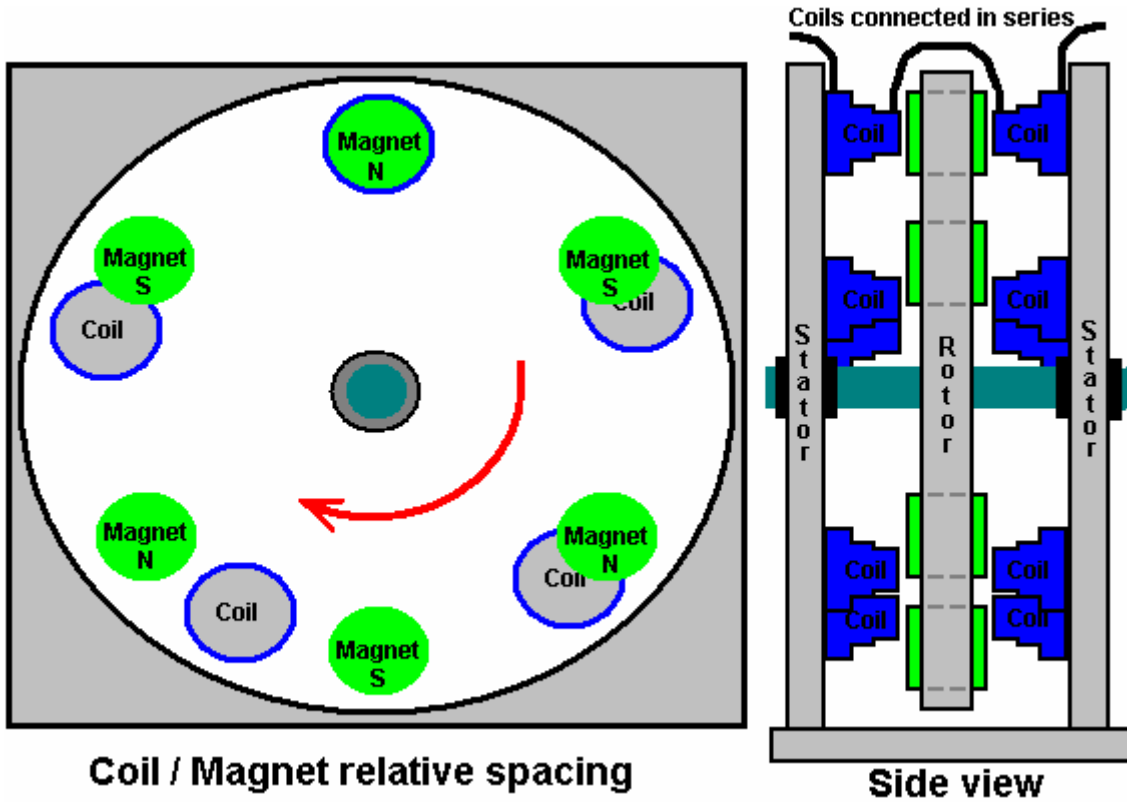
Bill Muller who died in 2004, produced a series of very finely engineered devices, the latest of which he stated produced some 400 amps of output current at 170V DC for 20 amps at 2V DC drive current. The device both generates its own driving power and produces an electrical power output. Bill's device weighed some 90 kilos and it requires very strong magnets made of Neodymium-Iron-Boron which are expensive and can easily cause serious injury if not handled with considerable care. It should be noted that **Ronald Classen** shows the details of his work in replicating this motor on his web site <http://home.mchsi.com/~act2/index.html> and he reports that he spent in excess of US \$3,000 in construction and so far, has already achieved an output power of about 170% of the input power. A video of his motor in action is at <http://video.google.com/videoplay?docid=65862828639099378> and his development is progressing steadily. Ronald points out that decreasing the gap between the rotor and the stator by just one millimetre raises the input and output current by ten amps, so the potential of his machine is ten times greater than its present performance. Ronald has not implemented this as yet since the cost of the switching components is fairly high. His construction looks like this:



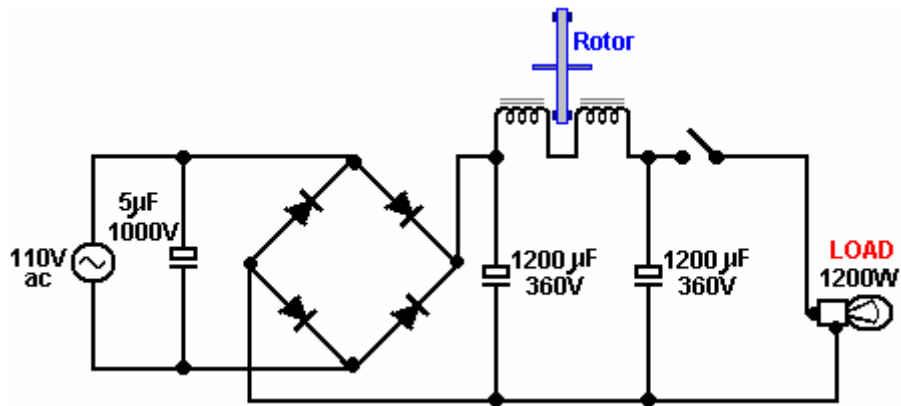
The Muller motor has a lot in common with Robert Adam's pulsed permanent-magnet motor. Both use a rotor which contains permanent magnets. Both pulse electromagnets at the precise moment to achieve maximum rotor torque. Both have pick-up coils for generating an electrical output. There are, however, considerable differences. Bill Muller's coils are wound in an unusual way as shown below. He positions his rotor magnets off-centre in relation to the stator coils. His coils are operated in pairs which are wired in series - one each side of the rotor. He has an odd number of coils and an even number of permanent magnets. His magnets are positioned with alternate polarity: N, S, N, S, ...

In order to make it easier to follow, the diagrams below show just five coil pairs and six magnets, but much larger numbers are normally used in an actual construction of the device, typically sixteen magnets.

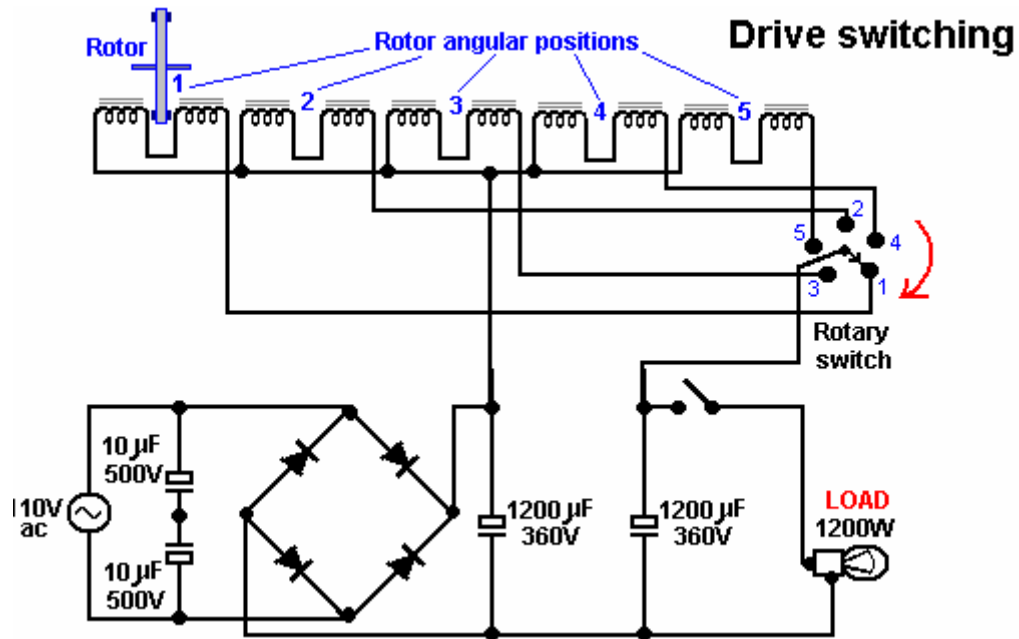




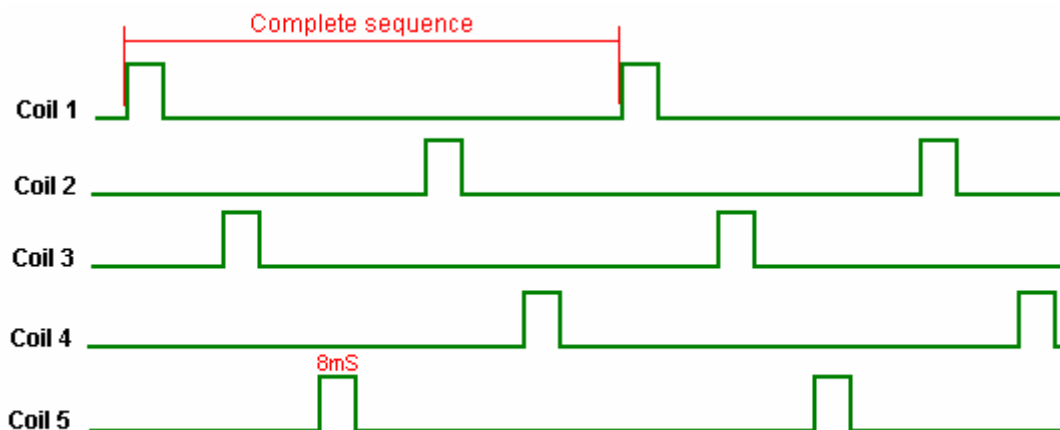
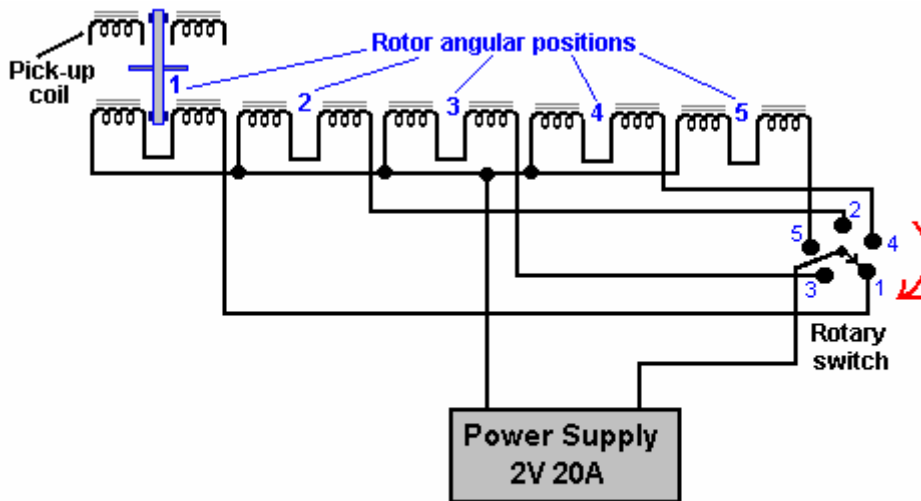
If AC mains voltage is used then the drive wiring may be as shown here:



When adapted for five pairs of coils, this becomes:



If DC switching is used, then the circuit may be:

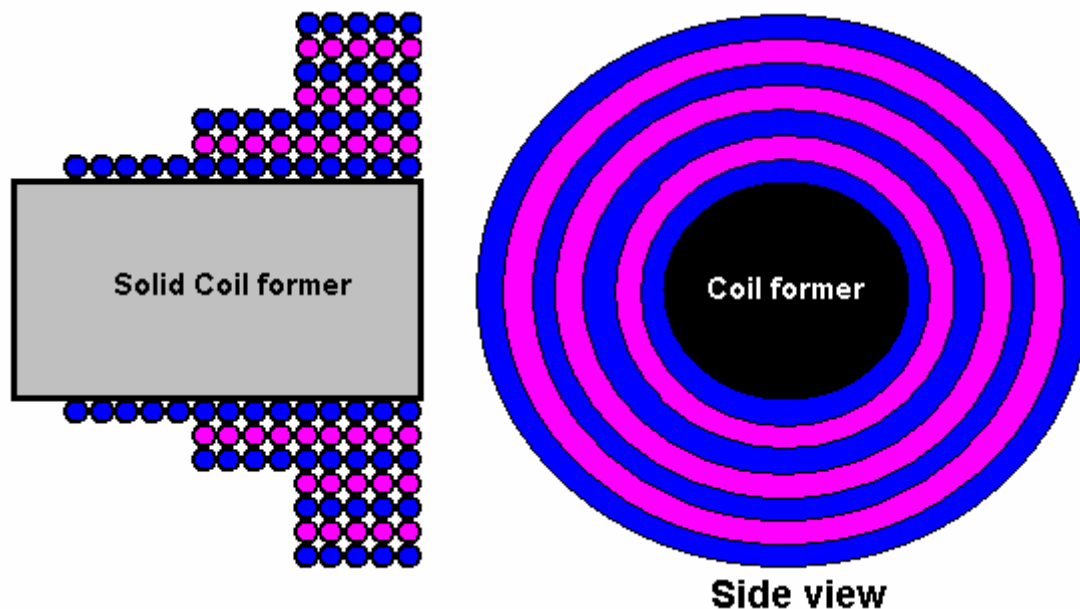


This is an unusual arrangement made all the more peculiar by the fact that the drive pulsing is carried out on the same coils which are used for power generation. The driving power pulse is applied to every successive coil which, with just five coils, makes the drive sequence 1, 3, 5, 2, 4, 1, 3, 5, 2, 4 For this operation, Coil 1 is disconnected from the power generation circuitry and then given a short high-power DC pulse. This boosts the rotation of the rotor. Coil 1 is then re-connected to the power generating circuitry, and coil 3 is disconnected and then given a drive pulse. This is repeated for every second coil, indefinitely, which is one of the reasons why there is an odd number of coils. The following table shows how the drive is operated.

Pulse:	1	2	3	4	5	6	7	8	9	10
Coil 1	Pulse	Power	Power	Power	Power	Pulse	Power	Power	Power	Power
Coil 2	Power	Power	Power	Pulse	Power	Power	Power	Power	Pulse	Power
Coil 3	Power	Pulse	Power	Power	Power	Power	Pulse	Power	Power	Power
Coil 4	Power	Power	Power	Power	Pulse	Power	Power	Power	Power	Pulse
Coil 5	Power	Power	Pulse	Power	Power	Power	Power	Pulse	Power	Power

It is essential that Neodymium-Iron-Boron magnets are used for this device as they are about ten times more powerful than the more common ferrite types. Bill used sixteen magnets in the 30 - 50 MegaGaussOersted energy density range, constructed in China, they held their magnetism unaltered for eight years of use. The air gap between the coils and the magnets is 2 mm. Bill used a computer chip to generate the switching sequence, and Ronald Classen who is expert in these systems points out that the pulsing system is adjusted when the motor speed increases. This change is not a simple one as when the speed of rotation reaches its maximum level, on a sixteen magnet rotor, only three of the magnets would be driven by coils pulses. That is, during one rotation, just three electromagnets would be energised in one simultaneous pulse, and that pulse would be of longer duration than the pulses which accelerated to rotor from its stationary position.

The output from each coil is passed through a full-wave bridge to give DC, before being added to the output from the other coils. A typical Muller motor would have 16 magnets and 15 coil pairs. The solid coil formers were made from 'amorphous metal' and are 2 inches (50 mm) in diameter and 3 inches (75 mm) long. Bill used a special mix of 'black sand' (probably magnetite granules) encased in epoxy resin, but an alternative is said to be hard steel - the harder the better. The coil core material is said to be very important and his construction was said to be free of any hysteresis eddy currents. The coils are wound from #6 AWG (SWG 8) or #8 AWG (SWG 10) wire and are formed in an unusual fashion as shown here:



The winding turns are all made in the same direction. The first layer has 14 turns, the next two layers have 9 turns each, and the remaining four layers have 5 turns each, which gives a total of 52 turns. The coils are used in pairs, being wired in series, with one of each pair being on the opposite side of the rotor to the second coil of the pair, as indicated on the drawings. The way in which the coils are connected to the stator is not certain. The thin end of the coils face the rotor magnets. The pick-up coils are not shown on the drawings, but they are placed on both of the stators, in every position where there is no drive coil.

The rotor is constructed of non-magnetic material and spins at about 3,000 rpm. This device has the potential to output 35 kW of excess power when constructed in the size described, which has a rotor diameter of 660 mm with

the magnets centred on a circle of 570 mm. In the demonstration which produced 35 kW of power, only five out of the intended thirty pairs of pick-up coils had been constructed. It is predicted that the output would be 400 horsepower if all thirty pairs of pick-up coils were in place. Predictions of this nature need to be borne out in a demonstration before they can be considered valid. Please be aware of the size of this item of equipment. I personally, would not be able to pick up a device of this weight, but would need mechanical lifting equipment to move it. It can, of course, be constructed in a scaled down size which will have a scaled down electrical output.

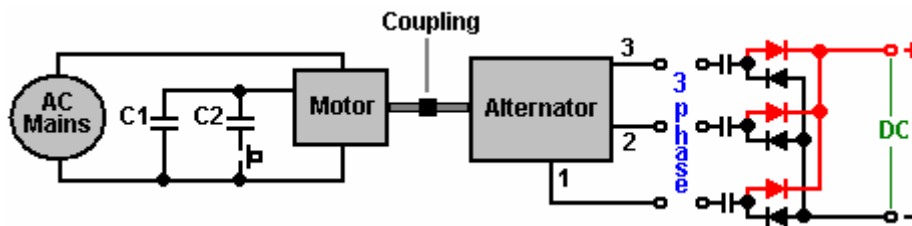
Let me stress that handling magnets of this strength has its dangers. Should you take a magnet in your hand and inadvertently move your hand near a loose steel item, then your hand is liable to become trapped between the magnet and the steel object. This may result in serious damage to your hand. Great care should be taken.

The official web site for this system is www.mullerpower.com which you may find difficult to display unless you have the MacroMedia software installed on your computer. An alternative information site on the constructional details is <http://www.theverylastpageoftheinternet.com/menu/muller.htm> which shows both motor details and details of a separate 'over-unity' experiment which lights four 300W light bulbs while taking 1100W directly from the AC mains supply.

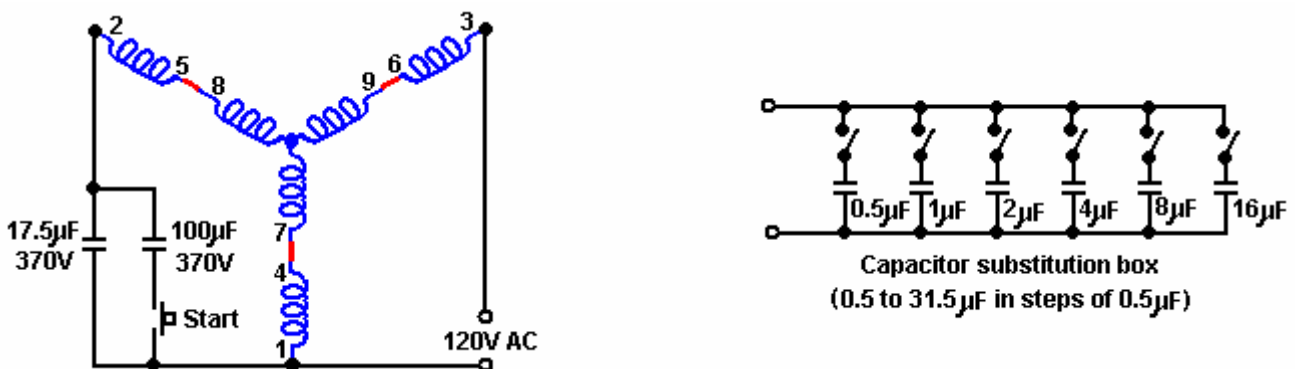
The RotoVerter

Not all pulsed-drive systems use permanent magnets as part of their drive mechanism. For example, the RotoVerter systems uses standard three-phase electric motors instead of magnets. In addition, some of the electrical driving power can be recovered for re-use.

This system has been reproduced by several independent researchers and it produces a substantial power gain when driving devices which need an electrical motor to operate. At this time, the web site: www.theverylastpageoftheinternet.com/ElectromagneticDev/arkresearch/rotoverter.htm has details on how to construct the device. The outline details are as follows:



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 objective is to tune the motor windings to give resonant operation. A start-up capacitor is connected into the circuit using the press-button switch shown, to get the motor up to speed, at which point the switch is released, allowing the motor to run with a much smaller capacitor in place. Although the running capacitor is shown as a fixed value, in practice, that capacitor needs to be adjusted while the motor is running, to give resonant operation. For this, a bank of capacitors is usually constructed, each capacitor having its own ON/OFF switch, so that different combinations of switch closures give a wide range of different overall values of capacitance. With the six

capacitors shown above, any value from 0.5 microfarad to 31.5 microfarad 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 nearly 900 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.

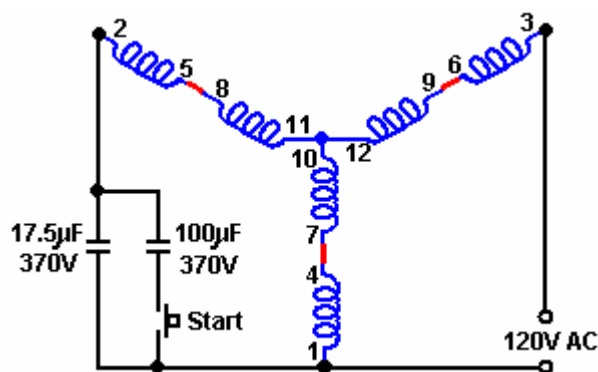
To move to some more practical construction details for this system. The motor (and alternator) considered to be the best for this application is the "Baldor EM3770T" 7.5 horsepower unit. The specification number is 07H002X790, and it is a 230/460 volts 60Hz 3-phase, 19/9.5 amp, 1770 rpm, power factor 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 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.

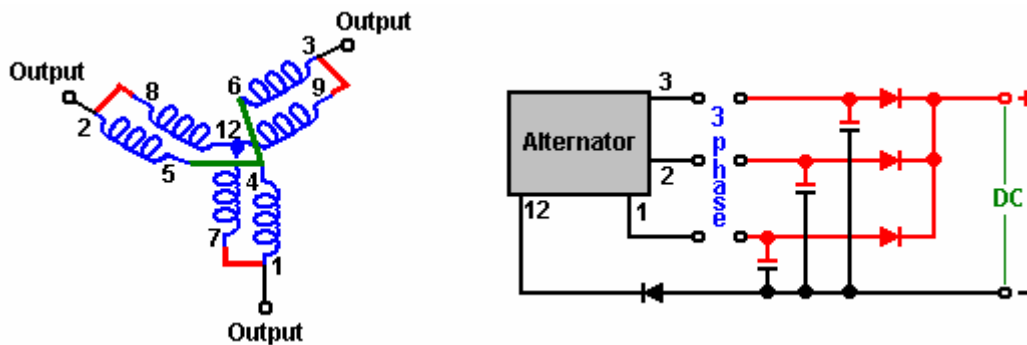
To reduce friction to an absolute minimum, the motor bearings need to be cleaned to an exceptional level. There are various ways of doing this. One of the best is to use a carburettor cleaner spray from your local car accessories shop. Spray inside the bearings to wash out all of the packed grease. The 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:

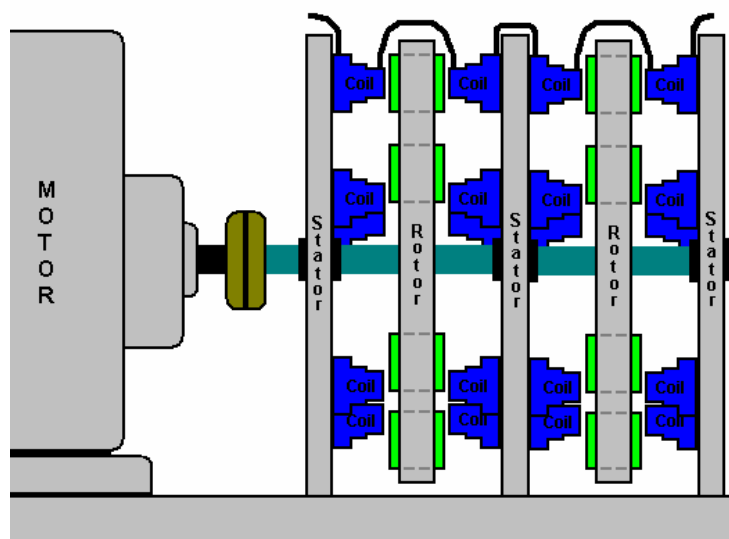


The motor and the alternator are then mounted securely in exact alignment and coupled together. The switching of the direction of the housing on the drive motor allows all of the jumpering to be on the same side of the two units when they are coupled together, facing each other:

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.

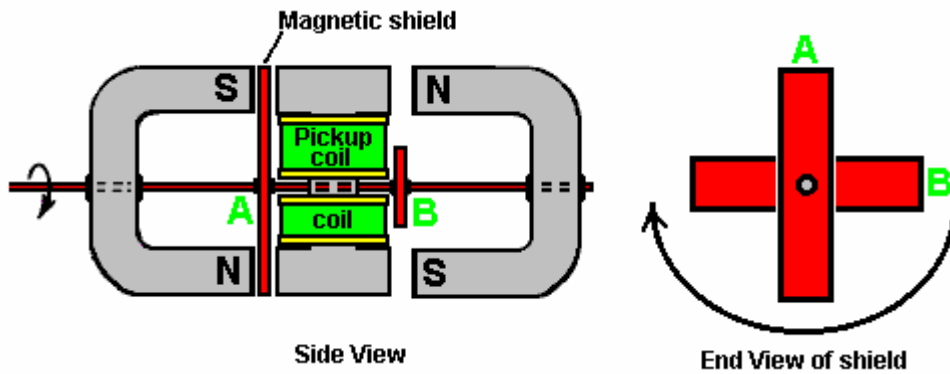
To summarise: This device takes a low-power 110 Volt AC input and produces a much higher-power electrical output which can be used for powering much greater loads than the input could power. The output power is much higher than the input power. This is free-energy under whatever name you like to apply 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.

It is not essential to construct the RotorVeter exactly as shown above, although that is the most common form of construction. The Muller Motor mentioned earlier, 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:

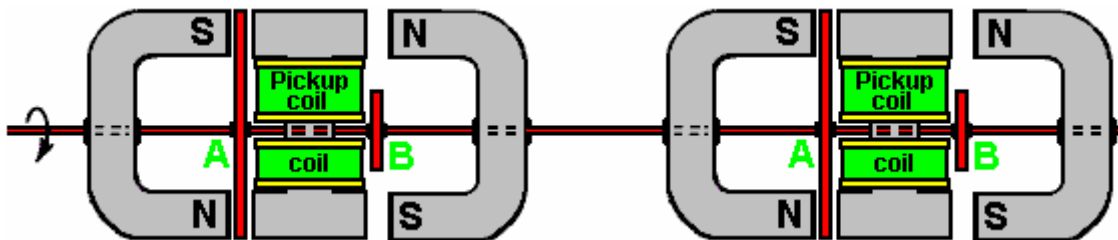


As the objective is to increase the output power and attempt to keep the motor loading as even as possible to make it possible to tune the motor power input as close to the "sweet" resonant point of its operation, another

alternative springs to mind. The output power generator which has the least variation in shaft power for changes in electrical output, namely the Ecklin-Brown generator as described in Chapter 1:

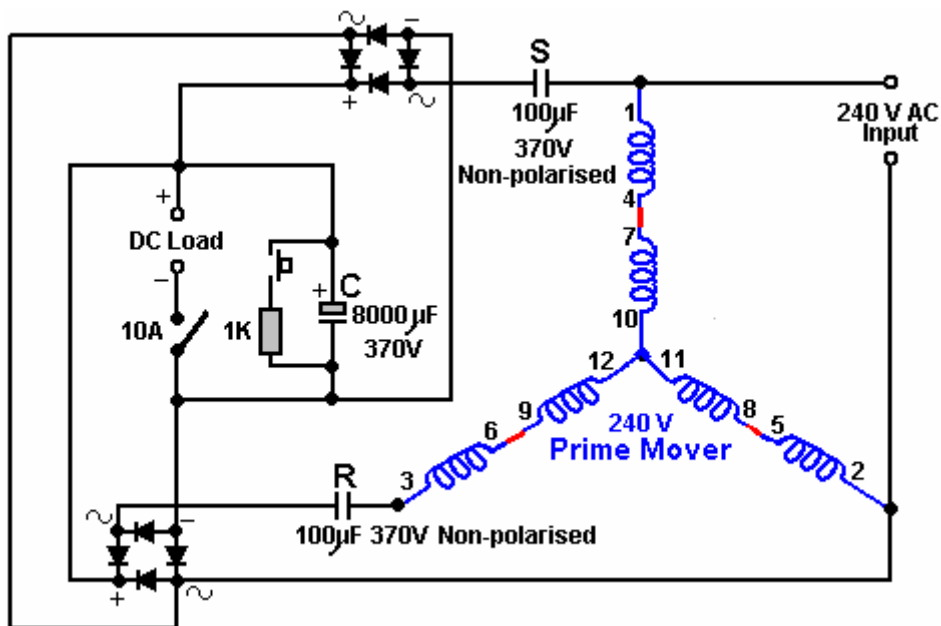


The electrical power generated in the coils wound on the I-Section is substantial and the key factor is that the power needed to rotate the shaft is almost unaffected by the current draw from the pick-up coils. These generator sets could be stacked in sequence and still facilitate the tuning of the "Prime Mover" drive motor:



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:

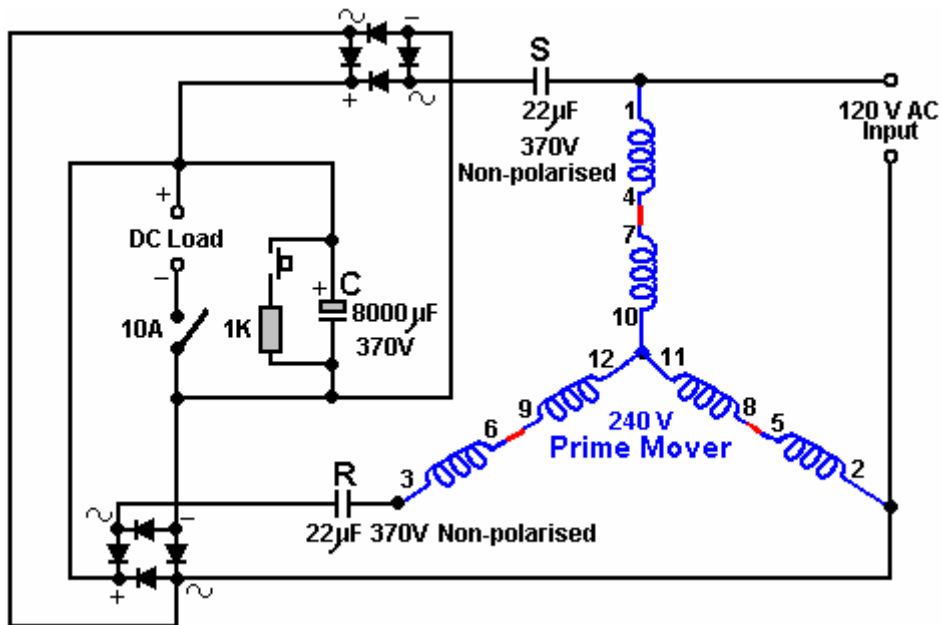
The charge capacitor "C" needs to be fully discharged before the motor is started, so the press-button switch is pressed to connect the 1K resistor across the capacitor to discharge it fully. If you prefer, the press-button switch and resistor can be omitted and the switch to the DC load closed before 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.

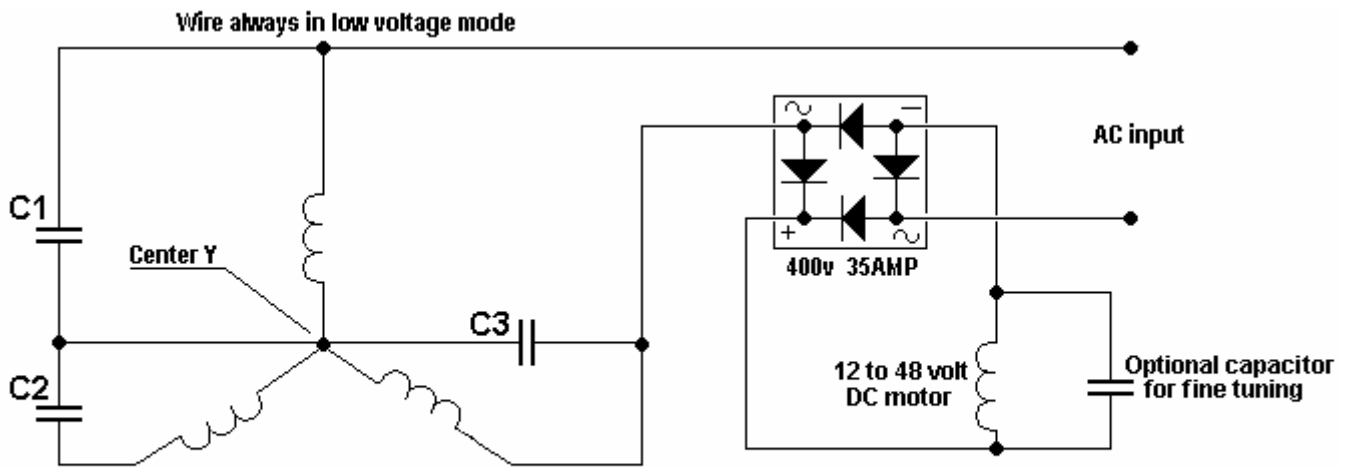
The capacitor values shown above were those found to work well with Phil's test motor which was a three-winding, 5 horsepower, 240 volt unit. Under test, driving a fan, the motor draws a maximum of 117 watts and a variable speed 600 watt drill was used for the DC load. The motor operates at its full 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.

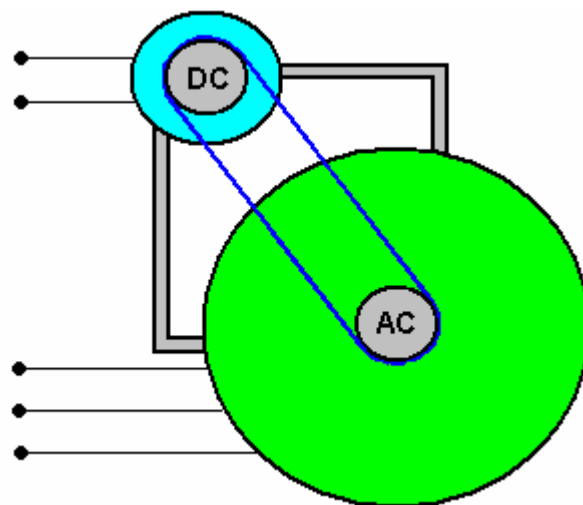
Advancing the design even further, Phil has now produced an extremely clever design by introducing an additional DC motor/generator coupled to the "Prime Mover" motor. The coupling is nominally mechanical with the two motors physically linked together with a belt and pulleys, but the electrical linking 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.

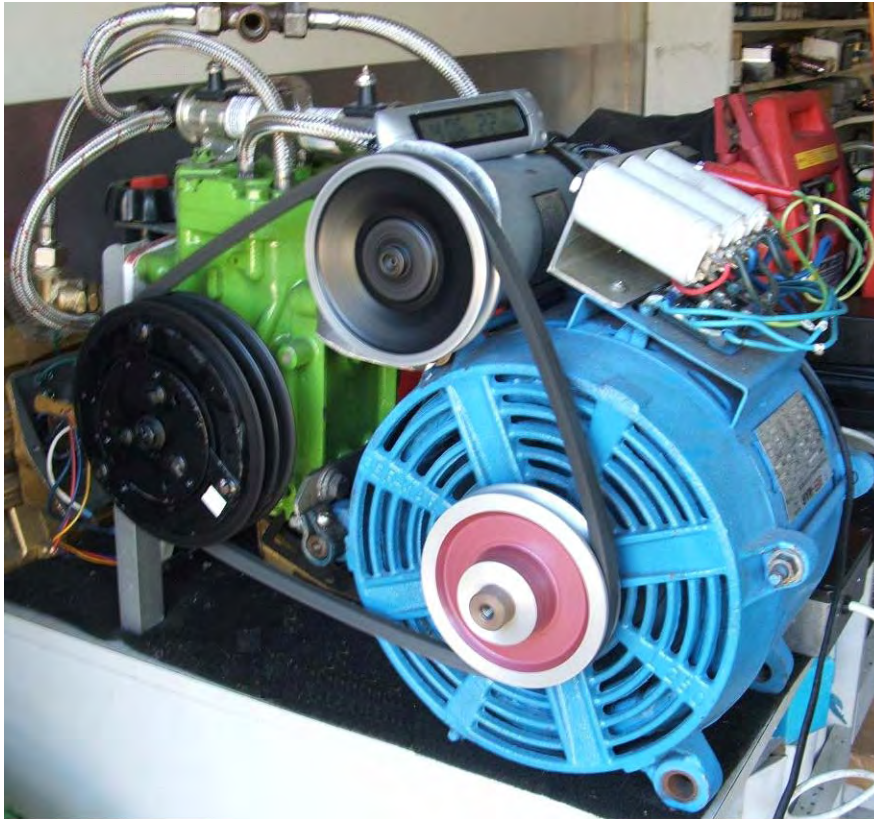


C1, C2 and C3 are all the same value between 10 μ F and 47 μ F 400 V

By Phil Wood

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.





Phil's setup

As the loading on the Prime Mover 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.

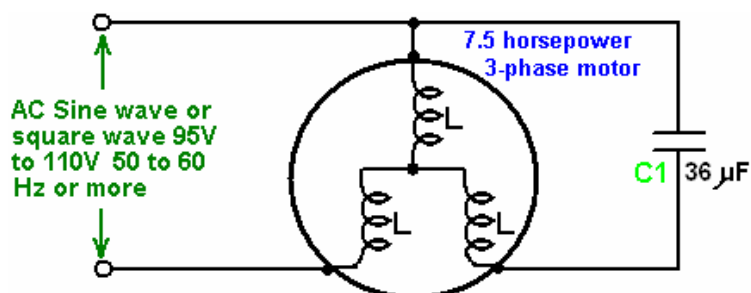
Extra Energy Collection

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.

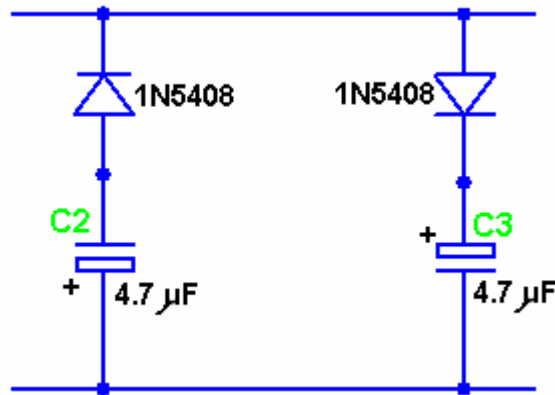
Let us examine the circuit section by section:

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:



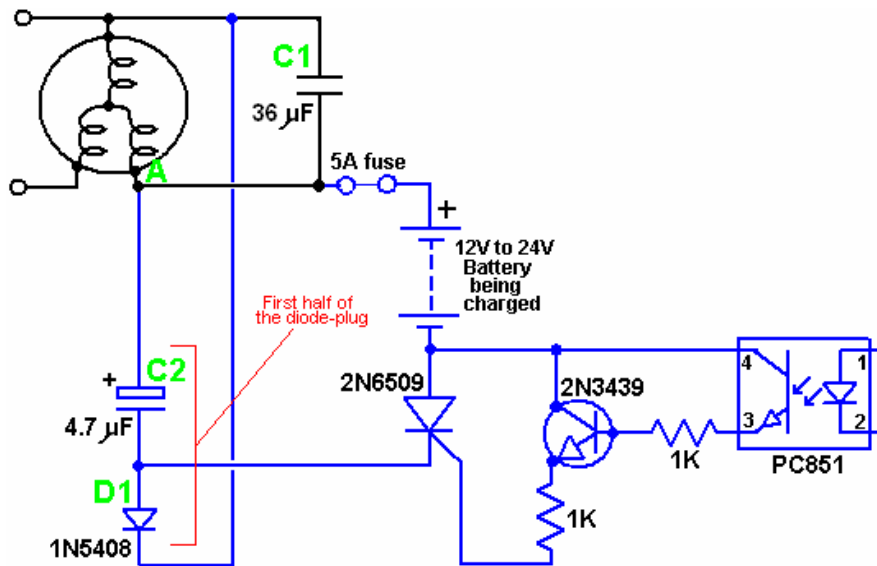
Because the running power draw is so low, it is possible to run this motor from a standard battery-powered inverter, but the current draw at start-up is some 17 amps, so the mains is used to get the motor started and then the motor is switched from the mains to the inverter. The inverter also allows 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:



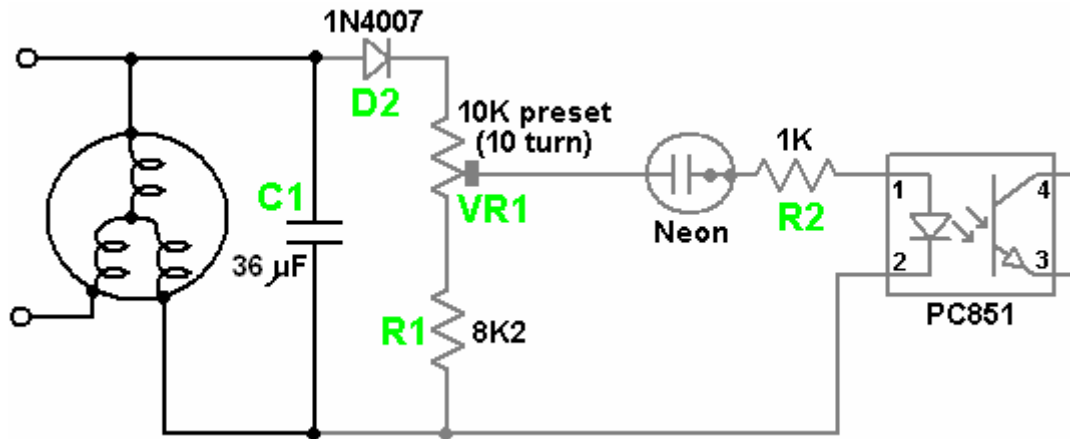
This circuit has been presented as a public-domain non-copyrightable circuit by Hector Perez Torres and it is capable of extracting power from a range of different systems, without affecting those systems or increasing their power draw. In the circuit presented below, just the first half of the diode 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:



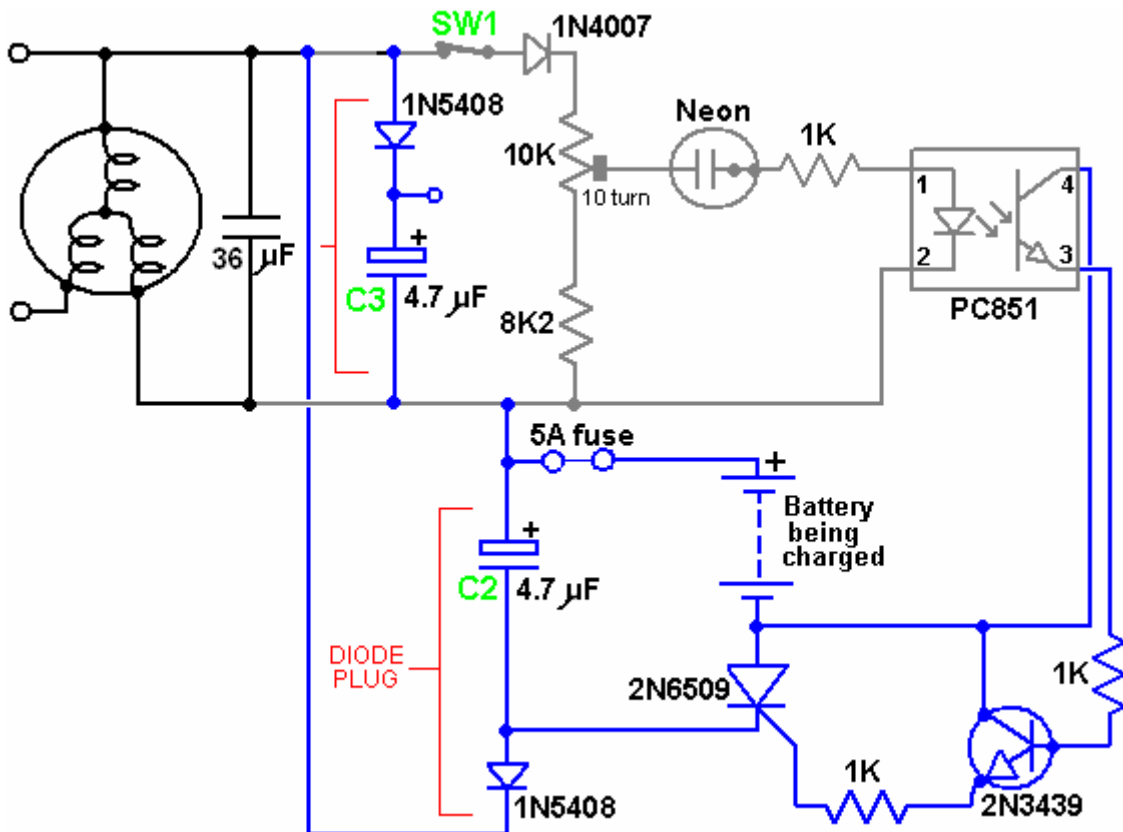
Here we have the same RotoVerter circuit as before, with high voltage being developed across capacitor C1. The battery-charging section is a free-floating circuit connected to point A of the motor. The high-voltage diode D1 is used to feed negative-going pulses to capacitor C2 which causes a large charge 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 optoisolator 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.

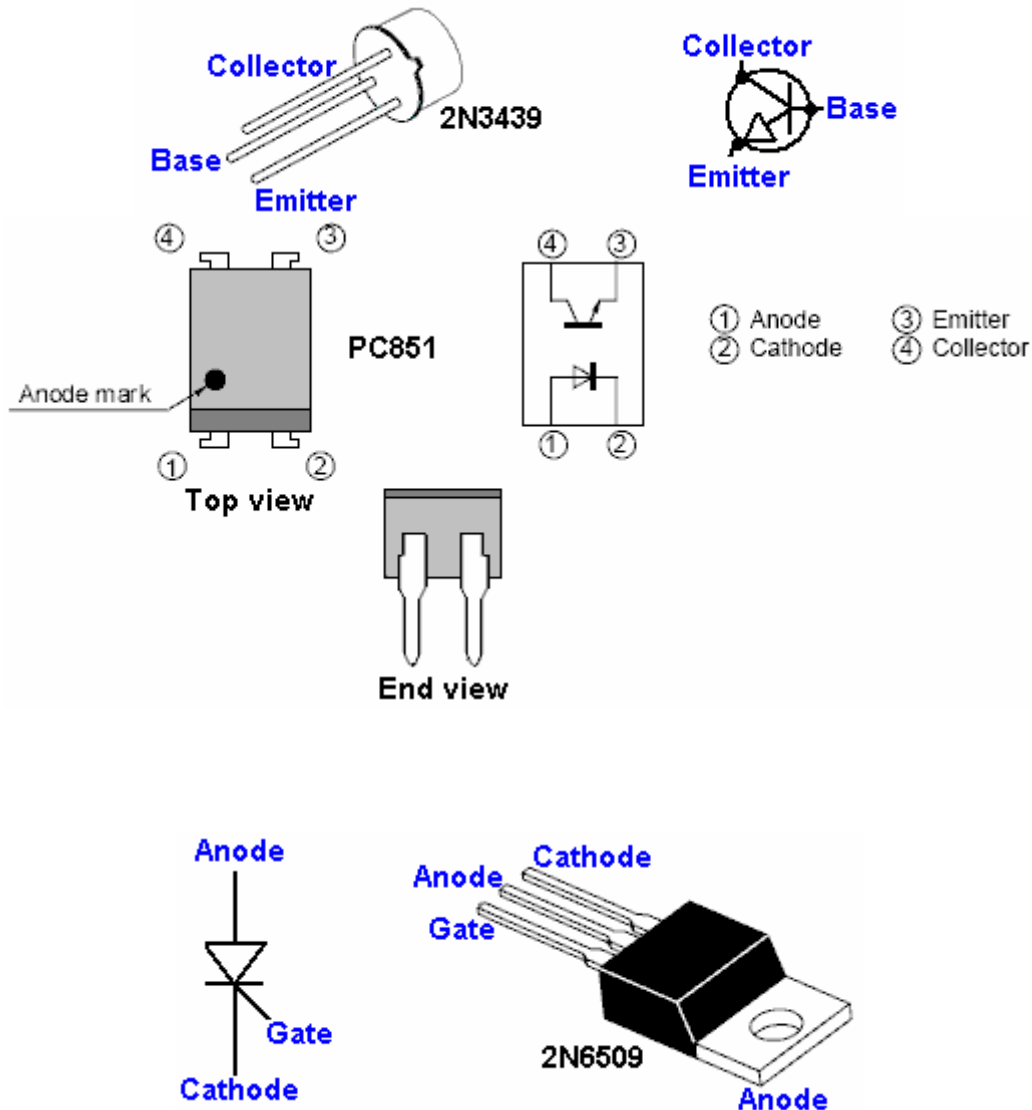
The circuit to test one half of the diode plug is then:



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 scrapyard 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:

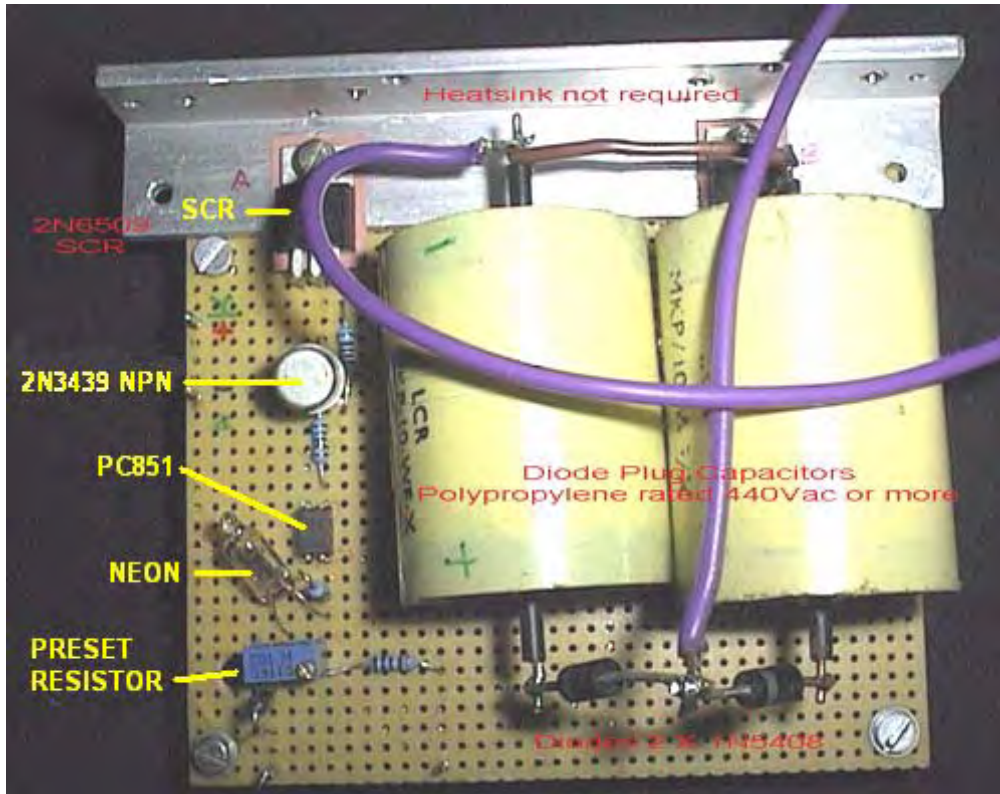
Before starting the motor, adjust the slider of the preset resistor VR1 to the fixed resistor end of its track. This ensures that the charging circuit will not operate as the neon will not fire. Power up the circuit and start adjusting the preset resistor very slowly until the neon starts to flash occasionally. 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.

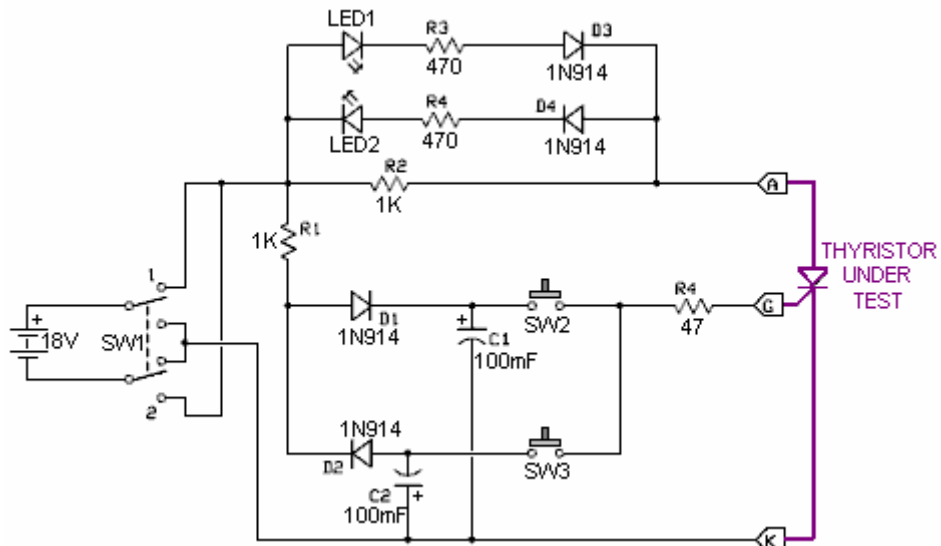
Here is a picture of David's actual board construction. There are various ways for building any circuit. This particular construction method uses plain matrix board to hold the components in position and the bulk of the interconnections are made underneath the board. The charge-collecting capacitor is 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 heatsink, which he marks as being "not required" but you will notice that there is insulation between the SCR and the heatsink. 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.



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 its 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.

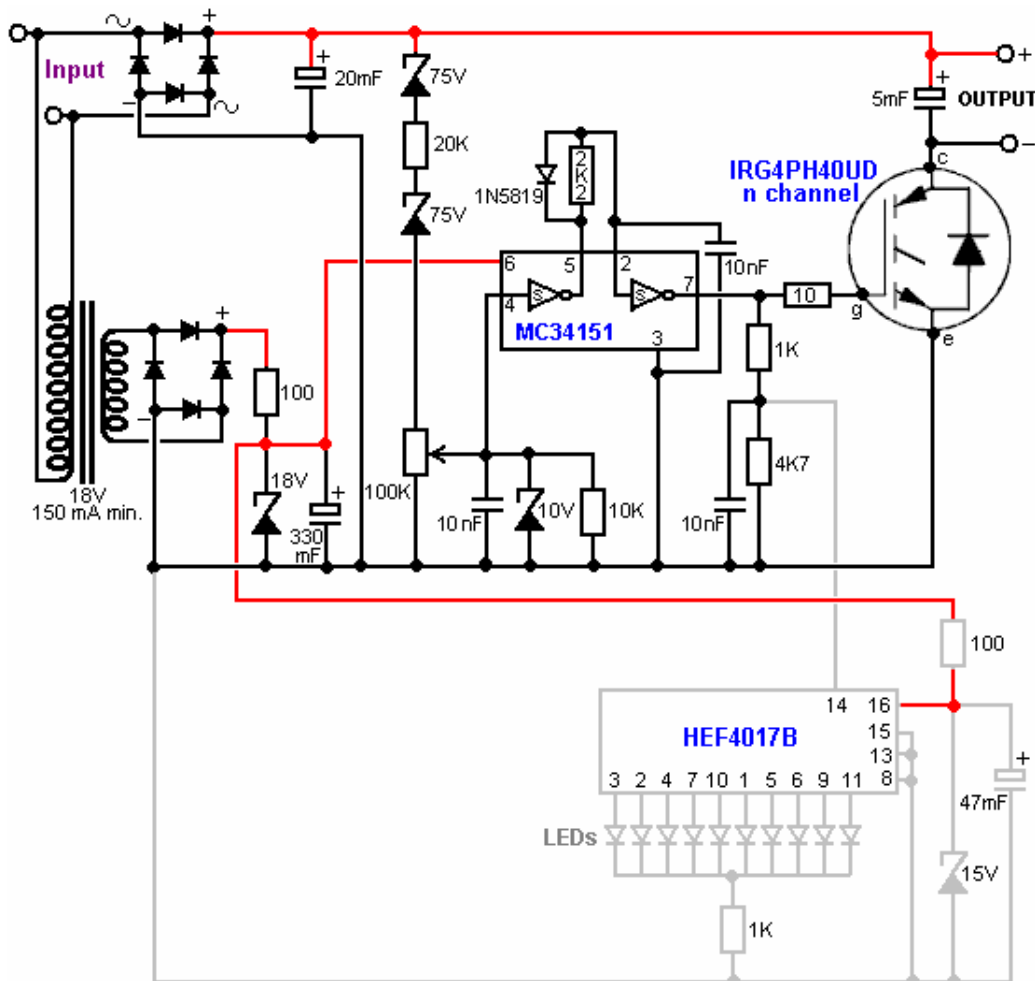
With LED1 lit, press SW3 and LED1 should go out. If that does not happen, then the thyristor is faulty.

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
47 ohm resistor 0.25 watt	1	Bands: Purple, Yellow, Black
470 ohm resistor 0.25 watt	2	Bands: Purple, Yellow, Brown
1K ohm resistor	2	Bands: Brown, Black, Red
100 mF 15V capacitor	2	Electrolytic
1N914 diode	4	
Light Emitting Diode	2	Any type, any size
Toggle switch 2-pole 2-throw	1	
Press-button Push-to-Make	2	Non-latching press-on, release off type
9V battery	1	Any type
Battery connector	1	To match chosen battery
Socket	1	Plug-in socket for thyristors
Veroboard or similar	1	Your preferred construction board
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

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.

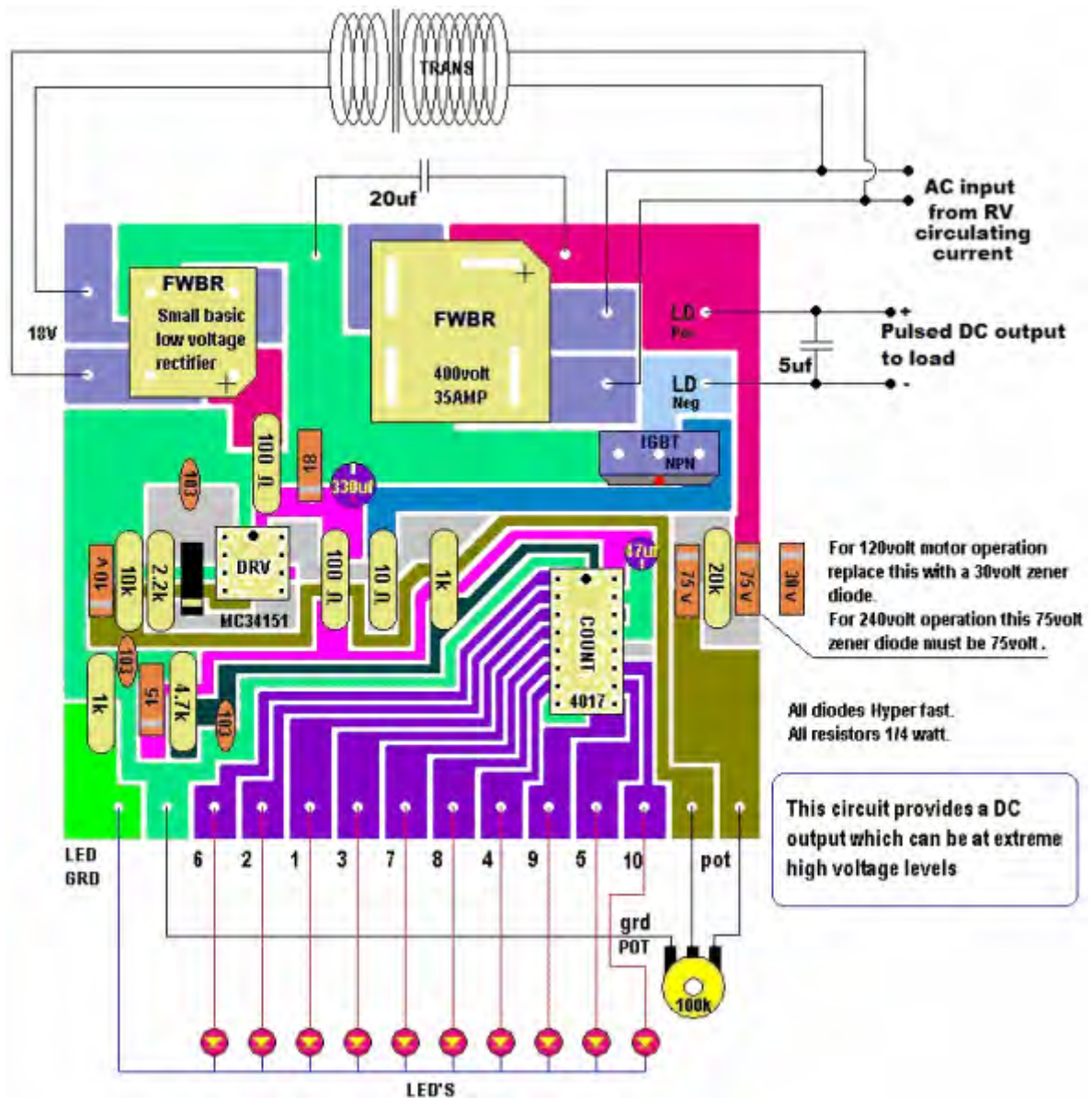
The circuit operation is as follows:

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.

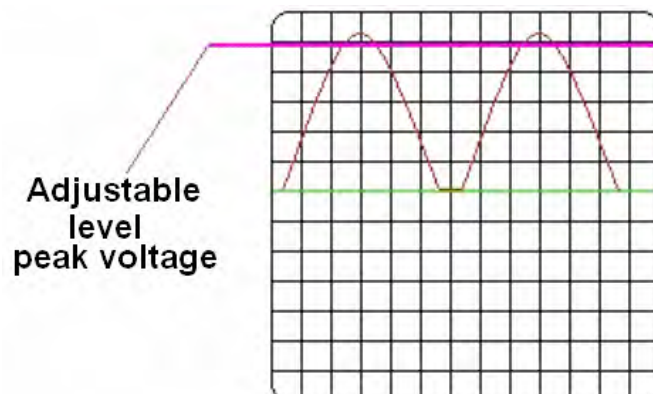
The resulting high-voltage DC is taken by the chain of components two 75-volt zener diodes, 20K resistor and the 100K variable resistor. The voltage developed on the slider of this variable resistor is loaded with a 10K resistor and voltage-limited with a 10-volt zener diode, and decoupled with a 10nF 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:

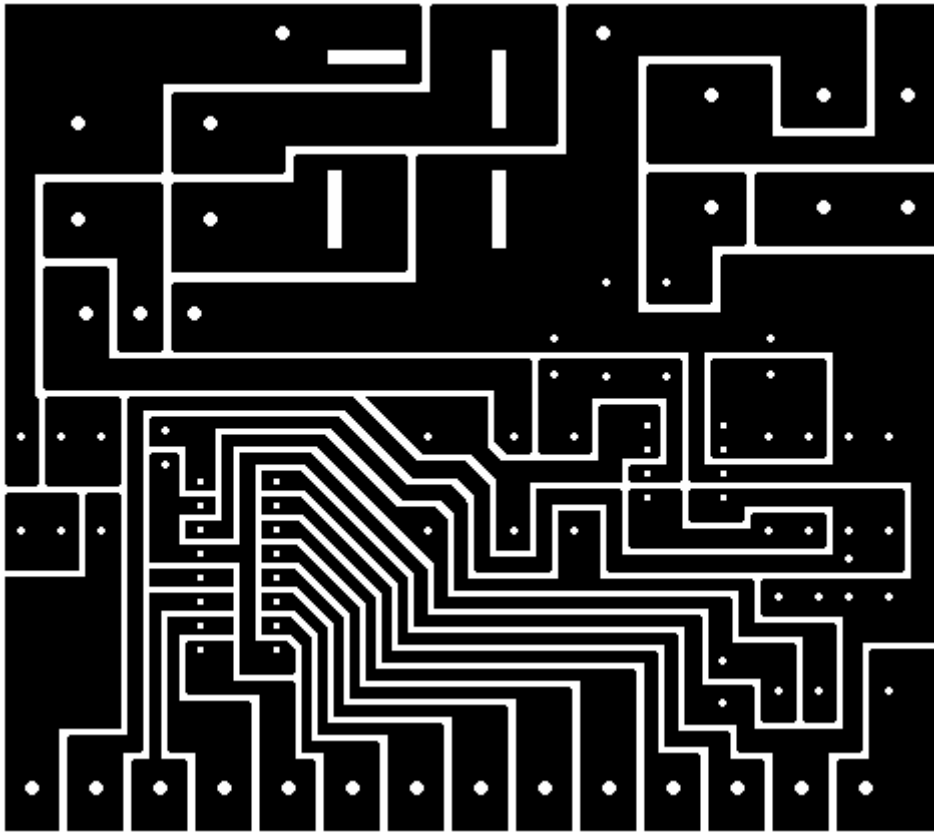


As you will notice from the notes on Phil's board layout shown above, the first of the 75-volt zener diodes used on the direct RotoVerter power feed, should be replaced with a 30-volt zener if a 120-volt motor is used in this circuit.

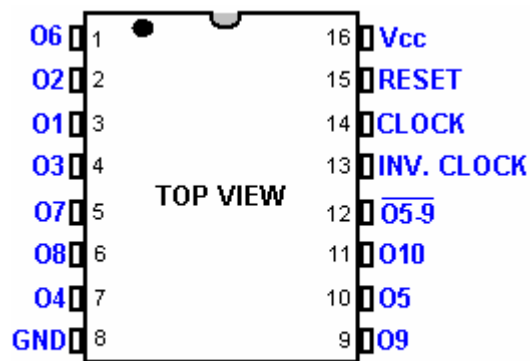
Another important point which needs to be stressed, is that the pulsed DC output from this circuit can be at extremely high voltages and needs to be treated with considerable care. This is not a circuit for beginners and anyone who is not familiar with handling high voltages needs the supervision of an experienced person. Also, if either this circuit or the RotoVerter is connected to the mains, then no scope ground leads should be connected as the circuit can be a hundred volts or more below ground potential.



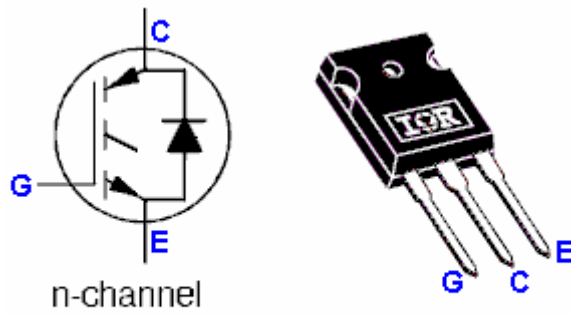
The pattern of the printed-circuit board when viewed from the underside of the board is shown here:



And component packaging is:

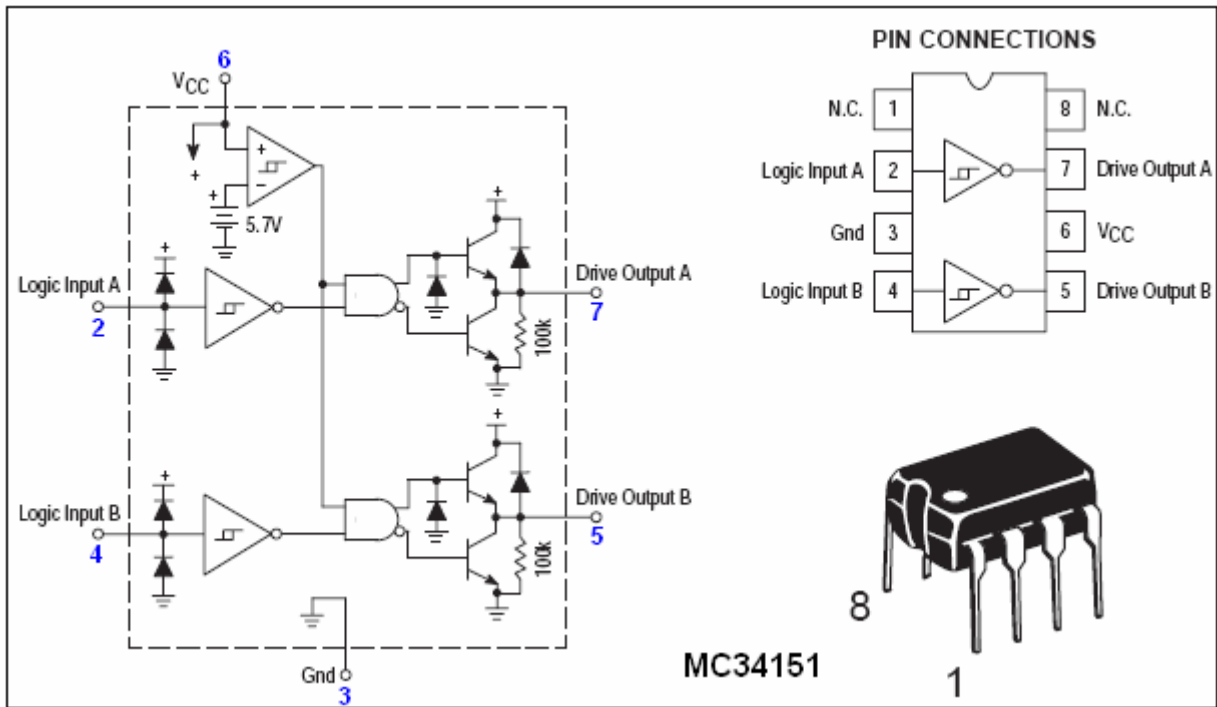


HEF4017B



n-channel

IRG4PH40UD



Phil's build of his circuit was implemented like this:



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	Polypropolene
20mF 440V (or higher) capacitor	1	Polypropolene
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

Professor Kevin R. Sullivan

It is felt that some specific information on alternators would be helpful at this point. My thanks goes to Professor Kevin R. Sullivan, Professor of Automotive Technology, Skyline College, San Bruno, California, who has given his kind permission for the reproduction of the following training material from his excellent web site at <http://www.autoshop101.com/> which I recommend that you visit. The following material is his copyright and All Rights are Reserved by Professor Sullivan.

[UNDERSTANDING THE ALTERNATOR](#)

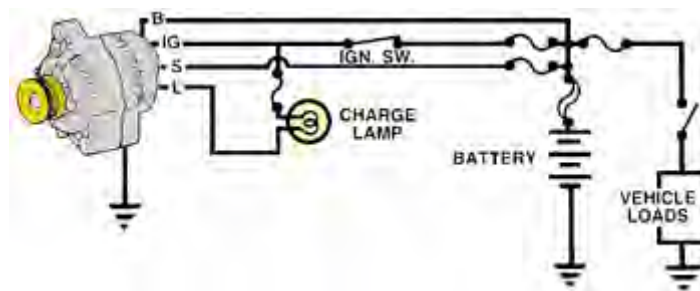


The Charging System



A vehicle charging system has three major components: the **Battery**, the **Alternator**, and the **Regulator**. The alternator works together with the battery to supply power when the vehicle is running. The output of an alternator is direct current (DC), however the alternator actually creates AC voltage which is then converted to DC as it leaves the alternator on its way to charge the battery and power the other electrical loads.

The Charging System Circuit



Four wires connect the alternator to the rest of the charging system:

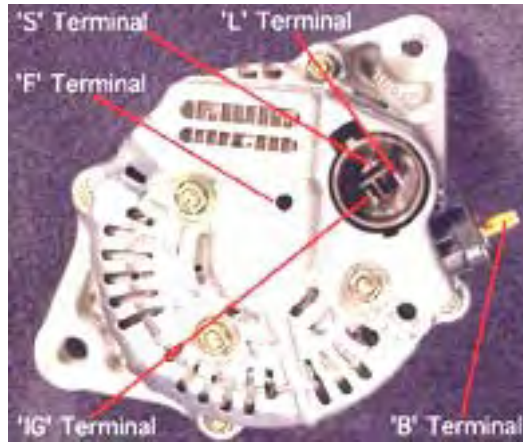
'**B**' is the alternator output wire that supplies current to the battery.

'**IG**' is the ignition input that turns on the alternator/regulator assembly.

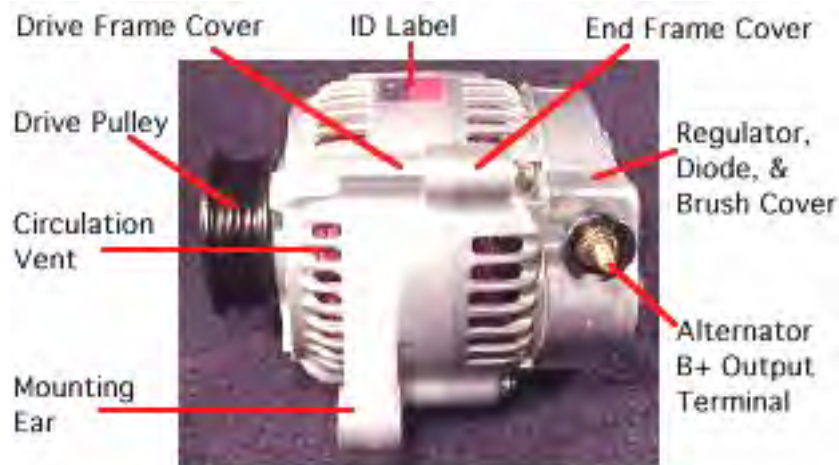
'**S**' is used by the regulator to monitor charging voltage at the battery.

'**L**' is the wire the regulator uses to ground the charge warning lamp.

Alternator Terminal ID's



- 'S' terminal: Senses the battery voltage
 - 'IG' terminal: Ignition switch signal turns regulator ON
 - 'L' terminal: Grounds warning lamp
 - 'B' terminal: Alternator output terminal
 - 'F' terminal: Regulator Full-Field bypass
- The Alternator Assembly**



Alternator Overview:

The alternator contains:

- A rotating field winding called **the rotor**.
- A stationary induction winding called **the stator**.
- A diode assembly called **the rectifier bridge**.
- A control device called **the voltage regulator**.
- Two **internal fans** to promote air circulation

Alternator Design



Most regulators are on the inside the alternator. Older models have externally mounted regulators.

Unlike other models, this model can be easily serviced from the rear of the unit. The rear cover can be removed to expose internal parts.

However, today's practice is to replace the alternator as a unit, should one of it's internal components fail.

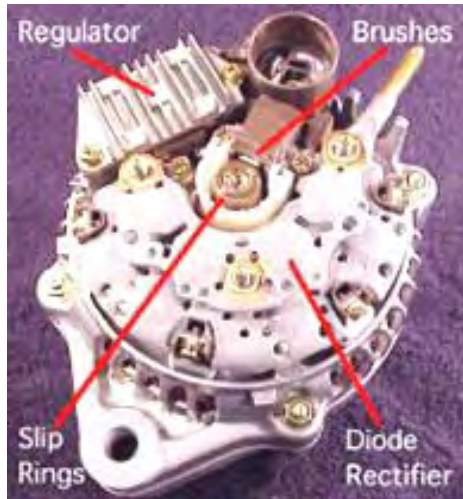
Drive Pulley



Alternator drive pulleys either bolt on or are pressed on the rotor shaft. Both 'V' and Multi-groove types are used. Please note this alternator does not have an external fan as part of the pulley assembly.

While many manufacturers do use a external fan for cooling. This alternator has two internal fans to draw air in for cooling.

Inside the Alternator



Removal of the rear cover reveals:

The Regulator which controls the output of the alternator.

The Brushes which conduct current to the rotor field winding.

The Rectifier Bridge which converts the generated AC voltage to a DC voltage.

The Slip Rings (part of the rotor assembly) which are connected to each end of the field winding.

Brushes



Two slip rings are located on one end of the rotor assembly. Each end of the rotor field winding is attached to a slip ring. This, allows current to flow through the field winding.



Two stationary carbon brushes ride on the two rotating slip rings. These brushes are either soldered or bolted in position.

Electronic IC Regulator



The regulator is the brain of the charging system. It monitors both the battery voltage and the stator voltage and, depending on the measured voltages, it adjusts the amount of rotor field current so as to control the output of the alternator.

Regulators can be mounted in an internal or an external position. Nowadays, most alternators have a regulator which is mounted internally.

Diode Rectifier



The **Diode Rectifier Bridge** is responsible for the conversion or rectification of AC voltage to DC voltage.

Six or eight diodes are used to rectify the AC stator voltage to DC voltage. Half of these diodes are used on the positive side and the other half on the negative side.

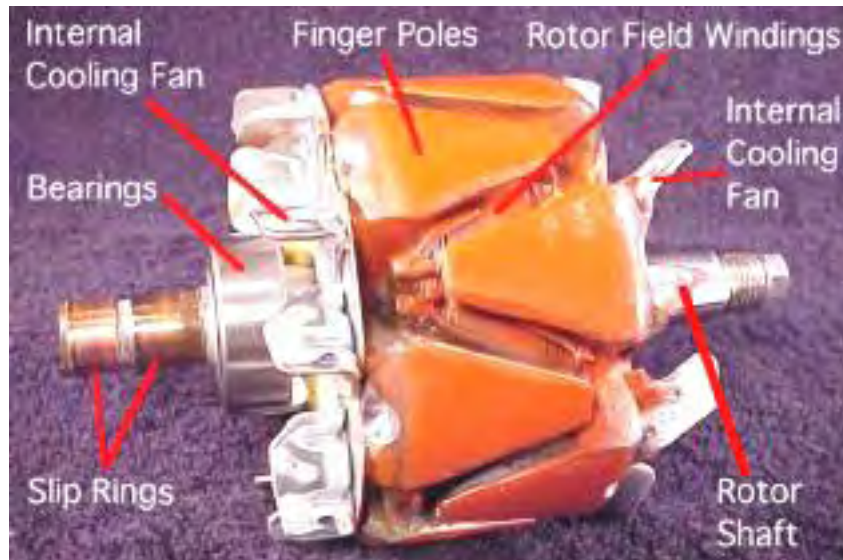
Inside the Alternator



Opening the case reveals:

The **rotor winding assembly** which rotates inside the **stator winding**. The rotor generates a magnetic field and the stator winding develops voltage, which causes current to flow from the induced magnetic field of the rotor.

The Rotor Assembly



A basic rotor consists of an **iron core**, a **coil winding**, two **slip rings**, and two claw-shaped **finger pole pieces**. Some models have support bearings and one or two internal cooling fans.

The rotor is driven or rotated inside the alternator by an engine (alternator) drive belt.



The rotor contains the field winding wound over an iron core which is part of the shaft. Surrounding the field coil are two claw-type finger poles. Each end of the rotor field winding is attached to a slip ring. Stationary brushes connect the alternator to the rotor. The rotor assembly is supported by bearings. One on the shaft and the other in the drive frame.

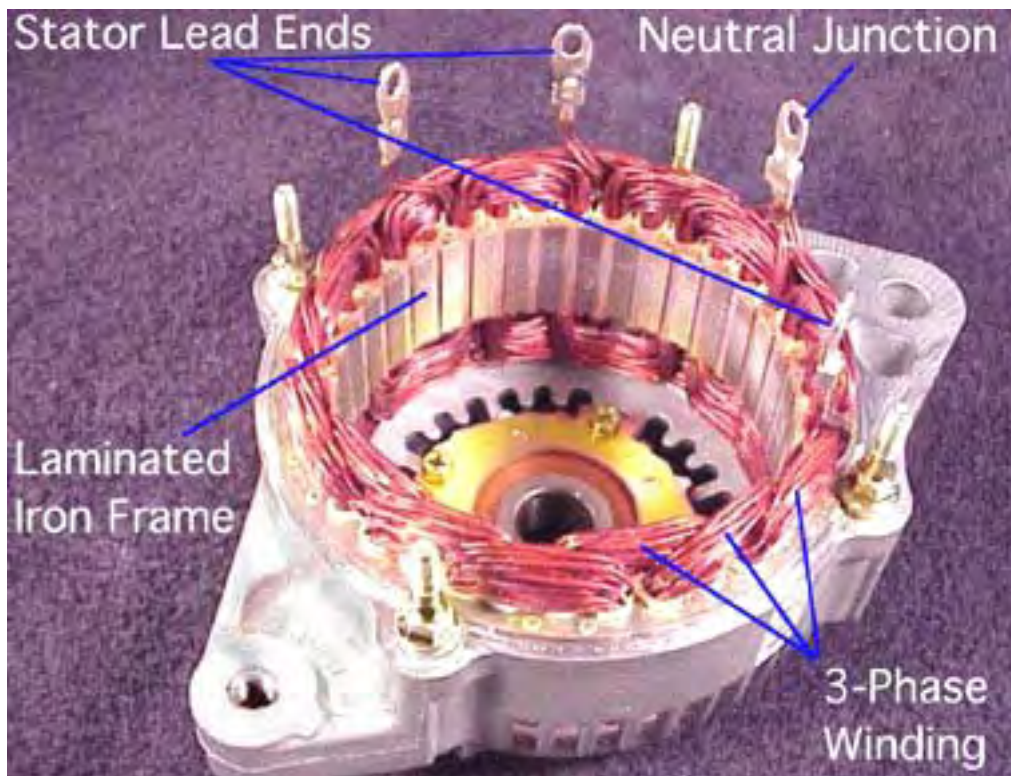
Alternating Magnetic Field



The rotor field winding creates the magnetic field that induces voltage in the stator. The magnetic field saturates the iron finger poles. One finger pole becomes a North pole and the other a South pole.

The rotor spins creating an alternating magnetic field, North, South, North, South, etc.

Stator Winding



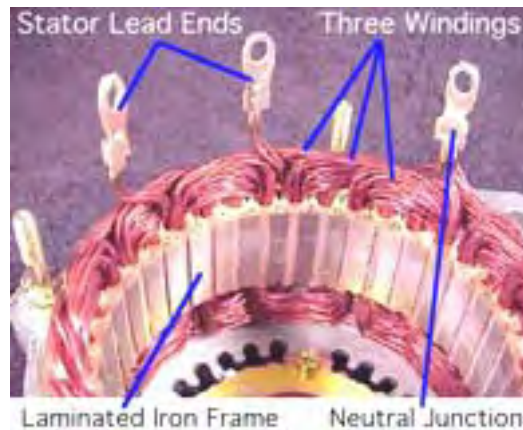
The stator winding looks like the picture above.

Rotor / Stator Relationship



As the rotor assembly rotates within the stator winding: The alternating magnetic field from the spinning rotor induces an alternating voltage into the stator winding. The strength of the magnetic field and the speed of the rotor affect the amount of voltage induced in the stator.

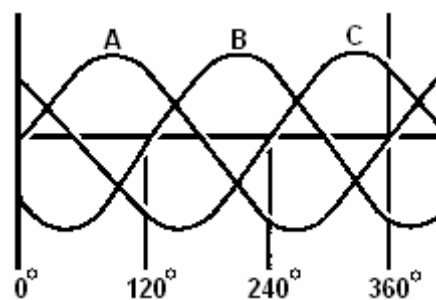
Stator Windings



The stator is made with three sets of windings. Each winding is placed in a different position compared with the others. A laminated iron frame concentrates the magnetic field. Stator lead ends output current to the diode rectifier bridge.

The Neutral Junction in the Wye design can be identified by the 6 strands of wire.

3-Phase Windings



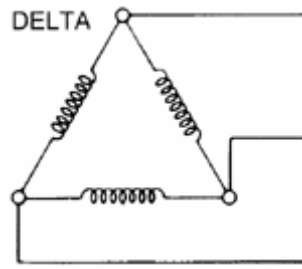
The stator winding has three sets of windings. Each winding is formed into a number of evenly spaced coils around the stator core.

The result is three overlapping single-phase AC sine-wave current peaks, A, B, C.

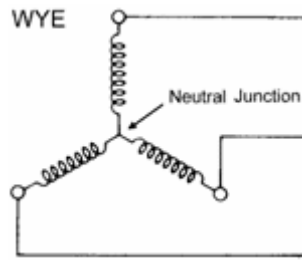
These waves add together to make up the total AC output of the stator. This is called three-phase current.

Three-phase current provides a more even current output than a single-phase output would do.

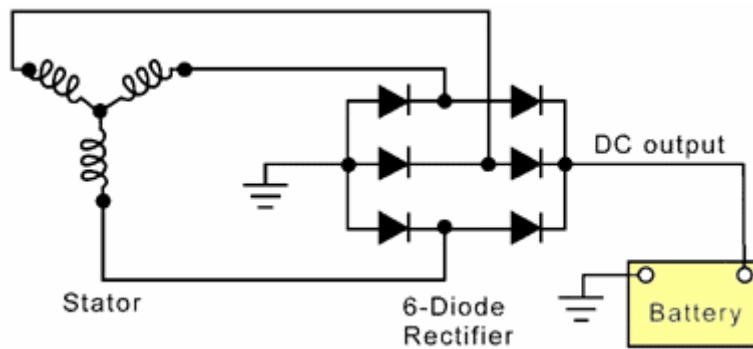
Stator Designs



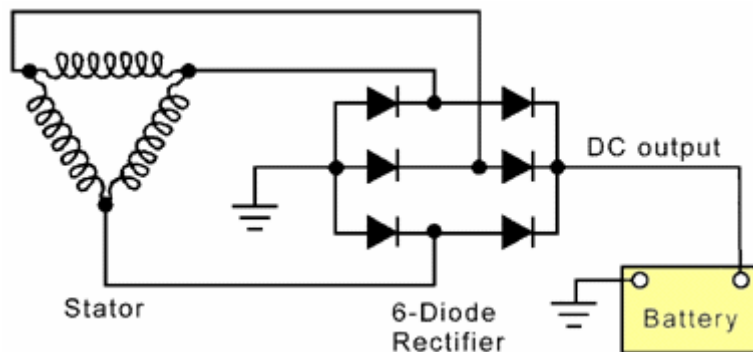
Delta-wound stators can be identified by having only three stator leads, and each lead will have the same number of wires attached.



Wye-style stators have four leads. One of the leads is called the Neutral Junction. The Neutral Junction is common to all the other leads.

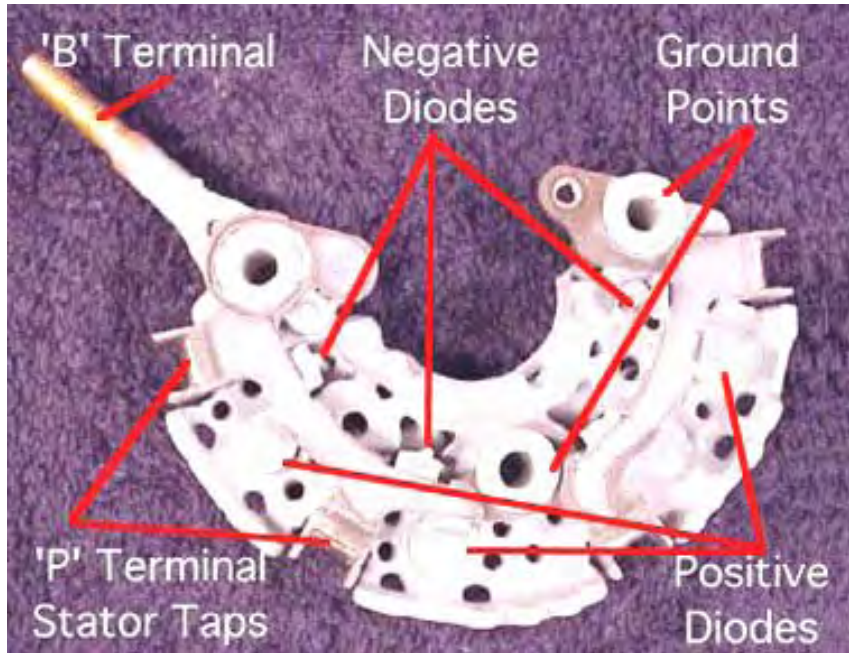


Wye-wound stators have three windings with a common neutral junction. They can be identified because they have 4 stator lead ends. Wye wound stators are used in alternators that require high-voltage output at low alternator speeds. Two windings are in series at any one time during charge output.

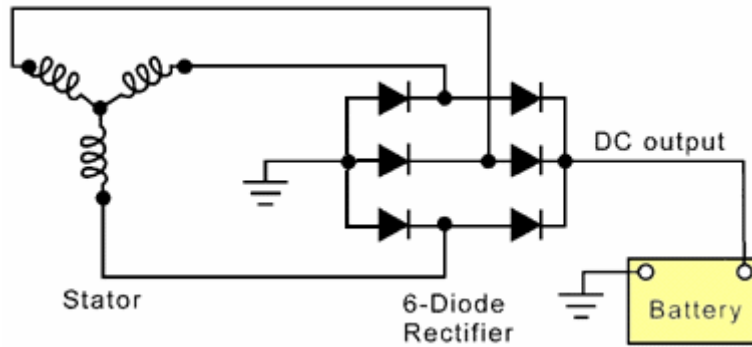


Delta-wound stators can be identified because they have only three stator lead ends. Delta stators allow for higher current flow being delivered at low RPM. The windings are in parallel rather than in series as the Wye designs have.

Diode Rectifier Bridge Assembly



Rectifier Operation:



Two diodes are connected to each stator lead. One positive the other negative. Because a single diode will only block half of the AC voltage, six or eight diodes are used to rectify the AC stator voltage to DC voltage.

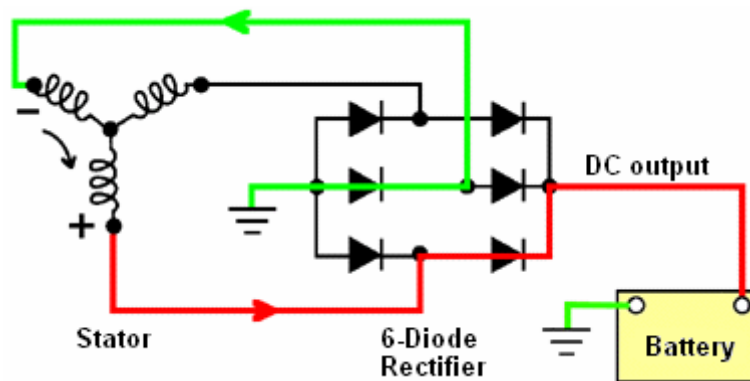
Diodes used in this configuration will redirect both the positive and negative parts of the AC voltage in order to produce a better DC voltage waveform. This process is called 'Full - Wave Rectification'.

Diodes

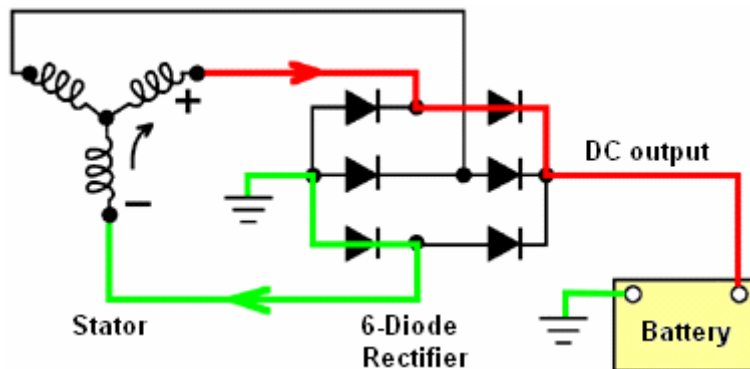


Diodes are used as one-way electrical check valves. They pass current in only one direction, and never in the other direction. Diodes are mounted in a heat sink to dissipate the heat generated by the current flow. Diodes redirect the AC voltage and convert it into DC voltage, so the battery receives the correct polarity.

Rectifier Operation:

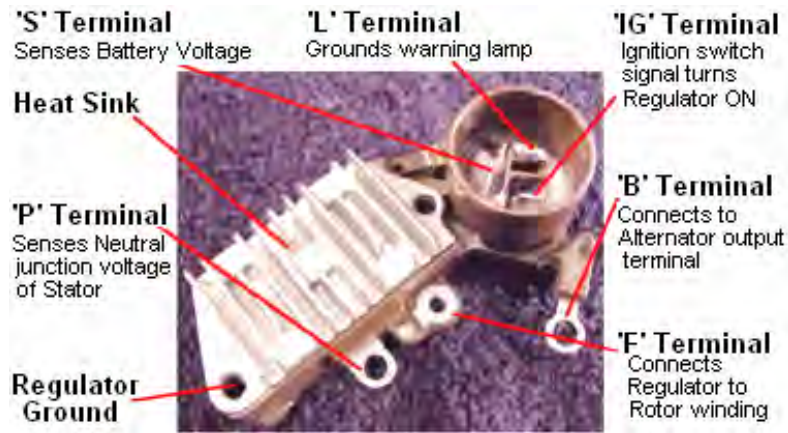


The red path is the positive current passing through the rectifier as it goes to the positive battery terminal. The path shown in green completes the circuit.



As the rotor continues its movement, the voltages generated in the three windings, change in polarity. The battery is still fed current, but now a different winding feeds it. Again, the red path shows the current flow to the battery and the green path shows how the circuit is completed. The same charging continues even though different windings and diodes are being used.

Electronic Regulator



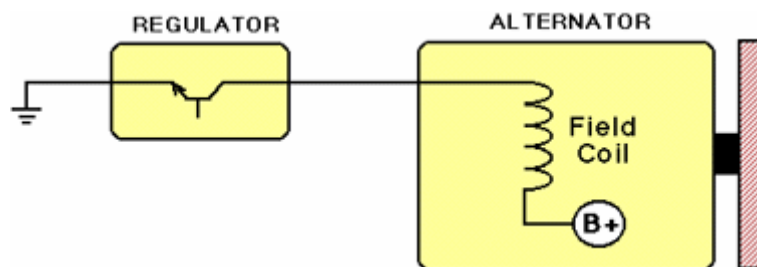
The regulator attempts to maintain a set charging voltage. If the charging voltage falls below this point, the regulator increases the field current, which strengthens the magnetic field, resulting in a raising of the alternator output voltage.

If the charging voltage rises above this point, the regulator decreases the field current, thus weakening the magnetic field, producing a lowering of the alternator output voltage.

Regulator Types:

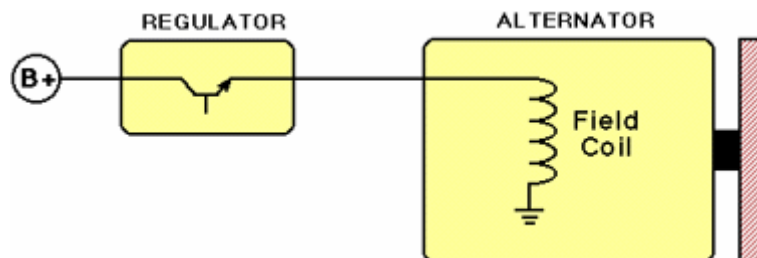
Two regulator designs can be used. The first type is:

The **Grounded Regulator** type. This type of regulator controls the amount of current flowing through the battery ground (negative) into the field winding in the rotor:

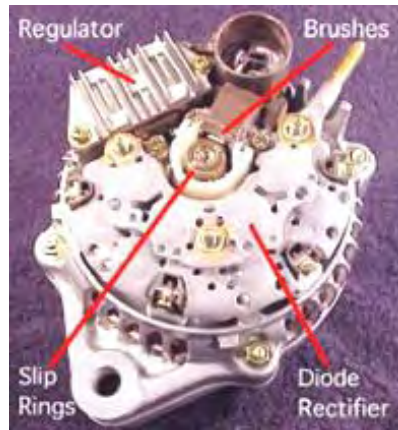


The second type is:

The **Grounded Field** type. This type of regulator controls the amount of current flowing from the Battery Positive ('B+') into the field winding in the rotor.



The Working Alternator



The **regulator** monitors battery voltage and controls current flow to the rotor assembly.

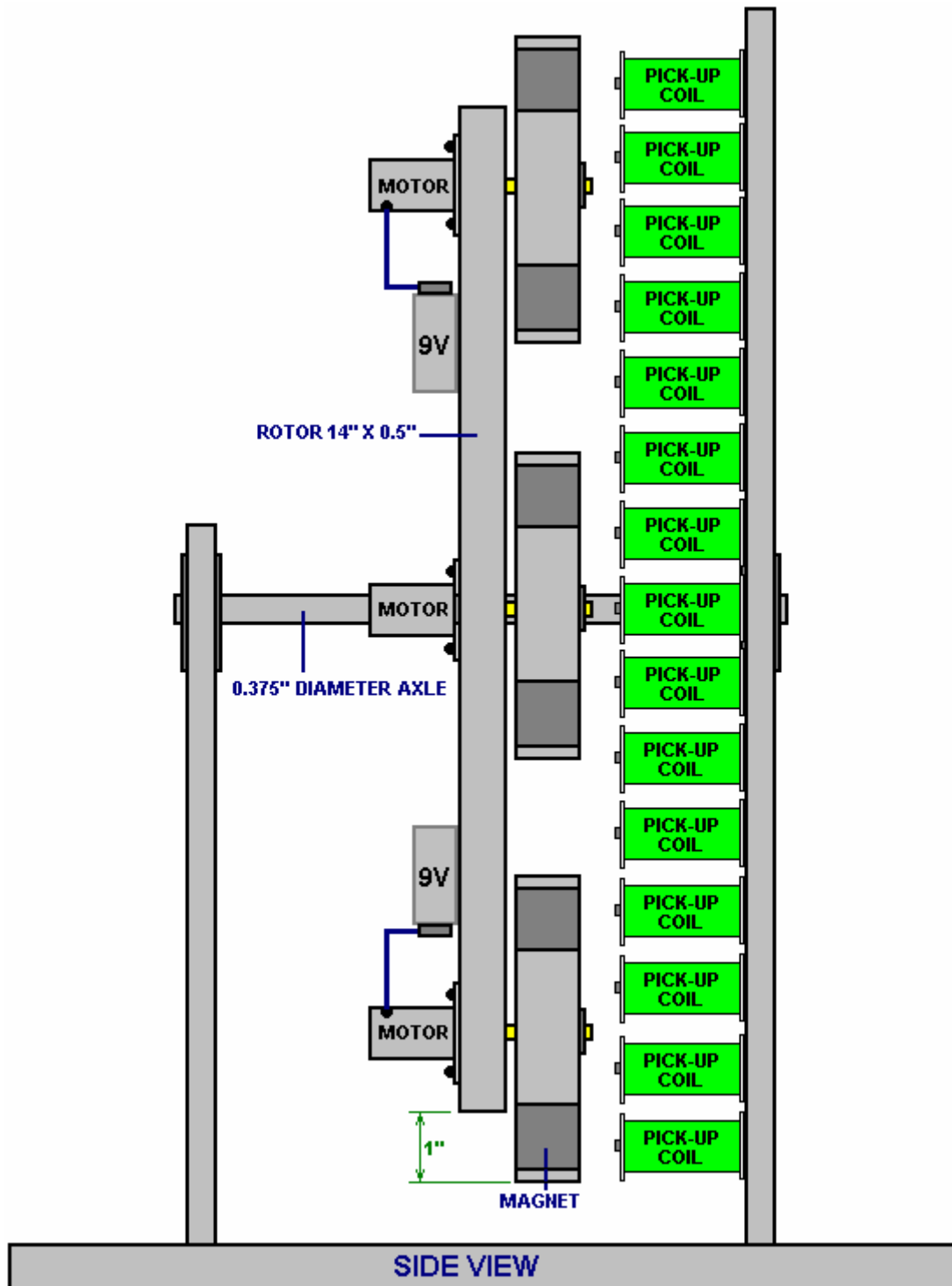
The **rotor** produces a magnetic field.

Voltage is induced in the **stator windings**.

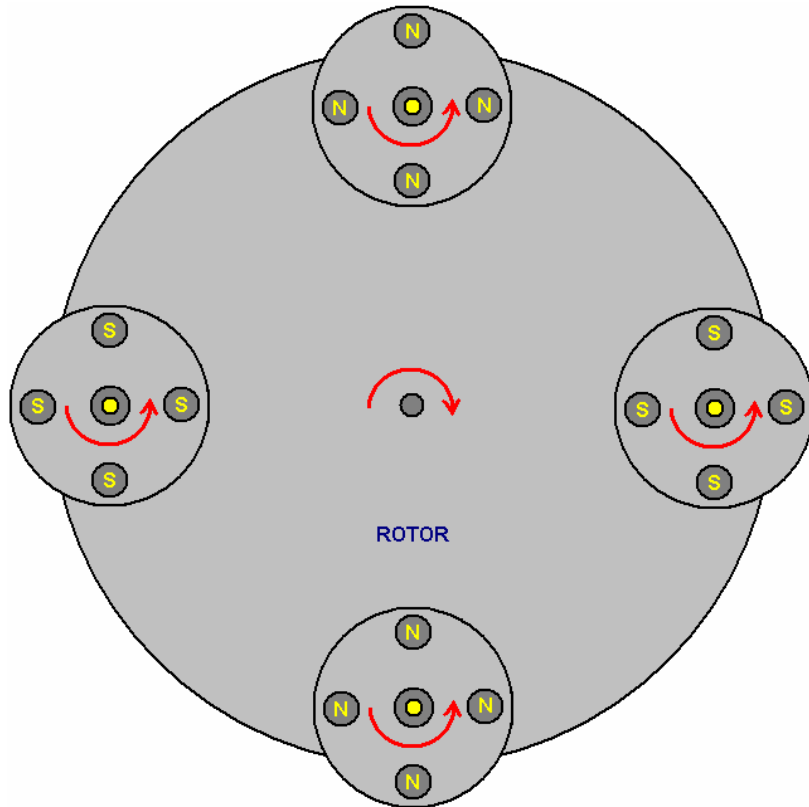
The **rectifier bridge** converts the AC stator voltage to DC output voltage for use by the vehicle.

Mark Wesling

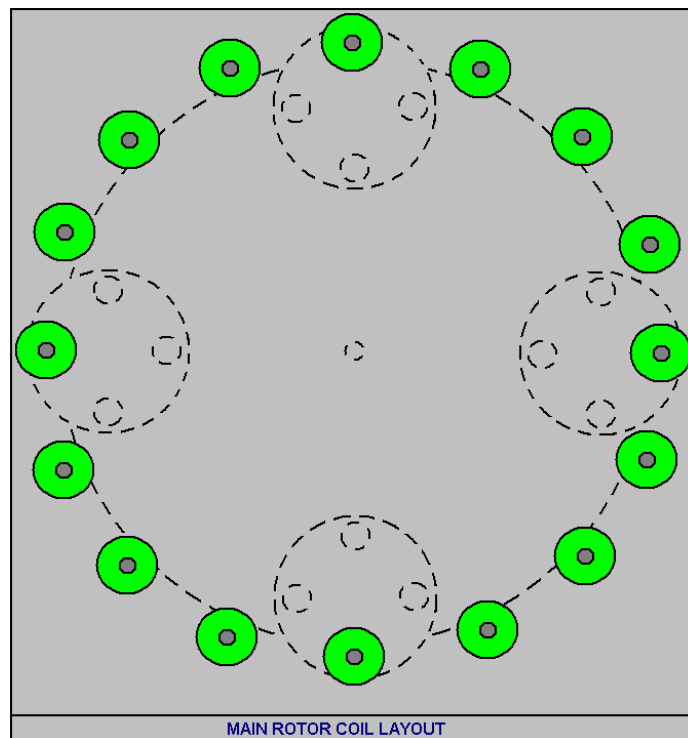
A proposed generator design put forward by Mark Wesling has the promise of particularly high performance. This is presented here as an idea as this device has not yet been built as far as I am aware. Mark calls this the 'Infinity' Motor/Generator. In this design, the rotor drive is achieved through the use of four or more independent small high-speed motors, each mounted on the main rotor and each provided with it's own smaller rotor as shown here:



Seen from the front, the rotors are positioned like this:



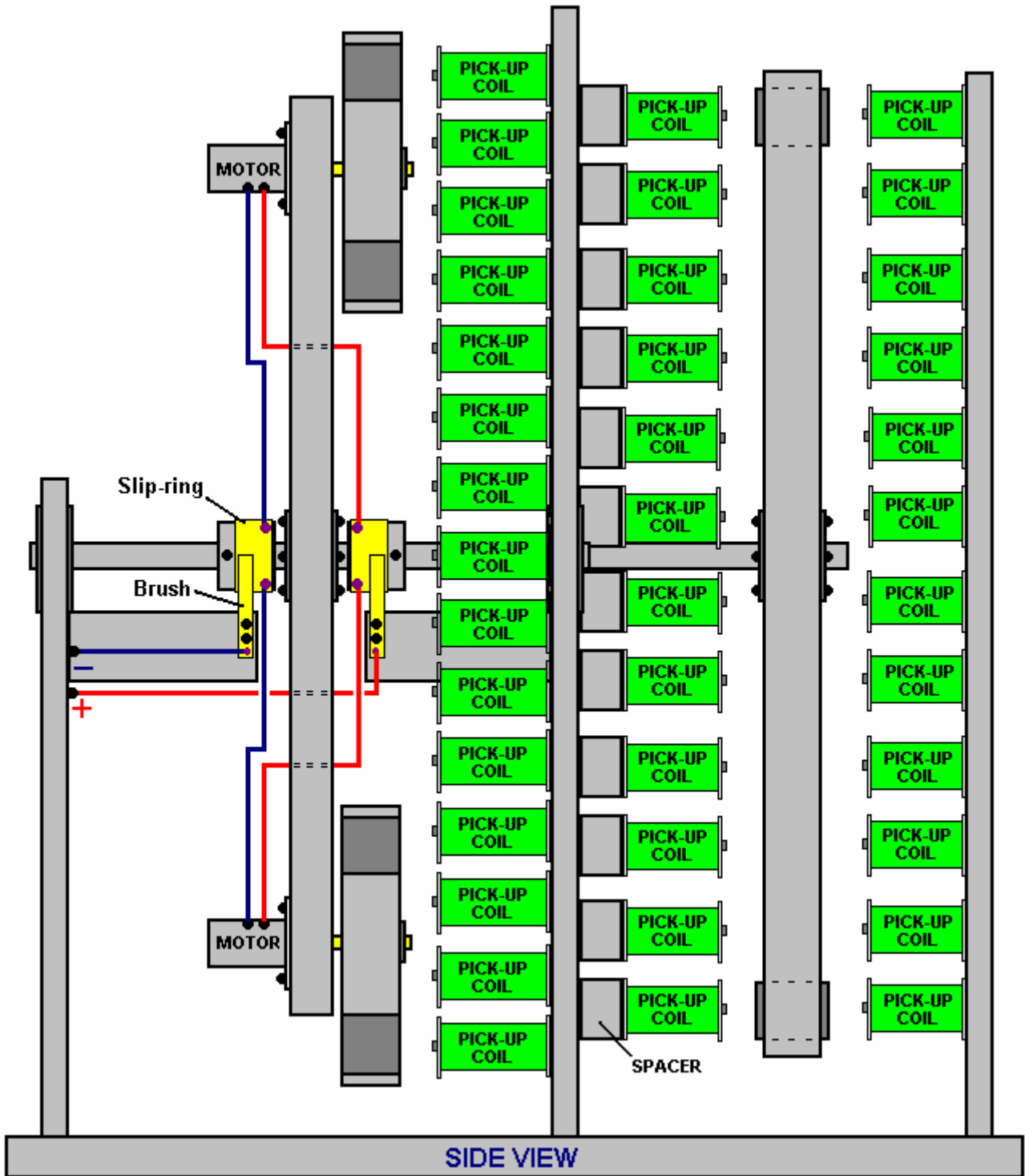
The magnets are mounted very securely in the small rotors so as to be sure that they cannot break loose when the rotor spins at high speed. The drive mechanism for the main rotor is unusual in that it uses the Lenz Law drag effect. There is a ring of power pick-up coils positioned so that when the magnets of the small rotors are in the position farthest from the main rotor axle, they are directly facing the coil as shown here:



This has very little effect until an electric current is drawn from the coils. When that happens, the Lenz Law drag opposes the movement of the magnet. But, as the moving magnet is effectively mounted on the large rotor, that opposing push drives the large rotor in the opposite direction. If the small rotors spin in a clockwise direction, then the large rotor will be driven in a counter-clockwise direction. Surprisingly, the greater the current draw, the greater the rotation rate of the large rotor.

It is envisaged that the spin rate of the large rotor may become excessive, so in order to slow it down while producing additional output power, the main rotor shaft is extended and an ordinary magnet/coil generator arrangement attached to it.

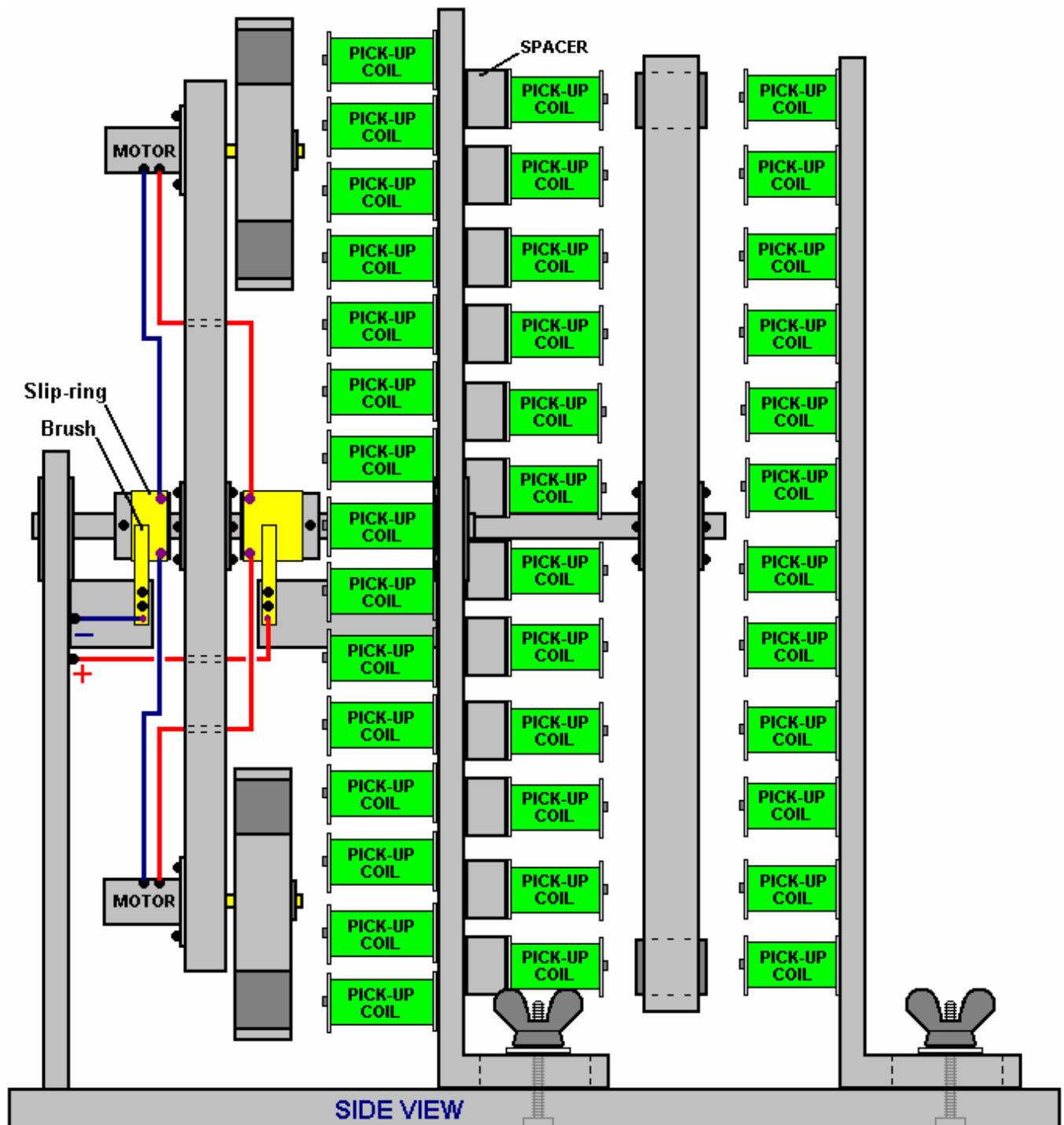
While initially, each 9-volt motor has been shown with it's own separate battery, there is no particular need for the motors to be 9-volt and a more convenient arrangement is where all four motors are fed power from a single source, using two insulated slip rings mounted on the axle with spring-loaded brushes pressing against them as shown here:

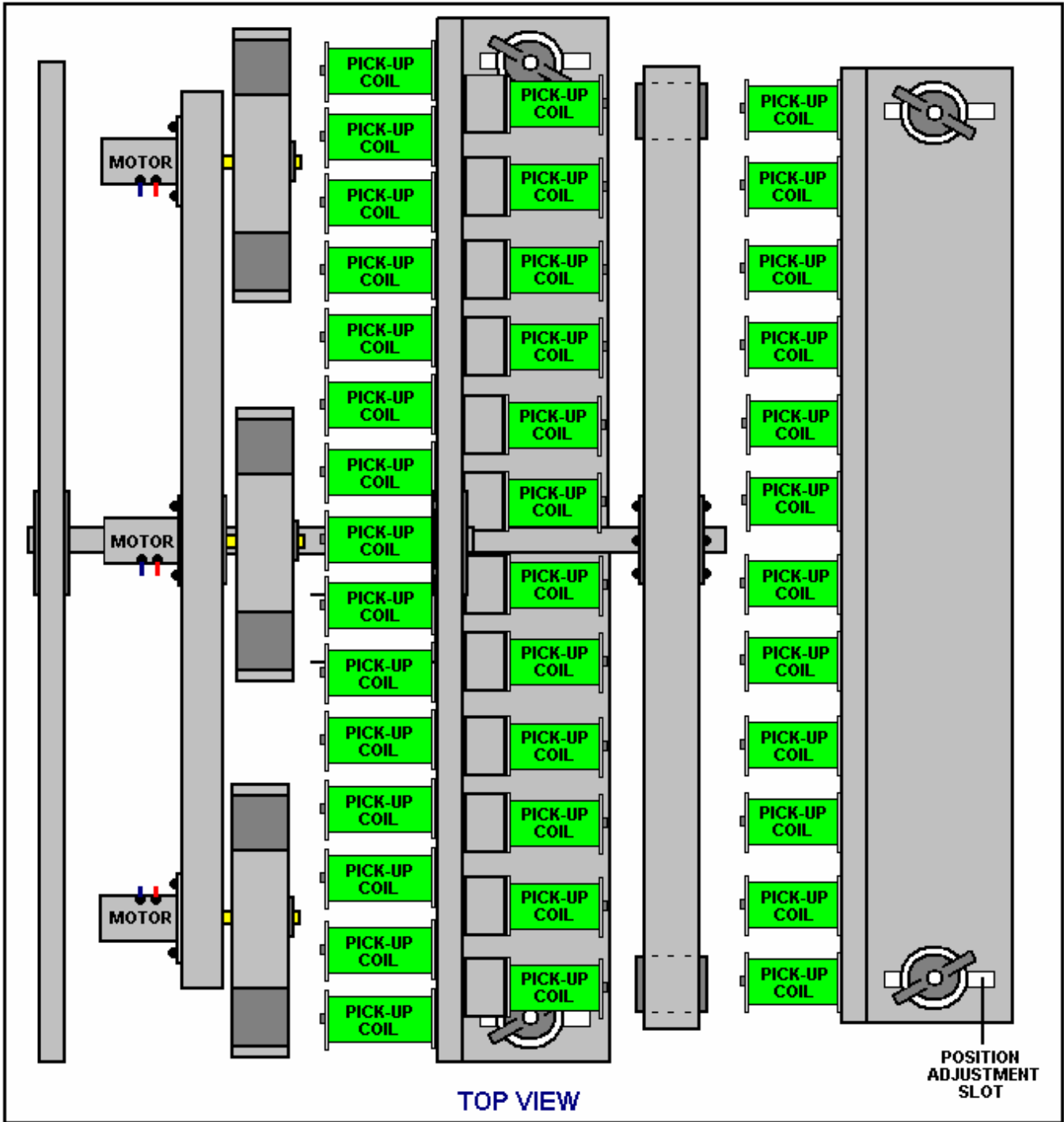


This drawing omits two of the small rotors and their motors in order to show a possible slip-ring and brush arrangement.

Each experienced constructor has his own idea as to the optimum spacing between magnets on a rotor and a set of power pick-up coils. The different types and strengths of the magnets used in different implementations of this

design also has an effect on this spacing. The very experienced New Zealand experimenter and inventor, Robert Adams has found that spacings around half an inch (12 mm) can give optimum performance. Other builders are of the opinion that the space between the magnet and the coils should be the minimum possible. To allow for experimentation to find the optimum spacing, it is suggested that the construction should allow for the gap between each set of magnets and their associated coils, to be adjustable. To allow for this, the style of construction shown here might be considered:





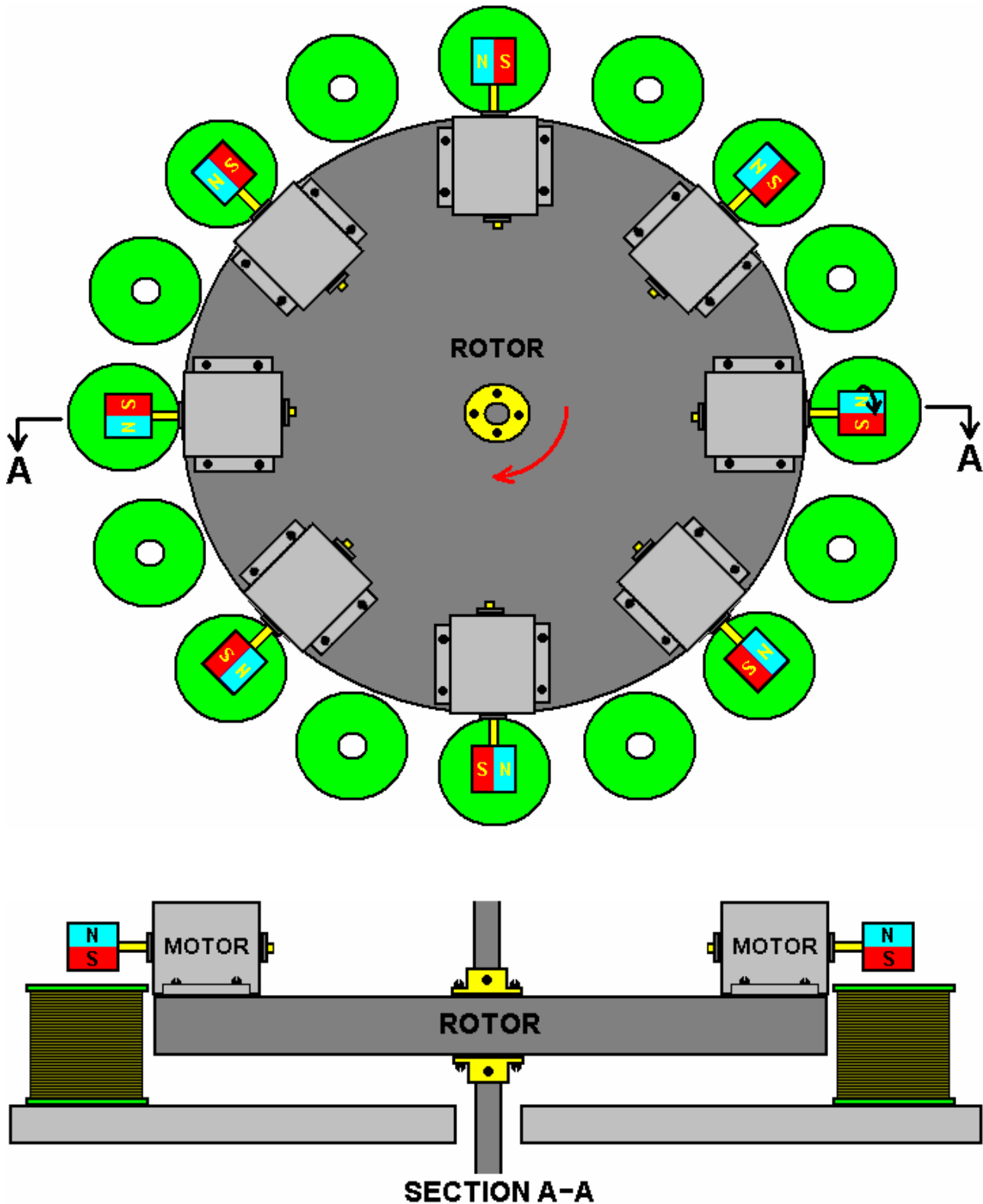
With this arrangement, wing nuts are used to allow easy adjustment of the position of the coils. The slip ring on that side of the axle needs to be much wider to allow this change of position without affecting the power feed through the slip ring.

Mark has advanced his idea further and is in the process of constructing a prototype. His more advanced method uses cylindrical magnets which are magnetised along the axis of the cylinder. One such magnet is this one from http://www.magnet4less.com/index.php?cPath=1_133:



Diametrically Magnetized 3/4 in OD x 1/4 in ID x 3/4 in Ring Magnets
 Diametrically Magnetized Neodymium Rare Earth N42 Magnets
 Pull force: 47 lbs Magnetized through diameter 3/4"
 Model# NR011-2

The design uses eight small DC motors with unloaded speed of 8,000 rpm, mounted on the rotor, each with one of these magnets mounted on the motor drive shaft, as shown here:



The other power-collection methods remain the same as shown previously. The coils shown for this latest suggestion are air-core, but what works best has to be determined through experimentation. The magnets are rotated very rapidly by the motors – perhaps 2,500 rpm – and each revolution causes a field reversal at the motor drive shaft. The magnets are powerful, so there should be a considerable effect on the coils and it only takes a thirty degree rotor movement to move from being exactly over one coil to being exactly over the next one, and there will be considerable magnetic effect in the intervening positions as well.

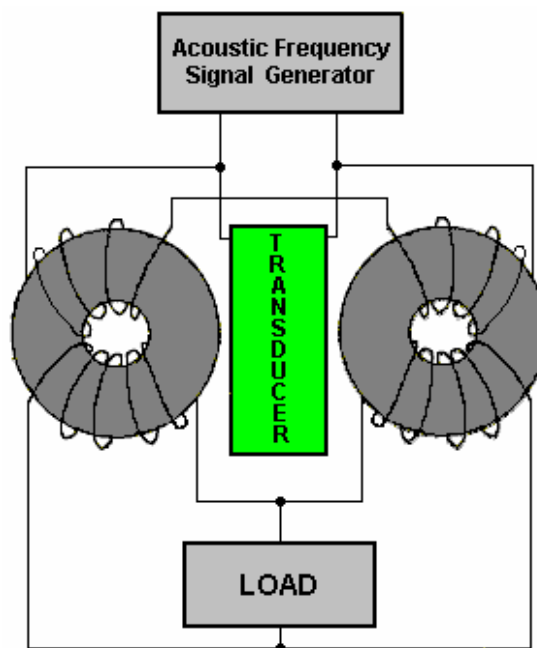
Mark comments on this arrangement: The main rotor will spin at just a few hundred rpm. This will pull the electrons forward through the coil (as opposed to a conventional coil that pushes the electrons). This action will pass the Lenz force on to the main rotor shaft as torque. The beauty of this design is that it puts the motor shaft in the same phase as the rotor spin whereas before, it was 180 degrees out and slowed the motors. Also, the gyroscopic forces on the small rotors/motors were great as the large rotor spun, while this design will hit every coil 100% on every rotation.

The technique of coil-shorting five times at the sine-wave peak can boost the output power by anything up to a hundred times, so using that method would be a major benefit if the necessary electronics skills are available. The coils shown appear to have a solid core, however, it is envisaged that the speed of rotation will be too great for a ferrous core and so either ferrite or air-core coils may be needed.

Omissions from Chapter 3:

Dan Davidson

Dan has produced a system rather similar to the 'MEG'. His system is different in that he uses an acoustic device to vibrate a magnet which forms the core of a transformer. This is said to increase the output by a substantial amount. His arrangement looks like this:



Dan's patent is in the Appendix and it gives details of the types of acoustic transducers which are suitable for this generator design.

Don Smith

While much of what Don Smith said is undoubtedly true, I am not convinced that his claims of what he actually achieved personally, are true. Please bear that in mind. Don died in 2004.

Donald Lee Smith



Don Smith is elderly and has suffered several serious strokes in the last few years. He is no longer able to respond to e-mails and his web site has been taken over by people who appear very keen to ensure that his work and information can no longer be accessed by members of the public.

At this point in time there is very little information available on Don's achievements. What I have been able to locate is four video recordings of lectures which he gave, plus a copy of his pdf document entitled "Resonance Energy Systems". There is also a web site with limited information. This site appears to have been set up by Don's son whom I suspect does not fully understand how his father's devices work. Don has 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.

It is said that 40,000 copies of Don's pdf document have been sold worldwide, but it appears that it is no longer possible to buy a copy, and for that reason, a copy is contained within this document. Please be aware that Don states quite openly that he does not disclose all of the details on any of his devices in his public discussions. This is because the rights to each device have been assigned to a different company in which Don has a financial interest, and so it is not in his interests to disclose the full details. However, he 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 is understandable). Having said that, Tariel Kapanadze of Georgia appears to have replicated one of the designs although it is quite likely that Tariel deduced the operating principles for himself. These principles are clearly based on the work of Nikola Tesla.

In Don's work, he refers to the educational kit entitled "Resonant Circuits" No 10 - 416 from The Science Source at www.thesciencesource.com. That kit now costs US\$100 and they don't mention the fact that you need a signal generator capable of producing a 10 volt output at up to 1 MHz in order to be able to do resonance tests, and the kit now uses an LED rather than a neon bulb.

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 available from <http://www.healthresearchbooks.com> and various other book companies. This book can be downloaded from <http://www.free-energy-info.com> as a pdf file, but a paper copy is much better quality and easier to work from.

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 called the 'zero-point energy field' elsewhere in this eBook. Don remarks that he has now 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 COP>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. A website which is run by Conny Öström of Sweden is <http://www.johnnyfg.110mb.com/> and it has brief details of his prototypes and theory. You will find the only

document of his which I could locate, here <http://www.free-energy-info.com/Smith.pdf> in pdf format, and it contains the following patent on a most interesting device which appears to have no particular limit on the output power. This is a slightly re-worded copy of that patent as patents are generally worded in such a way as to make them difficult to understand.

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.

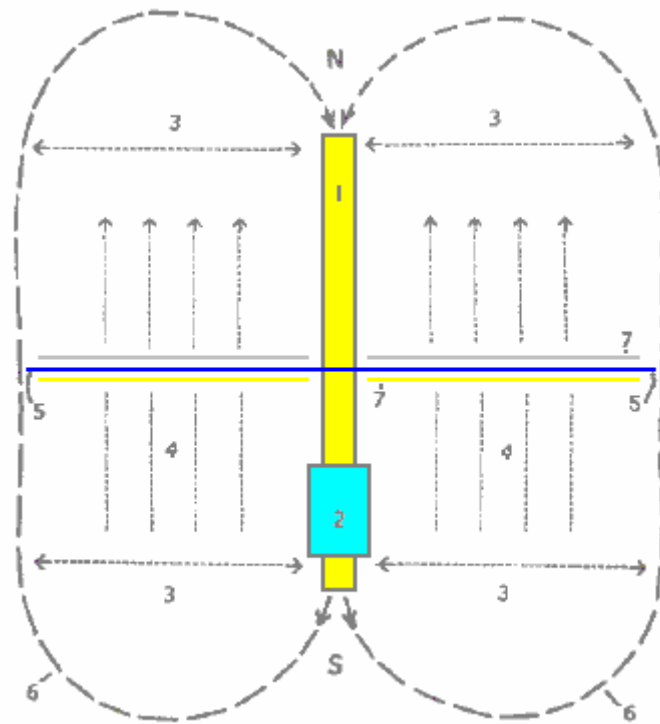


Fig.1 is a View of the Method, where **N** is the North and **S** is the South component of the Dipole.

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.

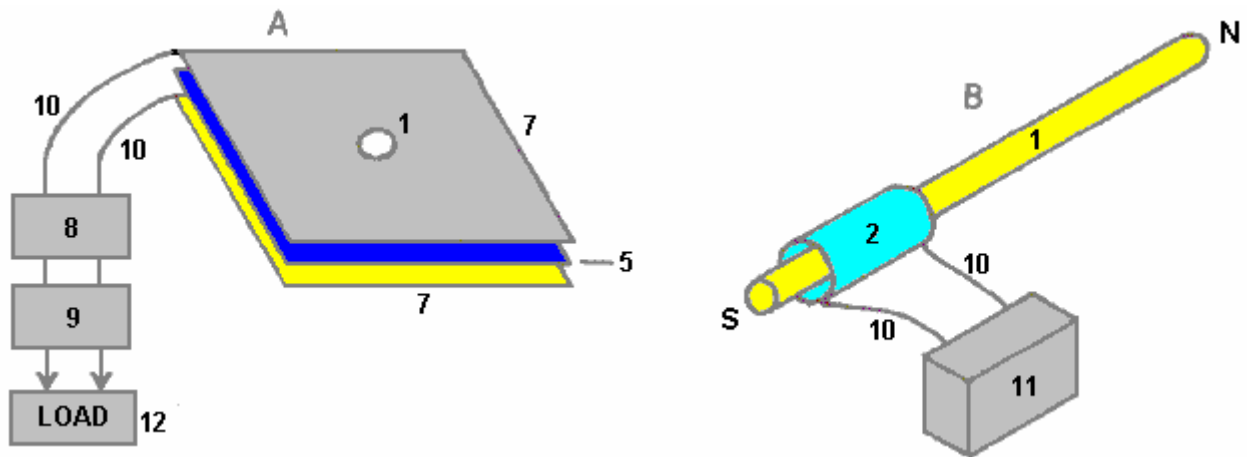


Fig.2 has two parts **A** and **B**.

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.

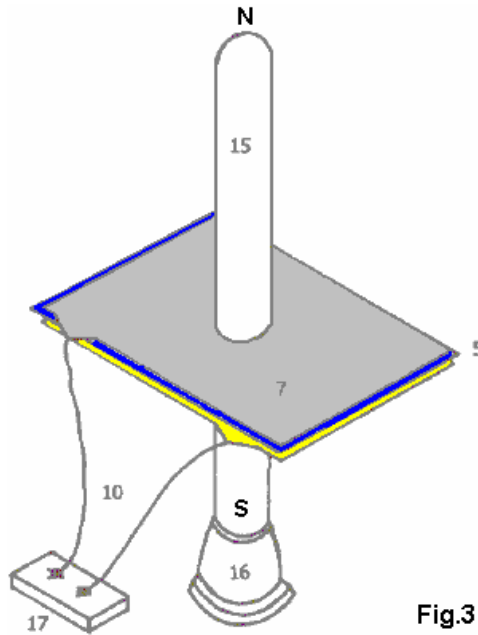


Fig.3

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 (150 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.

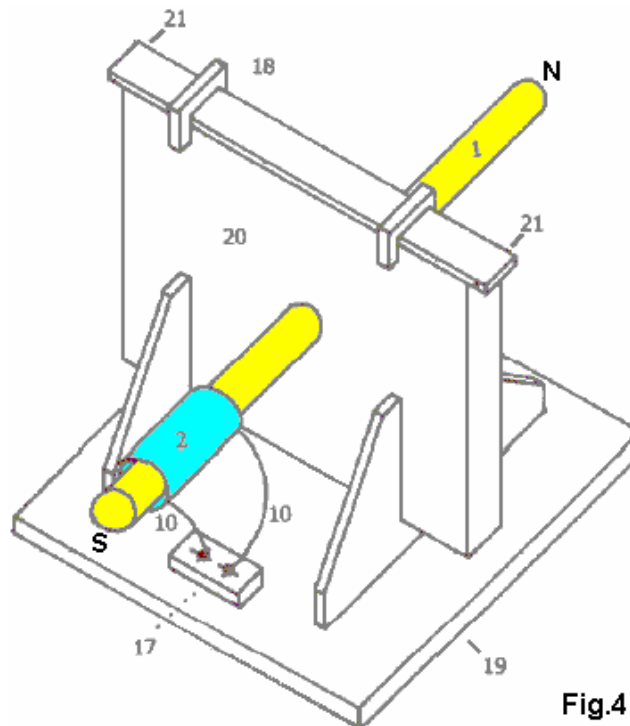


Fig.4

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 its 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.

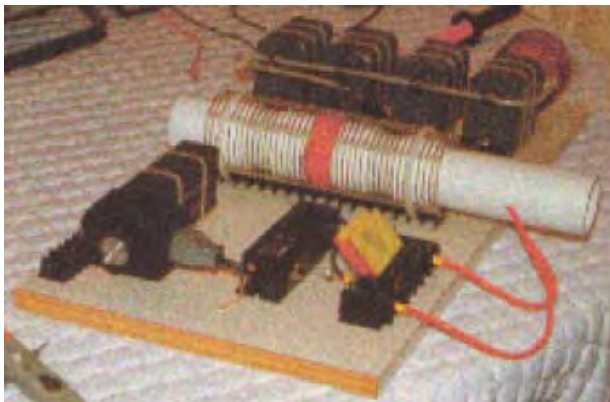
CLAIMS

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. 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.

Don Smith has produced some forty eight different devices, and because he understands that the real power in the universe is magnetic and not electric, these devices have performances which appear staggering to people trained to think that electrical power is the only source of power.

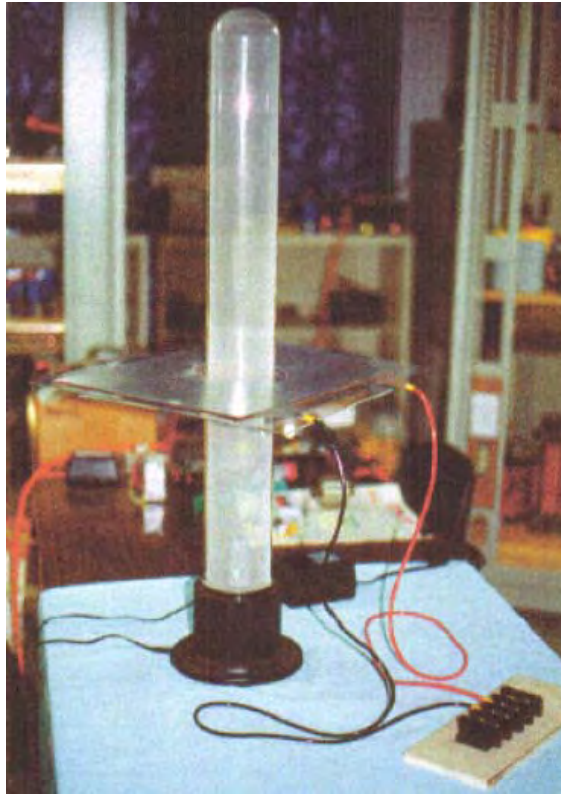
The device shown below is physically quite small and yet it has an output of 160 kilowatts (8000 volts at 20 amps) from an input of 12 volts 1 amp (COP = 13,333):



This is a device which can be placed on top of a table and is not a complicated form of construction, having a very open and simplistic layout. However, some components are not mounted on this board. The twelve volt battery and connecting leads are not shown, nor are the ground connections, the step-down isolation transformer and the varistor used to protect the load from over-voltage by absorbing any random induced voltage spikes which might occur.

The device shown above has various subtle points glossed over in spite of this being one device which Don says that we should be able to reproduce ourselves. Let me state here that reproducing this seemingly simple design of Don's is not an easy thing to do and it is not something which can be thrown together by a beginner using whatever components happen to be at hand at the time. Having said that, with careful study and commonsense application of some obvious facts, it should be possible to make one of these devices, but more of these things later on when a much more detailed description of this device is given.

Another of Don's devices, somewhat similar to the one described in his patent, is shown here:



This is a larger device which uses a plasma tube four feet (1.22 m) long and 6 inches (150 mm) in diameter. The output is a massive 100 kilowatts. This is the design shown as one of the options in Don's patent. Being an Electrical Engineer, none of Don's prototypes are in the "toy" category. If nothing else is taken from Don's work, we should realise that high power outputs can be had from very simple devices.

There is one other brief document "Resonate Electrical Power System" from Don Smith which says:

Potential Energy is everywhere at all times, becoming useful when converted into a more practical form. There is no energy shortage, only grey matter. This energy potential is observed indirectly through the manifestation of electromagnetic phenomenon, when intercepted and converted, becomes useful. In nonlinear systems, interaction of magnetic waves amplify (conjugate) energy, providing greater output than input. In simple form, in the piano where three strings are struck by the hammer, the centre one is impacted and resonance activates the side strings. Resonance between the three strings provides a sound level greater than the input energy. Sound is part of the electromagnetic spectrum and is subject to all that is applicable to it.

"Useful Energy" is defined as "that which is other than Ambient". "Electric Potential" relates to mass and it's acceleration. Therefore, the Earth's Mass and Speed through space, gives it an enormous electrical potential. Humans are like the bird sitting unaware on a high voltage line. In nature, turbulence upsets ambient and we see electrical displays. Tampering with ambient, allows humans to convert magnetic waves into useful electricity.

Putting this in focus, requires a look at the Earth in general. During each of the 1,440 minutes of each day, more than 4,000 displays of lightning occur. Each display yields more than 10,000,000 volts at more than 200,000 amperes in equivalent electromagnetic flux. This is more than 57,600,000,000,000 volts and 1,152,000,000,000 amperes of electromagnetic flux during each 24 hour period. This has been going on for more than 4 billion years. The USPTO insist that the Earth's electrical field is insignificant and useless, and that converting this energy violates the laws of nature. At the same time, they issue patents in which, electromagnetic flux coming in from the Sun is converted by solar cells into DC energy. Aeromagnetic flux (in gammas) Maps World-Wide, includes those provided by the US Department of Interior-Geological Survey, and these show clearly that there is present, a spread of 1,900 gamma above Ambient, from reading instruments flown 1,000 feet above the (surface) source. Coulomb's Law requires the squaring of the distance of the remote reading, multiplied by the recorded reading. Therefore, that reading of 1,900 gamma has a corrected value of $1,900 \times 1,000 \times 1,000 = 1,900,000,000$ gamma.

There is a tendency to confuse "gamma ray" with "gamma". "Gamma" is ordinary, everyday magnetic flux, while "gamma ray" is high-impact energy and not flux. One gamma of magnetic flux is equal to that of 100 volts RMS. To see this, take a Plasma Globe emitting 40,000 volts. When properly used, a gamma meter placed nearby, will

read 400 gammas. The 1,900,000,000 gamma just mentioned, is the magnetic ambient equivalent of 190,000,000 volts of electricity. This is on a "Solar Quiet" day. On "Solar Active" days it may exceed five times that amount. The Establishment's idea that the Earth's electrical field is insignificant, goes the way of their other great ideas.

There are two kinds of electricity: "potential" and "useful". All electricity is "potential" until it is converted. The resonant-fluxing of electrons, activates the electrical potential which is present everywhere. The Intensity/CPS of the resonant-frequency-flux rate, sets the available energy. This must then be converted into the required physical dimensions of the equipment being used. For example, energy arriving from the Sun is magnetic flux, which solar cells convert to DC electricity, which is then converted further to suit the equipment being powered by it. Only the magnetic flux moves from point "A" (the Sun) to point "B" (the Earth). All electrical power systems work in exactly the same way. Movement of Coils and Magnets at point "A" (the generator) fluxes electrons, which in turn, excite electrons at point "B" (your house). **None of the electrons at point "A" are ever transmitted to point "B"**. In both cases, the electrons remain forever intact and available for further fluxing. This is not allowed by Newtonian Physics (electrodynamics and the laws of conservation). Clearly, these laws are all screwed up and inadequate.

In modern physics, USPTO style, all of the above cannot exist because it opens a door to overunity. The good news is that the PTO has already issued hundreds of Patents related to Light Amplification, all of which are overunity. The Dynode used to adjust the self-powered shutter in your camera, receives magnetic flux from light which dislodges electrons from the cathode, reflecting electrons through the dynode bridge to the anode, resulting in billions of more electrons out than in. There are currently, 297 direct patents issued for this system, and thousands of peripheral patents, all of which support overunity. More than a thousand other Patents which have been issued, can be seen by the discerning eye to be overunity devices. What does this indicate about Intellectual Honesty?

Any coil system, when fluxed, causes electrons to spin and produce useful energy, once it is converted to the style required by its use. Now that we have described the method which is required, let us now see how this concerns us.

The entire System already exists and all that we need to do is to hook it up in a way which is useful to our required manner of use. Let us examine this backwards and start with a conventional output transformer. Consider one which has the required voltage and current handling characteristics and which acts as an isolation transformer. Only the magnetic flux passes from the input winding to the output winding. No electrons pass through from the input side to the output side. Therefore, we only need to flux the output side of the transformer to have an electrical output. Bad design by the establishment, allowing hysteresis of the metal plates, limits the load which can be driven. Up to this point, only potential is a consideration. Heat (which is energy loss) limits the output amperage. Correctly designed composite cores run cool, not hot.

A power correction factor system, being a capacitor bank, maintains an even flow of flux. These same capacitors, when used with a coil system (a transformer) become a frequency-timing system. Therefore, the inductance of the input side of the transformer, when combined with the capacitor bank, provides the required fluxing to produce the required electrical energy (cycles per second).

With the downstream system in place, all that is needed now is a potential system. Any flux system will be suitable. Any amplification over-unity output type is desirable. The input system is point "A" and the output system is point "B". Any input system where a lesser amount of electrons disturbs a greater amount of electrons - producing an output which is greater than the input - is desirable.

At this point, it is necessary to present updated information about electrons and the laws of physics. A large part of this, originates from me (Don Smith) and so is likely to upset people who are rigidly set in the thought patterns of conventional science.

Non - Ionic Electrons

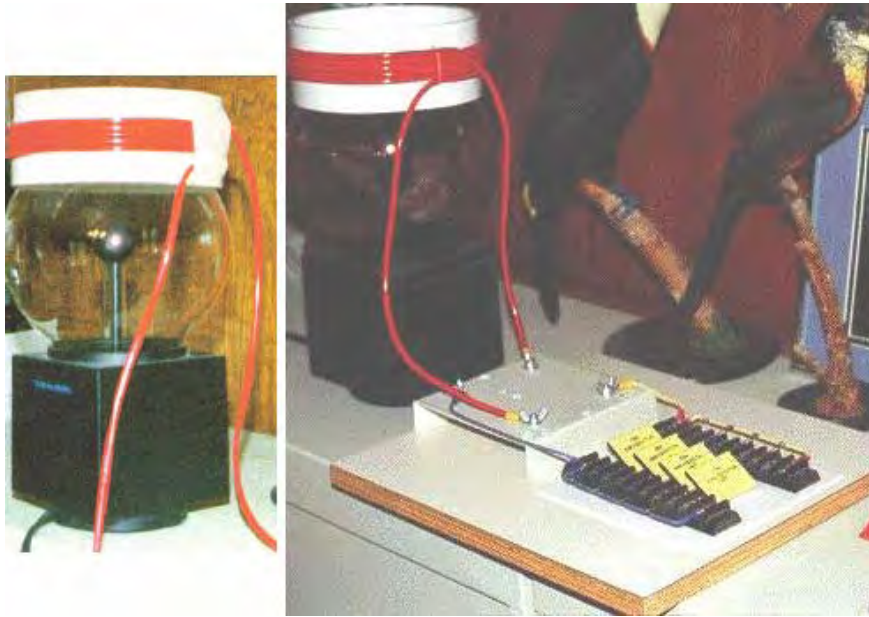
As a source of electrical energy, non-ionic electrons doublets exist in immense quantities throughout the universe. Their origin is from the emanation of Solar Plasma. When ambient electrons are disturbed by being spun or pushed apart, they yield both magnetic and electrical energy. The rate of disturbance (cycling) determines the energy level achieved. Practical methods of disturbing them include, moving coils past magnets or vice versa. A better way is the pulsing (resonant induction) with magnetic fields and waves near coils.

In coil systems, magnetic and amperage are one package. This suggests that electrons in their natural non-ionic state, exist as doublets. When pushed apart by agitation, one spins right (yielding Volts-potential electricity) and the other spins left (yielding Amperage-magnetic energy), one being more negative than the other. This further

suggests that when they reunite, we have (Volts x Amps = Watts) useful electrical energy. Until now, this idea has been totally absent from the knowledge base. The previous definition of Amperage is therefore flawed.

Electron Related Energy

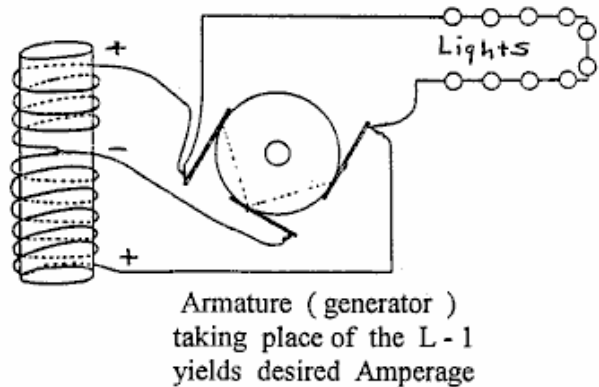
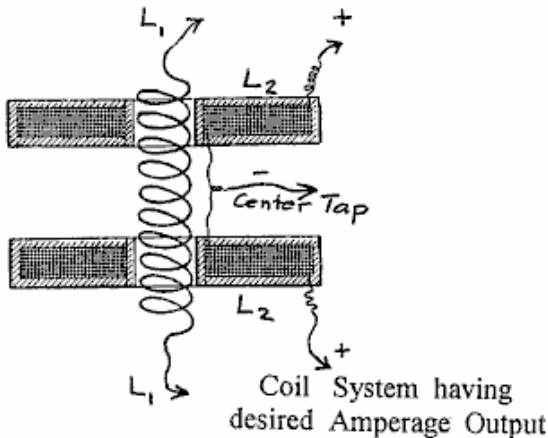
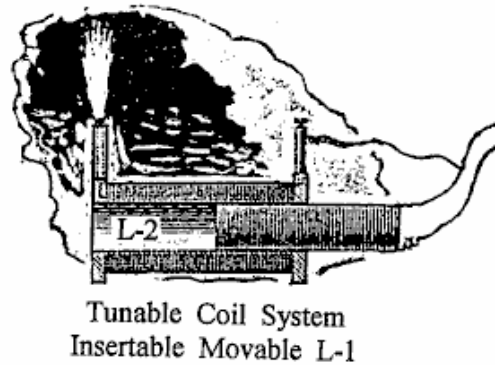
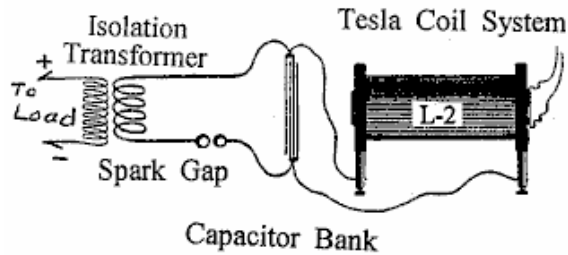
Left hand spin of electrons results in Electrical Energy and right hand spin results in Magnetic Energy. Impacted electrons emit visible Light and heat.



Useful Circuits, Suggestions for Building an Operational Unit

1. Substitute a Plasma Globe such as Radio Shack's "Illumna-Storm" for the source-resonant induction system. It will have about 400 milligauss of magnetic induction. One milligauss is equal to 100 volts worth of magnetic induction.
2. Construct a coil using a 5-inch to 7-inch (125 to 180 mm) diameter piece of PVC for the coil former.
3. Get about 30 feet (10 m) of Jumbo-Speaker Cable and separate the two strands. This can be done by sticking a carpet knife into a piece of cardboard or wood, and then pulling the cable carefully past the blade to separate the two insulated cores from each other. (PJK Note: "Jumbo-Speaker Cable" is a vague term as that cable comes in many varieties, with anything from a few, to over 500 strands in each core).
4. Wind the coil with 10 to 15 turns of wire and leave about 3 feet (1 m) of cable spare at each end of the coil. Use a glue gun to hold the start and finish of the coil.
5. This will become the "L - 2" coil shown in the Circuits page.
6. When sitting on top of the Plasma Globe (like a crown) you have a first-class resonant air-core coil system.
7. Now, substitute two or more capacitors (rated at 5,000 volts or more) for the capacitor bank shown on the Circuits page. I use more than two 34 microfarad capacitors.
8. Finish out the circuit as shown. You are now in business !
9. Voltage - Amperage limiting resistors are required across the output side of the Load transformer. These are used to adjust the output level and the desired cycles per second.

Useful Circuits from Nikola Tesla



Don Smith's Suggestions: Get a copy of the "Handbook of Electronic Tables and Formulas", published by Sams, ISBN 0-672-22469-0, also an Inductance/Capacitance/Resistance meter is required. Chapter 1 of Don's pdf document has important time-constant (frequency) information and a set of reactance charts in nomograph style ("*nomograph*": a graph, usually containing three parallel scales graduated for different variables so that when a straight line connects values of any two, the related value may be read directly from the third at the point intersected by the line) which makes working, and approximating of the three variables (capacitance, inductance and resistance) much easier. If two of the variables are known, then the third one can be read from the nomograph.

For example, if the input side of the isolation transformer needs to operate at 60 Hz, that is 60 positive cycles and 60 negative cycles, being a total of 120 cycles. Read off the inductance in Henries by using an Inductance meter attached to the input side of the isolation transformer. Plot this value on the (nomographic) reactance chart. Plot the needed 120 Hz on the chart and connect these two points with a straight line. Where this line crosses the Farads line and the Ohms line, gives us two values. Choose one (resistor) and insert it between the two leads of the transformer input winding.

The Power Correction Factor Capacitor (or bank of more than one capacitor) now needs adjusting. The following formula is helpful in finding this missing information. The capacitance is known, as is the desired potential to pulse the output transformer. One Farad of capacitance is one volt for one second (one Coulomb). Therefore, if we want to keep the bucket full with a certain amount, how many dippers full are needed? If the bucket needs 120 volts, then how many coulombs are required?

$$\frac{\text{Desired Voltage}}{\text{Capacitance in Microfarads}} = \text{Required frequency in Hz}$$

Now, go to the nomograph mentioned above, and find the required resistor jumper to place between the poles of the Correction Factor Capacitor.

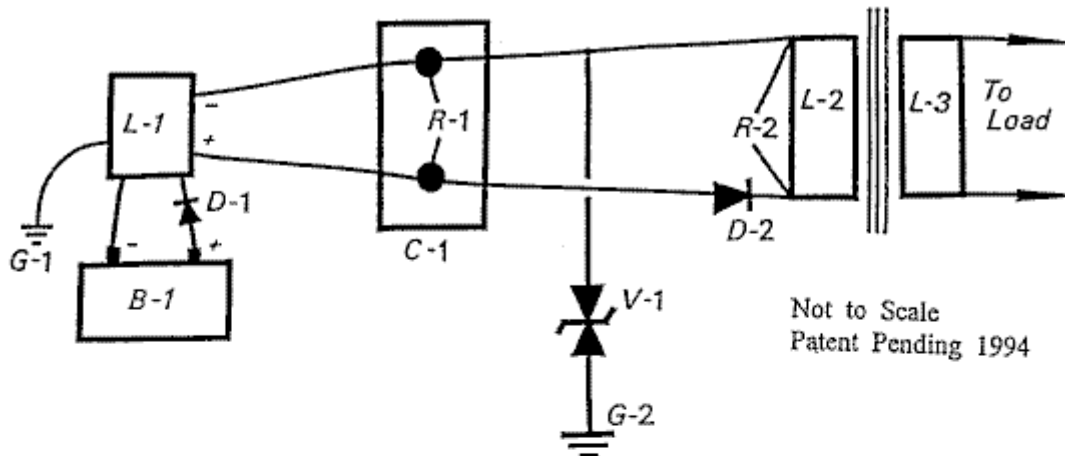
An earth grounding is desirable, acting as both a voltage-limiter and a transient spike control. Two separate earths are necessary, one at the Power Factor Capacitor and one at the input side of the isolation transformer. Off-the-shelf surge arrestors / spark gaps and varistors having the desired voltage/potential and amperage control are commonly available. Siemens, Citel America and others, make a full range of surge arrestors, etc. Varistors look like coin-sized flat capacitors. Any of these voltage limiters are marked as "V - 1" in the following text.

It should be obvious that several separate closed circuits are present in the suggested configuration: The power input source, the high-voltage module, a power factor capacitor bank combined with the input side of the isolation transformer. Lastly, the output side of the isolation transformer and its load. None of the electrons active at the power source (battery) are passed through the system for use downstream. At any point, if the magnetic flux rate should happen to vary, then the number of active electrons also varies. Therefore, controlling the flux rate controls the electron (potential) activity. Electrons active at point "A" are not the same electrons which are active at point "B", or those at point "C", and so on. If the magnetic flux rate (frequency Hz) varies, then a different number of electrons will be disturbed. This does not violate any Natural Law and it does produce more output energy than the input energy, should that be desirable.

A convenient high-voltage module is a 12 volt DC neon tube transformer. The Power Factor Correction Capacitors should be as many microfarads as possible as this allows a lower operating frequency. The 12-volt neon tube transformer oscillates at about 30,000 Hz. At the Power Correction Factor Capacitor bank we lower the frequency to match the input side of the isolation transformer.

Other convenient high-voltage sources are car ignition coils, television flyback transformers, laser printer modules, and various other devices. Always lower the frequency at the Power Factor Correction Capacitor and correct, if needed, at the input side of the isolation transformer. The isolation transformer comes alive when pulsed. Amperage becomes a part of the consideration only at the isolation transformer. Faulty design, resulting in hysteresis, creates heat which self-destructs the transformer if it is overloaded. Transformers which have a composite core instead of the more common cores made from many layers of thin sheets of soft iron, run cool and can tolerate much higher amperage.

RESONATE ELECTROMAGNETIC POWER SYSTEM



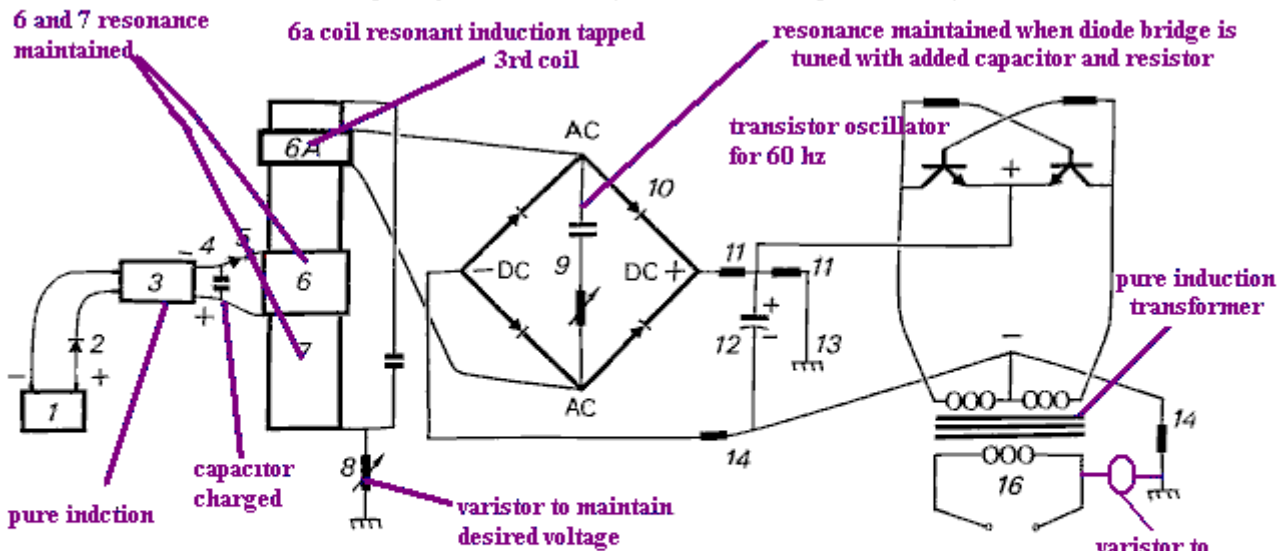
- Power Source: B - 1 Gelcell, 12 Volt, 7 Amp Hour
 D - 1 Kick back protection for L - 1
 L - 1 Bertonee, NPS - 12D8, constant burn Neon Tube transformer, Bertonee, Boston, MS
- Power Conditioner: C - 1, Capacitor or Capacitor Bank, 8,000 microfarads for 480 volts DC. R - 1, Resistor used to set electron pump rate, frequency of the capacitor. Maintains the desired voltage level required to operate the system.
- Voltage Control: V-1, Varistor, limits the voltage as required for the Output Transformer L -2. (480 V @ 60 Amps)
- Output Transformer: Isolation Type, (L - 2 / L-3) with R - 2 (resistor) correcting the output frequency to 60 CPS, being 60 UP and 60 DN (120 total). (28.8 KVA)

Useful Timing Formulas:

T = frequency in cycles per second
 C = capacitance in microfarads
 L = Inductance in millihenries
 R = resistance in ohms

Therefore: $T = RC$ and $T = \frac{L}{R}$

ELECTRICAL ENERGY GENERATING SYSTEM



1. Galcel, 6 or 12 Volt.
2. Diode, Pass. use a Varactor.
3. High Voltage Module, Consisting 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, 6A = L-5
7. Induction Receiving Coil L-4.
8. Voltage Control Shunt.
9. Frequency Adjustor, prevents derating 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).

20 Dec., 1994

The information shown above, relates to the small Suitcase Model demonstrated at the 1996 Tesla Convention, presented as Don Smiths' Workshop. This unit was a very primitive version and newer versions have atomic batteries and power output ranges of Gigawatts. The battery requirement is low level and is no more harmful than the radium on the dial of a clock. Commercial units of Boulder Dam size are currently being installed at several major locations throughout the world. For reasons of Don's personal security and contract obligations, the information which he has shared here, is incomplete.

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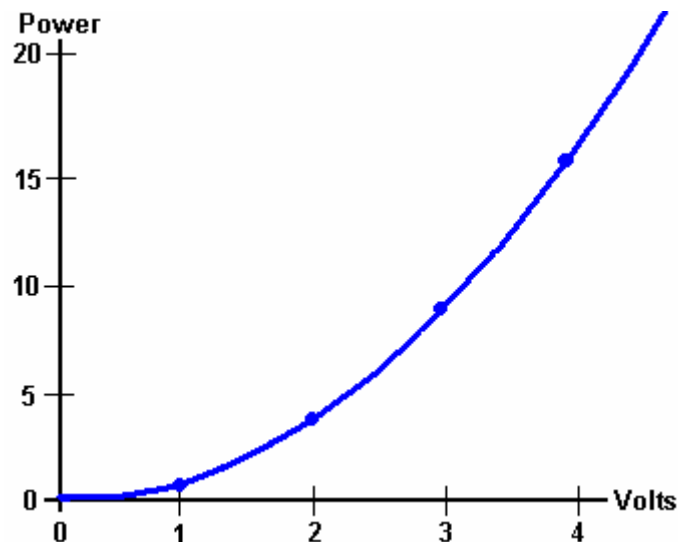
PJK: I am most definitely not an expert in this area. However, it is probably worth mentioning some of the main points which Don Smith appears to be making. There are some very important points being made here, and grasping these may make a considerable difference to our ability to tap into the excess 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 it's 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.

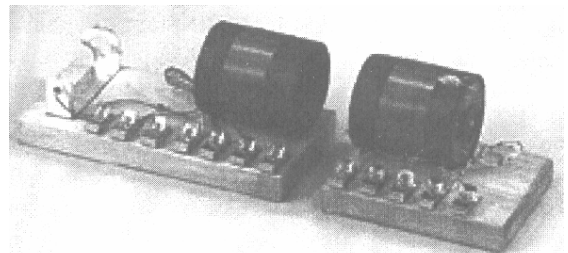
However, if we want to extract energy from the environment, then we should go for high voltage and high frequency. Then, when high power has been extracted, if we want a low frequency suited to electric motors, we can pulse the already captured power at that low frequency.

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.

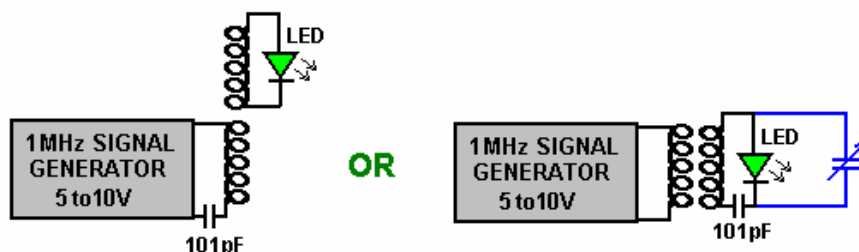
3. Magnetic / Electric relationship. Don states that the reason why our present power systems are so inefficient is because we concentrate on the electric component of electromagnetism. These systems are always COP<1 as electricity is the 'losses' of electromagnetic power. Instead, if you concentrate 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 it's 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 it's 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:



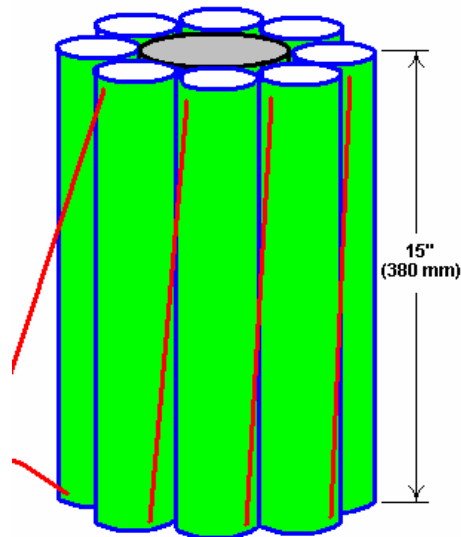
Before you buy the kit, it is not mentioned that in order to use it, you now need a signal generator capable of producing a 10-volt signal at 1 MHz. The coil has a DC resistance of just 1.9 ohms but at a 1 MHz resonant frequency, the necessary drive power is quite low.

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 as described in chapter 5.

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.

Note: 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 L - 1 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 L - 1 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:

Hz = Resistance x Farads then

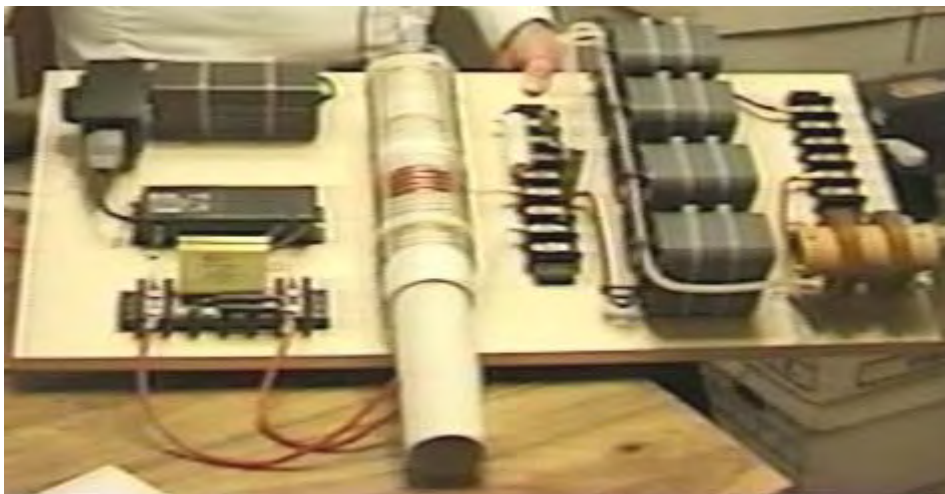
$50 \text{ Hz} = R \times 0.00002$

so $50 / 0.00002 = 2500000$

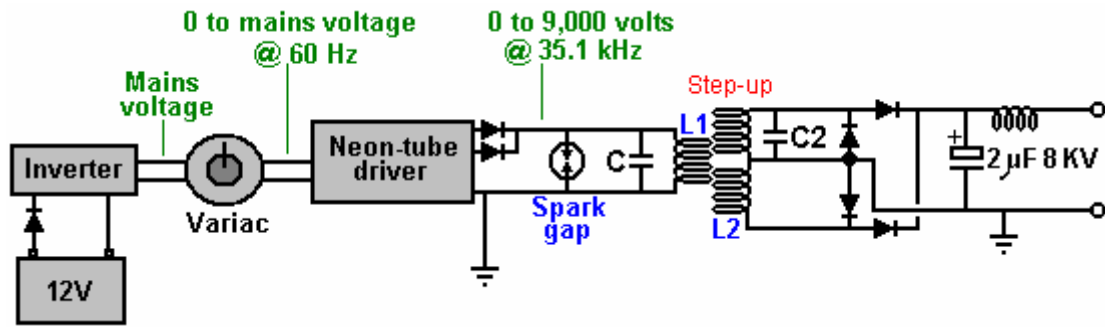
and $R = 2500000$ or 2.5 Meg Ohms.

We then place all three components in parallel and our coil should give us a 50 Hz output.

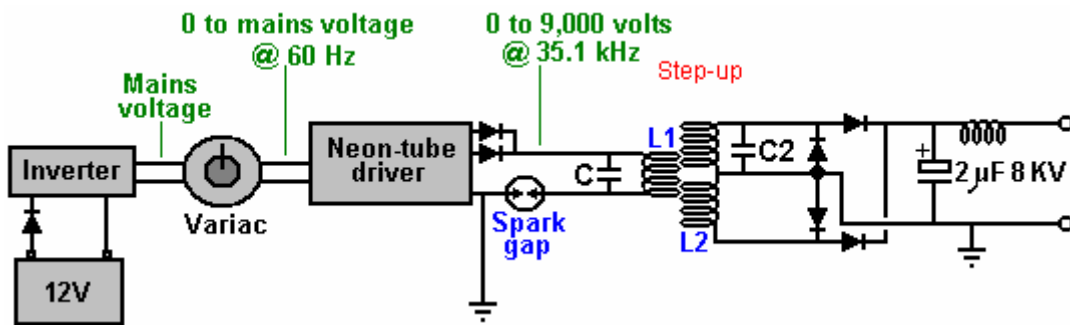
Don provides quite an amount of information on one of his devices shown here:



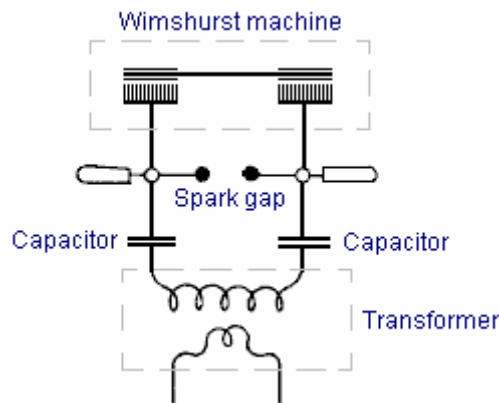
Without his description of the device, it would be difficult to understand its construction and method of operation. As I understand it, the circuit of what is mounted on this board is as shown here:



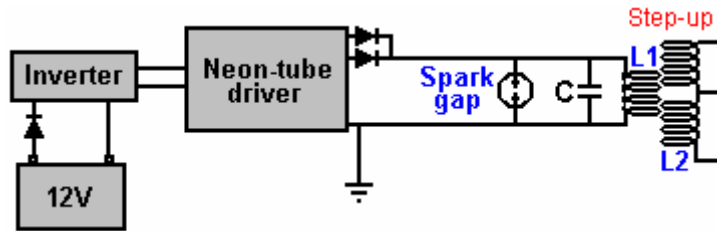
This arrangement has bothered some readers recently as they feel that the spark gap should be in series with the L1 coil, like this:



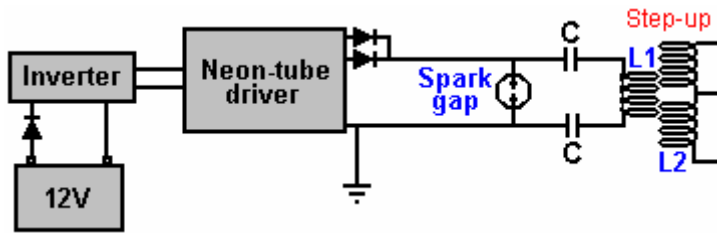
This is understandable, as there is always a tendency to think of the spark gap as being a device which is there to protect against excessive voltages rather than seeing it as an active component of the circuit, a component which is in continuous use. In 1925, Hermann Plauson was granted a patent for 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:



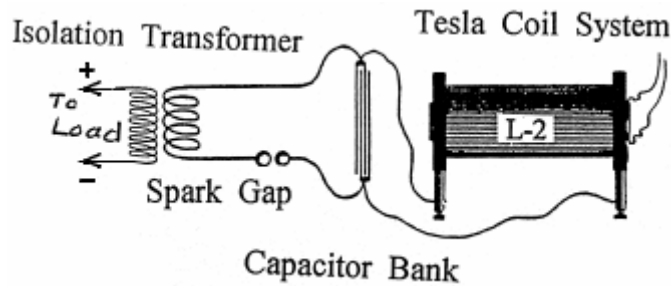
Here, the output of the Wimshurst machine is stored in two high-voltage capacitors (Leyden jars) causing a very high voltage to be created across those capacitors. When the voltage is high enough, a spark jumps across the spark gap, causing a massive surge of current through the primary winding of the 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:

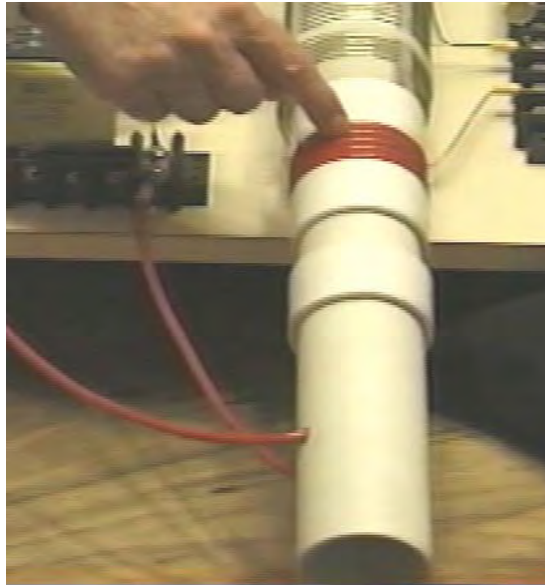


Please note that when an earth connection is mentioned in connection with Don Smith's devices, we are talking about an actual wire connection to a metal object physically buried in the ground, whether it is a long copper rod driven into the ground, or an old car radiator buried in a hole like Taniel 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.

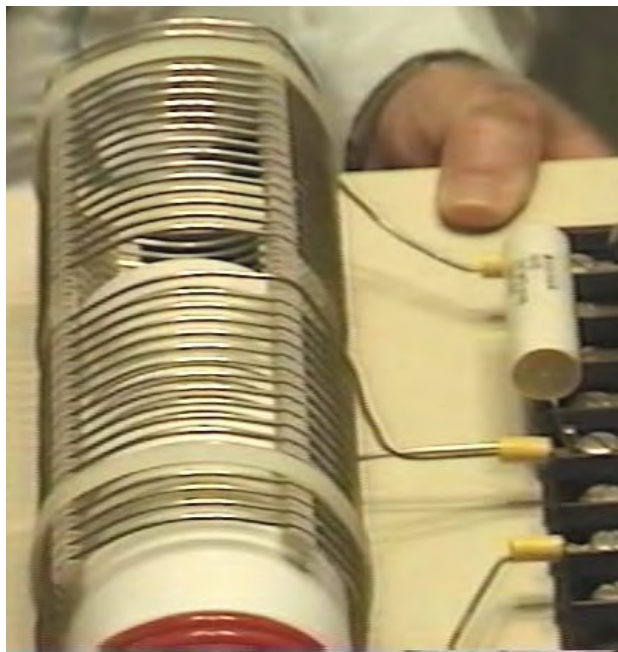
The operating frequency of 35.1 kHz is set and maintained by the neon-tube driver circuitry, and so, in theory, we do not have to do any direct tuning ourselves. However, we want the resonant frequency of the L1 coil and the capacitor across it to match the neon-driver circuit frequency. The frequency 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.

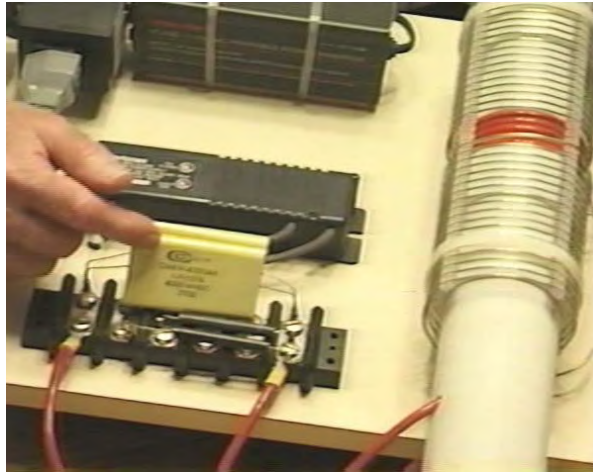
You will notice that Don has placed a plastic collar on each side of the winding, matching the thickness of the wire, in order to create a secure sliding operation inside the outer "L2" coil, and the additional plastic collars positioned further along the pipe provide further support for the inner coil. 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.

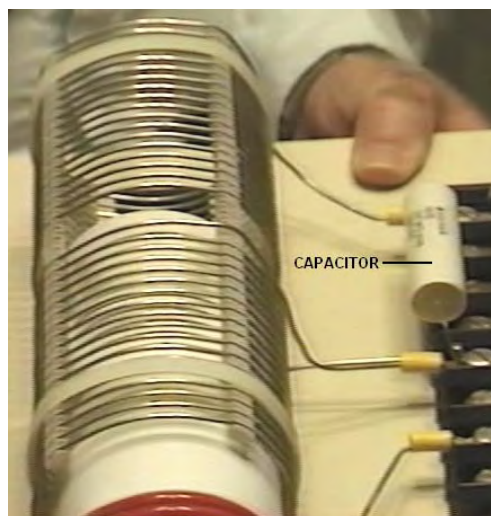
One point which Don stresses, is that the length of the wire in the "L1" coil and the length of wire in the "L2" coil, must be an exact even division or multiple of each other (in this case, the "L2" wire length in each half of the "L2" coil is exactly four times as long as the "L1" coil wire length). 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":

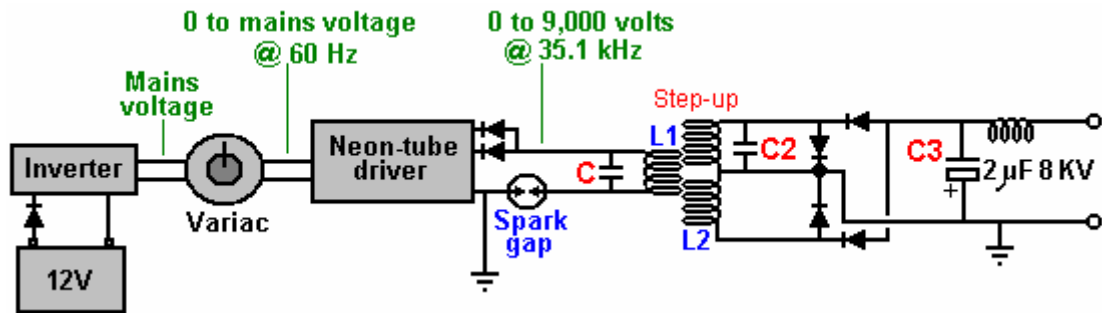


There are various ways of dealing with the output from the "L2" coil in order to get large amounts of conventional electrical power out of the device. The method shown here uses the four very large capacitors seen in the photograph. These have an 8,000 or 9,000 volt rating and a large capacity and they 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 "silverhealthu" 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:



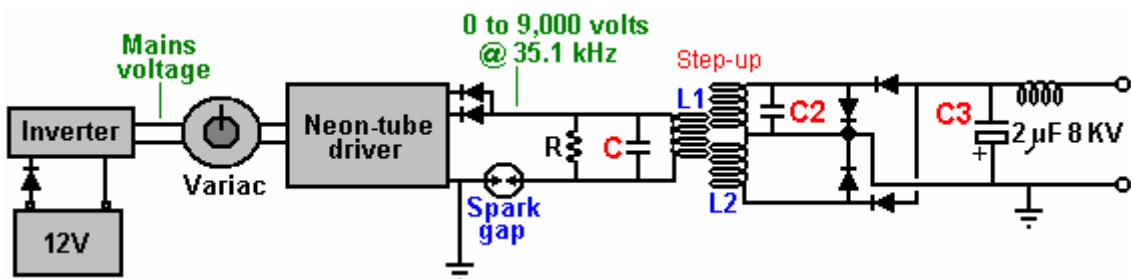
He comments: "the diodes leaving the Neon-tube Driver may need to be reversed as we want to collect the negative polarity. The spark gap will then operate on ambient inversion and the spark will look and sound totally different with a much faster crack and producing very little heat and even becoming 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.

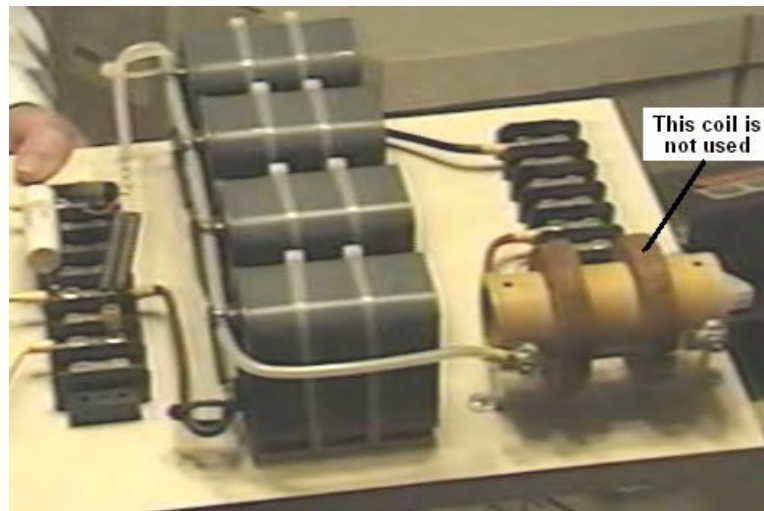
Also remember that the Back-EMF systems of John Bedini and others, create a small positive pulse but they collect a super large NEGATIVE polarity spike which shoots off the bottom of an oscilloscope display. This is what we want, plenty of this stored in capacitors, and then let the ambient background 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.

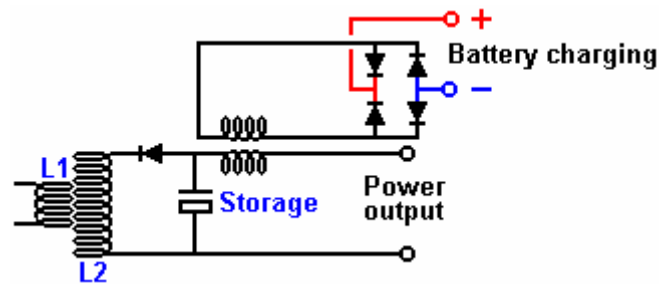


One reader has drawn attention to the fact that Don's main document indicates that there should be a resistor "R" across the L1 coil as well as the capacitor "C" and he suggests that the circuit should actually be as shown above, considering what Don said earlier about his "suitcase" design. Another 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.

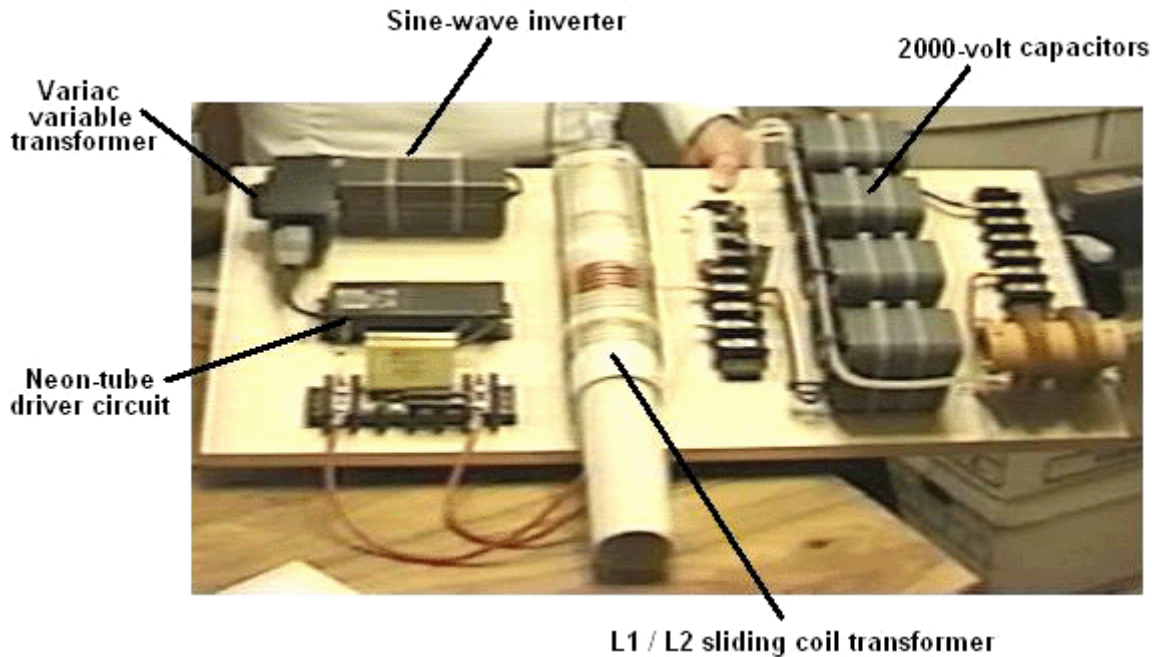
When the circuit is running, the storage capacitor bank behaves like an 8,000 volt battery which never runs down and which can supply 20 amps of current for as long as you want. The circuitry for producing a 220 volt 50 Hz AC output or a 110 volt 60 Hz AC output from the storage capacitors is just standard 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:



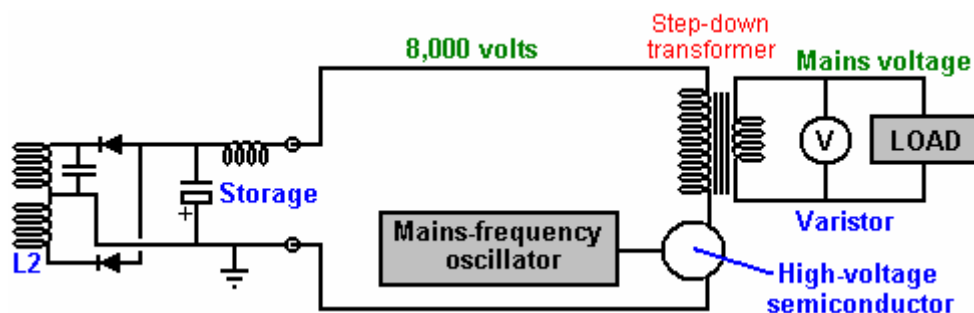
The DC output produced by the four diodes was then used to charge the driving battery, and the power level produced is substantially greater than the minor current drain from the battery. Consequently, it is a sensible precaution to pass this current to the battery via a circuit which prevents the battery 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:

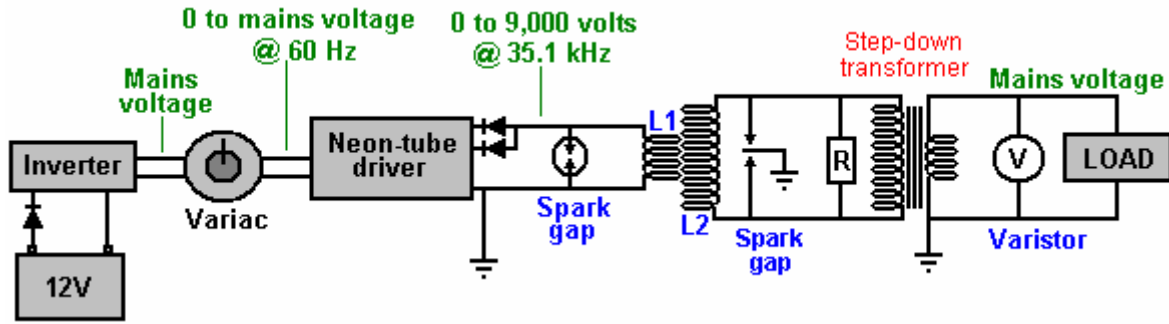


The voltage has to be dropped, so an iron-cored mains-frequency step-down transformer is used to do this. To get the frequency to the standard mains frequency for the country in which the device is to be used, an oscillator is used to generate that particular mains frequency. The oscillator output is 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

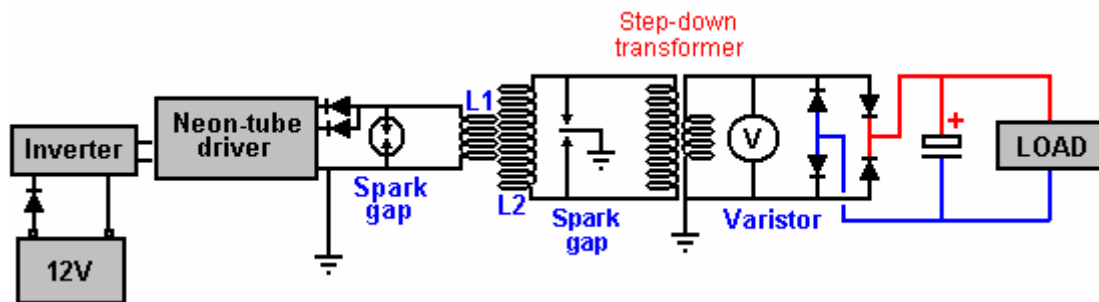
across the load. This device acts as a voltage spike suppressor as it short circuits any voltage above its design voltage, protecting the load from power surges.

Don also explains an even more simple version of the circuit as shown here:

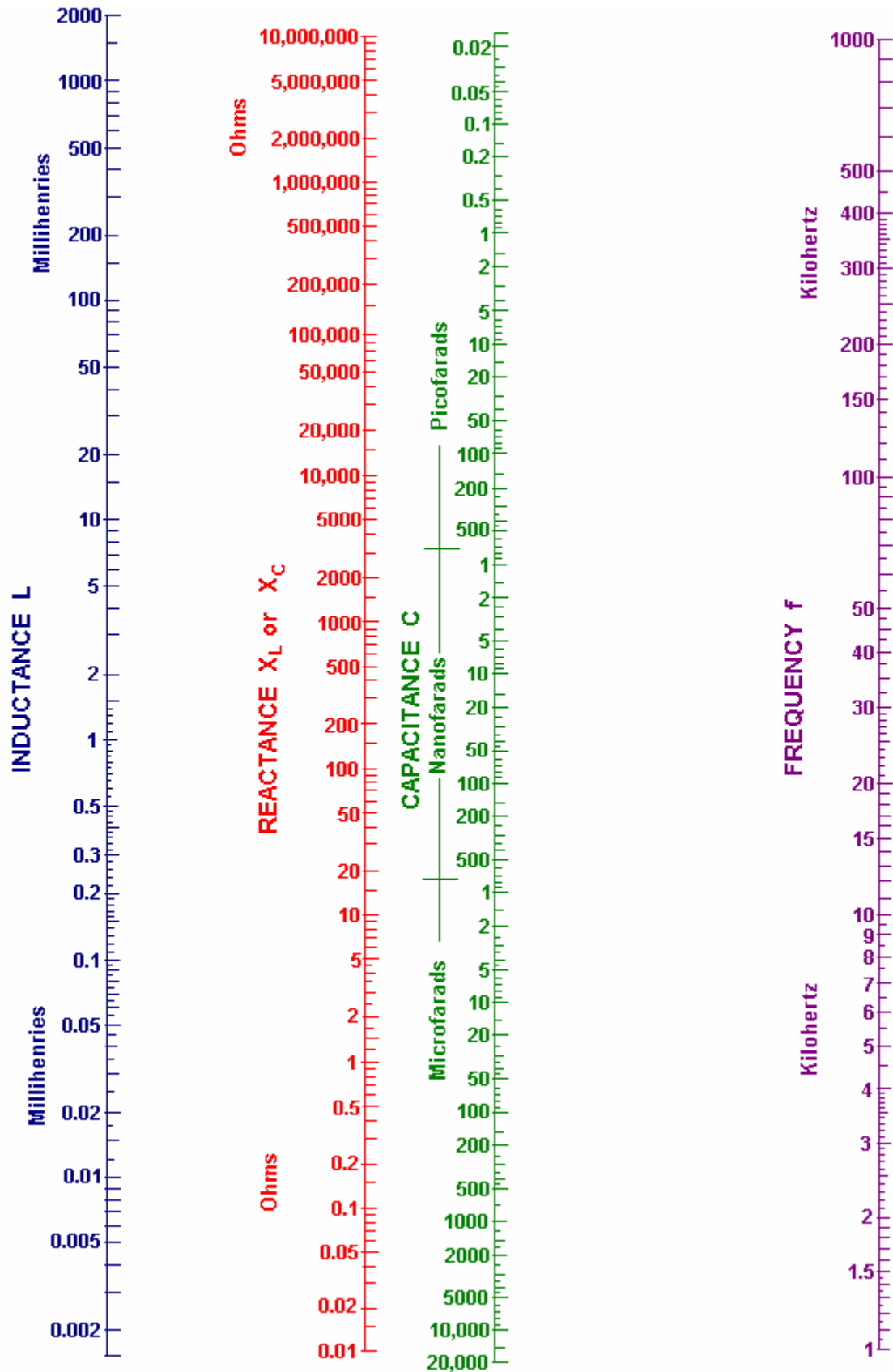


This simplified circuit avoids the need for expensive capacitors and the constraints of their voltage ratings, and the need for electronic control of the output frequency. The wire length in the turns of coil "L2" still needs to be exactly four times the wire length of the turns in coil "L1", but there 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 which can be downloaded using <http://www.free-energy-info.com/Smith.pdf>). 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:

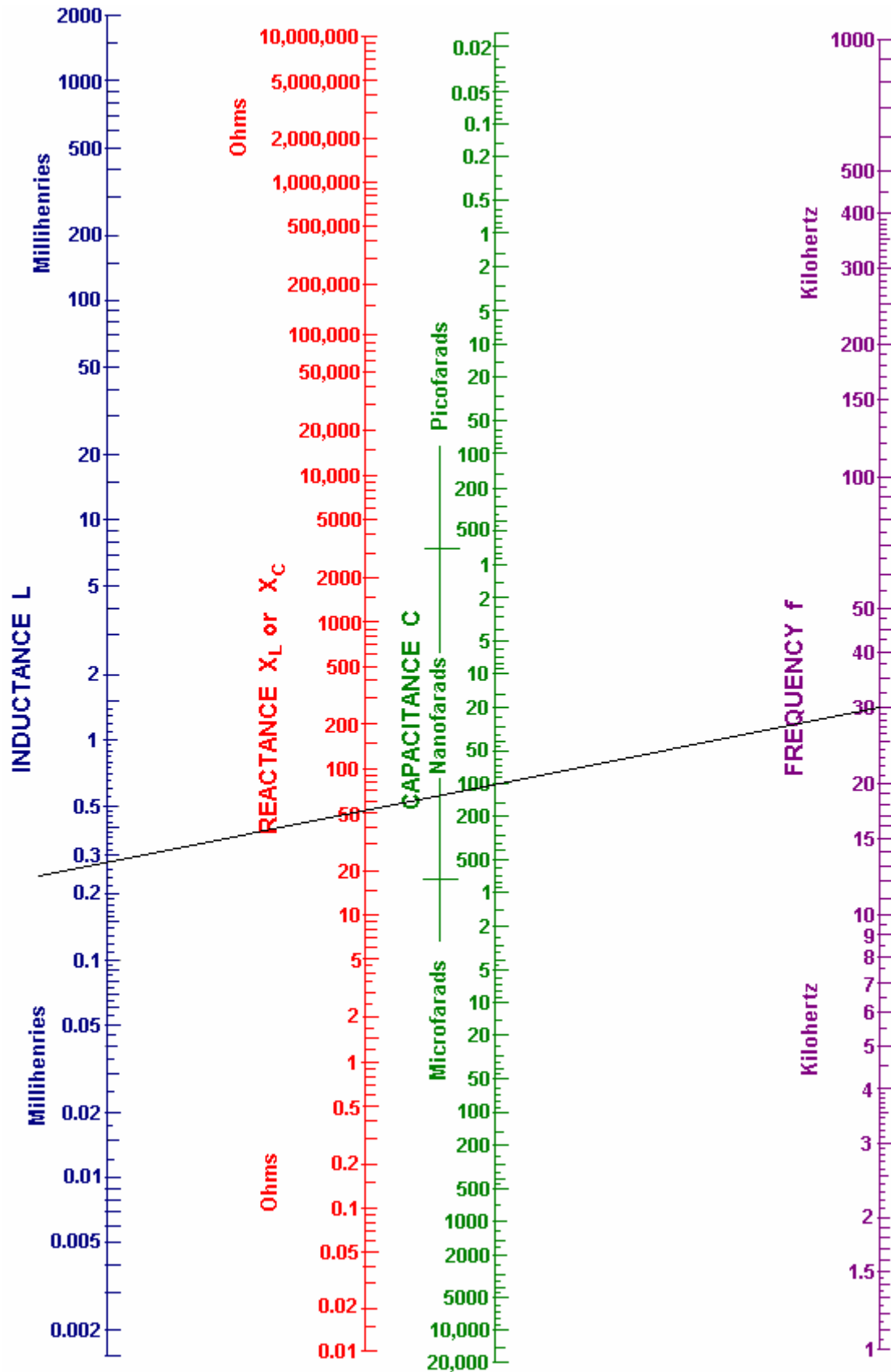


As many people will find the nomograph chart in Don's pdf document very difficult to understand and use, here is an easier version:



The objective here is to determine the "reactance" or 'AC resistance' in ohms and the way to do that is as follows:

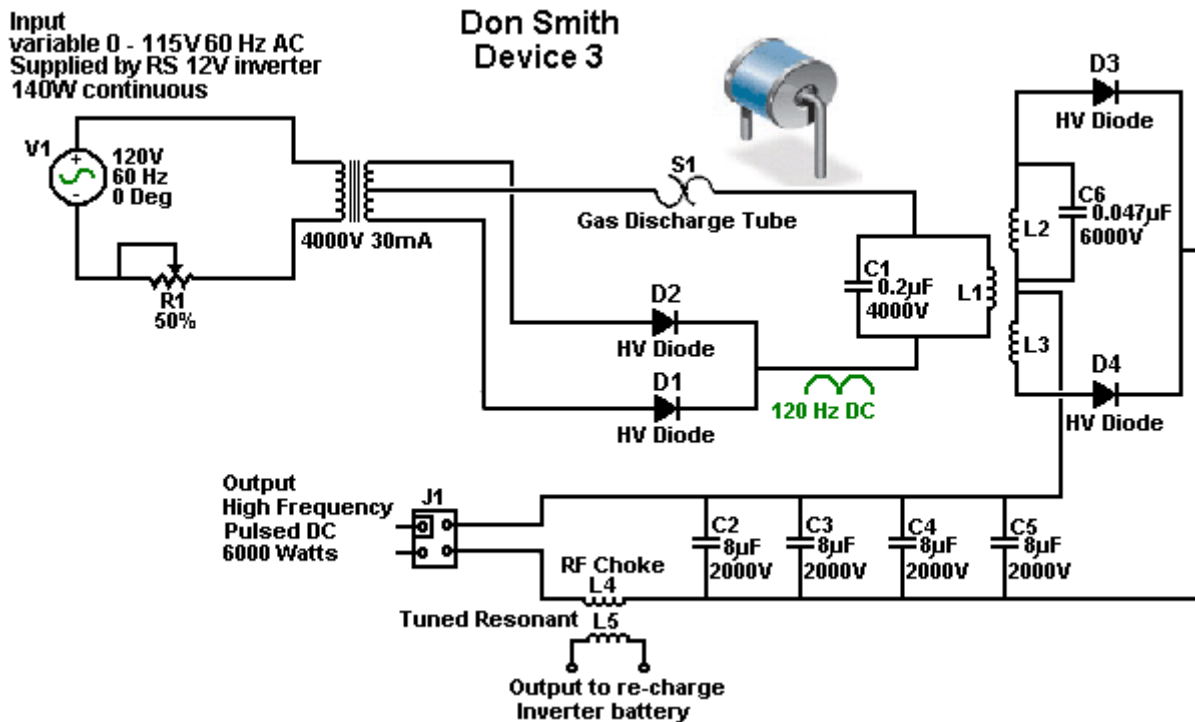
Suppose that your neon-tube driver is running at 30 kHz and you are using a capacitor of 100 nF (which is the same as 0.1 microfarad) and you want to know what is the AC resistance of your capacitor is at that frequency. Also, what coil inductance would have that same AC resistance. Then the procedure for finding that out is as follows:



Draw a straight line from your 30 kHz frequency (purple line) through your 100 nanofarad capacitor value and carry the line on as far as the (blue) inductance line as shown above.

You can now read the reactance ("AC resistance") off the red line, which looks like 51 ohms to me. This means that when the circuit is running at a frequency of 30 kHz, then the current flow through your 100 nF capacitor will be the same as through a 51 ohm resistor. Reading off the blue "Inductance" line that same current flow at that frequency would occur with a coil which has an inductance of 0.28 millihenries.

I have recently been passed a copy of Don's circuit diagram for this device, and it is shown here:



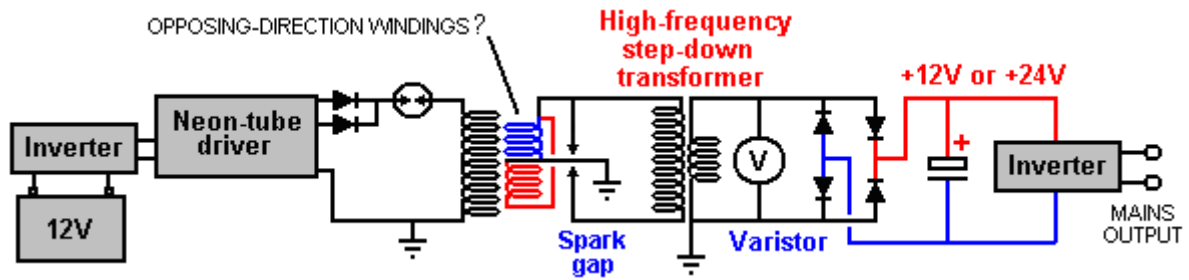
The 4000V 30mA transformer shown in this circuit diagram, may use a ferrite-cored transformer from a neon-tube driver module which steps up the voltage but it does not raise the frequency as that is clearly marked at 120 Hz pulsed DC. You will notice that this circuit diagram is drawn with Plus shown below Minus (which is most unusual).

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 used, or a buried metal plate. 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.

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 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.

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.

This circuit is effectively two Tesla Coils back-to-back and the circuit diagram might be:



It is by no means certain that in this circuit, the red and blue windings are wound in opposing directions. The spark gap (or gas-discharge tube) in series with the primary of the first transformer alters the operation in a somewhat unpredictable way as it causes the primary to oscillate at a frequency determined by its inductance and its self-capacitance, and that may result in megahertz frequencies. The secondary winding(s) of that transformer **must** resonate with the primary and in this circuit which has no frequency-compensating capacitors, that resonance is being produced by the exact wire length in the turns of the secondary. This looks like a simple circuit, but it is anything but that. The excess energy is produced by the raised frequency, the raised voltage, and the very sharp pulsing produced by the spark. That part is straightforward. The remainder of the circuit is likely to be very difficult to get resonating as it needs to be in order to deliver that excess energy to the output inverter.

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.

One very significant thing which Don pointed out is that the mains electricity available through the wall socket in my home, does **not** come along the wires from the generating station. Instead, the power station influences a local ‘sub-station’ and the electrons which flow through my equipment actually come from my local environment because of the influence of my local sub-station. Therefore, if I can create a similar influence in my home, then I no longer need that sub-station and can have as much electrical energy as I want, without having to pay somebody else to provide that influence for me.

A Practical Implementation of one of Don Smith’s Designs

The objective here, is to determine how to construct a self-powered, free-energy electrical generator which has no moving parts, is not too expensive to build, uses readily available parts and which has an output of some kilowatts. However, under no circumstances should this document be considered to be an encouragement for you, or anyone else to actually build one of these devices. This document is presented solely for information and educational purposes, and as high voltages are involved, it should be considered to be a dangerous device unsuited to being built by inexperienced amateurs. The following section is just my opinions and so should not be taken as tried and tested, working technology, but instead, just the opinion of an inexperienced writer.

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.

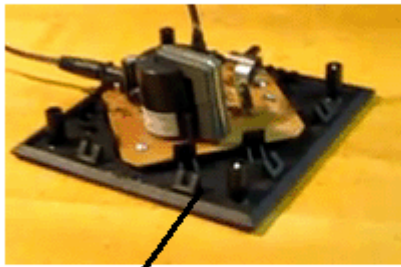
3. This high-voltage, high-frequency, high-power energy needs to be converted to the same sort of hot electricity which comes out of a mains wall socket at the local voltage and frequency. This is where skill and understanding come into play. The first step is to lower the voltage and increase the available 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:

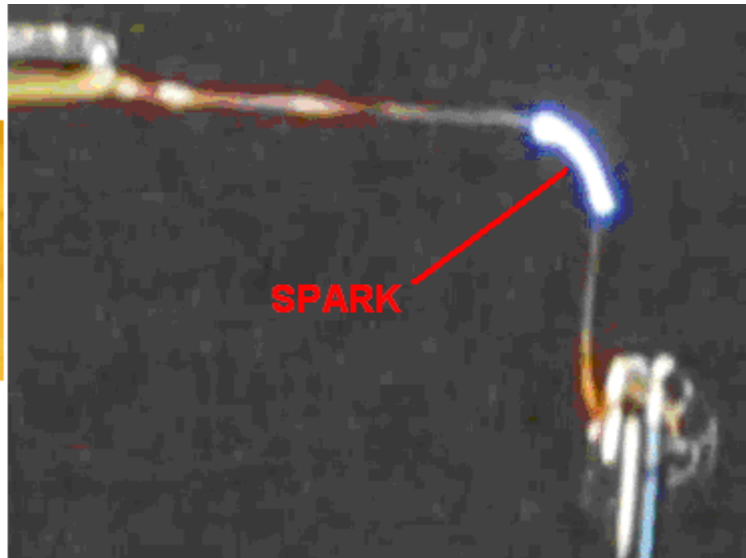
1. We want to produce a high-voltage, high-frequency, low-current power source. Don Smith shows a Neon-Sign Transformer module. His module produced a voltage which was higher than was convenient and so he used a variable AC transformer or “Variac” as it is commonly known, to lower the input voltage and 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.

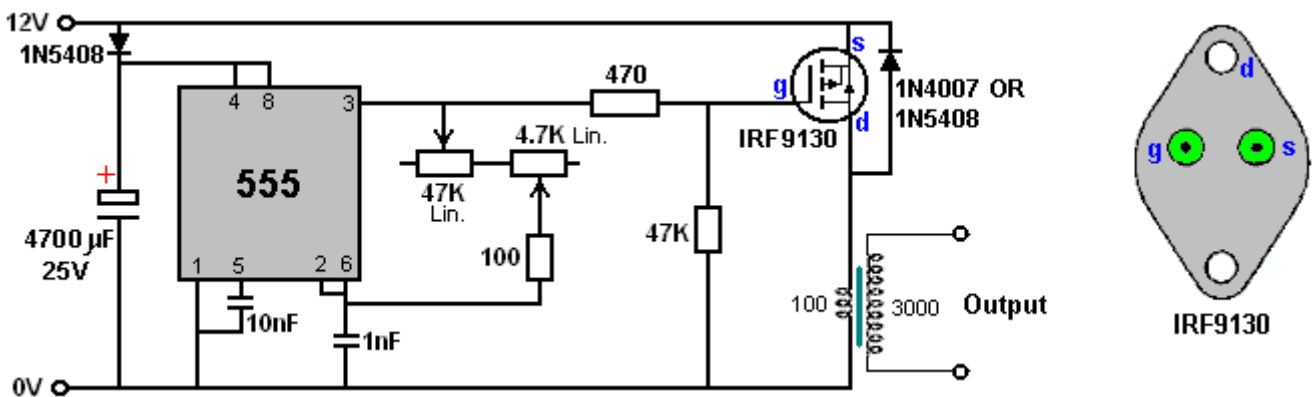
A much cheaper alternative is shown here: http://www.youtube.com/watch?v=RDDRe_4D93Q where a small plasma globe circuit is used to generate a high-frequency spark. It seems highly likely that one of those modules would suit our needs:



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 its 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:



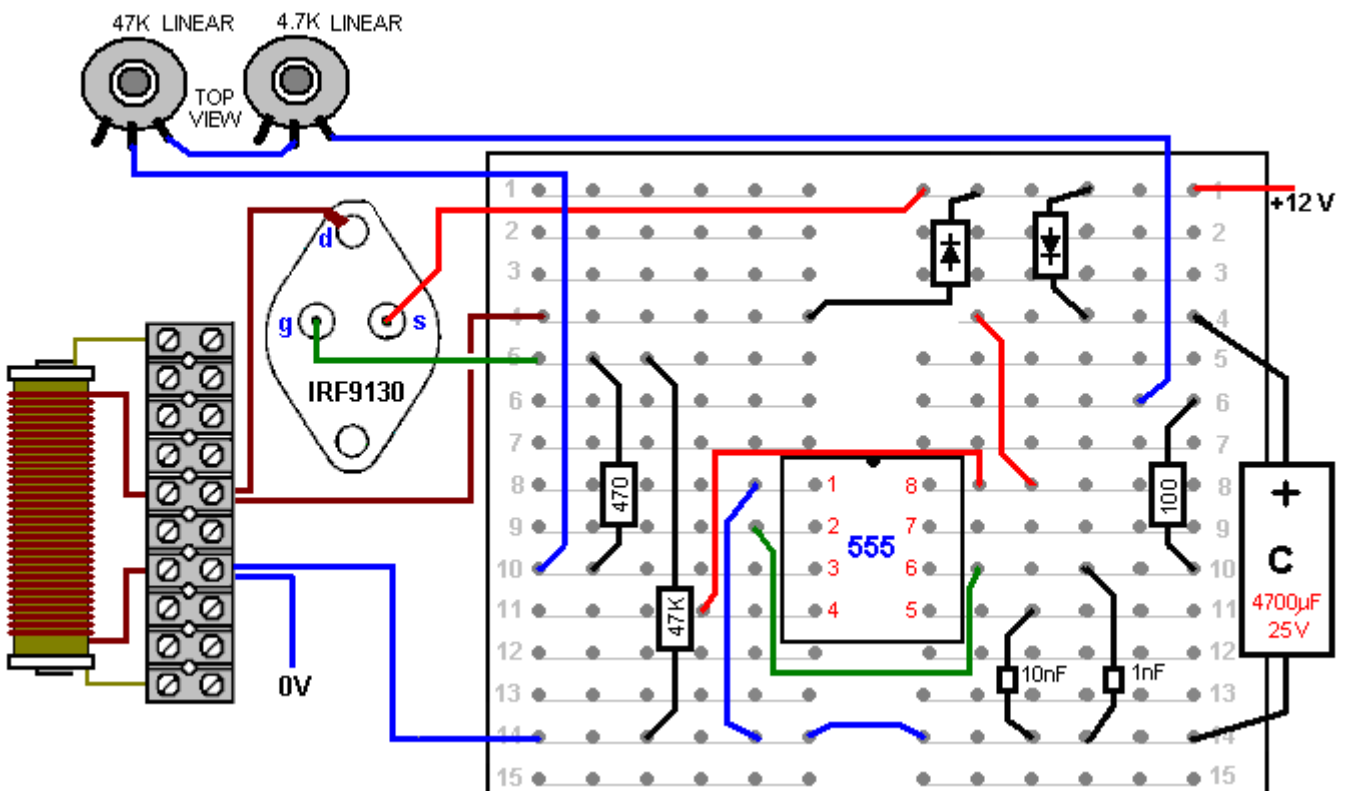
The circuit has a power supply diode and capacitor, ready to receive energy from the output at some later date if that is possible and desired. The 555 circuit is standard, giving a 50% Mark/Space ratio. The 10 nF capacitor is there to maintain the stability of the 555 and the timing section consists 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

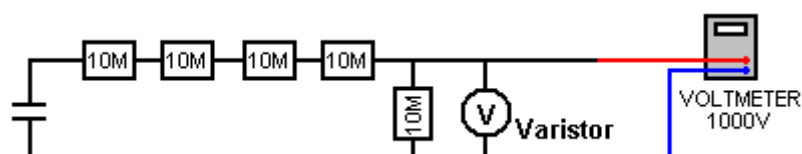
number of primary winding turns. With a 12-volt supply, this will give a 360-volt output waveform, and by reducing the primary turns progressively, allows the output voltage to be increased in controlled steps. With 10 turns in the primary, the output voltage should be 3,600 volts and with just 5 turns 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.



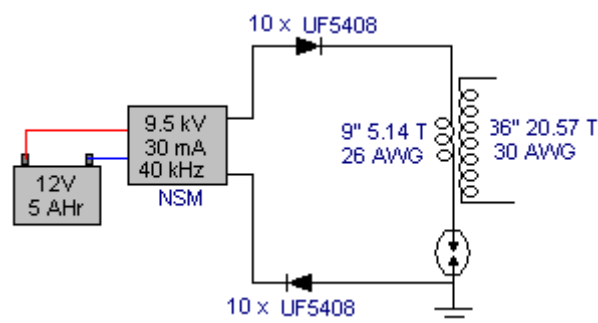
Neon



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:



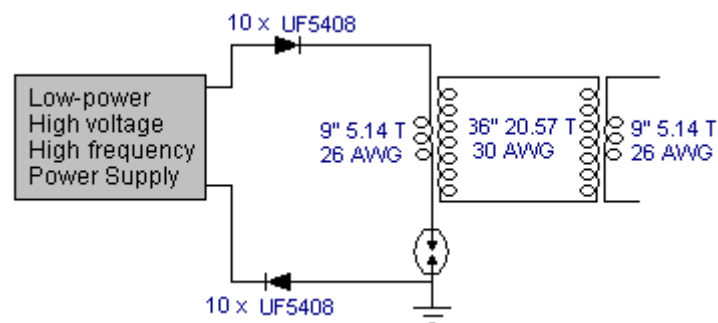
Ho Sung International. EI-2820 nylon bobbin. Core is 10 mm x 13 mm x 10 mm high. Top is 18.5 mm x 21.5 mm. Base is 22 mm x 26 mm. Four leads, 15 mm and 20 mm spacing

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.

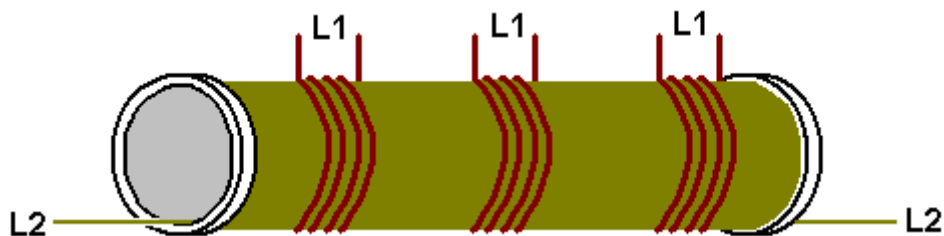
The circuit above, produces a cold electricity output of high voltage and high frequency. The voltage will not be the same as the neon transformer voltage, nor is the frequency the same either. The two coils resonate at their own natural frequency, unaltered by any capacitors.

3. The next step is to get the high voltage down to a more convenient level, perhaps, like this:



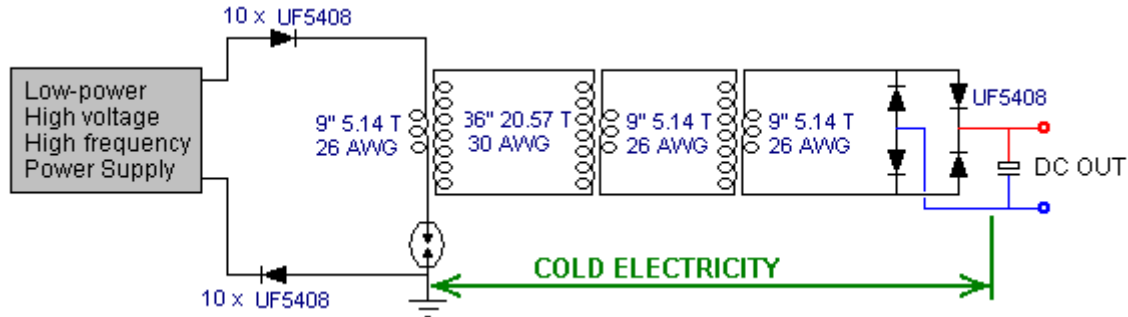
Here, an identical transformer, wound in exactly the same way, is used in reverse, to start the voltage lowering sequence. The wire length ratio is maintained to keep the transformer windings resonant with each other.

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:



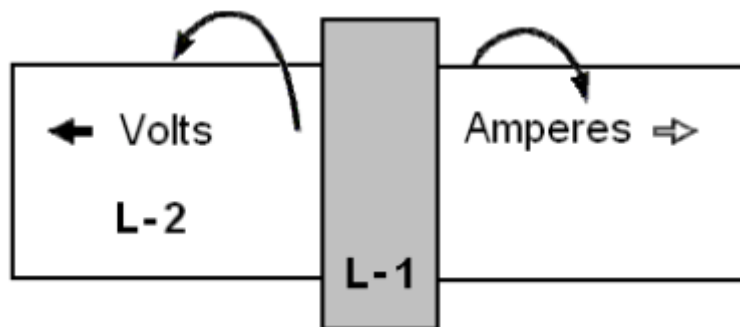
Probably the easiest conversion is by feeding the energy into a capacitor and making it standard DC. The frequency is still very high, so high-speed diodes (such as the 75-nanosecond UF54008) are needed here although the voltage level is now low enough to be no problem. The DC output can be used to power 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).

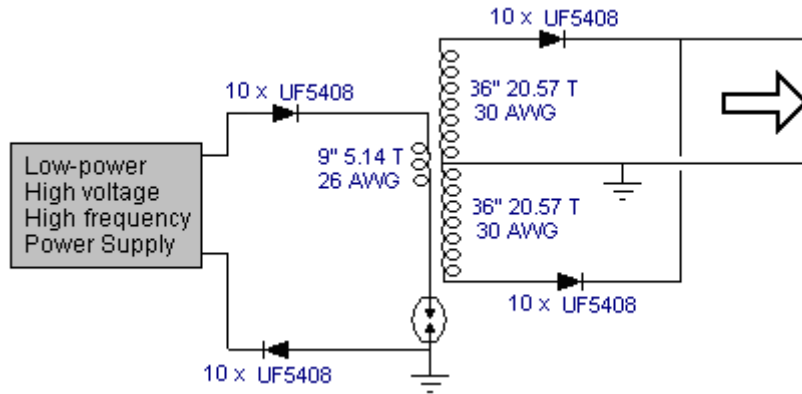
However, there are some other factors which have not been mentioned. For example, if the L1 coil is wound directly on top of the L2 coil, it will have roughly the same diameter and so, the wire being four times longer, will have roughly four times as many turns, giving a step-up or step-down ratio of 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:

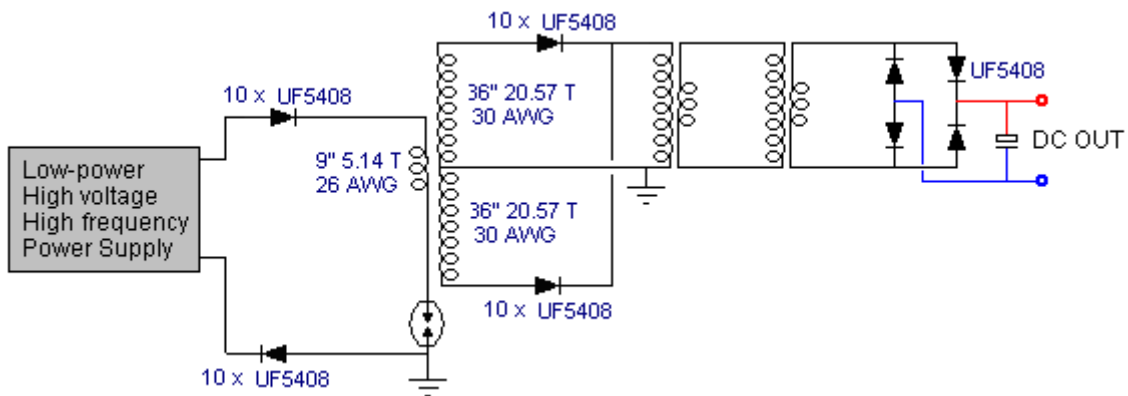


It has been suggested that a greater and more effective power output can be obtained by splitting the L2 coil underneath the L1 coil position, winding the second part of L2 in the opposite direction and grounding the junction of the two L2 windings. Don doesn't consider it necessary to reverse the direction of winding. The result is an L2 winding which is twice as long as before and arranged like this:

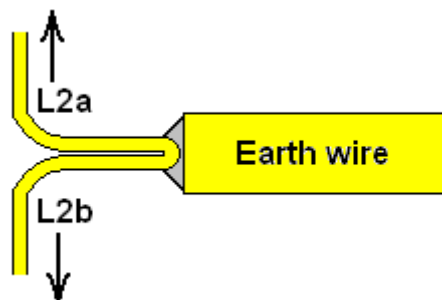


Here, the additional high-voltage diodes allow the two out of phase windings to be connected across each other. You will notice that this arrangement calls for two separate earth connections, both of which need to be high-quality connections, something like a pipe or rod driven deeply into moist soil 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:



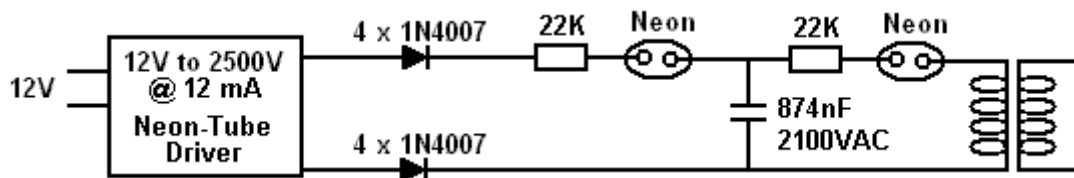
These are just some ideas which might be considered by some experienced developer who may be thinking of investigating Don Smith style circuitry.

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).

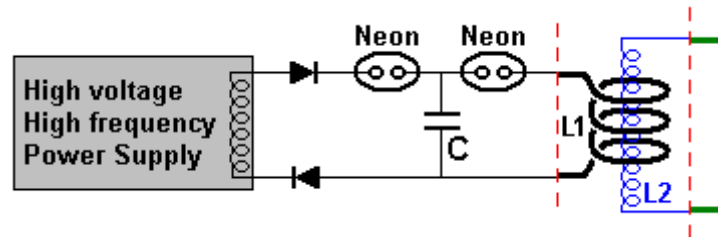
This output is fed through an optional 22K resistor via a neon lamp to a microwave oven capacitor which happens to be 874 nF with a voltage rating of 2,100 volts. You might feel that the voltage rating of the capacitor is too low for the output voltage of the neon sign module, but the neon has a striking 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.

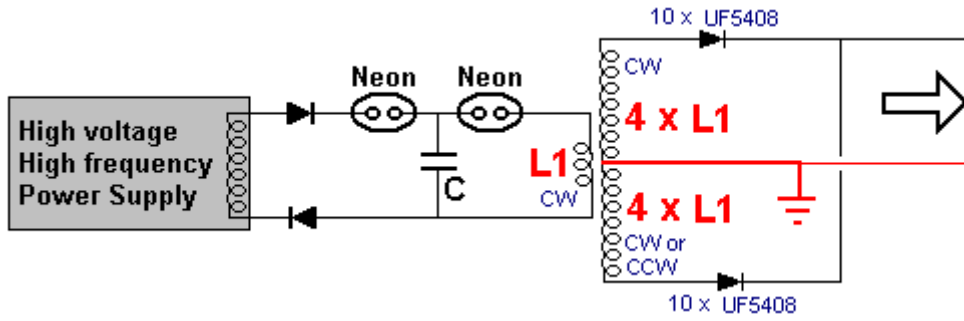
A point to note is that the lower diode is shown reversed when compared to the previous diagram. This is because the power supply shown is any generic power supply which drives a simple output coil which does not have a centre tap. The neon supply of the earlier diagram appears to have two separate outputs 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.

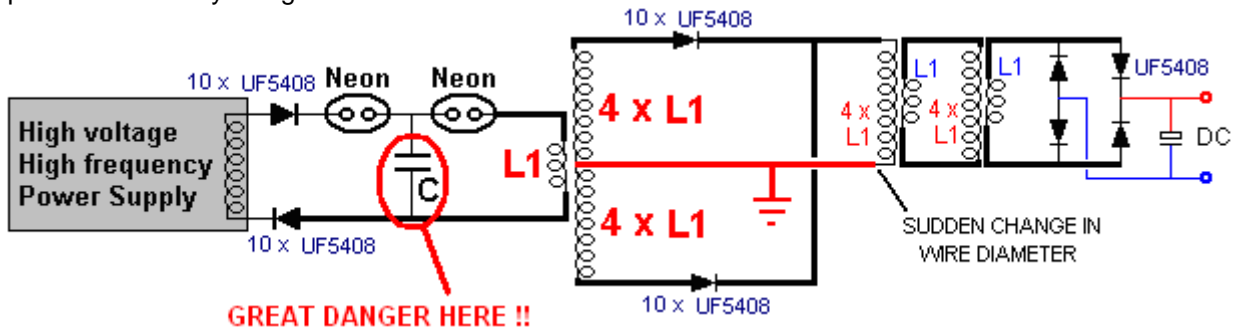
Actually, it doesn't matter at all, because the L1 coil (and the L2 coil if you measure them accurately) has a resonant frequency all of its own and it will vibrate at that frequency no matter what the frequency feeding it happens to be. A coil resonates in very much the same way that a bell rings when it is struck. It doesn't matter how hard you strike the bell or how rapidly you strike it – the bell will ring at its own natural frequency. So the L1 coil will resonate at its own natural frequency no matter what rate the voltage spikes striking it arrive, and as the L2 coil has been carefully constructed to have exactly that same frequency, it will resonate in synchronisation with the L1 coil.

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:



Mind you, there is one other factor to be considered when deciding what the most convenient wire length for L1 might be, and that is the number of turns in the L1 coil. The larger the ratio between the turns in L1 and the turns in L2, the higher the voltage boost produced by the L1/L2 transformer, and remember that the length of L2 is fixed relative to the length of L1.

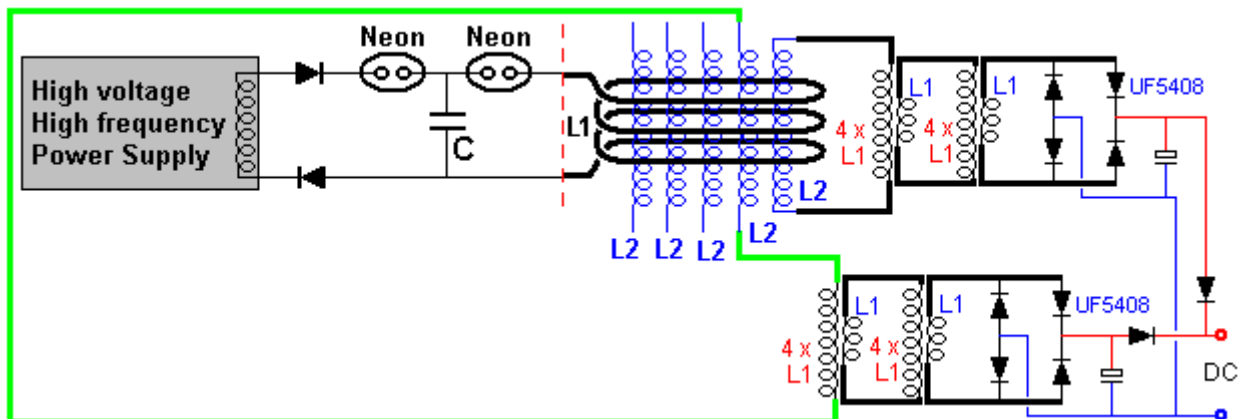
So, a possible circuit style might be:



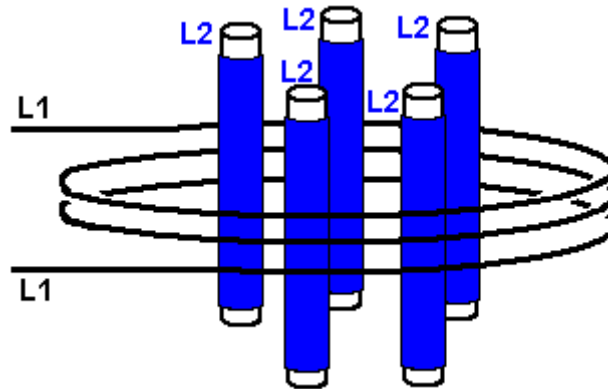
There are some important points to remember. One is that there must be a sudden change of wire diameter at both ends of each L1 coil and at the ends of each L2 coil. If there isn't, then the connecting wire length will form part of the coil and if there is some change in diameter but not very much, then it is anybody's guess what the resonant wire length for that coil will be. There can be as many step-down isolation air-core L1/L2 transformers as desired and these do not need to be particularly large or expensive.

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.

One final point is that as demonstrated in the video, the oscillating magnetic field produced by the L1 coil can power several identical L2 coils, giving several additional power outputs for no increase in input power, because the coupling is magnetic and not inductive as mentioned earlier in this chapter. Please notice that neither the L1 coil nor the L2 coil has a capacitor connected across it, so resonance is due 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.

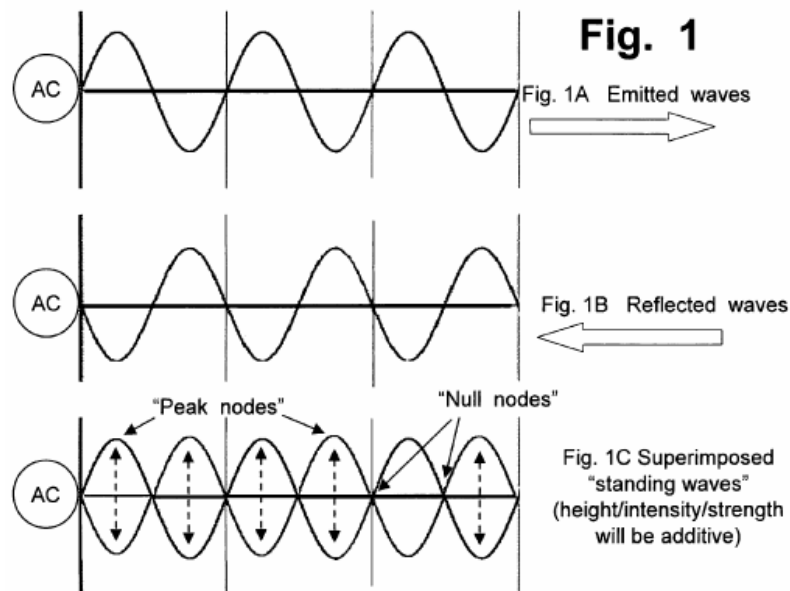


Fig.1A indicates an idealized wavelength of an alternating voltage, depicted by a sine wave which is being sent from an AC power supply (shown by a circle at the left end of a horizontal straight wire) into the “input” end of the wire. The voltage waves travel through the wire towards the right, as indicated 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.

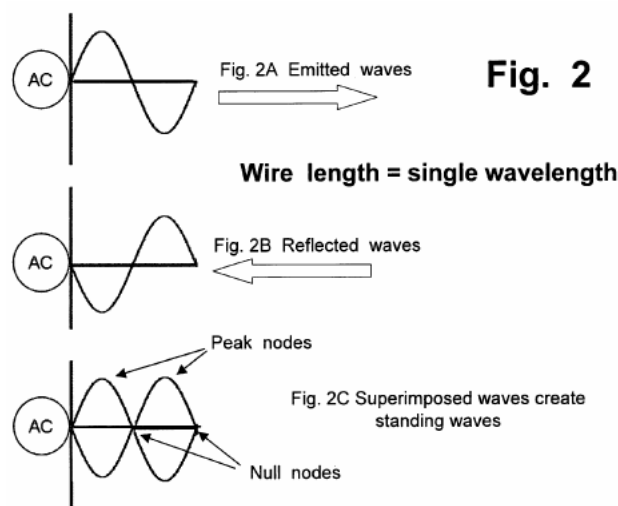
The second factor mentioned above, when the “double-double” boogie phrase was mentioned, relates to a doubling of the frequency of a standing wave. When a standing wave is created in a wire by reflection of an emitted AC voltage wave, the frequency of the standing wave is, quite literally, double the 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**.

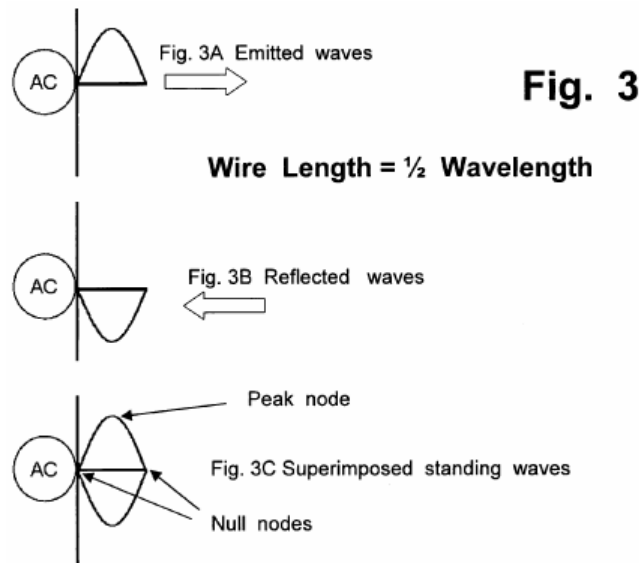
By contrast, each and every “bubble” shown in **Fig.1C** depicts a complete and total “wavelength”, in a standing wave. Six of those standing wave “bubbles” fit into exactly the same length of wire which holds only 3 emitted wavelengths from the power supply.

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.

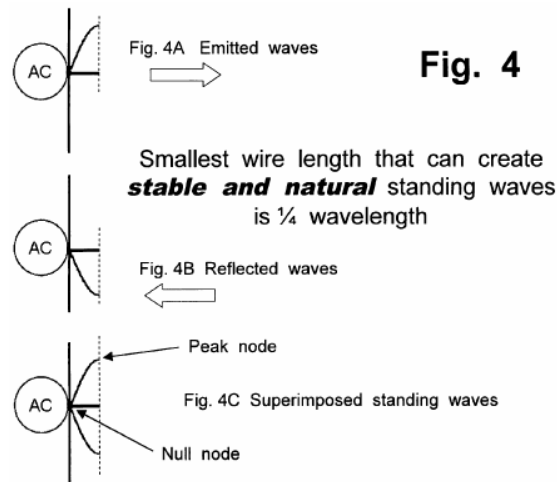
In the three panels of **Fig.1**, the wire length is three times as long as the wavelength of the voltage from the power supply. However, to create standing waves, a wire length does not need to be any particular multiple of the wavelength of an AC voltage. As can be seen by considering **Fig.1C**, the 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.

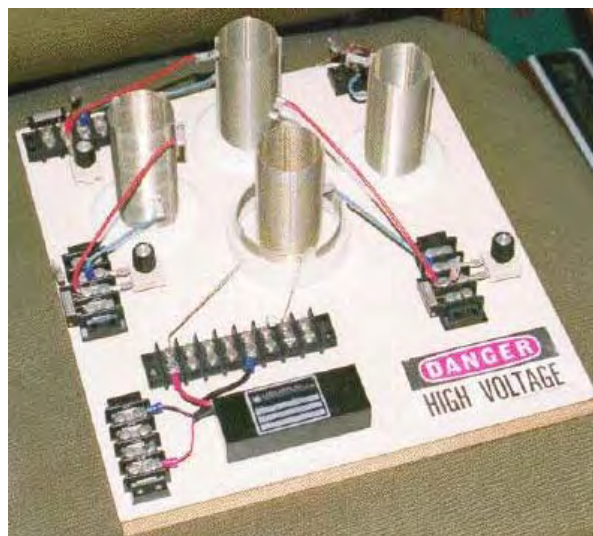
In some devices, telescoping components (or other elements which can alter the effective length of a wire-type element) can be used to alter the ability of the element to respond to a fixed wavelength. Many types of antennas use this approach, if they need to process signals which are being transmitted 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.

Another device of Don's 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").

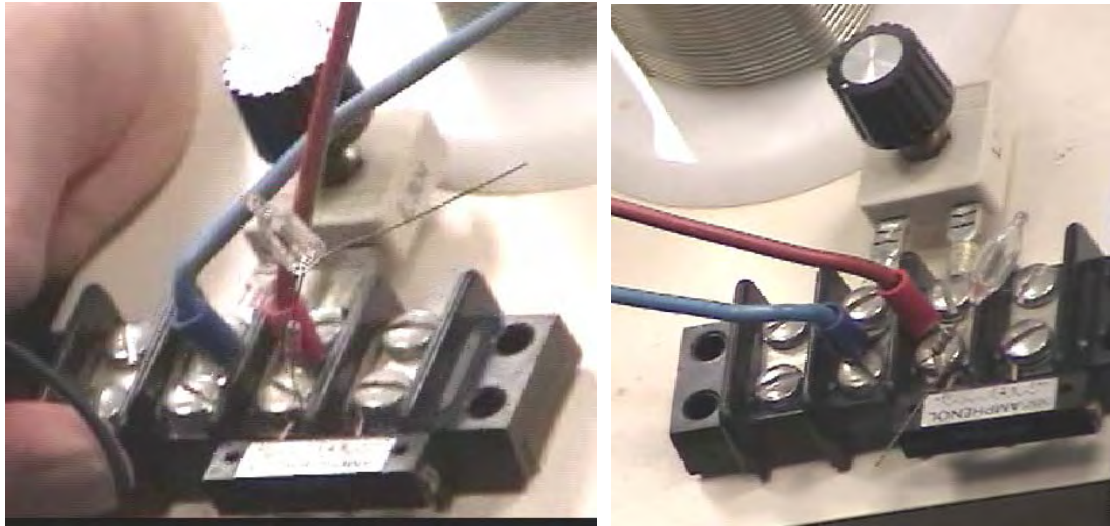
As before, a commercial neon-tube driver module is used to power the "L1" outer coil with high voltage and high frequency. It should be understood that as power is drawn from the local environment each time the power driving the transmitter coil "L1" cycles, that the power available is very much higher 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 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.

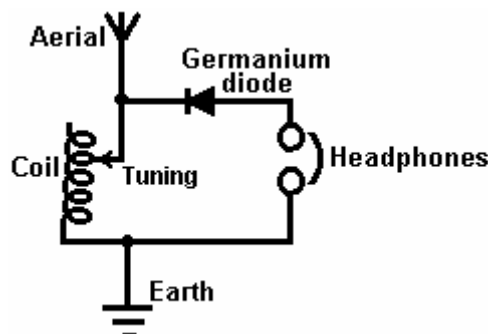
For higher frequencies, ferrite can be used for a core and that is why some portable radios use ferrite-rod aerials, which are a bar of ferrite with a coil wound on it. For higher frequencies (or higher efficiencies) iron dust encapsulated in epoxy resin is used. An alternative is to not use any core 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.

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:

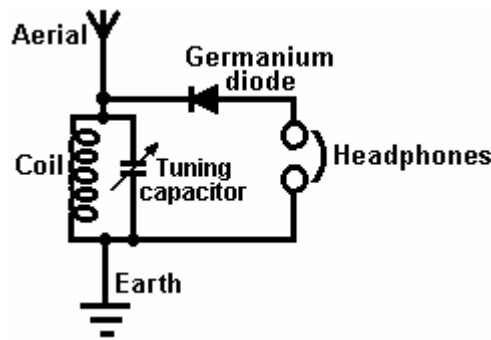


These have a coil of wire wound around a hollow former and a slider can be pushed along a bar, connecting the slider to different winds in the coil depending on it’s position along the supporting bar. The terminal connections are then made to the slider and to one end of the coil. The position of the 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 get 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:

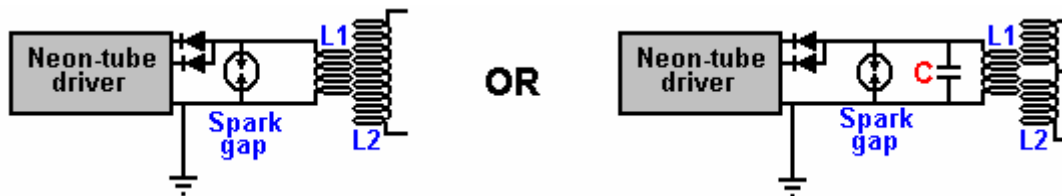


While the circuit diagram above is marked “Tuning capacitor” that is actually quite misleading. Yes, you tune the radio receiver by adjusting the setting of the variable capacitor, **but**, what the capacitor is doing is altering the resonant frequency of the coil/capacitor combination and it is the 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 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.

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A Russian Implementation of Don Smith's Design

Here is an attempt to translate a document from an unknown author on a Russian forum:

Assembly Instructions for the Free-Energy Generator

Part 1: Accessories and materials

1) The High-voltage power supply 3000V 100 – 200 W.

It is possible to use transformers from neon lamps, or any similar radio amateur designs with high EFFICIENCY of transformation and stabilisation of a desired current. Here is a possible implementation using the fly-back transformer from an old CRT TV set:



2) High-frequency resonant system L1/L2

The coil L1 is wound using a high-quality audio speaker cable with a cross-sectional area of 6.10 sq. mm, or alternatively, home-made litz wire. The litz wire or speaker cable length with connecting leads is about 2 meters.

The turns are wound on a plastic drain pipe of 50mm diameter, the number of turns is 4 or 5 (wound to the left, that is, counter-clockwise). Don't cut the rest of the winding wire, instead, pass it through the middle of the tube, and use it to connect the winding to the spark-gap and capacitor of the primary circuit.

Example of the construction:



The secondary coil L2 of the resonant circuit, is wound using solid uninsulated copper wire with a diameter of 2 mm to 3 mm, preferably silver-plated (tinned wire is not so good). The secondary coil is wound with a diameter of about 75 mm. This coil has a tap in the middle. Both halves of the coil are wound in the same clockwise direction (to the right).

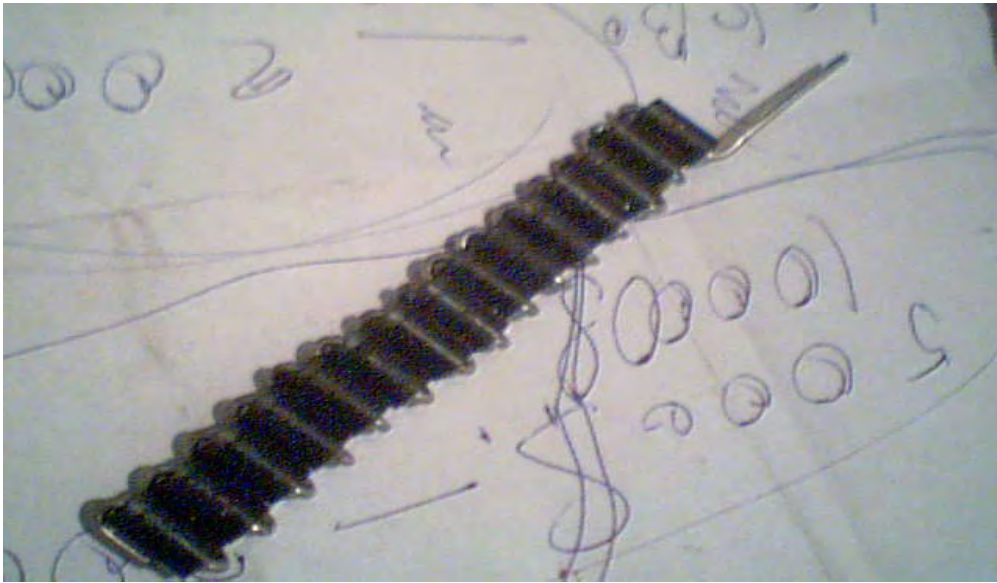
The approximate number of turns between 2 sets of 16 turns, to 2 sets of 18 turns. The coil must be wound without using a coil former.

These coils should be mounted in such a way as to prevent the flow of high-frequency high-voltage current to other parts of the circuit or components. The ends of the coil wires are clamped in terminal blocks mounted on the base plate, ready for connection to the other circuit components. The ratio of the wire lengths in coils L1 and L2 is 1 to 4, including the length of the connecting wires reaching to the other circuit components. A possible implementation of the secondary coil is shown here:



High-voltage diodes (chains) can be purchased ready-made or can be constructed from individual single diodes. The resulting diode chains should have a current rating of not less than 10 amperes at a voltage of 25 kV to 30 kV. It may be necessary to put several diode chains in parallel in order to meet this current rating requirement.

Here are examples of these high-voltage diode chains:



The resonance capacitors (for coils L1, L2) in the primary circuit, need to have a voltage rating of at least 4 kV, the capacitance depends on the frequency of the secondary circuit (28 nF was used by the author for a resonant frequency of 600 kHz). The capacitor must be high quality with minimal dielectric losses and good charge retention.

Usually a composite capacitor bank of low-power capacitors is used. The most appropriate types of Russian capacitors are the K78-2, K78-15, K78-25 or similar types, as these types can easily handle the impulse currents of the discharge.

For the capacitor of the secondary circuit it is better to use any of the above types of capacitors, but the composite voltage must be not less than 10 kV. Excellent working Russian capacitors are the KVI-3 type, or even better,

the K15-y2 type.

The secondary coil plus a capacitor form a resonant circuit. The capacitor used in the secondary circuit depends on the desired resonant frequency (the author used a KVI-3 type of 2200 pF and a 10 kV rating).

Here is a photograph of the capacitor used in the secondary circuit:

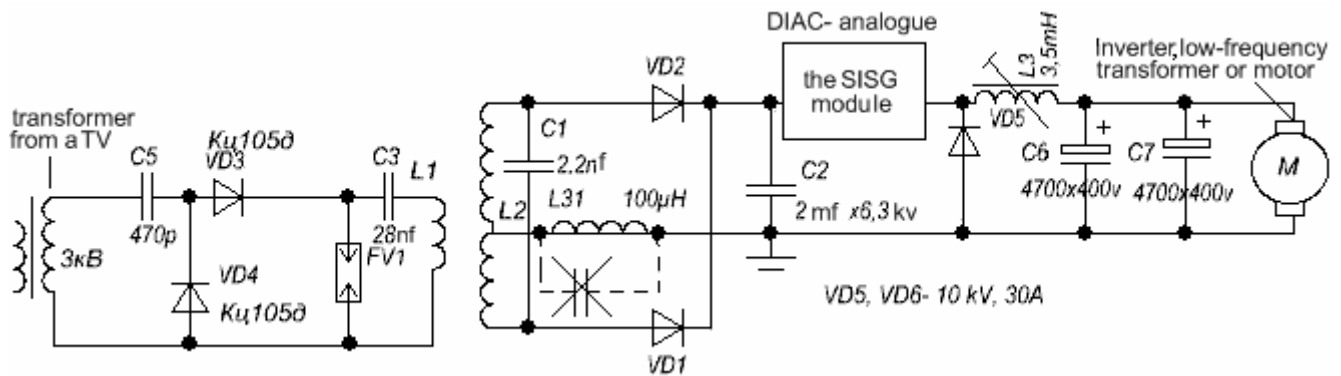


The high-frequency smoothing choke was used, wound in such a way as to get the minimum value of stray, parasitic capacitance in the inductor windings. The inductance range of this inductor is 100 - 200 micro-Henry, and using a partitioned winding helps to keep the coil capacitance low. The wire diameter to use is 1.5 to 2.0 mm enamelled copper wire. Here is a photograph of one implementation of this choke:



These windings can be made on a PVC pipe with a diameter from 50 mm to 75mm.

For the storage capacitor bank you can use capacitors with a voltage rating of anything from 5 kV to 15 kV with total capacity of about 2 microfarads. Suitable Russian oil-filled capacitors, include all types of K41-1, K75-53 and others. This is the circuit diagram of the device:



Diodes VD1, VD2 – high-voltage composites.

Diode VD5 needs to be an ultrafast type rated at 1200 V, 30-150 Amps.

Choke L3 is any kind with an open magnetic core, wound with wire of not less than 6 sq. mm., and giving a 1.5 milli-Henry inductance.

The load (an inverter or a DC motor) requires a low input voltage of 12V to 110 volts (lower voltage - high power output)

When building and experimenting be sure to take all Safety Precautions as you will be working with more than 1000 Volts.

Video Links showing this device running an angle-grinder and an electric motor are:

[#http://www.youtube.com/watch?v=NC3EYDYAXDU #](http://www.youtube.com/watch?v=NC3EYDYAXDU)

[#http://www.youtube.com/watch?v=-sckdMe3HCw#](http://www.youtube.com/watch?v=-sckdMe3HCw)

[#http://www.youtube.com/watch?v=OaqZ52dGMn4#](http://www.youtube.com/watch?v=OaqZ52dGMn4#)

The "SISG" module shown in the circuit above is an attempt to build a solid-state version of a spark gap. In this version of Don Smith's designs by 'Dynatron' he wanted the equivalent of a diac or a dinistor. A dinistor is basically a thyristor or SCR without the gate. It starts conducting very suddenly if the voltage on it's terminals exceeds it's design value and it stops conducting if the voltage drops to almost zero or the circuit is disconnected, forcing the current to become zero. Diacs or dinistors are hard to find for very high voltages over 5000V, so Dynatron tried to build equivalent circuits which could be used at high voltage and any one of those designs is what is indicated by the box marked "SISG".

Sergei's Dynatron circuitry

Russian experimenters are well advanced in their investigations of this type of circuitry. Here is an attempted translation from Russian to English, made, I believe by the energetic forum member "Davi" of Georgia. While I believe this translation to be reasonably accurate, as I can only understand English, I have no way of knowing if it is accurate. The information comes from an interview with Sergei concerning his Taniel Kapanadze style circuitry:

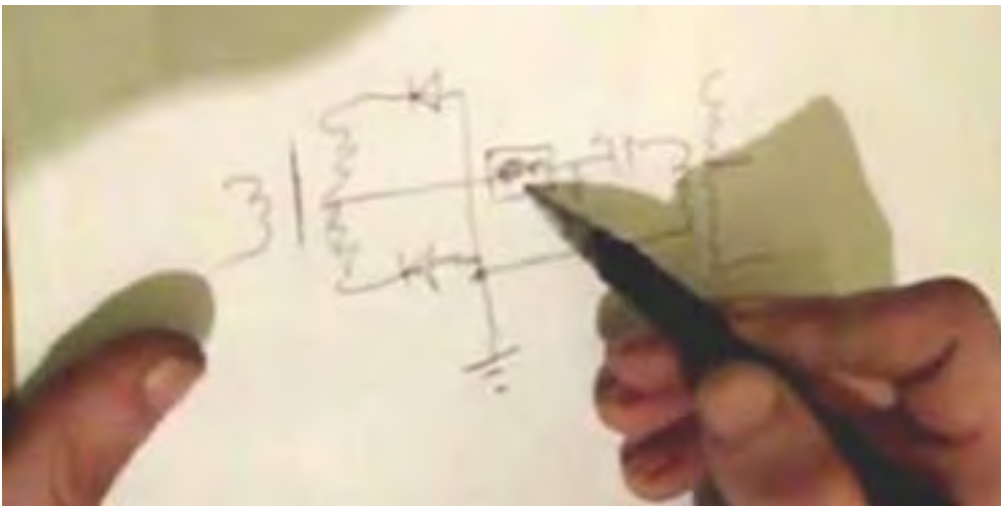
Dynatron-Sergei



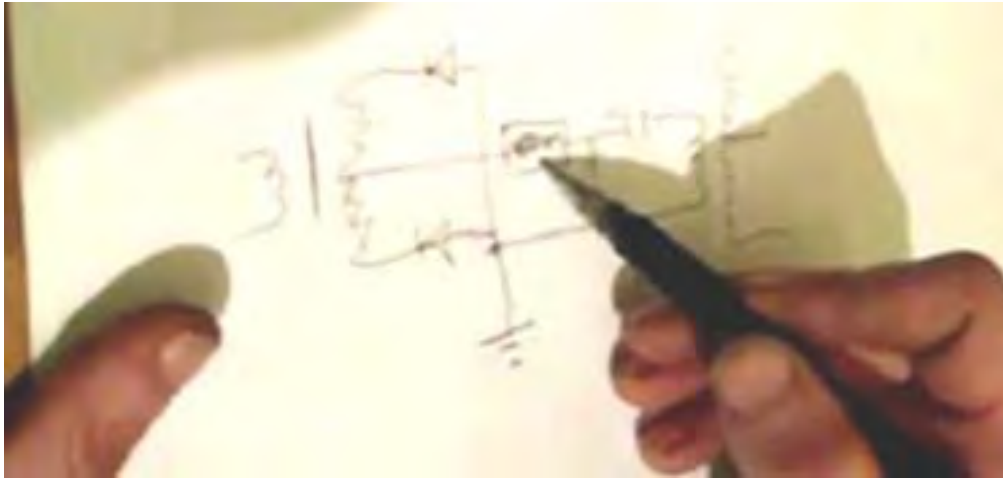
We begin to draw the schematic diagram



We use a line-scan transformer and point-contact diodes.



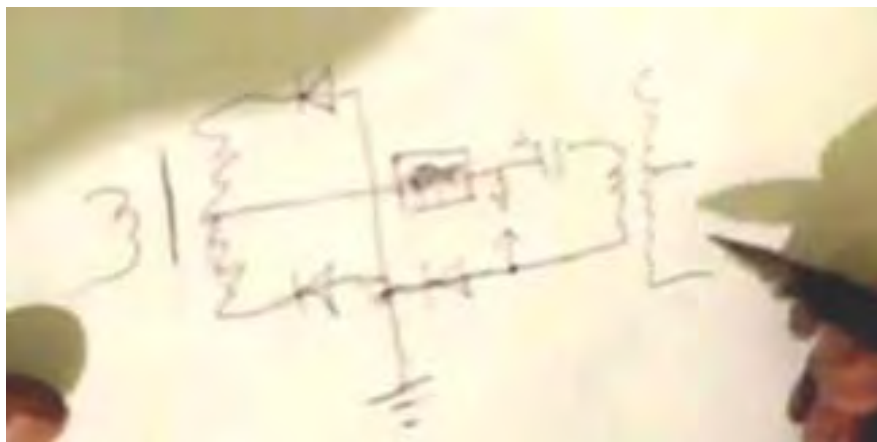
We add in an earth ground, a capacitor, a discharger, and a second transformer winding.



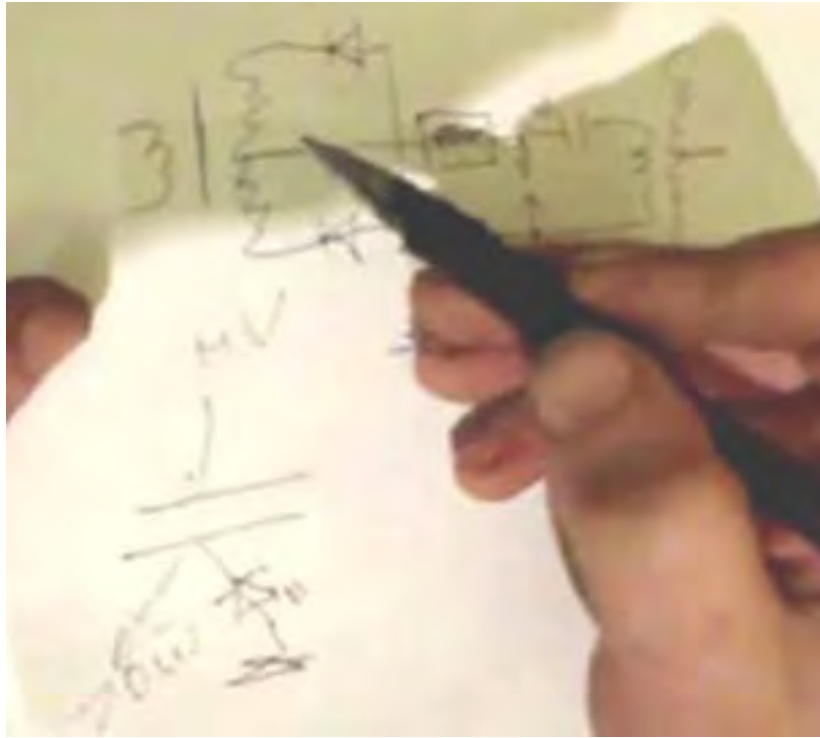
Notice this rectangle.

In the transformer we have an alternating voltage cycles. If we have a threshold voltage -control device, such as a discharger, then positive charges will be pumped from the earth-ground connection, through the diodes. This flow is first, through a one diode, and then through the other diode. That means that the secondary winding of the transformer will accumulate a positive charge. Consequently, you do not need a charged capacitor. Instead of the spark gap which Don Smith used, you can put a small choke coil of 100-200 millihenrys or a 100 ohm resistor and either of those work just fine. The usual spark gap will work perfectly well but it does not have a long working life. A resistor can be used and it will work. Vacuum or gas-discharge tubes work well. The voltage here is around 1000 volts.

While you can eliminate the spark gap, but when you do have one, the pumping of charges from the ground works better – it turns out to be something like a fork Avramenko plug. The transformer winding acts on the ground charge with the aid of the voltages developed in it.

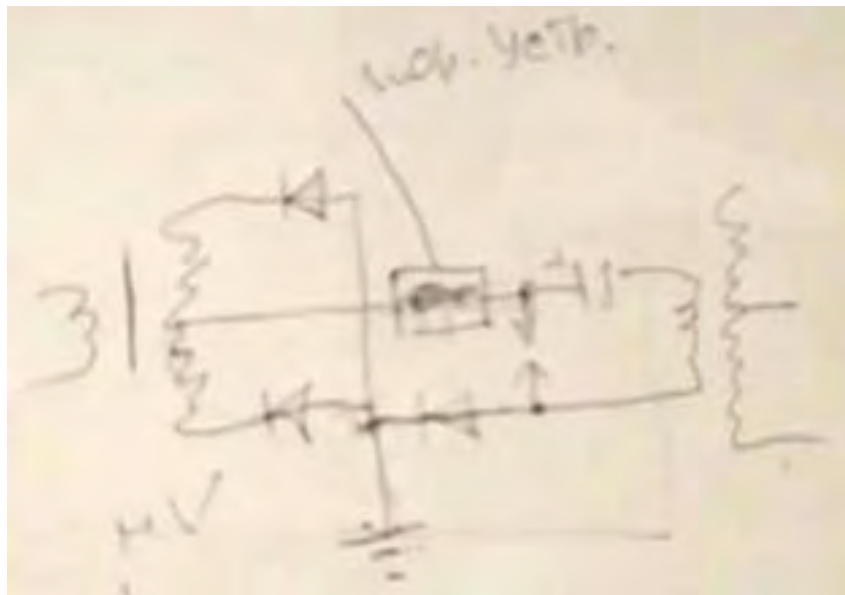


The secondary winding of the resonant transformer, destroys the dipole, according to Don Smith. As he explained, the upper plate of the capacitor develops a high voltage from the charges drawn in through the earth connection. This high voltage is then discharged through a diode or a spark gap.

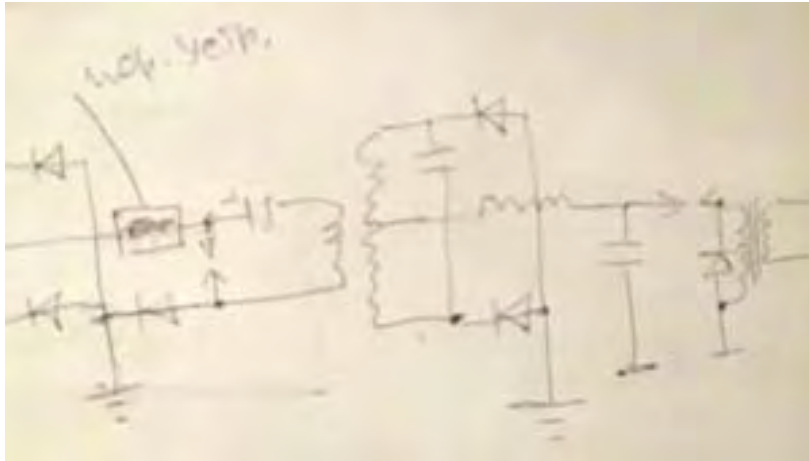


The same thing happens here.

The ground charge enters the secondary winding, and due to its self-capacitance, accumulates a high voltage on the winding. The diodes used in this location need to be high quality diodes which have a low capacitance. For example, Don Smith used diodes which have a capacitance of just 4 pF.

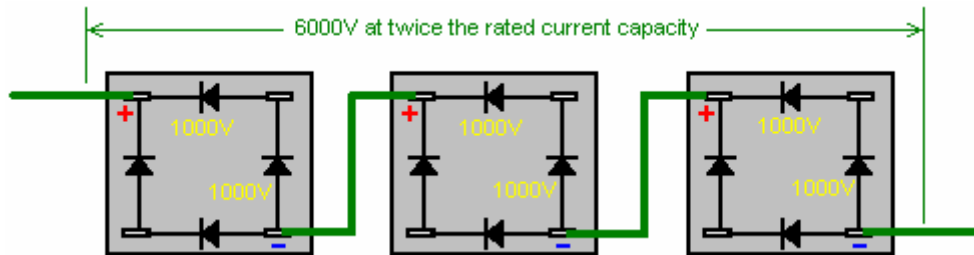


At this point, the pumping scheme will look like this, and I think that it will not change.

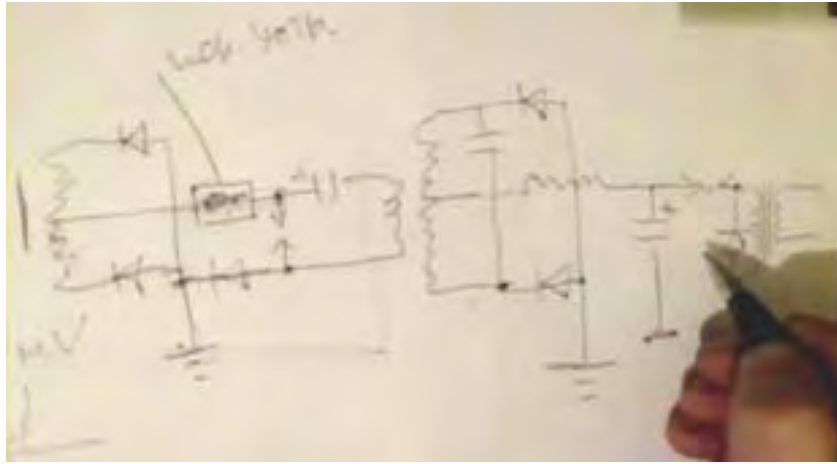


The second coil is exactly the same as the first coil.

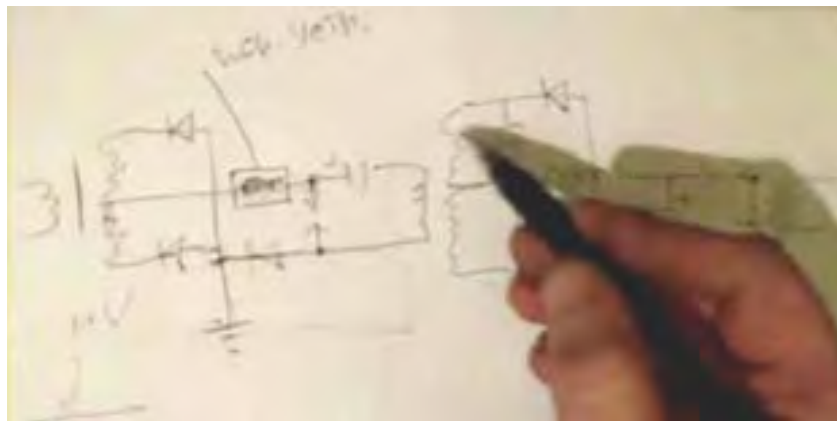
For the time delay we use a choking coil. The capacitor is an electrolytic type and we use a spark gap to feed an isolation transformer. To ensure that there will be no feedback of unwanted voltage spikes, we connect a 6 kV 20 to 50 A high-voltage diode in parallel with the primary winding of the isolation transformer. This can be arranged by connecting three 1000V diode bridges together like this:



Three 1000V diode bridges can be connected to withstand a voltage of 6 kV.

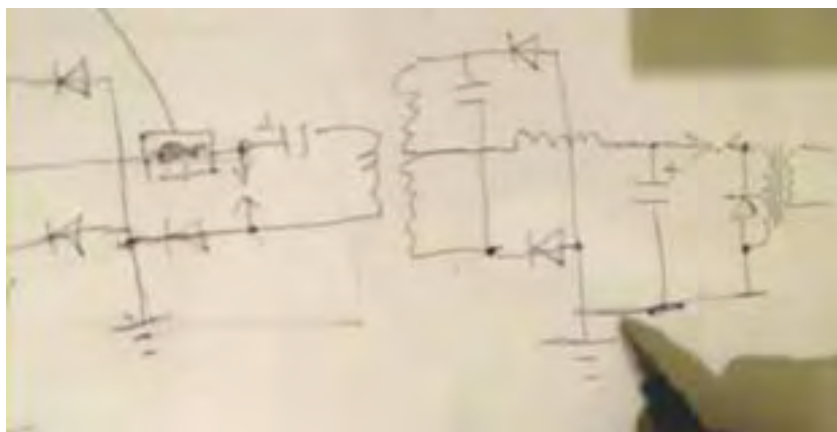


The spark gap is inserted in the positive wire, the same as the first spark gap . Why is this?



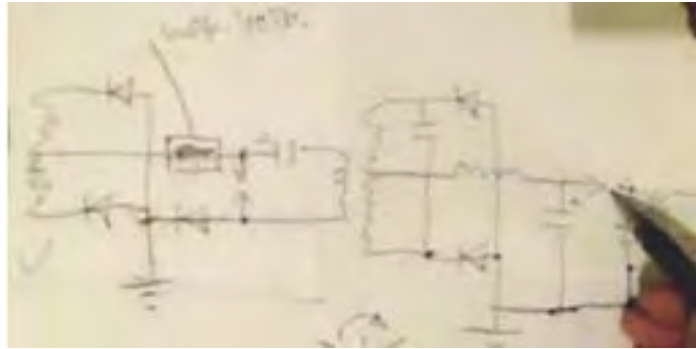
Here we have a separation of electrons.

We collect electrons both from the air and from out of the ground. We push the negatively charged electrons into the ground, and so a positive charge accumulates in our capacitor.



The ground wire carries the negative charges into the earth (which is an expansion tank).

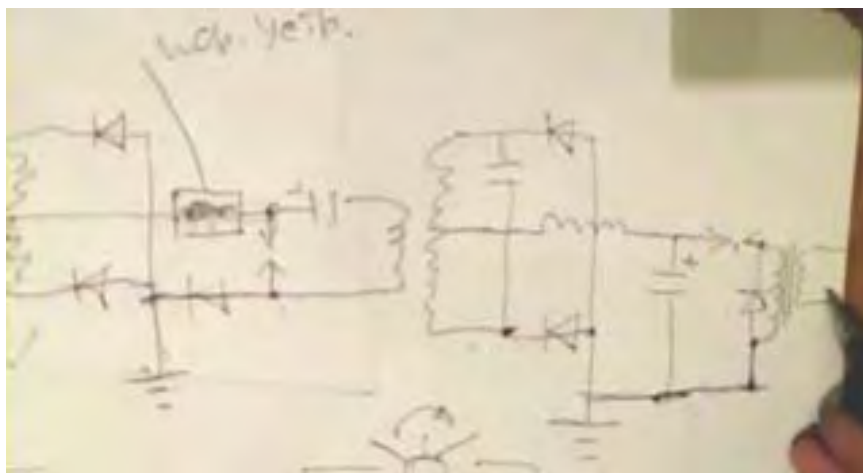
If you connect the spark gap between the earth and the upper end of the transformer which is positively charged, then the primary winding wire will get warm, and the efficiency falls. When correctly connected the primary winding can be constructed with wires which are 0.5 -1.0 mm diameter and the wires remain cold.



If we have achieved the splitting of the electron-positron pair, then if you put them in a discharger, or in a transistor, or whatever, only the radiation remains. However, the really important fact is that the magnetic component passes through the primary winding of the transformer, and it induces a strong magnetic field in the secondary winding.

Don Smith said that if you connect two batteries together and one is say, 30 volts, and the other 10 volts. The 30-volt battery passing 10-volt, the electrons in each battery resist each other. It appears that they do not "like each other" if one can describe it that way.

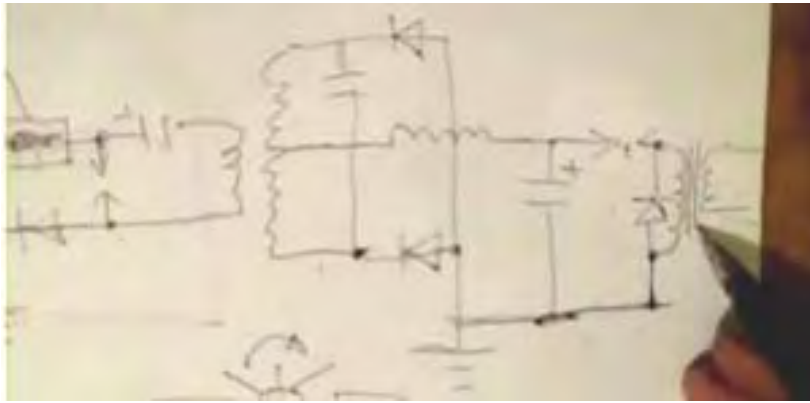
The same thing happens in an ordinary transformer. The current flowing in the secondary winding resists the flow of current in the primary winding - back EMF. But the following question is relevant: at the instant when the negative ion-electrons just start to flow in the primary winding, the interaction between the primary and secondary windings is absent. Because of this we get a huge load-carrying capacity in the secondary winding, practically without changing the inductance of the primary winding, well, if it is changed then that will be not more than 10% to 20%.



Generally, the minimum load impedance will kill the inductance causing the frequency to change. But this does not happen here, because the primary current flow is of another kind, which is not affected by the current flowing in the secondary winding. That is, moving a small number of electrons in the primary can cause a large number of electrons to flow in the secondary winding. The thicker the wire of the secondary, the more excited electrons there will be there and so, the greater the current flow in the secondary.

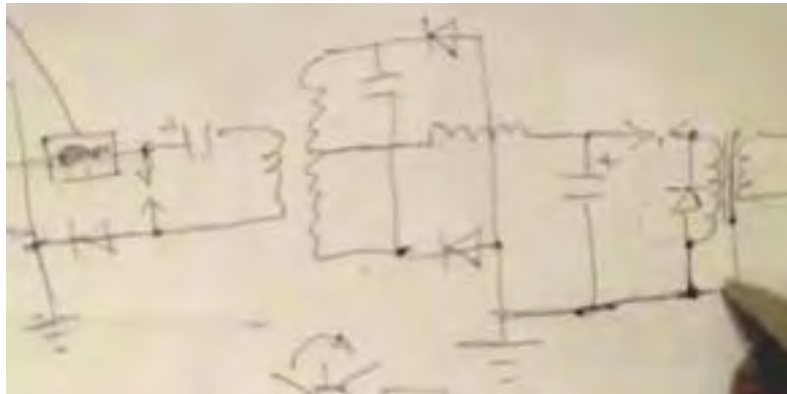
The mass of the secondary electrons does not depend on the mass of the primary electrons. The diameter of the secondary winding is not limited. For example, if you use a 110 mm. tube for the secondary, then the velocity of the electrons flowing through the winding will be the same as if it were wound with a wire diameter of just 1 mm or 2 mm. This is because the current flow is not impeded by the resistance.

The magnetic field of the secondary winding does not interact with the magnetic field of the primary winding. However, the primary magnetic field accelerates the electron moving in the secondary winding, i.e. This produces an asymmetric transformation.



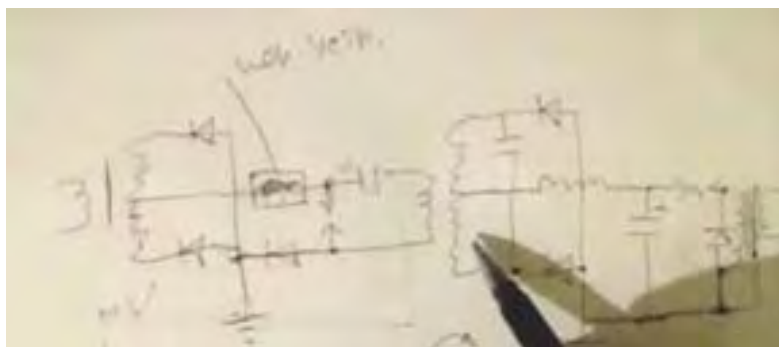
Naturally, here we need very good insulation.

Roughly speaking, if there is a small hole in the wire insulation, then the vaporous electrons in the primary winding will hold the equivalent vaporous electrons in the secondary winding, and that will squeeze the heavy electrons in the secondary winding. Consequently, there must be an anti-static screen in the form of a coil, or aluminium foil that is connected to ground.



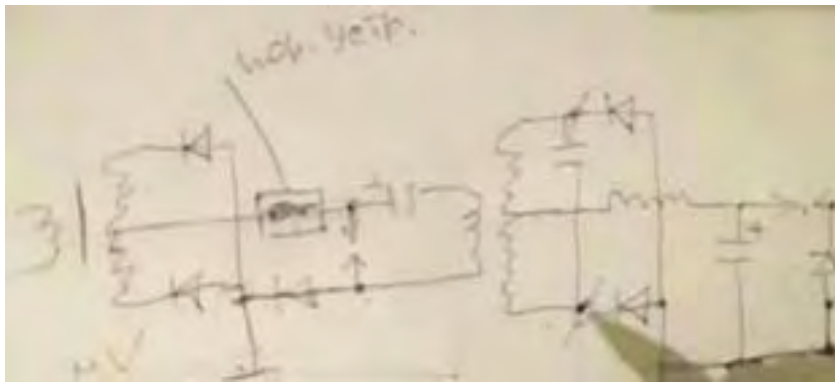
So, all the positively charged particles should go into the ground

If you want to ground the output transformer, then do it through a resistor connected to a ground point which is at least 10 metres away from the first grounding point in the circuit. The farther apart the grounding points are, the better, say, 10 to 30 metres apart. In principle, the length of the ground between the two ground connections can be considered to be an isolation capacitor between those two points in the circuit.

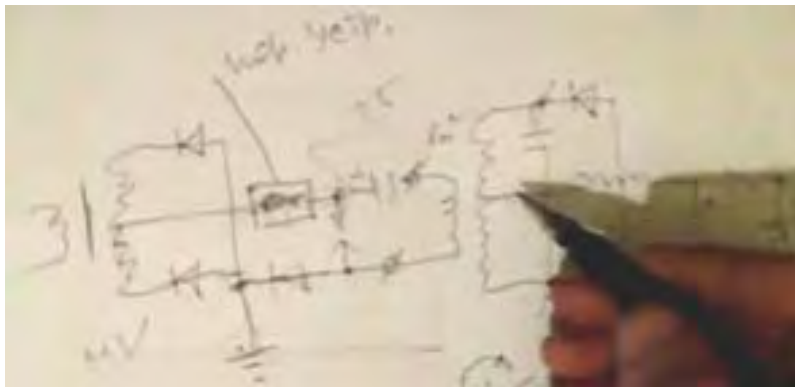


The big question is, of course, what should be the ratio of the primary winding turns to the secondary winding turns - 1:4 ? but here is some good advice:

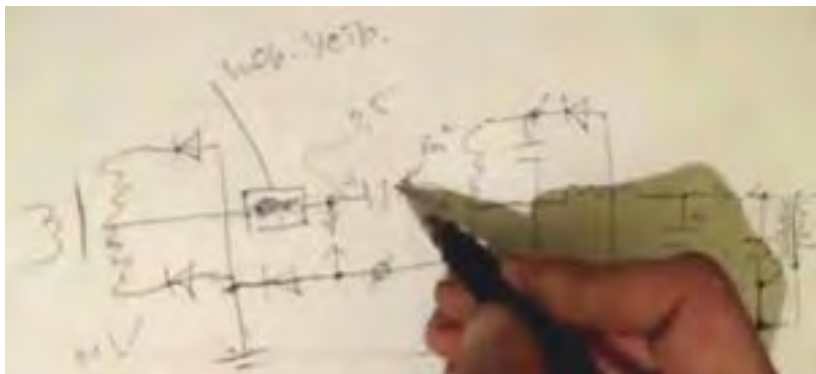
Accurately measure the total length of the secondary winding and make the primary winding wire length exactly one quarter of the wire length of the secondary winding. The connecting wires are not considered in this measurement, and it is better to make them thinner. If, for example, the primary wire has a cross-sectional area of 8 sq. mm, then make the connecting wires 2.5 sq. mm. in cross sectional area.



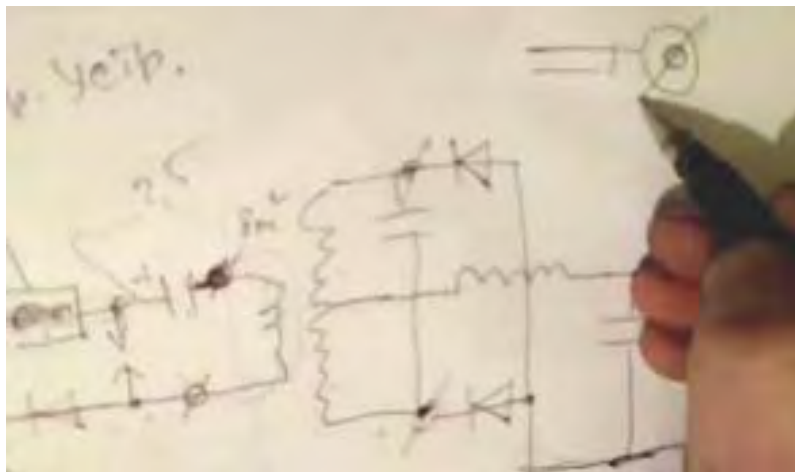
In other words, here are the terminals of the secondary winding.



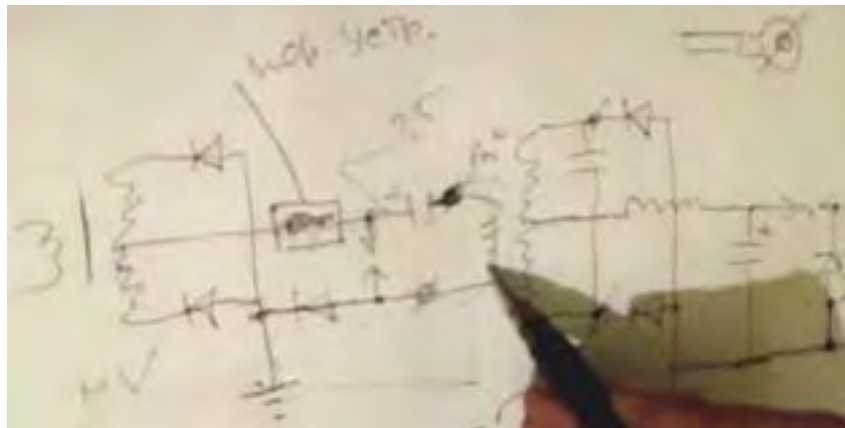
The oscillation amplitude increases massively at the resonant frequency. Why is that?



Because of the change in impedance at the junction between the two wires, the connection becomes a node and this is reflected in the anti-nodes, and the primary waveform remains a standing wave.



You will recall that Don Smith used a very thick cable but he reduced it to become a thin connection at each end. That thick-to-thin change causes a reflection of the wave. The secondary winding has LC resonance but the inductor depends on it's wave resonance length.



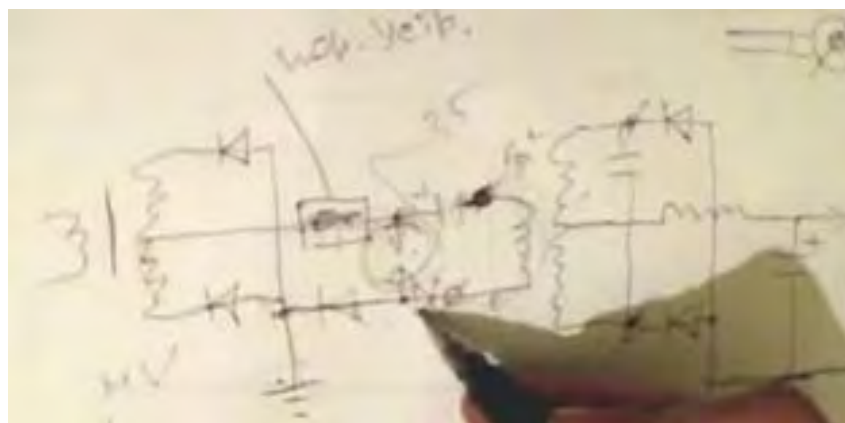
In fact, what we have here is a Tesla transformer, i.e. voltage, current.

You will recall that even in the green box of Tariel Kapanadze with it's thick pipe coil, that thin wires go from the pipe to the spark gap. Changing the impedance of the wire at the junction between the two different cross-sectional areas - That's it! That raises the efficiency, and so the spark gap works better.



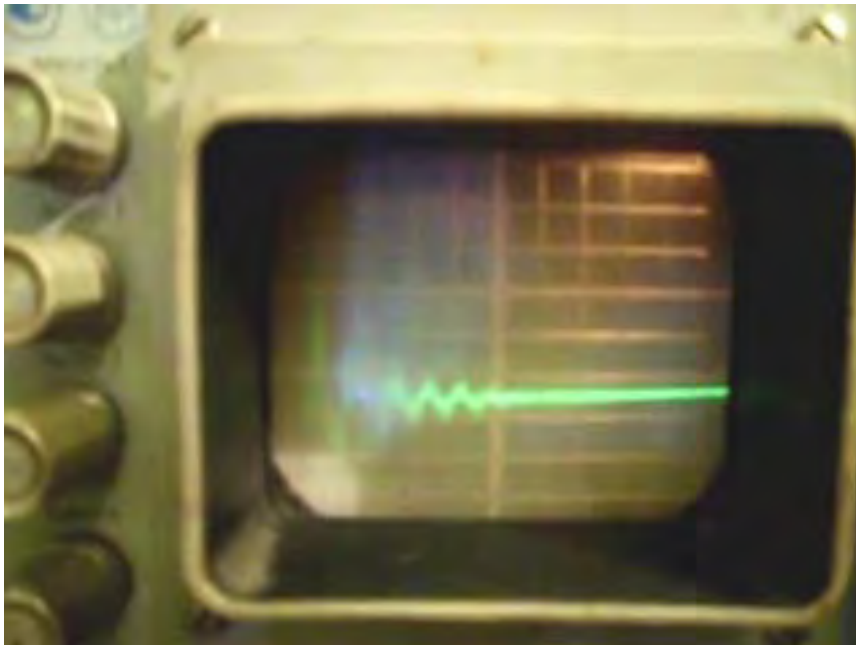
Ideally, you want to use a vacuum spark gap.

Unfortunately, our spark is not dispersed in the secondary winding. The spark might be triggered at anything from 50 kV up to 100 kV. We have a great 'Q-factor' (coil 'Quality' factor) in our winding! However, once the spark has occurred we get a roll-back of current moving in the reverse direction through the winding, although it is always less powerful than the forward action. This reverse pulse also passes through the spark gap, effectively shunting, the input circuit and so, decreasing the output Q of the circuit. The circuit's output voltage is reduced. The resonant frequency drifts and so the output power drops. Although this effect can be seen when using an air gap, it is much better to use either a vacuum spark gap or a spark gap which is enclosed in a tube filled with hydrogen gas.



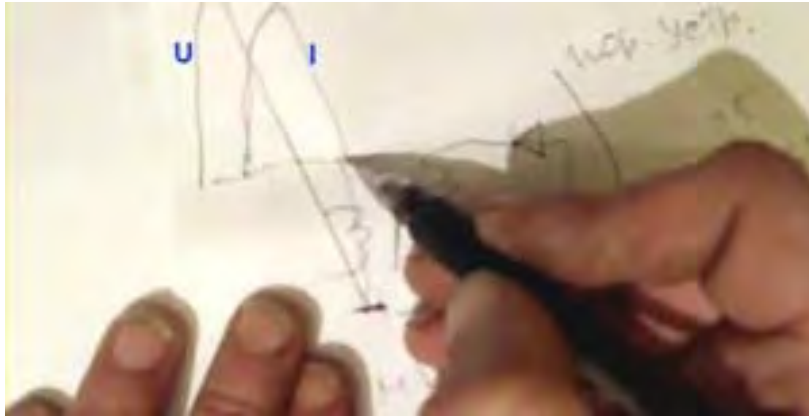
You can put a diode in series with the spark gap.

If that is done, then the reverse current will not pass. The diode must be able to withstand a reverse voltage of 10 to 20 kV. We ordered a hydrogen diode with power handling capacity of 120 watts. It's turn-on time is 0.1 ms, off time is less than 1 ms. We connected the current transformer using 24 ohm resistor. The result was a pure current transformer on the load, and without any interference. Let's see what we have done on the discharger. Take a look - the spark gap was lit up with a blue colour.



On the oscilloscope, we see dampened oscillations.

There must be only one oscillation, and the remaining excess. The 5 extra vibrations short-circuit the secondary winding, and prevent it from operating normally.



Ideally, this should be simple.

Clicking the inductor - capacitor recharges, but the current does not go back. (it stops at zero)

Picture voltage "U".

Picture current "I".

That is how such a process should be, but otherwise - buffeting vibration. (need a hydrogen diode)



Isolation transformer.

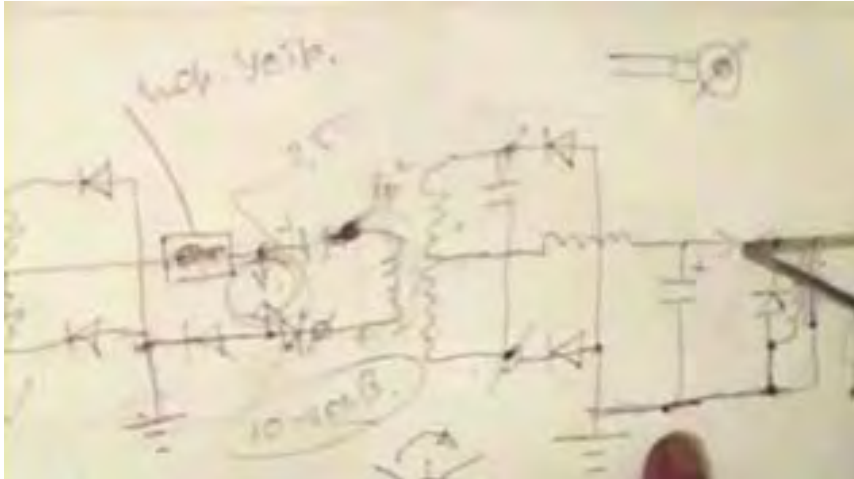
The isolation transformer is made up of rings. The primary winding is 2 bifilar layers wound in one direction. The secondary winding is with wire which has 10 sq. mm. cross sectional area, but today we will rewind it. The screen is made of foil - ordinary Scotch tape. But the screening must not form a complete turn as it must not be a closed-loop. Here, aluminium Scotch tape is used. Now short-circuit the secondary winding, and enable the device.



We check with a screwdriver, and there is practically no output. If you add an anti-static barrier, i.e. gasket between the primary and shield. It should be made from a good insulator, such as PTFE. It is possible to use cellophane which, being like acrylic is also a very good insulator. I shorted outputs, so as not to clatter. If you remove the jumper, the coil is bursting with no load like this. (We hear a crash, and after 3 seconds it stops) Sergey: We'll see what it was. (Blue spark coil pierced).

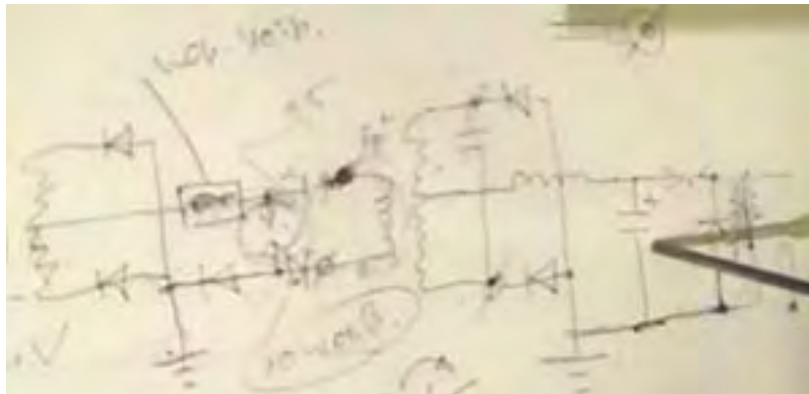


That's it! The experiment's completed. Blown diode bridge - Accident. Accidentally shorted to ground. Well, that's all. It is desirable, of course, have a good ground connection. The threshold-limiting device is a choke.

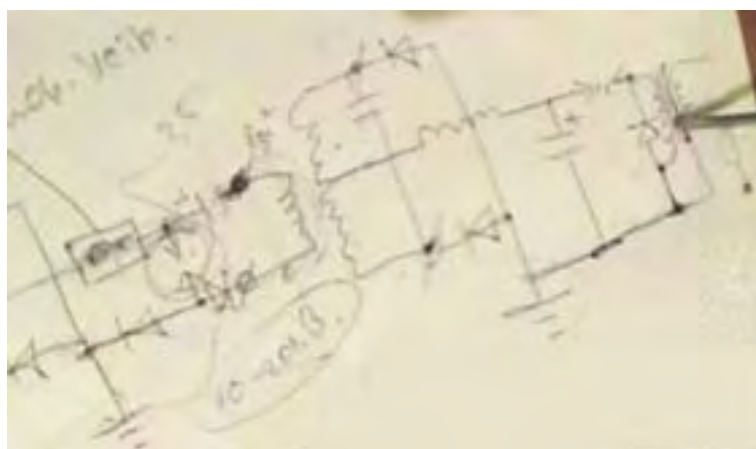


What can I say?

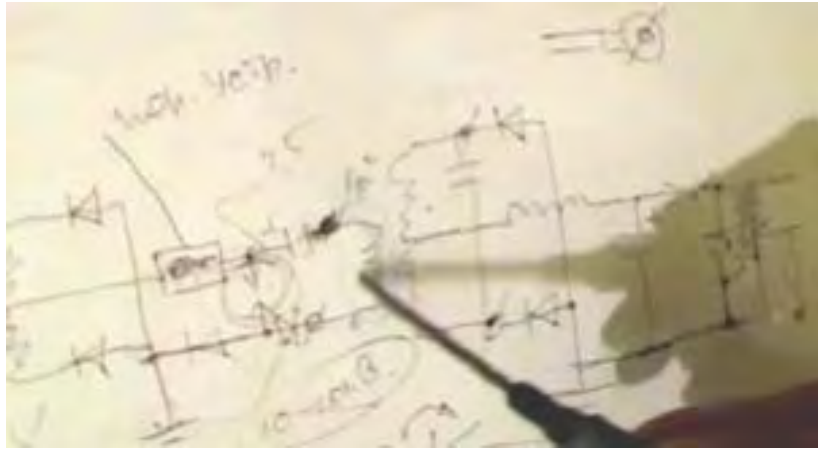
In principle, you can use the CISC module instead of a spark gap. In this circuit, the very sharp rise time of the driving waveform pulse fronts is not necessary, because the inductance is large.



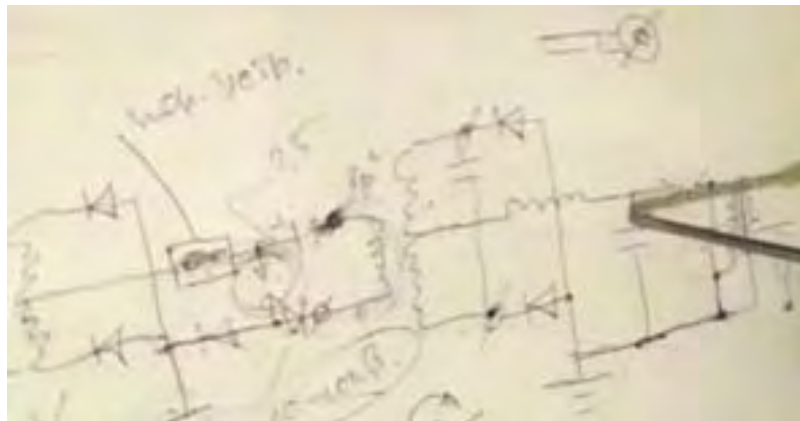
If the transformer has an iron core, then the rate of charging of the capacitor will be very fast, at, for example, 50 Hz. At that low rate, you can omit the discharger. In Don Smith's design where a neon tube driver is used, a diode and even a diac can be used instead of a spark gap. It will even work with a direct connection.



Then the impulses are often, but with smaller amplitude. Naturally, the better, when we divide the frequency, i.e. for two of the primary pulse charges the capacitor of the secondary.



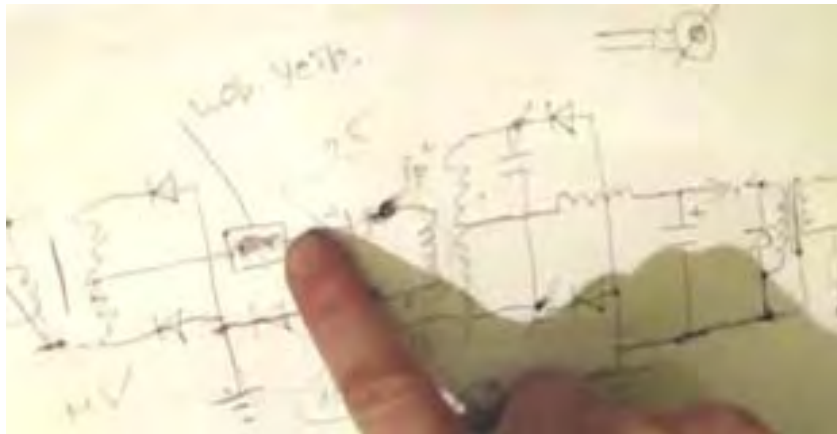
Then the amount of energy in the pulses is summed.



Here they are superimposed on one another, in a linear fashion.

$$C = Q/U \text{ end } U = Q/C$$

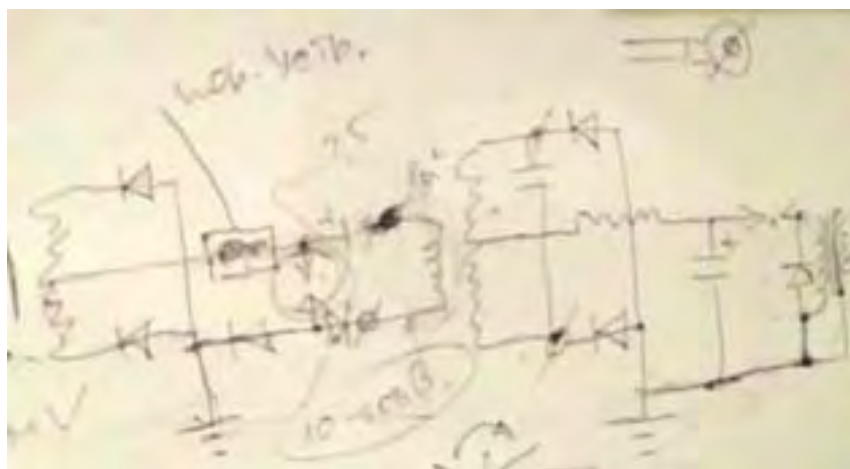
The capacitance is a constant. If we increase the number of charging pulses per second, then because the secondary coil at resonance increases the amplitude of the pulses, we get increased power. At 5 times more power, because there are 5 times the number of charging pulses passed to the capacitor, we get a squaring of the voltage-energy. That is an energy increase of 25 times.



Raising the spark frequency by, say a factor of 10, will give an energy gain of a factor of 100.



Well, I'm telling you, place a spark gap here in order to – INTERRUPT. Otherwise, the inductor will not be able to speed up and pass more pulses into the capacitor.



Gentlemen! Make it and test it.

Vladimir Utkin

Issue date: 14th June 2012

FREE-ENERGY: NIKOLA TESLA SECRETS FOR EVERYBODY



by Vladimir Utkin u.v@bk.ru

FIRST SECRET

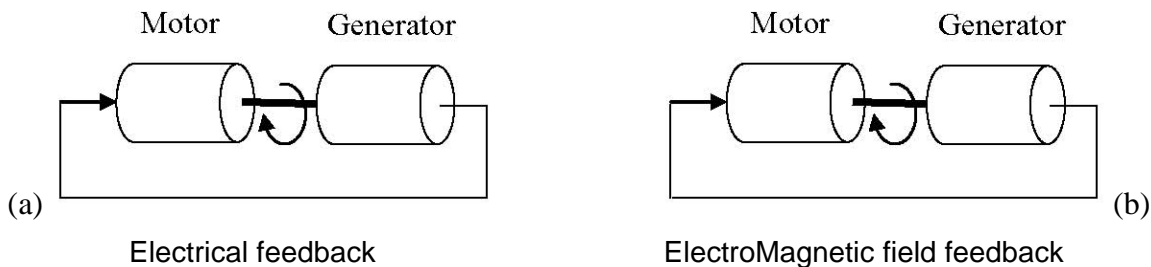
All of Tesla's secrets are based on

ELECTROMAGNETIC FEEDBACK

EXPLANATION: An ordinary energy system comprises a generator and motor (common view), and can be completed with an electric current feedback as shown here in electrical circuit (a)

NO FREE-ENERGY

FREE ENERGY IS POSSIBLE



In case (a), the system once started, will slow down and stop because of friction, resistance and so on. Nikola Tesla arranged a feedback loop for the electromagnetic field: case (b), and he said:

ELECTROMAGNETIC FIELD FEEDBACK DESTROYS THE INTERACTION SYMMETRY

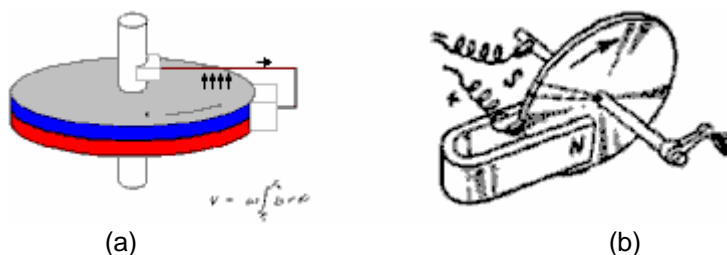
This means that an action no longer has an equal and opposite reaction

In case (b), once started, the system will accelerate in spite of friction, resistance and so on (provided that the phase of the electromagnetic feedback is positive and is sufficiently large). In order for an electromagnetic field to exist in a motor, there must be some energy input, and Tesla said:

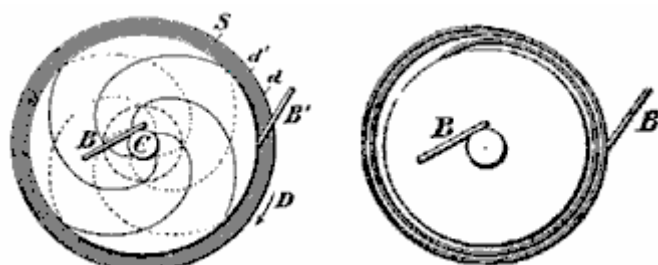
ENERGY GENERATION BY IT'S OWN APPLICATION

QUESTION: How can you produce positive electromagnetic field feedback?

AN ANSWER: The simplest and well-known example is Michael Faraday's unipolar motor, as modified by Nikola Tesla:



An ordinary unipolar motor consists of a magnetised disk, and a voltage applied between the axis and a point on the circumference of the disc as shown in (a) above. But an ordinary unipolar motor can also consists of an external magnet and a metal disc with a voltage applied between the axis and a peripheral point on the disc as in (b) above. Tesla decided to modify this version of the unipolar motor. He cut the metal disc into helical sections as shown here:

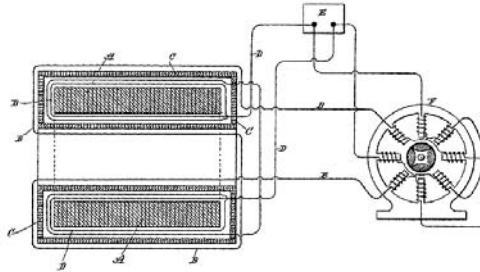


In this case, the consumption of current produces an additional magnetic field along the axis of the disc. When the current-carrying wires are tilted in one direction, their magnetic field augments the main external magnetic field. When the wires are tilted in the other direction, their magnetic field reduces the main external magnetic field. So, the current flow can increase or reduce the external magnetic field of the unipolar motor.

Amplification is not possible without applying power

If it is possible to arrange a magnetic field feedback loop for mechanical devices, then it is probably possible to arrange it for solid-state devices like coils and capacitors.

The others parts of this article are devoted to devices which use coils and capacitors. All of the examples in this article are only intended to help your understanding of the principles involved. Understanding would be made easier if we pay attention to the ferromagnetic shielding of the second coil in the transformer invented by Nikola Tesla:

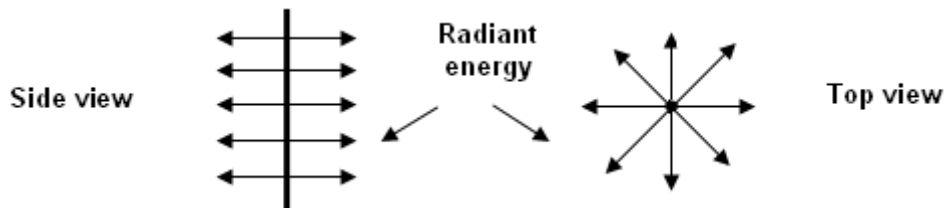


In this case, the ferromagnetic shield separates the first and second coils in the transformer from each other, and that shield can be used as magnetic field feedback loop. This fact will be useful for understanding the final part of this article. It is also helpful to consider the properties of the electrostatic field.

ELECTROSTATICS

(scalar field and the longitudinal electromagnetic waves)

Comment: Mr. Tesla said, “there is radiant energy, perpendicular to the surface of any charged conductor, produced by a scalar electromagnetic field, thus giving rise to longitudinal electromagnetic waves”.

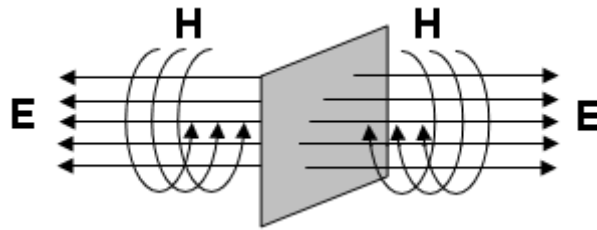


At first glance, this contradicts the age-old experience in studying the electromagnetic field (according to modern concepts, any electromagnetic field has components which are perpendicular to the direction of the propagated electromagnetic wave), also, Maxwell's equations describe an electromagnetic field as a vector. However, the first impression is erroneous, and no contradiction exists.

Definitions of Physics: Any conductor has both inductance and capacitance, that is, the ability to accumulate charge on it's surface. A charge on the surface of a conductor creates an electric field (electrostatic field). The potential (voltage) at any point of the electric field is a scalar quantity!!! (That is, it is a scalar electric field ...).



If the electric charge of the conductor varies with time, then the electrostatic field will also vary with time, resulting in the appearance of the magnetic field component:



Thus, the electromagnetic wave is formed (with the longitudinal component of E ...).

REMARK: In order to understand how a longitudinal wave interacts with conductive bodies, one needs to read the section of electrostatics entitled "Electrification by Influence". Particularly interesting are Maxwell's equations where they mention the displacement current.

Now we come to the first secret:

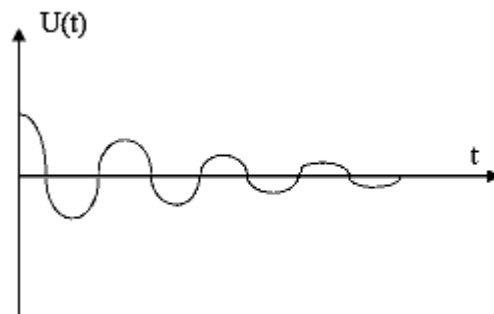
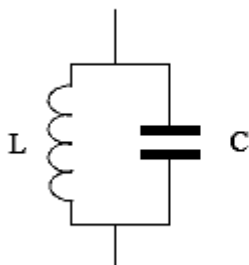
SECRET 1

The power source in Nikola Tesla's free energy device, the amplifying transformer, is a

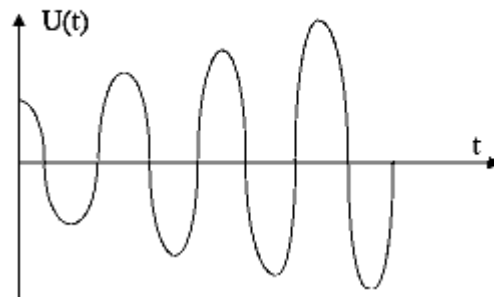
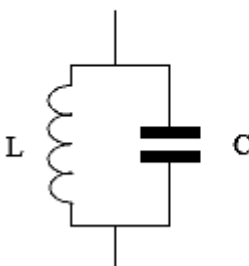
SELF-POWERED L-C CIRCUIT

EXPLANATIONS

An ordinary LC circuit – with decay

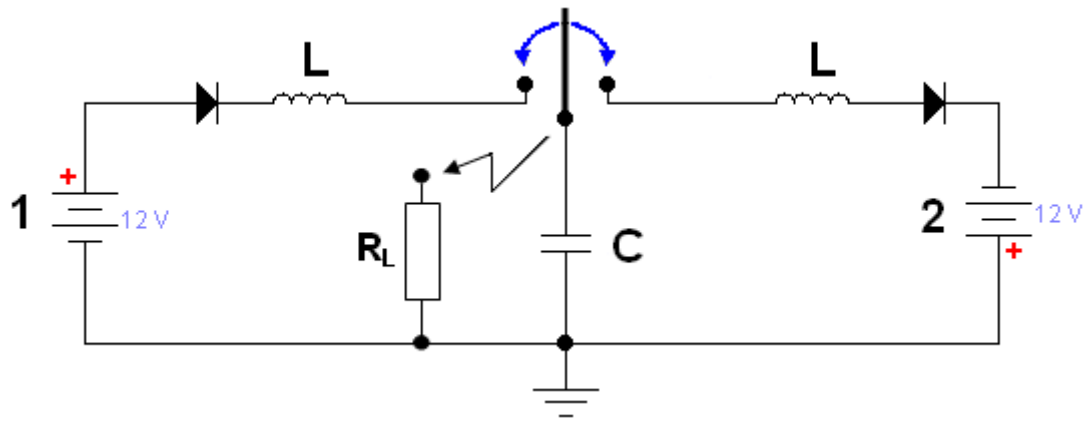


Nikola Tesla LC circuit – with amplification



AN EXAMPLE OF UNLIMITED VOLTAGE RISE

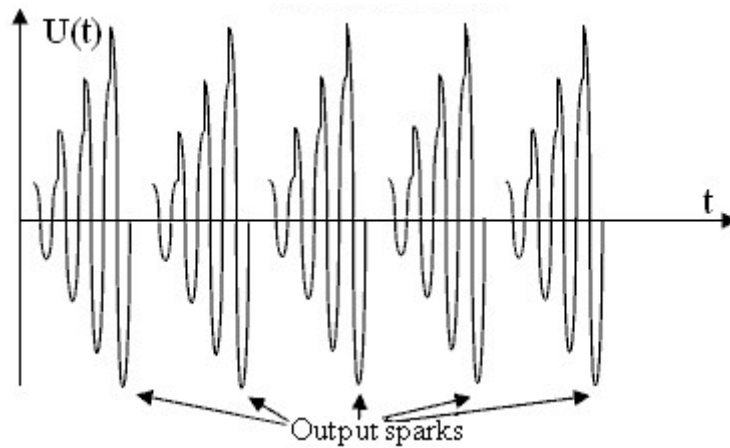
(Based on batteries and a switch)



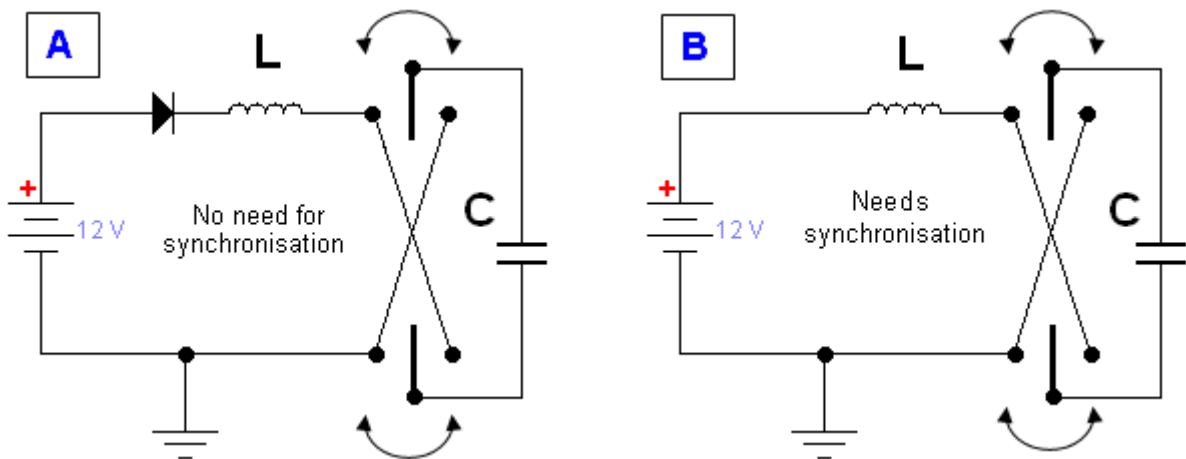
EXPLANATION: Batteries 1 and 2 are connected to the capacitor C alternately, through the inductances L. Voltage on capacitor C and the voltage from the batteries are increasing. As a result, there can be unlimited voltage rise. When the voltage on the capacitor reaches the desired level, it is connected to the load.

COMMENT: Two diodes were used to avoid synchronisation requirements. Manual or relay switching can be used. One implementation used a spark gap to connect the output load but a switch is an alternative method.

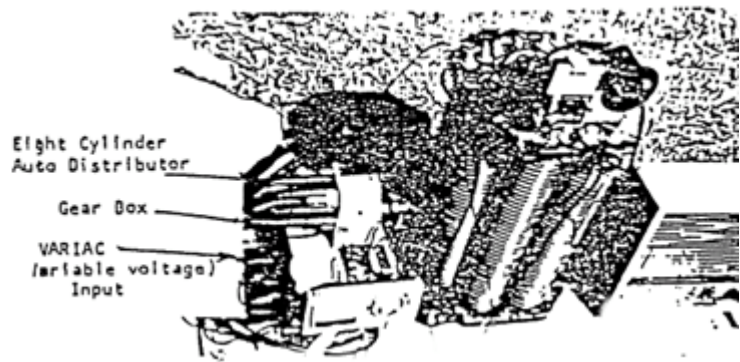
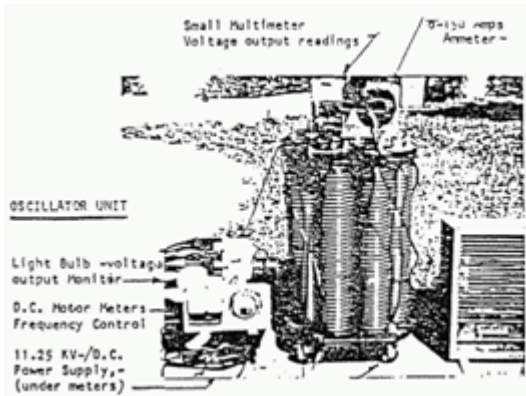
TIME LINE FOR THE PROCESS:



The schematics can be simplified, and only one battery used (load is connected in the same way).



COMMENT: Maybe Alfred Hubbard used an idea shown as option B, in some versions of his transformer



COMMENT: If you want to get a self-powered circuit, you have to arrange some kind of energy feedback to the batteries. But, is this an actual Free-Energy technology? I am not sure....

COMMENT: *Is this the only possible way?*

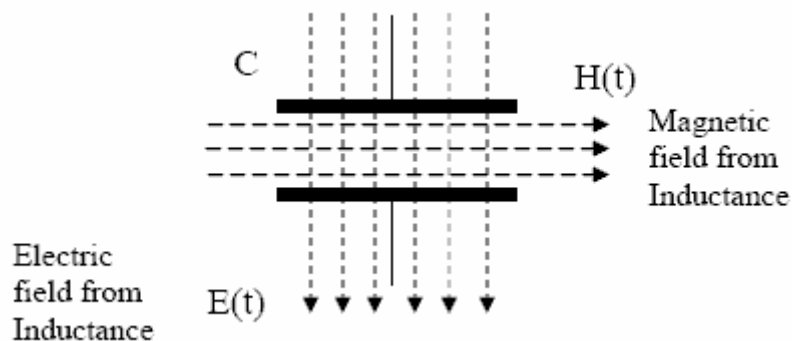
No, of course not - there are different ways of doing it. For example, you can use fields inside and outside of some LC circuits. How can we do that?

For more secrets read the following parts...

HOW DO WE GET THIS RESULT?

AN ANSWER

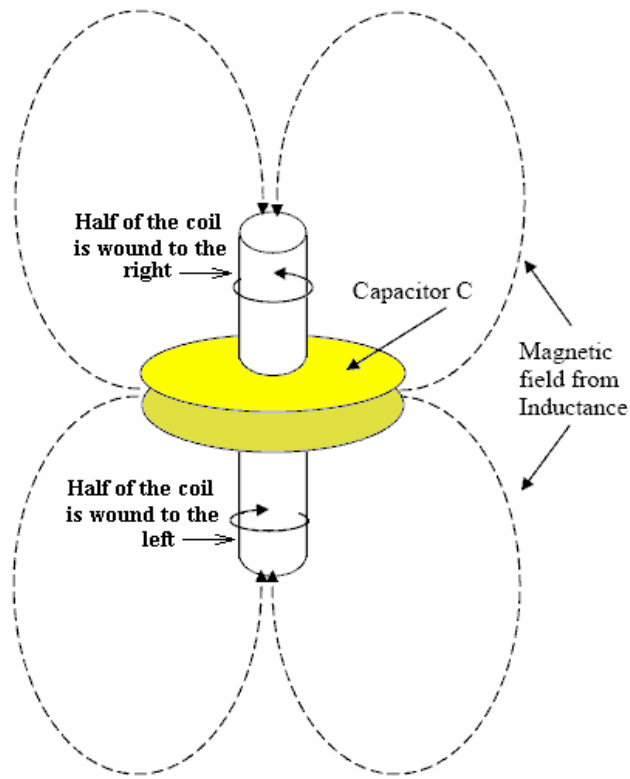
You need to charge the capacitor using the electric component of the electromagnetic field of the inductor (using the displacement current of Maxwell's equations)



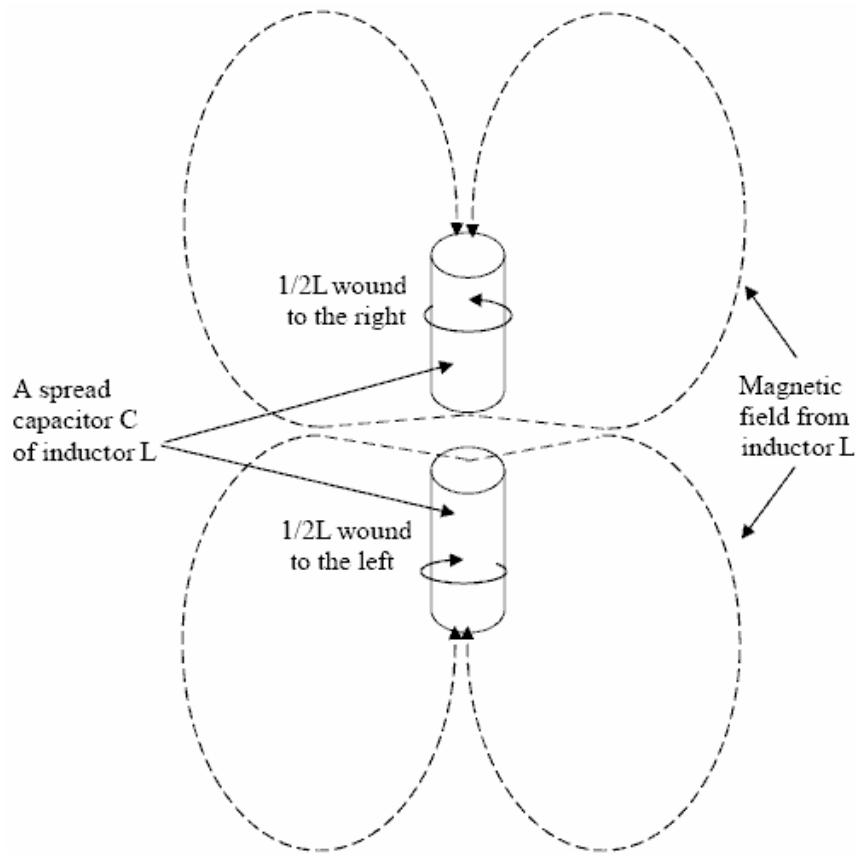
EXPLANATION

When the electric field in capacitor C is decaying, due to feeding electrical current into an inductor (not shown), the external electric field generated by the inductor tries to charge this capacitor with the inductor's displacement current. As a result, the capacitor draws energy in from the surrounding electromagnetic field, and the capacitor's voltage rises cycle by cycle.

IMPLEMENTATION A – a central capacitor is used:



IMPLEMENTATION B – no capacitors are used:



In this case instead of using a capacitor, the capacitance between the two sections of inductor L provides the necessary capacitance.

HOW DO WE START THE PROCESS?

In implementation A, you must charge the capacitor and connect it to the inductor to start the process.

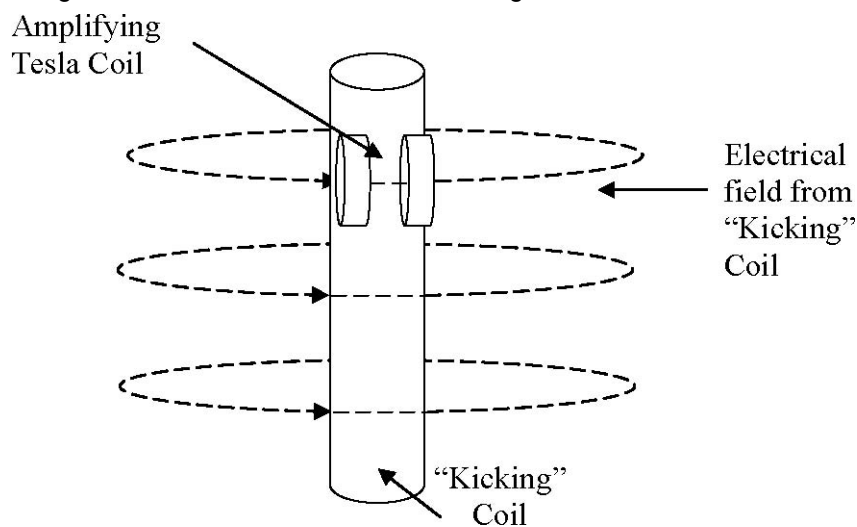
In implementation B, you must use an additional pulsing or “kicking” coil, which starts the process by providing a pulse in either the electrical field or the magnetic field (shown later on).

HOW DO WE STOP THE PROCESS?

The process of pumping energy can continue uninterrupted for an unlimited length of time and so the question arises; how do you stop the device if you should want to?. This can be done by connecting a spark gap across the coil L and the resulting sparking will be sufficient to stop the process.

THE “KICKING” PROCESS USING AN ELECTRIC FIELD

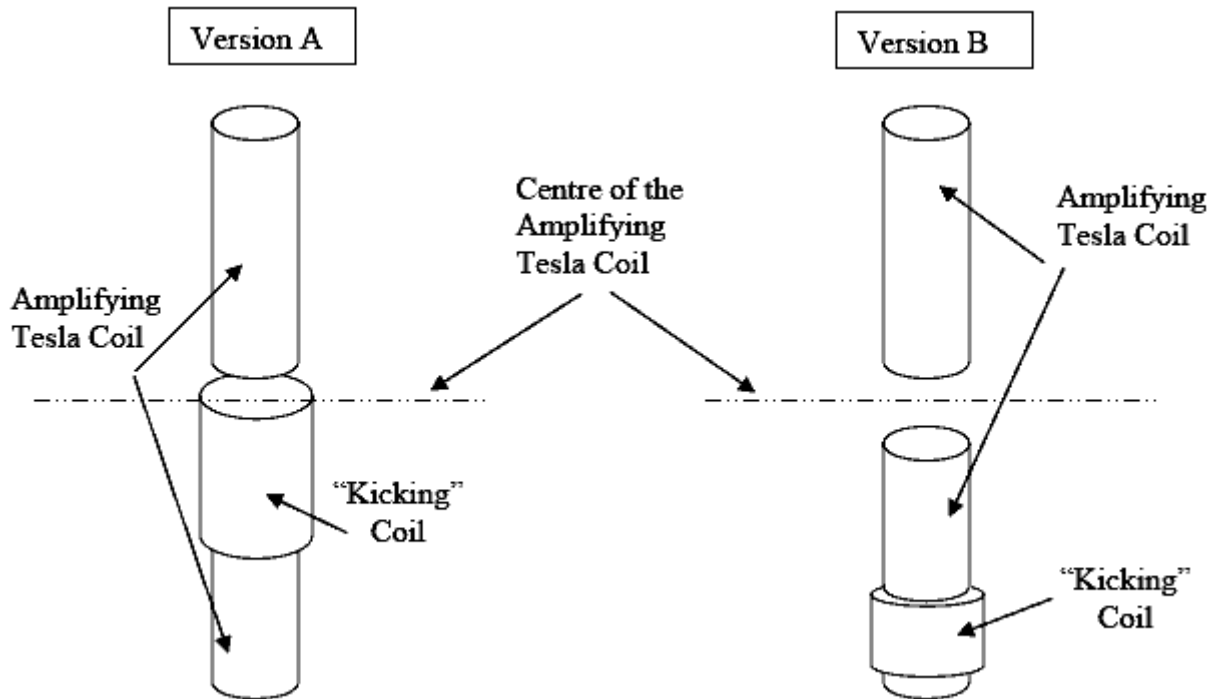
Use an additional special “kicking” coil, which can generate short powerful magnetic pulses, and install an amplifying Tesla coil along the electrical vector of the electromagnetic field of this coil.



The electrical field of the driving pulse or “kicking” coil will charge the spread capacitors of the inductor, and the process will be started. Use pulses as short as possible in “kicking” coil, because the displacement current depends on the speed of the changes in the magnetic field.

THE “KICKING” PROCESS WITH A MAGNETIC FIELD

It is not possible to “kick” the process by displacement of the amplifying Tesla coil in the uniform changing magnetic field of the “kicking” coil, because the output voltage on the ends of the Tesla amplifying coil will be equal to zero in this case. So, you must use a non-uniform magnetic field. For that you must install a “kicking” coil, not in the centre of the amplifying Tesla coil, but positioned away from the centre



IS THAT ALL TRUE, AND THE BEST TECHNIQUE TO USE?

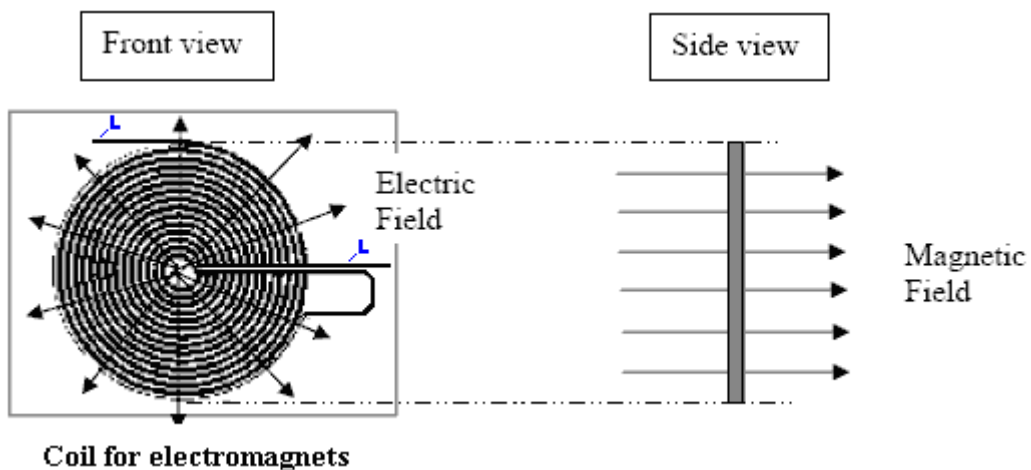
No, it is not! Nikola Tesla found more subtle and more powerful method – his bi-filar pancake coil!

BI-FILAR PANCAKE COIL – MAY BE THE BEST METHOD

The voltage between adjacent turns in an ordinary coil is very low, and so their ability to generate additional energy is not good. Consequently, you need to raise the voltage between adjacent turns in an inductor.

Method: divide the inductor into separate parts, and position the turns of the first part in between the turns of the second part, and then connect end of the first coil to the beginning of the second coil. **When you do that, the voltage between adjacent turns will be the same as the voltage between the ends of the whole coil !!!**

Next step – rearrange the position of the magnetic and electric fields in the way needed for applying amplifying energy (as described above). The method for doing this is – the flat pancake coil **where the magnetic and electric fields are arranged in exactly the way needed for amplifying energy.**



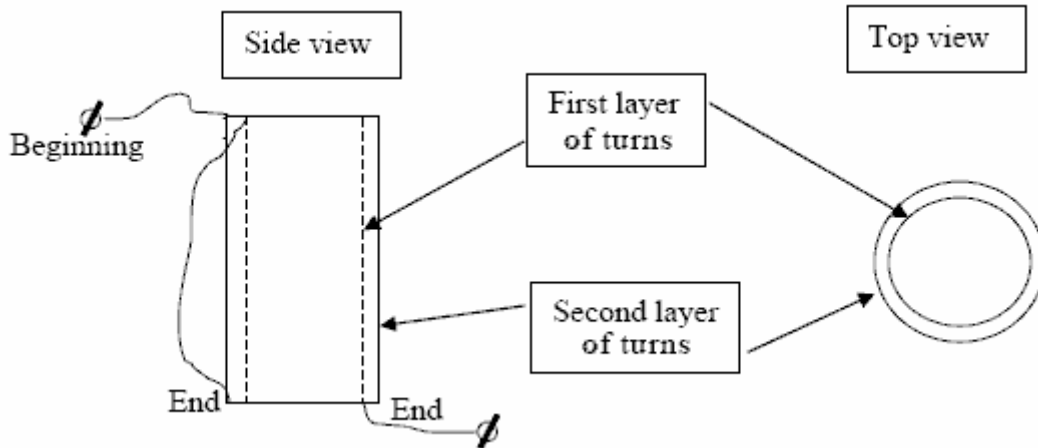
Now, it is clear why Tesla always said that his bi-filar pancake coil was an energy-

amplifying coil !!!

REMARK: for the best charging of the natural self-capacitance of the coil, you have to use electric pulses which are as short as possible, because the displacement current as shown in Maxwell's equation, depends to a major degree on the speed of the change in the magnetic field.

THE DUAL - LAYER CYLINDRICAL BI-FILAR COIL

Instead of the standard side-by-side cylindrical bi-filar coil, the coil winding may also be arranged in two separate layers, one on top of the other:



THE ELECTRO - RADIANT EFFECT

(Inductance in an electrostatic field)

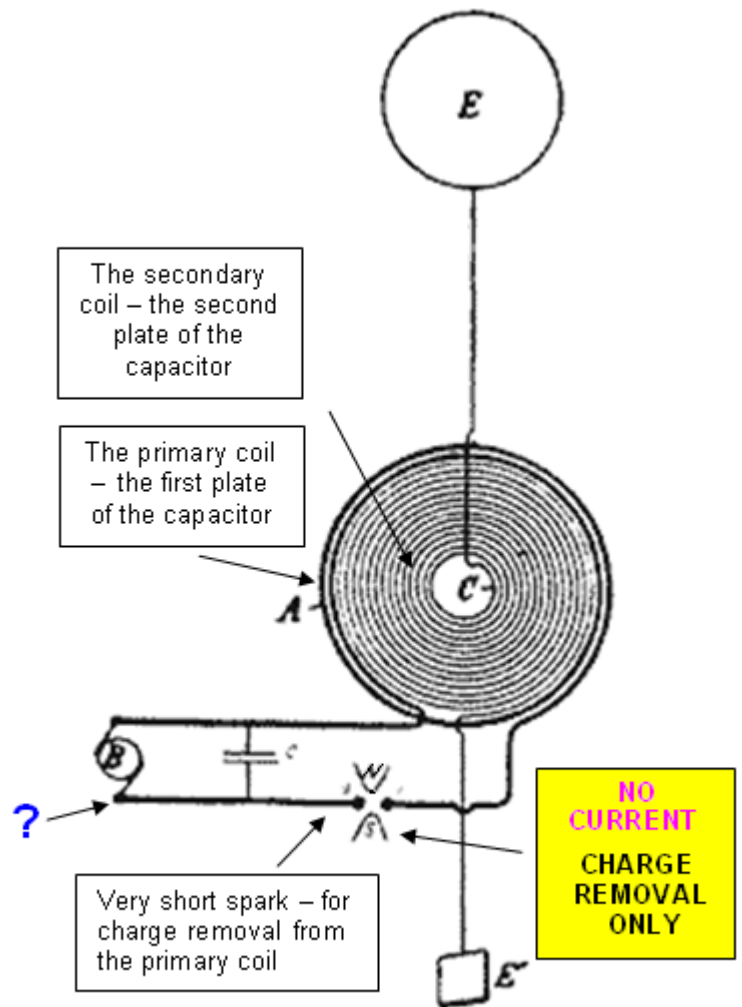
EXPLANATION

The primary coil in Tesla's transformer is the first plate of the capacitor. The secondary coil - is the second plate of the capacitor.

When you charge a capacitor C from your source of energy, you charge a wire of the primary coil also. As a result, a wire of the secondary coil is charging also (as a return from ambient space).

In order to start the process, you have to remove charge from the primary coil (by arranging a jump in potential in ambient space). When this is done, a huge displacement current occurs - as a result of that potential jump. Inductance catches this magnetic flux, and you have energy amplification.

If this process is operating, then you generate a magnetic field in ambient space.



Tesla's Magnifying Transmitter

COMMENT: The capacitance of the wire of the primary coil is very low, and so it takes very little energy to charge it, and a very short spark to discharge it (without removing charge from the capacitor C).

COMMENT: Notice that the spark gap **must be** connected to the ground as, in my opinion, this is a very important feature of this process, **but Mr Tesla did not show grounding**. Perhaps this needs to be a separate grounding point.

REMARK: In my opinion, this technology was also used in Gray's device and in Smith's devices and in both cases **the spark gap was connected to the ground**.

ALSO:

Pay attention to the words used in Gray's patent "... for inductive load".

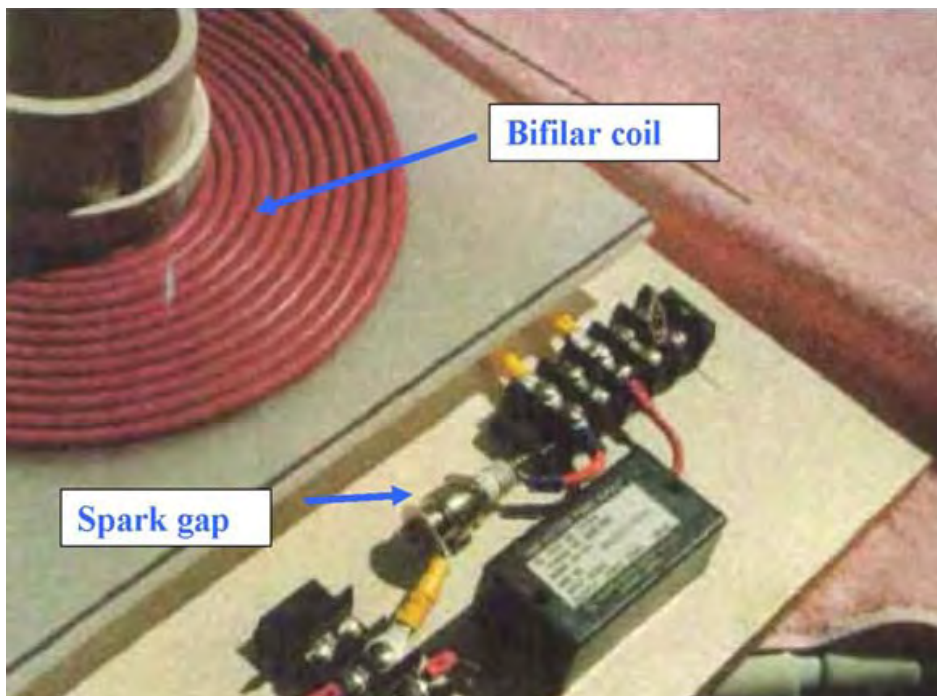
And, pay attention to Smith's words "I can see this magnetic field, if I use a magnetometer".

MODERN IMPLEMENTATIONS
in self-powered L-C circuits

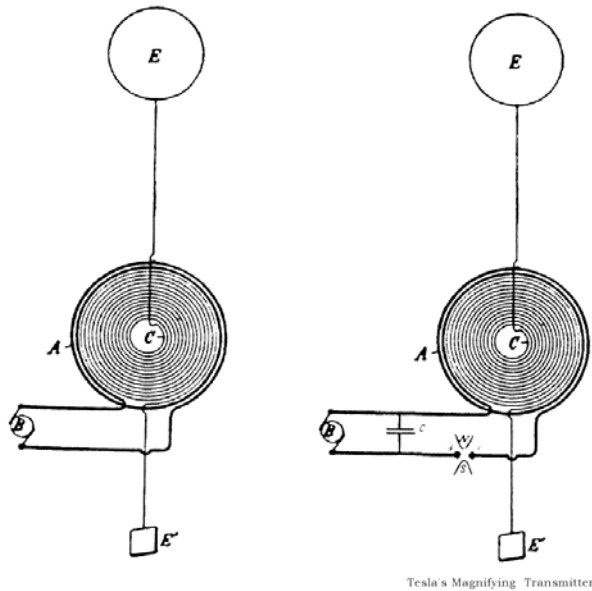
EXAMPLE 1

Using a bi-filar coil as the primary coil in a resonant Tesla transformer

By Don Smith



Explanation: The bi-filar primary coil is used as primary for energy amplification, and is pulsed through the spark gap.



EXAMPLE 2

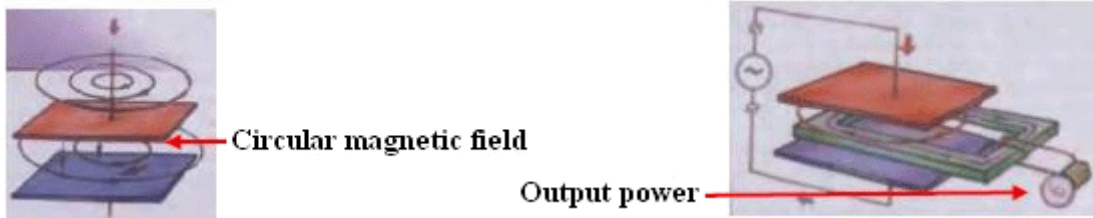
By Mislavskij

Is comprised of two capacitor plates sandwiching a ferrite ring core with a coil wound on it:



EXPLANATION

When a capacitor is charging (or discharging), this “displacement” current flow generates a magnetic field in the vacuum in a circular form (Maxwell’s equations). If a coil is wound on a ferrite toroid placed between the plates of the capacitor, then a voltage is generated in the turns of that coil:

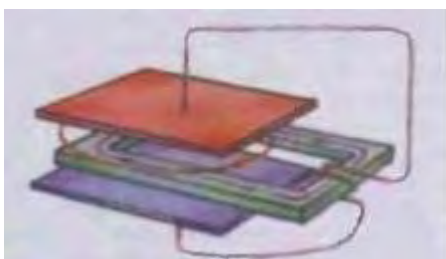


Also, if an alternating current is applied to the coil wound on the ferrite toroid, then voltage is generated on the capacitor plates.

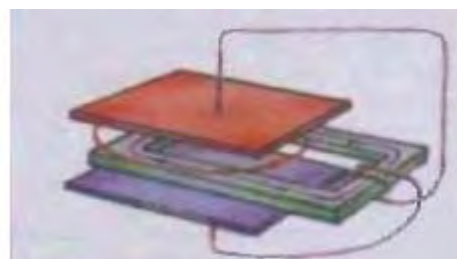
If an inductor and a capacitor are combined in an L-C circuit, then there are two cases inside such an L-C circuit:

a) energy amplification and **b) energy destruction**

The situation depends on how the coils and capacitor are connected together



Energy Generation



Energy Destruction

COMMENT: If the direction of the turns in the coil wound on the ferrite core is reversed, then the wires connecting the coil to the capacitor plates need to be swapped over as well.

The first experiments with a ferrite core inside a capacitor were made in 1992 by Mislavskij (a 7th-year pupil of the Moscow school), and so it is known as "Mislavskij's transformer".

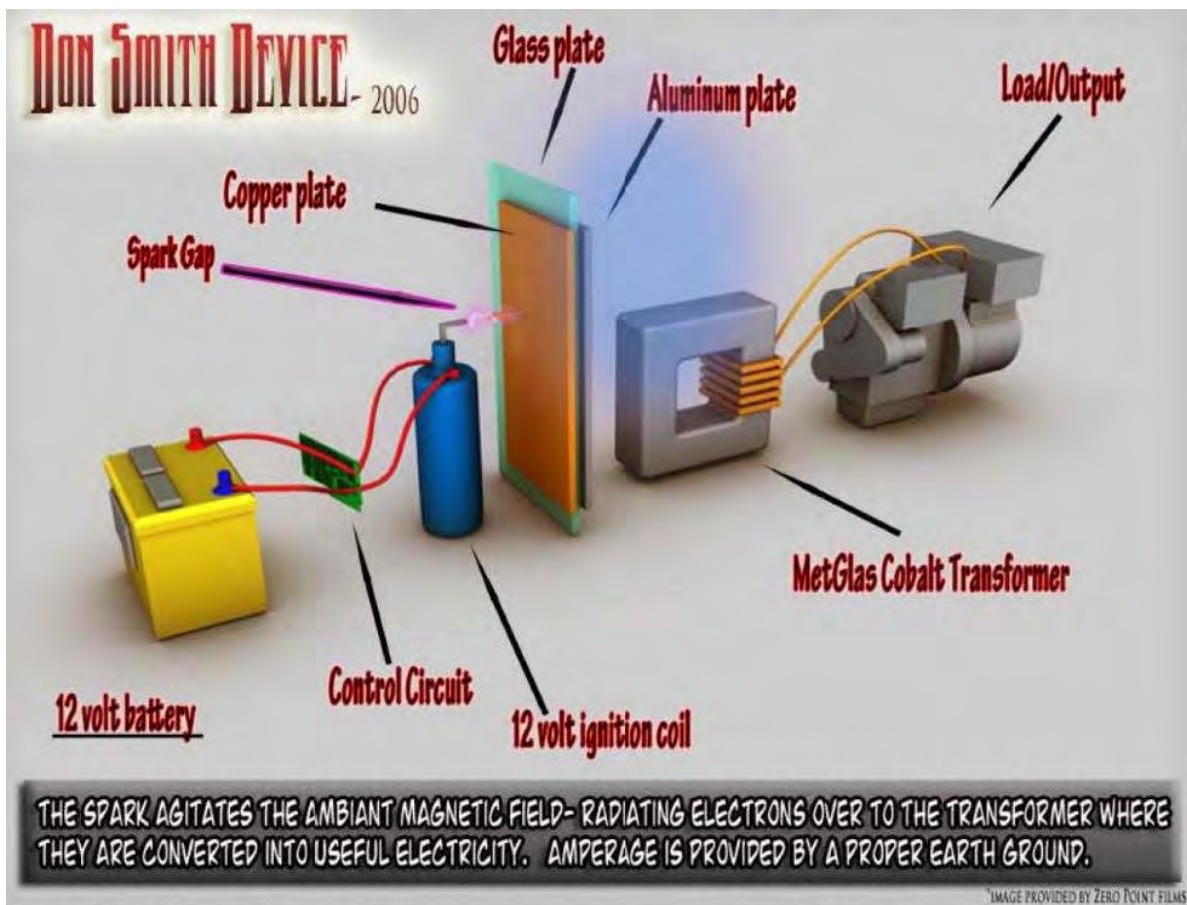


PROTOTYPE TRANSFORMER:

THE SAME APPROACH?

By Don Smith

In this arrangement, the capacitor is charged by sparks and powerful displacement current is produced. The transformer with the ferromagnetic core is collecting this current.

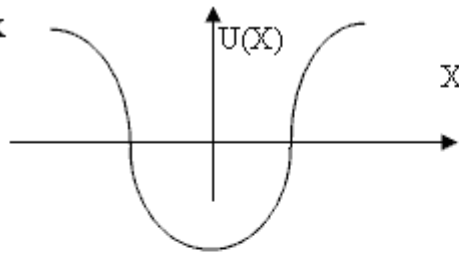


COMMENT: This schematic diagram is very rough, and lacking in details. It will not perform correctly without back-electromagnetic force suppression of some kind (see below).

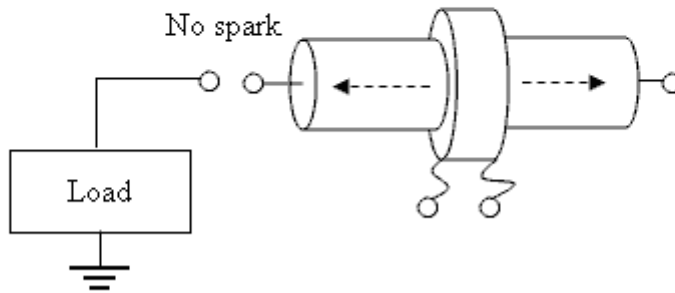
POTENTIAL (VOLTAGE) DISTRIBUTION ON THE COIL

Before the ground spark

For one moment



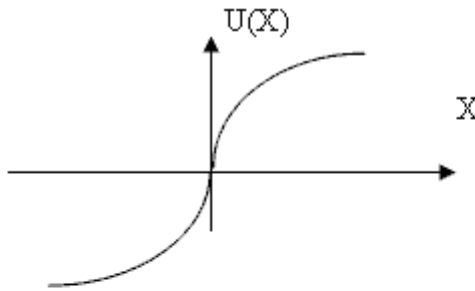
A



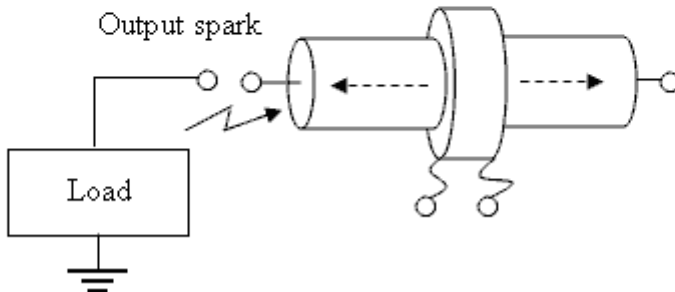
Prototype Coil

Added by ground spark

For one moment



B



EXPLANATION The task of the oscillating circuit is to create a local electromagnetic field with a large electrical component. In theory, it would only be necessary to charge up the high voltage capacitor just once and then a lossless circuit would maintain the oscillations indefinitely without needing any further power input. In reality, there are some losses and so some additional power input is needed.

THESE OSCILLATIONS ACT AS A "BAIT", ATTRACTING CHARGE INFLOW FROM THE LOCAL ENVIRONMENT. Almost no energy is needed in order to create and maintain such a "bait"...

The next step is to move to this "bait" to one side of the circuit, close to the source of the charges which is the Ground. At this small separation, breakdown occurs and the inherent parasitic capacitance of the circuit will be instantly recharged with energy flowing into the circuit from outside.

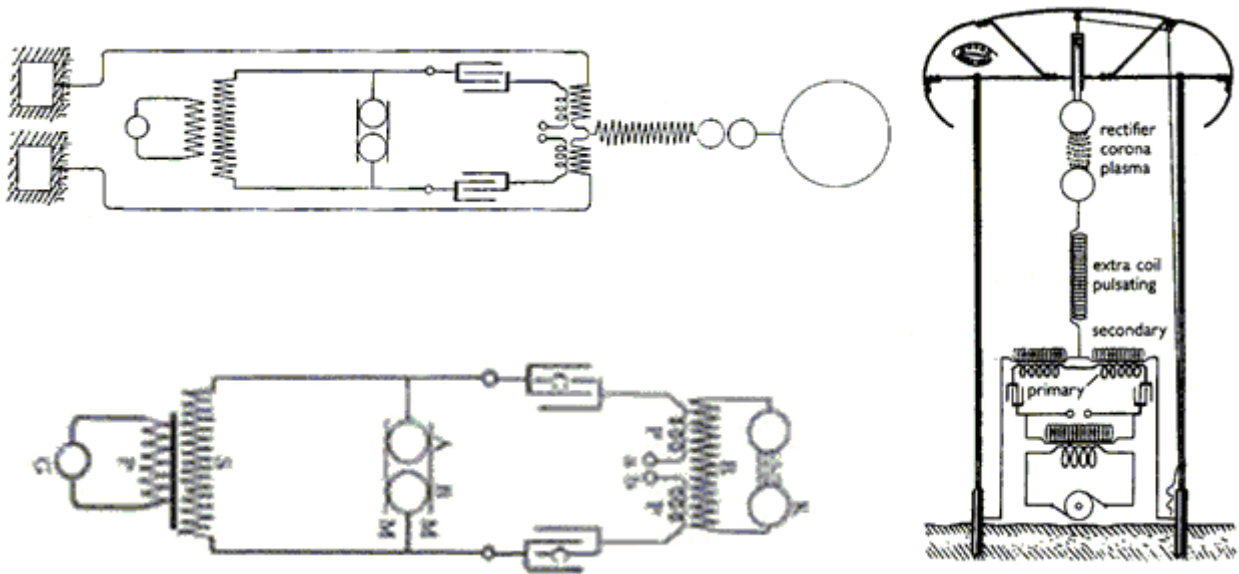
At the ends of the circuit there will be a voltage difference, and so there will be spurious oscillations. The direction of this electromagnetic field is perpendicular to the original field of the "bait" and so it does not destroy it. This effect is due to the fact that the coil consists of two opposing halves. The parasitic oscillations gradually die out, and they do not destroy the "bait" field.

The process is repeated spark by spark for every spark which occurs. Consequently, the more often sparks occur, the greater the efficiency of the process will be. The energy in the "bait" experiences almost no dissipation,

providing a much greater power output than the power needed to keep the device operating.

TESLA SCHEMATICS

COMMENT: Don Smith named this technology “Bird on the wire”. The bird is safe on the wire until a spark occurs.

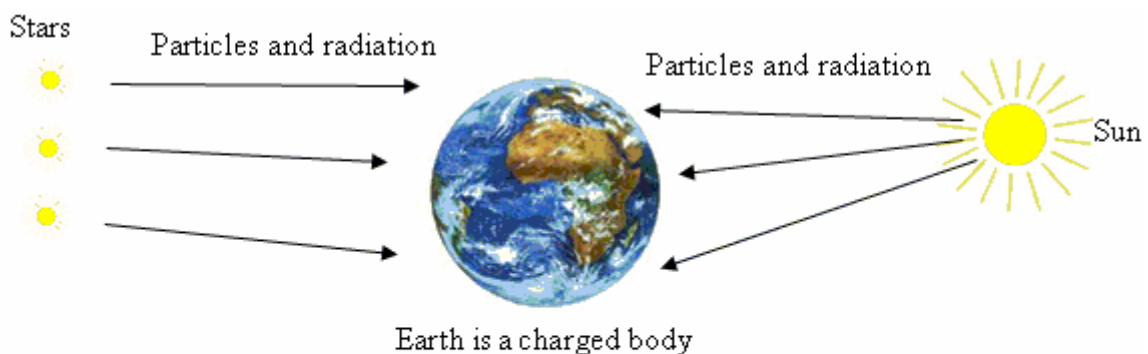


COMMENT: Mr. Tesla named this technology a “charge funnel” or “charge pump”

THE PRINCIPLE OF THE TECHNOLOGY

1. This Free-Energy device generates an AC electrical potential in ambient space (“bait” for electrons),
2. Electrons flowing through the load, flow in from the environment, attracted by this “bait” (pumped in)

NOT A SINGLE ELECTRON USED FOR EXCITING AMBIENT SPACE NEEDS TO FLOW THROUGH THE LOAD

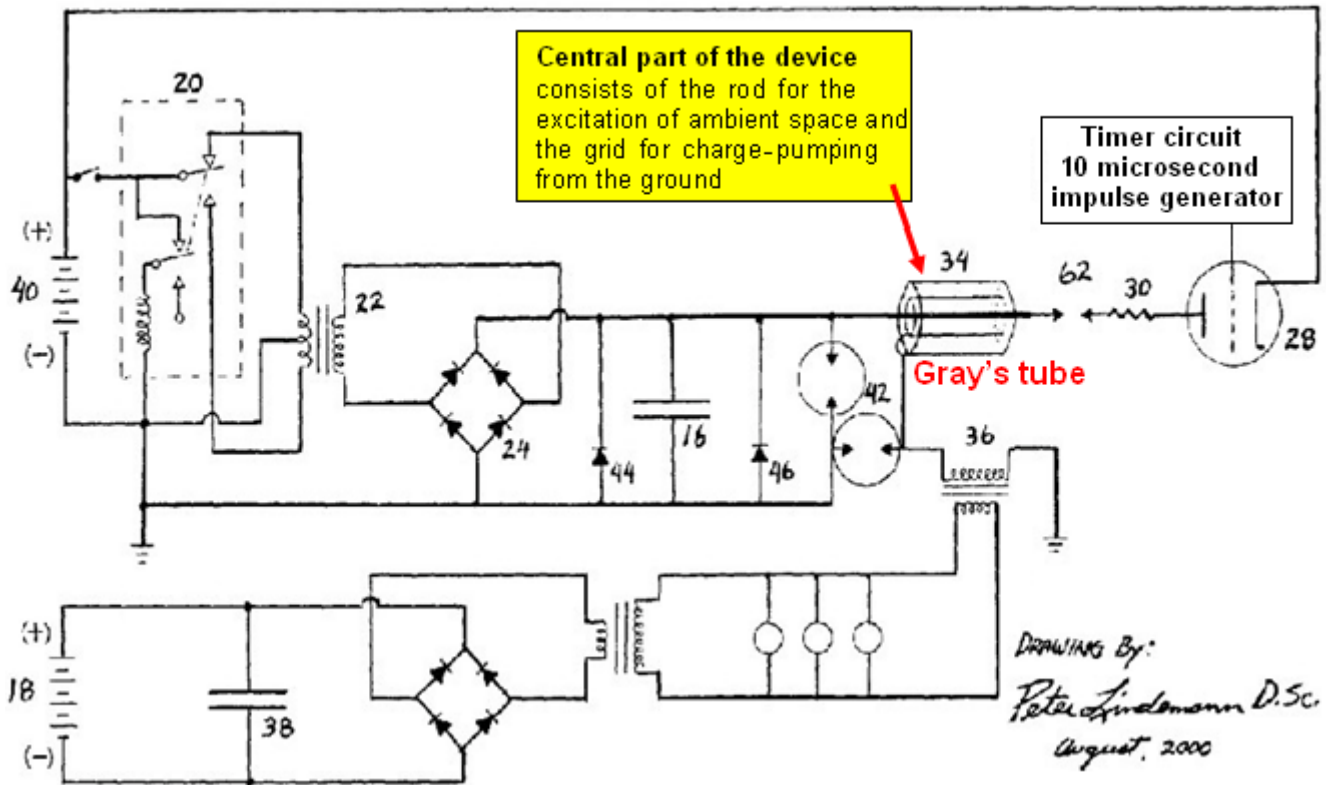


1. Potential (Voltage) – from FE device
 2. Electrons (Current) – from external body ➡ **Free Energy**

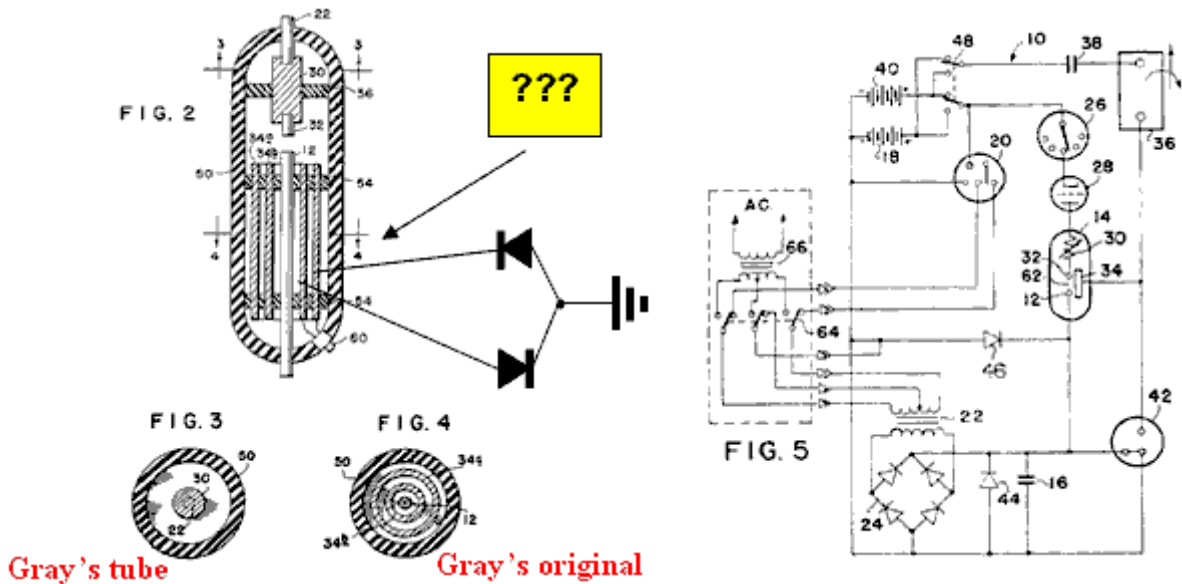
POSSIBLE DESIGN FOR THE “CHARGE PUMP” OR “CHARGE FUNNEL”

By Edwin Gray

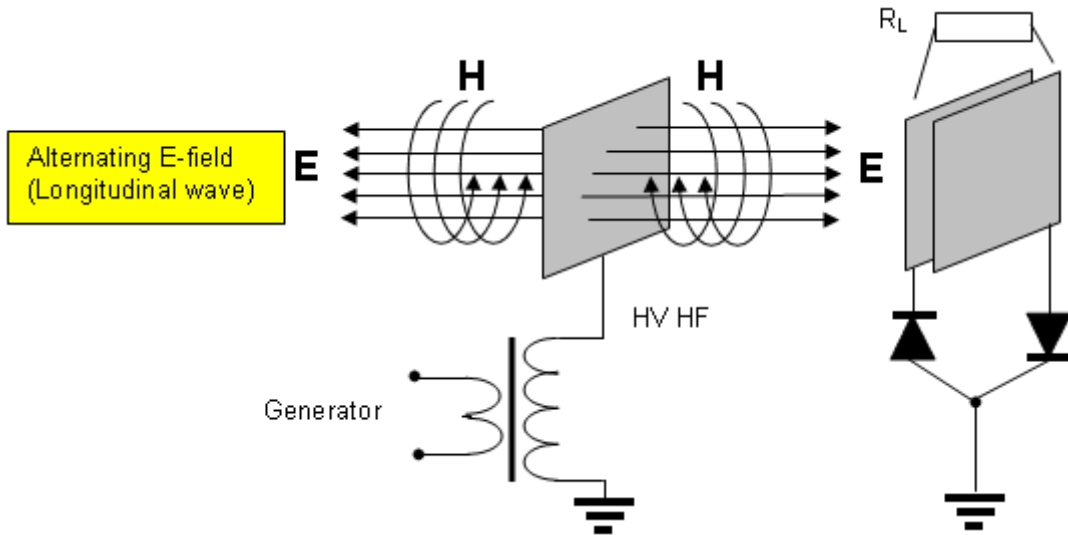
Probable Schematic for Edwin Gray's Cold Electricity Circuit



EXPLANATION: This schematic is a simplification of Gray's patent, produced by Dr. Peter Lindemann for greater clarification in his book.

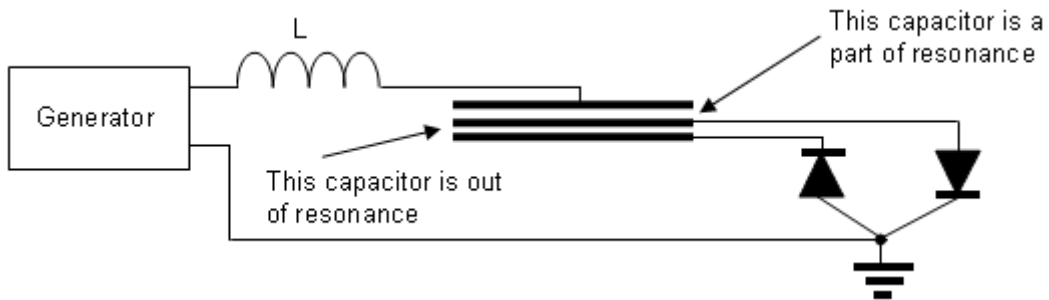


POSSIBLE DESIGN FOR THE “CHARGE PUMP” or “CHARGE FUNNEL”



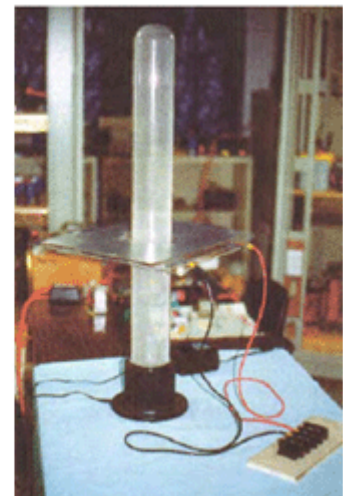
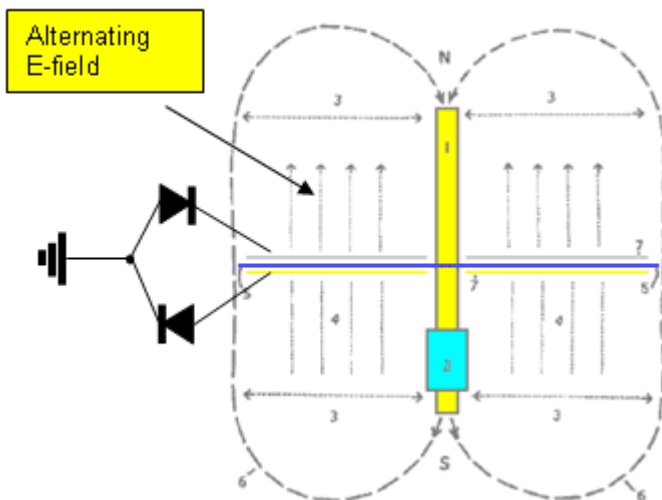
EXPLANATION: The charging system is unable to “see” the field inside a charging capacitor.

COMMON VIEW OF RESONANCE: Resonance is not destroyed if you short-circuit or open a “pumping” capacitor.



COMMENT: You can add an ordinary, very large capacitor in parallel with the “pumping” capacitor for more impressive results.

Don Smith illustration



COMMENTS: You have to use an alternating E-field, in order to charge the capacitor. But, Smith marked the North and South poles in his drawing. I think that this is true for only one instant. Diodes are not shown in his drawings, which indicates that his device as shown, is to my mind not complete.

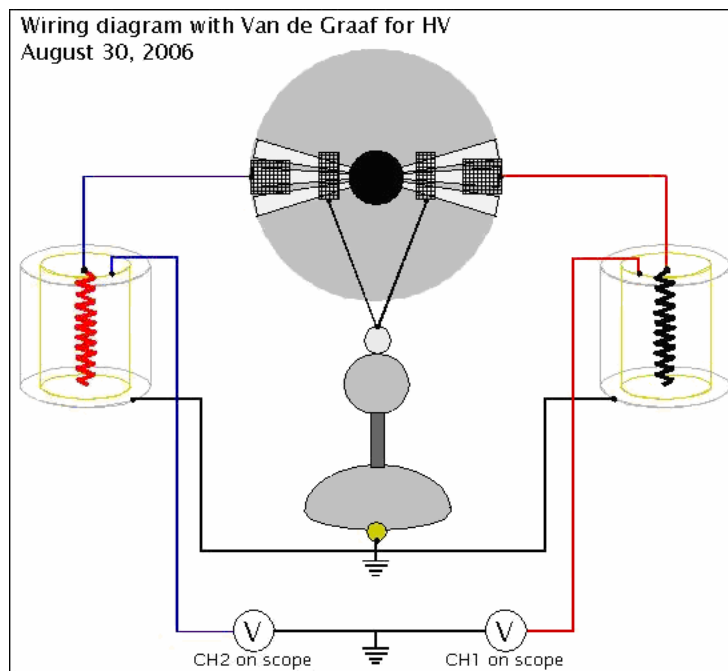
THE EXTERNAL APPEARANCE OF ED GRAY'S TUBE

EXPLANATION: Gray's tube with its two internal grids is seen in the middle. Two diodes are underneath the acrylic sheet (???). A Leiden Jar is located on the left (???). The HF HV coil is behind Gray's tube (???)



A POSSIBLE DESIGN FOR THE "CHARGE PUMP" or "CHARGE FUNNEL" THE TESTATIKA by Paul Bauman

EXPLANATION: The central electrode in the jars (capacitors) is for the excitation of ambient space; the two external cylinders are the plates of the charging capacitors.

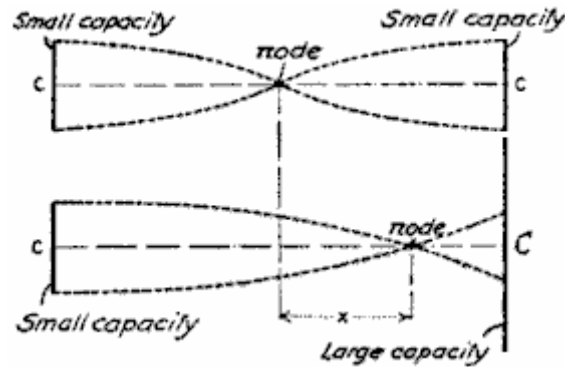


EXPLANATION: The charging mechanism is unable to "see" the field inside the charging capacitors.

COMMENT: For more details read the section on asymmetrical capacitors.

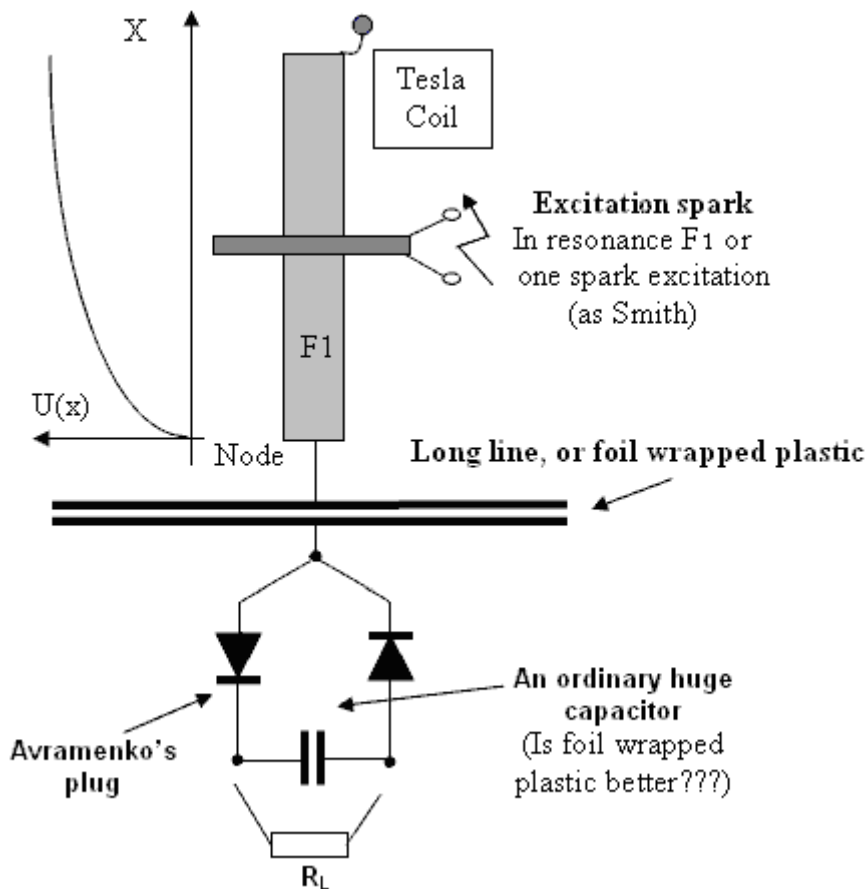
A POSSIBLE DESIGN FOR THE “CHARGE PUMP” or “CHARGE FUNNEL”

COMMENT: This is based on Tesla's schematics



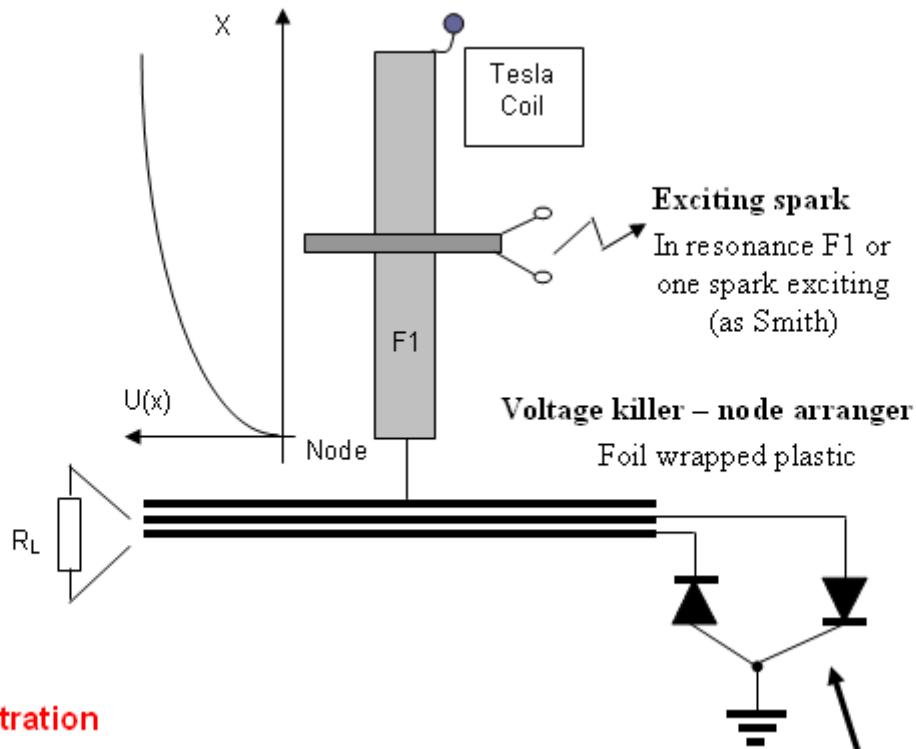
COMMENT: First, you need to arrange a “voltage killer” barrier on one side of the Tesla coil. This is to create a “BLIND” charging system which can’t “see” the charge on the capacitor (see below for more detail on “blindness”).

COMMENTS: ‘Huge capacitor’ means: as much ordinary capacitance as possible. Effectiveness depends on voltage and coil frequency, and current in the node. Effectiveness depends also on the frequency at which the excitation spark occurs. It is very similar to Don Smith’s devices.



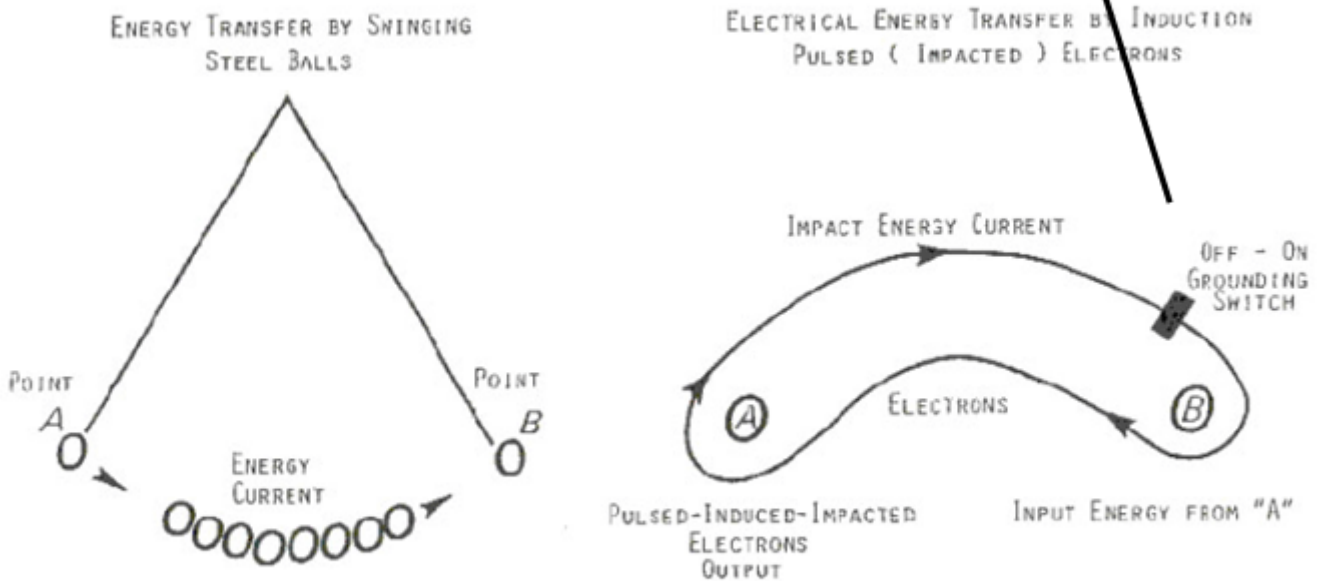
COMMENT: For more details read part devoted to Avramenko's plug...

POSSIBLE DESIGN FOR THE "CHARGE PUMP" or "CHARGE FUNNEL"



Don Smith illustration

ALTERNATING IMPACT ENERGY TRANSFER ANALOGY



IN ALTERNATING ELECTRICAL ENERGY SYSTEMS, ONLY THE POTENTIAL-IMPACT LEVEL REPLICATES IT'S SELF AT POINT "B". ELECTRONS DO NOT TRAVEL FROM POINT "A" TO POINT "B".

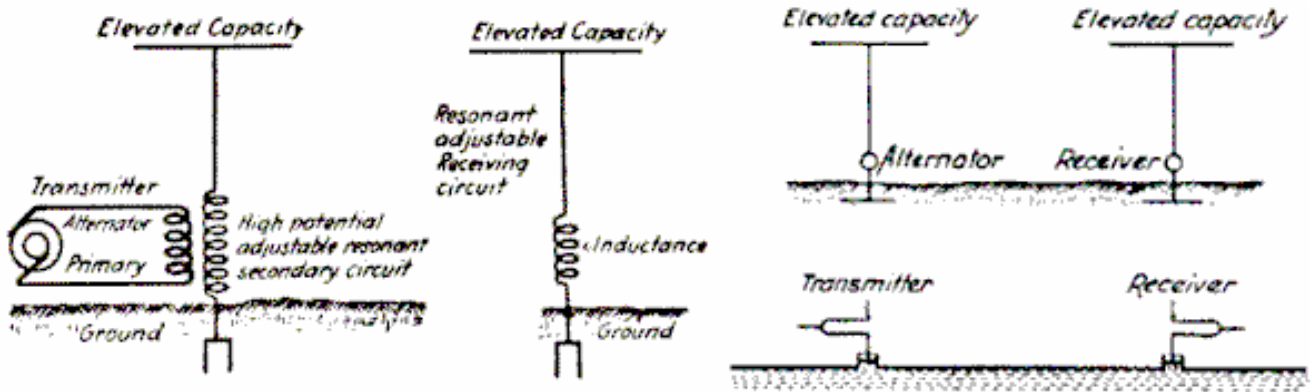
EXPLANATION: The charging system is unable to "see" the field inside the charging capacitor.

COMMENT: For more details read the part which is devoted to Avramenko's plug...

COMMENT: An ordinary piece of wire can be used in some versions of this gadget, see below....

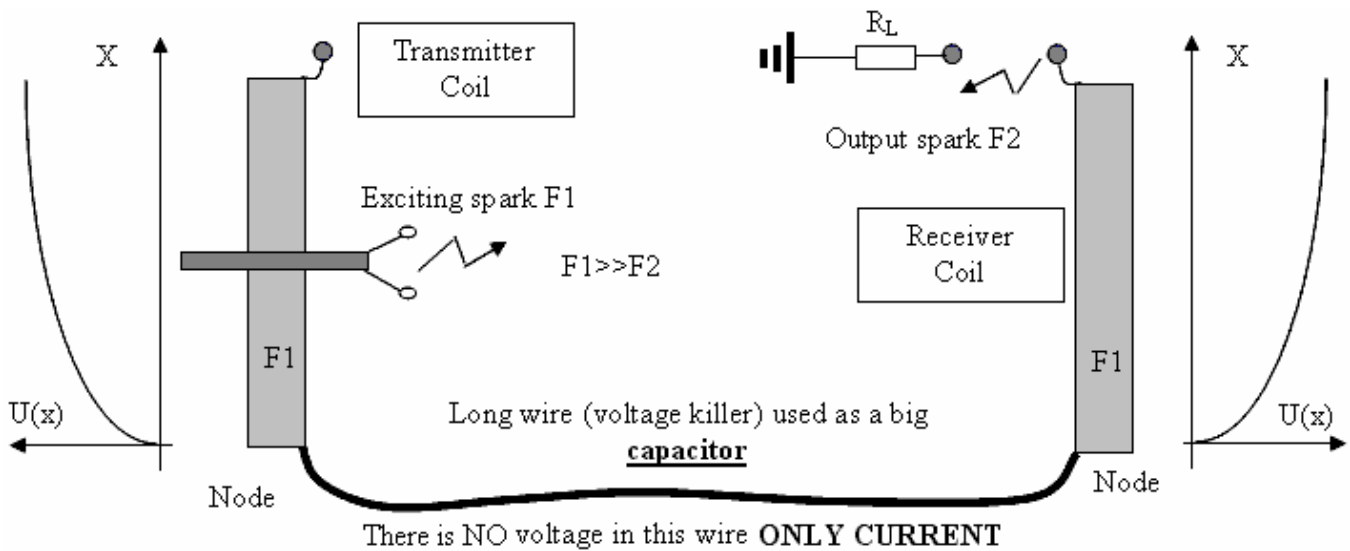
ENERGY REGENERATION BY L/4 COIL

COMMENT: This system is based on wireless energy transmission through the ground

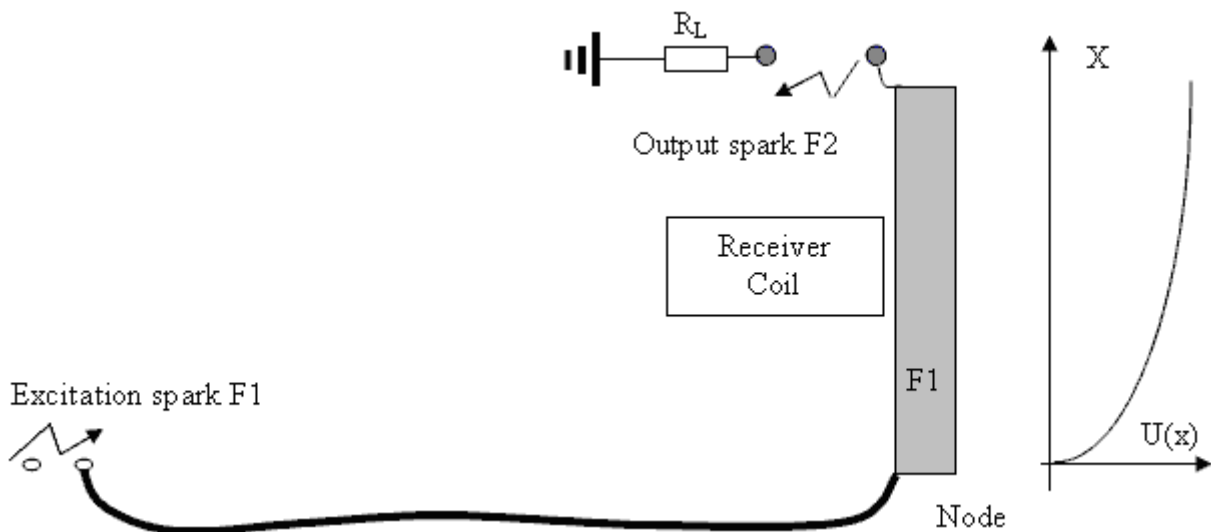


COMMENT: Energy radiated to ambient space lowers the efficiency of this process

COMMENT: The Receiver and Transmitter coils must have the same resonant frequency



COMMENT: Possible alternative arrangement:



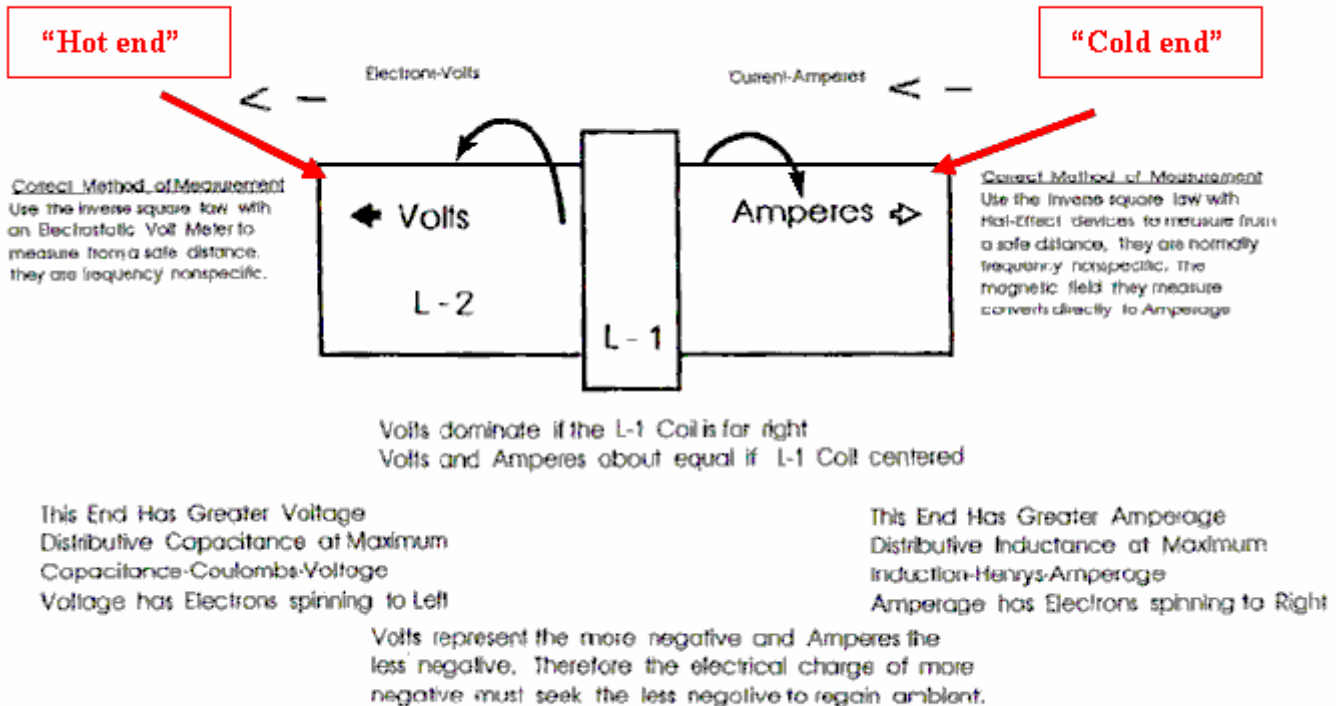
COMMENT: A metal sheet can be used instead of a long wire

The “COLD” and “HOT” ends of a Tesla Coil

by Donald Smith

COMMENT: If the excitation coil L1 is positioned in the centre of coil L2, then the Tesla Coil will have a “cold” end and a “hot” end. A spark gap can only be connected to the “hot” end. You cannot get a good spark if the spark gap is connected to the “cold” end.

Tesla Coil Geometry *



* Contains proprietary information related to Patent Procedure
Geometry - properties of lines, surfaces and solids

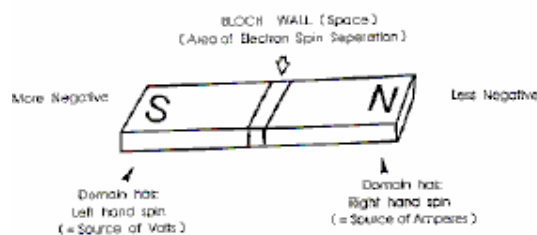
Donald L. Smith
2 November, 1995

COMMENT: This is very important for practical applications, so read Don Smith’s documents for more details.

Derivation of Magnetic and Electrical Power

Analogous Relationships:

1. Potential Power is present in a bar magnet as shown.



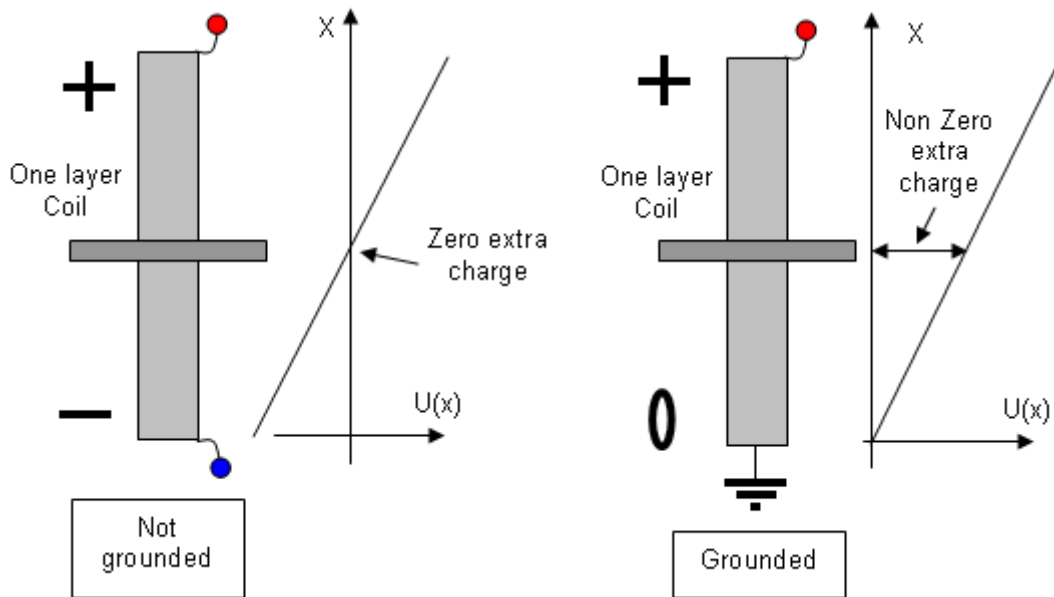
2. The Source of these Electrons being from the Solar Plasma, are none ionic and occupy all Free Space. They are commonly obtained from Earth and Air Groundings. They exist in Doublet Pairs, one being more negative than the other. The more negative one has a Left Hand Spin. The less negative one has 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 (Voltage Only) part of the Coil predominates. The right hand spin portion (Magnetic-Amperage) portion is mostly absent.

COMMENT: It is easy to understand the “Hot” and “Cold” ends, if one end of the Tesla Coil is grounded...

The Grounded Tesla coil – a hidden form of energy

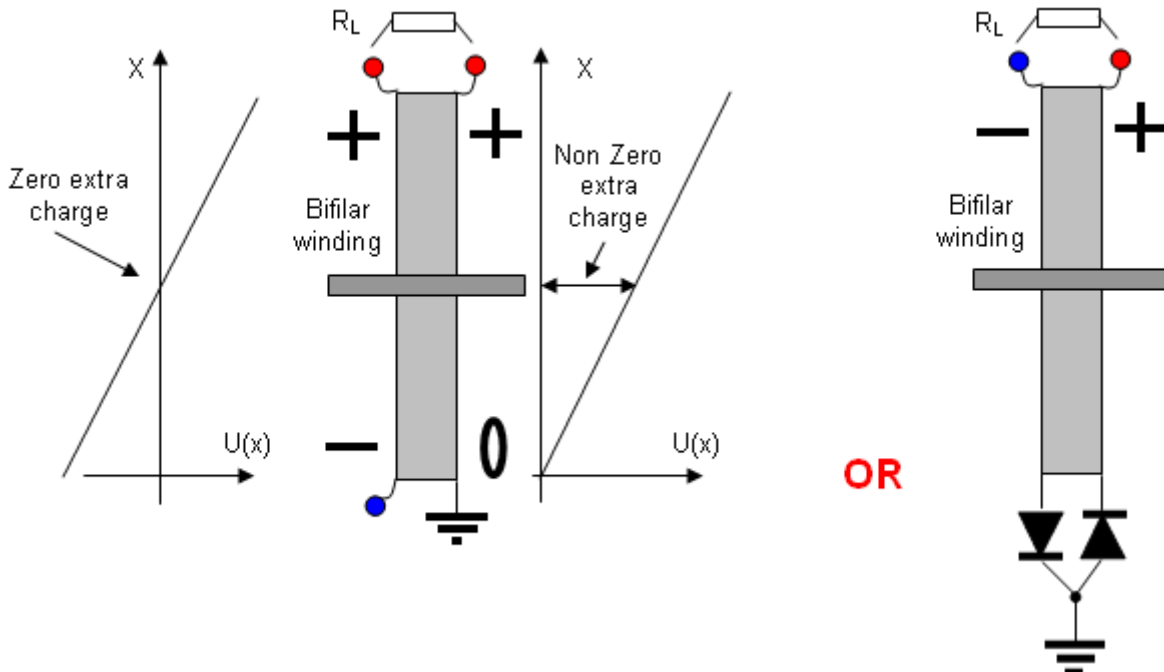
EXPLANATION: We can look at the Tesla coil as a piece of metal. Every piece of metal can be charged. If Tesla coil is grounded, it has an extra charge delivered from the ground, and has an extra energy also. But, it can be found out only in electrostatic interactions, not in electromagnetic one.



Comment: This diagram shows only one instant, after half a cycle, the polarities will be swapped over.

Question: How can we use this fact?

Answer: We have to arrange an electrostatic interaction:



Comments: Extra capacitors can be used for charging them.

This looks like Smith's plasma globe device. Maybe, he used this technology.

This can be used in charge pump technology for excitation by an alternating electrical field, read the section on the charge pump or charge funnel.

The wiring can be different to that shown above.

Examples of grounded bifilar (multi-strand) coils

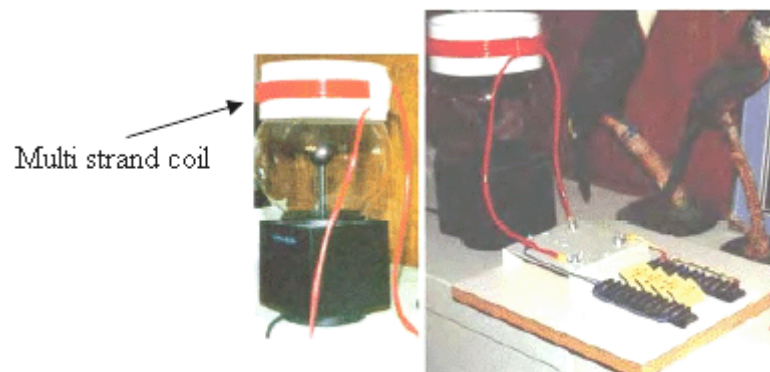
From Tariel Kapanadze in his 100 KW device



from Steven Mark in big TPU

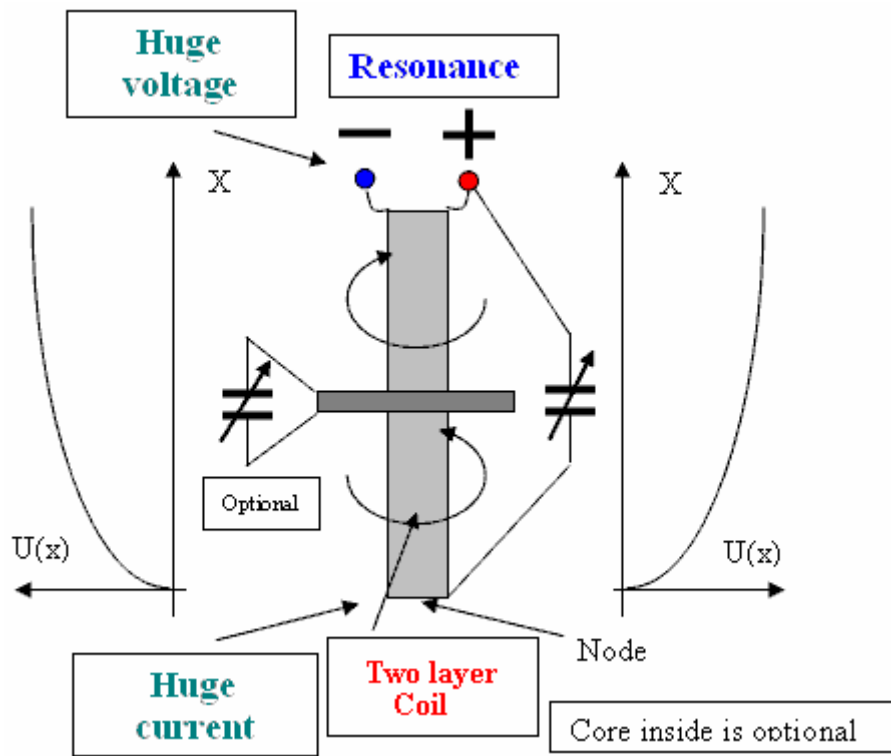
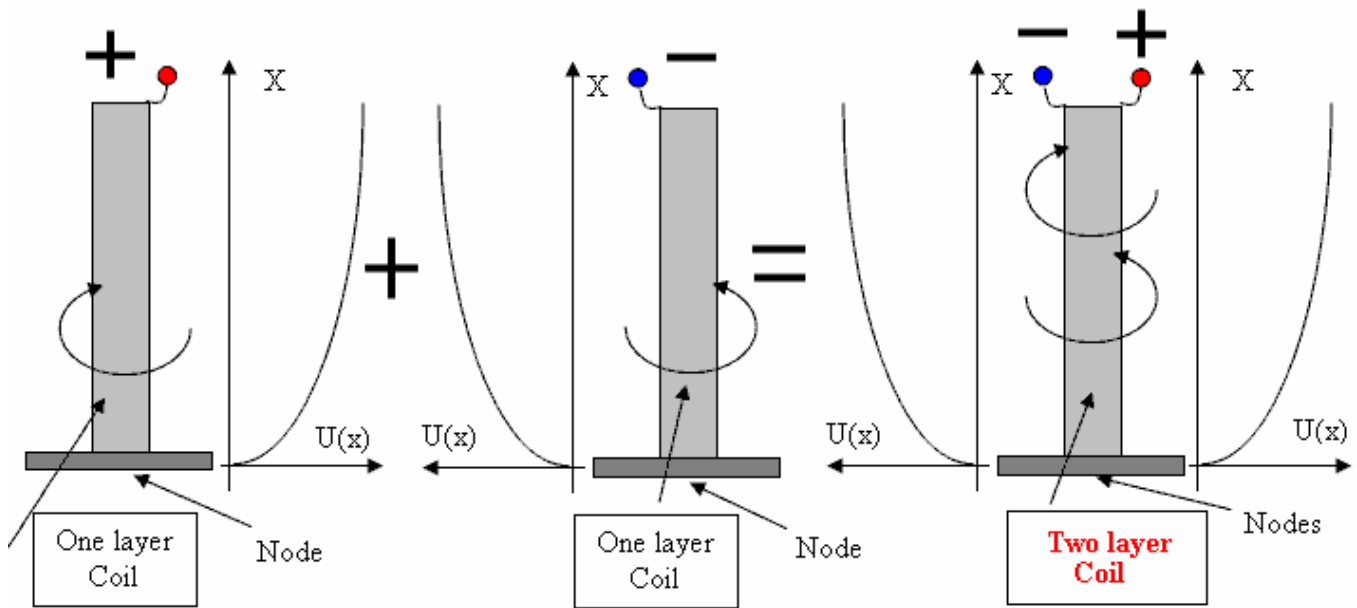


from Donald Smith



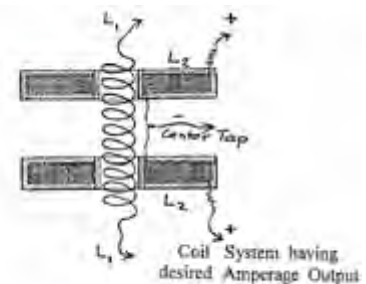
Globe device for energy generation

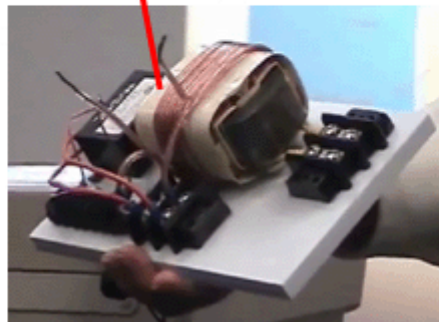
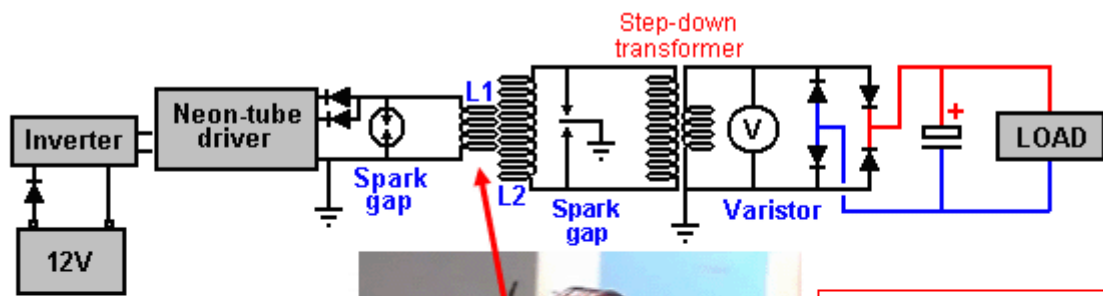
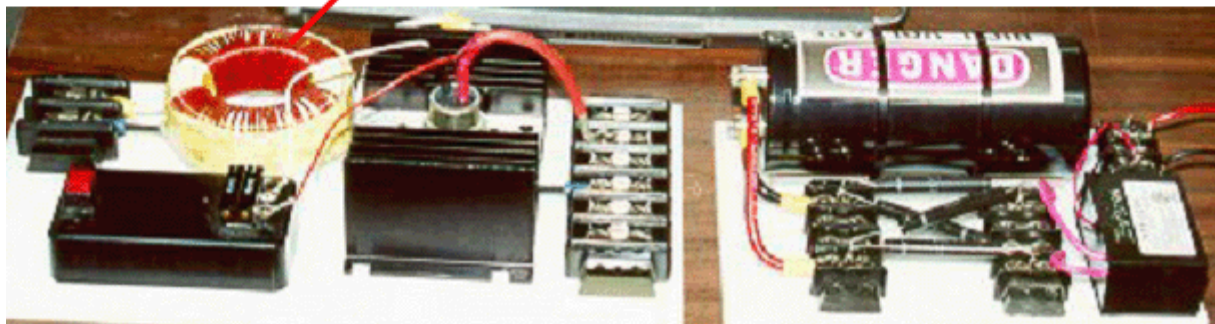
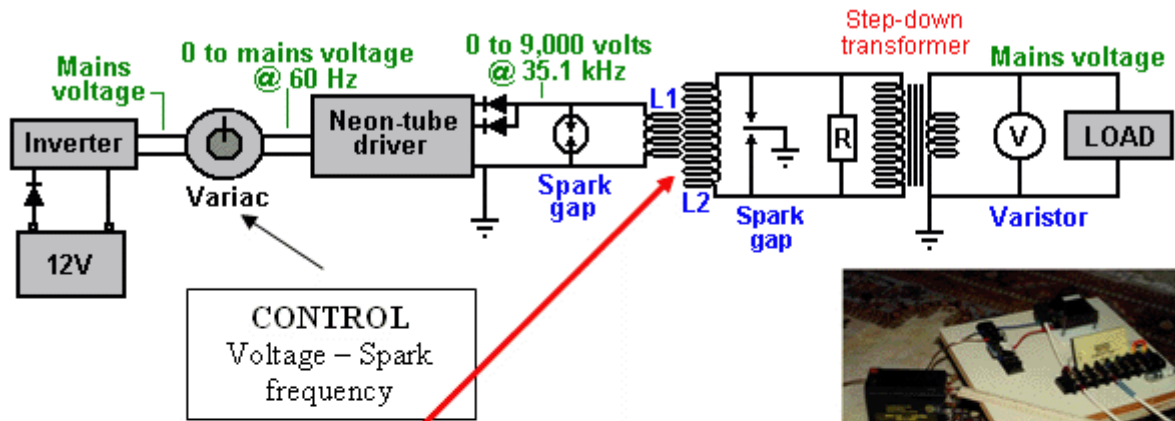
Possible simulation of the L/4 wave "Cold" and "Hot" ends



SYMMETRICAL VERSION
By Don Smith

MODERN OPTIONS
In back EMF suppression
Version 1





Primary coil in Smith's device plays the same role as the rod in Gray's tube. These devices use the same principle.

Explanation:

Both of the two out of phase outputs were used and both connected to the step-down transformer.

1. Between sparks:

There is no current in the step-down transformer and so the two ends of L2 are at the same voltage.

2. During a spark:

Parasitic capacitors (not shown) connected across both sections of L2 are discharged to ground, and current is produced in the step-down transformer. One end of L2 is at ground potential. But, the magnetic field of this current in L2 is perpendicular to the resonating field and so has no influence on it. **As a result of this, you have power in the load, but the resonance is not destroyed.**

COMMENTS: In my opinion, these schematics have errors in the excitation section. Find those errors.

Excitation by a single spark is possible.

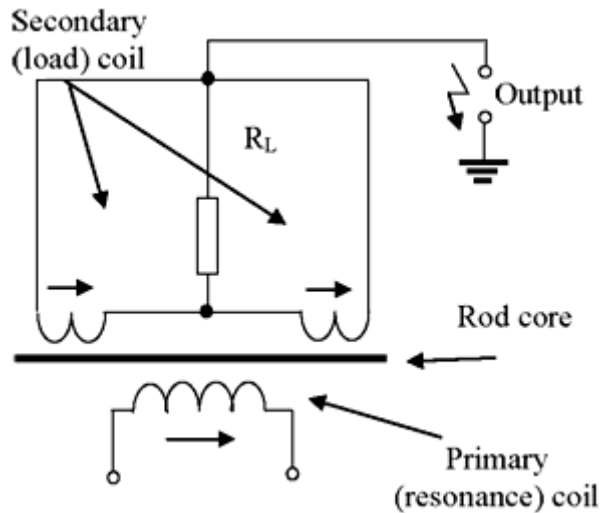
In the terminology of Mr. Tesla, this is a 'charge pump' or 'charge funnel'. The charges are coming from the Ground which is the source of the energy.

SECRET 1.1

Back EMF suppression in a resonance coil

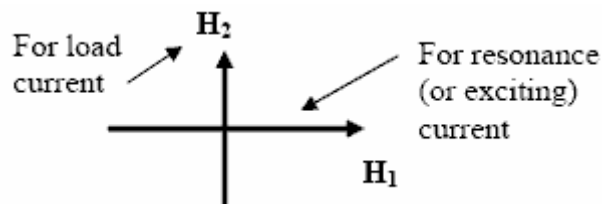
Version 2

Primary and secondary coils are placed on a rod core. All of the coils are arranged in special manner. The primary coil is placed in the middle of the core. The secondary coil is in two parts which are positioned at the ends of the rod. All of the coils are wound in the same direction.



Explanation:

The electromagnetic fields produced by the resonant (excitation) current and the load current are perpendicular to each other:



So, although you have power in the load, resonance is not destroyed by that output power.

Comments: The load must be chosen so as to get the maximum amount of power flowing into it. Very low loads and very high loads will both have close to zero energy flowing in them.

The secondary coil is shunting the primary coil, and so it has a current flowing in it even if no loads are connected.

The secondary coil can be adjusted for resonance too.

The "rod" material can be air, or other materials.

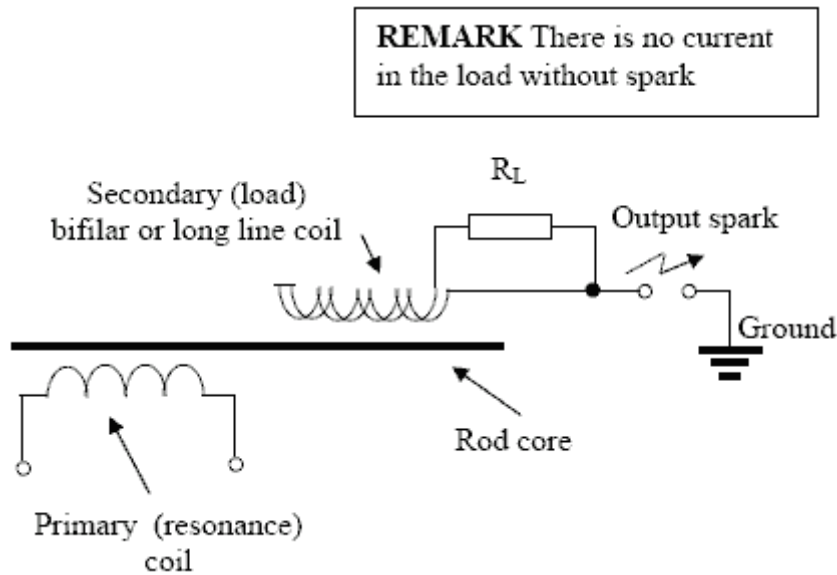
SECRET 1.1

Back EMF suppression in a resonance coil

Version 3

(long wire usage – bifilar usage)

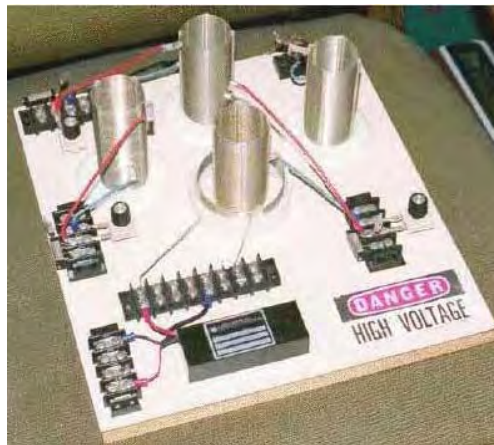
EXPLANATION: It is very much like **Version 1**, but here, the two coils are combined into a single coil.



IT IS IMPOSSIBLE!

(Without back EMF suppression)

By Don Smith

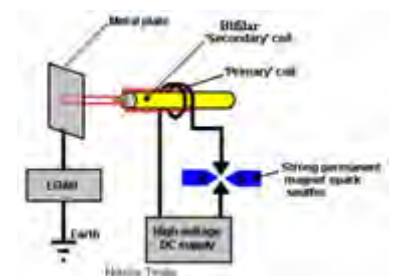


Multi-coil system for energy multiplication

COMMENT : You decide how you think it was made. Maybe short-circuited coils will be useful...

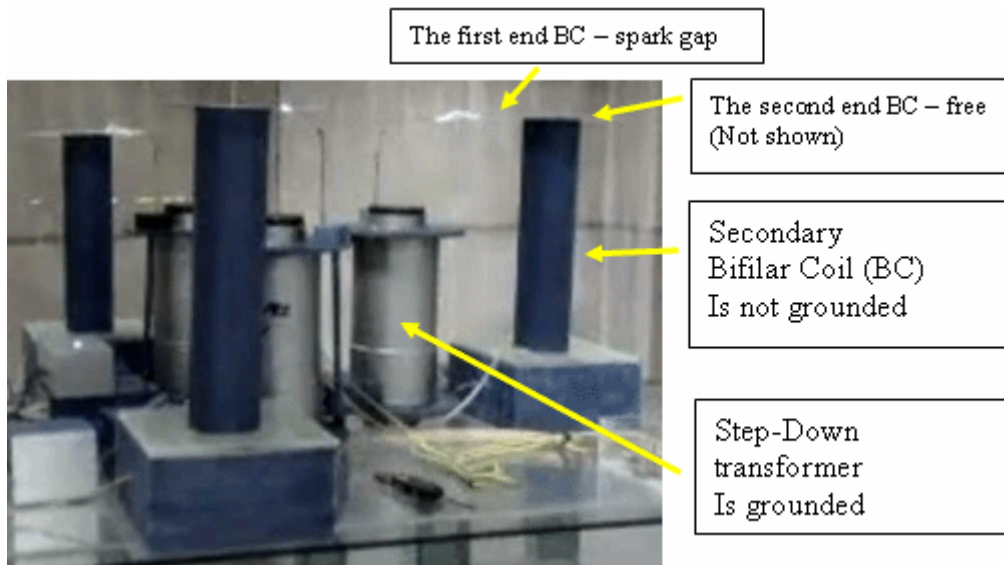
Read the following parts to discover more secrets...

MODERN OPTIONS? For Back EMF suppression Version 3

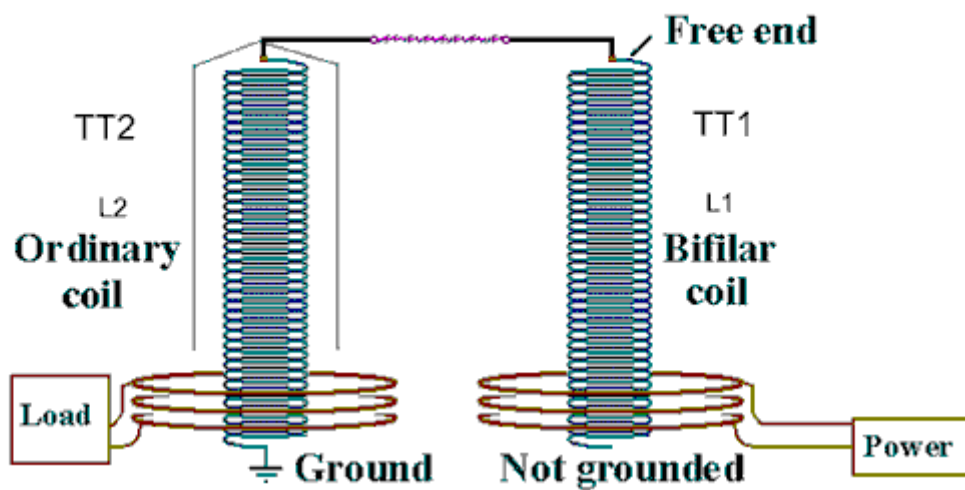


BI-FILAR USAGE

By Tariel Kapanadze



Possible schematics of the device



BIFILAR USAGE

By Timothy Trapp

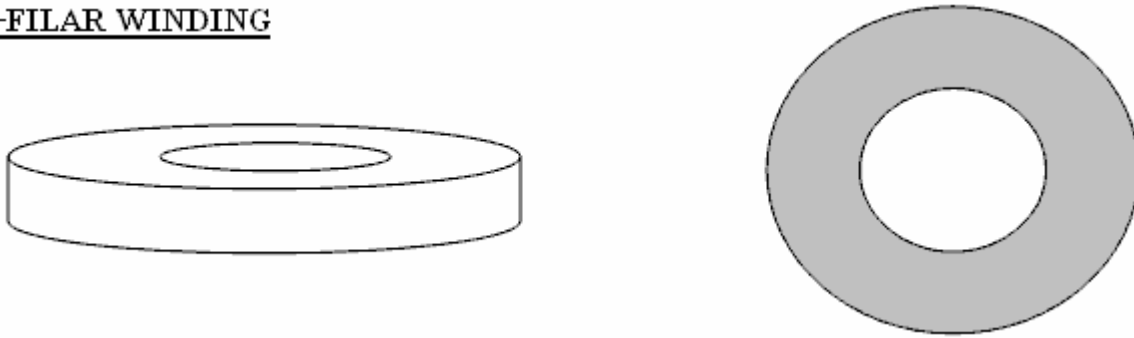
POSSIBLE CORE CONFIGURATION

For back EMF suppression

TOROIDAL CORE

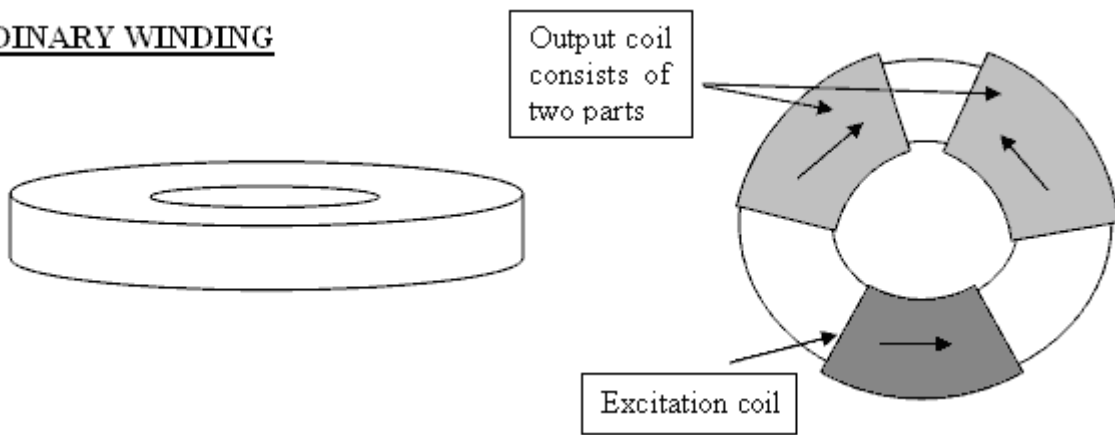


BI-FILAR WINDING

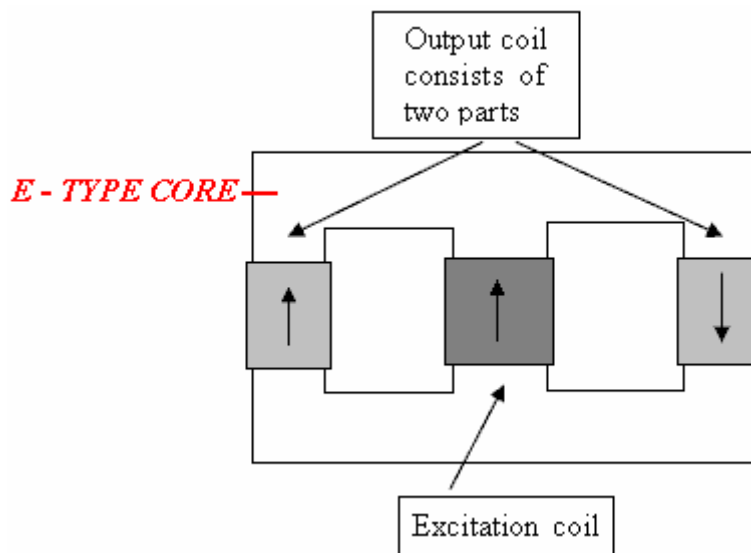


COMMENTS: An ordinary excitation winding is wound all of the way around a toroidal core.
A bi-filar output winding is wound around the whole of a toroidal core.
Remember about the "Hot" and "Cold" ends of a bi-filar coil.

ORDINARY WINDING



COMMENT: Remember about the "Hot" and "Cold" ends of the output coil



THE BASIS OF BACK EMF SUPPRESSION

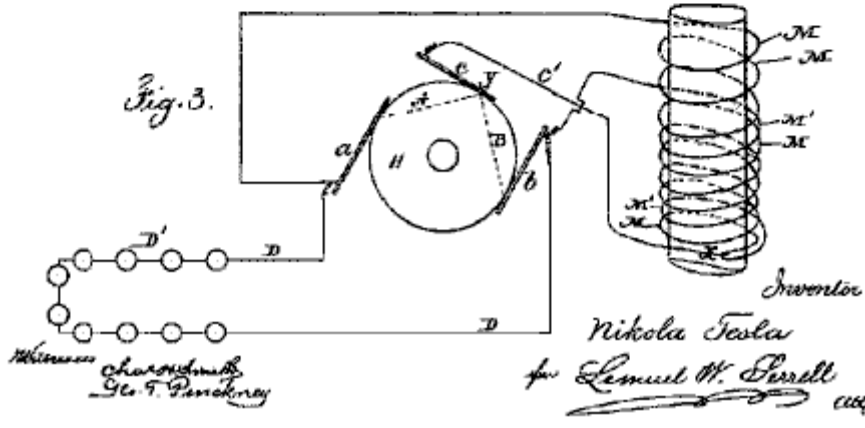
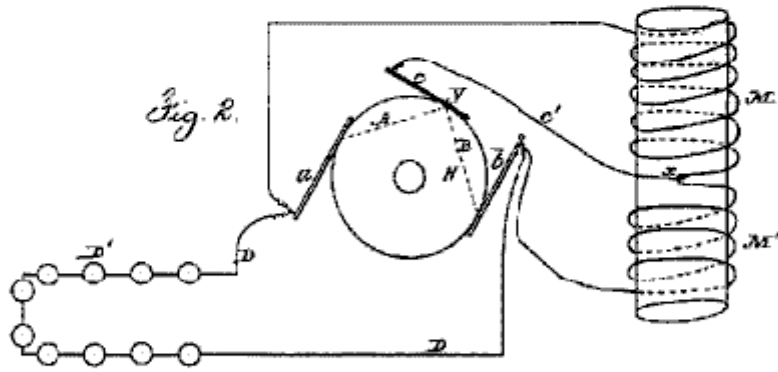
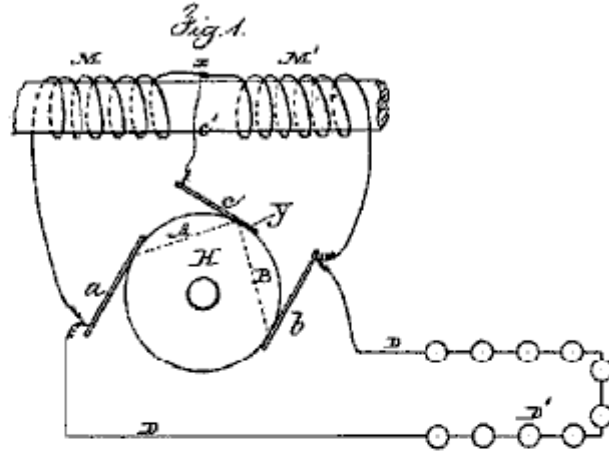
(Tesla patent)

N. TESLA.

REGULATOR FOR DYNAMO ELECTRIC MACHINES.

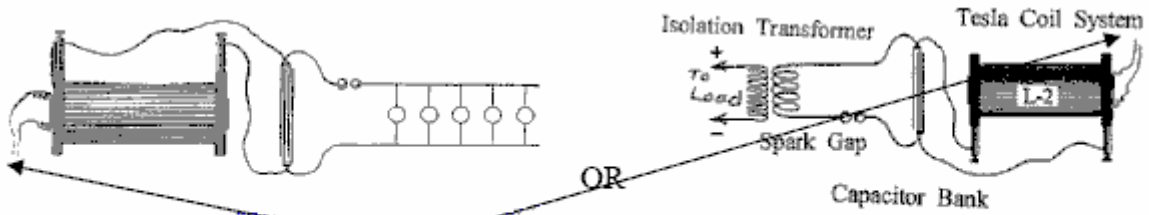
No. 336,961.

Patented Mar. 2, 1886.

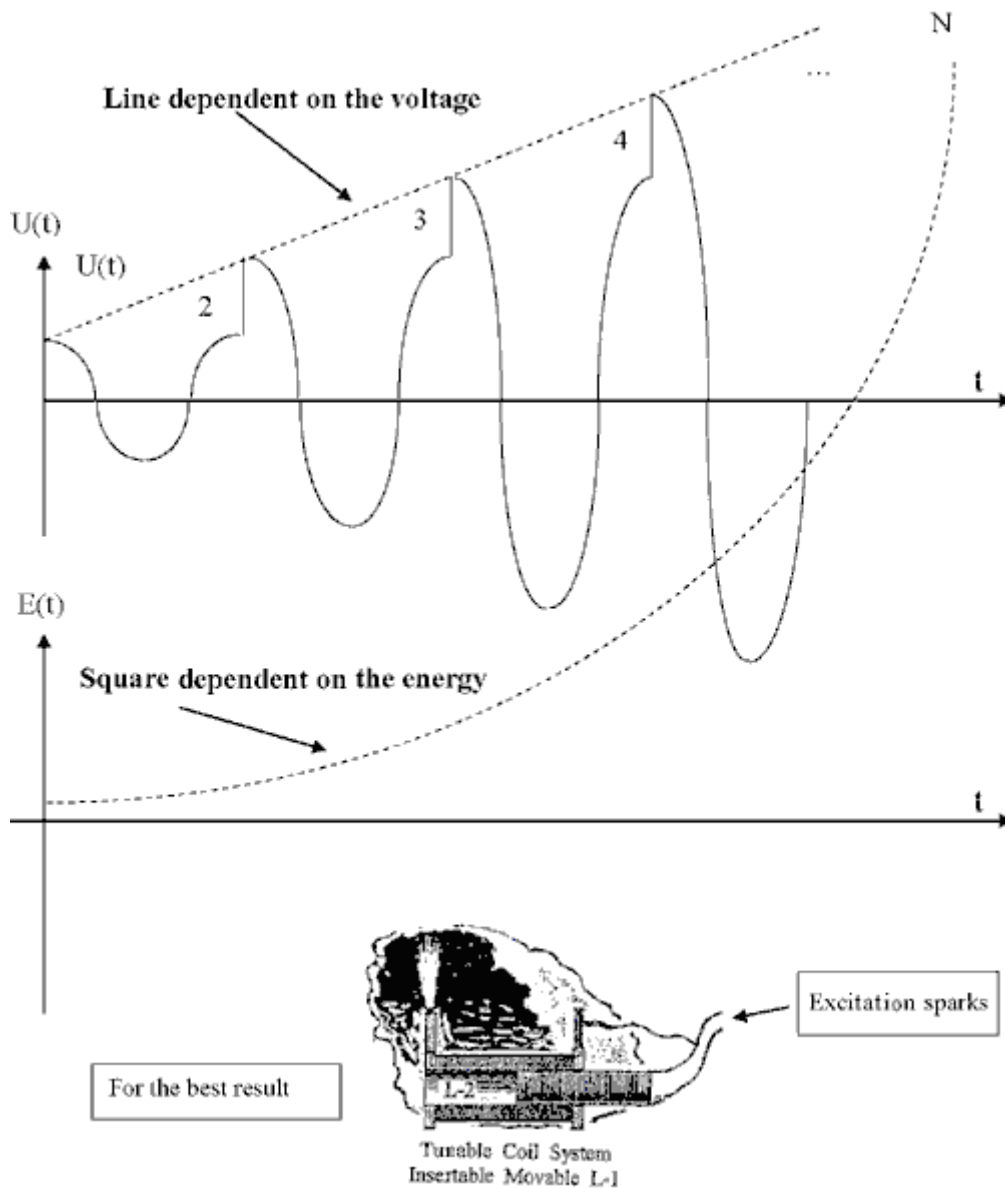


SECRET 1.2

The Spark-Exciting Generator ("SEG") (Charge delivering to LC circuit)



REMARK The frequency of sparks is equal to the resonance frequency of the Tesla coil, and the moment of exciting corresponds to the maximum voltage on the Tesla coil.



EXPLANATION:

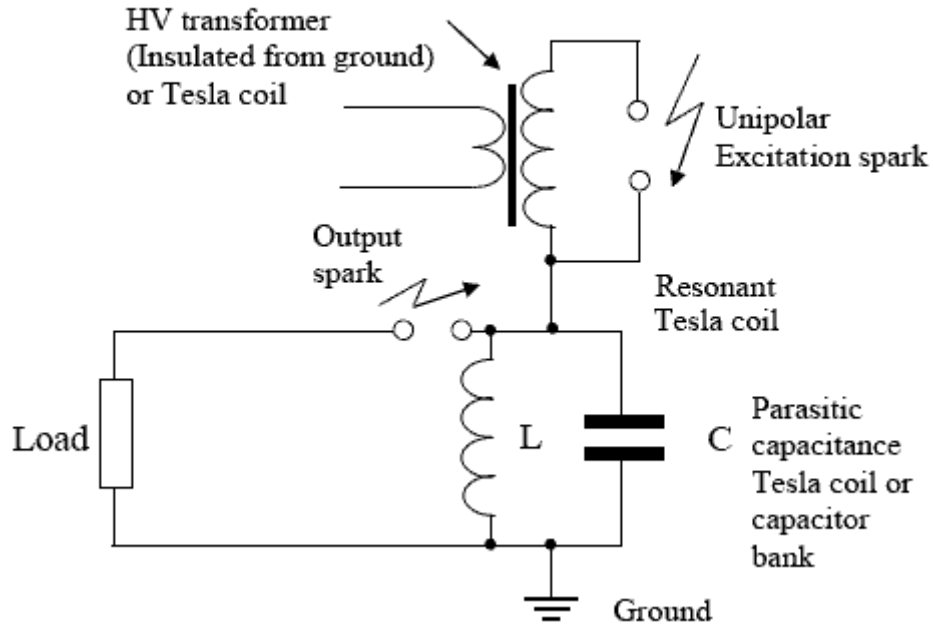
The spark delivers charge to the L-C circuit

The charge Q on a capacitor C with voltage U is: $Q = U \times C$ or $U = Q / C$

Where Q is a charge delivered by one spark.

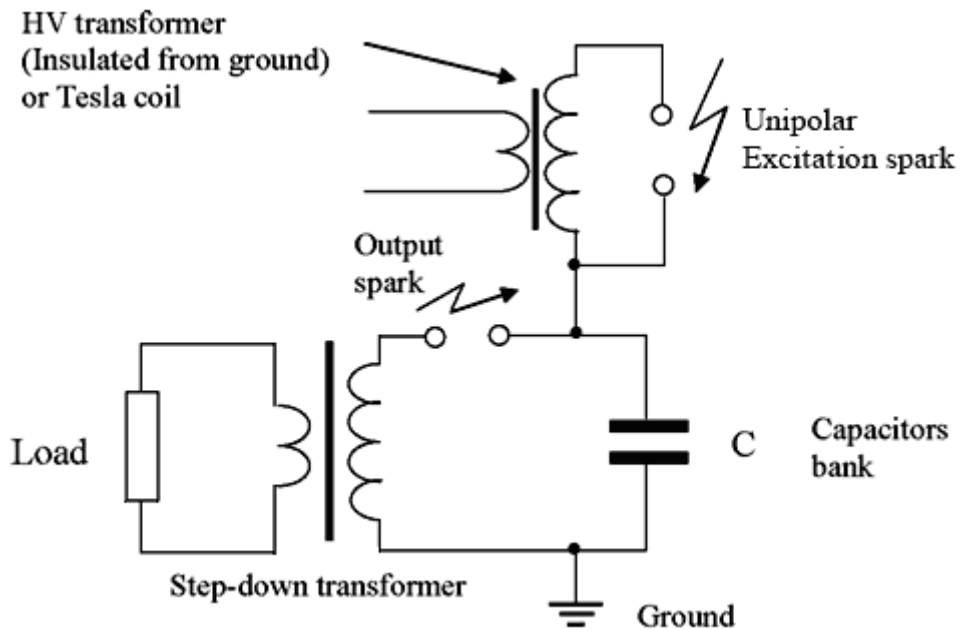
During the excitation of the L-C circuit by the sparks, the capacitance C is constant.
 After N excitations, the voltage U_n on C will be $U_n = N \times Q / C$ And, energy E_n will be raised as N^2 .
 In other words, **If the L-C circuit is excited by charges, we have energy amplification.**

POSSIBLE MODIFICATION



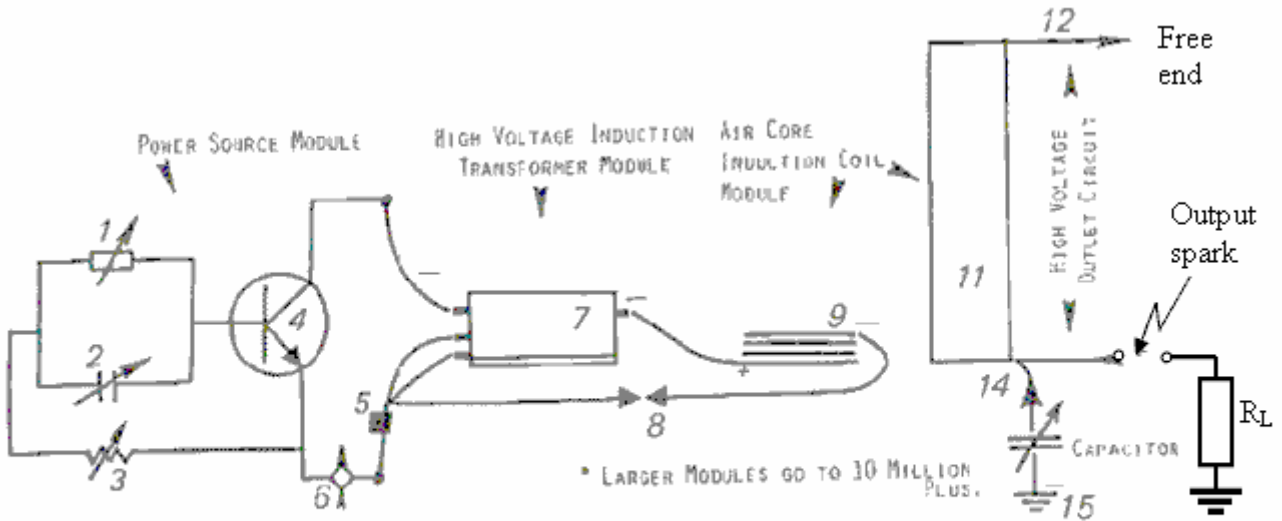
COMMENT: You need to understand that a feedback loop in the electromagnetic field is a changing voltage level in the L-C circuit capacitor, a high-voltage transformer is connected to collect the excess energy.

WITHOUT SYNCHRONISATION



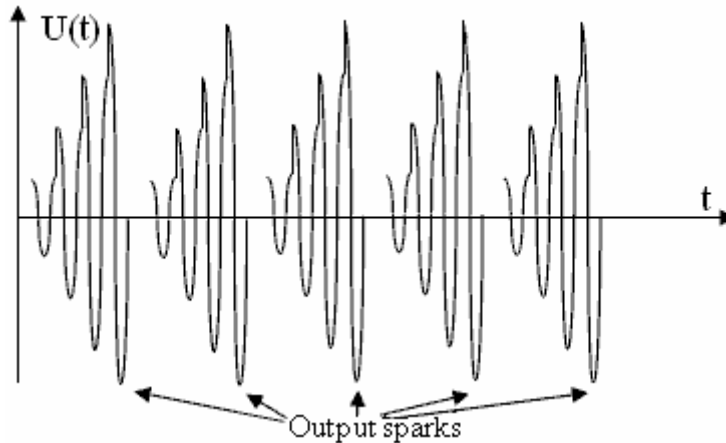
The Spark-Exciting Generator

From Don Smith



PARTS: 1. COIL, VARIABLE. 2. CAPACITOR, VARIABLE. 3. RESISTOR, VARIABLE. 4. TRANSISTOR, R.F.,
 5. BATTERY, RECHARGEABLE. 6. OFF-ON SWITCH, VARIABLE. 7. HIGH VOLTAGE TRANSFORMER,
 8. FEED BACK WITH SPARK GAP. 9. REACTOR, INDUCTION COIL. 10. FEED BACK WITH SPARK GAP,
 11. REACTANT COIL. 12. OUTPUT FOR # 11. 13. INPUT FOR ELEVEN. 14. GROUNDING FOR ELEVEN.

Time line for SEG



MAINTAIN RESONANCE AND GET FREE-ENERGY !!

EXPLANATION: It appears that we need to charge the capacitor circuit to an energy level which is greater than that of the source energy itself. At first glance, this appears to be an impossible task, but the problem is actually solved quite simply.

The charging system is screened, or "blinded", to use the terminology of Mr. Tesla, so that it cannot "see" the presence of the charge in the capacitor. To accomplish this, one end of a capacitor is connected to the ground and the other end is connected to the high-energy coil, the second end of which is free. After connecting to this higher energy level from the energising coil, electrons from the ground can charge a capacitor to a very high level.

In this case, the charging system does not "see" what charge is already in a capacitor. Each pulse is treated as if it were the first pulse ever generated. Thus, the capacitor can reach a higher energy level than of the source itself.

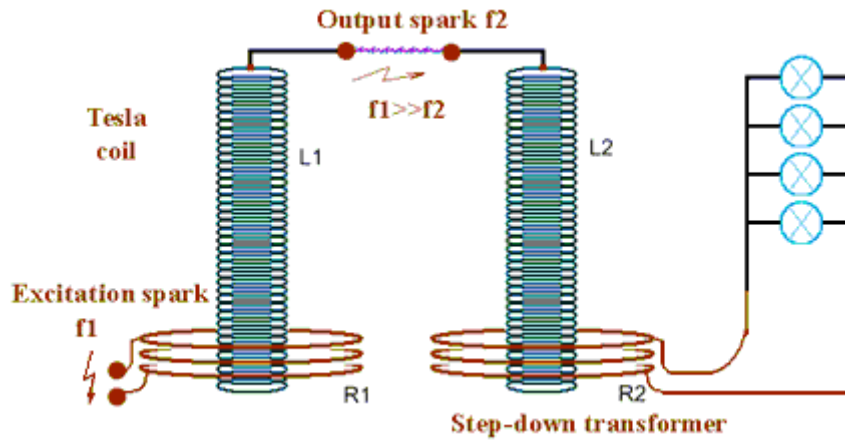
After the accumulation of the energy, it is discharged to the load through the discharge spark gap. After that, the process is repeated again and again indefinitely ...

COMMENT: The frequency of the excitation sparks, must match the resonant frequency of the output coil. (capacitors 2 and 14 are used to achieve this goal). This is multi-spark excitation.

COMMENT: Charges are pumping from the ground to 11-15 circuit, this device extracts charge from ambient space. Because of this, it will not work properly without a ground connection.

If you need Mains frequency, or don't want use an output spark, then read the following parts...
Asymmetrical transformers can be used (read the following parts)

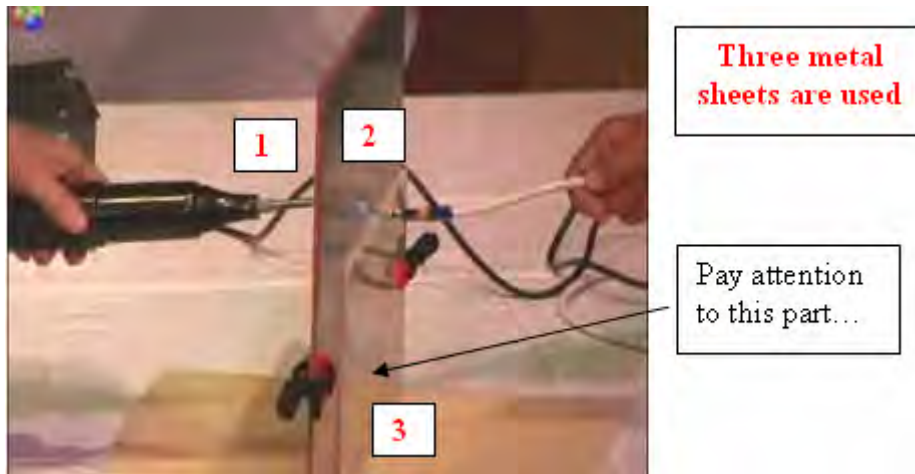
POSSIBLE SEG ARRANGEMENT (From Russian forum)



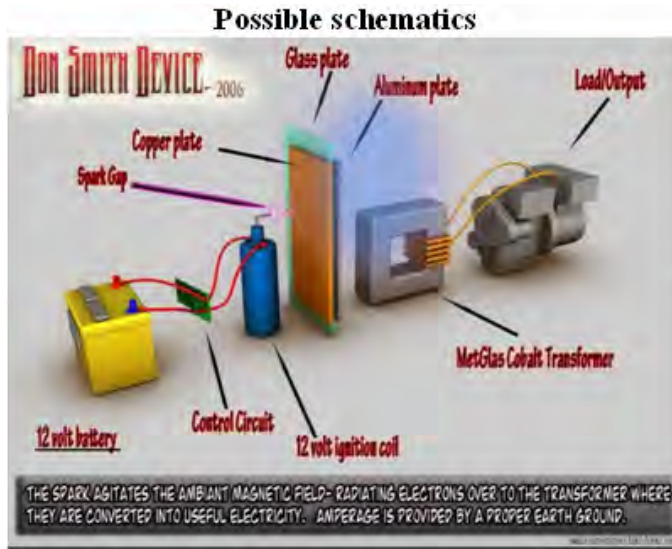
COMMENT: The L1 Tesla coil shown above, is energised by spark f1. Resonant, step-down transformer L2 is connected to the L1 Tesla coil by output spark f2. The frequency of f1 is much higher than that of f2.

SEG WITHOUT SYNCHRONISATION

From Don Smith

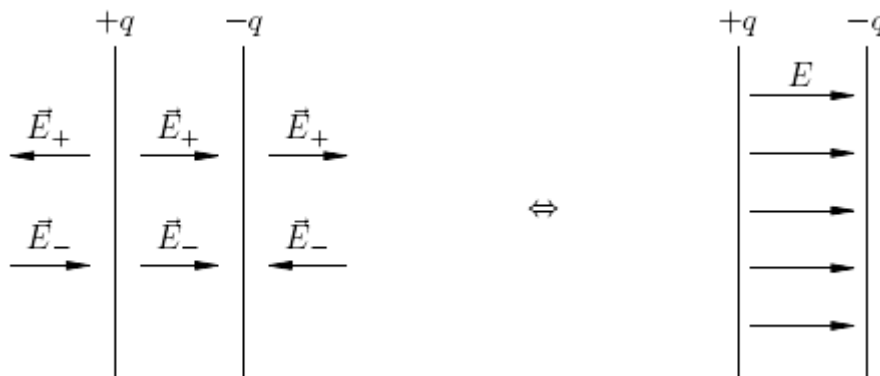


REMARK: It must be adjusted by dimensions, materials (???)



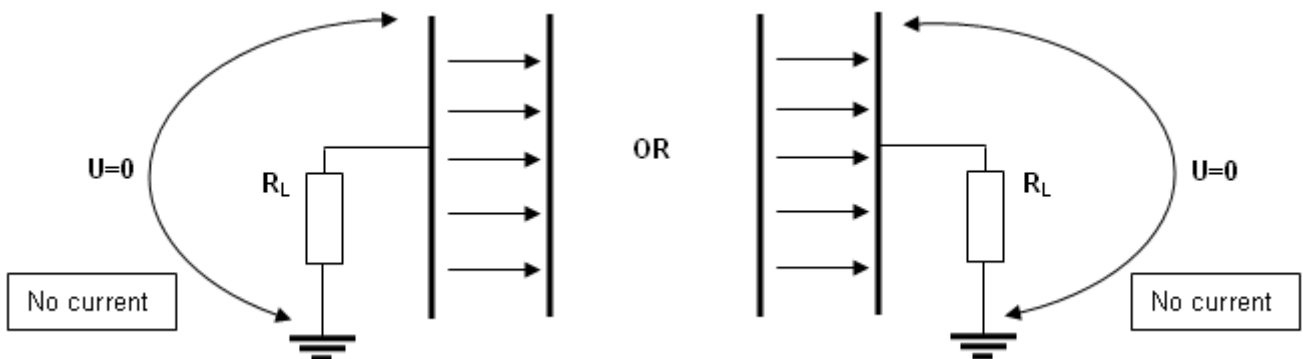
EXPLANATION

REMINDER: An ordinary capacitor is a device for separating charges on it's plates,
The total charge inside an ordinary capacitor is zero (read the textbooks).



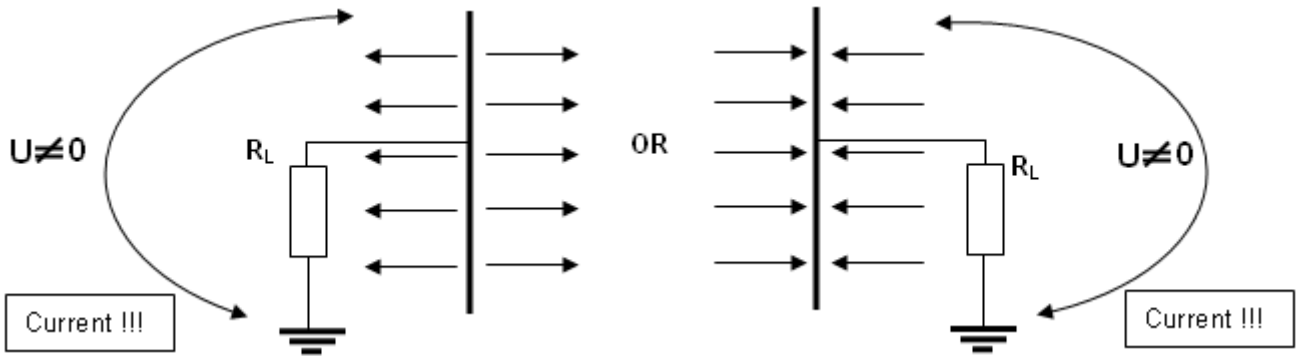
There is an electrical field only inside the capacitor. The electrical field outside the capacitor is zero (**because the fields cancel each other**).

So far, connecting one plate to the ground we will get no current flowing in this circuit:

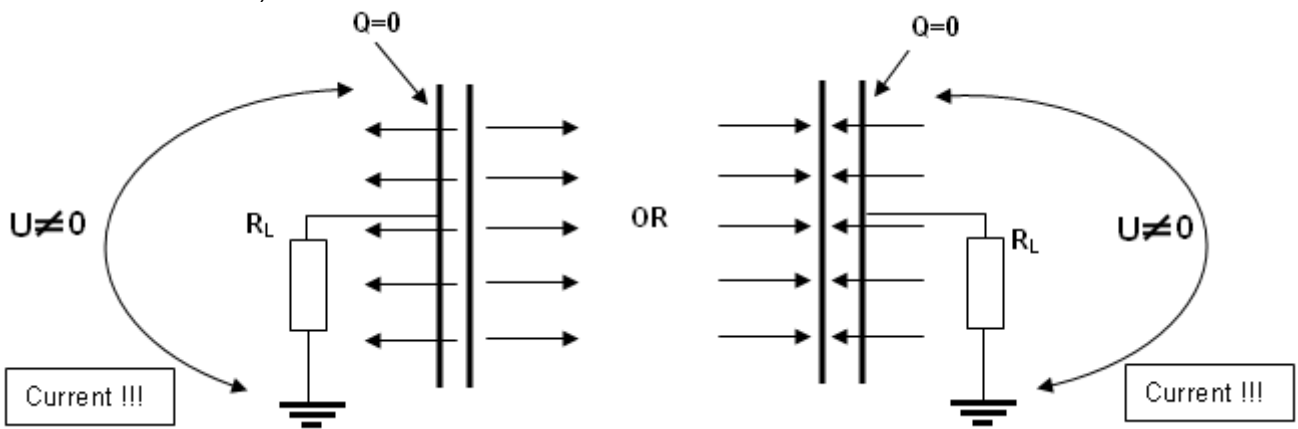


REMINDER: A separated capacitor is a device for accumulating charges on it's plates.

The total charge on a separated capacitor is NOT zero (read the textbooks). So far, by connecting one plate of the separated capacitor to the ground we will get a current flowing in this circuit (because there is an external field).



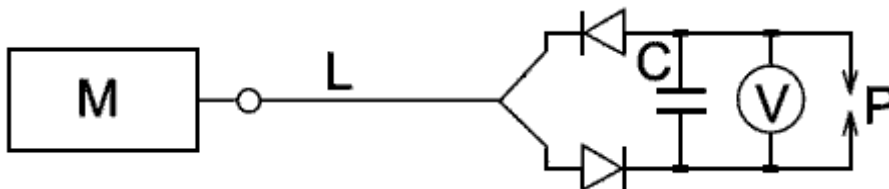
REMARK: We get the same situation, if only one plate of an ordinary capacitor is charged. So far, connecting an uncharged plate of an ordinary capacitor to the ground we get a current flowing in this circuit also (because there is an external field).



Alternately charging a capacitor's plates

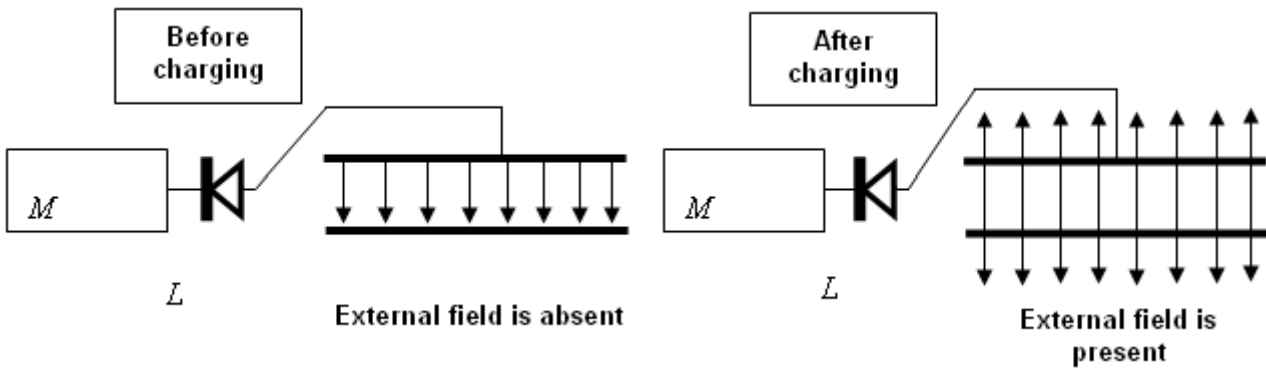
Avramenko's plug – is it a free energy device?

The principle: Each plate of a capacitor charges as a separated capacitor. Charging takes place in an alternating fashion, first one plate and then the other plate.

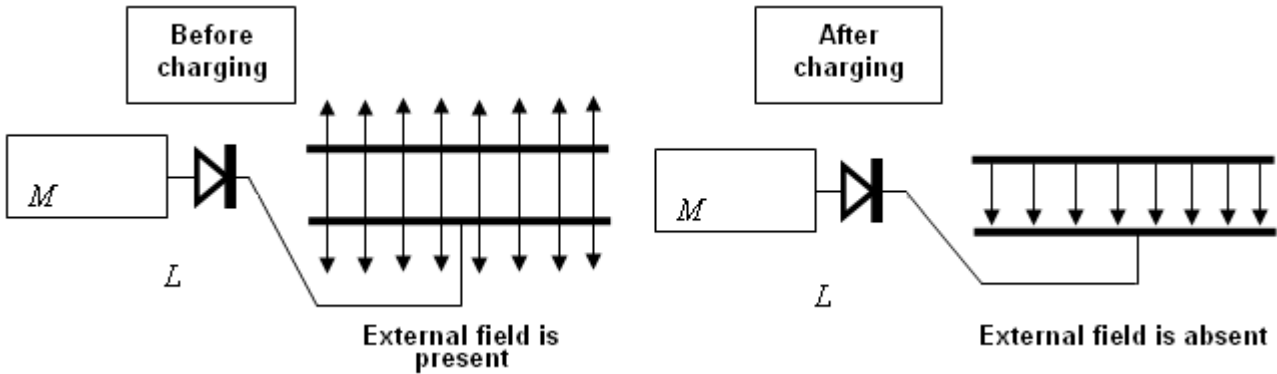


The result: The capacitor is charged to a voltage which is greater than that which the charging system delivers.

Explanation: The external field of an ordinary charged capacitor is equal to or near zero, as noted above. So, if you charge plates as a separated capacitor (upload or download charge), the charging system will not “see” the field which already exists inside the capacitor, and will charge the plates as if the field inside the capacitor is absent.



Once a plate has been charged, begin to charge another plate.

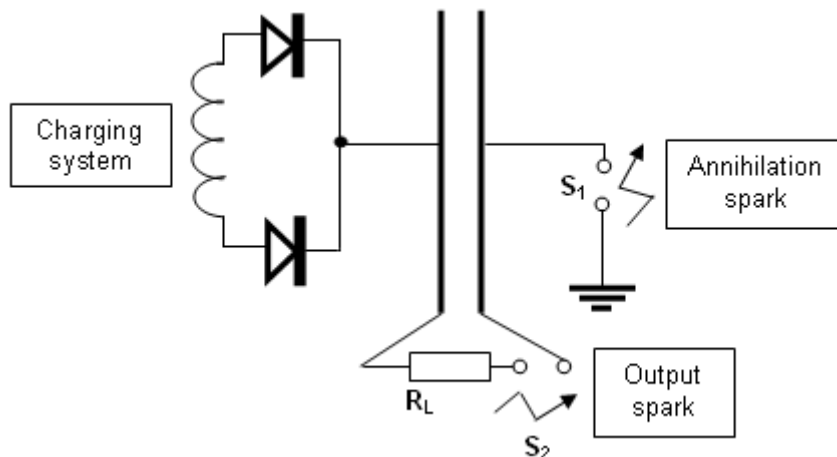


After the second plate of the capacitor has been charged, the external field becomes zero again. The charging system cannot "see" the field inside the capacitor once again and the process repeats again several times, raising the voltage until the spark gap connected to the output load discharges it.

REMARK: You will recall that an ordinary capacitor is a device for charge separation. The charging process of a capacitor causes electrons from on one plate to be "pumped" to another plate. After that, there is an excess of electrons on one plate, while the other one has deficit, and that creates a potential difference between them (read the textbooks). The total amount of charge inside the capacitor does not change. Thus the task of the charging system is to move charge temporarily from one plate to another.

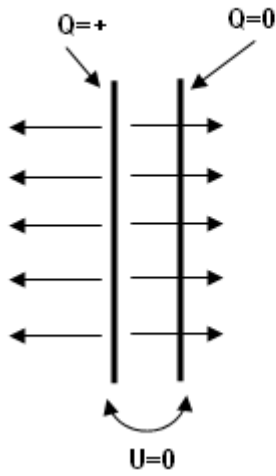
The simplest Free-Energy device (???)

REMARK: The capacitance of an ordinary capacitor is much greater than the capacitance of a separated plate capacitor (provided that it's plates are close to each other).

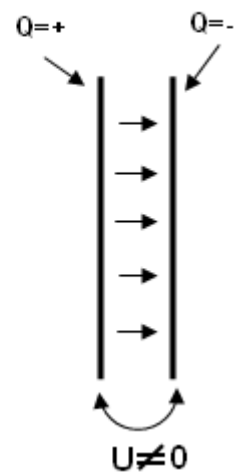


COMMENT: The time between S1 and S2 is very short.

FIELD BEFORE S1

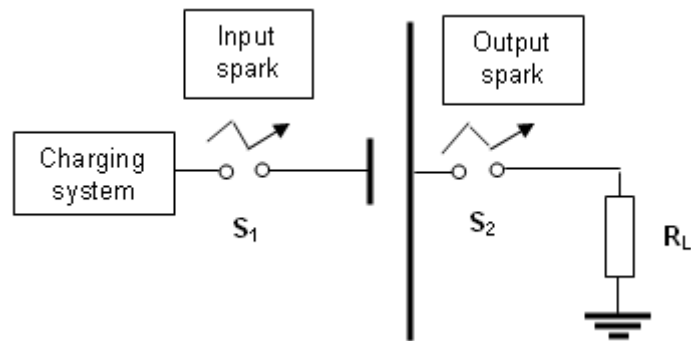


FIELD AFTER S1



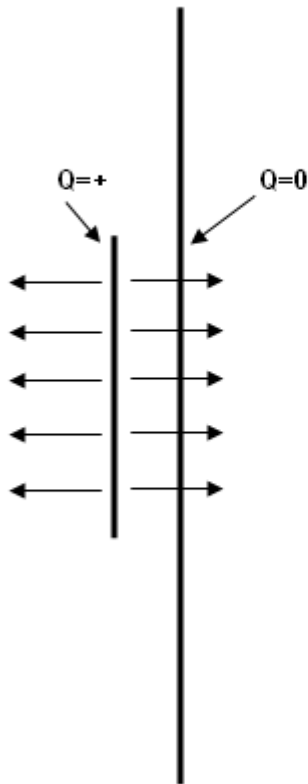
REMARKS: This is an illustration of energy-dependence in a coordinated system.
This is an illustration of the so-called Zero-Point Energy.

ASYMMETRICAL CAPACITOR
(Current amplification???)

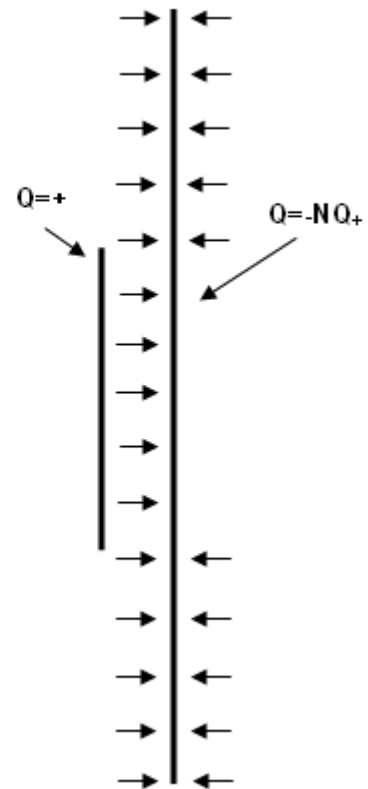


COMMENT: The capacitance (size) of the plate on the right is much greater than that of the plate on the left.

FIELD AFTER S1



FIELD AFTER S2

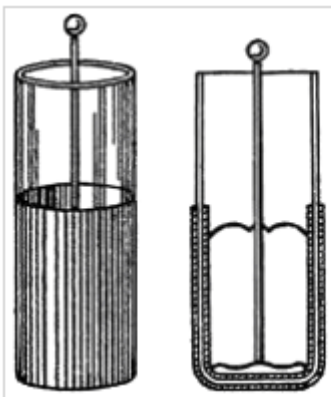


COMMENT: Charges from the ground will run on to the right hand plate UNTIL the moment when the external field drops to zero caused by the second spark ("S2"). It takes more charges flowing from the ground to annihilate the external field at the instant of the second spark, because the capacitance of the plate on the right is far greater. 'More charge' means 'more current', so you have achieved current amplification through this arrangement.

COMMENT: The field at the terminals of the plate on the right is not zero after both sparks have occurred, this is because a field remains due to the additional charges which have flowed in ('pumped') from the ground.

THE SIMPLEST ASYMMETRICAL CAPACITORS

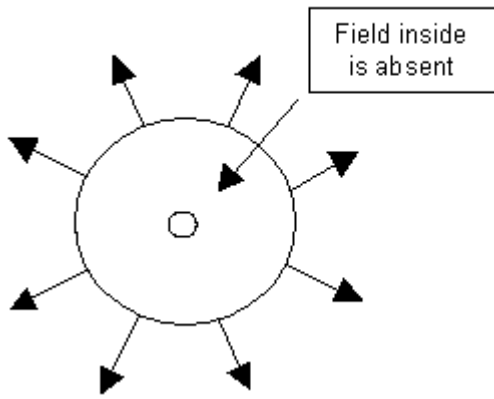
The most simple asymmetrical capacitors are the Leyden jar and the coaxial cable (also invented by Mr. Tesla).



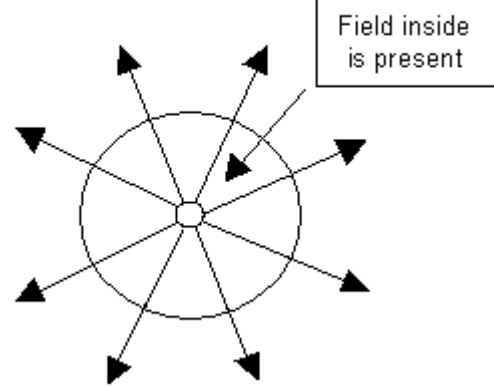
Apart from the fact that the area (capacitance) of the plates of these capacitors is different, and they therefore are asymmetrical, they have another property:

The electrostatic field of the external electrode of these devices does not affect the internal electrode.

Field from the external electrode



Field from internal electrode

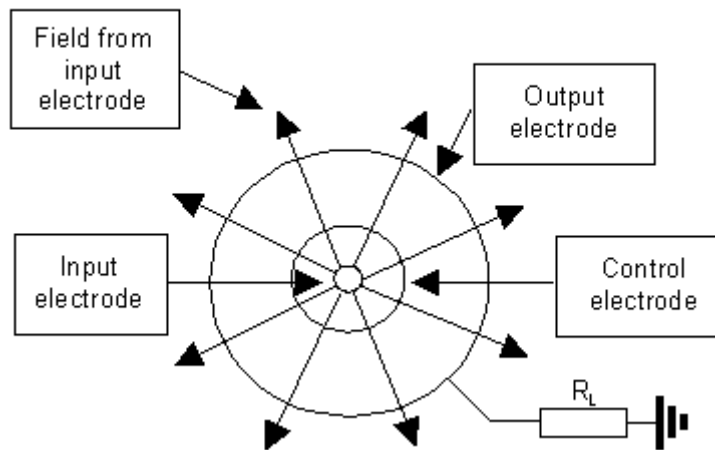


EXPLANATION: This is caused by the fact that the electrostatic field is absent inside the metal bodies (see textbooks).

REMARK: This is true provided that the plates are charged separately.

CAPACITOR - TRIODE

(The third electrode in an asymmetrical capacitor)



REMARK: Dr. Harold Aspden has pointed out the possibility of Energy Amplification when using this device.

THE PRINCIPLE OF CURRENT AMPLIFICATION IN THE CAPACITOR – TRIODE

EXPLANATION: You have to get zero potential on the inside of a small cylinder (on the input electrode). In this case, the charge on the external cylinder will be more than on the internal cylinder. More charge means more current, and so you'll have current amplification.

In detail:

The potential around any cylinder with radius 'R' is:

$$\varphi = \frac{q}{4\pi\epsilon_0 R} \quad \text{where } q \text{ is a charge on this cylinder}$$

Potential inside this cylinder is the same, because:

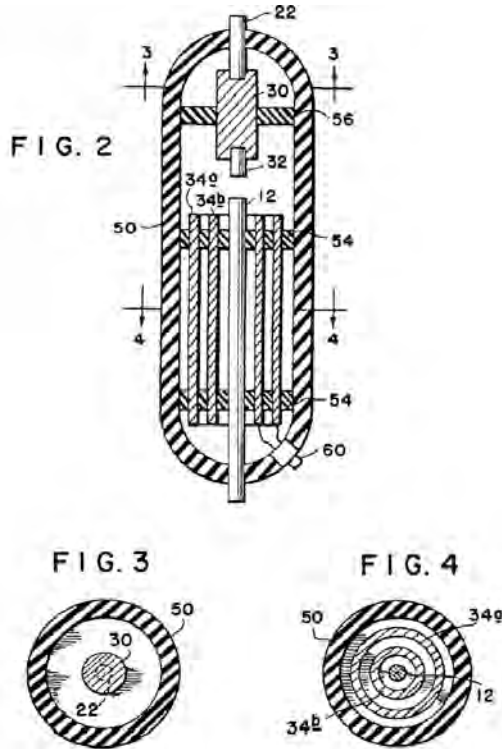
$$\frac{d\varphi}{dr} = 0 \quad \text{and} \quad \varphi = \text{const.}$$

If you want to get zero potential inside two cylinders (on the input electrode) you have to deliver more charge of the opposite sign to the external one, proportionally to the radius of this cylinder. A larger radius means more charge.

OPERATIONAL SEQUENCE:

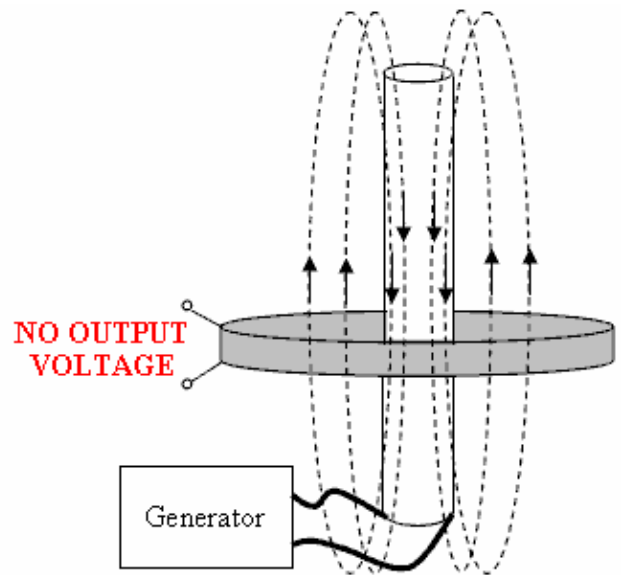
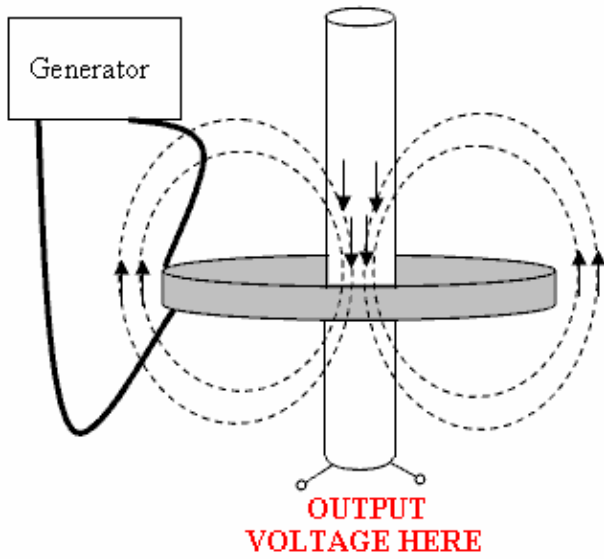
1. Charge the input electrode from your source of energy.
2. The small cylinder (control electrode) will be charged automatically, if it's connected to the ground through a diode with the properly polarity.
3. Discharge the input electrode to zero level (for example, by using a spark). As a result there will be a zero potential on it.
4. If the external cylinder is connected to the ground through a diode with the properly polarity, it will be charged automatically with the opposite sign. But the charge "pumped" from the ground will more than for small cylinder (proportional to the ratio of their radiuses).
5. As a result, there is current amplification.

COMMENT: Did Edwin Gray use this principle in his device?.



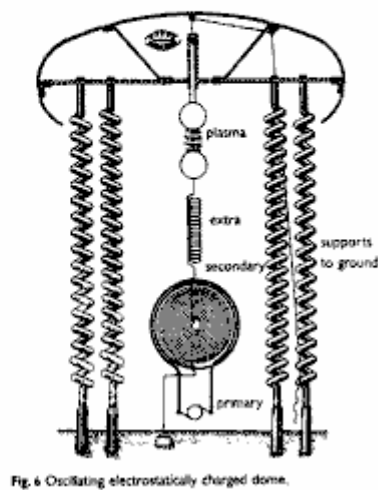
COMMENT: If so, then Gray's patent is lacking some very important details (???)

THE PRINCIPLE OF THE “BLINDNESS” CHARGING SYSTEM IN THE SEG

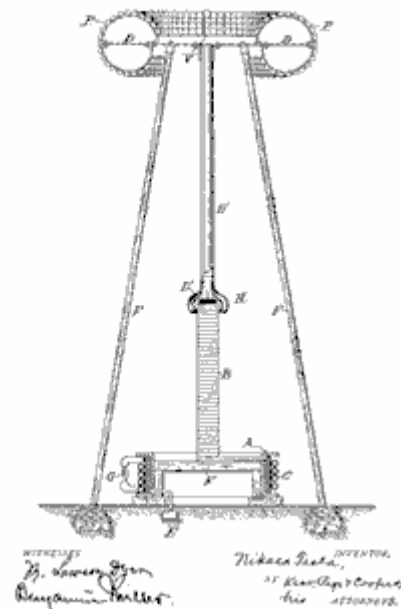


EXPLANATION: The “short” coil is not able to see the oscillations in the “long” coil, because the total number of magnetic lines from the “long” coil which are passing through the “short” coil is close to zero (because one half is in one direction and the other half is in the opposite direction).

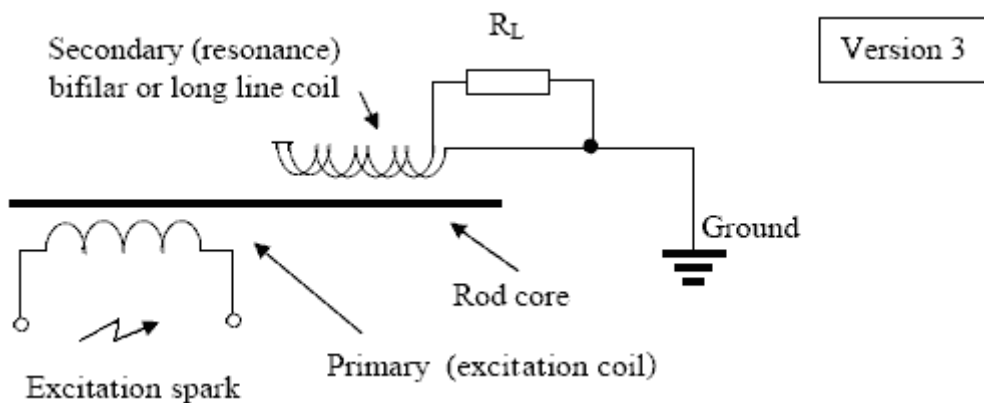
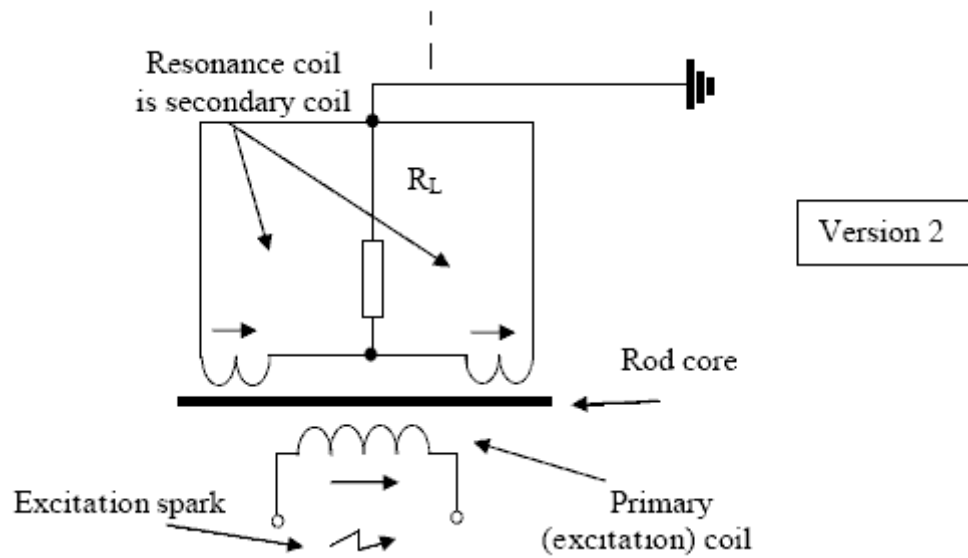
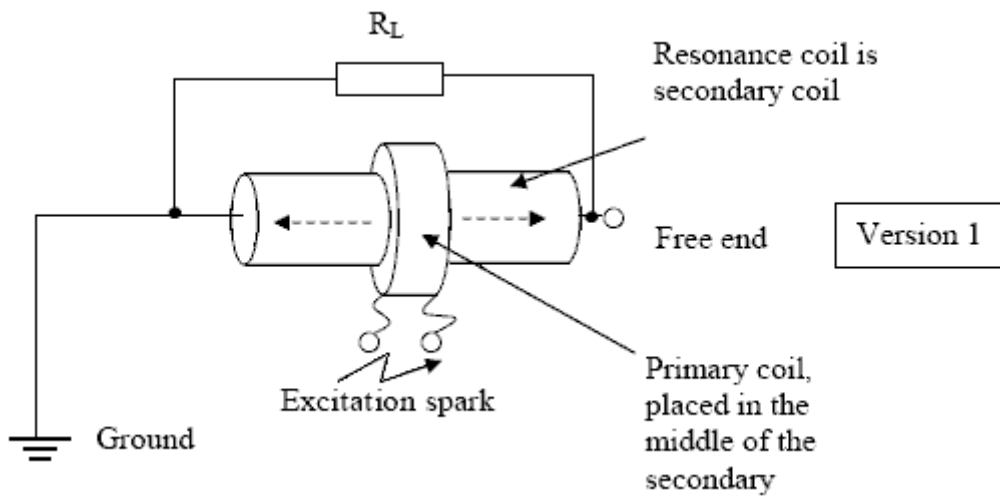
COMMENT: This a particular case of an asymmetrical transformer, for more details read the part about asymmetrical transformers.



S. TESLA.
APPARATUS FOR TRANSMITTING ELECTRIC ENERGY.
ATTORNEYS: THOMAS PARSONS, INC., SEATTLE, WASH. & L.A.
1,119,782. Patented Dec. 1, 1914.



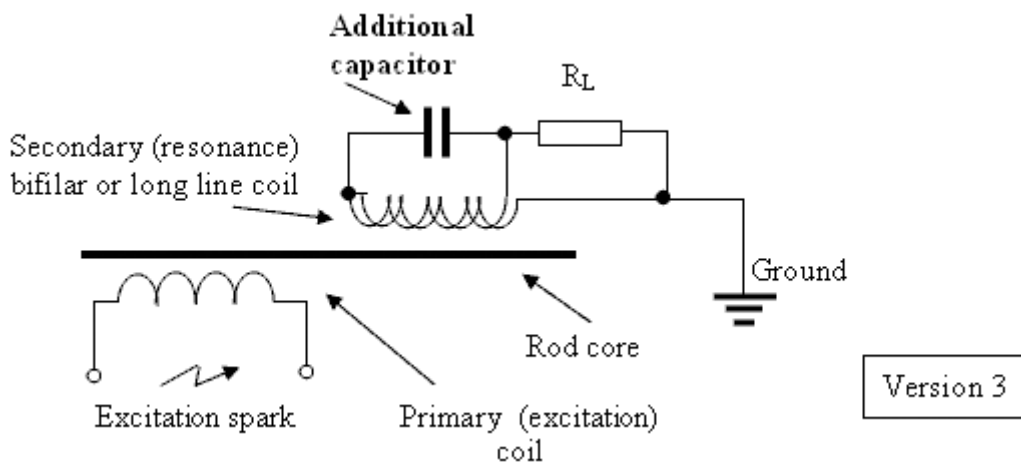
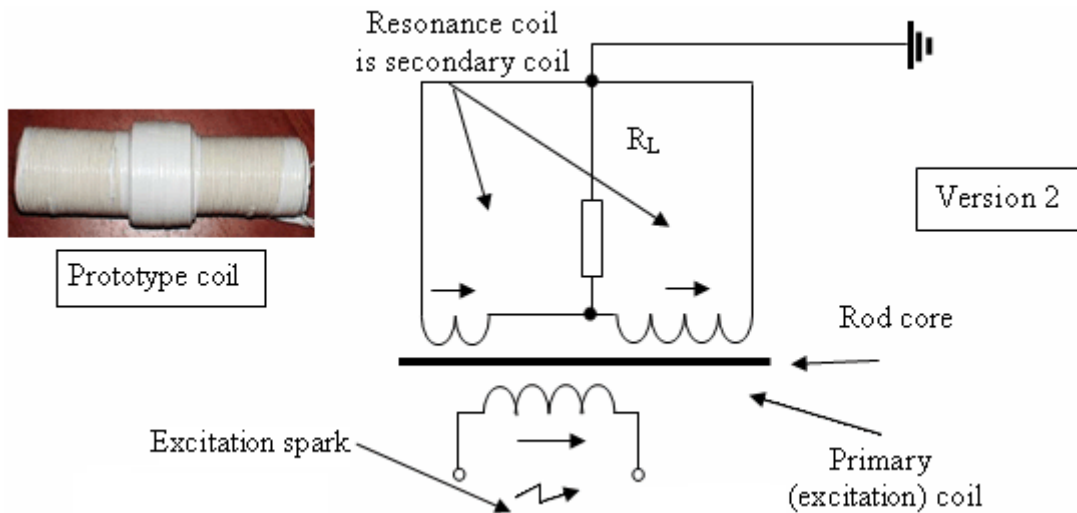
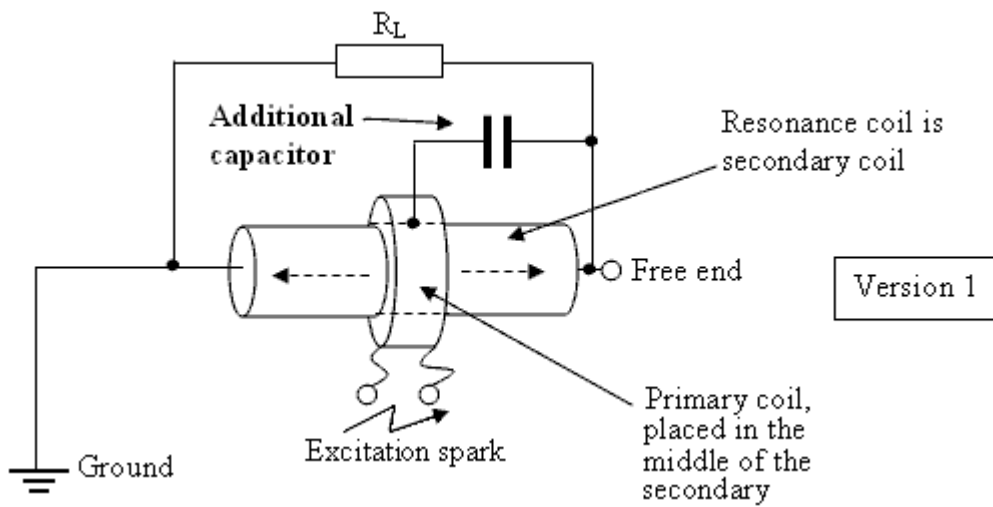
COMMENTS ABOUT THE SEG:
All Back EMF schematics can be used in SEG



COMMENTS: No current will be produced in the load in any of these circuits, unless there is a ground connection. Is excitation possible with just a single spark (???)

**FOR MORE ASYMMETRY IN SEG ?
FOR ONE SPARK EXCITING IN SEG ?**

By Don Smith

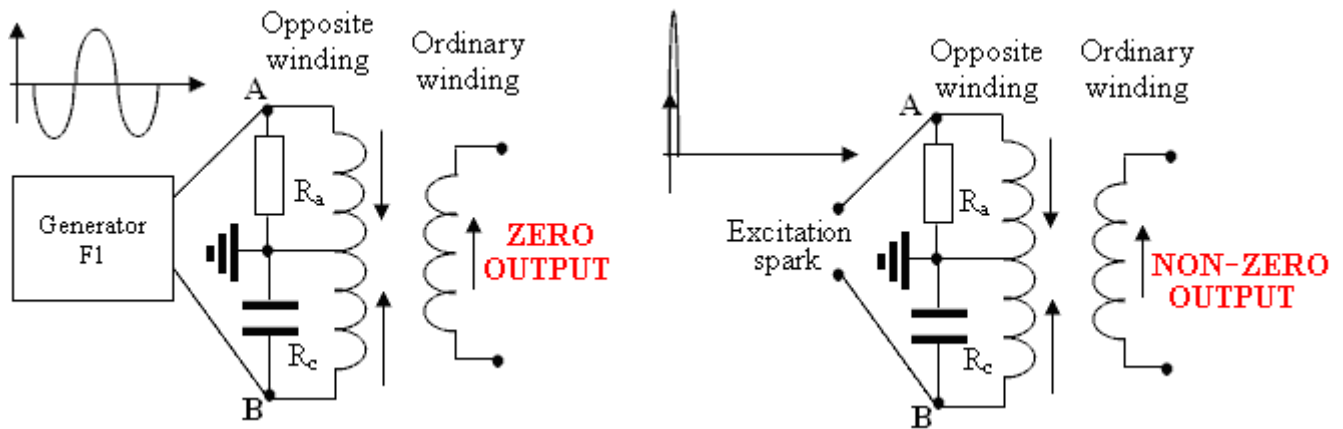


COMMENT: This arrangement becomes more asymmetrical after excitation

EXPLANATION

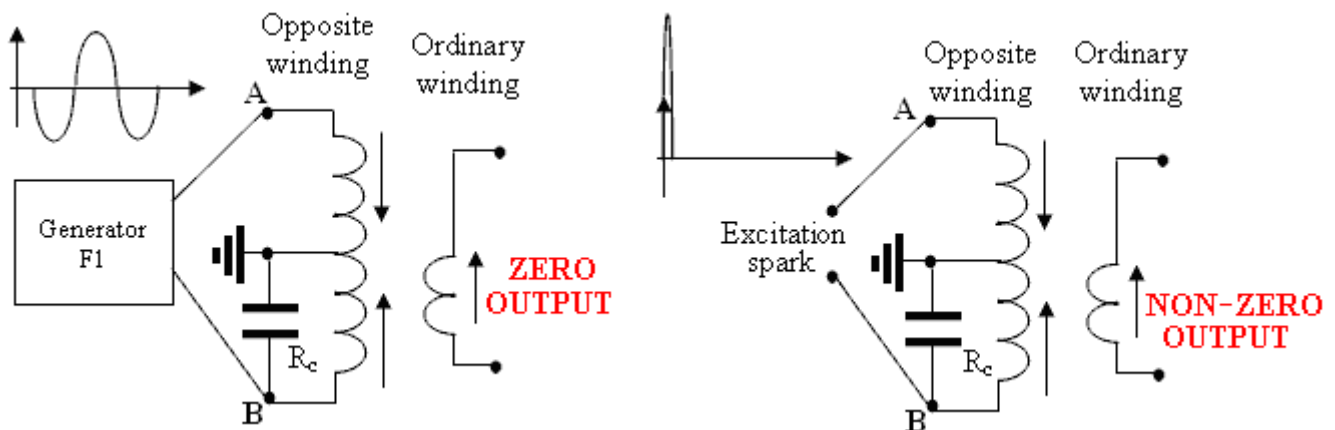
Symmetry is destroyed by a spark

If the impedances of R_a and R_c are the same at the frequency produced by signal generator F1, then the resulting voltage at points **A** and **B** will also be identical which means that there will be zero output.

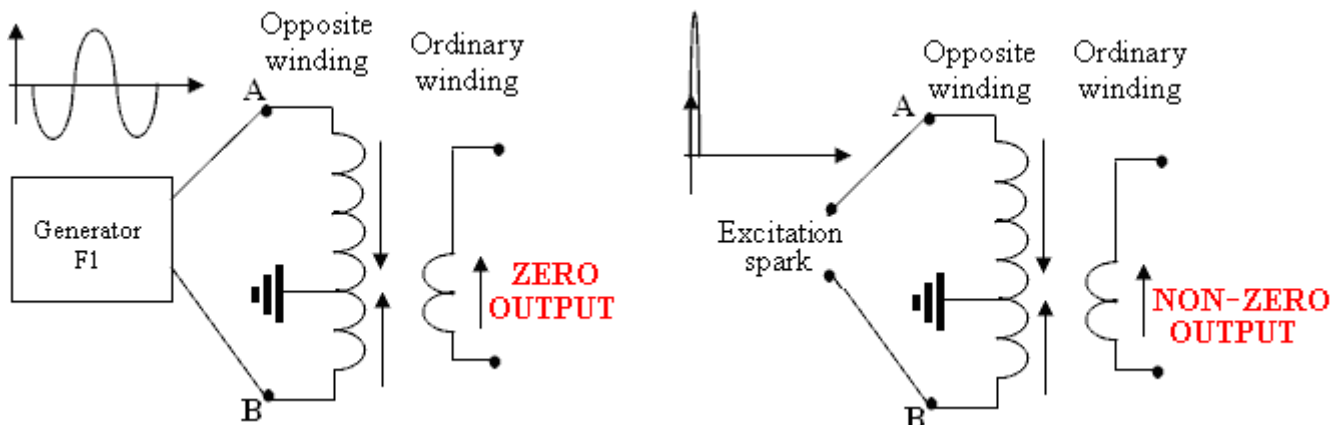


If the circuit is excited by the very sharp, positive-only, DC voltage spike produced by a spark, then the impedances of R_a and R_c are not the same and there is a non-zero output.

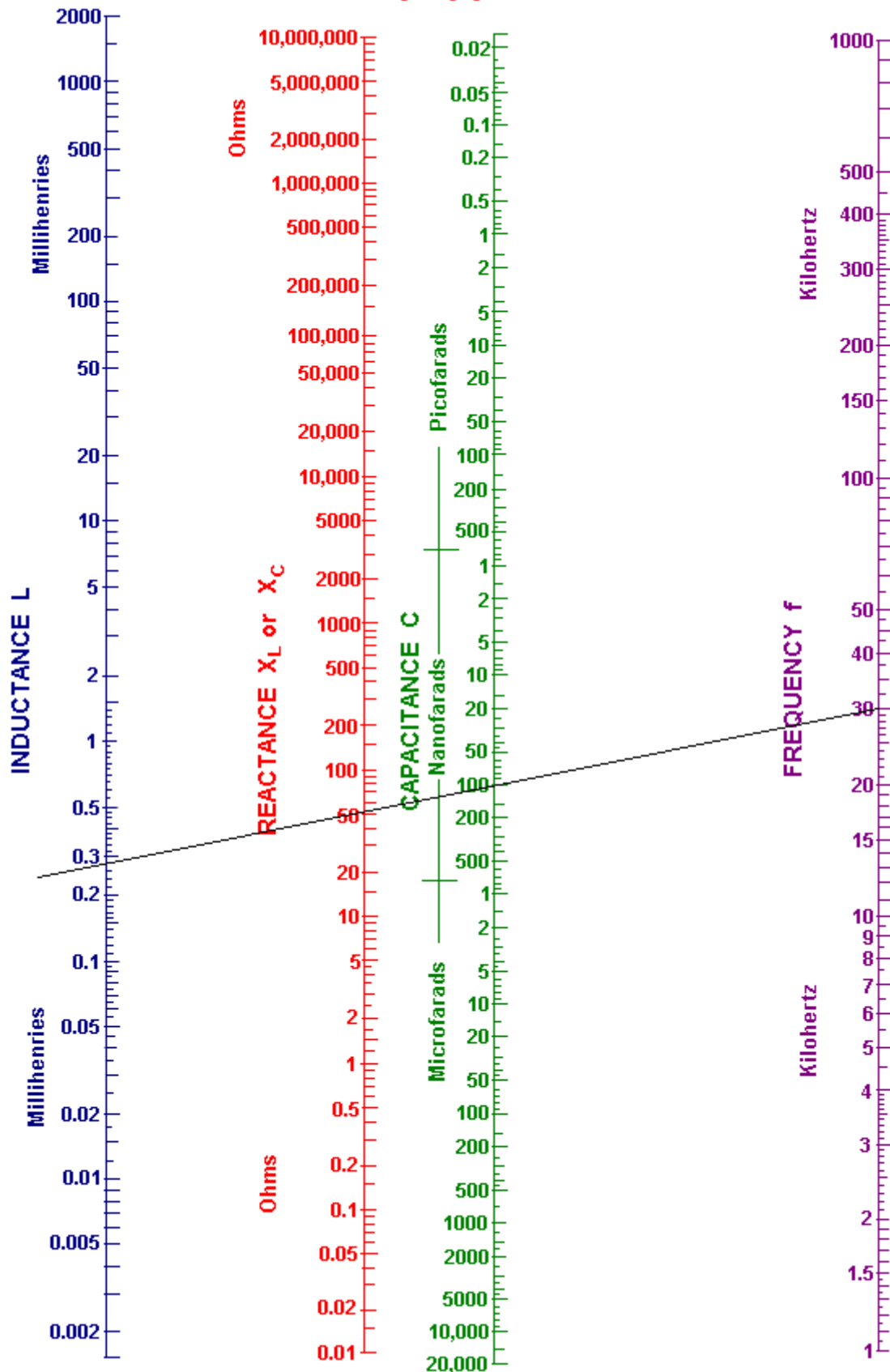
Here is a possible alternative. Please note that the position of the output coil must be adjusted, it's best position depending on value of resistor R_c and the frequency being produced by signal generator F1.



Here is another possible arrangement. Here, the position of the output coil depends on L_1 and L_2 :



A NOMOGRAPH



Using a nomograph: Draw a straight line from your chosen 30 kHz frequency (purple line) through your chosen 100 nanofarad capacitor value and carry the line on as far as the (blue) inductance line as shown above.

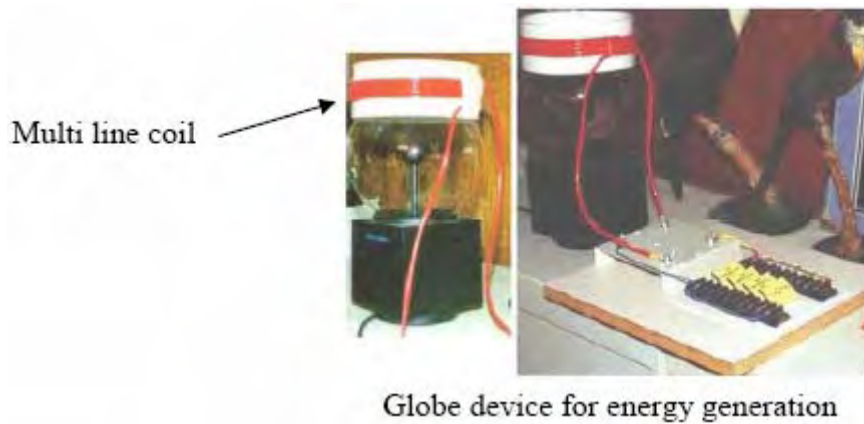
You can now read the reactance off the red line, which looks like 51 ohms to me. This means that when the circuit is running at a frequency of 30 kHz, then the current flow through your 100 nF capacitor will be the same as through a 51 ohm resistor. Reading off the blue "Inductance" line that same current flow at that frequency would occur with a coil which has an inductance of 0.28 millihenries.

MODERN OPTIONS IN SEG

Back EMF suppression in resonance coil

Version 3

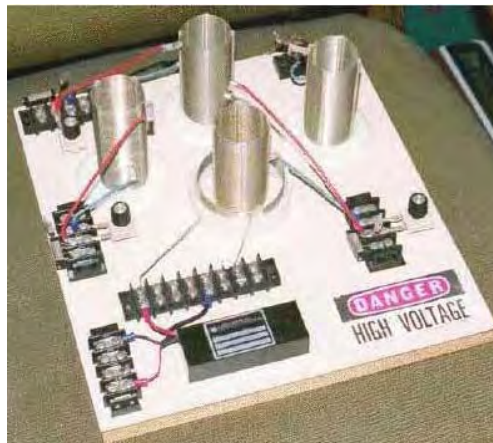
By Don Smith



COMMENT: Please note that a long wire is used and one-spark excitation, where additional capacitors are used to create non-symmetry (???)

Version???

By Don Smith



Multi coil system for energy multiplication

Version???

By Tariel Kapanadze



No description, so read the following section...

KAPANADZE PROCESS

The process requires only 4 steps:

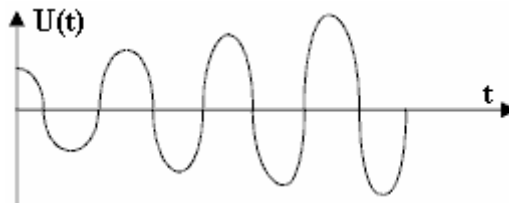
STEP 1

An L-C (coil-capacitor) circuit is pulsed and its resonant frequency determined (possibly by feeding it power through a spark gap and adjusting a nearby coil for maximum power collection).



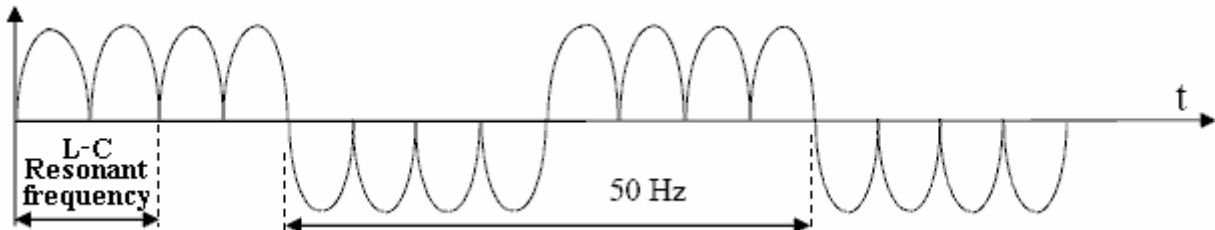
STEP 2

The SEG process causes the energy level in the L-C circuit to rise. Power is fed via a spark gap which produces a very sharp square wave signal which contains every frequency in it. The L-C circuit automatically resonates at its own frequency in the same way that a bell always produces the same musical frequency when struck, no matter how it is struck.



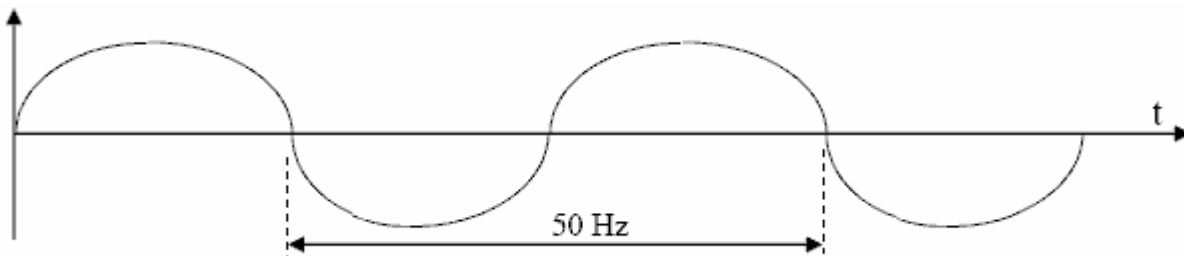
STEP 3

The output waveform from the L-C circuit is then manipulated to provide an output which oscillates at the frequency on the local mains supply (50 Hz or 60 Hz typically).



STEP 4

Finally, the oscillations are smoothed by filtering to provide mains-frequency output power.



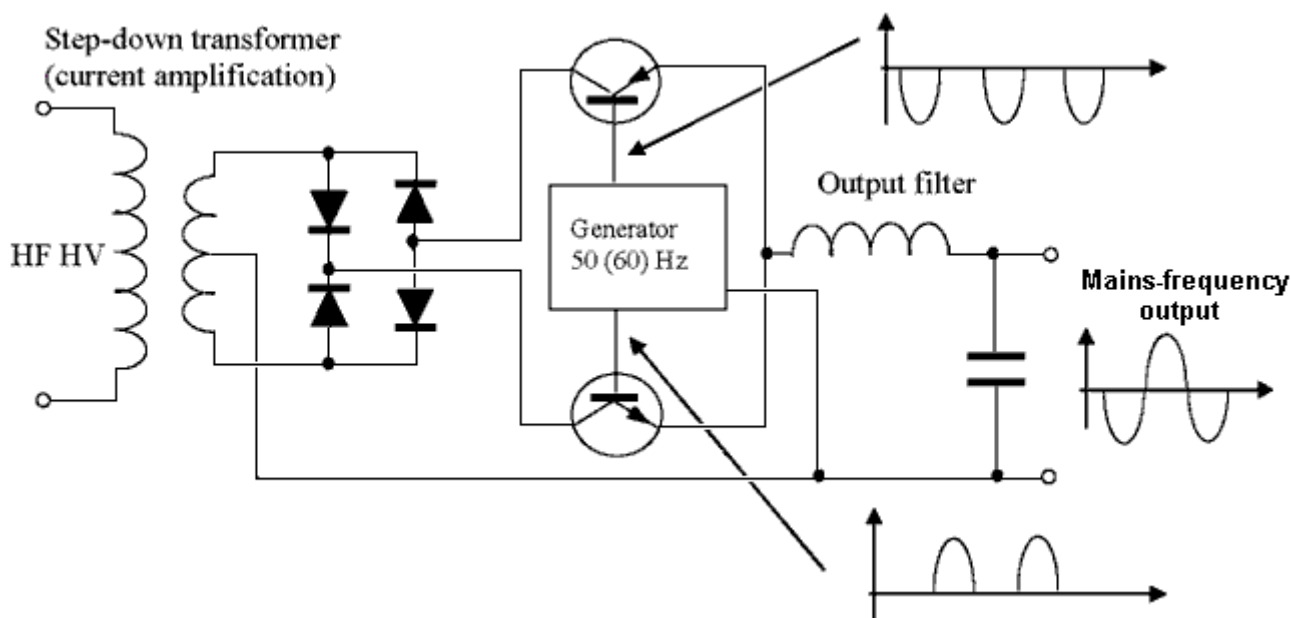
COMMENT: All of these processes are described in Kapanadze's patents and so, no state or private confidential information is shown here. Kapanadze's process is the SEG process.

COMMENT: As I see it, the main difference between the designs of Don Smith and Taniel Kapanadze is the inverter or modulator in the output circuit. At mains frequency you need a huge transformer core in a powerful inverter.

Read the following parts to discover more secrets...

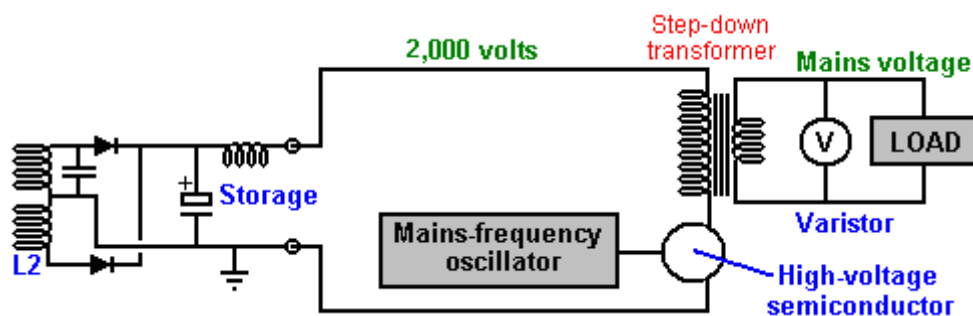
MODERN OPTION

Lowering the L-C frequency to mains frequency (Modulation)



COMMENTS: It is possible to use square waves instead of sine waves to ease the loading on the transistors. This is very similar to the output sections of Tariel Kapanadze's patents. This method does not require a powerful transformer with a huge core in order to provide 50 Hz or 60 Hz.

Don Smith's option (guessed at by Patrick Kelly)



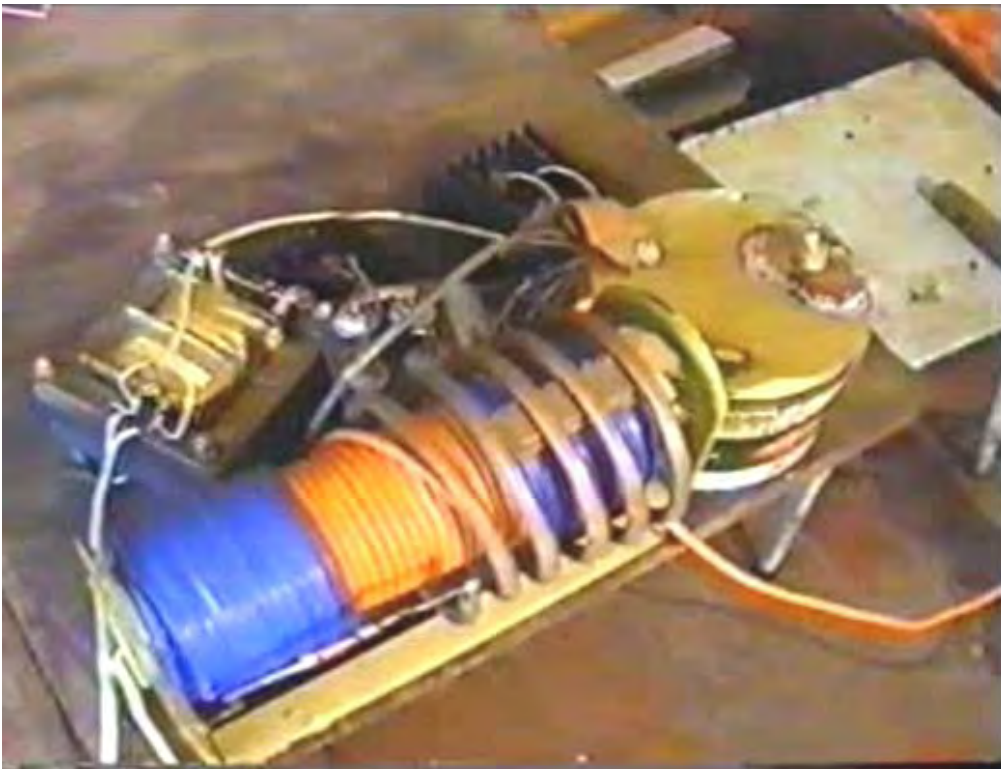
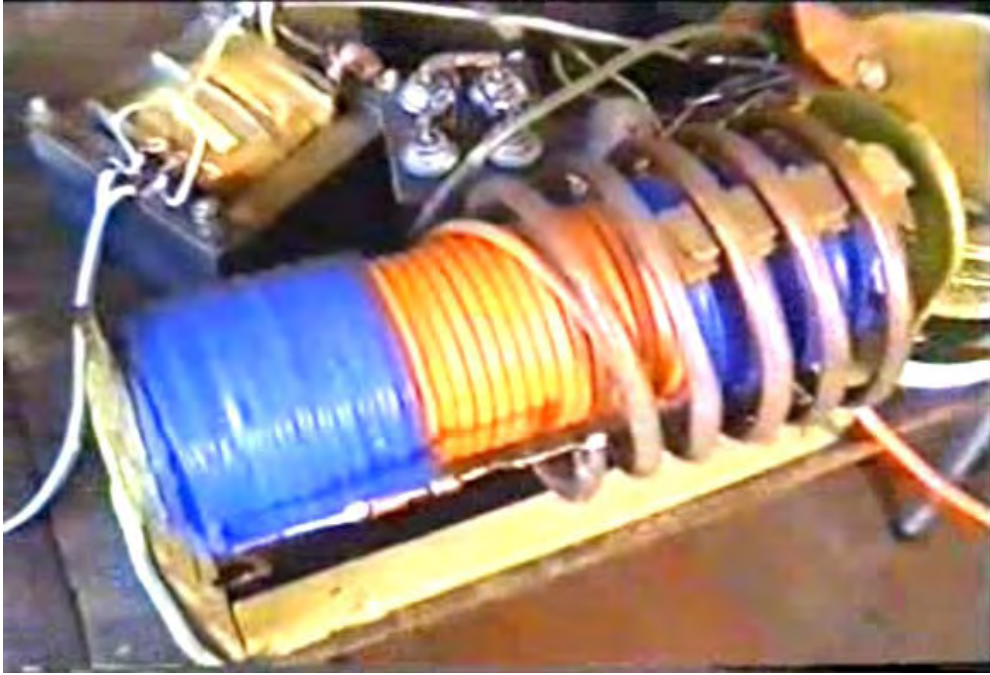
COMMENT : There is no high-frequency high-voltage step-down transformer, but a step-down transformer is used for mains frequency which means that it will need a huge core.

FOR BOTH SCHEMATICS:

You must choose the load in order to get the maximum power output. Very low, and very high loads will give almost no energy in the load (because the current flowing in the output circuit is restricted by the current flowing in the resonant circuit).

ILLUSTRATIONS FOR FREQUENCY LOWERING

From Taniel Kapanadze



ENERGY GAIN

(REMARKS on 1.1 and 1.2 SECRETS)

We must consider two options:

1. Back-EMF suppression (1.1)
2. Excitation by a spark (1.2).

THESE OPTIONS ARE DIFFERENT

However, in both cases, an increase of energy occurs due to the charges being pumped in from the ground. In the terminology of Mr. Tesla – “a charge funnel” or in modern terminology “a charge pump”.

1. In the first case, the problem for the oscillating circuit is to "create" an electromagnetic field which has a high intensity electrical component in ambient space. (Ideally, it is only necessary for the high-voltage capacitor be fully charged once. After that, if the circuit is lossless, then oscillation will be maintained indefinitely without the need for any further input power).

THIS IS A "BAIT" TO ATTRACT CHARGES FROM THE AMBIENT SPACE.

Only a tiny amount of energy is needed to create such a "bait"...

Next, move the "bait" to one side of the circuit, the side which is the source of the charges (Ground). The separation between the "bait" and the charges is now so small that breakdown occurs. The inherent parasitic capacitance of the circuit will be instantly charged, creating a voltage difference at the opposite ends of the circuit, which in turn causes spurious oscillations. The energy contained in these oscillations is the energy gain which we want to capture and use. This energy powers the load. This very useful electromagnetic field containing our excess power oscillates in a direction which is perpendicular to the direction of oscillation of the "bait" field and because of this very important difference, the output power oscillations do not destroy it. This vital factor happens because the coil is wound with two opposing halves. The parasitic oscillations gradually die out, passing all of their energy to the load.

This energy-gaining process is repeated, spark by spark. The more often a spark occurs, the higher the excess power output will be. That is, the higher the spark frequency (caused by a higher voltage across the spark gap), the higher the power output and the greater the efficiency of the process. Hardly any additional "bait" energy is ever required.

2. In the second case we must charge the capacitor circuit to an energy level higher than that of the source energy itself. At first glance, this appears to be an impossible task, but the problem is solved quite easily.

The charging system is screened, or "blinded", to use the terminology of Mr. Tesla, so that it cannot "see" the presence of the charge in the capacitor. To accomplish this, one end of a capacitor is connected to the ground and the other end is connected to the high-energy coil, the second end of which is free. After connecting to this higher energy level from the energising coil, electrons from the ground can charge a capacitor to a very high level.

In this case, the charging system does not "see" what charge is already in a capacitor. Each pulse is treated as if it were the first pulse ever generated. Thus, the capacitor can reach a higher energy level than that of the source itself.

After the accumulation of the energy, it is discharged to the load through the discharge spark gap. After that, the process is repeated again and again indefinitely ...

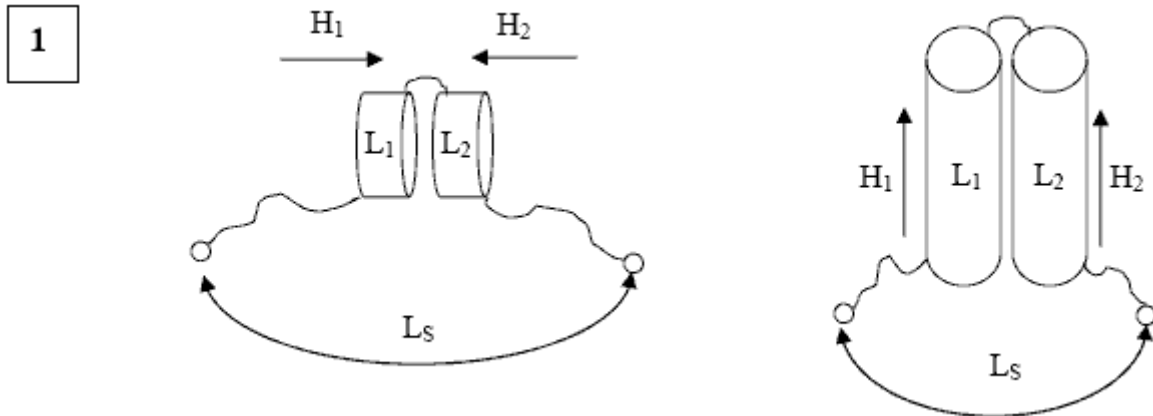
THIS PROCESS DOES NOT REQUIRE THE SUPPRESSION OF BACK-EMF

3. It should be noted, that option 1 and option 2 above could be combined.

SECRET 2

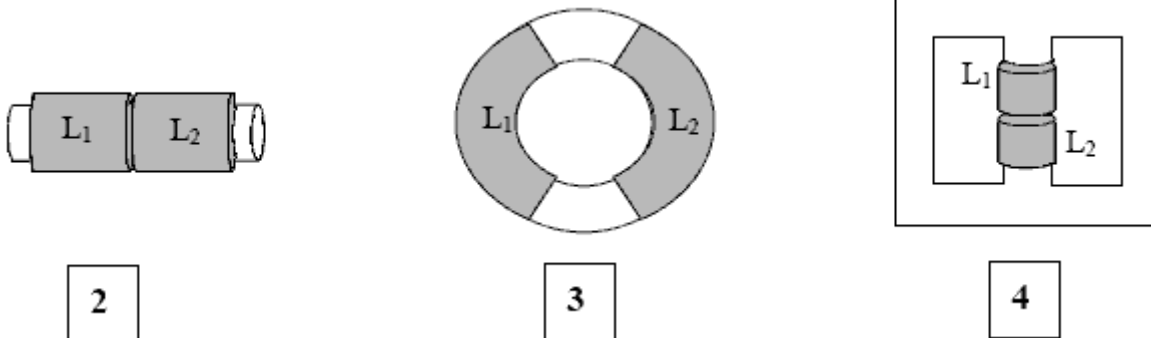
SWITCHABLE INDUCTANCE

The inductance is comprised of two coils which are positioned close to each other. Their connections are shown in front.



CONSTRUCTION: When constructing this arrangement there are many different options due to the various types of core which can be used for the coils:

1. Air-core
2. A ferromagnetic bar core
3. A ferromagnetic toroidal core
4. A transformer style ferromagnetic core.



PROPERTIES: (tested many times with a variety of cores)

The value of the total inductance L_s does not change if you short one of the inductors L_1 or L_2

(This may have been tested for the first time by Mr. Tesla back in the 19th century).

APPLICATION TECHNIQUE:

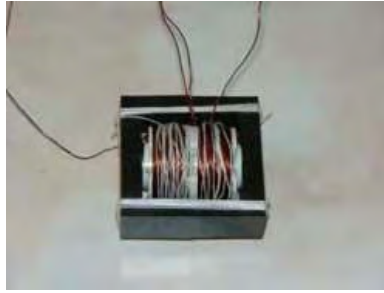
This energy generation is based on the asymmetrical process:

1. Feed the total inductance L_s with a current I
2. Then short-circuit one of the inductors (say, L_1)
3. Drain the energy from inductor L_2 into a capacitor
4. After draining L_2 , then remove the short-circuit from L_1 , short-circuit L_2 and then drain the energy from L_1 into a capacitor

QUESTION: Is it possible, using this method, to get twice the energy amount due to the asymmetry of the process, and if not, then what is wrong?

AN ANSWER: We need to start winding coils and performing tests.

EXAMPLES OF COILS ACTUALLY CONSTRUCTED



A coil was wound on a transformer ferromagnetic core (the size is not important) with permeability 2500 (not important) which was designed as a power-supply transformer. Each half-coil was 200 turns (not important), of 0.33 mm diameter wire (not important). The total inductance L_S is about 2 mH (not important).



A coil was wound on a toroidal ferromagnetic core with permeability 1000 (not important). Each half-coil was 200 turns (not important), of 0.33 mm diameter wire (not important). The total inductance L_S is about 4 mH (not important).



An ordinary laminated iron core transformer intended for 50-60 Hz power supply use (size is not important) was wound with a coil placed on each of its two halves. The total inductance L_S is about 100 mH (not important).

THE OBJECTIVE OF THE TESTS

To make tests to confirm the properties of the coils, and then make measurements of the L_S inductance both with coil L2 short-circuited and coil L2 not short-circuited, and then compare the results.

COMMENT: All of the tests can be done with just the toroidal coil as the other coils have been shown to have the same properties. You can repeat these tests and confirm this for yourself.

OPTION 1

These simple inductance measurements can be carried out with the help of an ordinary RLC (Resistance / Inductance / Capacitance) meter, such as the one shown here:



The measurements taken:

The total coil inductance L_S was measured without short-circuited coils, the figure was recorded. The L2 coil was then short-circuited and the inductance L_S measured again and the result recorded. Then, the results of the two measurements were compared.

The result: The inductance L_S was unchanged (to an accuracy of about a one percent).

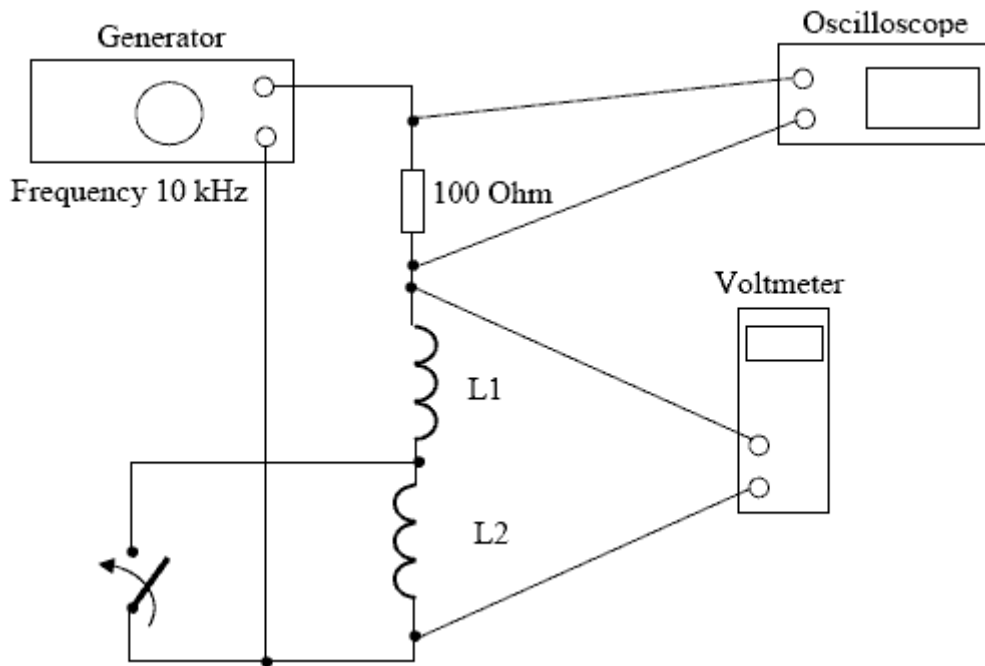
OPTION 2

A special set-up was used, consisting of an analogue oscilloscope, a digital voltmeter and a signal generator, to measure a voltage on the inductance L_S without L2 being short-circuited and then with L2 short-circuited.



After the measurements were made, all of the results were compared.

Schematic of the set-up:



The order in which the measurements were taken

The voltage on the resistor was measured using the oscilloscope and the voltage on the inductor was measured using the voltmeter. Readings were taken before and after short-circuiting L2.

The result: The voltages remained unchanged (to an accuracy of about one percent).

Additional measurements

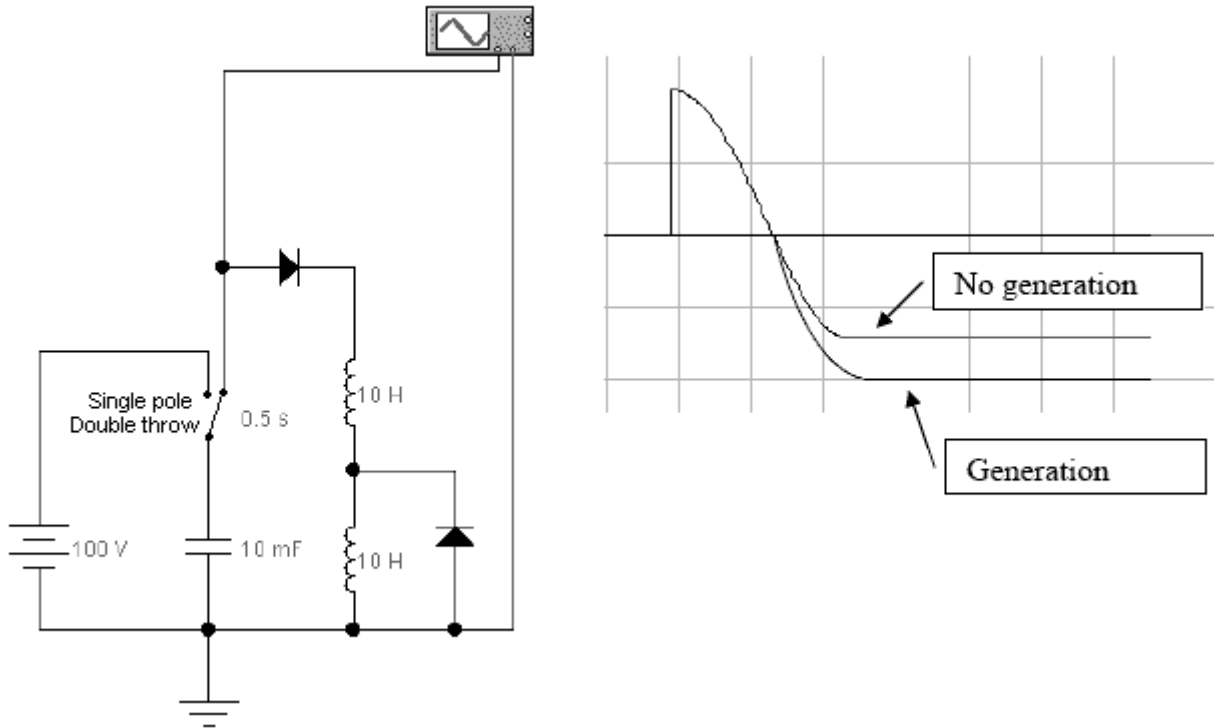
Before the above measurements were taken, the voltages across L1 and L2 were measured. The voltage on both halves was a half of the voltage on the total inductor L_S .

COMMENT: The frequency of about 10 kHz was chosen because the coil did not have parasitic resonances at this frequency or at low frequencies. All measurements were repeated using a coil with a ferromagnetic E-shaped transformer core. All of the results were the same.

OPTION 3

Capacitor recharging.

The objective was to match voltages on a capacitor, both before and after it being recharged by interaction with an inductor which could be connected into the circuit via a switch.

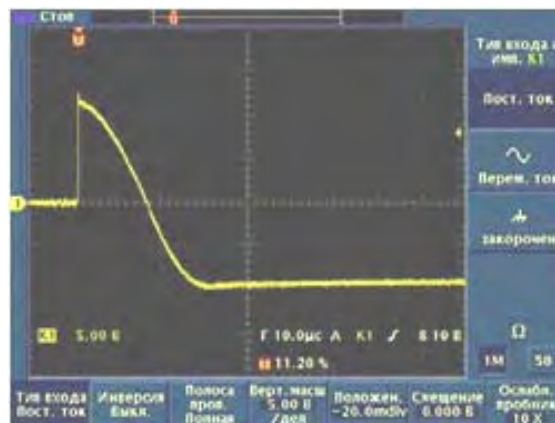


The experiment conditions

A capacitor is charged from a battery and is connected to the inductor through the first diode (included to give protection against oscillations). At the moment of feedback, half of the inductor is shunted by the second diode (due to its polarity), while the inductance must remain unchanged. If after recharging the capacitor the capacitor voltage is the same (but with reversed polarity), then generation will have taken place (because a half of the energy remains in the shunted half of the inductor).

In theory, it is impossible, for an ordinary inductor consisting of two coils to do this.

The result :



The result confirms the prediction – the remaining energy is more than the capacitor gives to the coil (with an accuracy of 20%).

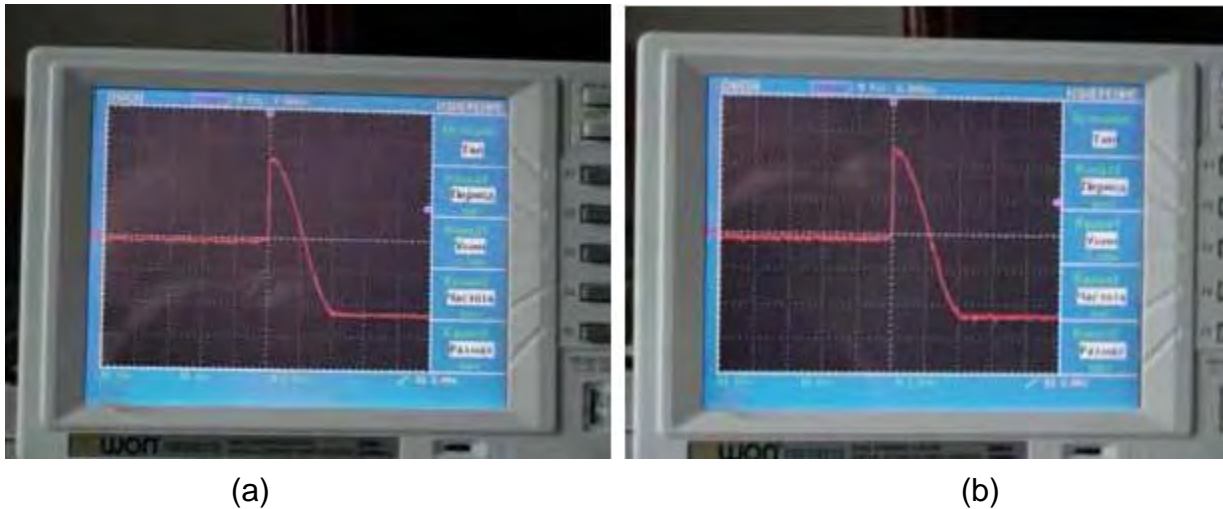
Test components: Capacitor 47 nano Farads, inductor LS is about 2 mH , Shotky silicon diodes BAT42, voltage used: 12 V.

THE RESULT VERIFICATION FOR OPTION 3

For verification of these results and in order to improve the accuracy, all measurements were repeated using alternative components.

Test components: Capacitor: 1.5 nano Farads; total inductance: 1.6 mH, germanium diodes: (Russian) D311, charging voltage: 5V.

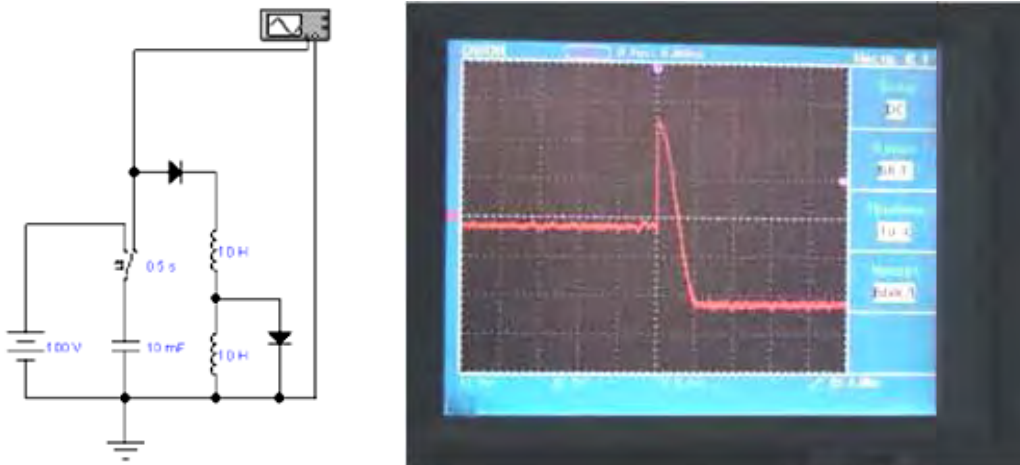
The result: Confirmation of the previous measurements (a) shown below:



The recharging accuracy was improved to 10 percent. Also, a check measurement was made **without the second diode**. The result was essentially the same as the measurement which used the shunting diode. The missing 10 percent of the voltage can be explained as losses due to the spread capacitor's inductance and in it's resistance.

CONTINUED TESTING

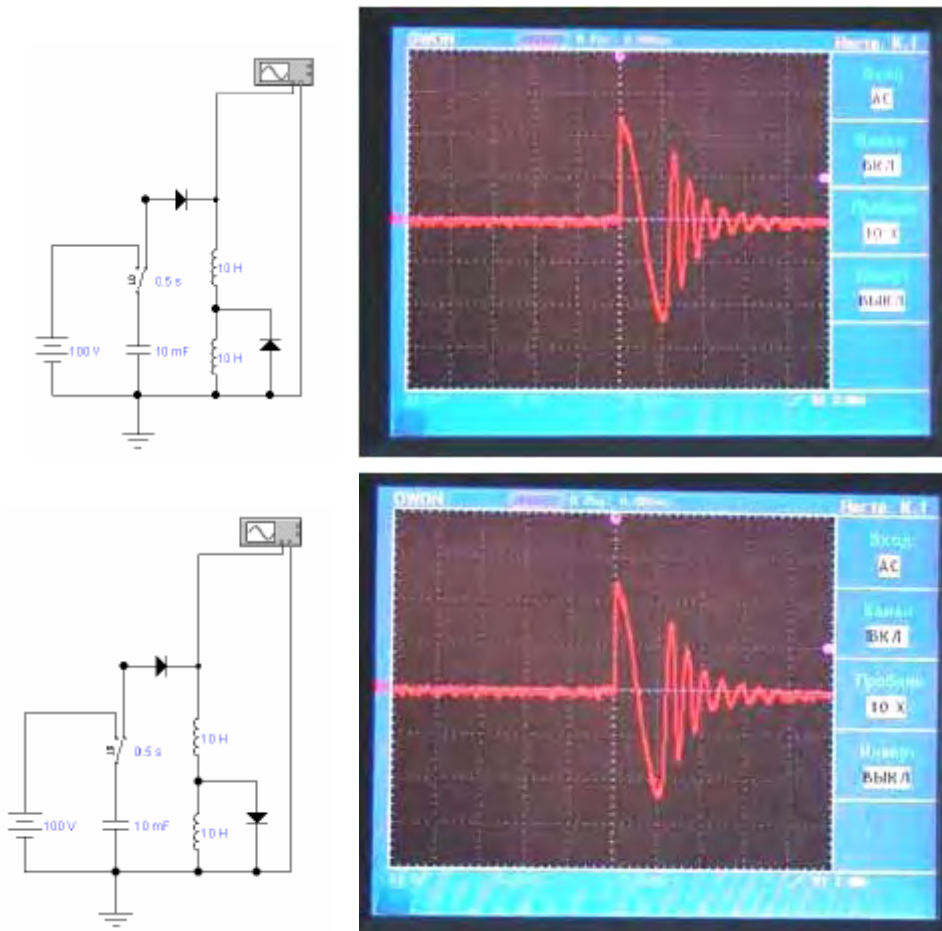
The shunting diode was reversed and the test performed again:



The result: It seems that the charge is spot on...

Further testing

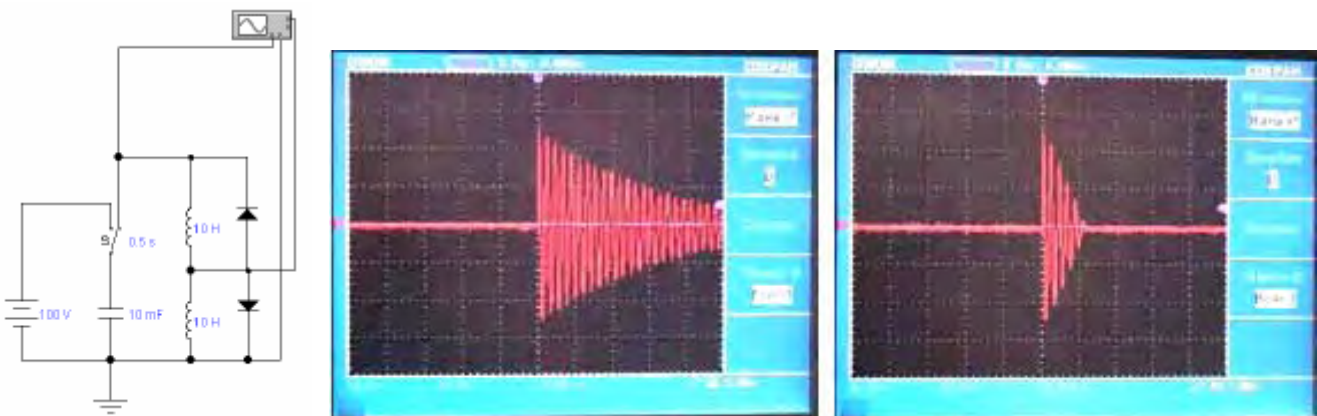
An oscilloscope was connected to the coil instead of to the capacitor, in order to avoid influence of the first diode so the oscillations viewed were based on the inductance of the spread capacitors.



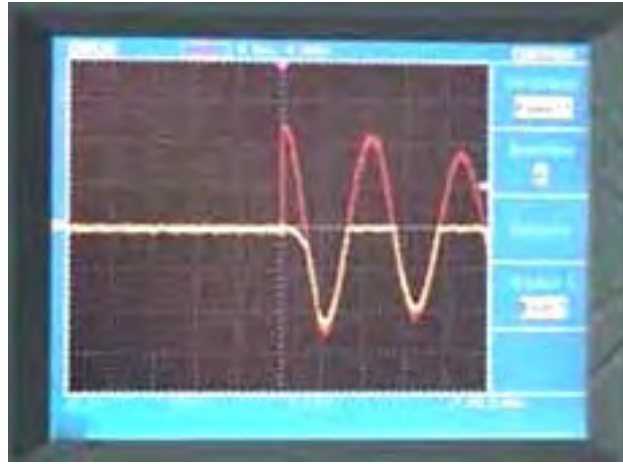
The result: The accuracy of capacitor recharging was improved to 5 percent (due to the removal of the influence of the first diode). After the main capacitor was switched off (by the diode), you can see oscillations caused by the spread capacitance of the inductors. Based on the frequency of the oscillations which were 4 to 5 times higher than that of the main capacitor, one can estimate the spread capacitance as being 16 to 25 times lower than the main capacitor.

Still further testing

Testing of the oscillation circuit shunting, with the two cases combined (and without the first diode):

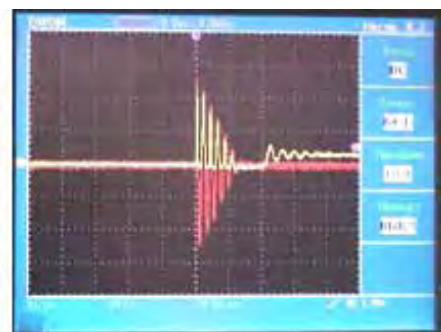
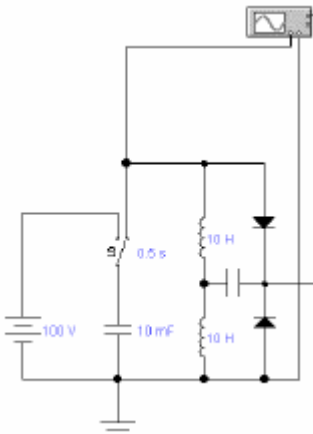
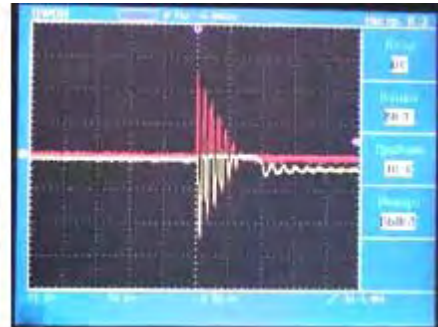
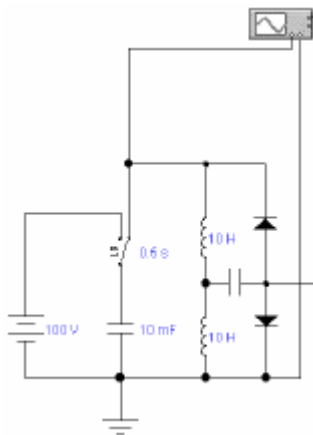


The result: A contour (oscillation circuit) is not destroyed, but it is shunted a lot. One can explain it by considering the moments when both diodes are conducting and so, shunt the circuit. As an addition, the voltage on the down diode is shown (the time scale is stretched). The negative voltage is close to maximum.



Still further testing

Charging a capacitor by shunting current in oscillation mode.



Conditions: The addition of a charging capacitor of 47 nano Farads.

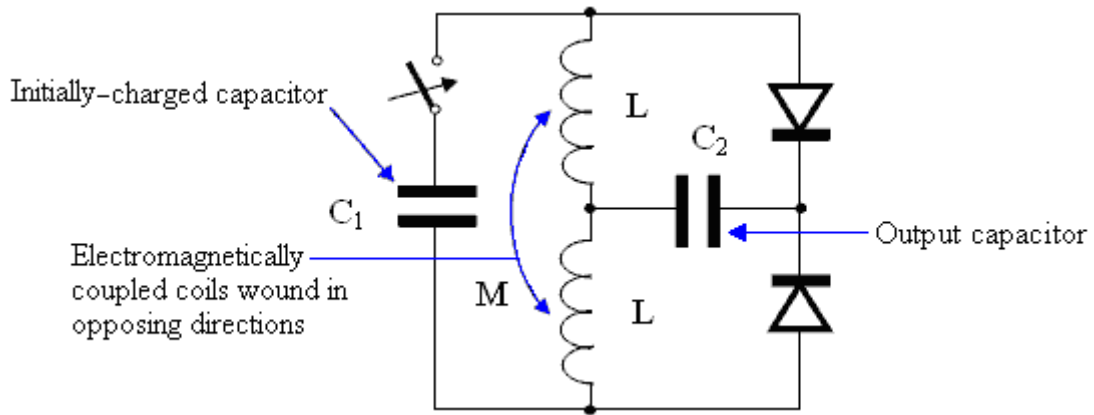
The result: A capacitor is charging without shunting the circuit. The final voltage on it is 0.8 V, and rises and falls of the voltage depend on the value of the capacitor.

THE OVERALL RESULTS OF THE TESTS (OPTIONS 1, 2 and 3)

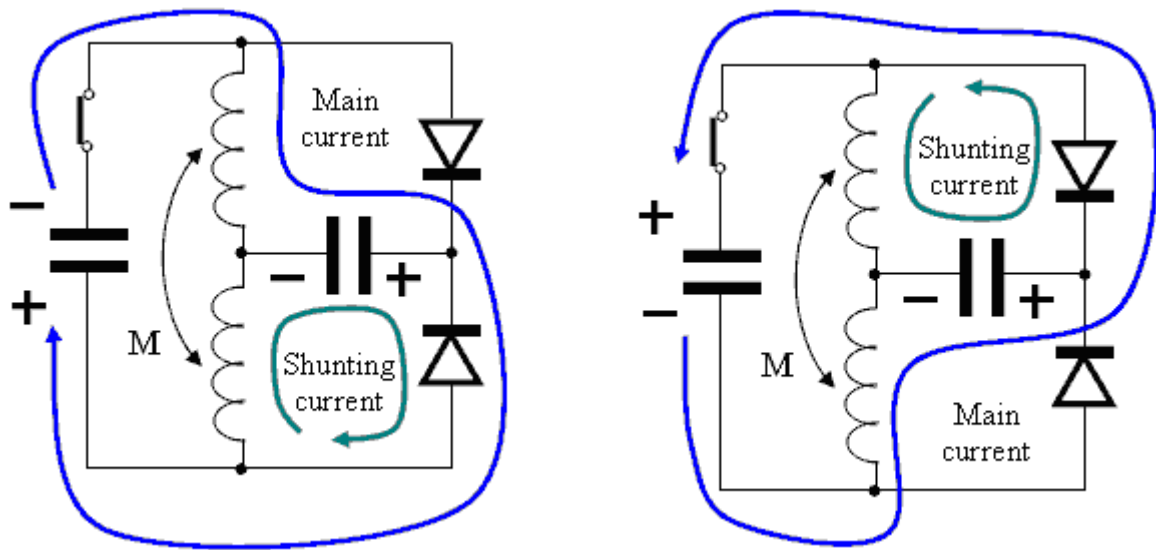
The symmetry of interaction in systems with electromagnetic field feedback (as with switched inductance) appears to be violated, and this implies that this arrangement could be used to generate energy.

COMMENT: You need to choose the load in order to get the maximum power output. **Very low, and very high loads, will send almost no energy to the load.**

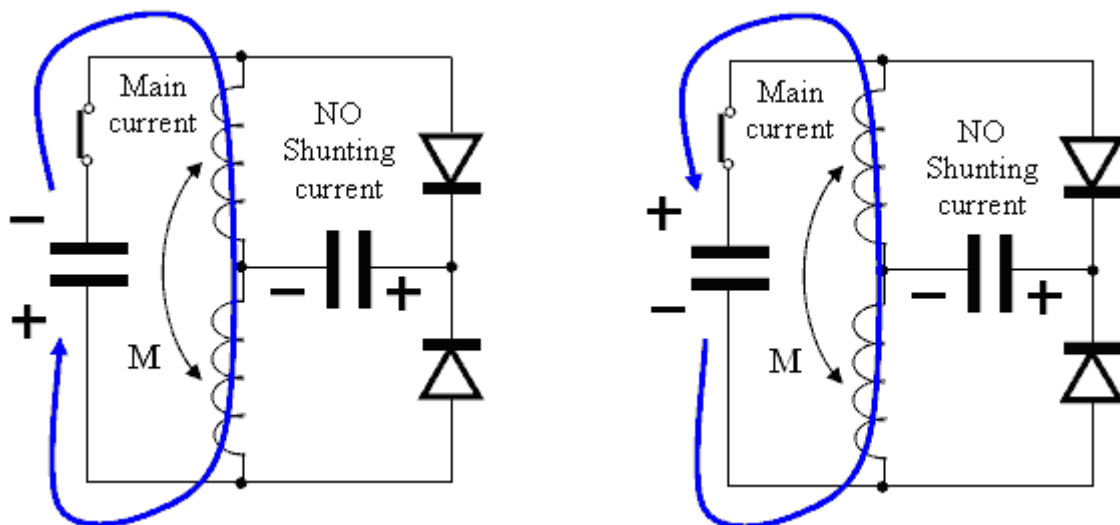
ILLUSTRATION FOR SWITCHABLE INDUCTANCE



EXPLANATION: The circuit has two kinds of currents: the main current and the shunting current.



The main and the shunting currents run through the same output capacitor in one direction, if the output capacitor is discharged.



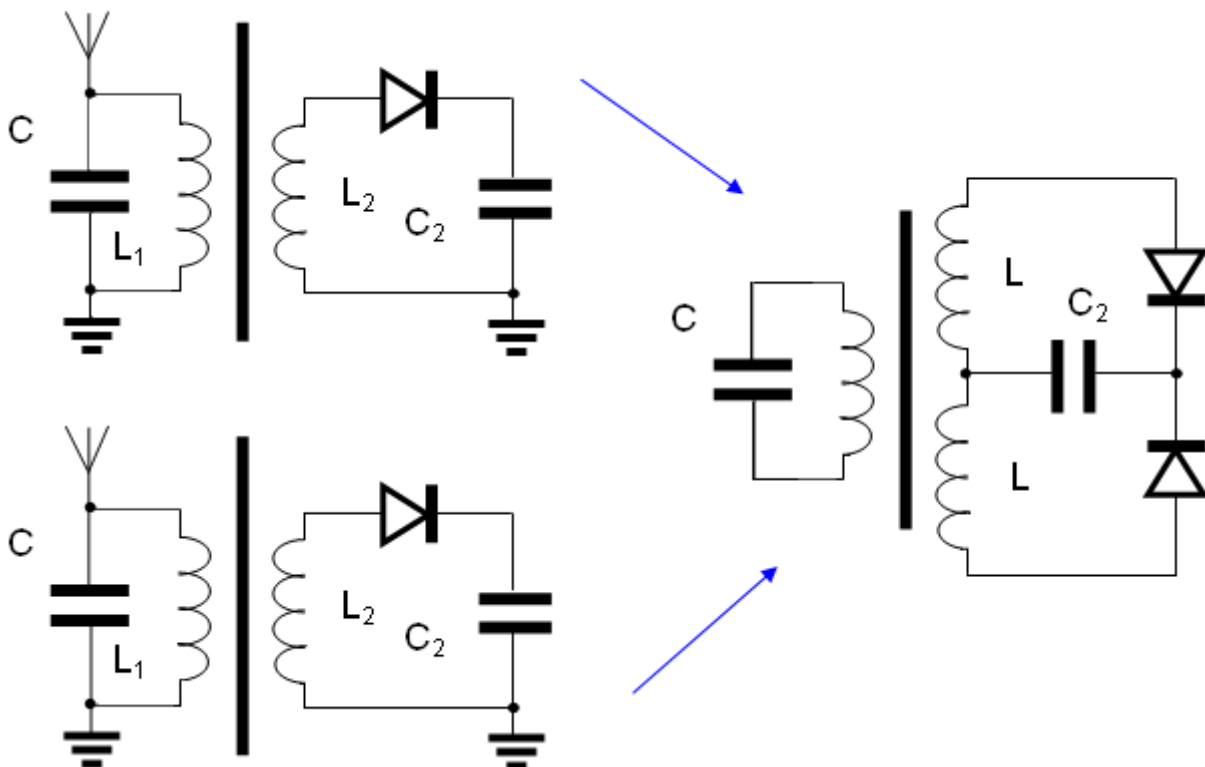
There is no shunting current, if the output capacitor is charged.

ILLUSTRATION FOR SWITCHABLE INDUCTANCE

From Don Smith



EXPLANATION As Don Smith said, two detector receivers were combined, and one FE device was constructed.



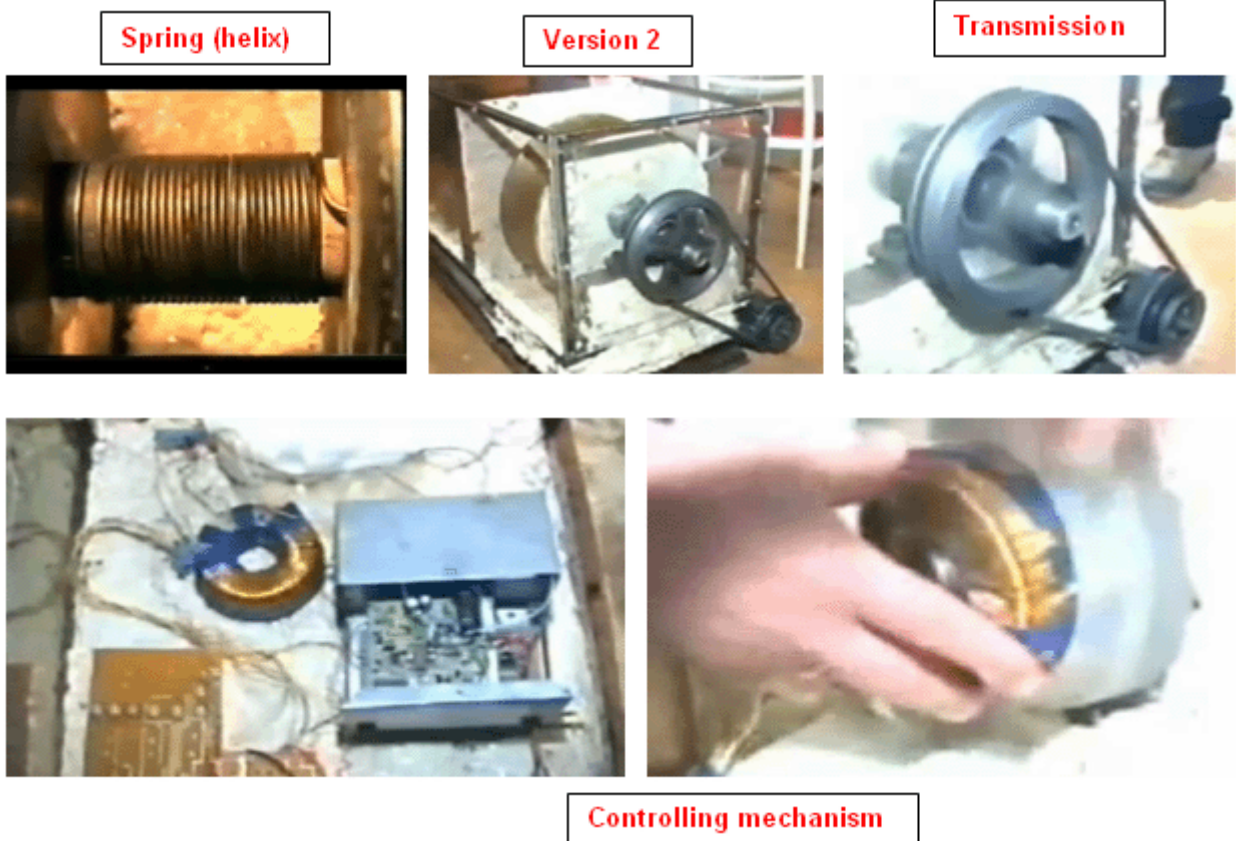
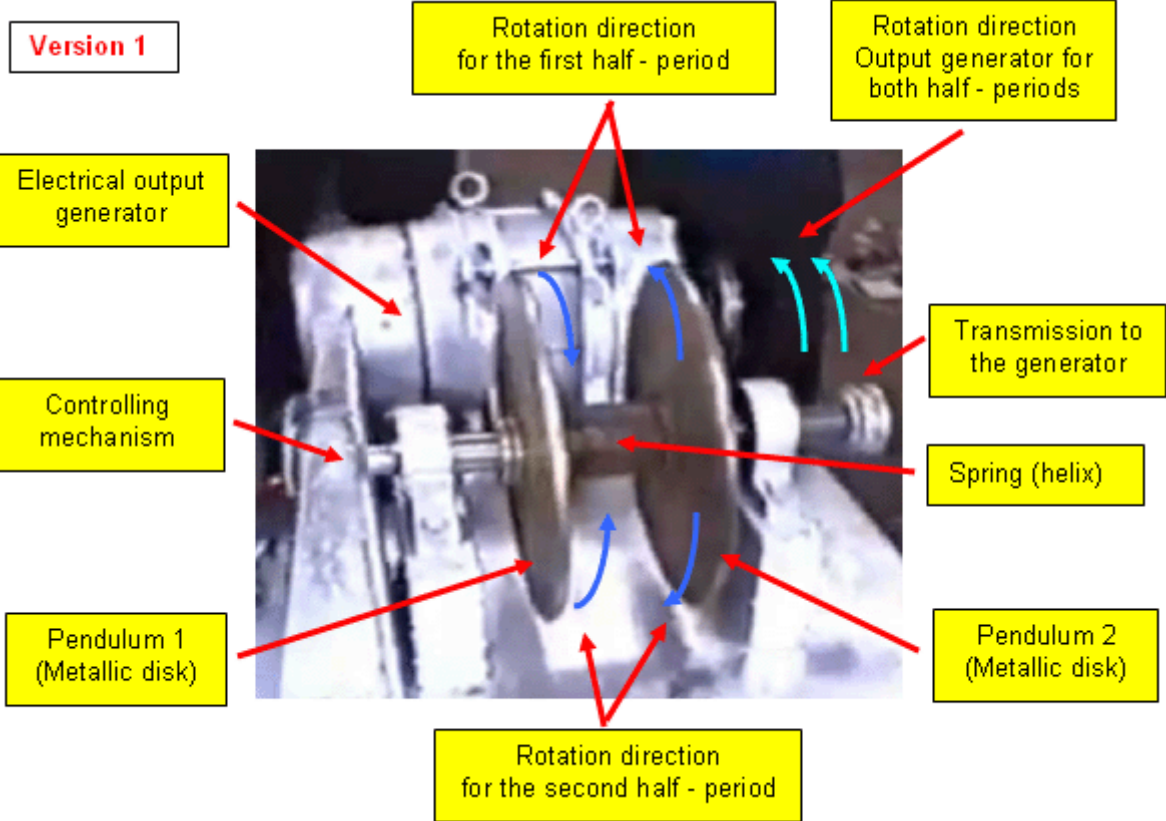
COMMENTS: Don Smith produced this explanation as a PDF file: www.free-energy-info.com/Smith.pdf

The resistance of the load must be chosen so as to get the maximum possible power in it.

The "board" does not contain an output circuit, because a couple of spark gaps and one step-down transformer can be used instead of diodes and a capacitor (this was pointed out before, so read the part which describes the suppression of back EMF).

MECHANICAL (INERTIAL) ANALOGUE OF SWITCHABLE INDUCTANCE

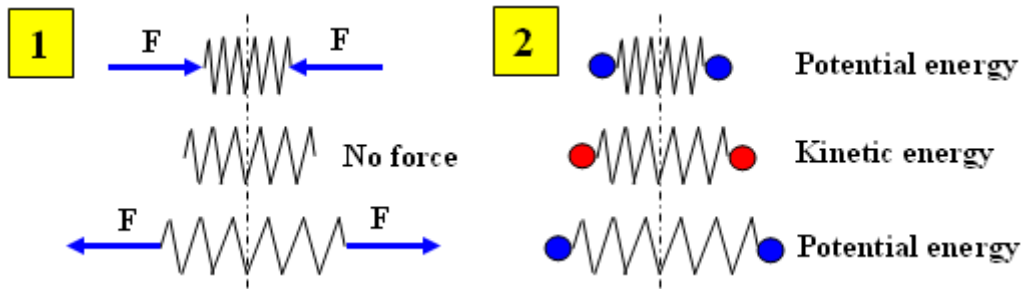
From Taniel Kapanadze



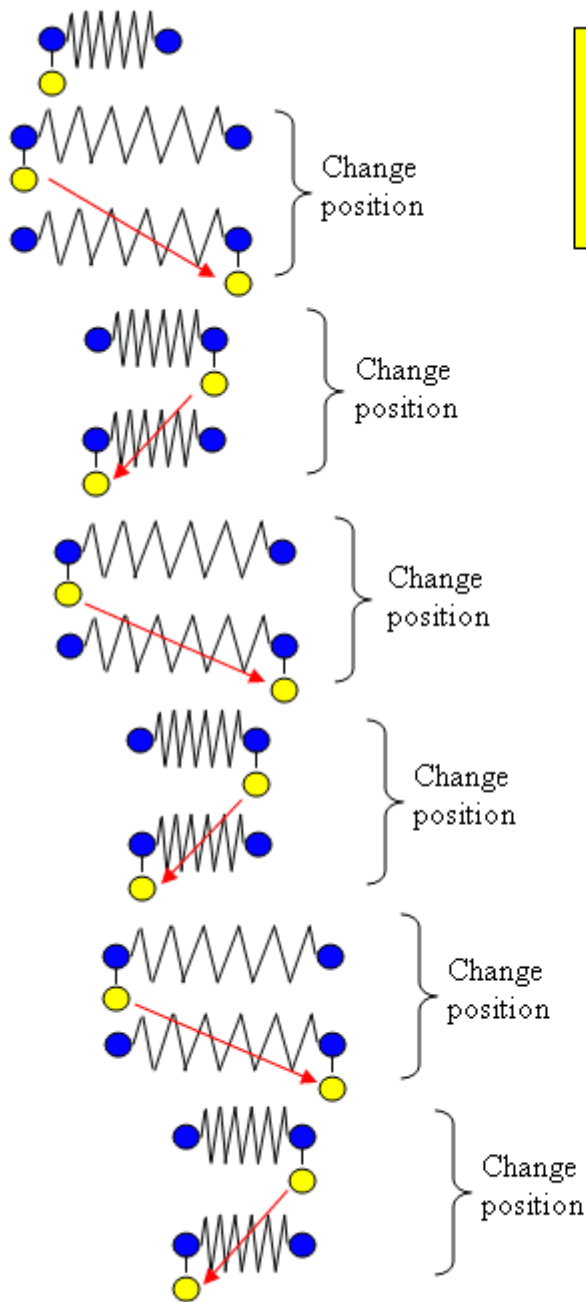
EXPLANATION: When one pendulum is stopping the other is accelerating. The controlling mechanism connects the pendulums to the output generator one after the other and so maintains the oscillations.

CONNECTING EXTRA MASS TO A MECHANICAL OSCILLATOR

EXPLANATION: Mechanical energy can be stored in any spring by compressing it or stretching it (1). It corresponds to two positions in a mechanical oscillator (2), when only potential energy takes place in an oscillating process



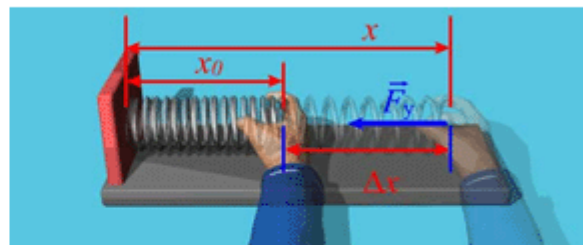
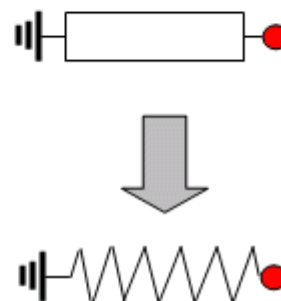
EXPLANATION: If extra mass is connecting periodically to one side or the other, of a mechanical oscillator, it will be shifting without any energy loss during the oscillation process



And so on ...

COMMENT There is no need to transfer extra mass from one position to another in an actual device, because extra mass is a disc and masses in a mechanical oscillator are discs also. You only have to connect them in a variety of ways.

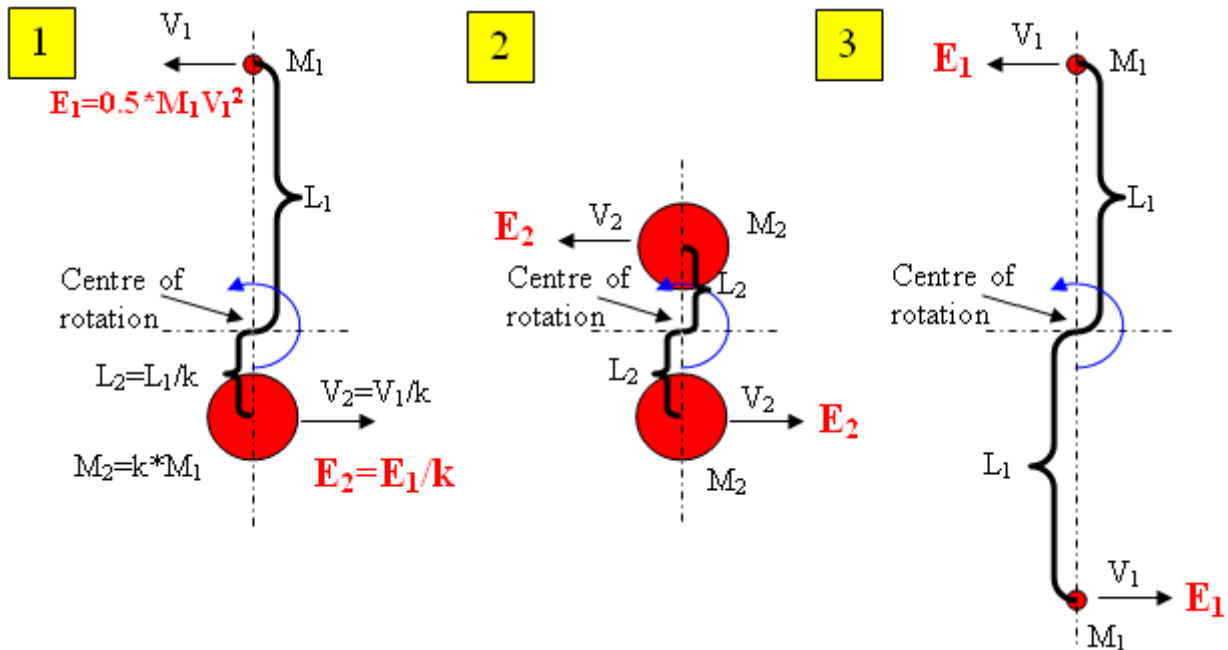
COMMENT A grounded Tesla coil is an analogue of a spring with one side fixed



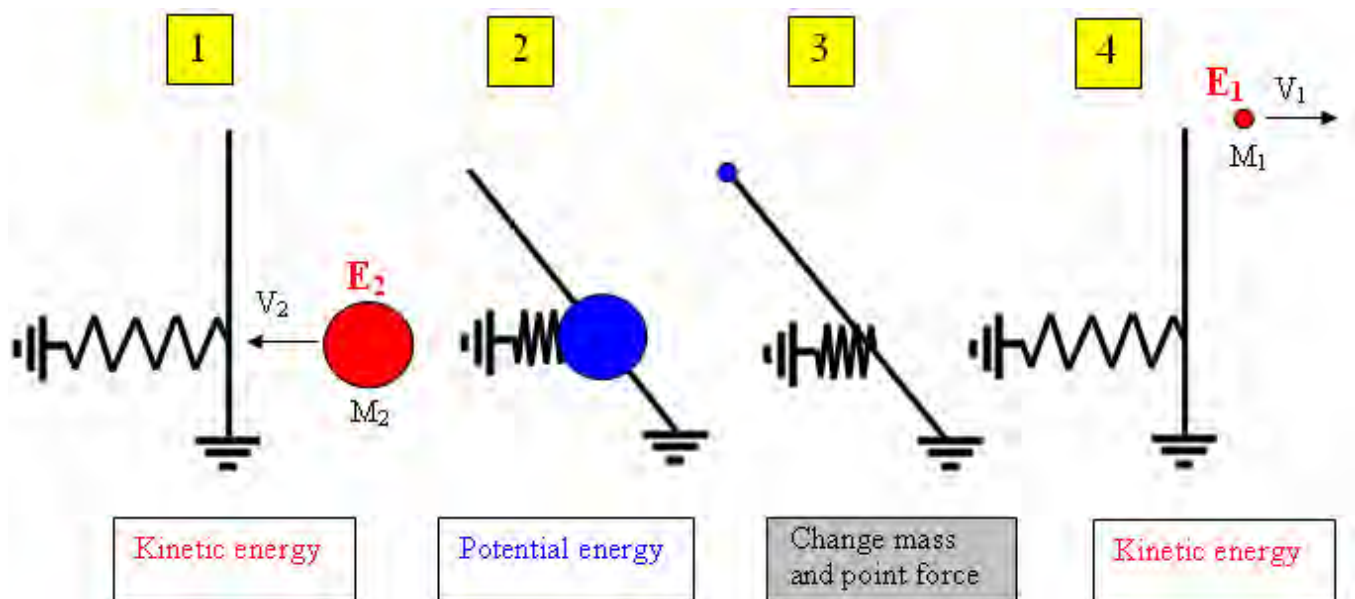
$E_p = k(dx)^2/2$ – Potential energy of deformed spring (helix)

THE PRINCIPLE OF AMPLIFICATION OF MECHANICAL ENERGY

Explanation: The principle is based on an asymmetrical flywheel (1) consisting of a small mass and a large mass. These masses are balanced across the centre of rotation, that is, are located at a distance proportional to their weights, from the center of rotation. This helps to avoid vibration when they are rotating (the same principle used when balancing a car wheel).

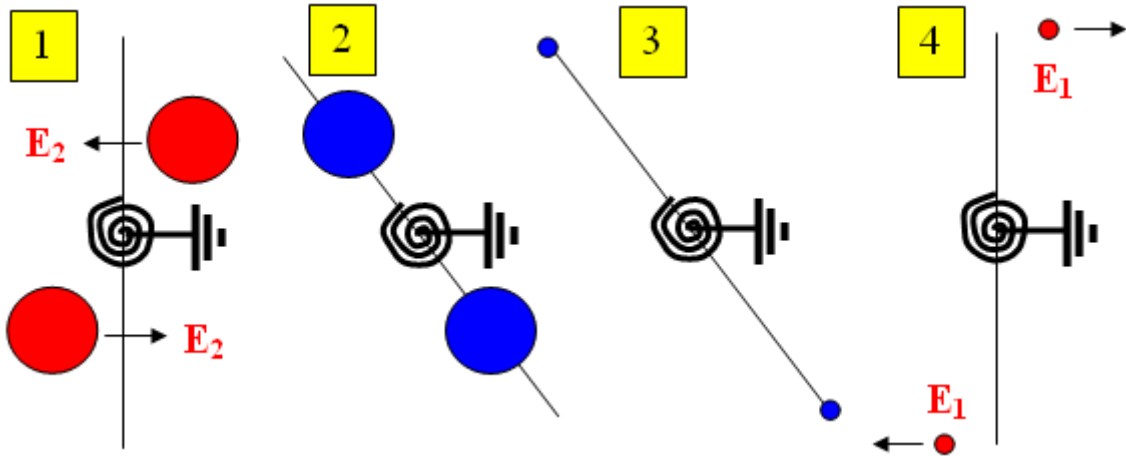


The inertial moment of such a flywheel (1) is analogous to the inertial moments of flywheels (2) and (3), consisting only of large or small masses. However, from the point of view of kinetic energy, all of these examples, (1), (2) and (3) are different. This is because the kinetic energy of every mass depends on the direction and speed at which it moves (if is released during rotation). The highest common kinetic energy is in the masses of flywheel (3), as less energy is contained in flywheel (1) and the smallest kinetic energy is in flywheel (2). In order to get an increase in energy one needs to achieve a set-up which is based on a spring (for energy transformation from kinetic energy to potential energy and back again) and a lever of Archimedes (for changing the point where the force is applied).

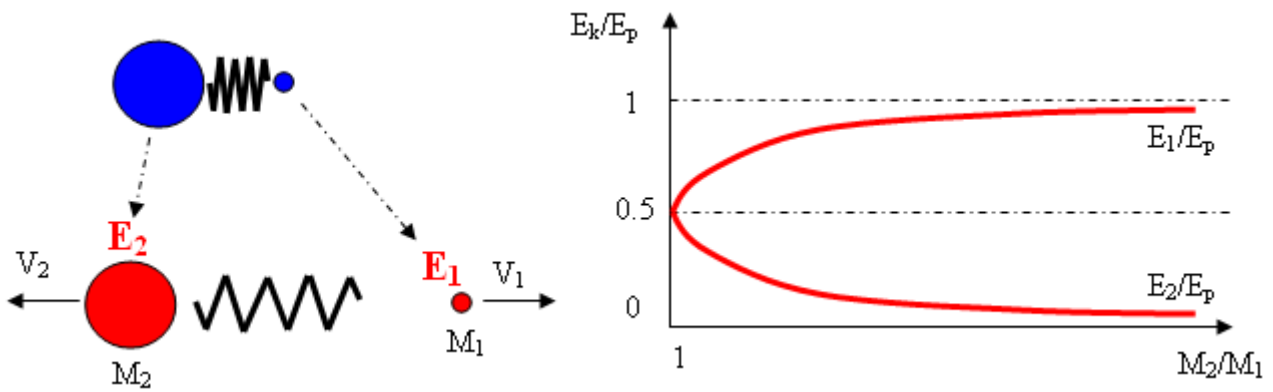


Comments:

1. The simplified schematic diagrams shown here are for explanation purposes only.
2. In an actual device, you can use a spring in rotation mode (as Tariel Kapanadze did).
3. You can use disks and rings as flywheel masses (as Tariel Kapanadze did).
4. Altering one mass to another is actually achieved by connecting them in various ways.

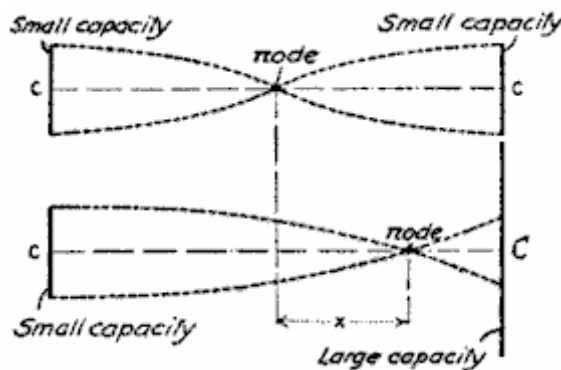


Comment: Any asymmetrical mechanical oscillator behaves as indicated above, when the potential energy of a compressed spring is transformed to the kinetic energy of moving masses.



The potential energy of the spring is distributed unequally between the small and large masses. A small mass acquires more energy relative to its size than a large mass does. The sum of the kinetic energies of both masses is equal to the potential energy of the spring.

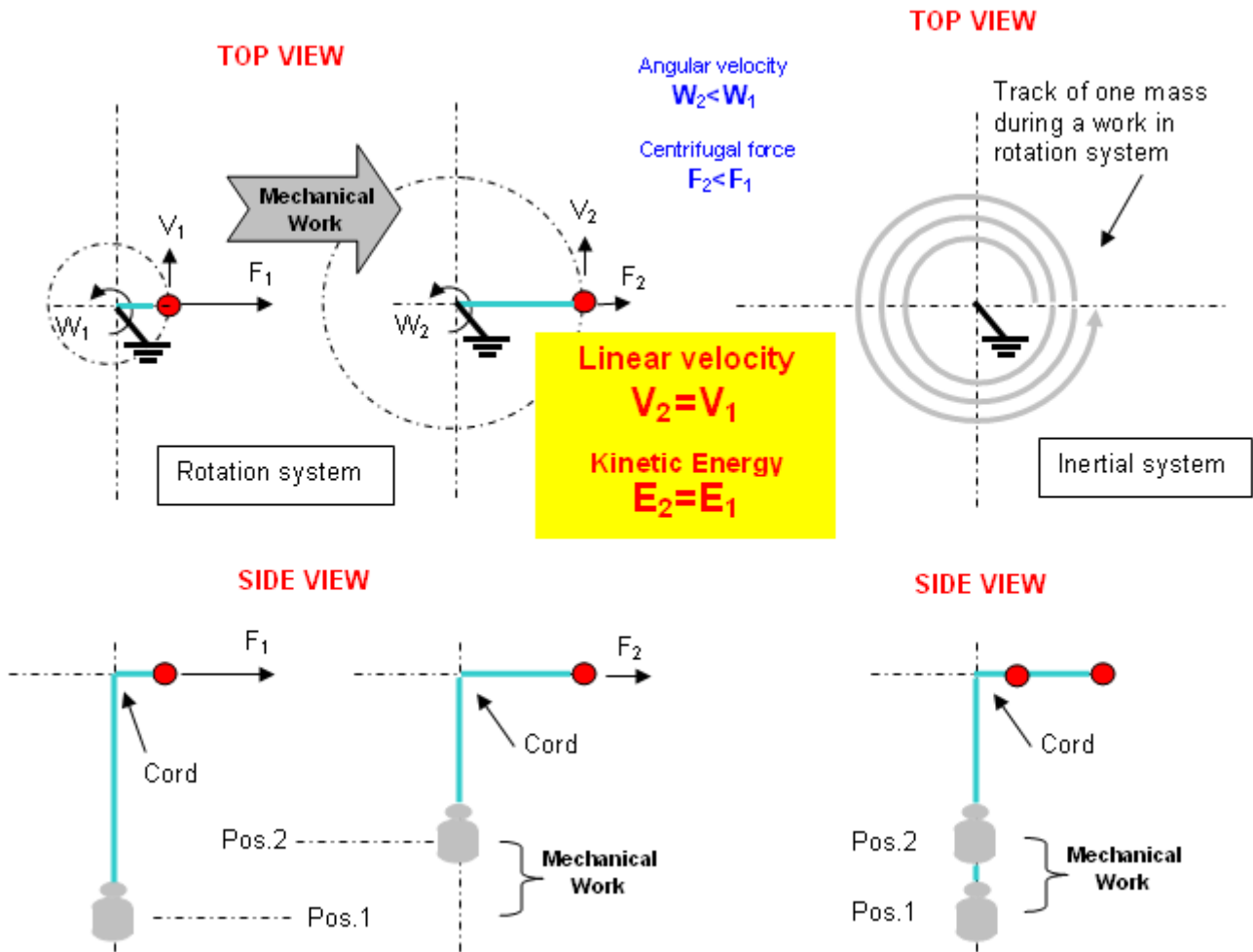
Comment: This is based on Tesla's asymmetrical schematic:



FLYWHEEL – A HIDDEN FORM OF ENERGY

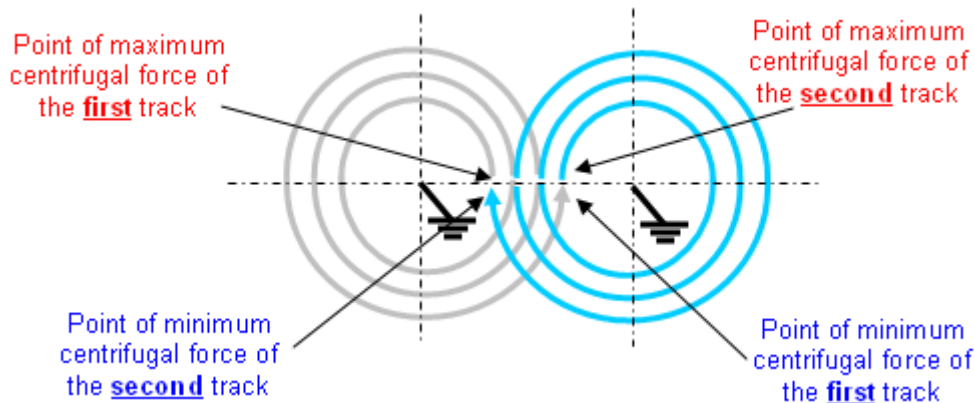
(Clarifications on mechanical energy amplification)

EXPLANATION: If you don't want to lose mechanical energy when doing work, then this work must be done by an imaging force. This force is absent in an inertial coordinate system, but it is present in a non-inertial coordinate system. When in a rotational coordinate system this force is called 'centrifugal' force.



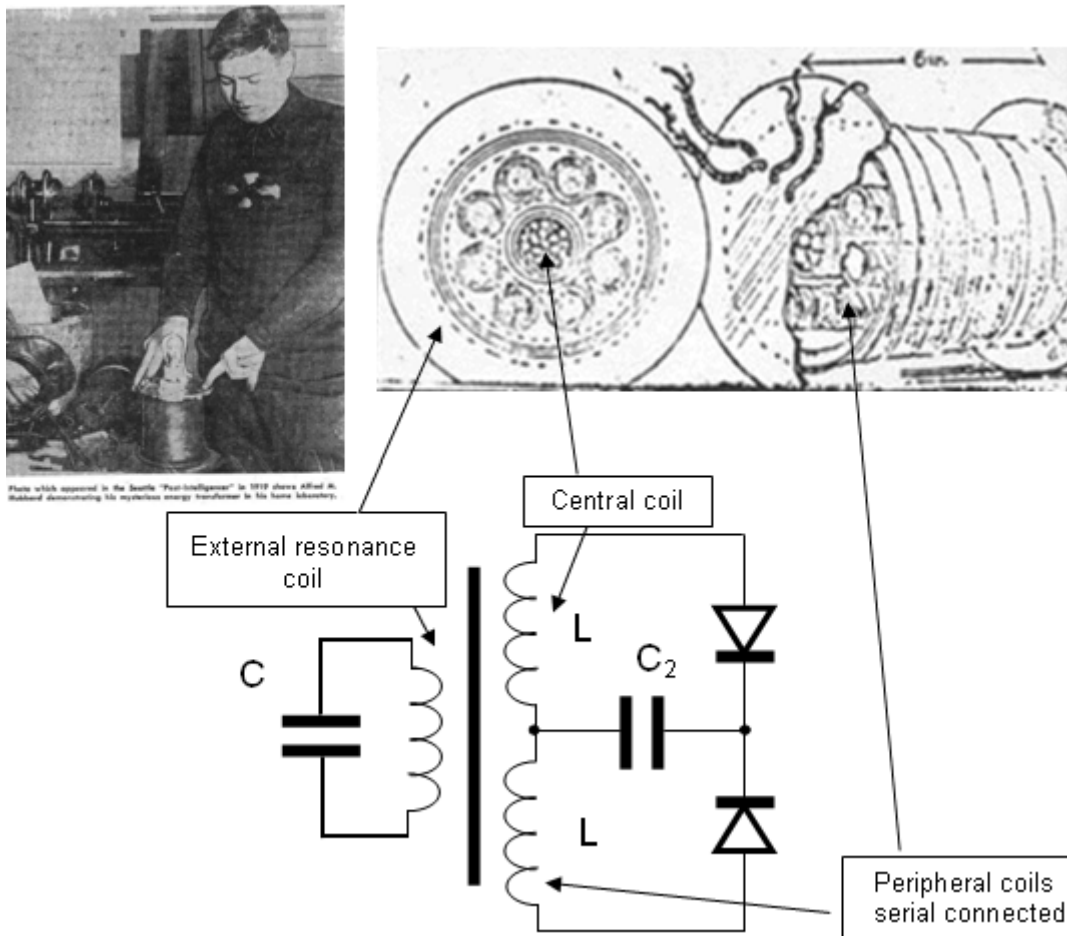
COMMENT: After the work is done, the centrifugal force is low and if you want to continue producing mechanical work, you have to use **the other** coordinate system where centrifugal force is high again. This is possible because linear velocity does not change. You have to provide **the other** support point only (and a cord) in order to produce mechanical energy again.

COMMENT: If you want to make this mechanical work continuous, then the end of the first track must also be the beginning of the second track. You have to change coordinate system periodically.



COMMENT: In a real situation, you have to compensate for energy loss due to friction and so a part of the excess energy must be used to maintain the process.

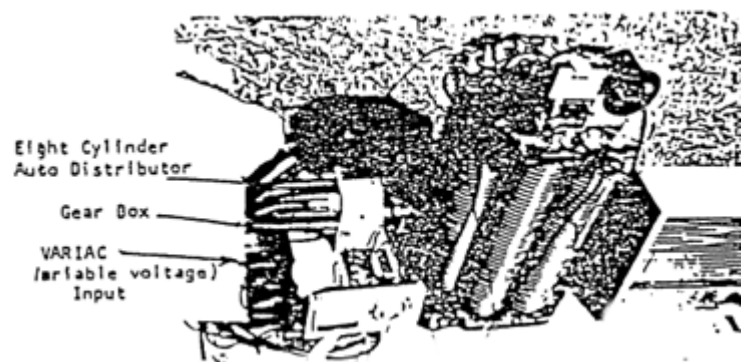
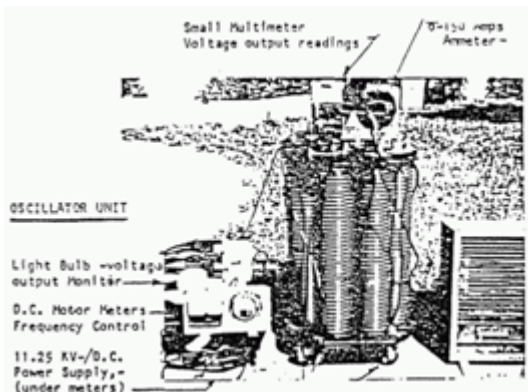
ILLUSTRATION FOR SWITCHABLE INDUCTANCE From Alfred Hubbard



EXPLANATION: The center coil and all of the peripheral coils can “grasp” the same flux coming from the resonance coil. All other details are the same as in Smith’s version.

COMMENTS: In other words, you can use rods as the coil core, instead of a closed ferromagnetic core.

But, this is not the only option in Hubbard’s device. He may have had another one, based on a different principle, perhaps the principle of energy amplification in an LC circuit as described earlier, but with switchable inductance being used.

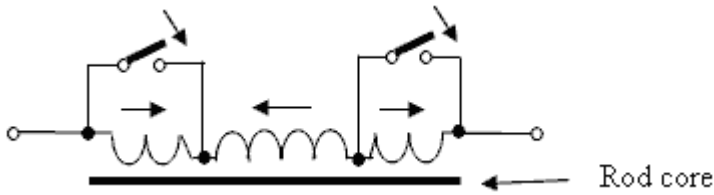


MODERN OPTIONS?

In switchable inductance

Version 1

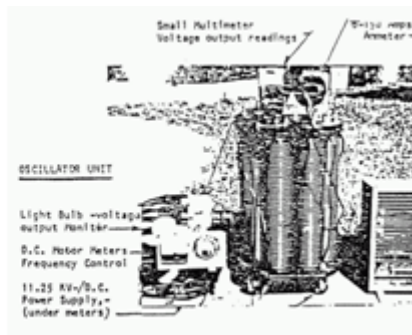
A coil has more inductance when some of its parts are short-circuited:



EXPLANATION: The central section of the coil and its two end sections are wound in opposite directions.

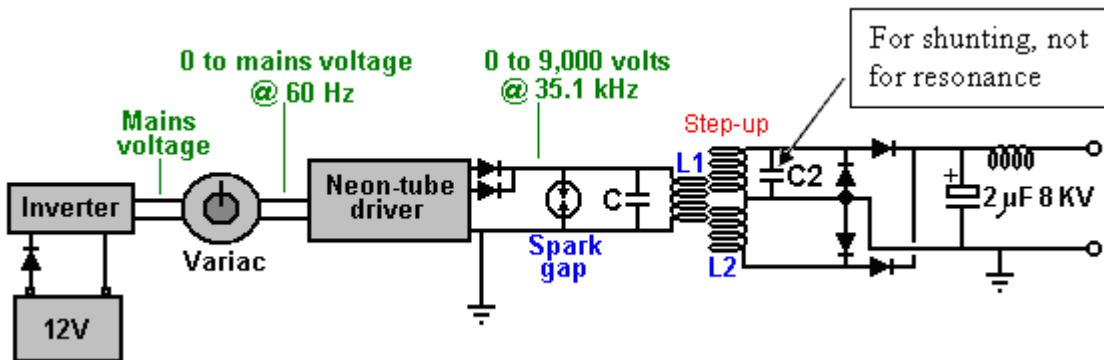
COMMENT: The coil shown in the picture above has **twice the inductance**, when its end sections are short-circuited (measurements made with the Chinese-built RLC test meter shown here):

Hubbard's version



Version 2

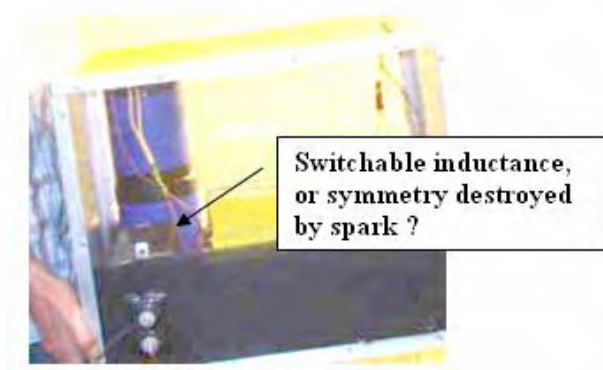
By Don Smith



But, this looks like resonance in an asymmetrical transformer ??????

Version 3

By Tariel Kapanadze



No description ...???

Read on for further details....

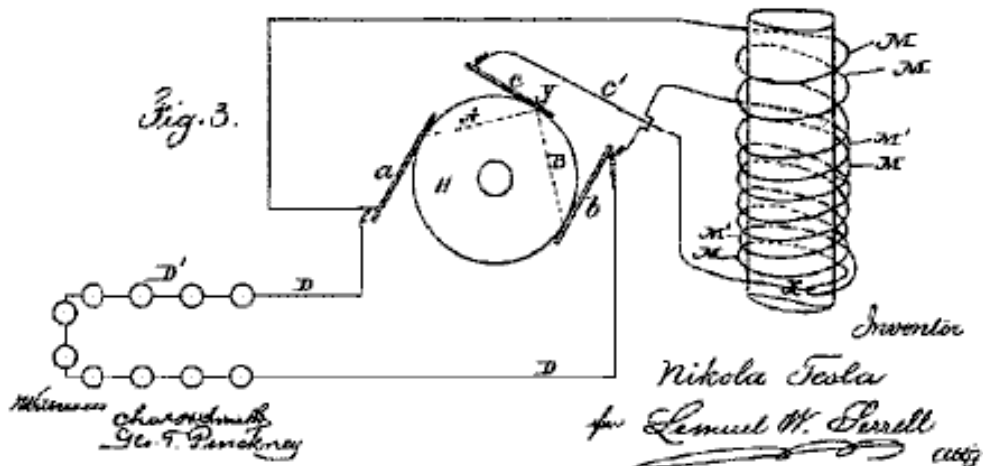
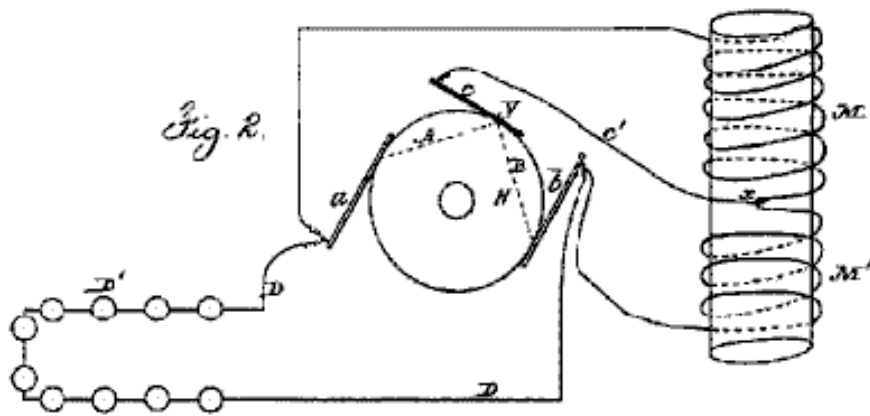
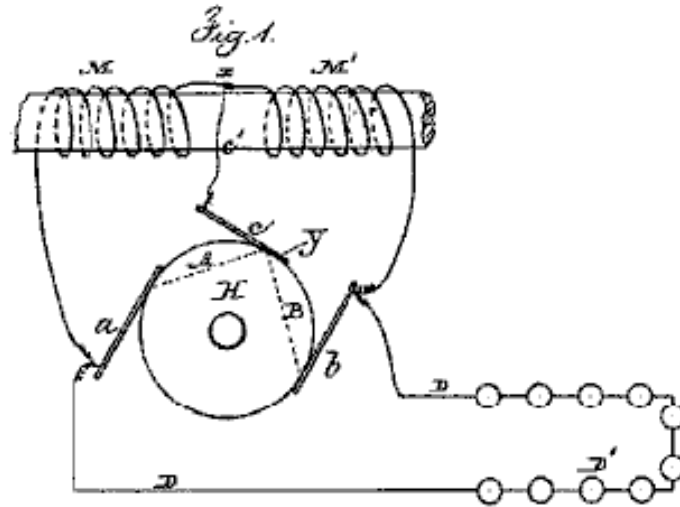
THE BASIS OF SWITCHABLE INDUCTANCES (Tesla patent)

N. TESLA.

REGULATOR FOR DYNAMO ELECTRIC MACHINES.

No. 336,961.

Patented Mar. 2, 1886.



SECRET 3

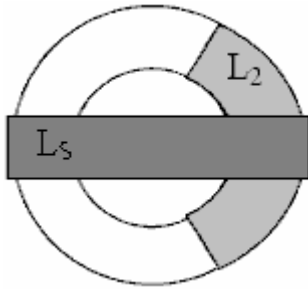
THE ASYMMETRICAL TRANSFORMER

With a magnetic field feedback loop (evolution of the 2nd secret)

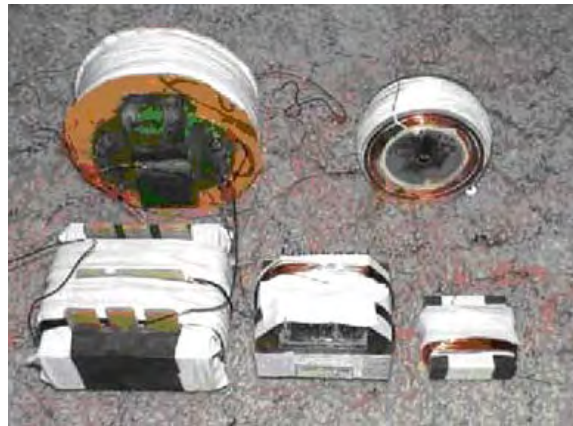
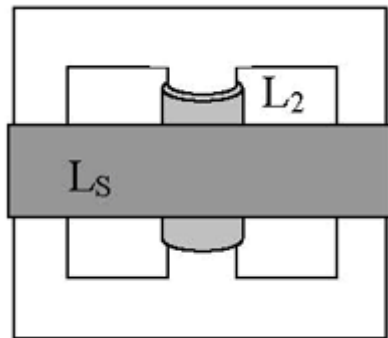
LENZ LAW IS VIOLATED IN AN ASYMMETRICAL TRANSFORMER

(Therefore it is not possible to use it as an ordinary transformer)

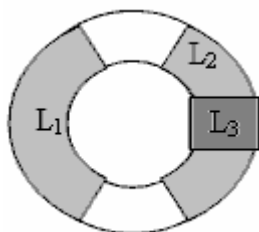
An asymmetrical transformer can have two coils: L_2 and L_S . Coil L_2 is wound on one side of the toroidal core while L_S is wound so that it encloses both the toroid and the coil L_2 as shown here:



Optionally, this arrangement can be implemented with a wide range of styles of transformer core:



One option is to use the above (switched inductor) arrangement and add one more coil:



Now that you understand the operational principles of this system, you can use any configuration which you need. For example:

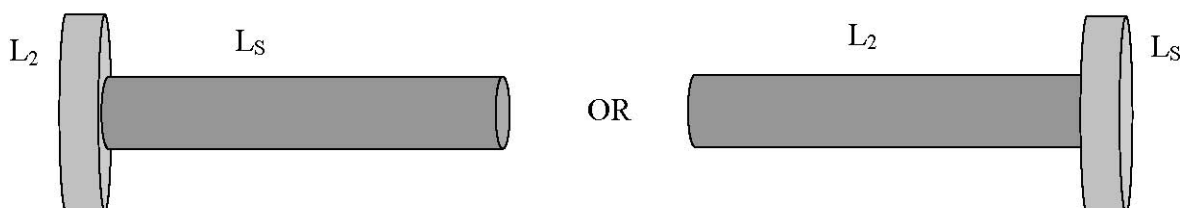
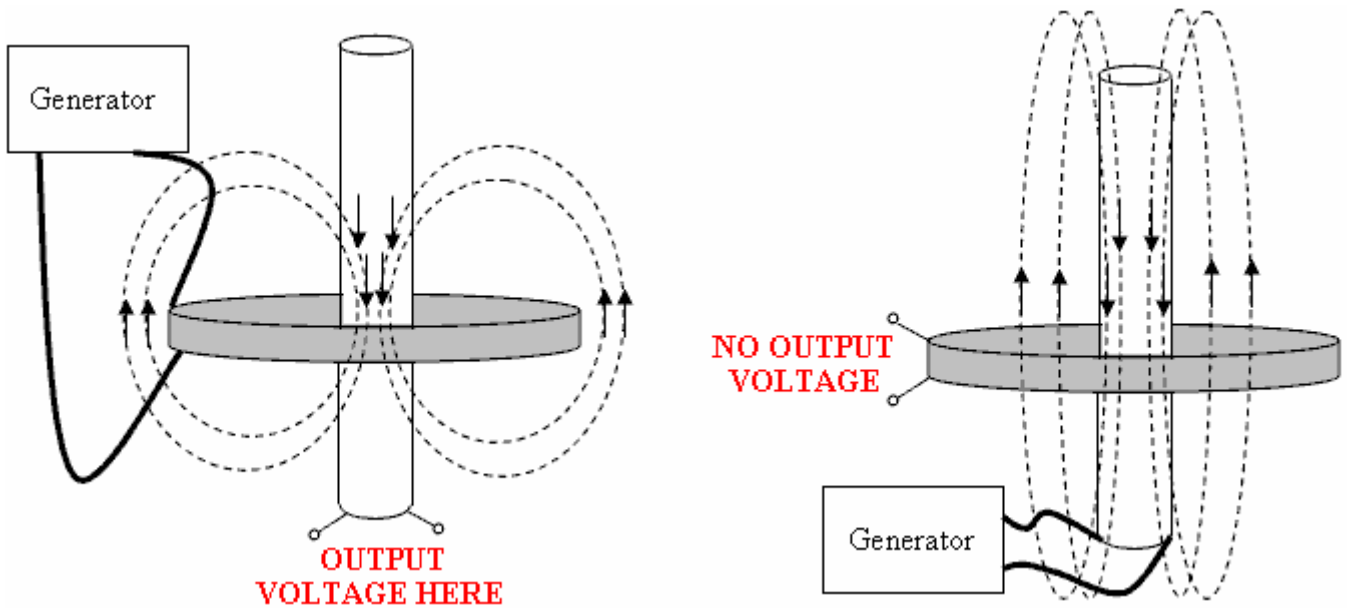


ILLUSTRATION FOR AN ASYMMETRICAL TRANSFORMER OF SOME KIND



THE MECHANICAL EQUIVALENT OF AN ASYMMETRICAL TRANSFORMER

This example shows an ordinary transformer, wound on an E-core plus an external excitation magnet:



The magnet orientation may be different



The magnet orientation may be different



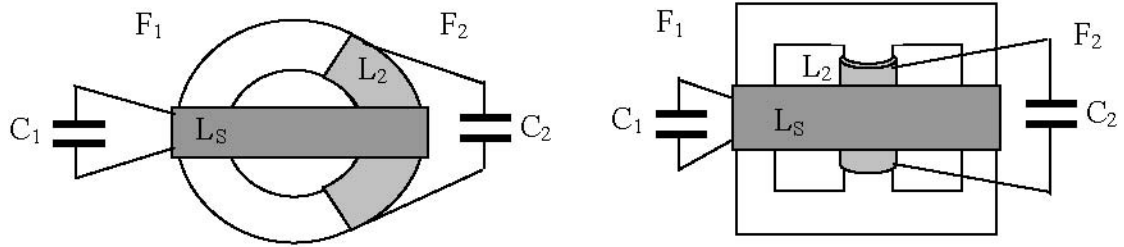
In other words: L2 is still used, but instead of L_S the exciting magnet is used.

The result:

1. The voltage developed across coil L2 depends on the number of turns in L2, but **the short-circuit current through L2 does NOT depend on the number of turns in coil L2.**
2. You need to choose the load connected to L2 in order to get the maximum power output. **Very low, and very high loads, will give almost no power output.**

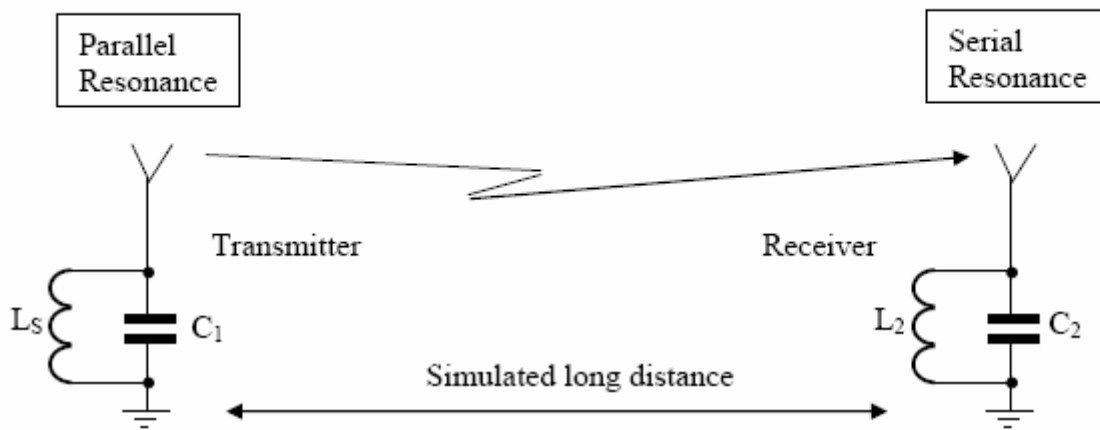
RESONANCE IN AN ASYMMETRICAL TRANSFORMER

The first coil is used as a transmitter of energy, and the second coil as a receiver of energy.

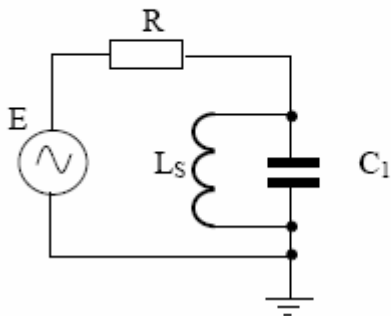


It is very like radio broadcasting, where the receiver is located far away from the transmitter, and has no feedback. The first coil works in **parallel resonance** and the second coil in **serial resonance** (although the two schematic diagrams look alike).

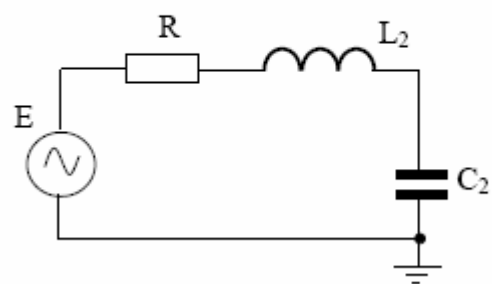
EQUIVALENT SCHEMATICS



FOR TRANSMITTER

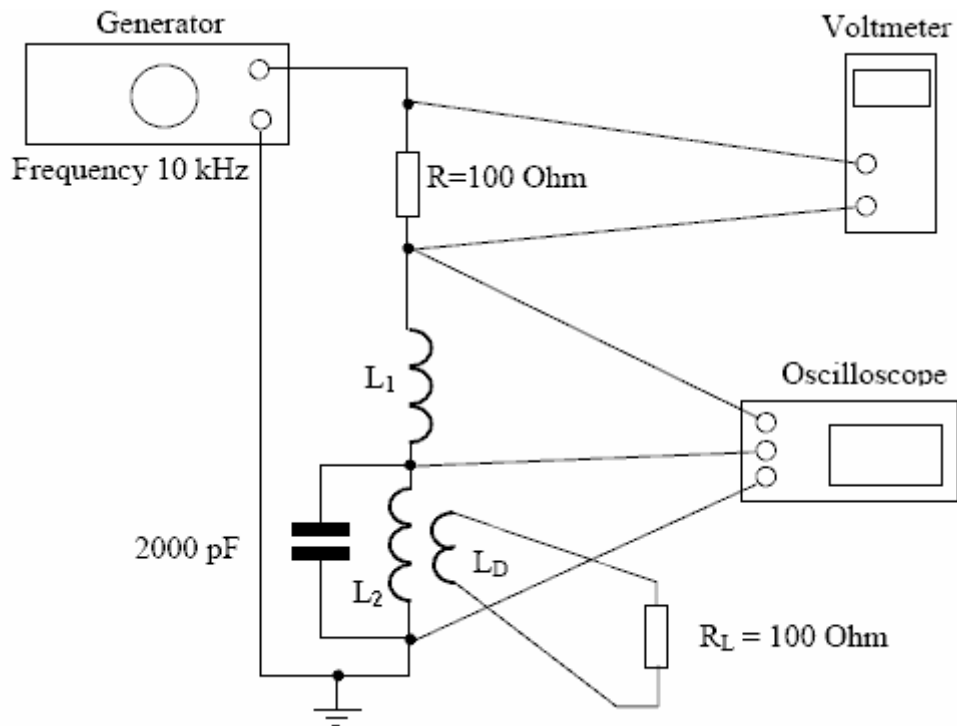


FOR RECEIVER



CONSEQUENTLY: You can get much more voltage on L2 than on Ls

An experiment:



Conditions:

The resonance frequency is about 10 kHz. The total inductance L_S is 2.2 mH, the L_2 inductance (same as the L_1 inductance) is 100 mH, the ratio $L_S:L_2$ is 1:45 with an E-shape core, permeability is 2500.

The result:

At the resonance frequency, there can be a voltage which is **50 times more** on any parts (L_1 or L_2) matched with the total coil L_S , and voltage changes on R are **no more than 15 percent**.

The phase shift in voltage is about 90 degrees between L_S and L_2 .



(The amplitudes were equalised)

Further

An additional step-down coil L_D was wound around L_2 , turns ratio 50:1 (matched with L_2), and the load resistor $R_L = 100$ Ohms was connected to it.

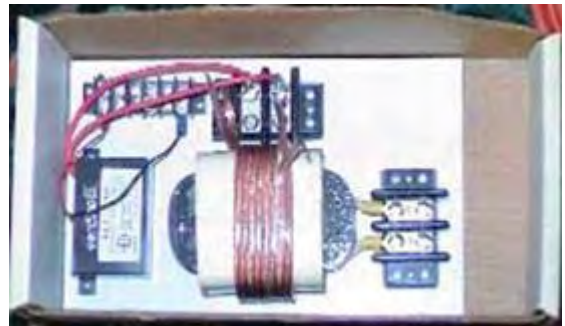
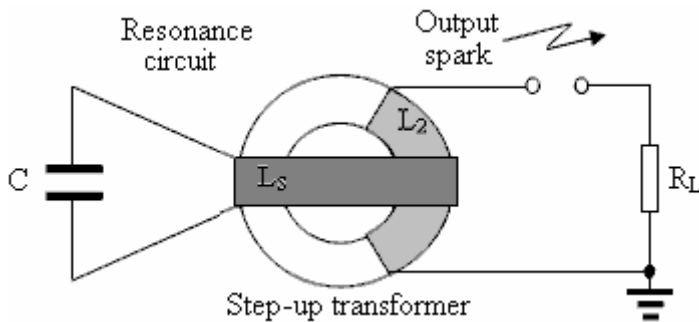
The result

Changes in current consumption (estimated by measuring the voltage across R) are no more 15 percent.

MODERN OPTIONS IN USAGE OF AN Asymmetrical transformer

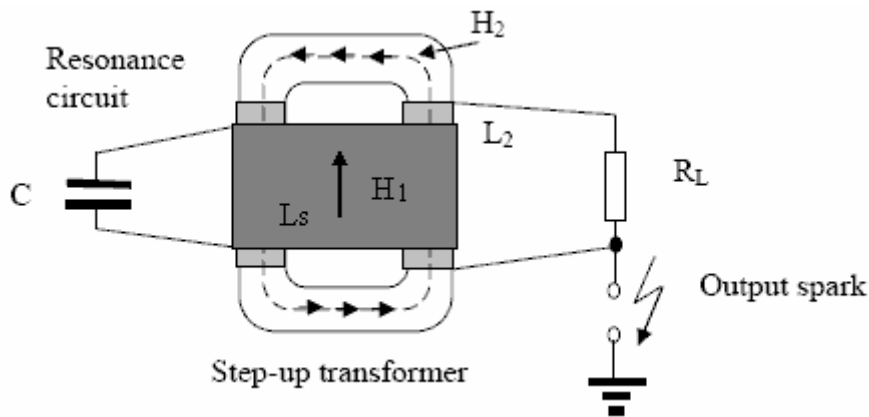
By Don Smith

The schematic is like this:

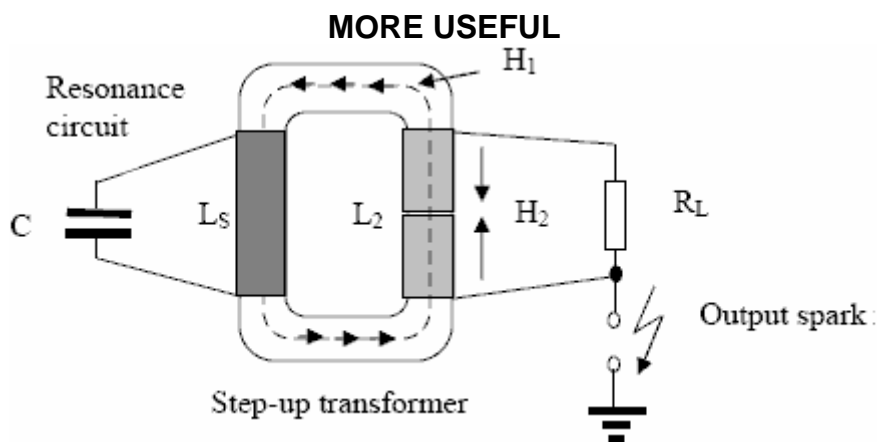


COMMENTS: Between sparks, L_2 has a voltage on it's ends. If R_L is connected directly to L_2 then there will be no output current without resonance and there will be no output current without a spark.

MORE ACCURATE:



COMMENTS: L_2 has no voltage on it's ends (without a spark). This is ordinary back-EMF suppression, invented by Nikola Tesla.



COMMENT: L_2 has no voltage on it's ends (without a spark).

Secret 3.1

THE ASYMMETRICAL TRANSFORMER BASED ON THE SHORT-CIRCUITED COIL

INTRODUCTION

Remark: Voltage distribution on the shorted coil depends on the position of the exciting coil.

DESCRIPTION

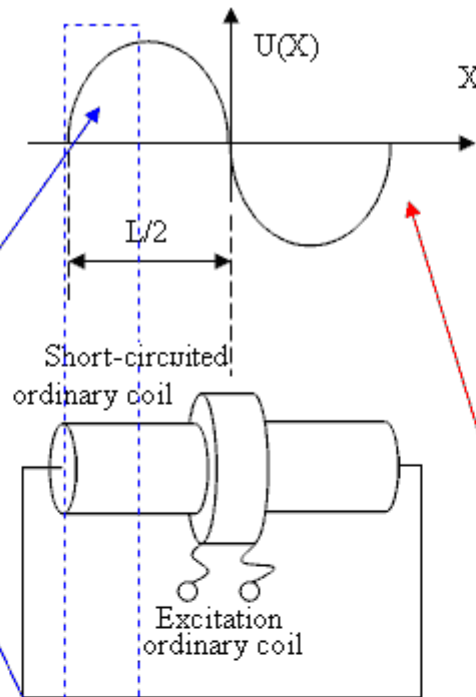
CASE 1 The excitation coil is centered:

Result: We have the full period of the voltage distribution on the short-circuited coil

FULL PERIOD

1

No orthogonality in this part



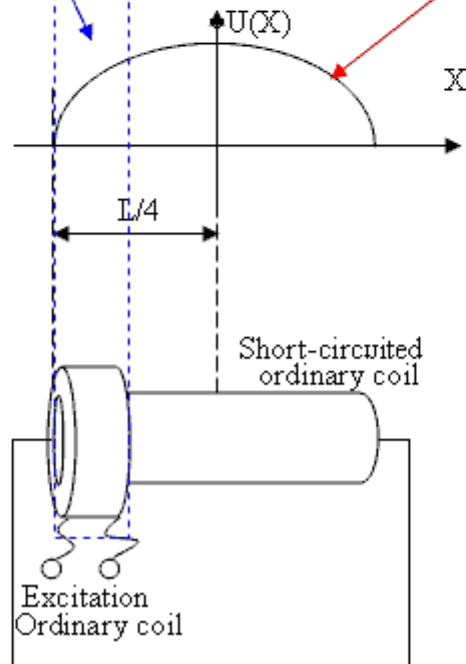
Voltage distributions are orthogonal

CASE 2 Excitation coil is on one side

Result We have half period of the voltage distribution on the short-circuited coil

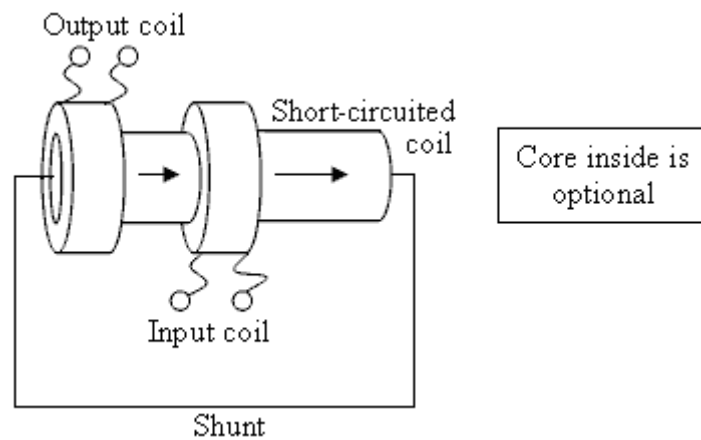
HALF PERIOD

2



CONSTRUCTION OF THE ASYMMETRICAL TRANSFORMER based on the short-circuited coil

CASE 1 The short-circuited coil is wound in one direction

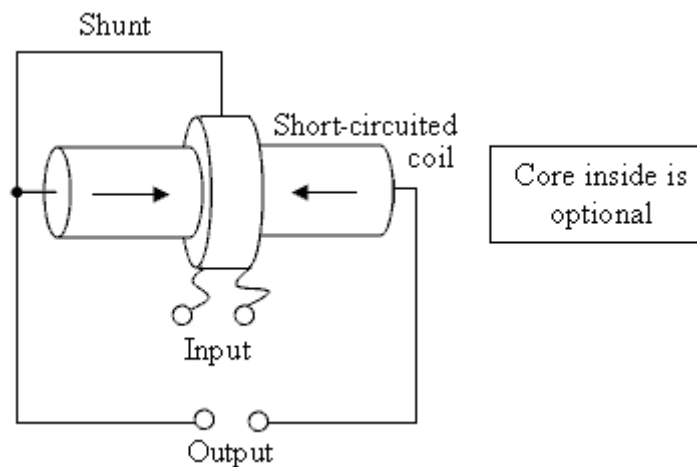


Result: The output does not influence the input in any way.

Explanation: The signal from the output coil generates zero voltage difference on the input coil.

Remark: The position of the coils should be adjusted in order to give the best result.

CASE 2: The short-circuited coil is wound in opposite directions from the centre outwards, and only half of the coil is short-circuited:



Result: The output has no influence on the input coil

Explanation: The signal from the output coil generates zero voltage difference on the input coil.

Remark: The position of the input coil needs to be adjusted to get the best result.

Remark: The coil's position depends on permeability of the core. More permeability means more alike with distribution pointed at the beginning.

Best Position: To find the best coil position, connect the signal generator to the output, and then find the coil position which shows zero at the input terminals. Alternatively, use an RLC meter connected to the input terminals and then find the coil position which gives no change in reading when the output terminals are short-circuited (**for both case 1 and case 2**).

Comment: The length of the wire, the total length of the coil, and the diameter of the coil are not important. The number of turns in the input and output coils plays the same role as in an ordinary transformer, **for both case 1 and case 2**.

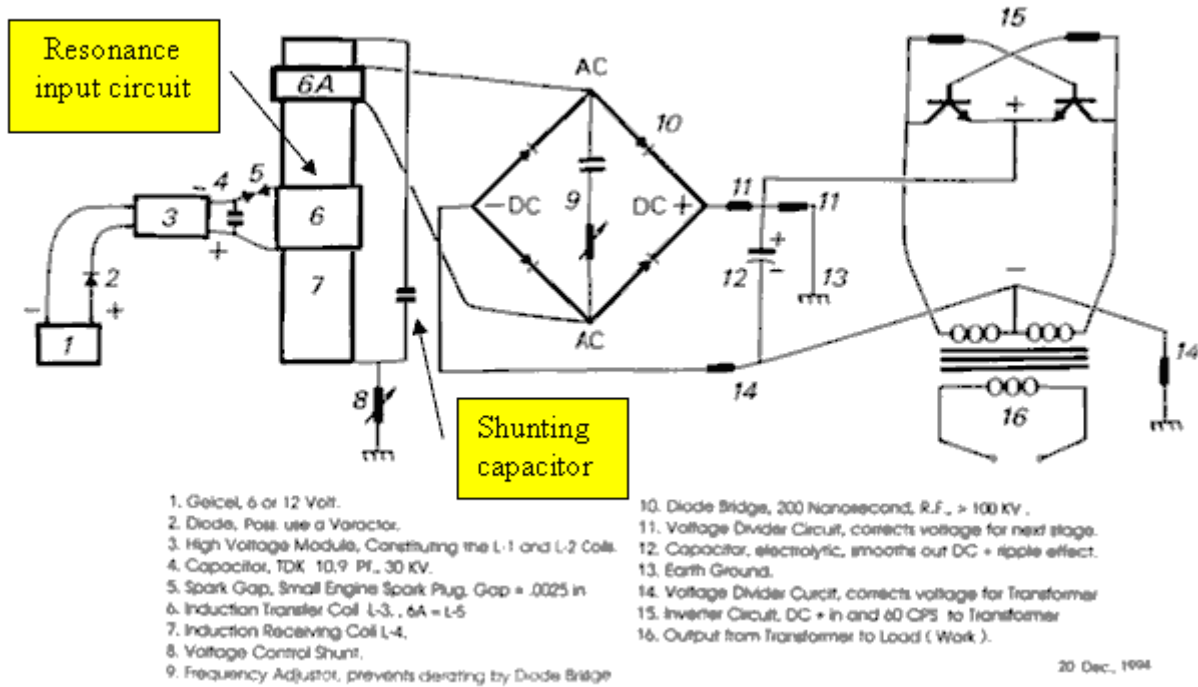
MODERN APPLICATIONS FOR SHORT-CIRCUCITED COILS

By Don Smith

CASE 1

ELECTRICAL ENERGY GENERATING SYSTEM

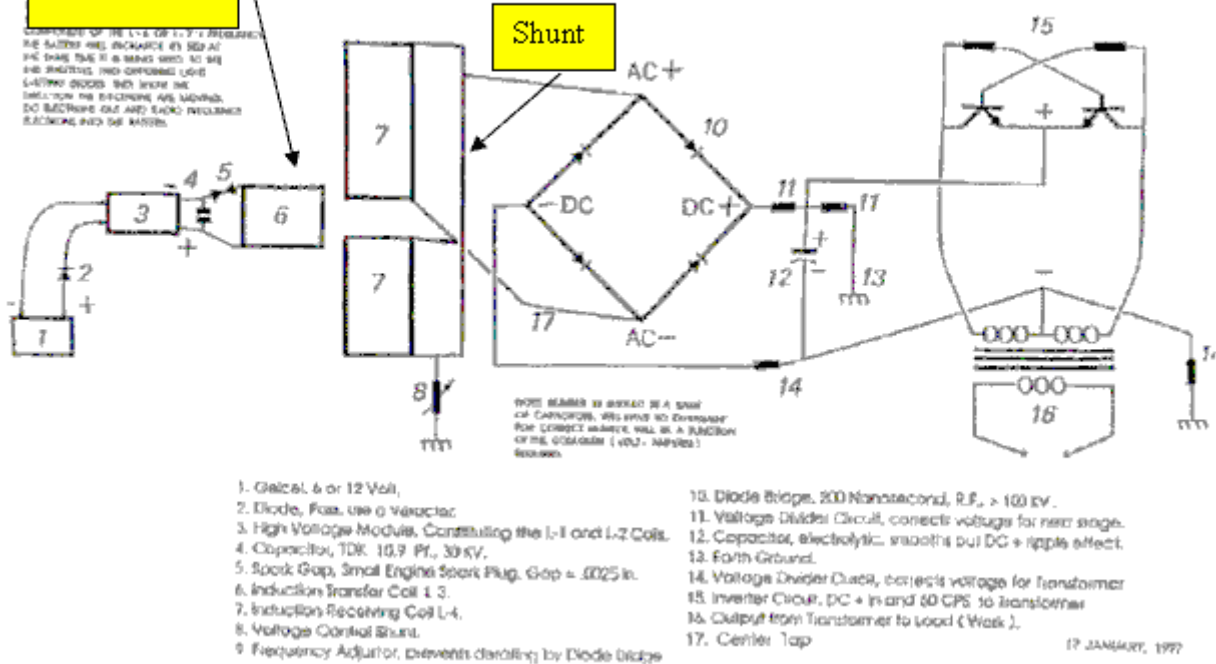
Patent Pending 08 / 100,074



CASE 2

ELECTRICAL ENERGY GENERATING SYSTEM

Patent Pending 08 / 100,074

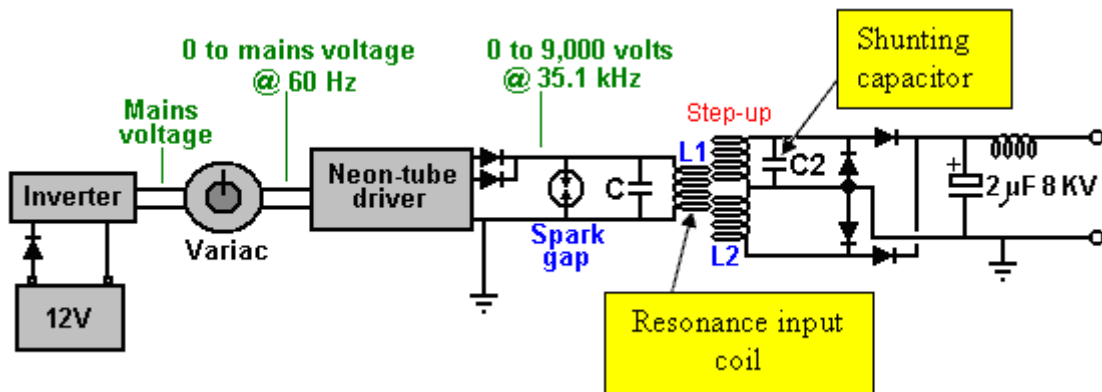


REMARK: The position of the coils must be adjusted until the output has zero influence on the input.

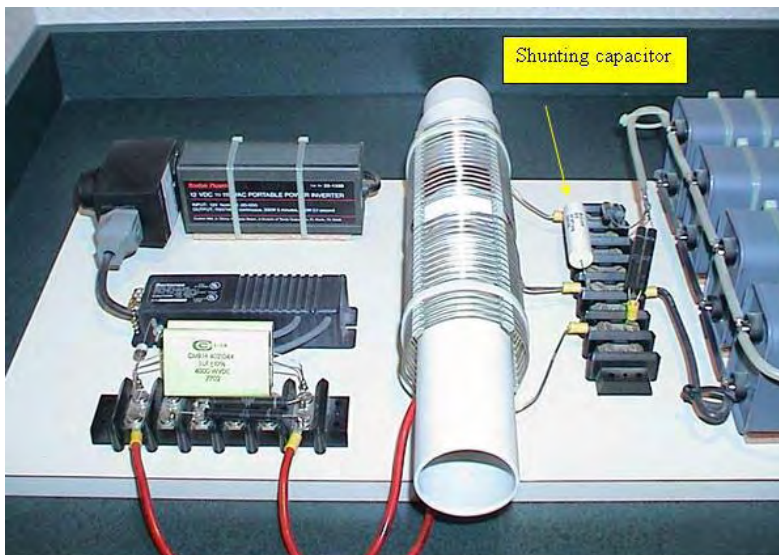
REMEMBER: None of the (input) energy used for exciting ambient space should appear in the load.

AN EXAMPLE OF CASE 2

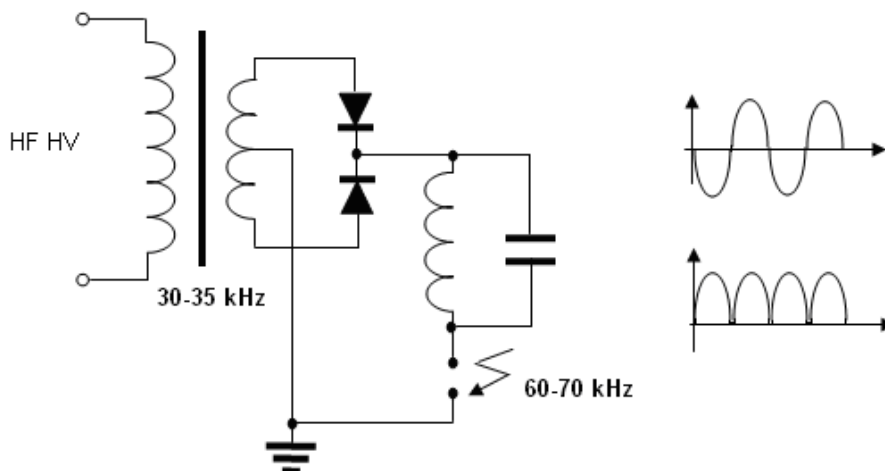
By Don Smith



COMMENTS: The output coil can be adjusted to resonate with the input coil, but this is not important for understanding the principle. Excitation with just one spark is possible (not in resonance), but the frequency of the sparks influences the output power directly.



COMMENT: Don Smith used the simplest doubling excitation frequency



COMMENTS: Resonance frequency of the circuit is about 60-70 kHz, but dimmer is for 30-35 kHz. For adjusting the excitation frequency, voltage/frequency technology was used. You have to adjust two parameters: the position of the slider and the excitation frequency.

MODERN APPLICATION FOR SHORT-CIRCUITED COILS
By William Barbat

US Patent Application number 2007/0007844

Self-Sustaining Electric-Power Generator Utilizing Electrons of Low Inertial Mass to Magnify Inductive Energy

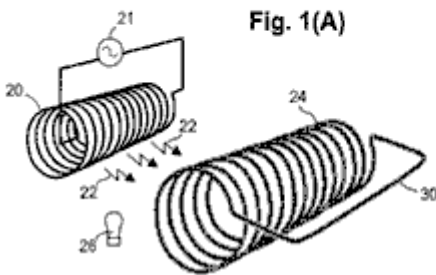
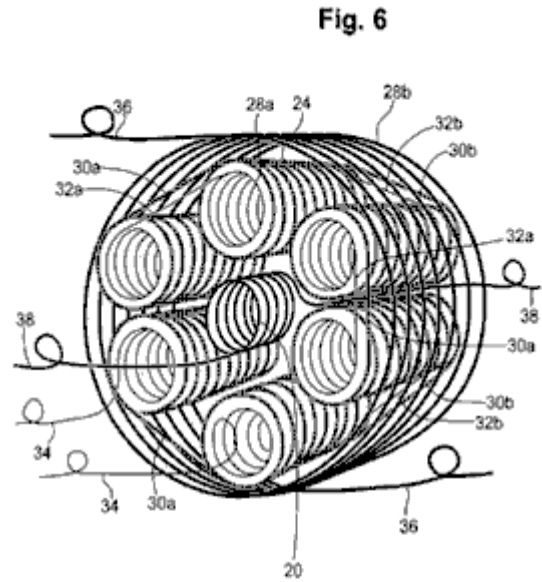
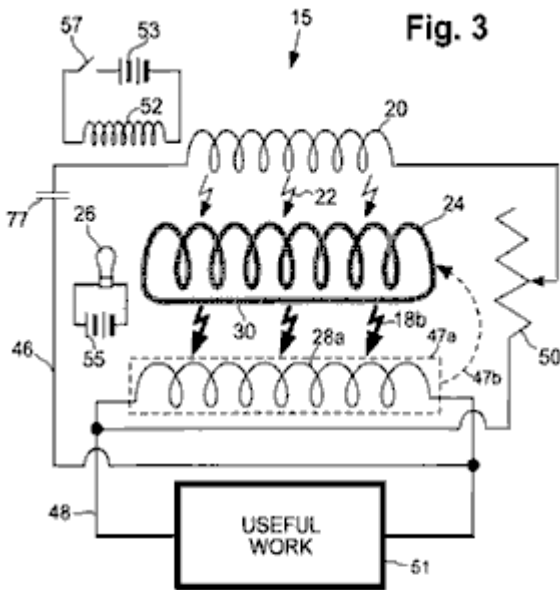


Fig. 1(A)

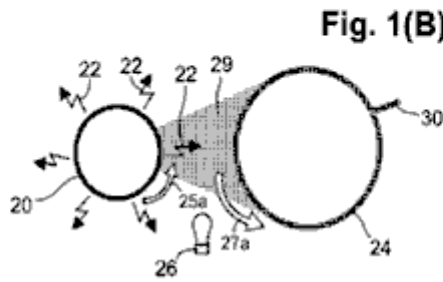


Fig. 1(B)

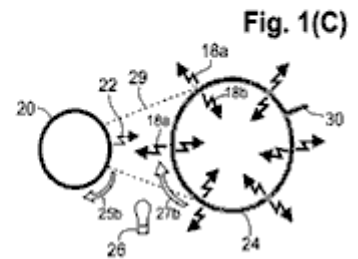


Fig. 1(C)

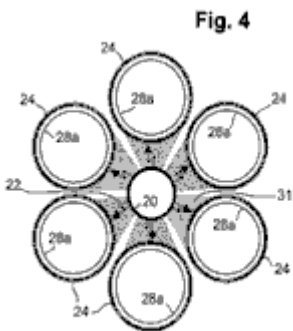


Fig. 4

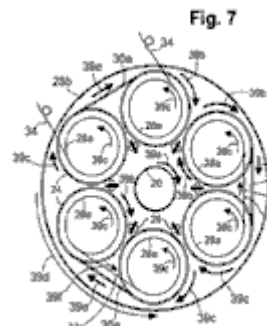


Fig. 7

COMMENT In order to understand this device, you have to read Barbat's patent application US 2007/0007844 A1: www.free-energy-info.com/PatD25.pdf

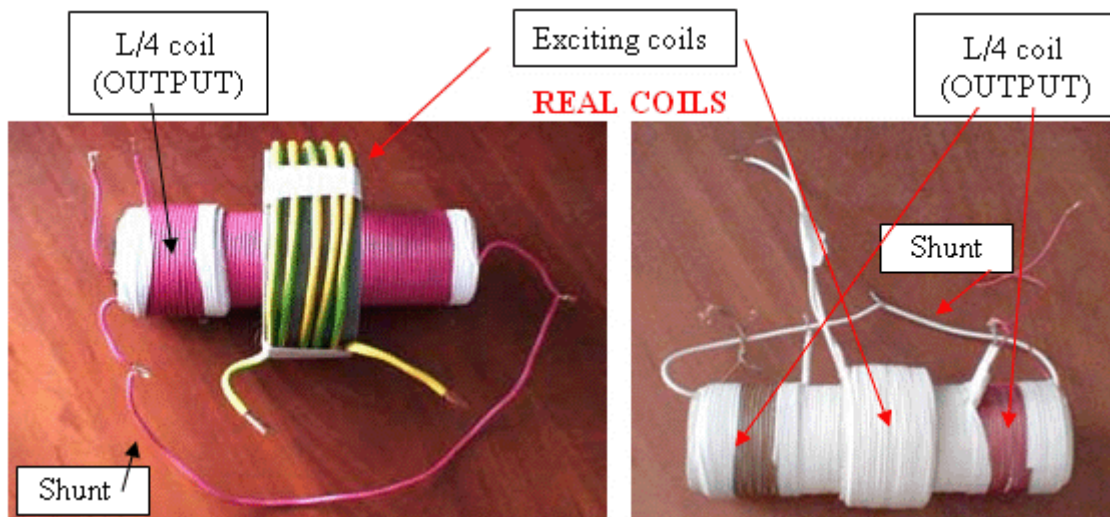
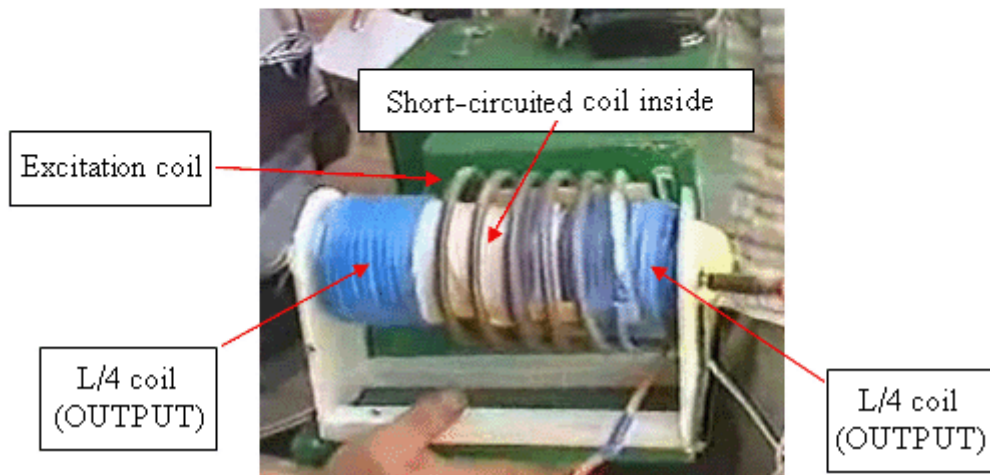
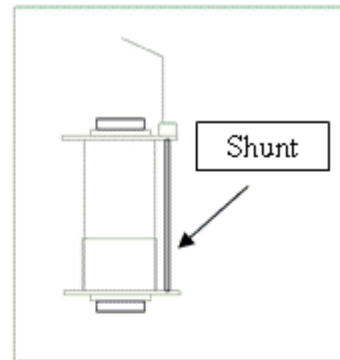
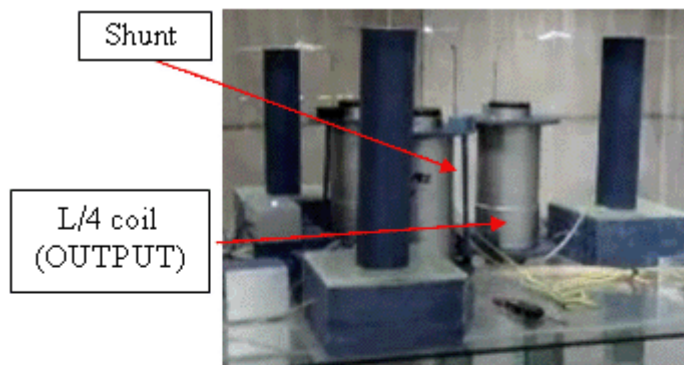
COMMENT I would like to point out that externally, it looks very much like Alfred Hubbard's device.



This is Hubbard's device.

AN EXAMPLE OF CASE 1

By Tariel Kapanadze



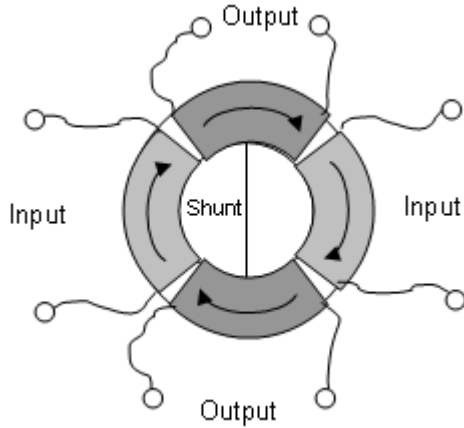
COMMENT: Adjust the positions of the coils to get the best result.

AN EXAMPLE OF CASE 1

By Steven Mark

TPU

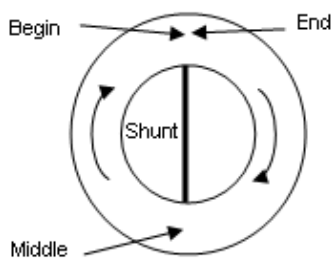
REMARK: An idea – an asymmetrical transformer based on the shorted-circuited coil:



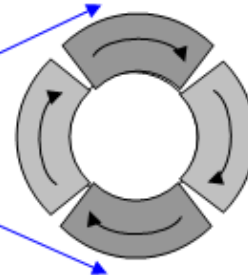
REMARK: The positions of the coils must be properly adjusted, in order to have no transmission feedback from the output to the input. To understand this better, read the part which is devoted to switchable inductance.

EXPLANATION:

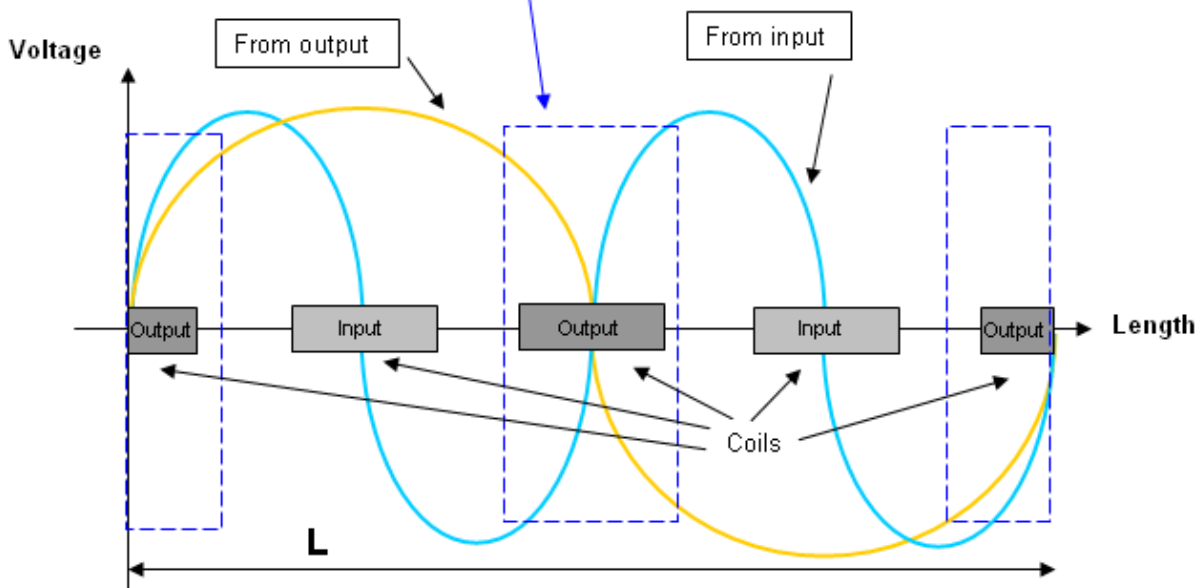
The first layer (shunted coil wound around the whole core) The second layer (coils for input and output)



No orthogonally in this part

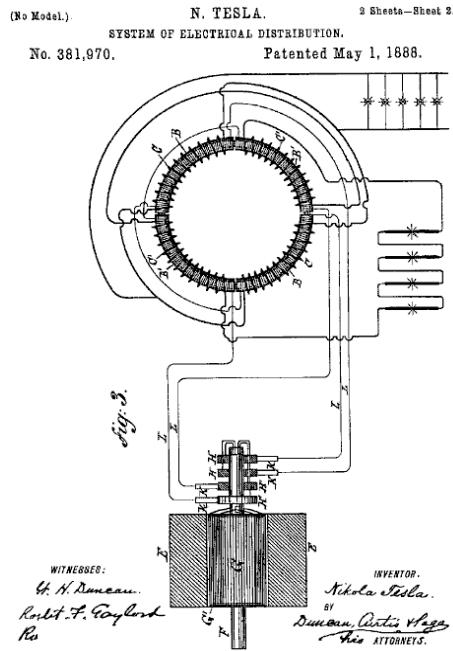


VOLTAGE DISTRIBUTION



THE BASIS OF THE TPU

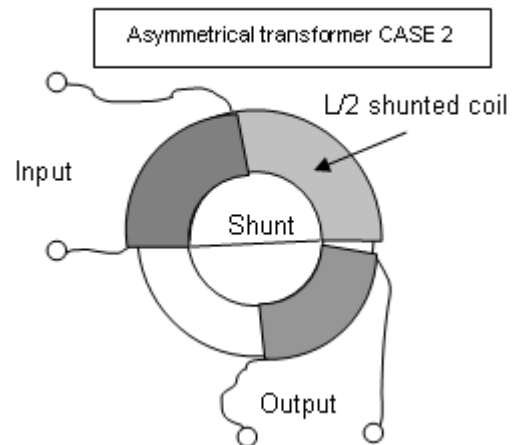
(Tesla Patent)



REMEMBER:

The position of the coils must be adjusted.
The easiest way to do this is to add or remove turns at the ends of the coils.

ACTUAL TPU

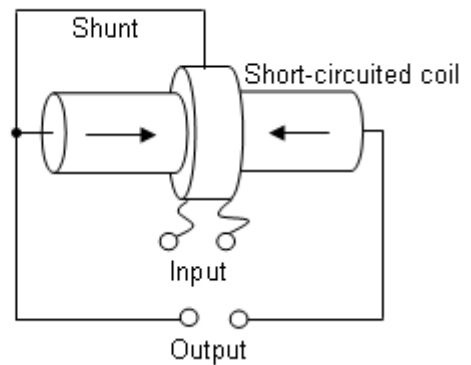


AN EXAMPLE OF CASE 2

By Tariel Kapanadze
 Mechanical device

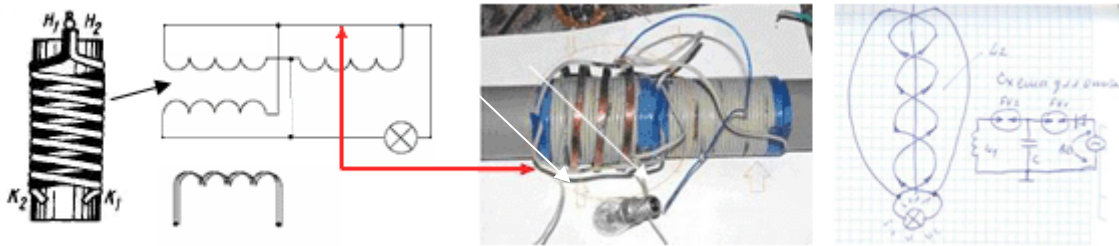


??????



MODERN USE OF SHORT-CIRCUITED COILS

by Cherepanov Valera ('SR193' in Russian forum)

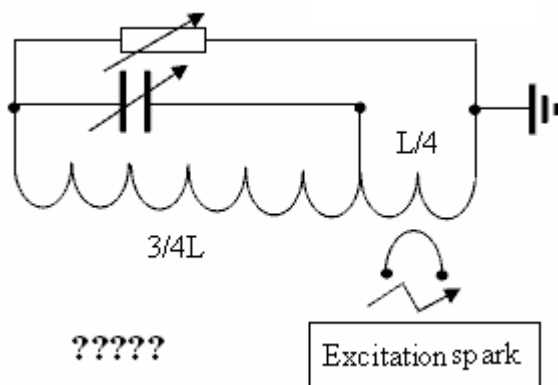


COMMENT: This arrangement can be used for back-EMF suppression in resonance (spark excited) mode to get a laser effect (very exciting summation effects).



COMMENT: This was copied from this device of Tariel Kapanadze (???)

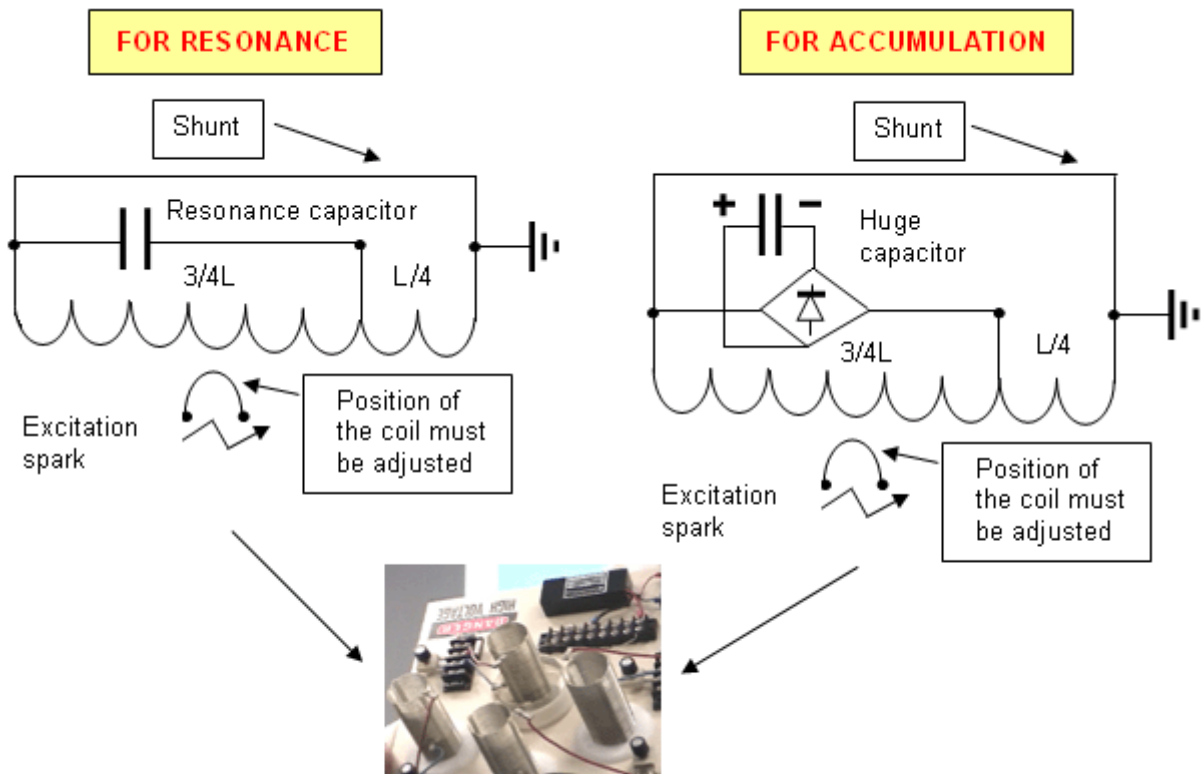
Don Smith



COMMENT: Mr. Tesla said: "The optimum relation for the main and additional coil is $3/4L$ and $L/4$ ". Is that ratio used here?

COMMENT: If you don't understand this schematic, look at simplest version of the coil.

THE SIMPLEST VERSION
 where the output has zero influence on the input

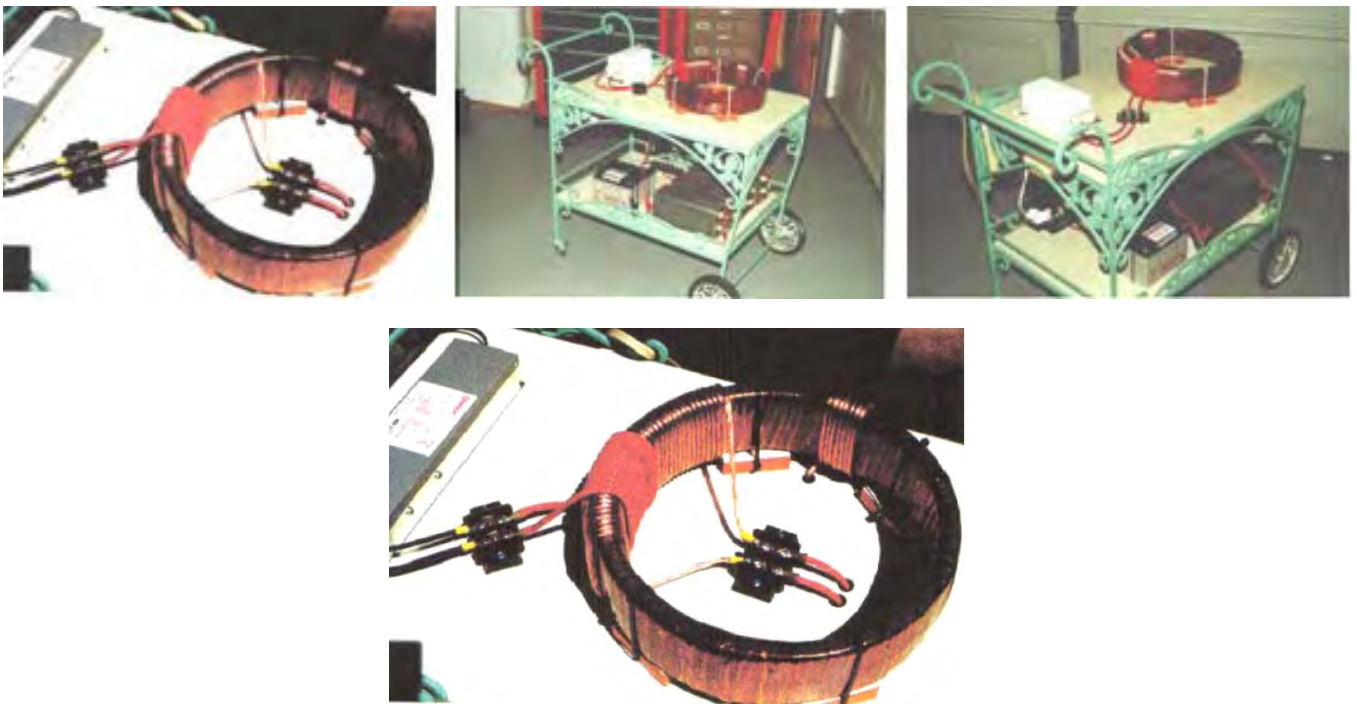


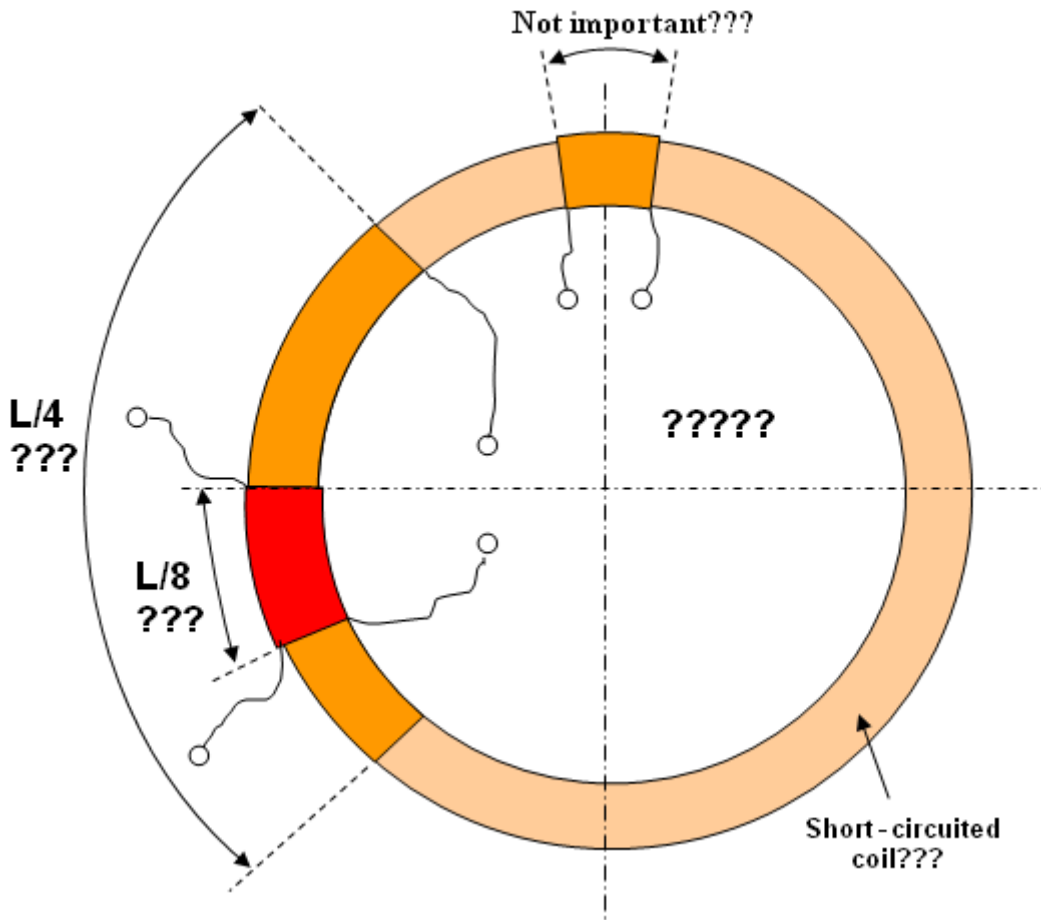
It can be used like this....

Comment: This is an instance of case 1 where the output coil was removed, and some of the turns from the short-circuited coil were used instead.

THE ASYMMETRICAL TRANSFORMER (BASED ON A SHORT-CIRCUITED COIL) COMBINED WITH A STEP-DOWN TRANSFORMER?

Don Smith





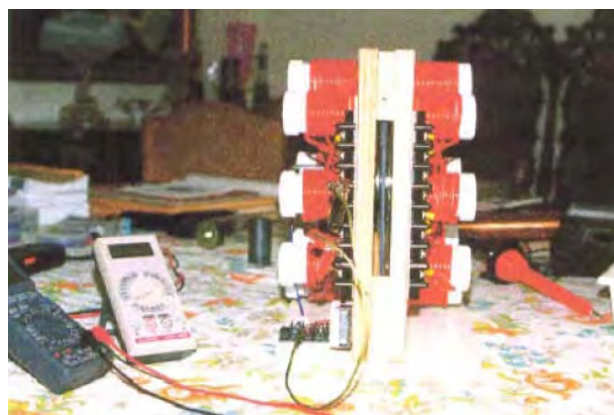
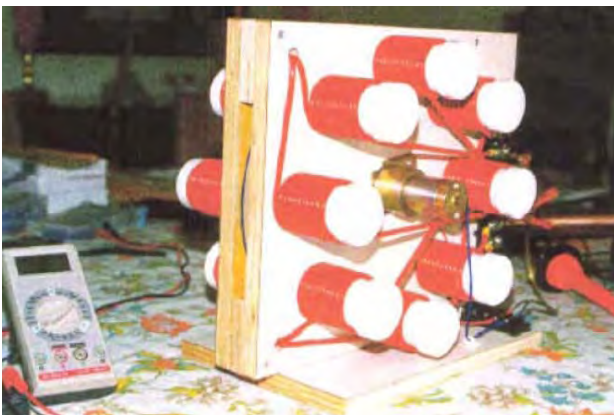
THE RELATIONSHIPS of Don Smith's TPU size and position are important.

REMARK: Those relationships are used to produce an asymmetrical transformer

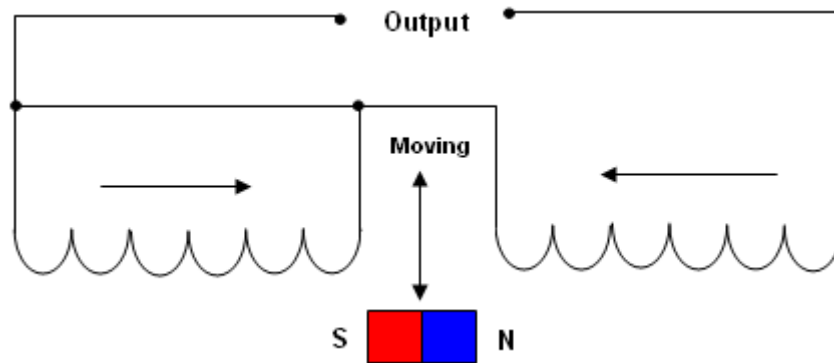
MECHANICAL ANALOGUE OF THE ASYMMETRICAL TRANSFORMER

CASE 2

By Don Smith



Schematic:



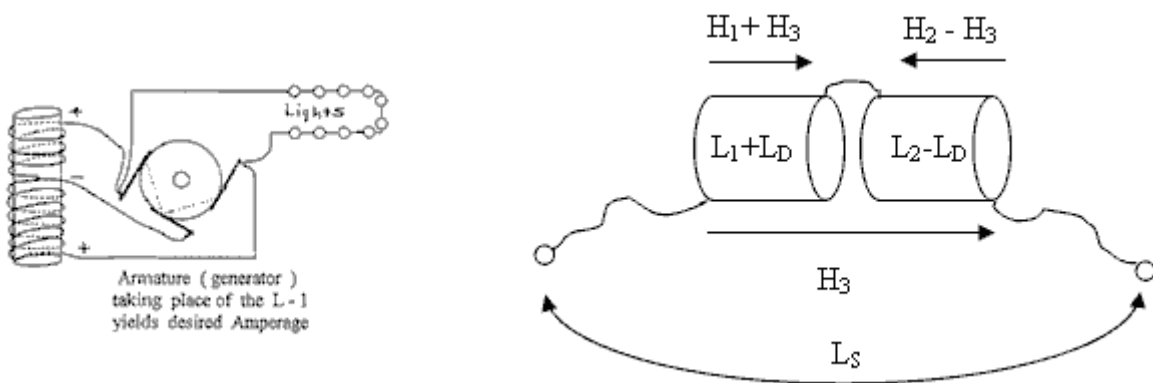
REMEMBER: Any asymmetrical transformer must be adjusted.

REMARK: Don Smith placed magnets inside the coils, but that is not important for understanding the process as his device does not match the schematic.

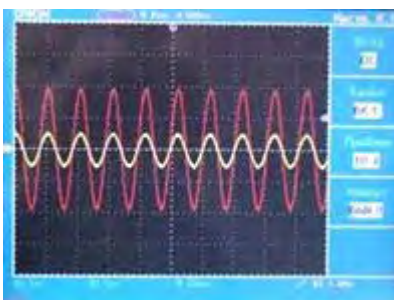
SOME REMARKS ON ASYMMETRICAL IN-FRONT CONNECTION

(Useful remarks)

Some turns were added on one half of the coil, and some turns were removed from the other half. An additional magnetic field H_3 was created, with inductance - L_D .



RESULT: A large part of the total inductance acts as an inductor, and a small part acts as a capacitor.
This is a well known fact (read books). The total voltage on the coil is less than on it's halves.



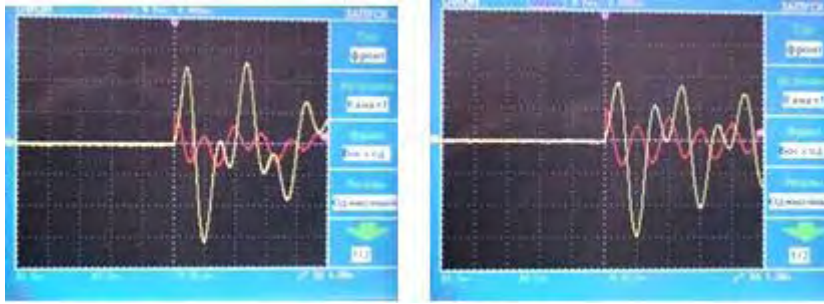
Yellow – The voltage on the total coil

Red – The voltage on the large section of that coil

RESULT: The voltage on it's halves is 4 times the voltage on the total coil

The measurements were made in the frequency band 10 kHz to 100 kHz.

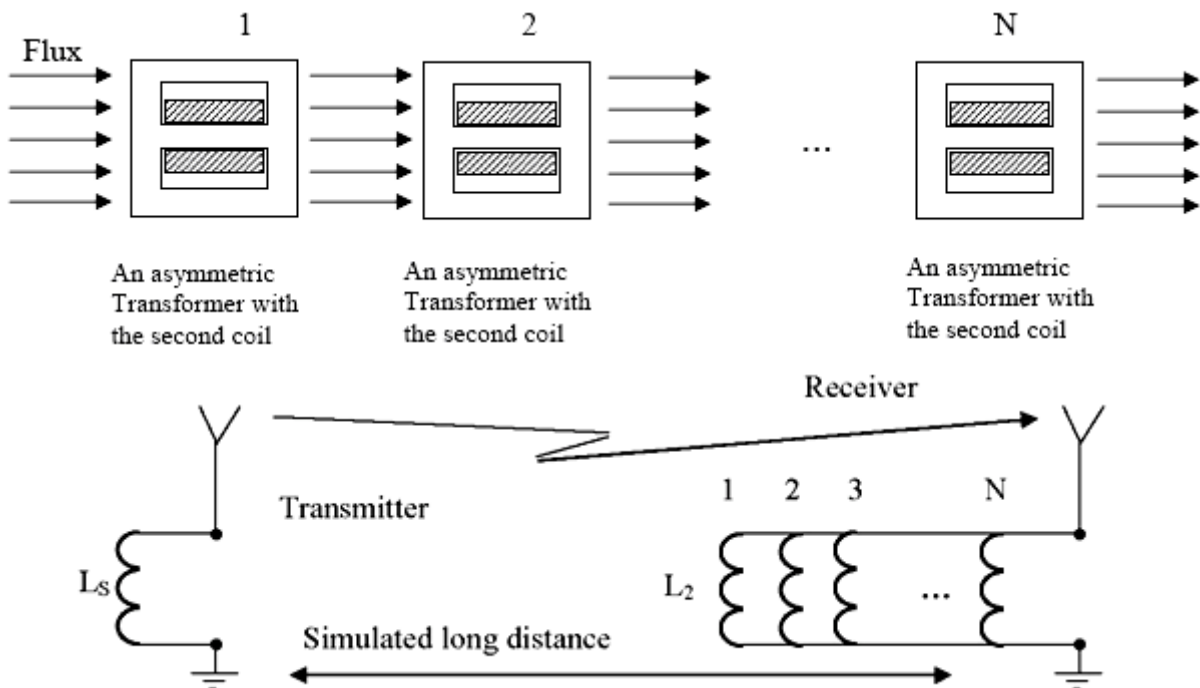
Here is the result of a capacitor discharging into this coil:



SECRET 4

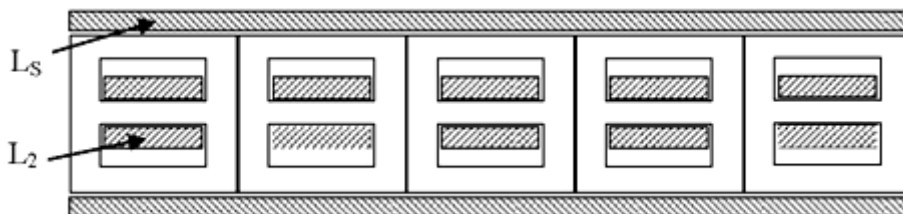
CURRENT AMPLIFICATION

If a lot of asymmetric transformers are placed with a common flux flow through them, they will have no influence on this flux flow, as any one asymmetric transformer does not have any influence on the flux flow. If the secondary L_2 transformer coils are then connected in parallel, this produces current amplification.

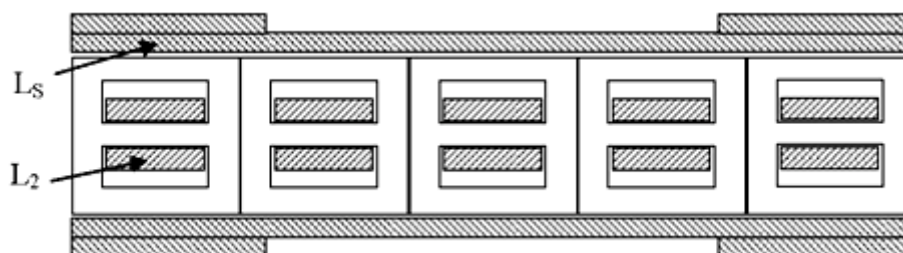


AS A RESULT

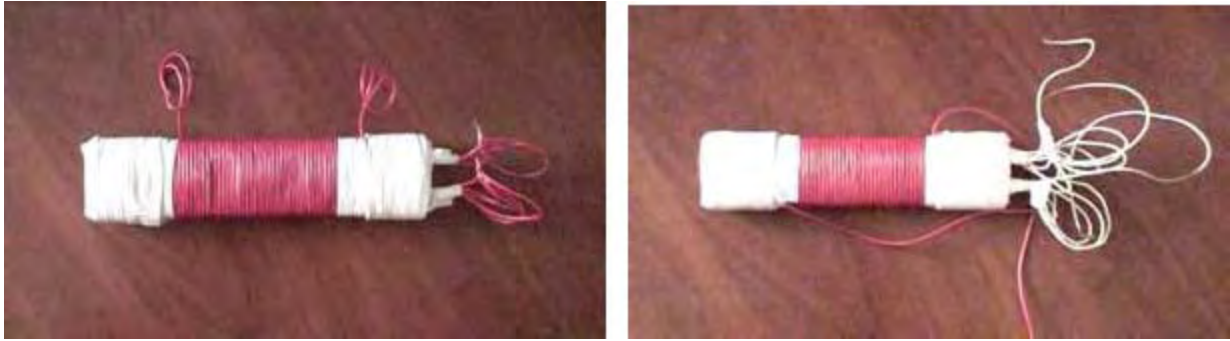
You have an asymmetric transformer arranged in a stack:



For flat (uniform) field inside of L_S , it can be arranged with additional turns at it's ends.



EXAMPLES OF COILS WHICH WERE ACTUALLY CONSTRUCTED



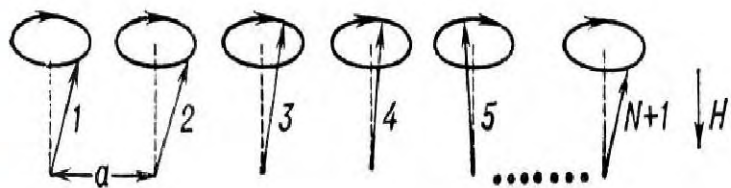
The coils are constructed from 5 sections, made from E-type ferrite core with a permeability of 2500, and wound using plastic-covered wire. The central sections L2 have 25 turns, and edge sections have 36 turns (to equalise the voltage on them). All sections are connected in parallel. The coil Ls has field-flattening turns at it's ends, and a single-layer winding Ls was used, the number of turns depending on the diameter of the wire used.

The current amplification for these particular coils is 4 times.

Changing Ls inductance is 3% (if L2 is short-circuited)

SECRET 5

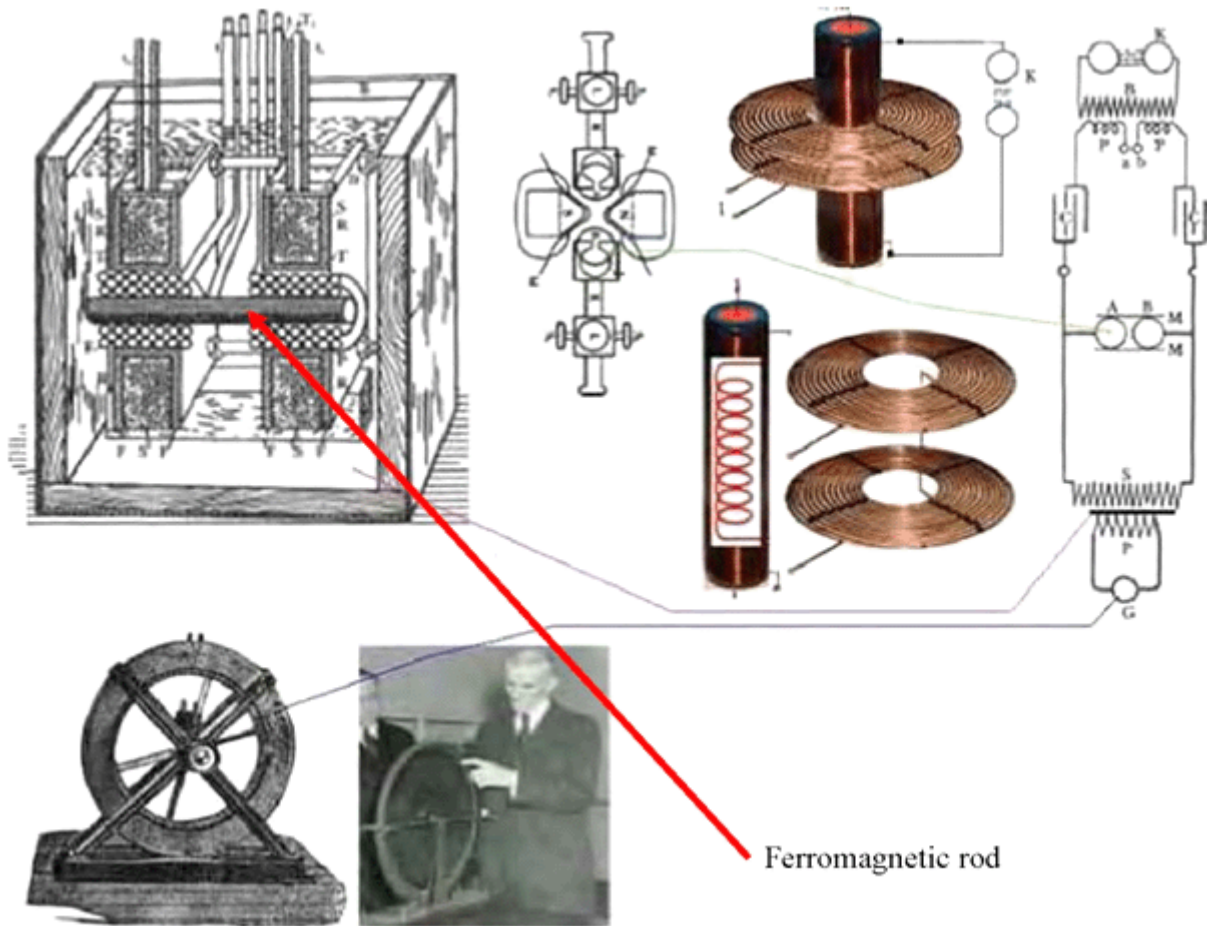
**The power source in Nikola Tesla car “Red arrow” is
FERROMAGNETIC RESONANCE**



COMMENT: To understand electromagnetic feedback, you must consider the action to be like that of domains which have a group behaviour, or alternatively, spin waves (like a row of standing dominos falling over where each one is toppled by the previous one hitting it).

THE BASIS OF FERROMAGNETIC RESONANCE

When a ferromagnetic material is placed in a magnetic field, it can absorb external electromagnetic radiation in a direction perpendicular to the direction of the magnetic field, which will cause ferromagnetic resonance at the correct frequency.



Ferromagnetic rod

This is an energy-amplifying transformer invented by Mr. Tesla.

QUESTION: What use is a ferromagnetic rod in Free-Energy devices?

AN ANSWER: It can change magnetisation of the material along magnetic field direction without the need for a powerful external force.

QUESTION: Is it true that the resonant frequencies for ferromagnetics are in the tens of Gigahertz range?

AN ANSWER: Yes, it is true, and the frequency of ferromagnetic resonance depends on the external magnetic field (a strong magnetic field produces a high frequency). But with ferromagnetics it is possible to get resonance without applying any external magnetic field, this is the so-called "natural ferromagnetic resonance". In this case, the magnetic field is defined by the local magnetisation of the sample. Here, the absorption frequencies occur in a wide band, due to the large variations possible in the conditions of magnetisation, and so you must use a wide band of frequencies to get ferromagnetic resonance

A POSSIBLE PROCESS FOR ACQUIRING FREE-ENERGY

1. Subjecting a ferromagnetic to a short electromagnetic pulse even without an external magnetic field, causes the acquisition of spin precession (domains will have group behaviour, and so ferromagnetics can easily be magnetised).
2. Magnetisation of ferromagnetics can be by an external magnetic field.
3. Energy acquisition can be as a result of strong sample magnetisation caused by an external magnetic field of lesser strength.

COMMENT: You must use synchronisation for processes of irradiation and magnetisation of the sample.

USEFUL COMMENT: A ferromagnetic shield will not destroy the inductance of any coil placed inside it, provided that the ends of that coil are positioned on one side of the coil.



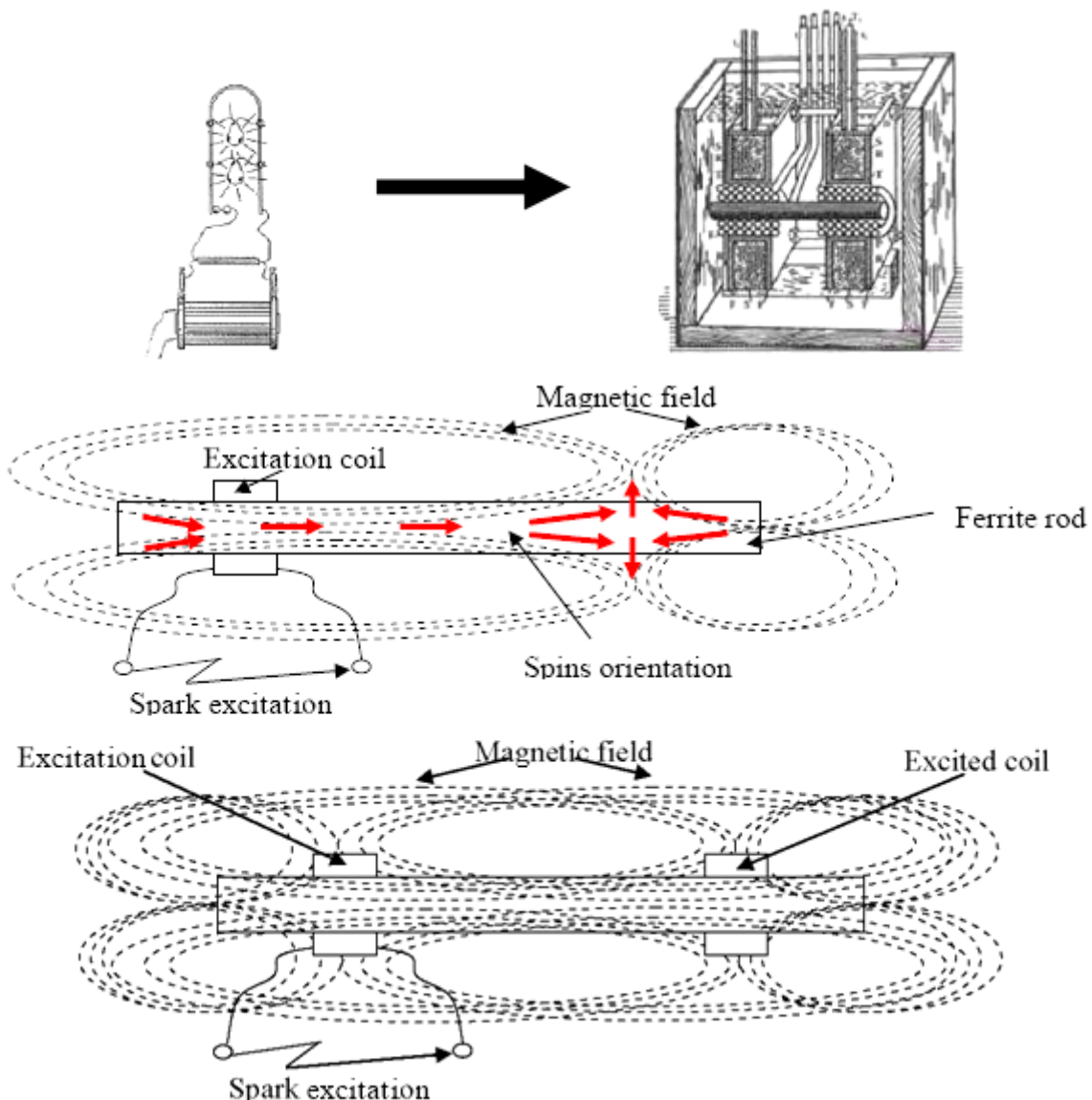
But, this coil can magnetise the ferromagnetic shield.

SECRET 5 CONTINUATION ...

TWO PERPENDICULAR COILS ON A COMMON AXIS

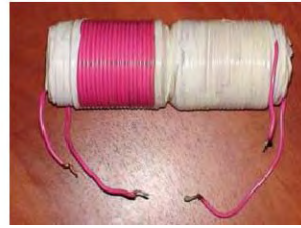
(Standing waves, spin waves, domino effect, laser effect, open resonator, etc...)

EXPLANATION: Standing waves can be excited not only in Tesla's "horseshoe" magnet, but also in Tesla's ferromagnetic transformer (excited by sparks...)



COMMENT: Excitation can be arranged in different ways, by coils connection. The frequencies of oscillations in a coil depends on the number of turns in it (a big variation is possible due to this factor).

ACTUAL COILS



COMMENT: The positions of the coils on the rods depends on whatever ferromagnetic material is being used, and on its size. The optimum arrangement has to be determined through experimentation.

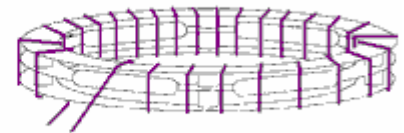
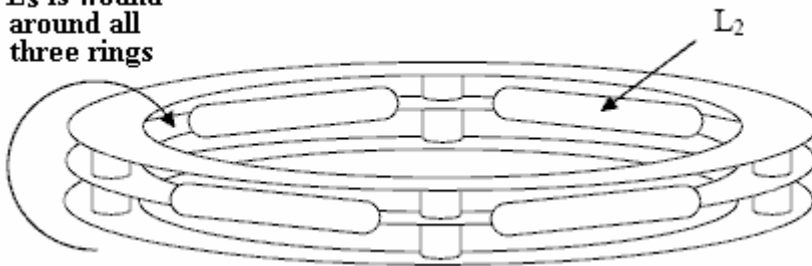
A transformer can have two pairs of coils: exciting (tubes), resonance or load (inside)

– see Tesla's picture

TOROIDAL VERSION OF AN ASYMMETRIC STACKED TRANSFORMER

An inductor L_2 is placed on the central ring between the short-circuits of the core, and the coil L_S (not shown) is wound around all three rings, covering the whole of the toroid - this is an ordinary toroidal coil.

L_S is wound
around all
three rings



The number of short-circuits depends on your requirements, and influences on the current amplification.

THAT IS ALL, GOOD LUCK ...

CONCLUSIONS

1. The Energy-Conservation Law is a result (not reason) of symmetrical interaction.
2. The simplest way to destroy symmetrical interaction is by using electromagnetic field feedback.
3. All asymmetrical systems are outside the area covered by the Energy-Conservation Law.

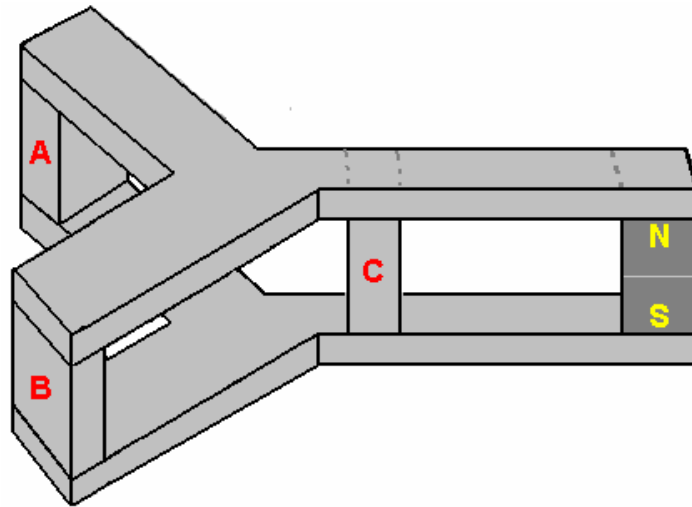
THE ENERGY CONSERVATION LAW CANNOT BE VIOLATED
(The field covered by this law is **only symmetrical interactions)**

No Private or State secrets are contained in this document.

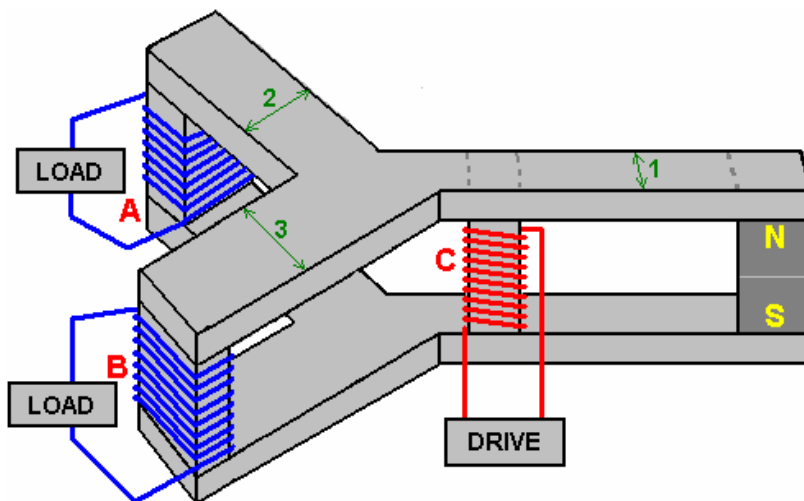
There are no ready-to-use schematics in this document, as all diagrams are only provided as an aid to understanding the principles involved.

Dietmar Wehr's Y-Frame Suggestion

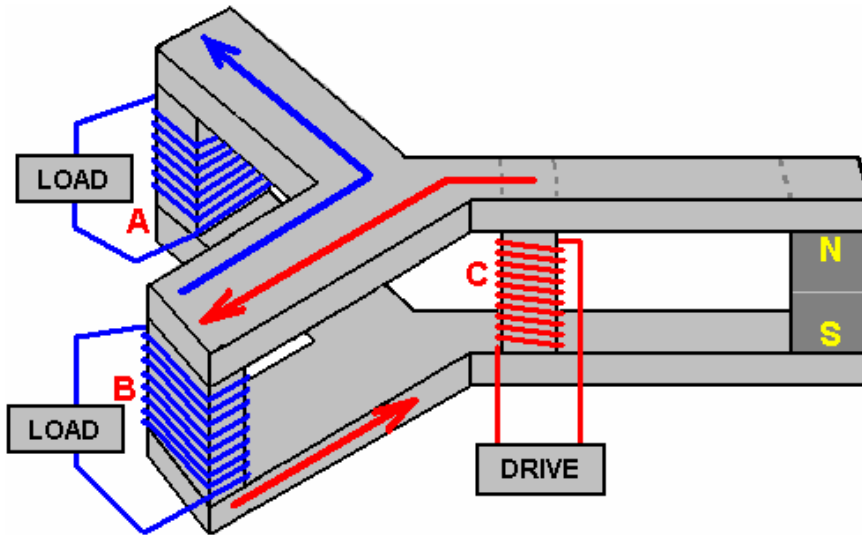
Dietmar Wehr has an idea for an electricity generator which is a self-oscillating device with no moving parts, which generates electricity through induction. The device consists of two Y-shaped pieces of soft iron, three iron pillars and a permanent magnet as shown here:



The pillars and the permanent magnet separate the two Y-pieces, forming a simple, robust shape. The width of the three arms of the Y-pieces is important as the operation of the device depends on these dimensions. The iron pillars marked "A" and "B" have output coils wound on them. The iron pillar marked "C" has an input coil wound on it as shown here:

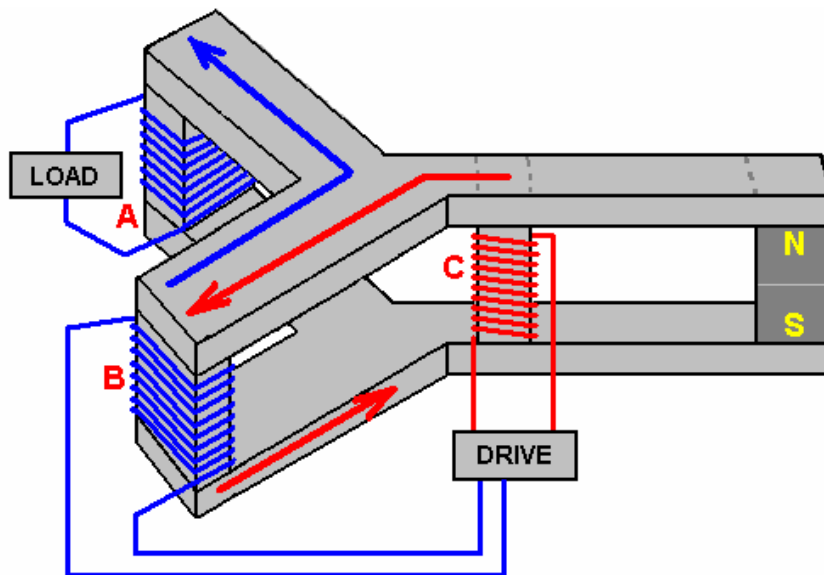


When the coil "C" is pulsed, the magnetic field generated by that pulse either strengthens the existing magnetic field caused by the permanent magnet or opposes it. Either way, the pulse causes a change in the magnetic field in the Y-pieces. The effect of that change moves away from the permanent magnet and reaches the branching point of the Y-pieces. Because the "B" arm provides a better magnetic path, the magnetic flow passes along it as shown by the red arrows here:



This change in magnetic flux, generates output power in coil "B", powering then load attached to that winding. When the drive pulse is cut off, coil "B" develops a back-EMF current flowing in the opposite direction. That change in current generates a magnetic pulse indicated by the blue arrow. This magnetic pulse travels back along the arm of the Y-piece until it reaches the junction. At this point it has two possible paths, either back towards the permanent magnet, or left towards coil "A". As the path to coil "A" is much broader than the path back to the magnet, the flux flows through coil "A", generating output power in the load connected to coil "A".

This results in situation where one input pulse generates two separate output pulses. It should be possible to make the drive circuitry the load of, say, coil "B" and have the device self-powered as well as powering load "A", as shown here:



Using diodes, it should be possible to combine the outputs from the two output coils if that is preferred. It is not necessary to make the device self-powered, especially in the prototype testing stages. If it is self-powered, then it can be started by waving a permanent magnet across the coil "C" to generate the starting pulse.

The Generator Proposal of "Silverhealthu"

One of the EVGRAY yahoo forum members whose ID is 'silverhealthu' has described a simple device which may give good performance.



The device consists of an iron bar one inch (25 mm) in diameter and one foot (300 mm) long. At one end, there is a stack of five neodymium magnets and at the opposite end, a single neodymium magnet. At the end with the five magnets, there is a coil of wire which is strongly pulsed by a drive circuit. Down the length of the bar, a series of pick-up coils are positioned. Each of these coils picks up the same level of power that is fed to the pulsing coil and the combined output is said to exceed the input power.

Robert Norrby's Generator

Another device which is thought to be along the same lines as the high-power devices of Hans Coler is shown in an early patent which is reproduced here:

I, Robert NORRBY, of 10, Hamngatan, Stockholm, subject of the King of Sweden, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:

The generation of high power electrical energy is usually effected by mechanical interruption by means of special and complicated arrangements which consume a considerable amount of power.

According to the present invention, electrical energy is generated not through mechanical interruption, or by chemical action but through physical interruption.

The method adopted consists in effecting the interruption required in order to obtain the cutting of the field of the lines of force of two current circuits by subjecting the conductors of the one circuit to the action of the alternate poles of magnets of which the cores are connected with the conductors of the same current.

One form of apparatus for carrying out the method is shown by way of illustration or example, in the drawings hereto appended whereon:

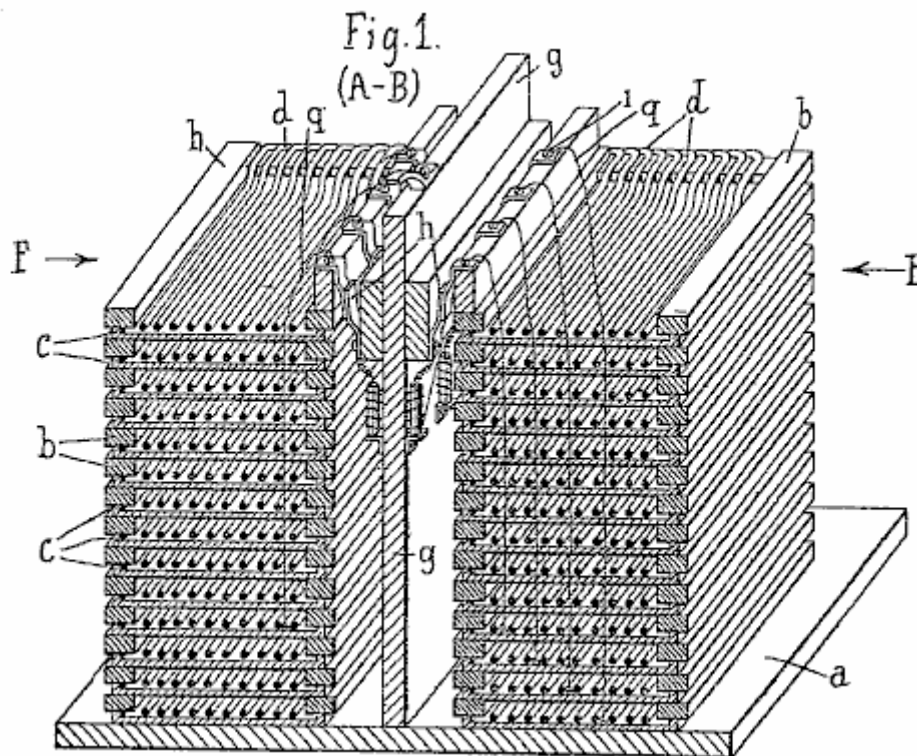


Fig.1 is a perspective view of a section of the apparatus taken on the line A—B of Fig.2.

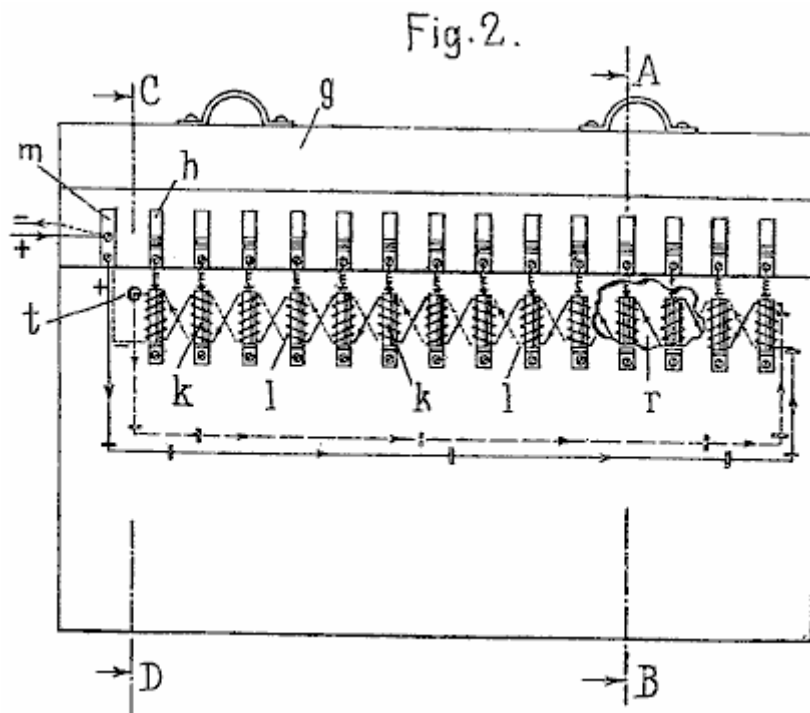


Fig. 2 is a face view of the central part of the apparatus.

Fig. 3. (C-D)

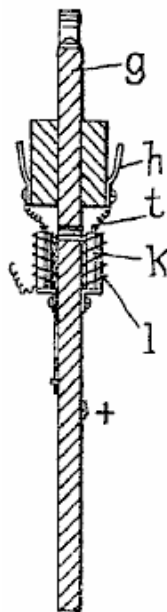


Fig. 3 is a section along the line C—D of Fig. 2.

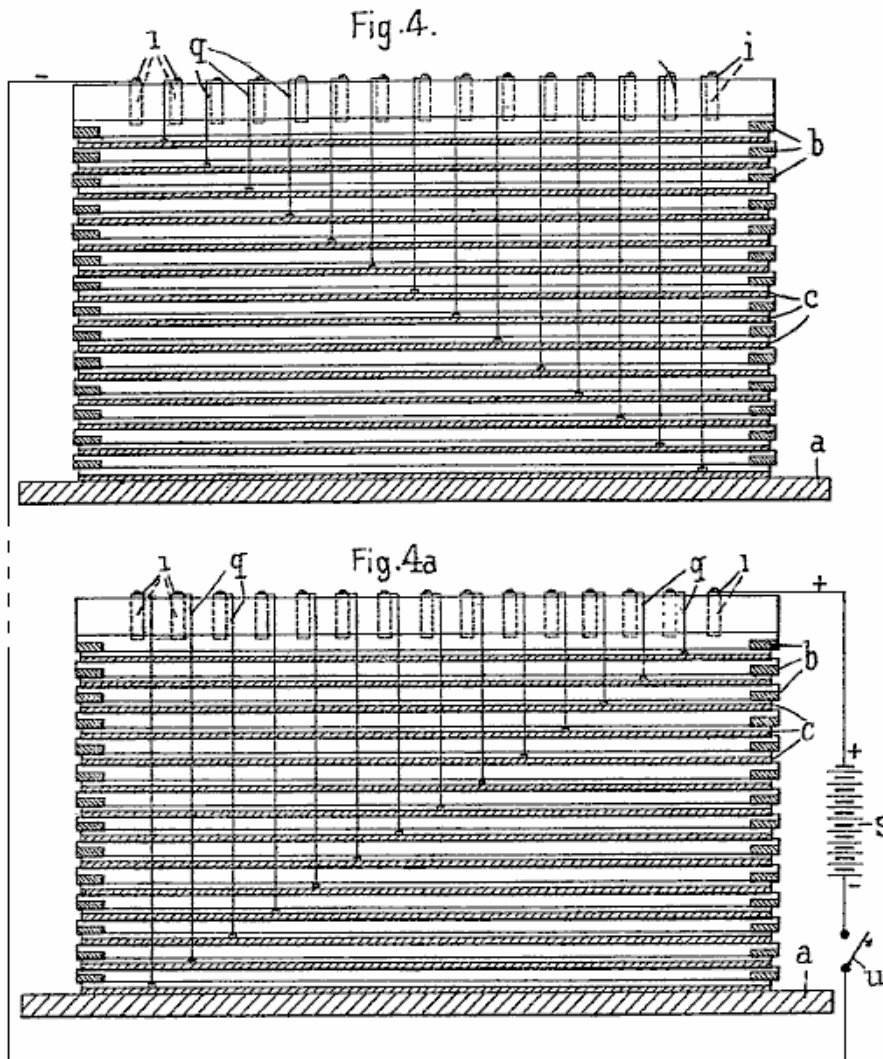


Fig.4 and **Fig.4a** show the connections between the plates and the magnet cores, — **Fig.4** being a view looking in the direction of the arrow **E** and **Fig.4a** a view looking in the direction of the arrow **F** of **Fig.1**.

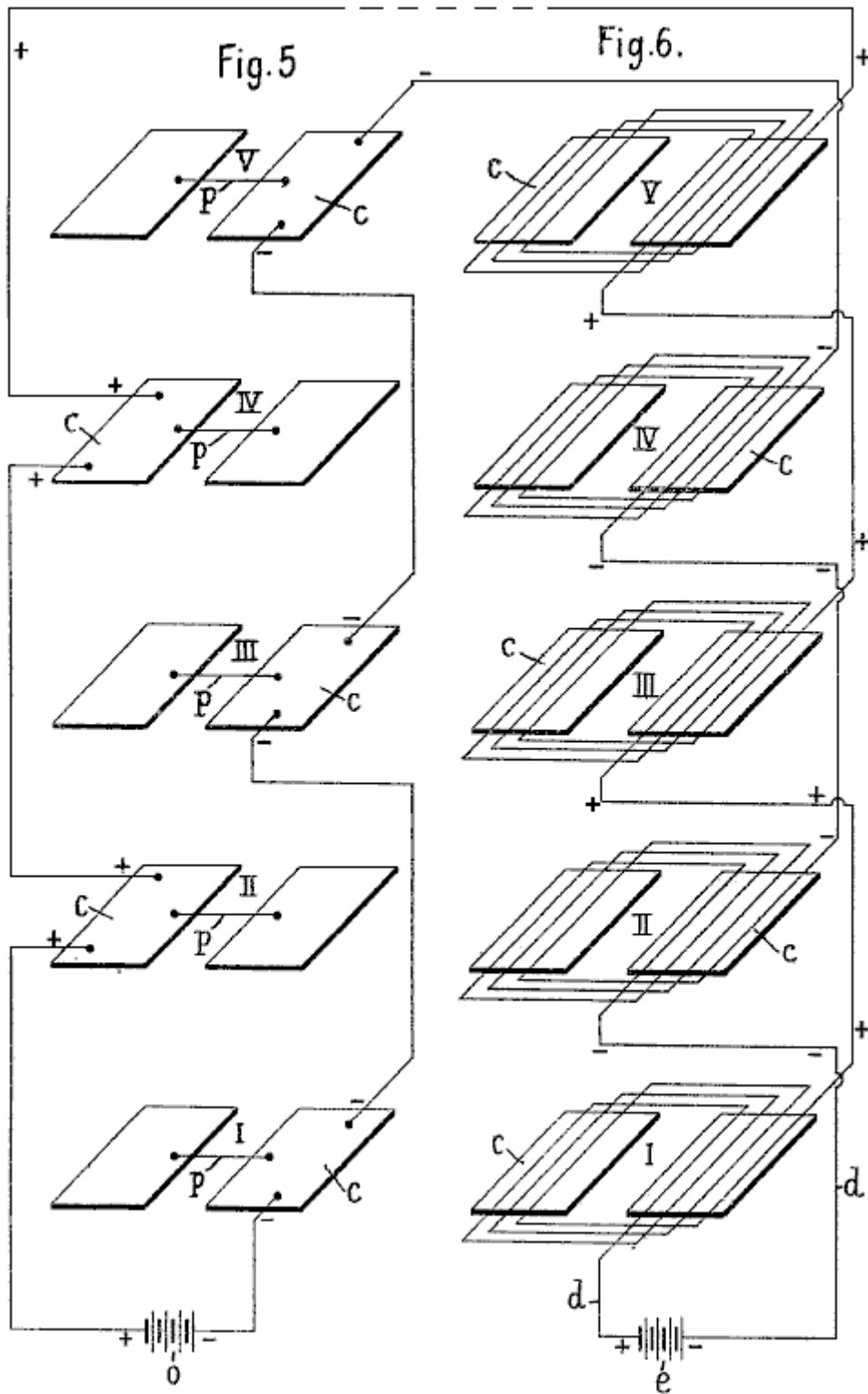
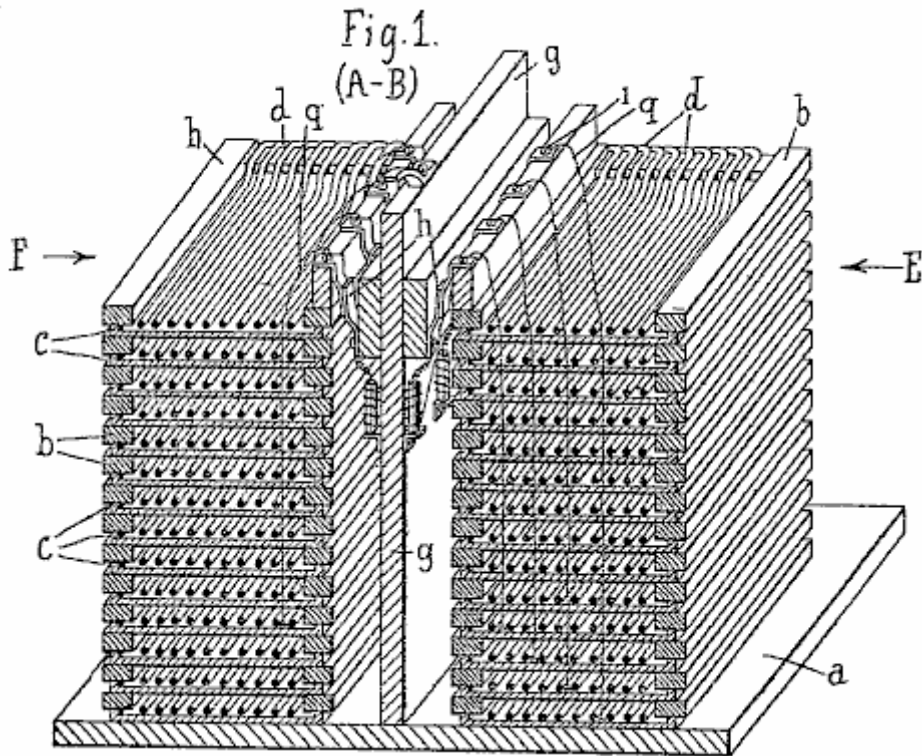


Fig.5 is a diagrammatic representation of the connections between the different plates **c** of the apparatus.

Fig.6 is a diagrammatic representation of the way in which the windings are wound between the plates.

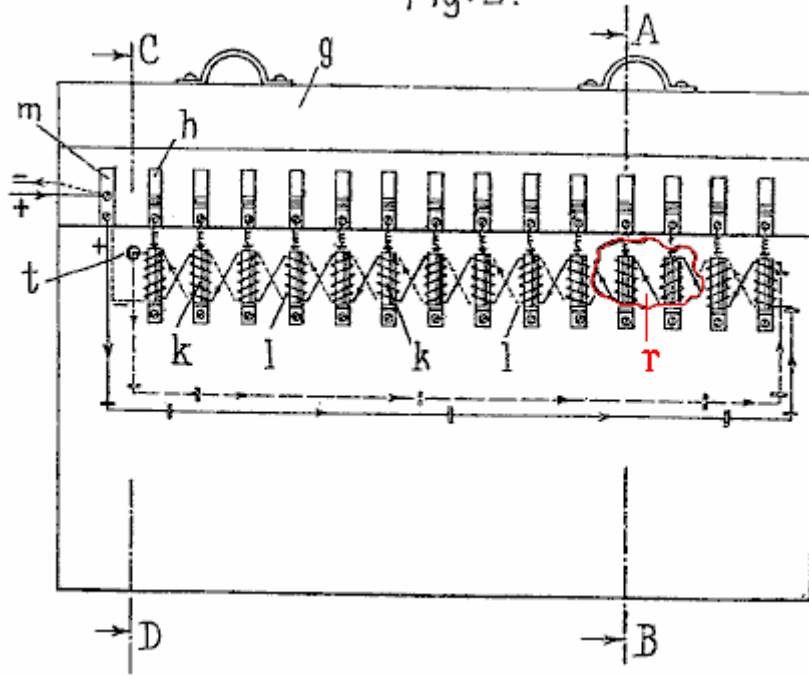
Referring to the drawings:



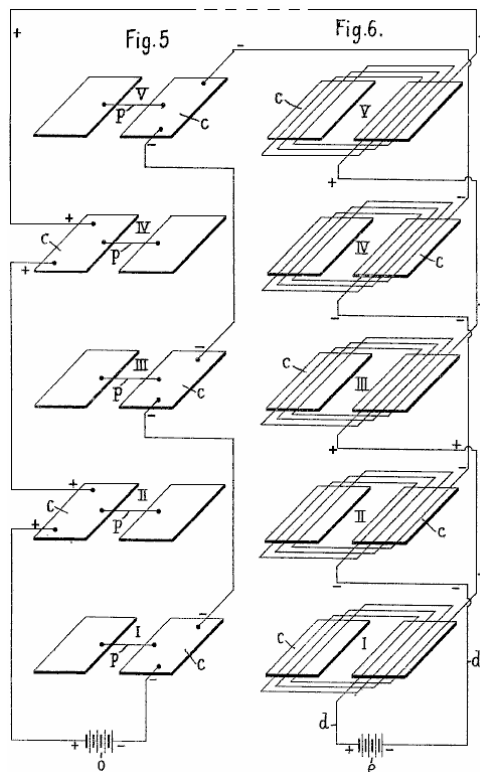
Here, **a.** represents a base on which are two sets of frames **b** and between the frames **b**, are laid conducting metal plates **c**. In the example selected for illustration, there are 14 plates on each side. Over the plates are windings **d**, so placed that the positive of the winding **d** is led from a low power battery **e** over the lowest pair of plates to the third pair and so on. The negative of the winding **d** goes to the second pair of plates and from there to the fourth, and so on (**Fig.6**). Between the two groups of frames there is a central piece **g** (**Fig.2**) provided with a number of sliding contacts **h** which are connected with magnet cores **k** surrounded by windings **l**. The contacts **h** are placed directly opposite the contacts **i**, and these are also connected with the separate plates **c**. In addition to the sliding contacts **h** there are terminals **m** fitted at the outer ends on the front of the central piece. The terminals **m** serve to bring in a low power electric current from another battery.

The plates **c** are electrically connected with one another through a third low power battery **o**, in such a manner that the negative conducting wire goes to the first pair of plates, then to the third, the fifth, and so on, while the positive goes to the second, the fourth, the sixth, etc. pair of plates. Each pair of oppositely disposed plates are further connected by means of conductors **p**. The end wires of each pair of plates are connected with similar poles to the end wires of the plate windings **d**, so that the circuits of the batteries are coupled in parallel, but in opposite directions. The separate plates, as for example **c**, are connected by conducting wires **q** with the terminals, or with the sliding contacts, on both sides of the centre piece **g** (**Fig.4** and **Fig.4a**). Between the two inner sides of the groups of frames **b** there is fitted a central piece in such a way that the terminals **h** are in contact with the sliding contacts **i**.

Fig.2.



In the central piece (Fig.2) a portion **r** is broken out to show that the cores with the windings are fitted directly opposite one another on both sides. The windings **l** round the magnet cores **k** are fed from a low power current battery **s**. A conductor passes from the battery **s** to the connecting terminal **m** and from there through the windings of the bobbins on the one side and then through the opening **t** to the other side of the central piece **g**, whence it goes through the windings of the bobbins on that side and then from the last bobbin back to the battery, thereby completing the circuit. The pole cores are therefore constantly in a closed circuit as soon as the switch **u** of Fig.4a is closed.



The mode of operation is as follows:-

The pairs of plates are first and foremost in electrical connection one with another, being fed by the low power battery **o**. The windings **d** over the plates are fed by a low power battery **e**, and lastly the windings **l** round the cores **k** are connected to a low power battery **s**. The separate pairs of plates, which are polarised through the battery **o**, are fitted with opposite poles over each other, while the windings **d** (Fig.6) are arranged in a direction contrary to the direction of the current from the battery **o**. If all three batteries are coupled up, the currents from them in the closed circuits, which are hereafter named according to the respective battery **o**, **c** and **s**, will behave

in the following way:

The currents **o** and **e**, which flow in contrary directions as already mentioned, bring about a constant state of tension between the field of the lines of force of the plate current and of the current in the windings. The constant tension is interrupted with very high frequency through the action of the magnet poles as soon as the third circuit is closed and the energy latent in the plates (rising up from below) is released through the high frequency interruptions.

An increase of the final energy can be obtained by enlarging the size of the plates and/or by increasing their number.

The current consumers are connected to the current generator in such a way that the line conductor is connected to the end terminals of the current circuits **o** and **e** which are brought together for the purpose.

Having now particularly described and ascertained the nature of my invention, and in what manner the same is to be performed, I declare that what I claim is:—

1. A method of generating electric energy without mechanical interruption, characterised in that the interruption required to cut the field of the lines of force of both current circuits is effected by alternately exposing the conductors of the one circuit to the action of the poles of magnets whose cores are in connection with the conductors of the same circuit.

2. Apparatus for carrying out the method claimed in Claim 1, having the characteristic feature that a set of plates, arranged with their poles opposite to one another and in electrical connection through one with another with a low power current battery, lie between windings which are supplied, from another low power battery, with current flowing in a direction opposite to the direction of the current passing through the plates: while at the same time, the plates are also in connection with the cores of magnets of which the windings are connected with a third low power current. in such a manner that when all the three circuits are closed the tension of the first circuit is physically interrupted with high frequency.

Dated this 29th day of May, 1920.

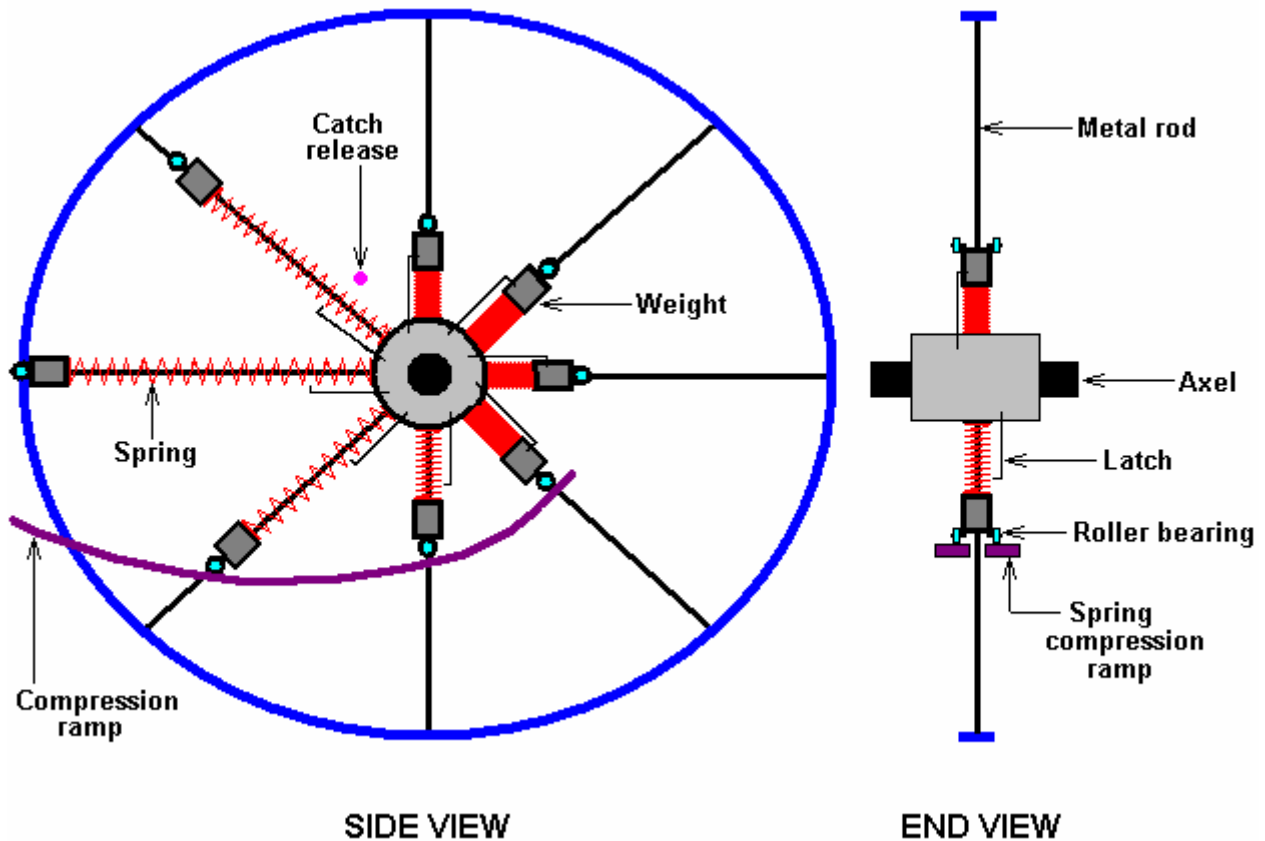
Omissions from Chapter 4:



Dale Simpson's Gravity Wheel Suggestion.

The design of gravity-operated machines is an area which has been of considerable interest to a number of people for quite some time now. The design shown here comes from Dale Simpson of the USA. It should be stressed that the following information is published as open-source, gifted to the world and so it cannot be patented by any individual or organisation. Dale's prototype wheel has a diameter of about five feet, utilising weights of a substantial value. The overall strategy is to create excess torque by having the weights slide along metal rods radiating from a central hub somewhat like the spokes of a cart wheel. The objective is to create an asymmetrical situation where the weights are closer to the hub when rising, than they are when falling.

The difficulty with designing a system of this type is to devise a successful and practical mechanism for moving the weights in towards the hub when they are near the lowest point in their elliptical path of movement. Dale's design uses a spring and a latch to assist control the movement of each weight. The key to any mechanical system of this type is the careful choice of components and the precise adjustment of the final mechanism to ensure that operation is exactly as intended. This is a common problem with many free-energy devices as careless replication attempts frequently result in failure, not because the design is at fault, but because the necessary level of skill and care in construction were not met by the person attempting the replication. Here is a sketch of Dale's design:



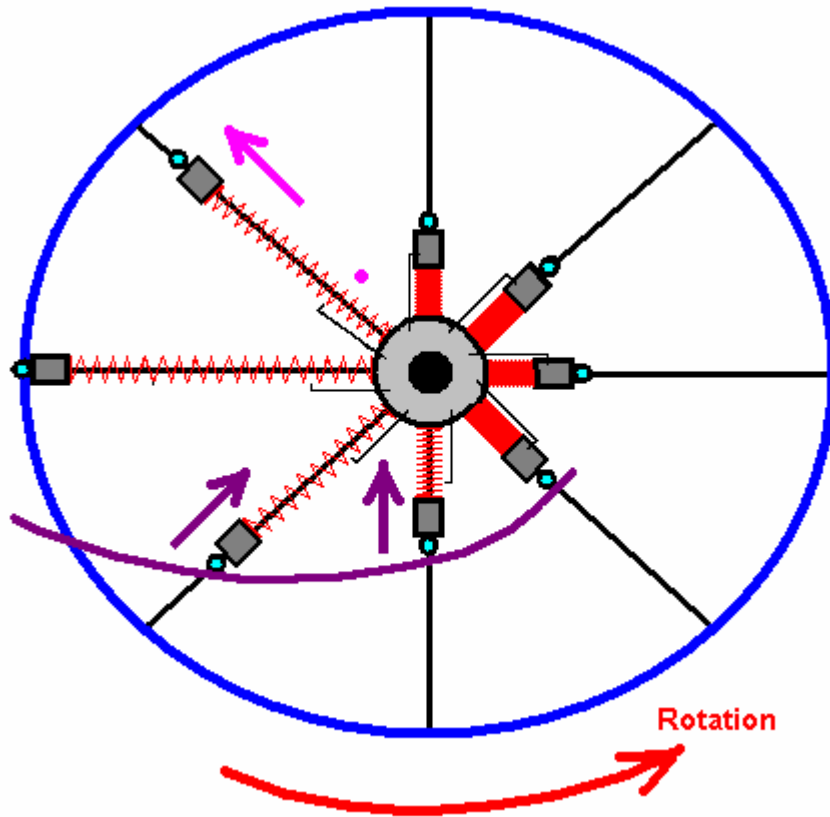
The wheel has an outer rim shown in blue and a central hub shown in grey. Metal spokes shown in black run out radially from the hub to the rim. Eight spokes are shown in this diagram as that number allows greater clarity, but a larger number would probably be beneficial when constructing a wheel of this type.

The wheel as shown, rotates in a counter-clockwise direction. Each weight, shown in dark grey, has a pair of low-friction roller bearings attached to it. There is also a spring, shown in red, between the weight and the hub. When a weight reaches the 8-o'clock position, the roller bearings contact a spring compression ramp, shown in purple. This ramp is formed of two parts, one on each side of the spokes, providing a rolling ramp for each of the two roller bearings. The ramp is formed in a curve which has a constant rate of approach towards the hub of the wheel.

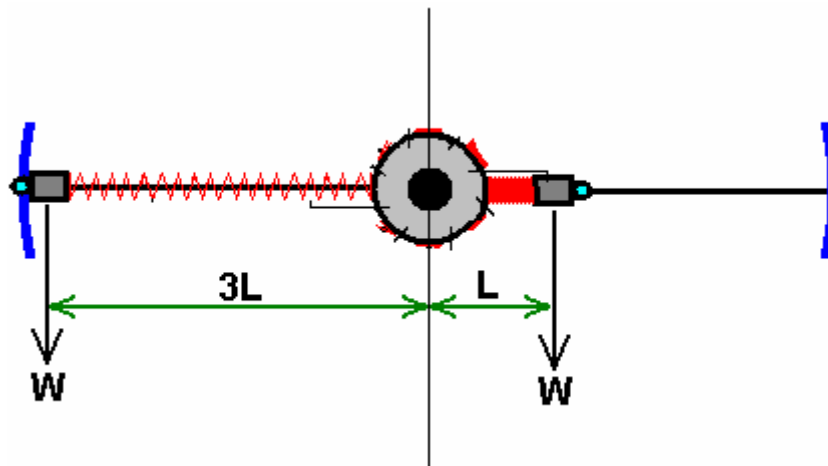
The ramp is positioned so that the spring is fully compressed when the weight has just passed the lowest point in its travel. When the spring is fully compressed, a latch holds it in that position. This holds the weight in close to the hub during its upward movement. The springs are not particularly powerful, and should be just strong enough to be able to push the weight back towards the rim of the wheel when the spoke is at forty five degrees above the horizontal. The "centrifugal force" caused by the rotation assists the spring move the weight outwards at this point. The push from the spring is initiated by the latch being tripped open by the latch release component shown in pink.

The weights have an inward motion towards the hub when they are pushed by the wheel's turning motion which forces the roller bearings upwards along the spring-compression ramp. They have an outward motion along the spokes when the catch holding the spring compressed is released at about the 11-o'clock position. The latch and the release mechanism are both mechanical - no electronics or electrical power supply is needed in this design.

These details are shown in the diagram below:



The question, of course is, will there be enough excess power to make the wheel rotate properly? The quality of construction is definitely a factor as things like the friction between the weights and their spokes needs to be very low. Let us consider the forces involved here:



Take any one weight for this calculation. Any excess rotational energy will be created by the difference between the forces attempting to turn the wheel in a clockwise direction and those forces trying to turn the wheel in a counter-clockwise direction. For the purpose of this discussion, let us assume that we have built the wheel so that the compressed-spring position is one third of the spring-uncompressed position.

As the weights are all of the same value "W", the see-saw turning effect in a clockwise direction is the weight ("W") multiplied by it's distance from the centre of the axle ("L"). That is, $W \times L$.

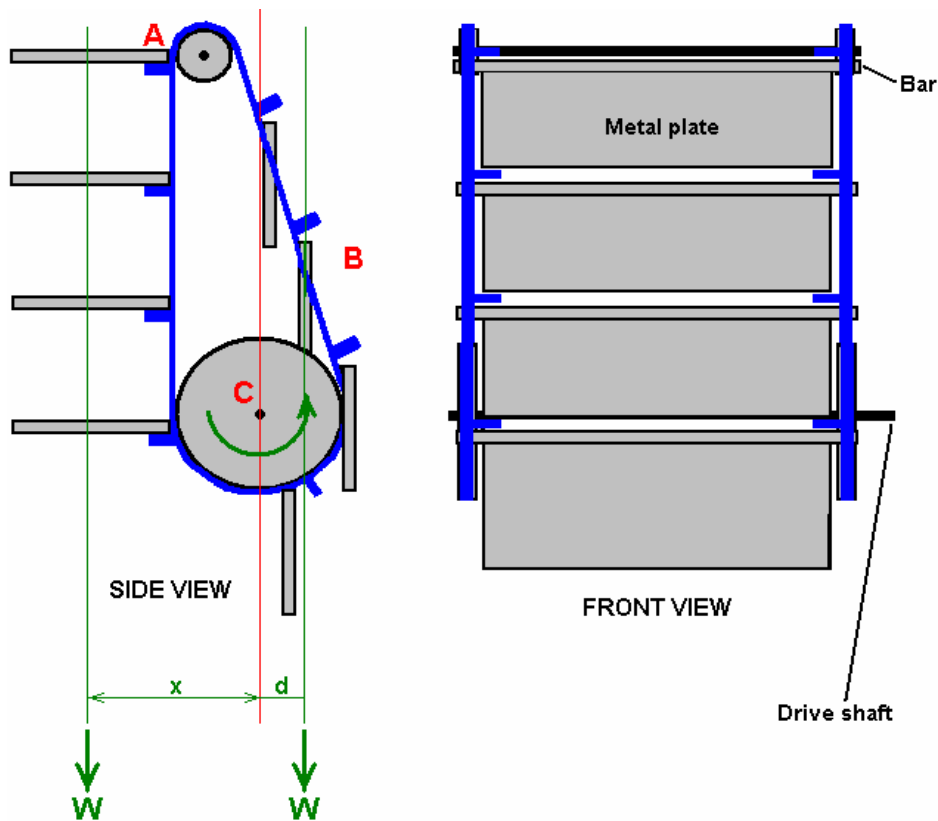
The turning effect in the counter clockwise direction is the weight ("W") multiplied by it's distance from the centre of the axle (" $3W$ "). That is, $W \times 3 \times L$.

So, with WL pushing it clockwise, and $3WL$ pushing it counter-clockwise, there is a net force of $(3WL - WL)$, i.e. a net force of $2WL$ driving the wheel in a counter-clockwise direction. If that force is able to push the weight in towards the hub, compressing the spring and operating the spring latch, then the wheel will be fully operational. There is actually, some additional turning power provided by the weights on the left hand side of the diagram, both above and below the horizontal, as they are a good deal further out from the axle than those with fully compressed and latched springs.

The only way of determining if this design will work correctly is to build one and test it. It would, of course, be possible to have several of these wheels mounted on a single axle shaft to increase the excess output power available from the drive shaft. This design idea has probably the lowest excess power level of all those in this document. The following designs are higher powered and not particularly difficult to construct.

The Dale Simpson Hinged-Plate System

Again, this is an open-source design which cannot effectively be patented by any person, organisation or other legal entity. This design is based on the increased lever arm of the weights on the falling side compared to the lesser lever arm on the rising side and special attention is drawn to the fact that the upper wheel is offset very considerably to the left:

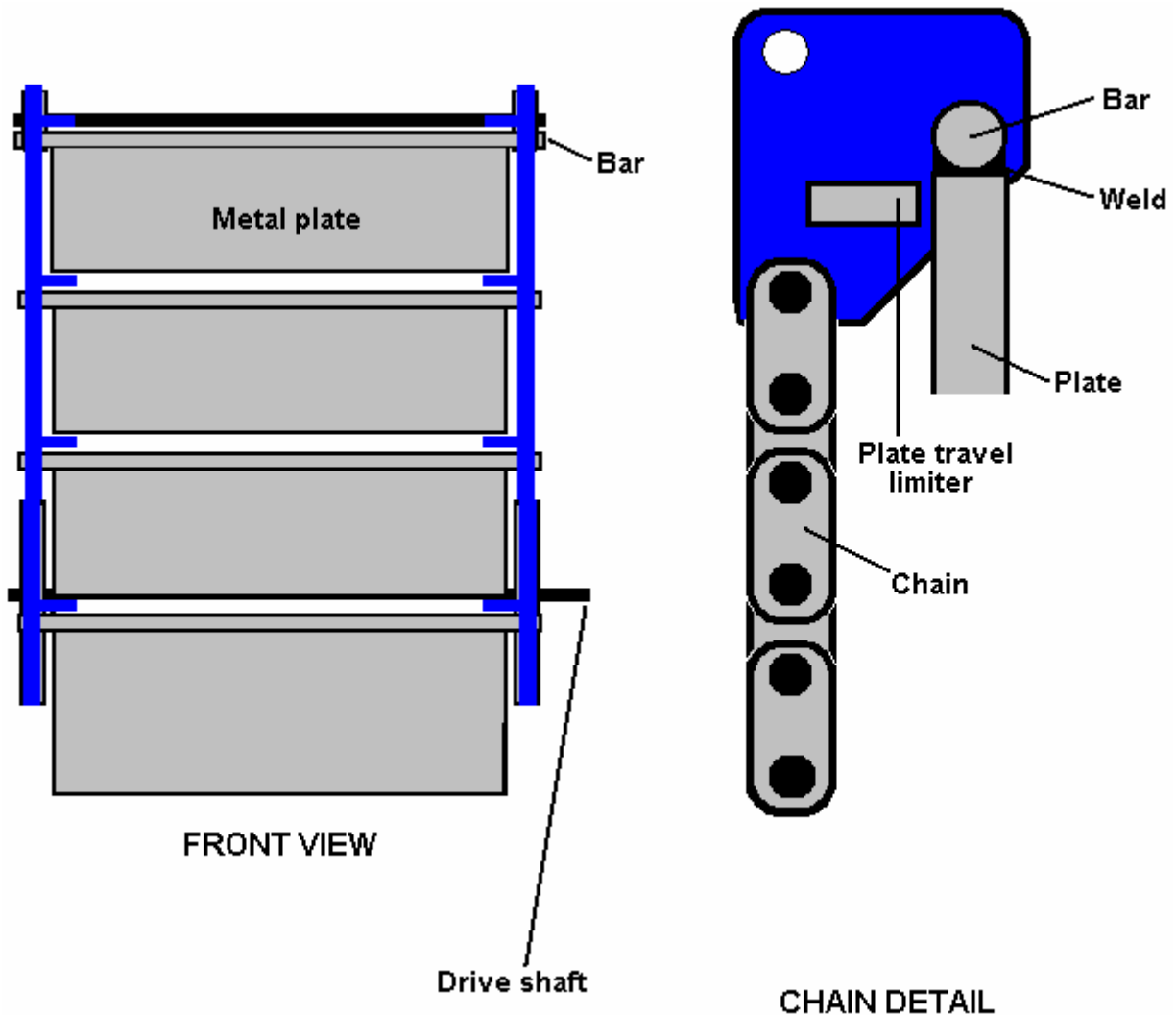


This design uses heavy metal plates which are carried on two drive belts shown in blue in the diagram above. These plates are hinged so that they stand out horizontally on the falling side, resting on a pair of lugs welded to the chain link and hang down vertically on the rising side as they are narrower than the gap between the belts.

This difference in position alters the effective distance of their weights from the pivot point, which in this case is the axle of wheel "C". This is exactly the position described above with the see-saw with equal weights placed at different distances from the pivot. Here again, the distance "x" is much greater than the distance "d" and this causes a continuous turning force on the left hand side which produces a continuous force turning the drive shaft of wheel "C" in a counter-clockwise direction as seen in the diagram.

A key point in this design are the robust hinges which anchor the heavy metal plates to the belt. These are designed so that the plates can hang down and lie flat on the rising side (point "B") but when the plate passes over the upper wheel to reach point "A", and the plate flips over, the hinge construction prevents the plate from moving past the horizontal. The upper wheel at point "A" is offset towards the falling side so as to help reduce the length "d" and improve the output power of the device. The chain detail below, shows the inside view of one of

the right-hand chain plates. The metal plate swings clear of the chain and the sprocket wheels which the chain runs over.

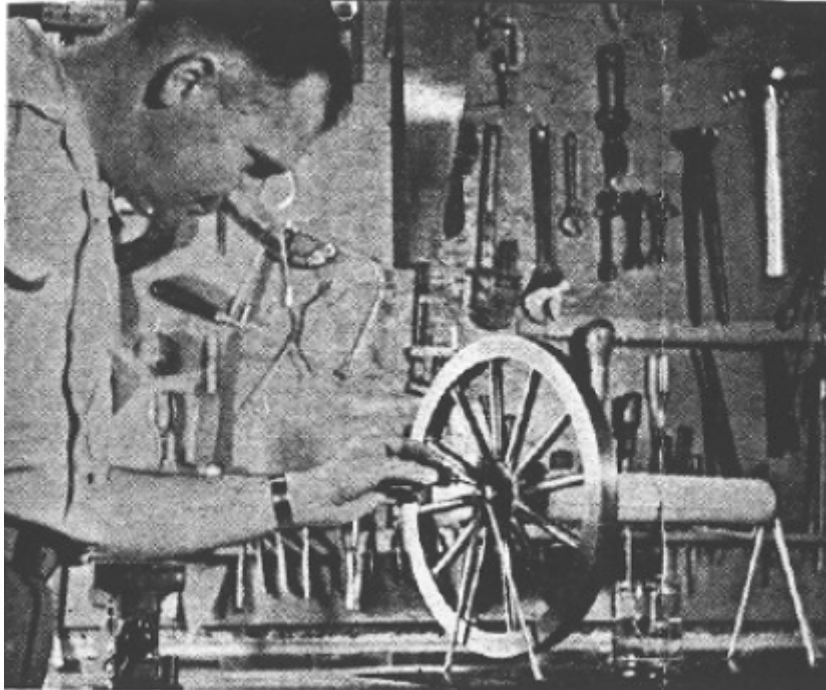


It should be noted that the movement of the lowest edge of the plates as they turn over when moving past the upper wheel at point "A", is much faster than anywhere else, and so putting a protective housing around it would definitely be advisable as you don't want anybody getting hit by one of these heavy plates.

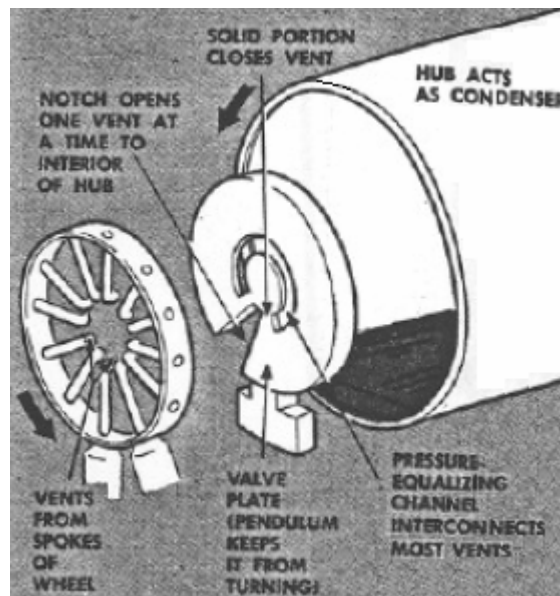
It is, of course, possible to make this device to a much smaller scale to demonstrate it's operation or test different chain designs. The plates could be made from chipboard which is fairly heavy for its size and relatively cheap.

Ivan Monk's Rotary Power Unit

This patent is a combination of a gravity-operated device and a heat-pump. Energy is drawn from the surrounding environment and used to cause a weight imbalance which then utilises gravity to cause the rotation of the motor shaft. This invention is described as a device for powering toys and other non-serious applications, however, when used to drive the magnetic shields of an Ecklin-Brown electrical generator, it might well become a serious power-generating device.



The device operates by using the temperature difference between a horizontal tube cooled by a damp cloth cover and a hollow spoked wheel. Freon inside the device is continually evaporating in the wheel section and condensing in the horizontal tube. A simple valve arrangement then allows the liquid freon to flow back into the spokes of the wheel at a time when gravity can provide a turning force on the wheel. Presumably, when built to a convenient size, the power of this device will be very limited.



Ivan patented his design because he felt that it was possible that it might be used to power small devices such as toys or clocks. The cloth sleeve over the horizontal tube can be kept wet by a loop of string which goes down into a container of water. Here is the patent:

Patent US 2,597,890

27th May 1952

Inventor: Ivan Monk

ROTARY POWER UNIT OPERABLE ON ATMOSPHERIC ENERGY

DESCRIPTION

The present invention relates to a power unit for amusement devices, toys, clocks, or the like, and more particularly to a rotary power unit which requires no fuel but which operates under conditions of small differences in temperature.

Toys, clocks, amusement and advertising devices and the like, which have moveable parts, require some type of motive power for their operation and this motive power is usually supplied by a motor of one kind or another, such as electrical, vibratory or spring-driven, and in each case a power source is needed, whether it be a battery, a spring or something else. It has been found that such devices need considerable attention, and in order for them to function constantly, they must be rewound, reset or the batteries replaced at frequent intervals. Over a period of time, this procedure becomes not only bothersome but also expensive.

The present invention is self-contained and self-sufficient for power purposes and it will operate indefinitely solely by the heat of the surroundings, with practically no attention or supervision, and in addition, it is comparatively inexpensive to manufacture. Furthermore, the device will operate over long periods of time and needs no resetting, rewinding or batteries. The exact nature of this invention will be readily understood from the following description and drawings where:

Fig.1. Shows a perspective view of a preferred embodiment of the invention:

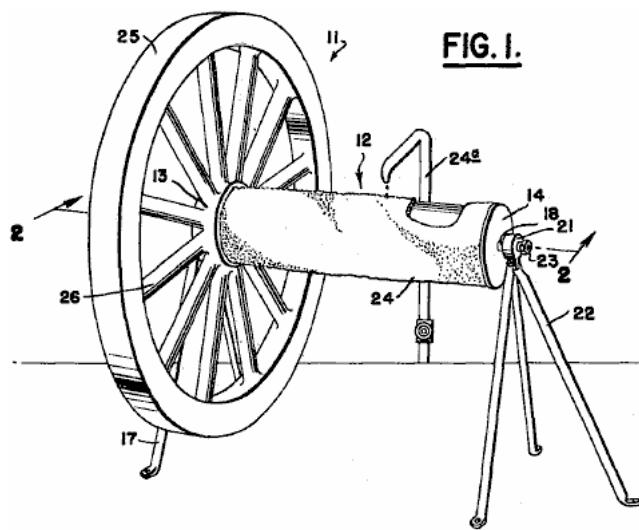


Fig.2. Shows a sectional view taken along line 2--2 of Fig.1, looking in the direction of the arrows:

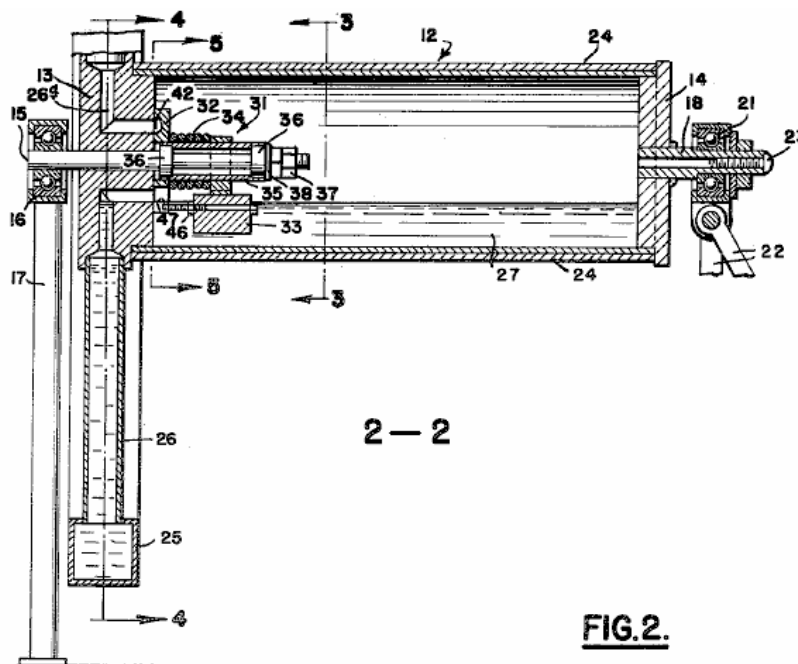


Fig.3. Shows a sectional view taken along line 3--3 of Fig.2, looking in the direction of the arrows:

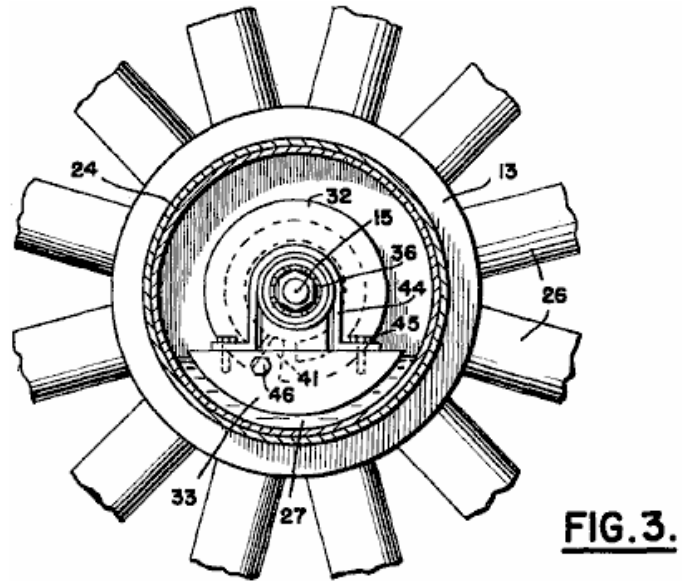


Fig.4. Is an enlarged sectional view of the wheel and hub, taken along line 4--4 of Fig.2, looking in the direction of the arrows:

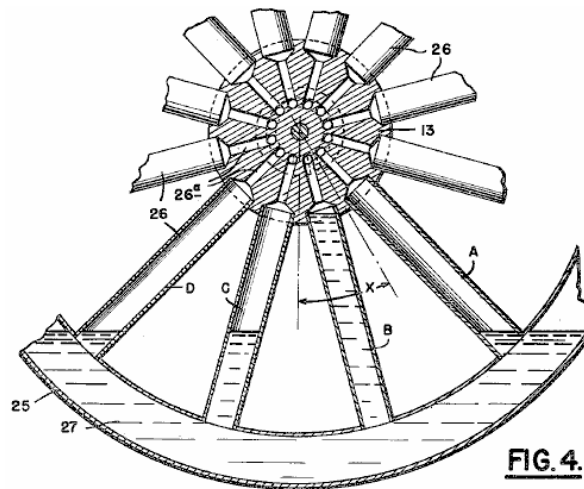


Fig.5. Shows a sectional view taken along line 5--5 of Fig.2, looking in the direction of the arrows:

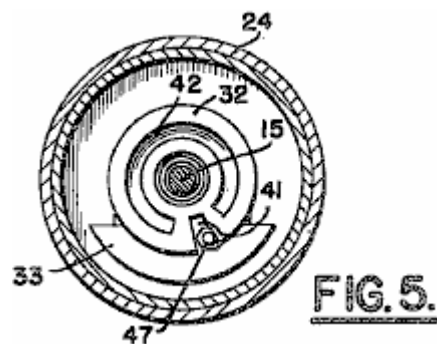


Fig.6. Illustrates an enlarged perspective view of the valve plate and pendulum elements of the valve assembly:

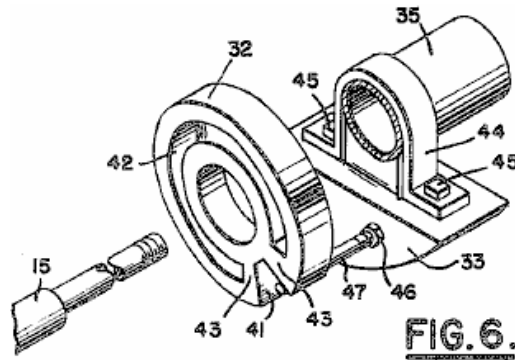


Fig.7. Shows an enlarged view of the pendulum:

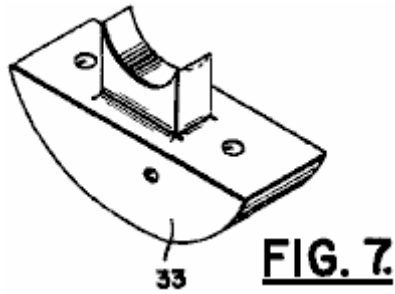


Fig.8. Illustrates a modification of the valve assembly where floats are used instead of a pendulum. This view is taken along line 8--8 of Fig.9 looking in the direction of the arrows:

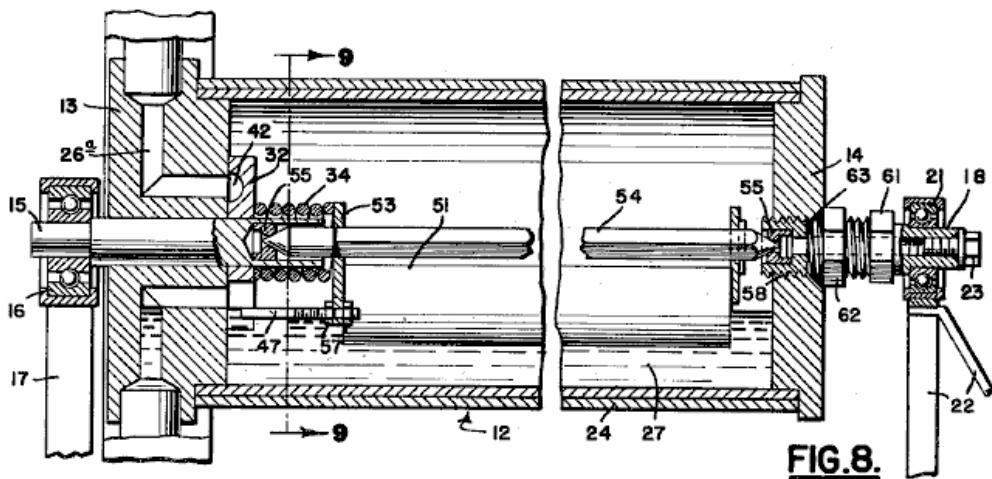


Fig.9. is an end view, taken along the line 9--9 of Fig.8 looking in the direction of the arrows:

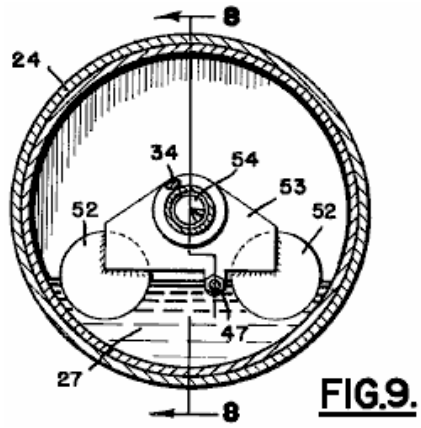


Fig.10. is a perspective view of the float assembly:

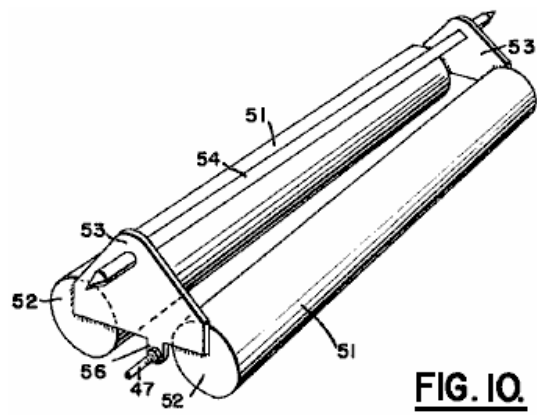


Fig.11. shows an alternative position for the filling plug:

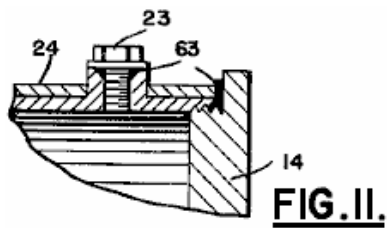


Fig.12. is a view showing a modification of the invention:

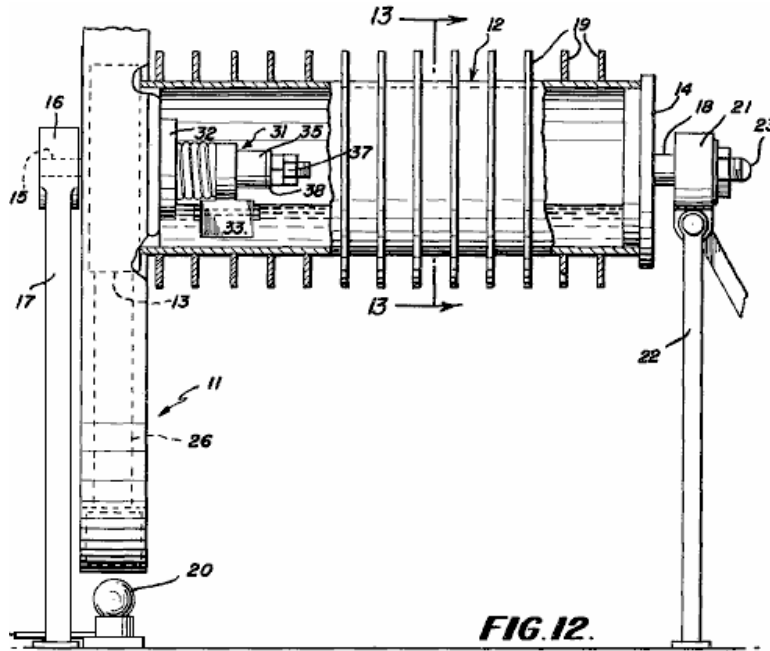


FIG. 12.

Fig.13. is a view along line 13--13 of Fig12, looking in the direction of the arrows:

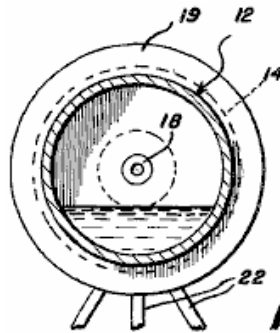


FIG. 13.

In each drawing, the numbers used for any component are the same in each view shown. In **Fig.1** the perspective view shows the power unit which has the general appearance of a wheel 11 with a cylinder 12

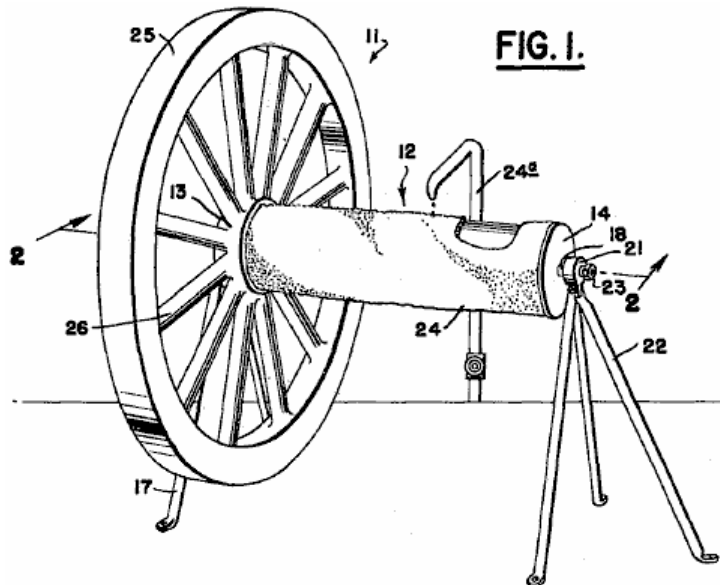
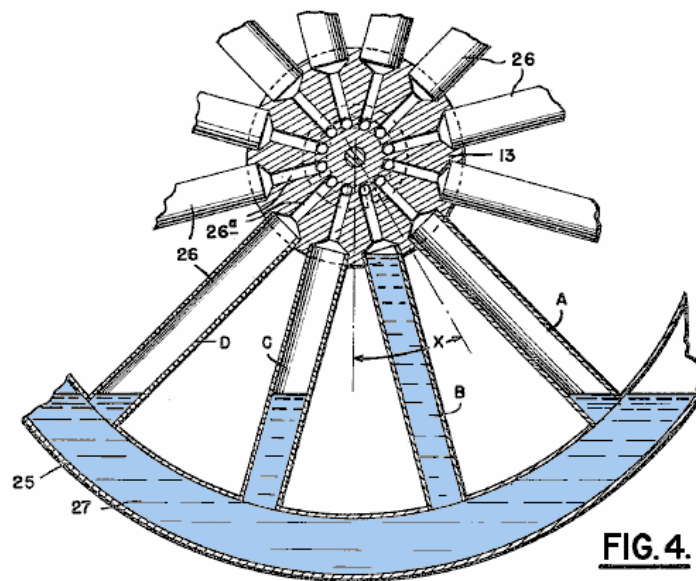


FIG. 1.

which is attached to the hub **13** of the wheel. The cylinder **12** has an end cap **14** which is sealed to it. Wheel **11** which is described in more detail later on, has a metal hub **13** and the cylinder **12** is also made of a thin metal such as brass, copper or something similar. The joints between the cylinder **12**, the hub **13**, and the end cap **14**, are soldered, sweated or brazed to form inside the cylinder **12** a hermetically sealed compartment capable of containing a fluid under pressure, or a vacuum, without leaking.

Rigidly attached to hub **13** is a hub shaft **15** which is supported in bearings **16**, which in turn are mounted in pedestal **17**. At the opposite end of cylinder **12**, and rigidly attached to end cap **14**, is a hollow cap shaft **18** which is supported in bearings **21**, which in turn are mounted in pedestal **22**. Ideally, the entire power unit is mounted so that it can rotate as freely as possible, so any well-known means such as jewel bearings can be used to mount the supporting shafts. A screwed filling plug **23** is placed in the exposed end of cap shaft **18**. This hermetically seals cylinder **12** after the working fluid is inserted through the hollow shaft **18**. The working fluid is described in detail later on.

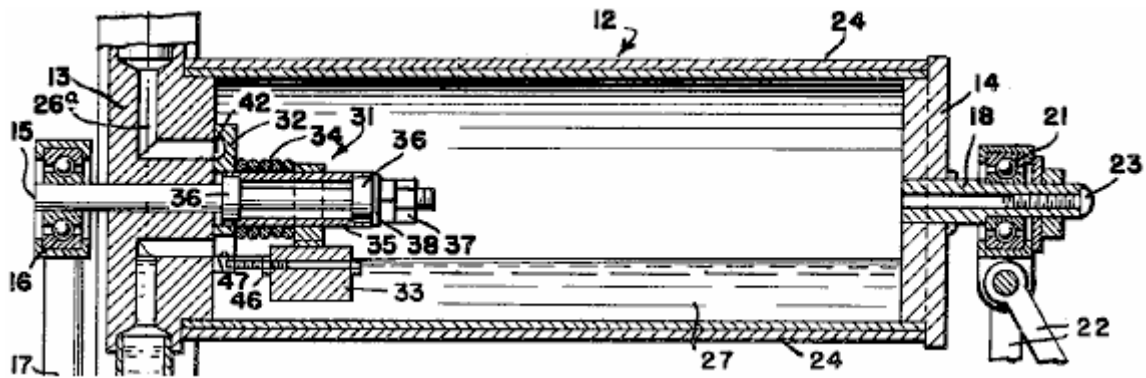
Completely encasing the entire outer surface of cylinder **12**, is a wick **24**, made from cloth or similar material, which when it is dampened with water or other fluid, acts to cool cylinder **12** through evaporation. For continued operation of the device over long periods of time, any well-known method of keeping wick **24** wet, such as a siphon system (not shown) or a continual drip pipe **24a**, may be used.



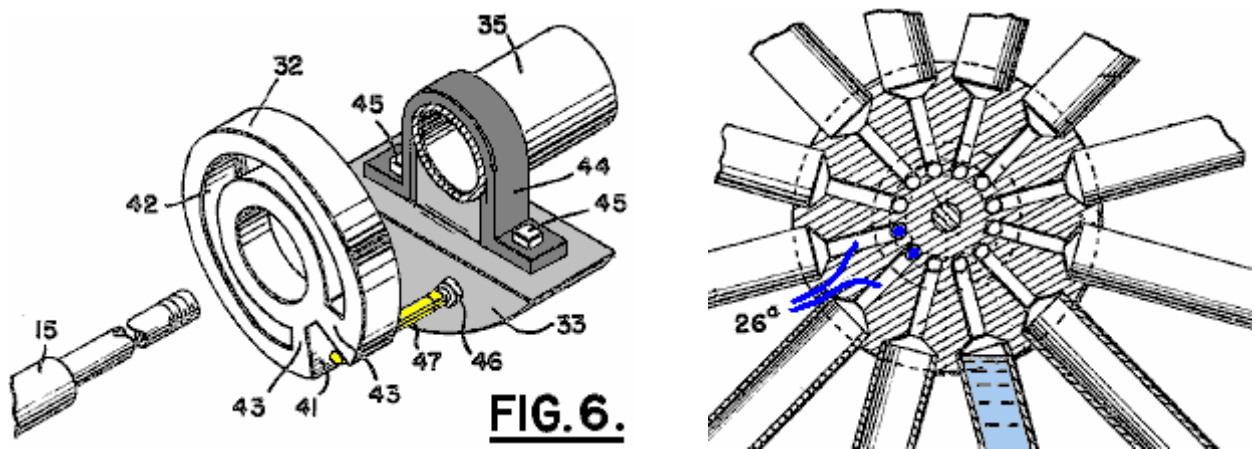
The element **11**, which has the general appearance of a wheel, consists of a hollow rim **25**, which is concentric with the axis of cylinder **12** and hub **13**. Rim **25** is held rigidly to hub **13** by several equally-spaced hollow spokes **26**. Each of these spokes connects to the interior of cylinder **12** by means of a passage **26a** in the hub. The rim **25**, is constructed using any light weight material which has good heat-conducting properties and it can have a cross-section of any convenient shape. For example, it could be a square cross-section as shown in **Fig.1** and **Fig.2**, or it could perhaps, be a circular shape. Other forms may also be used, provided that the internal volume of the rim and spokes is approximately uniform around the wheel.

Experience has shown that for efficient operation of the power unit, any transfer of heat from the higher temperature region of the rim **25** to the lower temperature region of the cylinder **12**, by conduction along the spokes **26**, should be kept to a minimum. This may be achieved by making the spokes as thin as possible and making them from a material which is a poor conductor of heat, such as glass, plastic, thin brass, nickel-silver, or the like, or by using a layer of insulating material, or synthetic rubber and cement between the surfaces of the spokes and the hub **13**.

Partially filling the hollow interior of the wheel assembly **11**, and the cylinder **12**, is a volatile liquid **27**, whose vapour fills the remaining space inside the device when all air and relatively non-condensable gases have been removed. It is desirable that the liquid **27** be some non-corrosive fluid having a boiling point (at atmospheric pressure) at somewhat below that of water and that it also have the fluid characteristics of low viscosity, high liquid specific gravity, large changes in vapour pressure for small changes in temperature, low specific heat for vapour and liquid, large specific volume for the vapour and low latent heat of vaporisation. Liquids such as trichloroethylene, methylene chloride, and those of the "freon" class such as trichloromonofluoromethane, dichlorotetrafluoroethane or trichlorotrifluoroethane or the like have been found satisfactory since they readily form a vapour at the temperature of the rim **25**, and just as readily condense back into a liquid in the relatively cool confines of cylinder **12**.



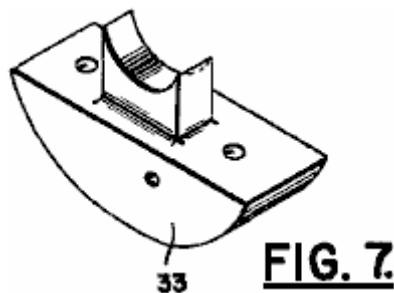
Inside cylinder 12, and free to rotate in its mounting on shaft 15, is a valve assembly 31 consisting of a valve plate 32, a pendulum 33 and a spring 34. Concentric with shaft 15 is a short sleeve 35, which is mounted on bearings 36, and held in position by means of a nut 37 and washer 38. Mounted on sleeve 35 and free to move, is valve plate 32, which is better seen in the enlarged view of Fig. 6:



The valve plate 32 is a circular plate with a radial slot 41 which extends from its outer edge to about half way to its inner diameter and with a width approximately equal to the diameter of the passages 26a through the hub 13. The valve plate 32 acts as a self-aligning sliding seal over the ends of the passages 26a in the hub which lead to the spokes 26 and slot 41 allows individual spokes to connect to the inside of cylinder 12, one at a time as will be described fully later on.

The valve plate 32 also contains, on its hub side, a circular groove (as shown in Fig. 6) whose ends terminate on each side of slot 41, so that the distances 43 between the slot and each end of the groove is approximately equal to or slightly greater than the diameter of the passage openings 26a, which allows the distance 43 to block the opening to one spoke while the groove 42 allows the pressure to equalise between the other spokes whose passages 26a connect with the groove.

While the entire valve assembly 31 is constructed so that it is prevented by pendulum 33 from rotating when wheel 11 rotates, it is desirable that the friction between hub 13 and valve plate 32 is kept to a minimum, and it has been found that when the valve plate is made from carbon or brass, it accomplishes this desired result.



The pendulum 33 consists of a curved piece of lead which is rigidly attached to sleeve 35 by means of a strap 44 and bolts 45, so that the pendulum hangs below sleeve 35 and forms an integral part of it. Inserted through the lower part of pendulum 33, and held in place by nut 46, is a guide pin 47 which extends beyond the pendulum

towards valve plate 32, parallel with shaft 15. Pin 47 is positioned somewhat to one side of the vertical, with the entire pendulum and strap 44 located along the length of sleeve 35 so that pin 47 extends into slot 41 (or other suitable recess in valve plate 32) thereby maintaining the slot at an angle of the order of 20° to 50° from the vertical as shown in Fig.3 and Fig.5.

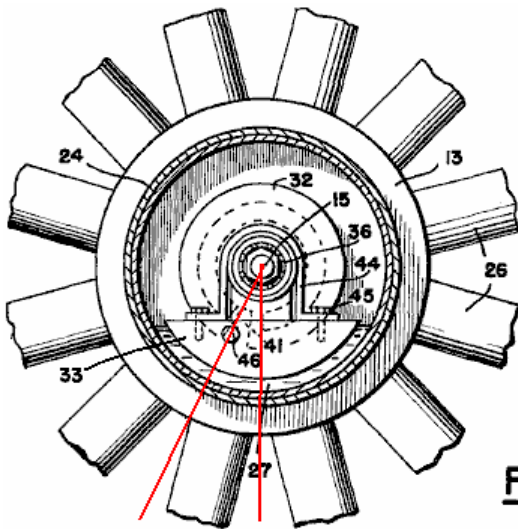


FIG. 3.

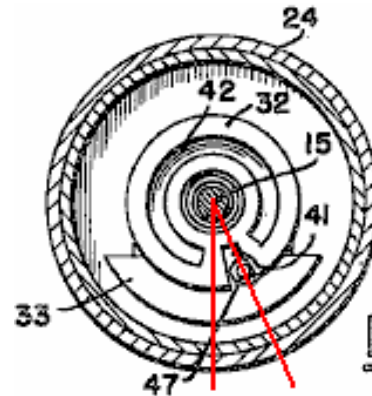


FIG. 5.

The angle of the slot which gives the best performance is discussed later on. Spring 34 is wound concentrically about sleeve 35 and held in compression between valve plate 32 and the pendulum strap 44 which holds the valve plate sufficiently tightly against hub 13 to provide a seal, but at the same time, not tight enough to prevent the plate from sliding when the wheel rotates. During operation, the pendulum remains stationary, keeping the valve plate stationary, causing it to operate as a sliding valve which successively opens and closes the passages 26a which connect to the spokes.

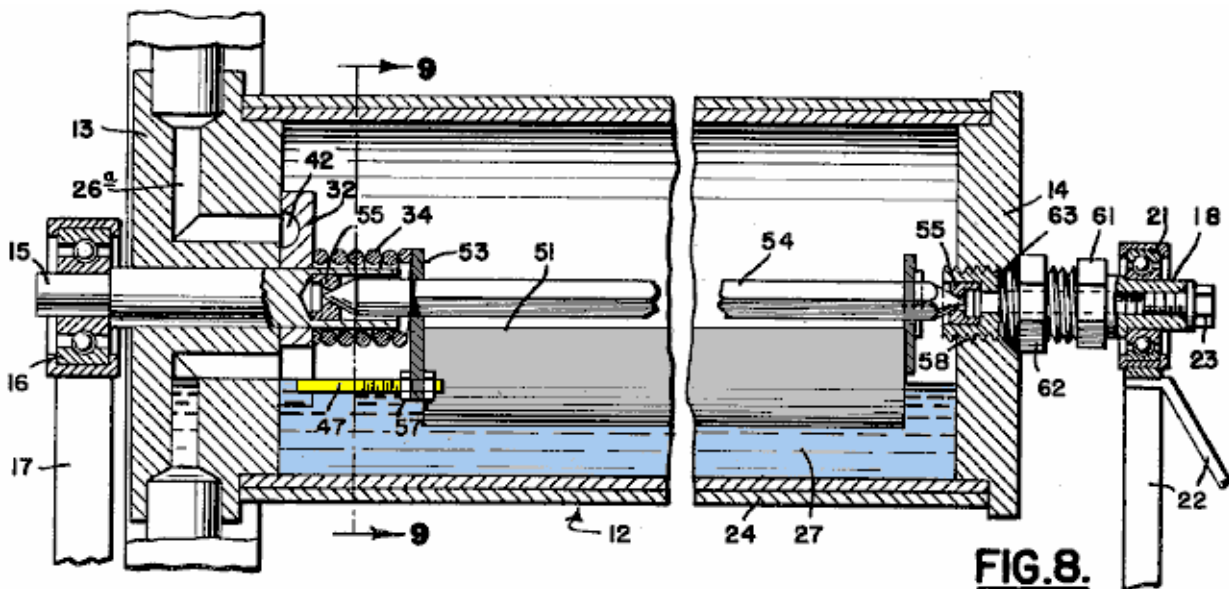


FIG. 8.

The modification shown in Fig.8 illustrates a variation of the valve assembly and its method of support, where twin floats are used to maintain the angle of the valve plate. Here, a pair of light metal floats 51 extend for most of the length of cylinder 12. These light metal float cylinders are closed at the ends and they have triangular plates 53 attached to their ends:

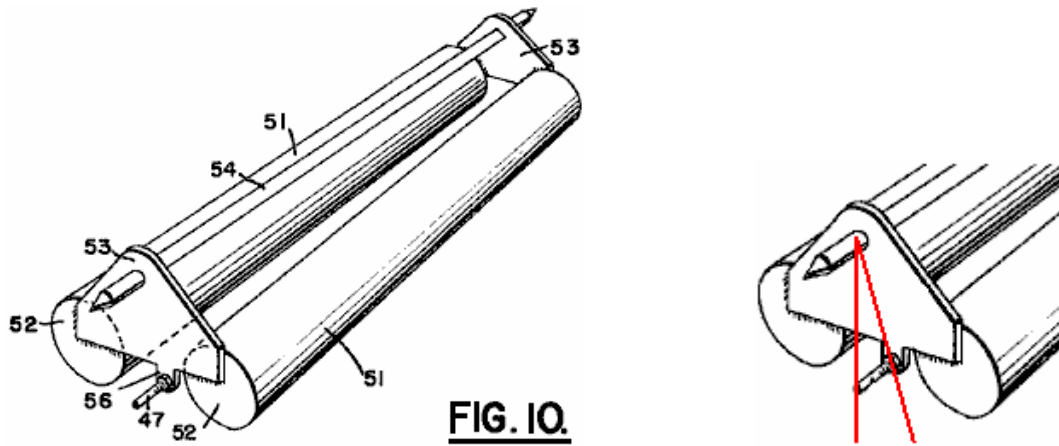


FIG. 10.

Supporting rod **54** is attached securely to plates **53** and is taped at its ends in order to fit into jewel bearings **55** at each end of cylinder **12**. On the lower edge of the plate **53** which is nearest to the hub **13**, there is lug through which is mounted the guide pin **47**, secured by nuts **57**. As before, the guide pin is offset to one side of the vertical centreline of plate **53**.

In the modification of **Fig.8**, the cap shaft **18** is hollow and a portion of its length is threaded as at **58**, so that it can be screwed in and out of end cap **14**, allowing slight adjustments in the contact between support rod **54** and jewel bearings **55**. Nut **61** is integral with shaft **18** for making the adjustment, and lock nut **62** holds it secure while packing or sealing ring **63** forms a tight joint between end cap **14**, shaft **18** and lock nut **62**. Filling plug **23** screws into the end of hollow shaft **18** to make an air-tight connection, after liquid **27** has been inserted, there being sufficient clearance between support rod **54** and jewel bearings **55** for the liquid to pass between them and into cylinder **12**.

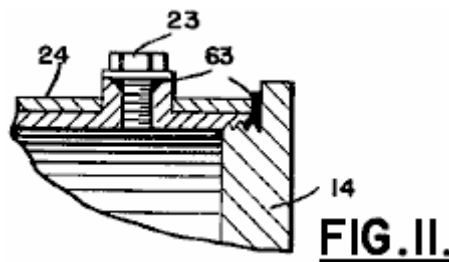


FIG. 11.

Fig.11 is a view of an alternative method of locating the filling plug **23** by placing it in the side of cylinder **12**, with the inner end flush with the inside surface of the cylinder, rather than in the end of the hollow shaft **18**, but if this is done, then a small counterweight should be placed diametrically opposite to the plug in order to maintain the balance of the cylinder.

During operation, the rotation of the power unit is obtained by restricting the flow of vapour to a limited number of passages so that a non-symmetrical distribution of the liquid is maintained in the spokes. This unbalanced distribution of mass causes rotation due to the action of gravity.

When setting up the power unit to operate for the first time, filling plug **23** is removed from cap shaft **18** and the volatile liquid **27** is inserted into the cylinder **12**, care being taken to remove all of the air and relatively non-condensable gases before resealing with plug **23**. Enough liquid is put into the device to cover the lower portion of cylinder **12** and the lower portion of hollow wheel rim **25** as well as a portion of the lowermost spokes **26**, as seen in **Fig.2** and **Fig.4**. Next, the wick **24** is dampened and in a few moments the power unit will automatically begin to rotate and it will continue to rotate so long as wick **24** is kept wet. Once liquid **27** has been placed in the device, it does not normally need replacing.

When the unit is in operation, it should be noted that broadly speaking, the liquid **27** vaporises in the wheel and re-condenses in the cylinder. The wheel being relatively warm, approaching room temperature, readily vaporises the volatile liquid **27** to form a pressure inside the hollow rim **25** and most of the spokes **26**. When the vapour passes through passages **26a** into the cooler confines of cylinder **12**, which is made relatively cool by the evaporation of the water in wick **24**, the vapour immediately re-condenses, forming a relatively low pressure within the cylinder.

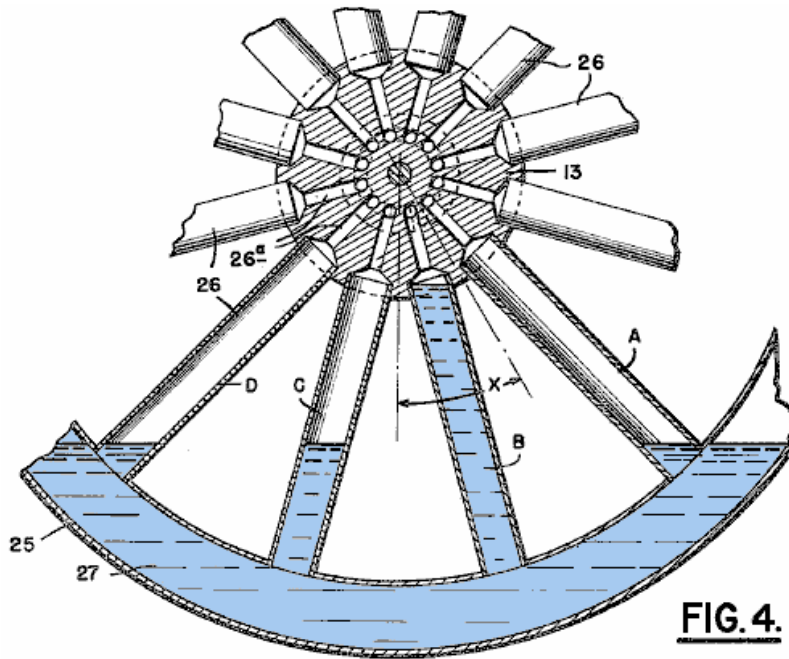


FIG. 4.

As shown in **Fig.4**, the rotation of the wheel is in a clockwise direction as seen in that view. The valve plate **32** is held stationary by its pendulum **33** while hub **13** and spokes **26** (as well as the external wheel assembly) rotate, the valve plate **32** being held by the pin **47** on pendulum **33** so that the entering side of slot **41** is set at an angle "x" to the vertical. The angle "x", which may be from 20 to 50 degrees, is such that when a spoke is in the approximate position of spoke **A** (**Fig.4**), further rotation will cause slot **41** to uncover passage **26a** thereby connecting spoke **A** with cylinder **12** so as to permit vapour to flow from the spoke to the cylinder, and at the same time, permit excess liquid to flow from the cylinder into the spokes and rim. As the pressure in the spoke decreases, the higher pressure in the rim forces liquid into the spoke, tending to fill the spoke with liquid, and this process continues as the spoke travels past the position of spoke **B**.

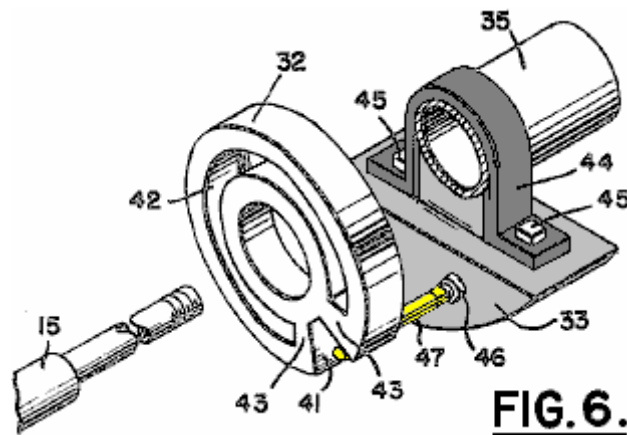


FIG. 6.

Finally, as the spoke approaches a vertical position, the spoke passage **26a** is covered by the surface **43** (**Fig.6**) on the valve plate, which surface is at least as great as the diameter of **26a**, thereby stopping further flow of the vapour, or liquid if the spoke has been filled completely, from the spoke to the cylinder.

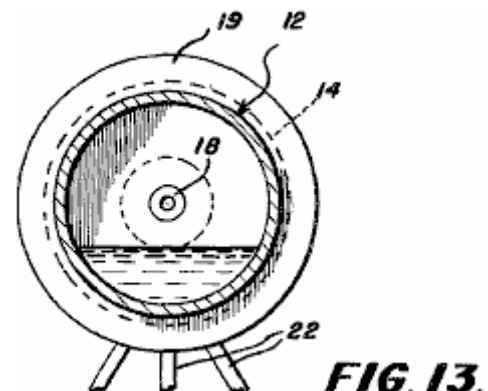
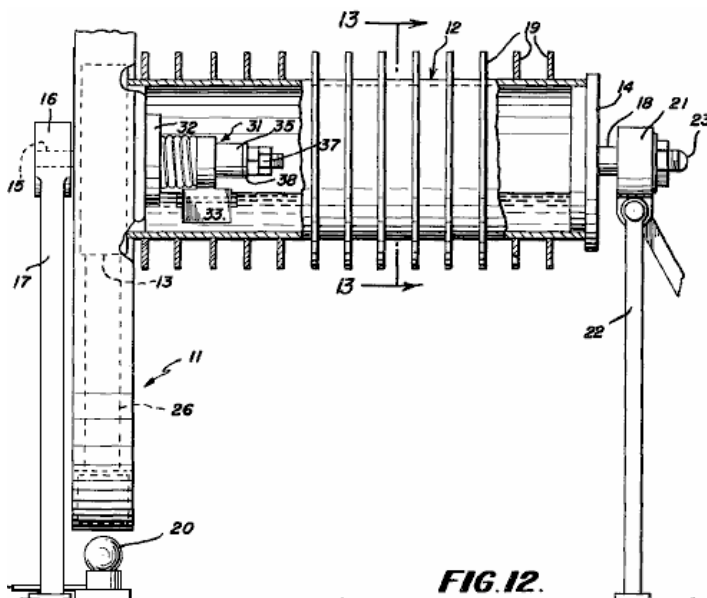
Further movement of the spoke causes its passage **26a** to be uncovered by the end of the circular groove **42**, thereby equalising the spoke pressure with that in the circular groove. It should be noted that the groove **42** simultaneously connects all of the spokes, except for those which are opposite the flat surfaces **43** and the slot **41**, as at positions **A** and **B**. When the passage **26a** is uncovered by groove **42**, this causes the liquid level in the spoke to fall immediately to that in the rim **25**, as shown in position **C**, so that as the spoke moves away from the vertical position it contains less liquid than it did while approaching the vertical position. This process is repeated for each succeeding spoke with the result that those spokes between position **A** and the vertical contain more liquid than those between the vertical and position **D**, and the resulting unsymmetrical distribution of liquid causes the unit to rotate.

The cycle of operation for the modification of **Fig.8** is the same as that for the version shown in **Fig.2**, the floats **51** and guide pin **47** holding valve plate **32** stationary so that the entering side of the slot makes an angle "x" with the vertical.

Experience has shown that several variables influence the optimum angle of travel during which the spokes **26** connect with cylinder **12** via the slot **41** in valve plate **32**. Large angles cause the unbalanced liquid to have a greater turning force around the axis of rotation, however, this requires a higher liquid level in the rim **25** (since the "active" spokes should have their lower ends submerged) and the retarding effect of the liquid, which does not rotate with the wheel, is greater. Tests of units geometrically similar to those shown here, indicate that the optimum angle ranges from 20 to 50 degrees although the power unit will operate at angles somewhat above and below those figures.

The Passages **26a** leading from the spokes to the cylinder **12** should be large enough to prevent capillary action from sealing off the vapour flow as the condensate drains back in the opposite direction. Tests indicate that for circular passages, a diameter of about 3/16" (5 mm) or greater is satisfactory, although diameters somewhat smaller may be used with liquids having small surface tensions.

Furthermore, smoother operation results when the passages **26a** and valve plate slot **41** are proportioned so that the slot uncovers and entering passage before the leaving passage is covered. In other words, slot **41** may be so proportioned that for an instant, both spokes **A** and **B** are connected to cylinder **12** as they move toward the vertical, thereby increasing the average torque produced by the unbalanced liquid.



Increased efficiency of operation may be obtained by the addition of fins **19** (**Fig.12** and **Fig.13**) which may be circular discs placed around the circumference of the cylinder **12**, or other means for extending the surface area of the cylinder, or by constructing the rim and spokes (which are receiving heat from the atmosphere) from a material which has a high heat absorption factor, or by coating the surface with a thin layer of dull black paint. Furthermore, a light bulb **20** (**Fig.12**) or any other source of low intensity heat may be directed on the rim and spokes, in which case the wick **24** may not be required, since cylinder **12** will be maintained at a temperature lower than at the rim, due to radiation and convection to the surroundings.

Thus, from the above specification, it can be clearly seen that this is a rotary power unit which operates under conditions of small temperature differences, one which operates without fuel but on energy obtained from the atmosphere, one whose working fluid is hermetically sealed within the power unit, and one which can be used for training, advertising, amusement, etc.

Omissions from Chapter 5:

The Ed Gray Power System

The power tube presented to the public by Edwin Gray snr. operates by generating a series of very short, very

sharp pulses using a spark gap. This device is reputed to have a power output which is one hundred times that of the power input. Ed Gray and his electric pulse motor are very famous, but as far as I am aware, nobody has successfully replicated this claimed performance. Further, an in-depth examination of the background details by Mr Mark McKay have turned up a number of facts which present a very different picture, and while it is perfectly correct to say that spark-gap pulses generate a good waveform for shocking the local zero-point energy field into the sort of imbalance which can provide a massive power inflow into a device or circuit, we need to be careful to get the full facts in this case.



First, let us put the whole thing in its proper perspective. In May 1973, Cal-Tech in the US performed an independent assessment of an engine provided to them by Edwin Gray. They measured the input and the output and certified that the output power was 275 greater than the input power. This demonstrates clearly that excess power can be drawn into an engine and provide a performance which can power both the engine as well as doing additional useful work.

Having said that, it needs to be made clear that Edwin Gray did not build that small motor, did not understand how it worked, nor did he ever disclose the design in any of the patents which he obtained afterwards. We need to follow the sequence of events and notice when each thing happened. The history is as follows:

In 1957, a Russian immigrant to the USA, one Alexei Poppoff, showed Edwin Gray a circuit which he said that he had been shown by Nikola Tesla. Edwin Gray did not understand the circuit and had no idea how to create anything useful based on it. He then joined up with his next-door neighbour Marvin Cole, who held a Masters degree in Mechanical Engineering and who, unlike Gray, was able to understand the circuitry.

In 1958, Ed Gray (shown above) left the Los Angeles area in a hurry.

From 1958 to 1967 Marvin Cole, working alone, designed and built ever more powerful prototype engines, and it was a small one of these which was tested by Cal-Tech. In this period, Marvin also developed ever more powerful power supplies, which are the really important item in all of this.

In 1967, Ed Gray rejoins Marvin Cole and together from 1967 to 1972 they solicited venture capital and promoted the technology.

Early in 1972, Marvin Cole disappeared and never saw Gray again. It is not clear if he was intimidated, died, or just did not want to be involved in all the publicity and effort needed to turn the prototype engines into a commercial product. No matter what the reason, the result was that Edwin Gray was suddenly disconnected from the brains behind the project, and that left him in a very difficult position. He didn't want to let go of the dream of becoming rich through this spectacular development, and so he tried to continue the development on his own.

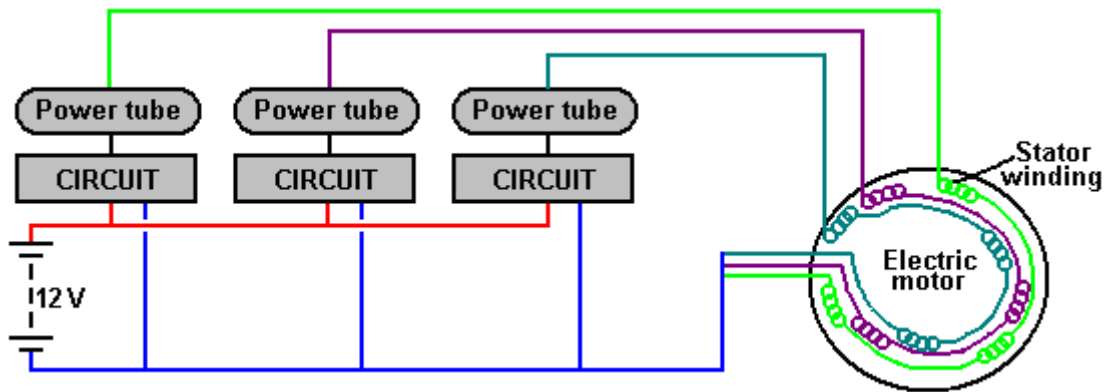
As already mentioned, in May of the following year (1973), Gray had a small Marvin Cole motor independently third-party tested at the famous Cal-Tech laboratory in Los Angeles, where a measured input of just 27 watts produced a measured output of 10 horsepower (7460 watts). The objective was to provide solid evidence of a new technology which was capable of changing the world and so would attract investors. To further boost his image and convince potential investors, in that same year of 1973, Edwin staged demonstrations which jumped electromagnets up into the air, showing the strength of the power which drove the Marvin Cole engines.

It is very important to understand that all of Edwin Gray's patents were applied for after the departure of Marvin Cole. These do not disclose the technology tested by Cal-Tech and it must be understood that Edwin was very much afraid of revealing anything important in any of the patents in case some other person would understand the things which were a mystery to him and snatch away the prize of commercial success. So, please be aware that the patents were applied for solely to encourage investors and most definitely not to show any significant details.

Edwin then assembled a small team of people to attempt to understand and advance the work of Marvin Cole. However, the subsequent changes to the Cole implementations did not result in genuine, reliable working motors due to Gray's lack of understanding of the underlying energy-tapping methods used by Cole.

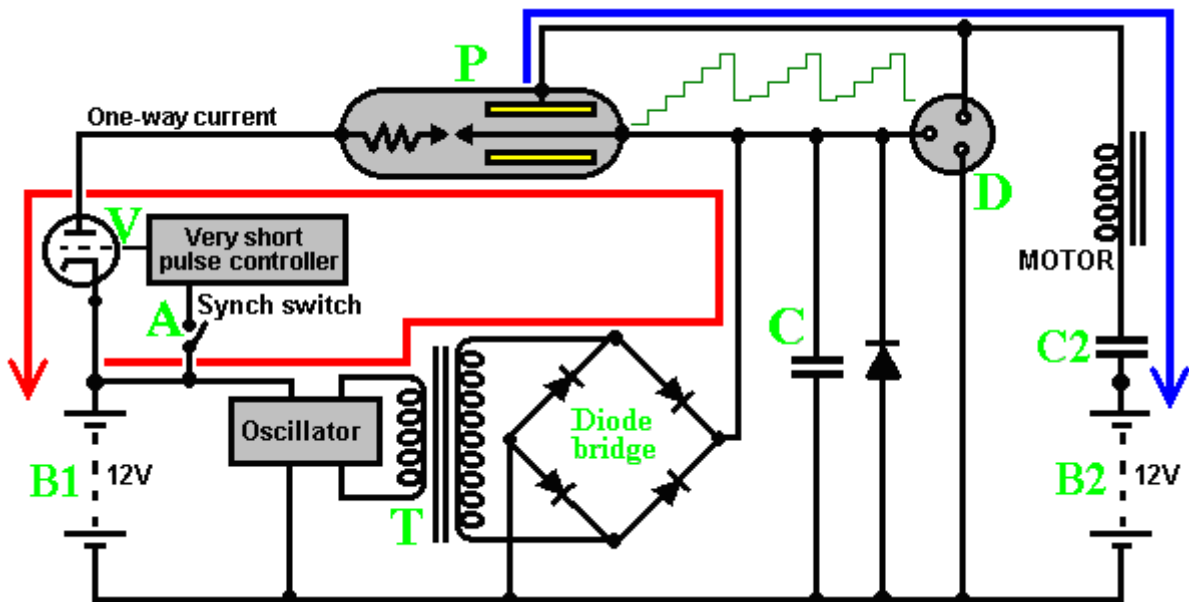
The Power Tube shown in Gray's patents has never been shown to provide the COP=100 energy performance which is sometimes mentioned, nor did it form part of Marvin Cole's system. In 1976, Edwin Gray shows three of these Power Tubes driving one (failed version) motor. This technique is in direct conflict with Marvin Cole's successful technique which had 24 separate power supplies driving the motor. Please understand that the power-gathering mechanism of the Cole system is the key feature of all of the successful systems. Unfortunately, as far as I am aware, that technology has never been disclosed.

Just to clarify the differences, let me briefly outline my understanding of what Edwin Gray put forward as the power-gathering system of the motors which he attempted to develop after he parted company with Marvin Cole. Edwin shows three Power Tubes connected to the engine like this:



Here, three separate sets of electromagnets inside the motor are pulsed in sequence by three separate identical circuits, each driving the electromagnets via a power Tube. Marvin Cole's system used twenty-four separate power-gathering circuits which drove twenty-four separate electromagnets inside the motor (Power Tubes were not used).

You may wish to try Edwin's Power Tube for yourself, so let me explain the basic details as I understand them. The overall circuit is like this:



You will notice that the power driving the load does **not** come from the battery as the battery circuit produces the spark inside the Power Tube and nothing else. The motor's electromagnet winding is driven by power picked up by the copper shells around a half inch (12 mm) diameter, copper rod, spark-gap electrode which has silver coated tips. The circuit supposedly operates as follows:

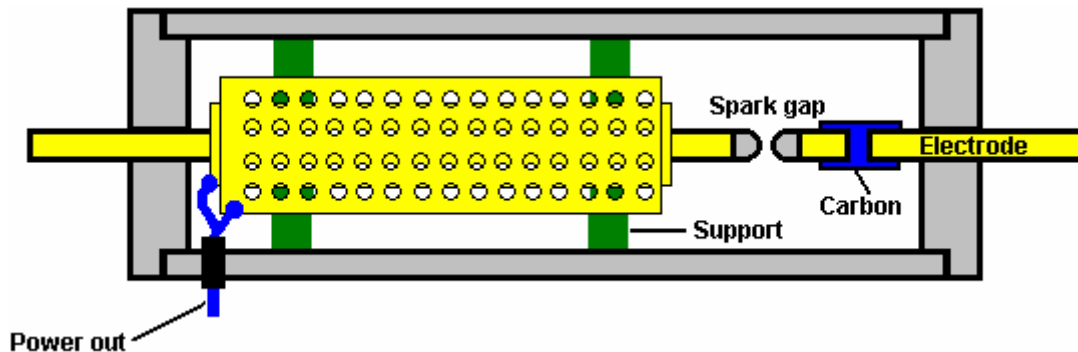
The driving 12V battery "B1", continuously powers an oscillator which uses transformer "T" to step the voltage up to a high level. This high voltage is full-wave rectified by a bridge of high-voltage diodes, and the resulting DC voltage is fed to capacitor "C". If any malfunction causes this DC voltage to get too high for safety, the discharge contacts "D" cause the voltage to discharge via a spark to the earth connection. Under normal circumstances, the high voltage on "C" creates a spark in the power tube "P" when it's circuit is completed by the closing of switch

“A”, which is used to synchronise the power pulse to the rotation position of the electric motor's shaft. The switch drives a monostable circuit which delivers a very short enabling pulse to “V” the “one-way current switch” which is a powerful electronic triode valve. These days, it is very difficult to get a valve of that type and the best source is probably the power output valve from a World War Two radio transmitter.

The power tube “P” has a resistor shown in it. This was actually a block of carbon, and as such, will have had minimal electrical resistance. However, several different devices which appear to have COP>1 power outputs use a spark gap associated with a carbon electrode, so there may well be a second effect coming into play here. A key factor in this circuit is the fact that the power which drives the motor does not come from this electrical circuit at all, but from the apparently disconnected cylinders inside power tube “P”. This power is “cold” electricity, flowing into the circuit from the local environment. Remember that Floyd Sweet in his first measured test had an 500 watt electrical output from a power input of just 0.31 of a milliwatt.

In this circuit, the “MOTOR” represents just one of the coil windings inside the electric motor and instead of the power flowing through the motor being fed to ground as normal, it is fed to the +12 volts of battery “B2”. The objective was to charge battery “B2”, the charging current being limited by capacitor “C2”, the idea being that “B1” and “B2” could be swapped over when “B1” became discharged. This arrangement was soon discontinued and battery “B2” was charged from a standard car alternator driven by the engine in an entirely conventional manner.

A rapid and abrupt electrical discharge is produced by generating a spark, and power pick-up is achieved by two copper cylinders surrounding the conductor which carries the spark current. There is more than one way of doing this. In the following diagram, the spark gap is shown exposed to make it easier to see, but in practice, the perforated copper shells extend to cover the spark gap:



A full and detailed description of how it is believed that “Ed Gray’s” system works is given in Peter Lindemann’s book “The Free Energy Secrets of Cold Electricity” which is available via the website <http://www.free-energy.ws/products.html>.

Tesla used this spark gap method with spark quenching provided by a strong magnetic field at right angles to the spark, in order to get really high-quality DC pulses with durations of one microsecond or less. Pulse trains of individual pulses with very short durations produce heat, spontaneous lighting, cooling, etc. depending on the frequency of the pulsing. The power tube is placed around a heavy-duty copper conductor which is pulsed, unbalancing the zero-point energy field and a tiny part of the resulting energy flow as the field moves back into equilibrium again, is captured by the surrounding perforated copper shells.

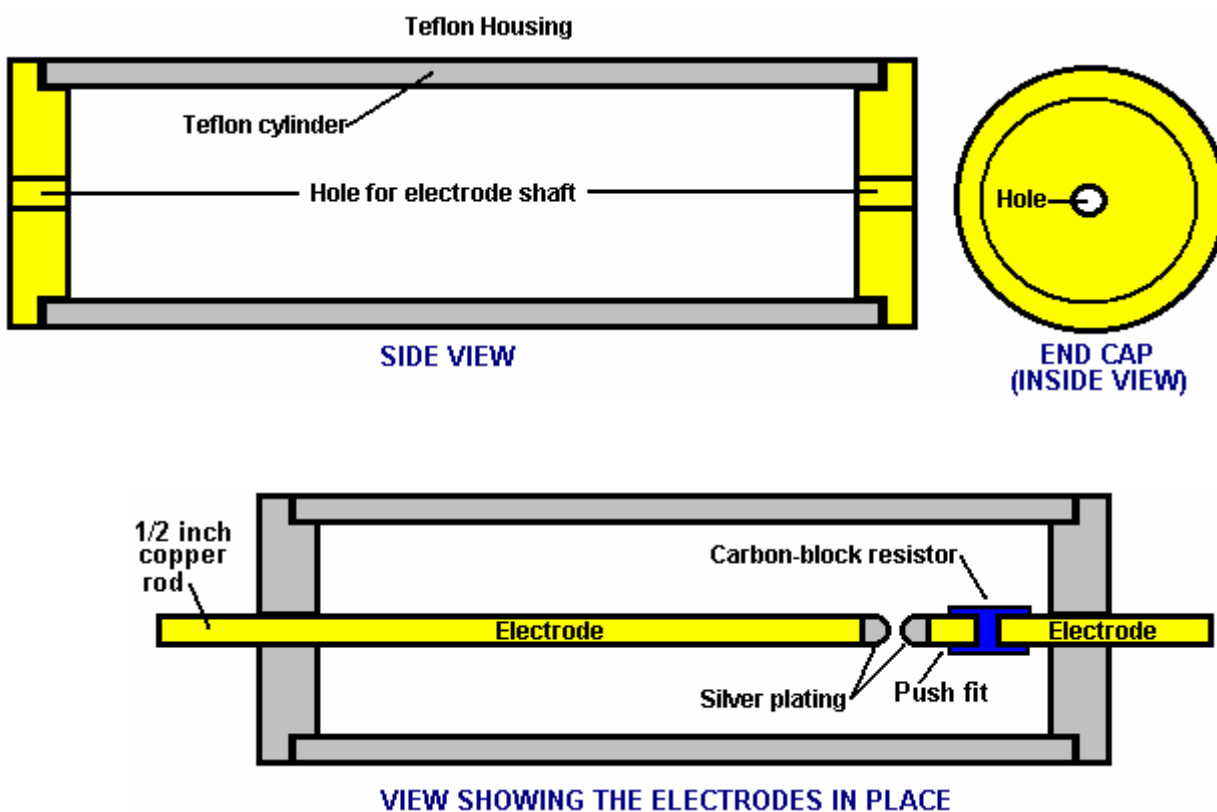
While the switching valve in the electronics circuit looks like a very difficult component to come by, the possibility of constructing one yourself should be considered. Essentially, a thermionic valve is a simple device. A heated filament at one end of the tube emits electrons. A high voltage along the length of the tube provides an electrical urge for those electrons to flow along the tube. A metal grid between the heated filament and the electrode at the far end of the tube can be used to prevent that current flow by connecting an opposing voltage to that grid. It is that grid voltage which is turned off very briefly to provide the current pulse to one set of motor windings. A seeming obstacle is producing the glass envelope for the valve, but there is actually no need for the valve to have a glass container and a wide range of other materials can be used. Another obstacle is creating a vacuum inside the valve housing, but it has been stated that the main reason why these valves have a vacuum inside them was mainly commercial, namely, an attempt to encourage people not to make their own. It is said that there is no reason why a thermionic valve should not have air inside it – the current flow is not a spark. I have no idea how accurate, or inaccurate, this information on valve construction is, but I strongly suspect that it is correct.

Marvin Cole's power system produced "cold electricity" which could power lights and other devices. It was frequently demonstrated that the output was not conventional electricity and powered light bulbs which were placed under water and at the same time, it was quite safe for a hand to be put into that same water along with the lit bulb. The glass of the conventional bulbs used in these demonstrations would have shattered when placed

under water if they had been powered by conventional "hot electricity" as the sudden change in temperature would have broken the glass. Powered as they were by "cold electricity", they ran cool and so there was no stress on the glass when submerged in water.

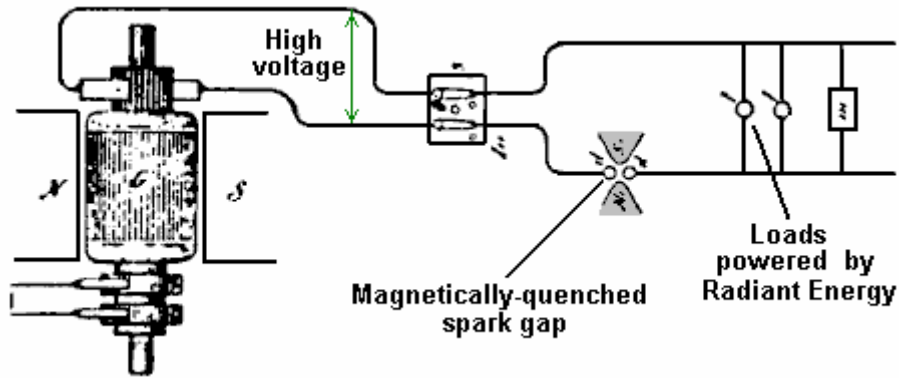
The construction of the pick-up tube is not particularly difficult. It is comprised of a teflon (plastic) cylinder of about 80 mm diameter with teflon plates at each end, grooved to hold the pick-up cylinders in place. A pair of 12 mm diameter copper rods are positioned down the centre of the cylinder and provided with a means to adjust the gap between them where they meet. The rod ends form the spark gap and these ends are plated with silver. One rod has a graphite block inserted in it, using a push-fit connection into slots cut in the bar. This carbon insert is supposedly a resistor, but in fact it is an important part of the excess energy generation system. In some successful constructions of the tube an 8-inch long, half-inch diameter carbon rod with a silver tip, is used for one of the electrodes.

The two or three cylinder shells which pick up the Radiant Energy, are constructed from copper sheet. The gap between the outside of one cylinder and the inside of the surrounding cylinder is about 6 mm. These cylinders are more effective if they have a matrix of holes drilled in them. They are connected together electrically and the connection is led out through the teflon casing to feed the load circuit. The cylinder contains air rather than a vacuum or an inert gas. The copper cylinders are held in place by push-fit supports, one set positioned between the outside of the smaller cylinder and the inside of the larger cylinder. The second set are placed between the outside of the larger cylinder and the inside of the housing tube:

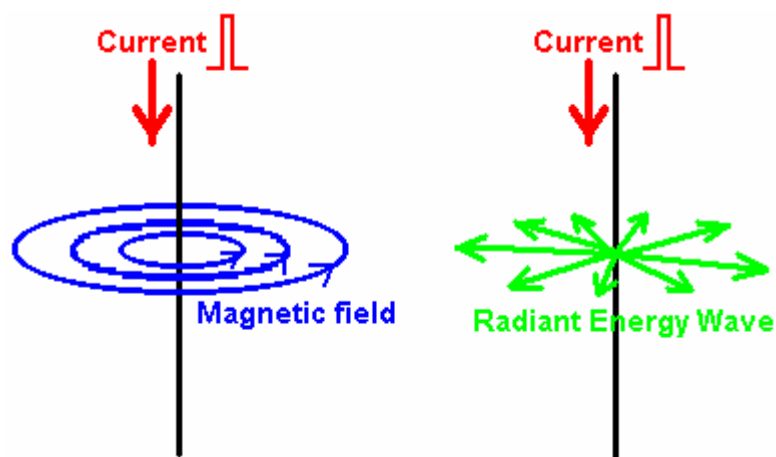


The power tube is constructed this way because the Radiant Energy wave generated by the sharp pulse of current through the electrodes, radiates out at right angles to the electrodes.

Peter Lindemann points out that Ed Gray's power conversion tube circuit is effectively a copy of Nikola Tesla's circuit for doing the same thing:



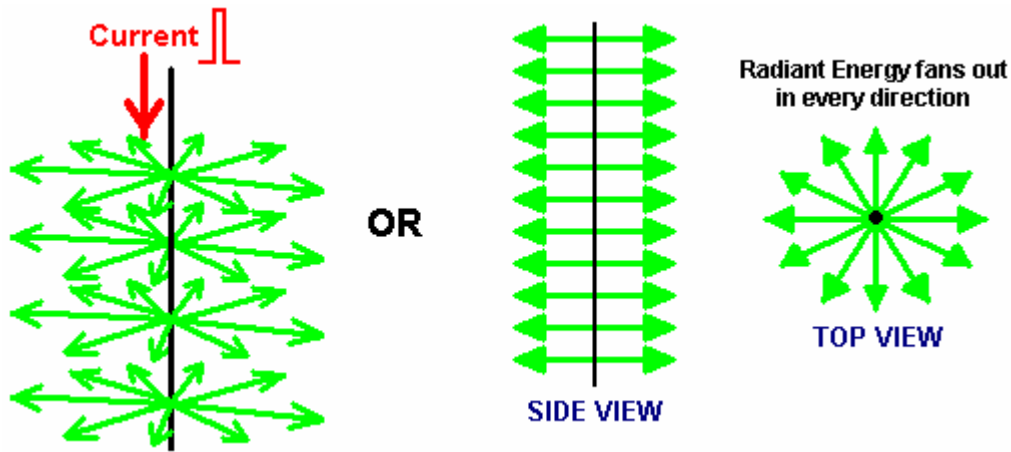
This was disclosed by Tesla in his 'Philadelphia and St Louis' lecture in 1893 and shows how loads can be powered when a high voltage source is pulsed by a magnetically-quenched sparks - this creates DC pulses of **very** short duration.



The diagram above, illustrates the difference between the Magnetic field generated around a conductor fed with a pulse of Direct Current and the Radiant Energy waves created by that pulse. If a sharp current pulse is driven down a vertical wire, it causes two different types of field. The first field is magnetic, where the lines of magnetic force rotate around the wire. These lines are horizontal, and rotate clockwise when viewed from above. The magnetic field remains as long as the current flows down the wire.

The second field is the Radiant Energy wave. This wave will only occur if the current pulse is in one direction, i.e. it will not occur if the wire is fed with alternating current. The wave radiates out horizontally from the vertical wire in every direction in the form of a shock wave. It is a one-off event and does not repeat if the current in the wire is maintained. The Radiant Energy briefly unbalances the zero-point energy field and that causes an energy flow as the field moves back into equilibrium again.

The Radiant energy wave is not restricted to a single plane as shown in the diagram above, which is intended to indicate the difference between the electromagnetic field circling around the wire, and the Radiant Energy field which radiates away from the wire. Both of these fields occur at all points along the full length of the wire as shown here:

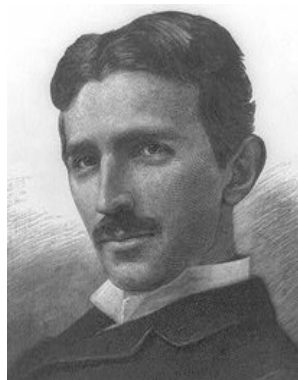


Radiant Energy, when converted to electrical power, produces a different kind of electrical power to that produced by batteries and by the mains supply. Power a motor with conventional electricity and it gets hot under load. Power the same motor by Radiant Energy electricity and under load the motor gets cold. Really overload it by stalling it and the motor housing is likely to be covered with frost. That is why this form of electricity is referred to as “cold” electricity.

In his book “Cold War Secrets - HAARP and Beyond”, Gerry Vassilatos quotes research work done in this area by Tesla and others:

Tesla’s Experiments

In 1889 Tesla began experimenting with capacitors charged to high voltages and discharged in very short time intervals. These very short pulses produced very sharp shockwaves which he felt across the front of his whole body. He was aware that closing a switch on a high-voltage dynamo often produced a stinging shock. This was believed to be static electricity and it occurred only at switch-on and only for a few milliseconds. However, in those few milliseconds, bluish needles of energy stand out from the electrical cables and they leak to ground, often through the bodies of any people standing nearby, causing immediate death if the installation is large. While the generators of that time were rated at some thousands of volts, these discharges were millions of volts in intensity. The generator problem was eliminated by the use of highly insulated switches which were provided with a very large ground connection.



Tesla was intrigued by this phenomenon which appeared to match the effect of his capacitor discharges. He calculated that the voltages produced were hundreds of times greater than could be supplied by the capacitor or generator. It was clear that the power supplied was being amplified or augmented in some way, but the question was, from where was the extra energy coming?

Tesla continued to investigate through experiments, taking precautions against the high voltages being produced. He was soon able to produce these shockwaves whenever he wanted to. The shockwaves produced a stinging sensation no matter where he stood in his laboratory, and hands and face were particularly sensitive to the wave. These waves radiated out and penetrated metal, glass and every other kind of material. This was clearly not an electromagnetic wave, so he called the new wave ‘Radiant Electricity’.

Tesla searched the literature to find references to this radiant energy but he could not find much. In 1842, Dr. Joseph Henry had observed that steel needles were magnetised by a Leyden Jar spark discharge located on a

different floor of the building. The magnetising wave had passed through brick walls, oak doors, heavy stone and iron flooring and tin ceilings to reach the needles located in a vault in the cellar.

In 1872, Elihu Thomson took a large Ruhmkorff Spark Coil, attached one pole of the coil to a cold-water pipe and the other pole to a metal table top. This resulted in a series of massive sparks which electrified the metal door knob of the room and produced the stinging shockwaves which Tesla was investigating. He found that any insulated metal object anywhere in the building would produce long continuous white sparks discharging to ground. This discovery was written up briefly in the Scientific American journal later that year.

Tesla concluded that all of the phenomena which he had observed, implied the presence of "a medium of gaseous structure, that is, one consisting of independent carriers capable of free motion - besides the air, another medium is present". This invisible medium is capable of carrying waves of energy through all substances, which suggests that, if physical, its basic structure is much smaller than the atoms which make up commonplace materials, allowing the stream of matter to pass freely through all solids. It appears that all of space is filled with this matter.

Thomas Henry Moray demonstrated this energy flow passing through glass and lighting standard electric light bulbs. Harold Aspden performed an experiment known as the "Aspden Effect" which also indicates the presence of this medium. Harold made this discovery when running tests not related to this subject. He started an electric motor which had a rotor mass of 800 grams and recorded the fact that it took an energy input of 300 joules to bring it up to its running speed of 3,250 revolutions per minute when it was driving no load.

The rotor having a mass of 800 grams and spinning at that speed, its kinetic energy together with that of the drive motor is no more than 15 joules, contrasting with the excessive energy of 300 joules needed to get it rotating at that speed. If the motor is left running for five minutes or more, and then switched off, it comes to rest after a few seconds. But, the motor can then be started again (in the same or opposite direction) and brought up to speed with only 30 joules **provided** that the time lapse between stopping and restarting is no more than a minute or so. If there is a delay of several minutes, then an energy input of 300 joules is needed to get the rotor spinning again.

This is not a transient heating phenomenon. At all times the bearing housings feel cool and any heating in the drive motor would imply an increase of resistance and a build-up of power to a higher steady state condition. The experimental evidence is that there is something unseen, which is put into motion by the machine rotor. That "something" has an effective mass density 20 times that of the rotor, but it is something that can move independently and take several minutes to decay, while the motor comes to rest in a few seconds.

Two machines of different rotor size and composition reveal the phenomenon and tests indicate variations with time of day and compass orientation of the spin axis. One machine, the one incorporating weaker magnets, showed evidence of gaining strength magnetically during the tests which were repeated over a period of several days.

This clearly shows that there is an unseen medium which interacts with everyday objects and actions, and confirms Tesla's discovery. Tesla continued to experiment and determined that a very short uni-directional pulse is necessary to generate the radiant energy wave. In other words, an alternating voltage does not create the effect, it has to be a DC pulse. The shorter the pulse time and the higher the voltage, the greater the energy wave. He found that using a capacitor and an arc discharge mechanism with a very powerful permanent magnet placed at right angles to the spark, improved the performance of his equipment by a major factor.

Additional experiments showed that the effects were altered by adjusting the duration of the electrical pulse. In each instance, the power of the radiated energy appeared to be constant irrespective of the distance from his apparatus. The energy was in the form of individual longitudinal waves. Objects placed near the equipment became powerfully electrified, retaining their charge for many minutes after the equipment was switched off.

Tesla was using a charging dynamo as a power source and he found that if he moved his magnetic discharger to one side of the dynamo, the radiant wave was positive. If he moved the magnetic discharger towards the other side of the dynamo, the radiant wave became negative in sign. This was clearly a new electrical force which travelled as light-like rays, showing them to be different in nature to the electromagnetic waves of Maxwell.

Investigating the effects of adjusting the duration of the pulses, Tesla found that a pulse train which had individual pulses with durations exceeding 100 microseconds, produced pain and mechanical pressures. At this duration, objects in the field visibly vibrated and were even pushed along by the field. Thin wires subjected to sudden bursts of the radiant field, exploded into vapour. When the pulse duration was reduced to 100 microseconds or below, the painful effect was no longer felt and the waves are harmless.

With a pulse duration of 1 microsecond, strong physiological heat was felt. With even shorter pulse durations, spontaneous illuminations capable of filling rooms with white light, were produced. Even shorter pulses produced

cool room penetrating breezes with an accompanying uplift in mood and awareness. These effects have been verified by Eric Dollard who has written about them in some detail.

In 1890, Tesla discovered that if he placed a two-foot long single-turn deep copper helix coil near his magnetic disrupter, the thin-walled coil developed a sheath of white sparks with long silvery white streamers rising from the top of the coil. These discharges appeared to have much higher voltages than the generating circuit. This effect was greatly increased if the coil was placed inside the disrupter wire circle. The discharge seemed to hug the surface of the coil with a strange affinity, and rode up its surface to the open end. The shockwave flowed over the coil at right angles to the windings and produced very long discharges from the top of the coil. With the disrupter charge jumping one inch in its magnetic housing, the coil streamers were more than two feet in length. This effect was generated at the moment when the magnetic field quenched the spark and it was wholly unknown at that time.

This train of very short uni-directional pulses causes a very strange field to expand outwards. This field resembles a stuttering electrostatic field but has a far more powerful effect than would be expected from an electrostatic charge. Tesla was unable to account for the enormous voltage multiplication of his apparatus using any of the electrical formula of his day. He therefore presumed that the effect was entirely due to radiant transformation rules which would have to be determined through experimental measurements. This he proceeded to do.

Tesla had discovered a new induction law where radiant shockwaves actually auto-intensified when encountering segmented objects. The segmentation was the key to releasing the action. Radiant shockwaves encountered a helix and "flashed over" the outer skin, from end to end. This shockwave did not pass through the windings of the coil but treated the surface of the coil as a transmission path. Measurements showed that the voltage increase along the surface of the coil was exactly proportional to the length travelled along the coil, with the voltage increase reaching values of 10,000 volts per inch of coil. The 10,000 volts which he was feeding to his 24 inch coil were being magnified to 240,000 volts at the end of his coil. This was unheard of for simple equipment like that. Tesla also discovered that the voltage increase was mathematically linked to the resistance of the coil winding, with higher resistance windings producing higher voltages.

Tesla then began to refer to his disrupter loop as his special "primary" and to the long helical coil as his special "secondary" but he never intended anyone to equate these terms to those referring to electromagnetic transformers which operate in a completely different way.

There was an attribute which baffled Tesla for a time. His measurements showed that there was no current flowing in the long copper 'secondary' coil. Voltage was rising with every inch of the coil, but there was no current flow in the coil itself. Tesla started to refer to his measured results as his "electrostatic induction laws". He found that each coil had its own optimum pulse duration and that the circuit driving it needed to be 'tuned' to the coil by adjusting the length of the pulses to give the best performance.

Tesla then noticed that the results given by his experiments paralleled the equations for dynamic gas movements, so he began wondering if the white flame discharges might not be a gaseous manifestation of electrostatic force. He found that when a metal point was connected to the upper terminal of the 'secondary' coil, the streamers were directed very much like water flowing through a pipe. When the stream was directed at distant metal plates, it produced electronic charges which could be measured as current at the receiving site but in transit, no current existed. The current only appeared when the stream was intercepted. Eric Dollard has stated that this intercepted current can reach several hundred or even thousands of amps.

Tesla made another remarkable discovery. He connected a very heavy U-shaped copper bar directly across the primary of his disrupter, forming a dead short-circuit. He then connected several ordinary incandescent filament bulbs between the legs of the U-shaped bar. When the equipment was powered up, the lamps lit with a brilliant cold white light. This is quite impossible with conventional electricity, and it shows clearly that what Tesla was dealing with was something new. This new energy is sometimes called "cold electricity" and Edwin Gray snr. demonstrated how different it is by lighting incandescent-filament bulbs directly from his power tube, submerging them in water and putting his hand in the water. Cold electricity is generally considered to be harmless to humans. Ed Gray's power tube operates by generating radiant electricity waves by using a spark gap, and collecting the energy using three encasing copper cylinders surrounding the spark gap. The cylinders are drilled with many holes as that enhances the pick-up and the load is driven directly from the current in the cylinders. When lighting bulbs, Ed used an air-cored transformer made of just a few turns of very heavy wire. I, personally, am aware of two people who have independently reproduced Ed's power tube.

Tesla viewed the streamers coming off his coils as being wasted energy so he tried to suppress them. He tried a conical coil but found that this accentuated the problem. He then tried placing a copper sphere at the top of his coil. This stopped the streamers but electrons were dislodged from the copper sphere, creating really dangerous

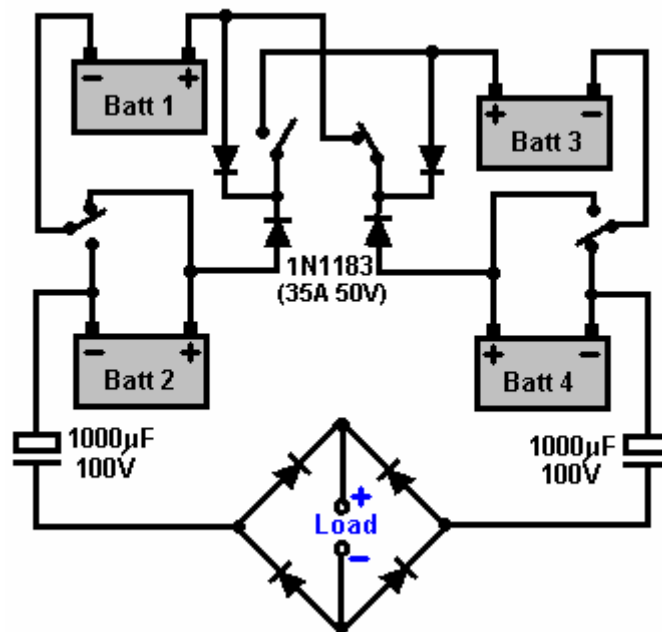
conditions. This implied that metals generate electron flows when struck by the coil streamers (as had been seen when the streamers had been aimed at remote metal plates and current was generated as a result).

Tesla designed, built and used large globe lamps which required only a single external plate for receiving the radiant energy. No matter how far away these lamps were from the radiant source, they became brilliantly lit, almost to the level of an arc lamp and far, far brighter than any of the conventional Edison filament lamps. By adjusting the voltage and the pulse duration of his apparatus, Tesla could also heat or cool a room.

The Tesla Switch

Nikola Tesla introduced the world to Alternating Current ("AC") but later on he moved from AC to very short, sharp pulses of Direct Current ("DC"). He found that by adjusting the frequency and duration of these high-voltage pulses, that he could produce a whole range of effects drawn from the environment - heating, cooling, lighting, etc. The important point to note is that the pulses were drawing energy directly from the immediate environment. Leaving aside the advanced equipment which Tesla was using during those experiments and moving to Tesla's simple-looking 4-battery switch, we discover the same background operation of sharp voltage pulses drawing free-energy from the environment.

Consider the Electrodyne Corp. circuit (The Manual of Free-Energy Devices and Systems, 1986, Vol 1) tested by them for a period of three years:



This simple-looking circuit needs to have an inductive load, preferably a motor, but that aside, consider the results of that very extended period of testing. If the switching rate and switching quality were of a sufficiently high standard, then the load could be powered indefinitely.

The batteries used were ordinary lead-acid batteries, and after the three years of tests, the batteries appeared to be in perfect condition. Their tests revealed a number of very interesting things. If the circuit was switched off and the batteries discharged to a low level, then when the circuit was switched on again, the batteries returned to full charge in under one minute. As no electrical charging circuit was connected to the system, the energy which charged those batteries had to be flowing into the batteries (and load) from outside the circuit. The similarity with the Bedini pulsed battery charger circuits immediately springs to mind, especially as no heating occurred in the batteries in spite of the massive charging rate. If the circuit was switched off and heavy current drawn from the batteries, then heat would be produced which is quite normal for battery discharging. The system operated lights, heaters, television sets, small motors and a 30-horsepower electric motor. If left undisturbed, with the circuit running, then each battery would charge up to nearly 36 volts with no apparent ill effects. Control circuitry was developed to prevent this over-charging.

Here we have spectacular battery charging and performance, quite outside the normal range associated with these ordinary lead-acid batteries. Are they being fed very short, very sharp pulses, like the previous two systems? It would look as if they were not, but one other very interesting piece of information coming from Electrodyne is that the circuit would not operate correctly if the switching rate was less than 100 Hz (that is 100

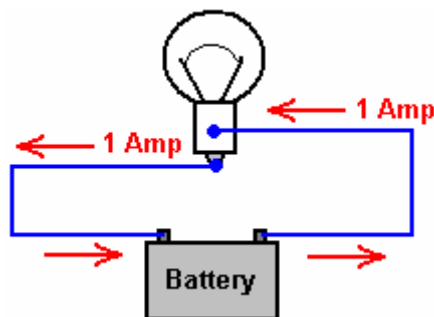
switchings in one second). The Electrodyne switching was done mechanically via three discs mounted on the shaft of a small motor. It is distinctly possible that the brushes pressing on those rotating discs experienced the equivalent of “switch bounce” which plagues mechanical switches used with electronic circuits. Instead of a single, clean change over from Off to On states, there is a series of very short makes and breaks of the circuit. If this happened with the Electrodyne mechanical switching, then the circuit would have experienced very short, sharp electrical pulses at the instant of switching. The fact that the switching speed had to reach one hundred per second before the effect started happening is certainly interesting, though not proof by any means.

One other detail reported by the Electrodyne testers, is that if the switching speed exceeded 800 times per second, that it was “dangerous” but unfortunately, they didn’t say why or how it was dangerous. It clearly was not a major problem with the batteries as they were reported to be in good shape after three years of testing, so definitely no exploding batteries there. It could well be as simple a thing that the voltage on each battery rose so high that it exceeded the voltage specifications of the circuit components, or the loads being powered, which is a distinct possibility. In my opinion, considering the way that the batteries responded, it would be perfectly reasonable to take it that short pulses were being generated by their mechanical system. If that is the case, then here is another system drawing free-energy from the environment via sharp voltage pulses.

The Tesla Switch circuit has some very interesting features. Pupils in school are taught that if a bulb is connected across a battery, a current flows from the battery, through the bulb and back to the battery. This current causes the bulb to light, and after a time, the battery runs down and is no longer able to light the bulb. This is completely correct.

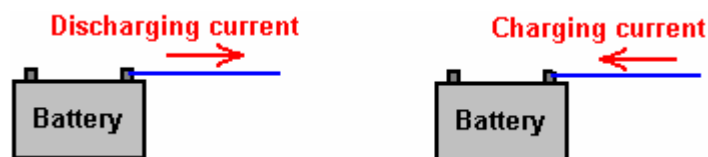
However, this teaching gives the wrong impression. It implies that the “work” done in lighting the bulb, uses up the electricity coming from the battery and that the battery somehow has a store of electricity, something like the sand in an hourglass or egg-timer, which when it runs out will no longer be able to light the bulb. In passing, it can be remarked that not a single electron which flows at a power station actually comes out of your mains wall socket. The reality is that the power station electrons flow in one winding of your local step-down transformer and cause a fluctuating magnetic field there which causes some of the many free electrons in your locality to flow into another winding of the transformer and then on to your wall socket. If you were to cause those same magnetic fluctuations yourself, then you would receive the same level of electrical power without the power company being involved.

Interestingly, those same school teachers will show the correct picture of the circuit, drawing it like this:



You will notice that the 1-amp current flowing out of the bulb is exactly the same as the 1-amp current flowing into the bulb. Exactly the same amount of current comes out of the bulb as the current which flows into the bulb. So, how much current is “used up” in doing the work of lighting the bulb? Answer: **None**. Energy is never destroyed, the most that can happen to it is that it gets converted from one form to another.

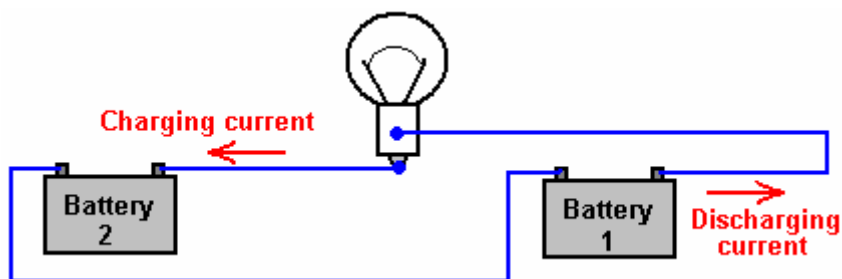
So why does the battery end up not being able to light the bulb any more? Well, that is a feature of the way that batteries operate. If the current flow is in one direction, then the battery gets charged up, and if it is in the other direction, then the battery gets discharged:



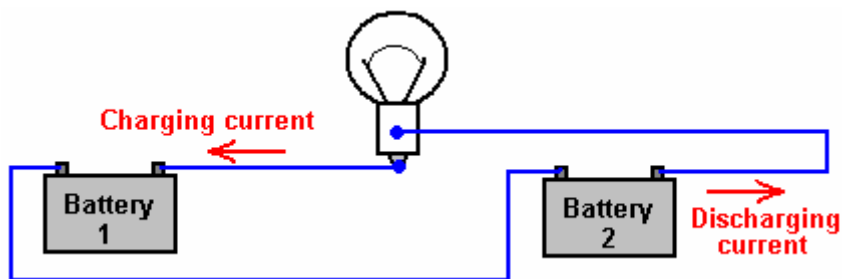
The battery getting run down, has nothing to do with the current flowing through the bulb, the battery would get run down if the bulb were left out of the circuit. The useful “work” of creating light by having the current flow through the bulb, does not “use up” any current, and more importantly, it does not “use up” any energy. Energy cannot be “used up” - it just gets transformed from one form to another. This is difficult to understand as we have

been taught that we have to keep buying energy from the electricity supply companies to power our equipment. The false idea is that we buy the energy, and it then gets “used up” in the equipment, so we have to buy some more to keep the equipment going. We accept it because that’s what we were taught. It isn’t true.

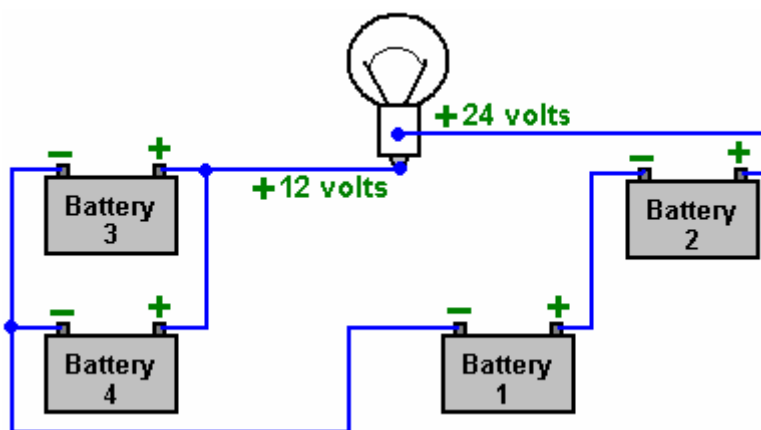
The current flowing through the bulb can be arranged to be a charging current for another battery. It can both light the bulb and charge another battery without needing any extra current:



Here, the circuit is powered by battery 1 as before, but this time the current goes on to charge battery 2. Yes, battery 1 gets discharged just as before, but the plus side is that battery 2 is getting charged up all the time. The final step is to swap the batteries over:



And now, the newly charged battery 2 lights the bulb and charges up battery 1 again. Seem impossible? Well it isn't. Nikola Tesla demonstrates this with his “4-battery switch” system where he chooses to use four identical batteries to implement this circuit:



With 12-volt batteries as shown here, the bulb has the same 12 volts across it as it would have had with the single battery shown in the first diagram, as batteries 1 and 2 are wired “in series” to give 24 volts, while batteries 3 and 4 are wired “in parallel” to give 12 volts. The Tesla switch circuit swaps the batteries over with 1 and 2 taking the place of 3 and 4, hundreds of times per second. If you wire a simple manual change-over switch and use it to change the battery arrangement as shown above, tests show that the batteries can power the light for a longer time than if they were not switched over. The snag is that batteries are not 100% efficient and so you can only take about half of the charging current back out of the battery again. For a Tesla 4-battery switch to operate indefinitely, there has to be inflow of outside energy to offset the poor efficiency of a lead-acid battery. NiCad batteries are more efficient and so they are sometimes used in this circuit, where they can work well.

There is another important factor involved in battery-charging circuits to be used with normal lead-acid batteries and that is the characteristics of the materials involved. The charging process in this switching circuit is carried out by electrons flowing down the connecting wire and into the battery. The electrons flowing along the outer surface of the wire, move very rapidly indeed. The main current inside the battery is carried by the charged ions

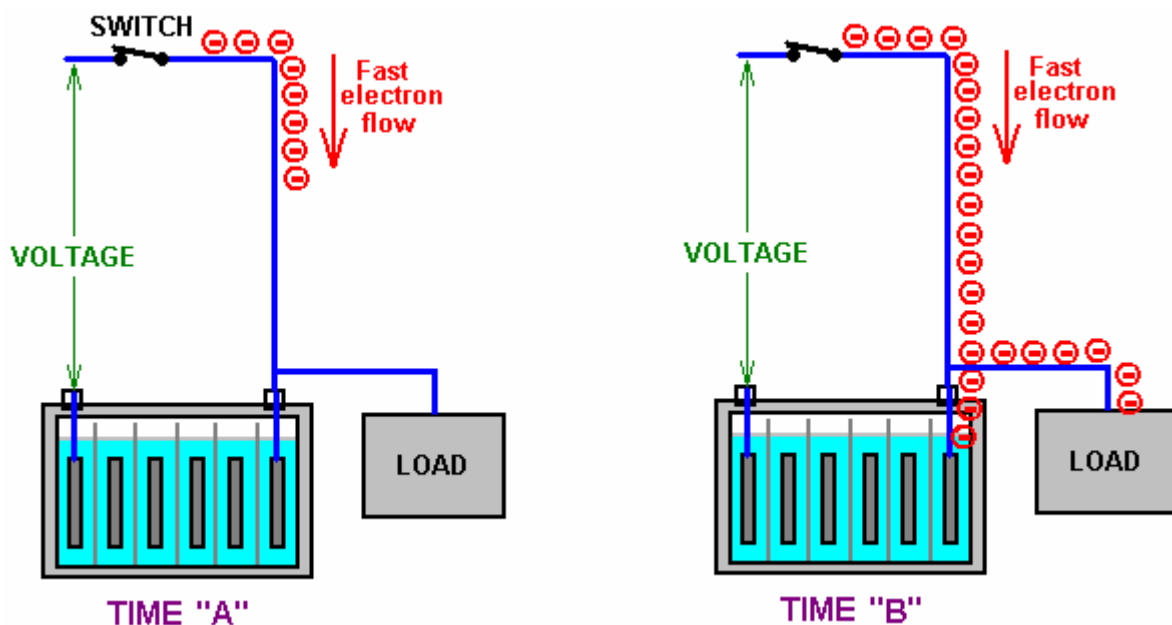
inside the lead plates inside the battery. These ions are hundreds of thousands of times heavier than the electrons. This doesn't matter at all once the ions get moving, but in the initial split second before the ions get going, the incoming electrons pile up like in a traffic jam tail-back. This pile-up of electrons pushes up the voltage on the terminal of the battery, well above the nominal battery voltage, and so the charging starts off with a high-voltage, high-current pulse into the battery.

This is not normally noticed when using a standard mains-powered battery charger, as switch-on only occurs once during the whole charging process. In the Tesla switch shown here, and in the Bedini circuits shown earlier, this is not the case. The circuit takes advantage of this difference in momentum between the electrons and the lead ions, and uses it repeatedly to great advantage. The technique is to use very short duration pulses all the time. If the pulses are short enough, the voltage and current drive into the receiving battery is far greater than a quick glance at the circuit would suggest. This is not magic, just common-sense characteristics of the materials being used in this circuit.

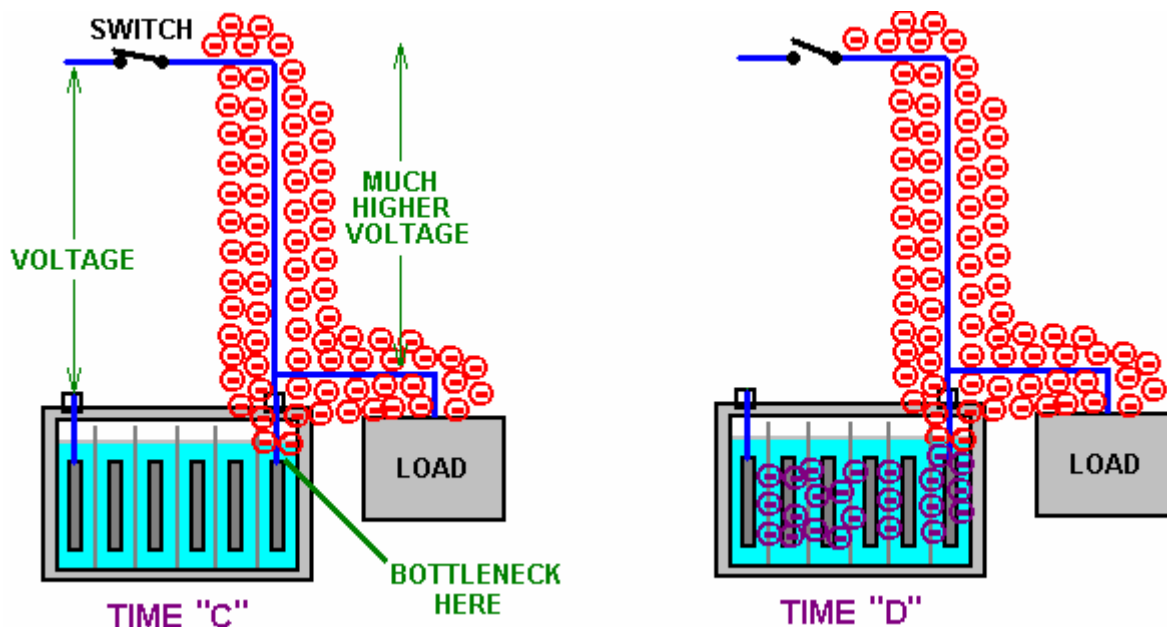
A person unfamiliar with these systems, seeing John Bedini's many advanced circuits for the first time, might get the impression that they are just crude, roughly-built circuits. Nothing could be further from the truth. John often uses mechanical switching because it gives very sharp switch-on and switch-off times. John is a complete master of this circuitry and knows exactly what he is doing

The Electrodyne Corporation tested the Tesla 4-battery circuit over a period of three years. They found that at the end of that period, the batteries did not show any unusual deterioration. The batteries used were ordinary lead-acid batteries. The system operated lights, heaters, television sets, small motors and a 30-horsepower electric motor. If the batteries were run down to a low level and then the circuit switch on with a load, the recharging of the batteries took place in under one minute. No heating was experienced during this rapid charging. Heat was only produced during discharge cycles. They used mechanical switching and stated that below 100 Hz there was not much advantage with the circuit and above 800 Hz it could be dangerous.

They didn't mention why they consider that higher rates of switching could be dangerous. If we consider what exactly is happening, perhaps we can work out why they said that. The charging situation is like this:

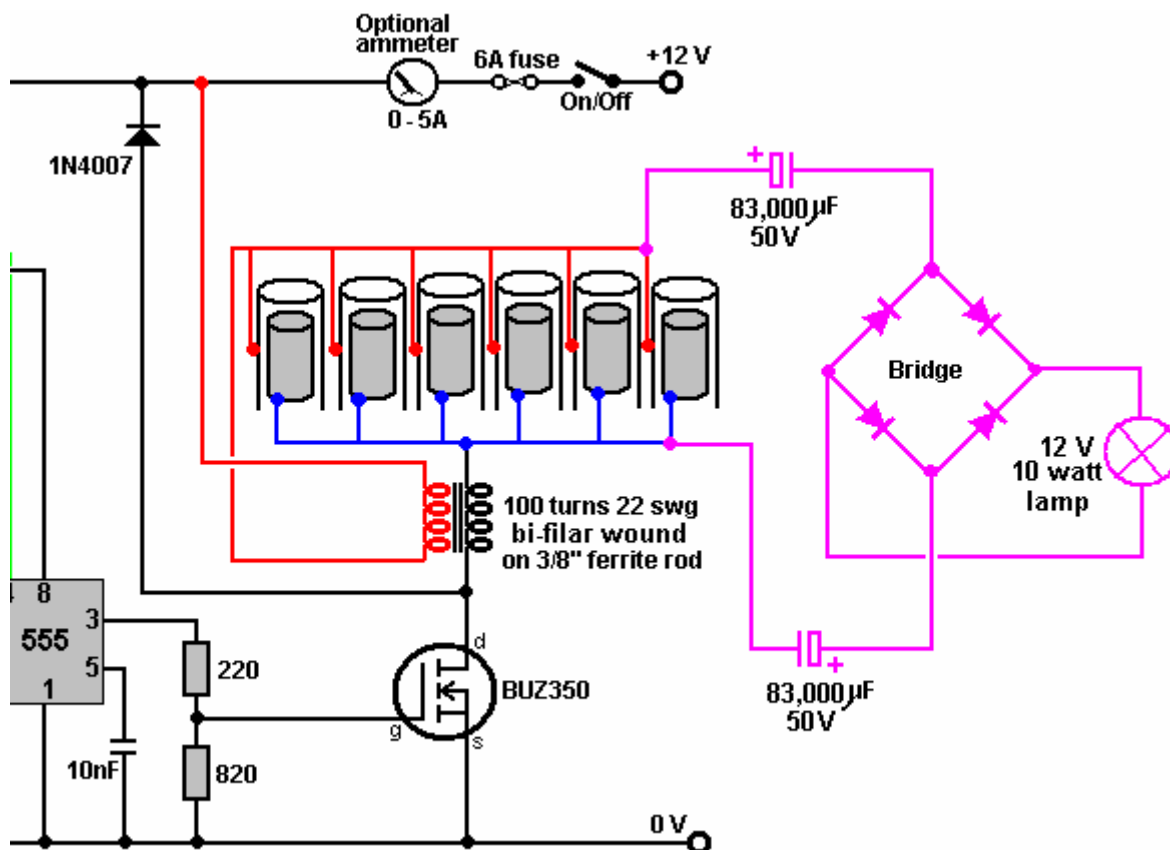


At Time "A" the switch closes, connecting a voltage source (battery, charged capacitor, or whatever) to a lead-acid battery. Electrons start flowing down the outside of the connecting wire. Being very light and having little obstruction, they move very fast indeed (the electrons inside the wire only move a few inches per hour as getting through the wire is difficult). All goes well until Time "B" when the leading electrons reach the lead plates inside the battery. Here, they have a problem, because the current flow through the plates is carried by lead ions. Lead ions are very good at carrying current, but it takes them a split second to get going due to their inertia. That split second is critical and it opens the door to free-energy. In that split second, the electrons pile up because they are still arriving down the wire at very high speed. So, at Time "C" they have built up into a large body of electrons.



This large body of electrons has the same effect as if there had been a sudden connection to a much higher voltage source capable of supplying a much higher current. This situation only lasts for a very short time, but it has three very important effects. Firstly, at Time "D", it drives a much larger current into the battery than could reasonably be expected from the original voltage source. Secondly, this high voltage pulse alters the Zero-Point Energy field in which the circuit is located, causing extra energy to flow into the circuit from the outside environment. This is a bit like sunshine generating current flow in an electric solar panel, but instead of visible sunshine, the energy flow is not visible to us and we have no instruments which react to this excess energy. Thirdly, the excess energy flows into the battery, charging it much more than would be expected, and at the same time, some of the excess energy flows into the load, powering it as well, and further, some of the flow goes back into the driving circuit, lowering its current draw.

Remember Dave Lawton's Water Fuel Cell? Well Dave also connects a bulb across the cell to extract additional energy:



A really interesting feature of this extra power draw-off is that when Dave adjusts the frequency to the optimum value, the supply voltage remains unchanged but the input current drops noticeably and the brightness of the lamp increases markedly. Less input power at the same time as greater output power - the circuit hasn't changed, so from where is the extra power coming? One possibility is certainly that it is flowing in from the environment.

So, returning to our excess energy is collected from the environment and used to both charge the battery and at the same time, perform useful work. The old saying "you can't have your cake and eat it" just does not hold in this situation as that is exactly what happens. Instead of the battery being run down from powering the load, the load gets powered **and** the battery gets charged up at the same time. This is why, with this system, a discharged battery can be used to apparently run a motor. It works because the plates in the discharged battery are made of lead which forms a bottleneck for the electron flow, causing the environment to charge the battery and run the load at the same time. That is why you get what looks like the magical effect of a discharged battery appearing to power a load. In passing, the more discharged the battery, the faster it charges as the environment adjusts automatically to the situation and feeds greater power into a flat battery. The environment has unlimited power available for use. John Bedini who is expert in this field has had motors running continuously for three or more years with the battery never running down and the motor doing useful work all the time. Great battery? No, - great environment !!

Not necessarily exactly the same effect, but Joseph Newman's motor exhibits this same result, much to the discomfort of a conventionally taught scientist, who measured the motor at a minimum of 400% "efficiency" (really COP = 4) and probably nearer 800% when all the major factors were taken into account. One thing which really bothered him was that when powering the motor on almost completely discharged dry cell batteries, the voltage measured at the motor was some three times the voltage at the batteries. That is very upsetting for a scientist who is not aware of the zero-point energy field and considers most systems to be "closed" systems, when in fact, there are practically no "closed" systems in our universe. Surprise, surprise, the Newman motor operates on electrical pulses.

Anyway, returning to the Tesla 4-battery switch. For the vital build up of excess electrons to take place, the switch closure has to be very sudden and very effective. A thyristor or an SCR might be suitable for this, but the sharp switching of a PCP116 opto-isolator driving an IRF540 FET is impressive and a TC4420 FET-driver could substitute for the opto-isolator if preferred. It is likely that the Tesla 4-battery switch circuit switching in the 100 Hz to 800 Hz region operates in this way.

This drawing in of excess energy from the environment can be further enhanced by suddenly cutting off the electron flow from the original voltage source while the excess electron pile-up is still in place. This causes a sudden (very brief) further surge in the excess power, building up the voltage and current even further and increasing the battery charging and load-powering drive.

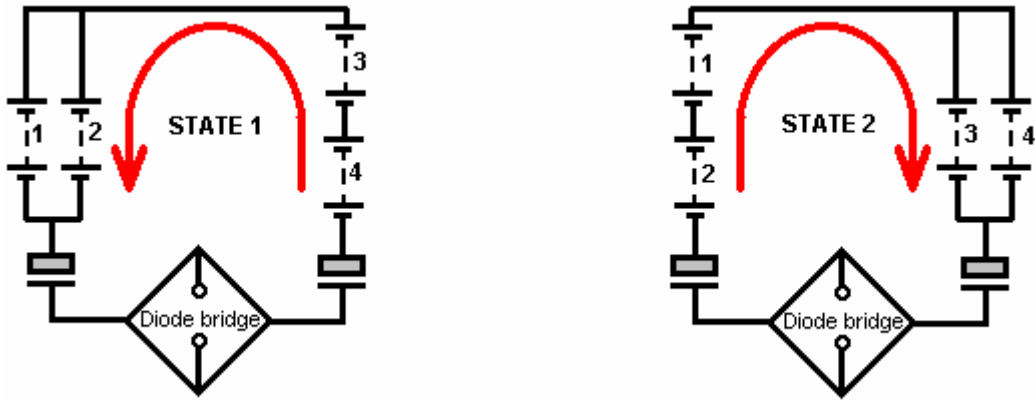
An even greater effect can be had if the next, short, sharp pulse is applied to the battery/load combination, just before the effect from the last pulse dies away. It may be that this is the situation which the Electrodyne Corporation people encountered when the pulse rate went over the 800 Hz rate. It may not be so much a case that the battery and load could not take the power, but more a case that the components which they were using were not rated high enough to carry that level of power. They do mention that if they went further, that they found that some of their circuit components started failing through not having high enough ratings (notice that the output capacitors are rated at 100 volts which is eight times the nominal battery voltage). This was hardly a problem, considering that they had 12-volt batteries operating happily at 36-volts if they wanted that. They ended up building circuitry to hold the voltages down to a convenient level.

To summarise the situation. The Tesla 4-battery switch appears to do the impossible through:

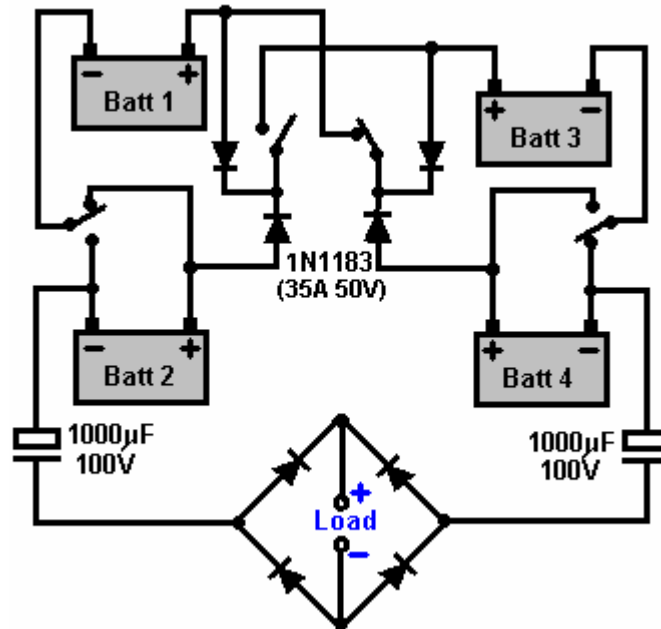
1. Catching the current coming out of the load and using it to charge another battery instead of wasting it.
2. Providing very short, sharp, and rapid switching pulses which exploit the momentum of the lead-ions current flow.
3. Pulling extra energy in from the local environment to both charge the batteries and power the load at the same time

This leaves aside the possibility of two further gains available through very precise timing of the switching pulses (mainly to make the power available more easily and cheaply handled). So, it should be borne in mind that the practical issues involved in getting this circuit operating effectively are primarily about very fast, clean and well-timed switching. Multi-strand, very large diameter, high-current rated wire will be helpful in getting the draw of excess energy into the circuit.

Here is the switching sequence for the Tesla 4-battery switch system:



As you can see, this is essentially the same circuit with batteries 1 and 2 swapping over with batteries 3 and 4. But he has added in two capacitors and a diode bridge of four diodes to power the “load” which needs to be inductive for this circuit (transformer, motor, etc.). The circuit used by the Electrodyne Corp. testers was:



Please Note very carefully that people familiar with conventional electronics will immediately say that the diodes in this circuit are the wrong way round. They aren't. This is not a conventional circuit. Firstly, the batteries need to be conditioned for using cold electricity (see Howard Halay's method in chapter 6). Secondly, the 1N1183 diodes used here break down suddenly when reverse biased, and that pulse recharges conditioned batteries very quickly.

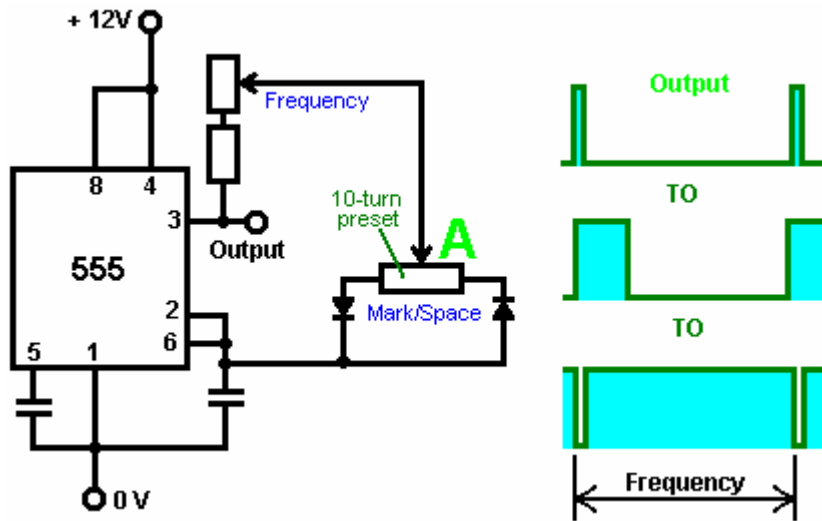
This circuit was reported to have excellent results using six On/Off switches on a motor-driven cam arrangement:



Here three discs are mounted on the shaft of a motor as shown here. These are insulated from each other and

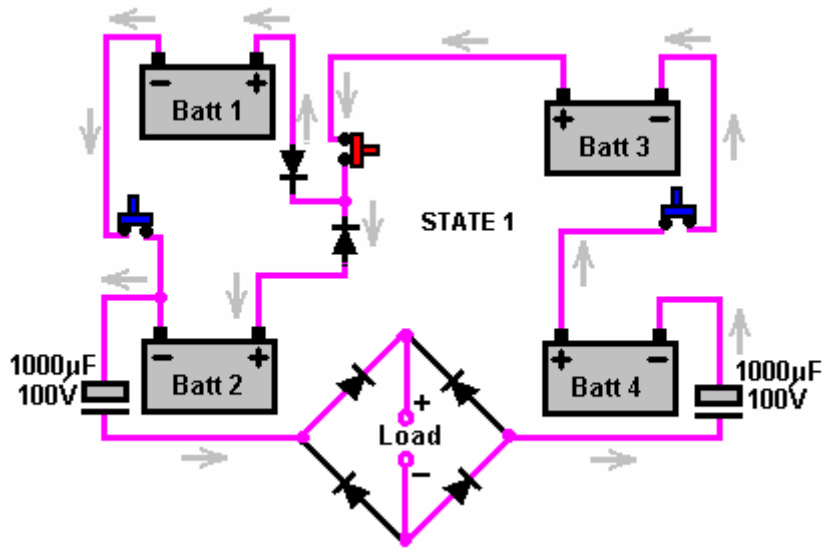
the conducting sectors are aligned, and so are the brushes. The arrangement gives a mechanical switching such that when the upper brushes are short-circuited together, the lower brushes are open-circuit. As there is a requirement for an inductive load for this circuit, the motor of a mechanical switching system could well form part of the load. Many people prefer solid-state switching to mechanical switching and so set out to design suitable circuits. It needs to be borne in mind that a very precise 50% Mark/Space ratio is essential and that may not be so easy to arrange. The common idea of using mechanical relays is not very practical. Firstly, relays have trouble switching at the speeds suggested for this circuit. Secondly, with a contact life of say, two million and a switching speed of just 100 times per second, the relays would reach their projected lifespan after two weeks of operation, which is not a very practical option.

To get an exact 50% Mark/Space ratio, possibly the following style of circuit could be used with a multi-turn preset resistor in position "A":

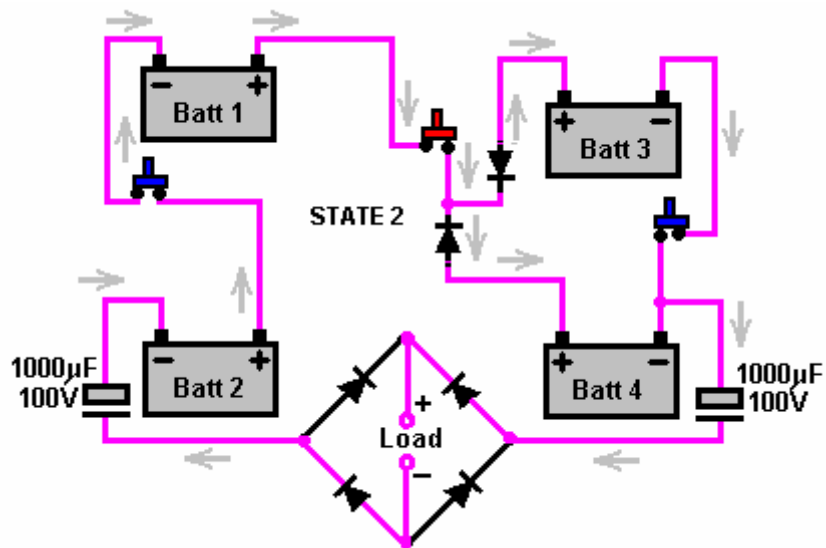


Here, the frequency is not noticeably affected by adjustment through a very wide range of Mark/Space settings. The output from Pin 3 needs to drive a very sharp switching combination such as a TC4420 FET driver connected to IRF540 FETs.

As the circuit diagram used by the Electrodyne Corp. people is a little difficult to follow, perhaps the following diagrams may help by showing the current flow during the two states:

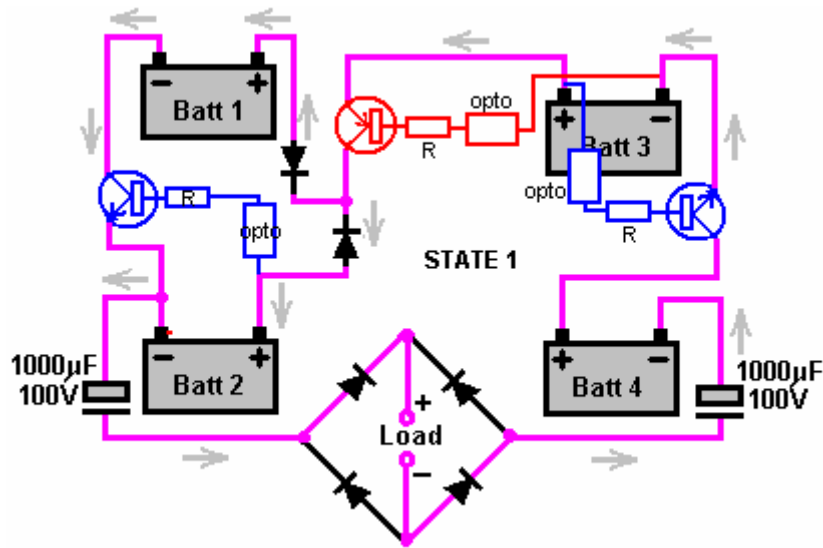


Here, batteries 1 and 2 are wired across each other while batteries 3 and 4 are wired in series (in a daisy-chain). This needs three On/Off switches and the two diodes are inserted so that the plus terminal of battery 1 is not permanently connected to the plus terminal of battery 2, because in State 2, that connection must not be made.

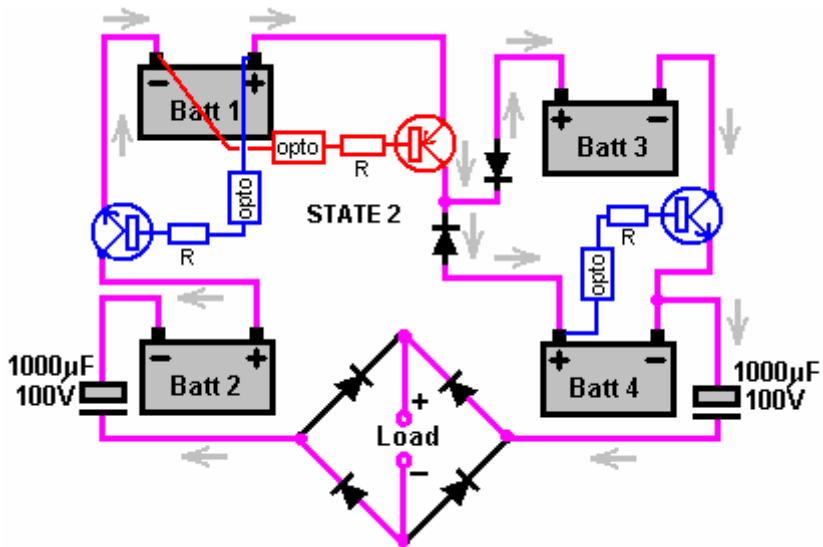


The State 2 wiring is almost identical, requiring another three On/Off switches and two diodes to avoid a permanent link between the plus terminals of batteries 3 and 4.

Here is a suggestion for doing that with PCP116 fast-operating opto-isolators:

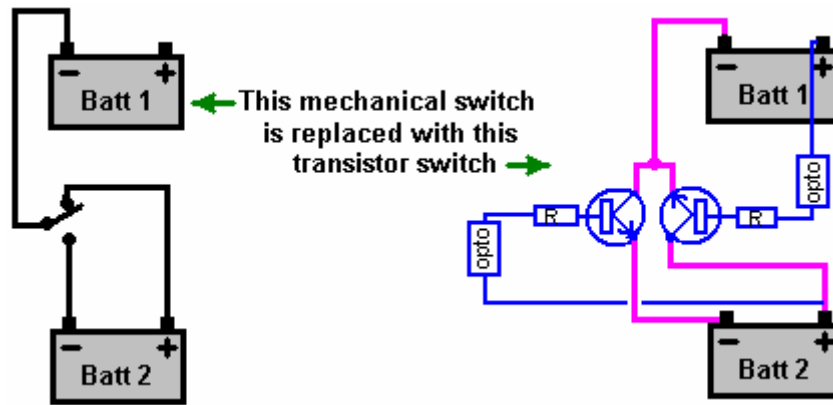


Each of the three mechanical switches are replaced with a transistor - one PNP type and two NPN type. These need to be able to handle 30 amps, so although not shown here, they will probably be Darlington pairs with the low gain of the high-power transistor being boosted by the additional gain of a driver transistor, perhaps something like a 2N3055 / 2N2222A combination. The transistor base current comes via a limiting resistor fed from an appropriate battery terminal a fixed 12 volts above it. The switching is controlled via an opto-isolator and the three opto isolators which switch together (shown above) are driven from one side of an astable multivibrator. The other three opto-isolators needed to perform the switching for State 2, will be Off during State 1, so they will be driven by the inverted version of the same oscillator waveform. This ensures that three will be On and three will be Off at the same time.

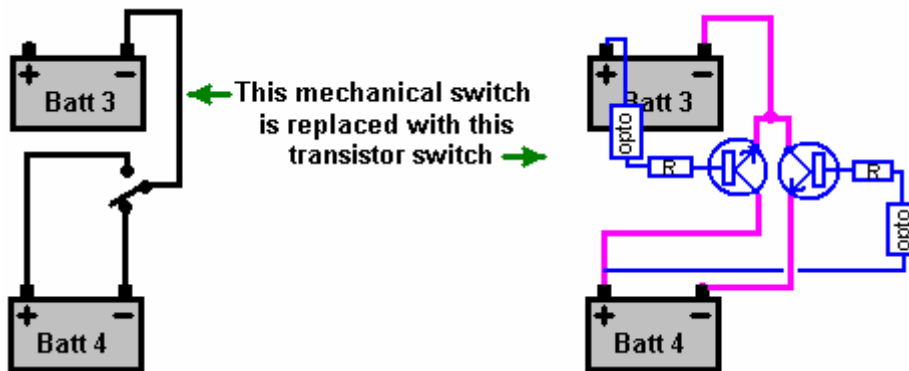


The suggested transistor switching for the State 2 situation is shown above. This is just an attempt to perform the switching with the most simple components available, and has been shown to work in practice.

The mechanical changeover switch can be replaced with transistors:



and



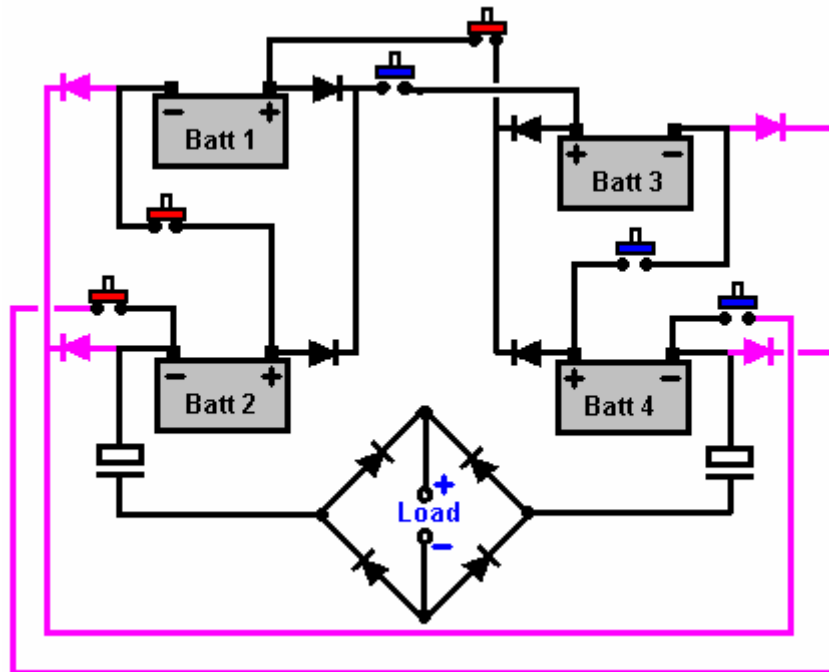
The Electrodyne Corp. experience indicates that it is likely that additional circuitry will be needed to cut off the extra power when the energy in the batteries rises to the point where it could endanger the equipment which it is powering or the components in the circuitry.

The electronics tutorial which forms part of this eBook shows the principles which can be used for the design and construction of this kind of circuitry. It might be sensible to have the control circuitry kick in at fourteen or fifteen volts and drop out again when the battery voltage drops back to 12.5 volts or so.

This switching circuit is said to be able to power its load indefinitely. It is also said that if one of the batteries is fully discharged, or nearly fully discharged, then putting it in any of the four positions returns it to full charge within one minute.

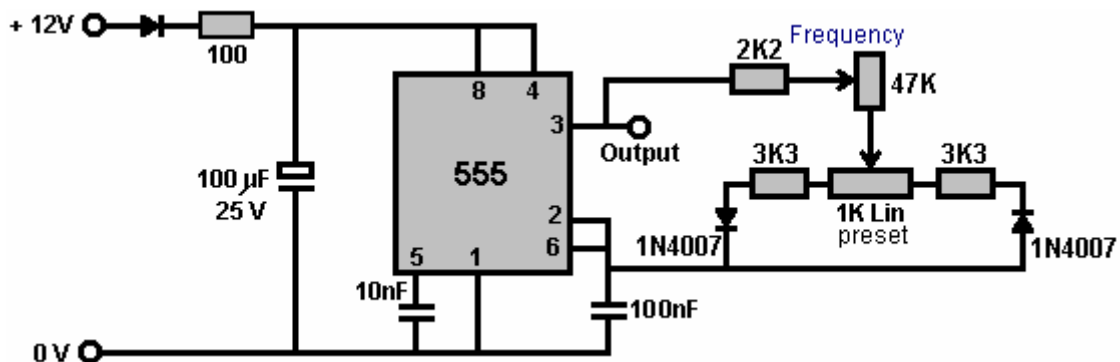
The connecting wires should be at least 30 Amp current carrying capacity and the individual diodes and the diode bridge are rated at 35 Amps 50 Volts. The circuit is intended for use with lead/acid batteries but it has been used successfully with rechargeable NiCad batteries. The circuit provides about 12 volts as the output, so mains equipment would be operated using a standard, commercial "inverter" which converts this low DC voltage to normal mains AC voltage capable of powering TV sets, DVD recorders, or whatever.

There have been various different versions of the Tesla 4-battery switch circuit. Some of these show additional diodes, making an absolutely symmetrical circuit where the current flow can continue even if the load is disconnected, as shown here:



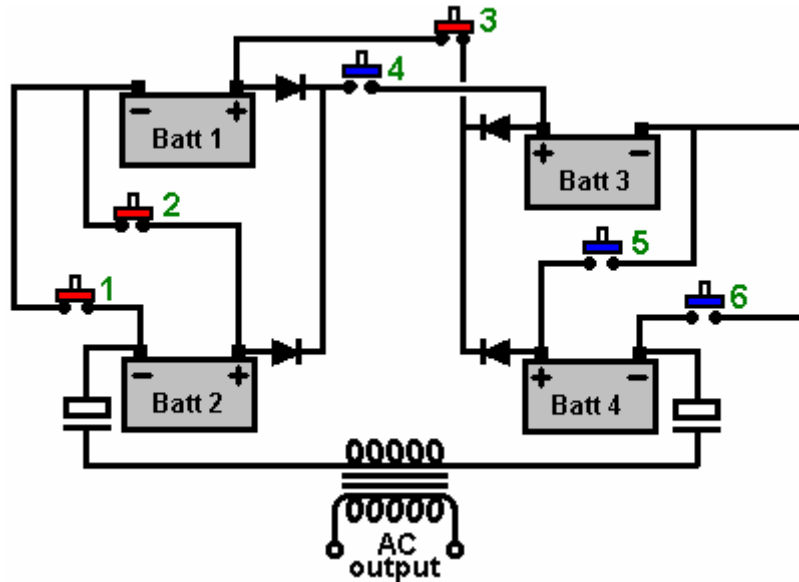
I have been asked to explain how the switching might be achieved. Usually there are many different way to achieve any wanted effect and switching circuits are no exception. What follows then is just a suggestion for one possible way of doing the switching and must **not** be thought of as **the** way in which the switching must be done.

The main objectives for the switching circuit are to have very fast switching and to have an exactly equal "On" period for the two switched states. As electronic components have manufacturing tolerances, it is not possible to have components with exactly the same values unless they are selected from a large stock of the same component. To deal with this situation, and avoid spending large amounts by buying high-specification components, we will aim for a manually adjusted circuit, where the switch "On" time can be adjusted to give exactly the right value:

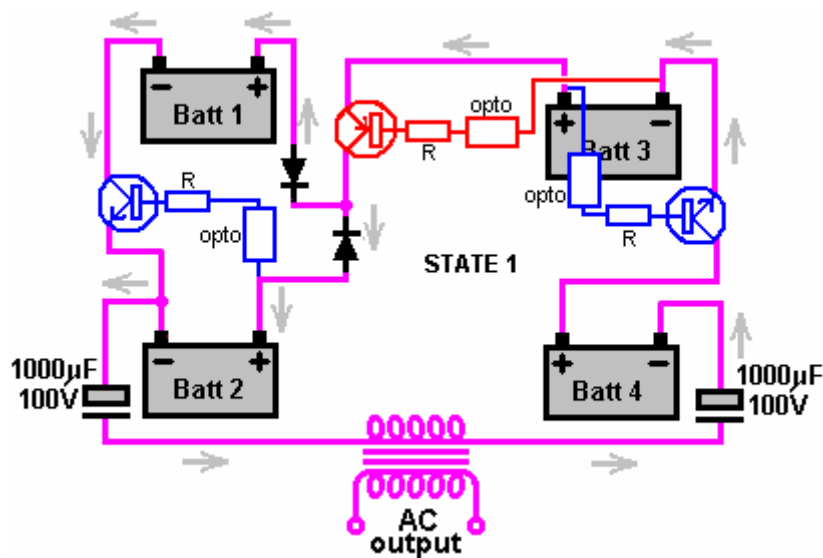


This circuit allows the Mark-Space ratio to be adjusted without altering the frequency, and the frequency can be adjusted without affecting the Mark-Space setting in any way. In the Tesla Switch circuit, three switches need to be in their On position and the other three switches in their Off position, so we will arrange this by using the ordinary NE555 timer circuit shown above, with it's adjustable Mark-Space ratio (that is, variable On-to-Off ratio). We will use this circuit to drive six opto-isolators which will turn the six transistors On and Off in groups of three as required. To get the very high switching speed needed, PCP116 opto isolators should be used and although these are difficult to find, every effort should be made to get them as they enhance the switching speed.

One feature of the Tesla Switch is the fact that it should have an inductive load. In simple terms, that means that the load should be a motor or a transformer. The need for an inductive load may well be the back-EMF voltages which are developed when the current flowing through the load is cut off suddenly. So, let's start with the circuit shown below which has a transformer as the load. In this circuit, switches 1, 2 and 3 switch On and Off at the same time, and switches 4, 5 and 6 form the second group. If one group of three switches is On, then the second group of switches needs to be Off.

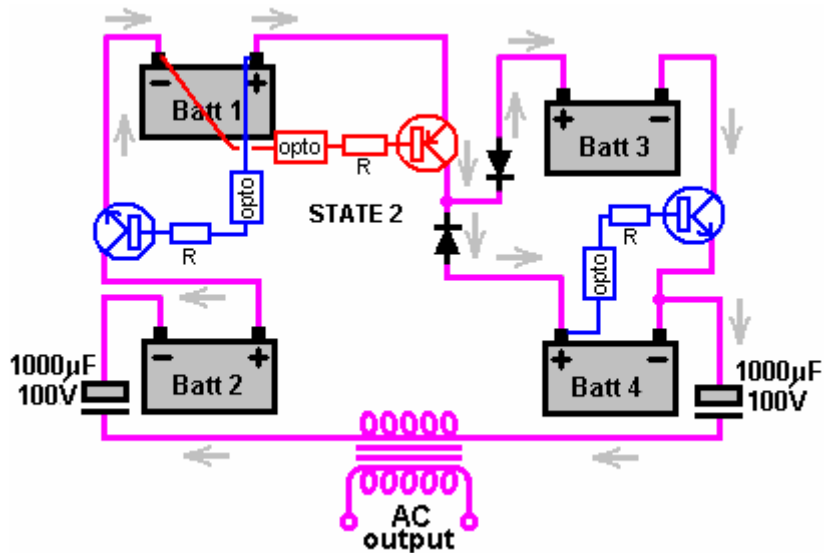


The following details show the preliminary stages of an implementation using 4N25 opto-isolators which are not nearly as satisfactory as PCP116 chips which switch typically 30 times faster. However, the circuit adaption is very minor in that it is only one board which needs to be altered. The circuitry choice was as follows:

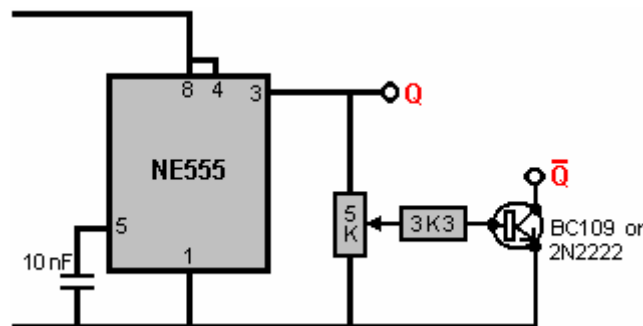


Here, each of the three mechanical switches are replaced with a transistor - two NPN type and one PNP type. As these were required to be able to handle 30 amps, the initial build used the Darlington pair devices MJ11016 for the NPNs and MJ11015 for the PNPs as these are rated at 30 amps and have a minimum gain of 1,000, allowing quite low switching currents for the control circuitry.

The switching is controlled via an opto-isolator and the three opto isolators which switch together as shown in the diagram above, are driven by the output of a 555 timer chip astable multivibrator (Chapter 12 explains all of this, so if you are not familiar with these things, then perhaps it would be a good idea to read through that chapter now). The other three opto-isolators needed to perform the switching for State 2, will be Off during State 1, so they will be driven by the inverted version of the same 555 signal. This ensures that three will be On and three will be Off at any time.



We need to get an inverted output from the timer circuit, that is, an output which goes high when the 555 timer chip goes low and which goes low when the 555 timer chip output goes high. There are various ways to do this, but the way shown here is the very simple method of using a transistor. If we were using mechanical switching, we would choose to use a switch which opens one set of contacts before closing the other set. We can arrange that by making the switch-on of the inverting transistor adjustable, like this:



The 5K variable or preset resistor is placed across the output of the NE555 timer chip. This resistor will have either a very low voltage across it or a voltage nearly the same as the battery supply. Please remember that the 555 chip can't handle supply voltages over 15 volts and will burn out if you feed them anything more than that. The Tesla Switch circuit with 12 volts batteries should be ok as you don't want the batteries to exceed 14 volts anyway.

When the 5K variable resistor has a high voltage on it, every voltage from zero to that high voltage can be selected by moving the slider of the resistor along its track. At some point when the slider is gradually moved up from the minimum voltage point, the transistor will turn on. The 3.3K resistor limits the current if the slider is moved to the very highest voltage point. The output transistor can be a BC109 or a 2N2222 type as these are high-gain types easily capable of handling the tiny current needed to drive three opto-isolators.

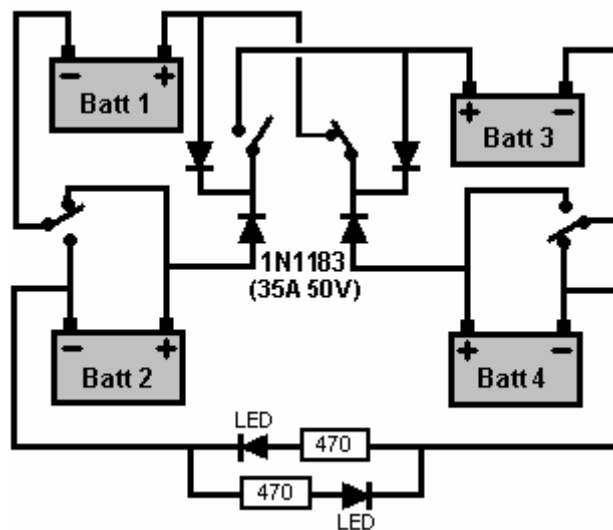
The variable resistors come in a wide range of types. It is probably best to use a preset type as they are very easy to adjust and hold their settings very solidly. Also, when the correct setting is found, the component will be left on that position permanently. Some common types are:



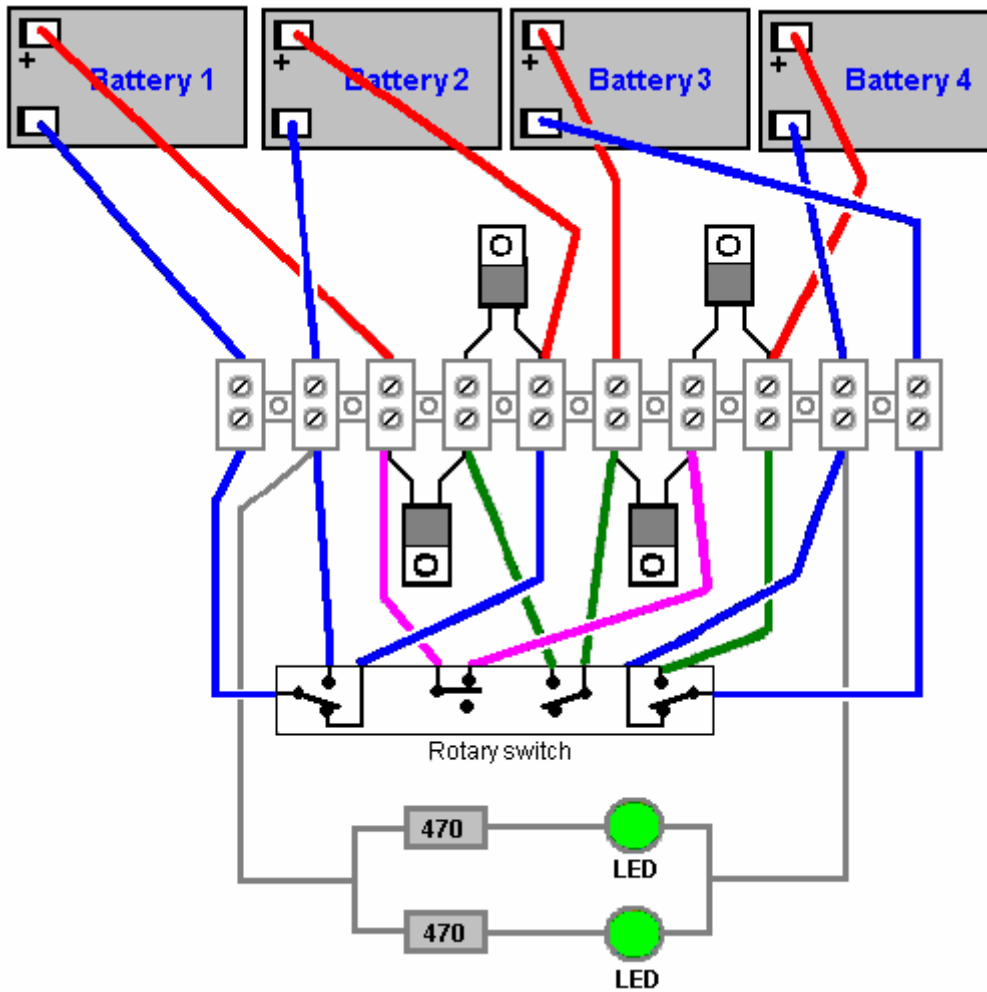
where some can be adjusted from the top and others adjusted from the side. All of them can be mounted directly on the strip-board or printed circuit board used to construct the circuit.

The initial build can be done in simple stages. This is to ensure that the switch wiring is correct before the semiconductor switching is attempted. Although the circuit does not show it, it would be no harm to have a fuse on each battery as a battery holds a considerable store of electrical energy and is easily capable of starting a fire if there is an inadvertent short-circuit. The excessive current draw caused by a short-circuit is not visible, and the first you know of it with a battery-powered circuit is the burning smell and wisp of smoke. Even using a mains-powered power supply unit with voltage and current displays, it is still very easy indeed to miss a short-circuit as you tend not to be watching the current display when the problem occurs.

To make the assembly and subsequent adjustment simple, a standard strip of ordinary screw-connectors is used. For initial testing, a four-pole three-way wafer switch is used. The switch provides the two changeover switches and the single On switch and the single Off switch. It also has the advantage that the third switch position switches the entire circuit off. The initial test, uses a low-current load of two LEDs with limiting resistors wired in opposite directions. This shows the direction of current flow and confirms that the switching is working correctly. By omitting the capacitors and pulse switching, it allows leisurely checking of the wiring and operation:

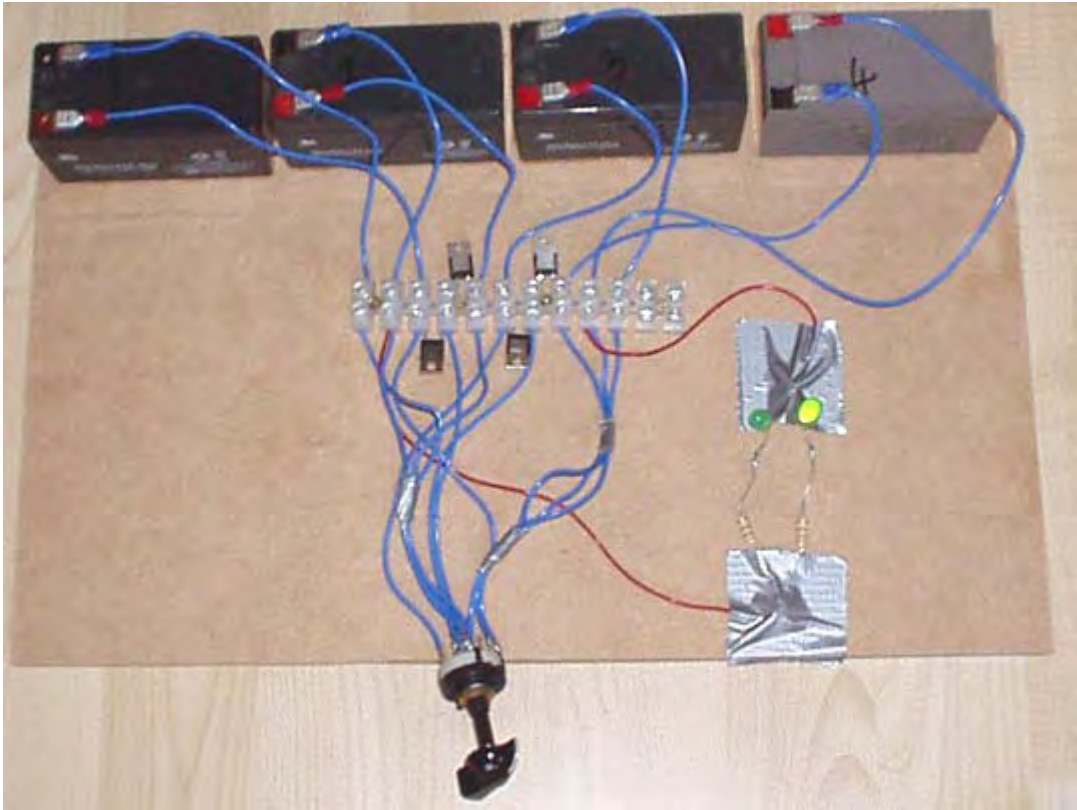


The physical layout with a mechanical rotary 4-pole 2-way switch could be:

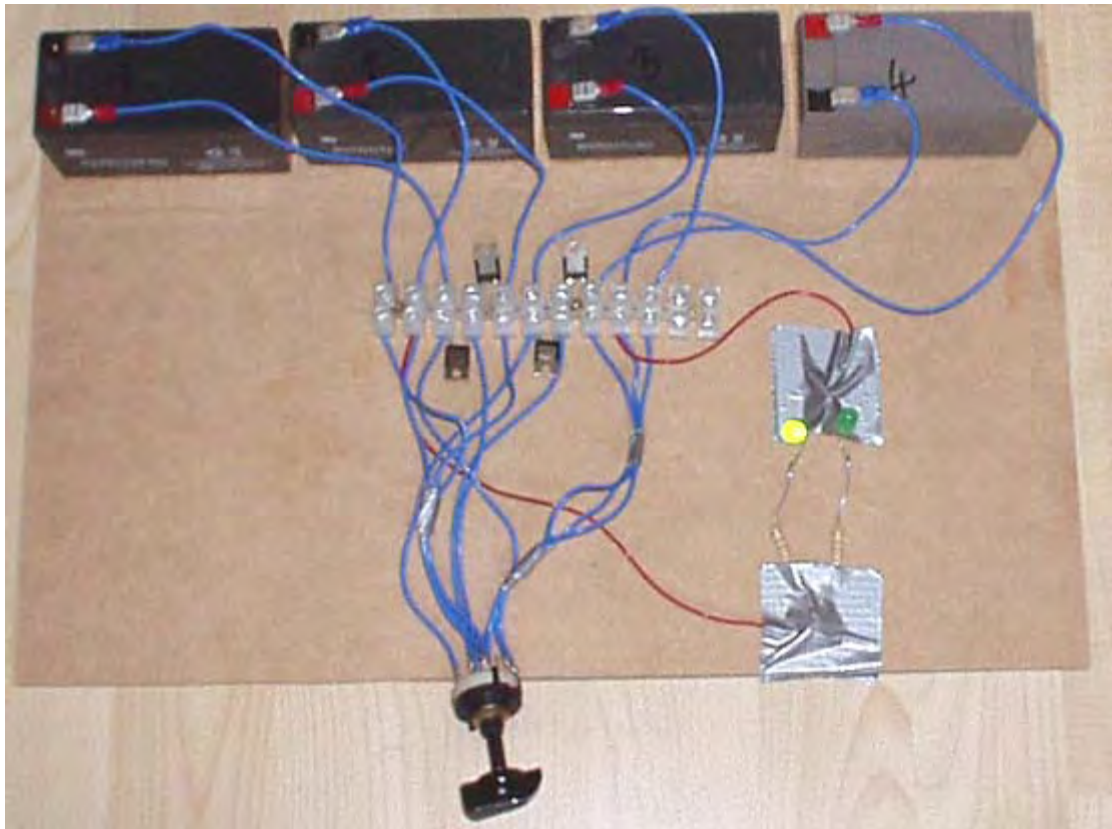


And the diodes used here happen to be high-speed, IXYS type DSEI 12-10A which were to hand and which are rated at 1,000 volts, 12 amps. While this does limit the initial current capacity, there is no reason why these cannot be doubled up or tripled up to allow a higher current. The batteries used initially in the test are very small 1.2 AHr types and so the allowable current draw from them is quite limited. If this circuit does not operate correctly straight off, it is quite likely that the diodes are the wrong way round. In this physical layout, the back of the diodes all face upwards.

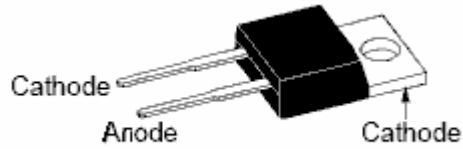
This particular build looks like this:



State 1 with the right-hand LED lit.

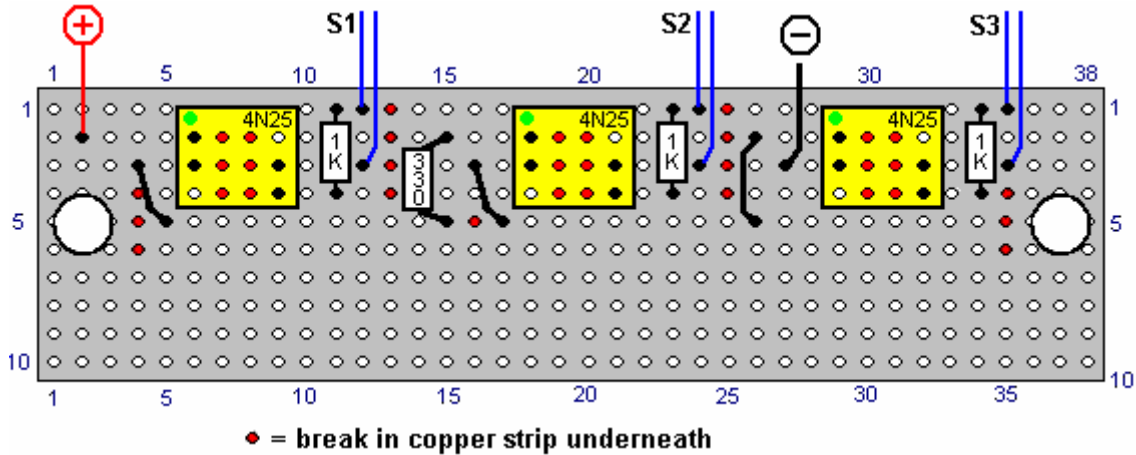


State 2 with the left hand LED lit.

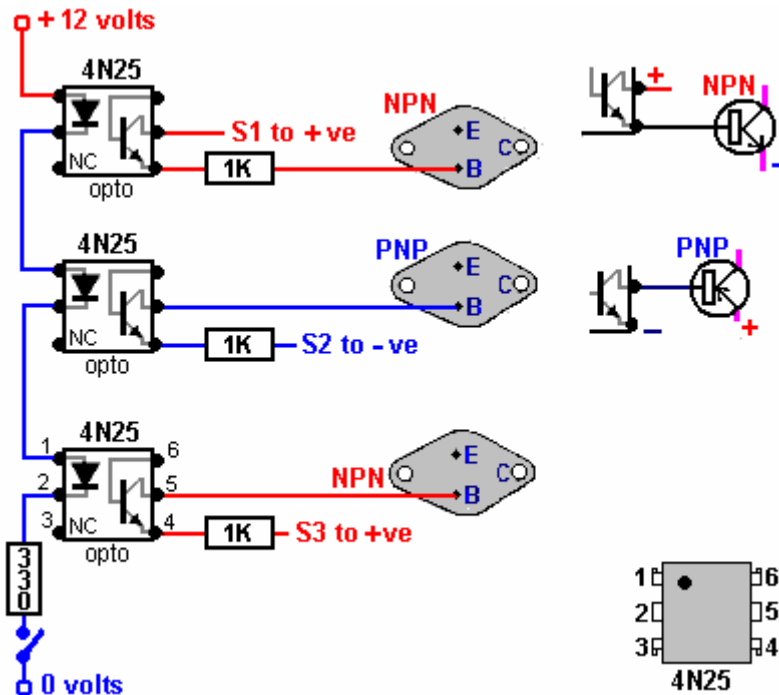


DSEI 12-10A

So far, this shows that the batteries, diodes and switch connections are correct. The next step is to change the switching for one of the states to transistor switching. This requires three transistors, three opto-isolators and three resistors. The transistors are housed in the large TO-3 package and so will mount on the base board. The small components can be mounted on a standard small piece of stripboard, 10 strips with 38 holes per strip:

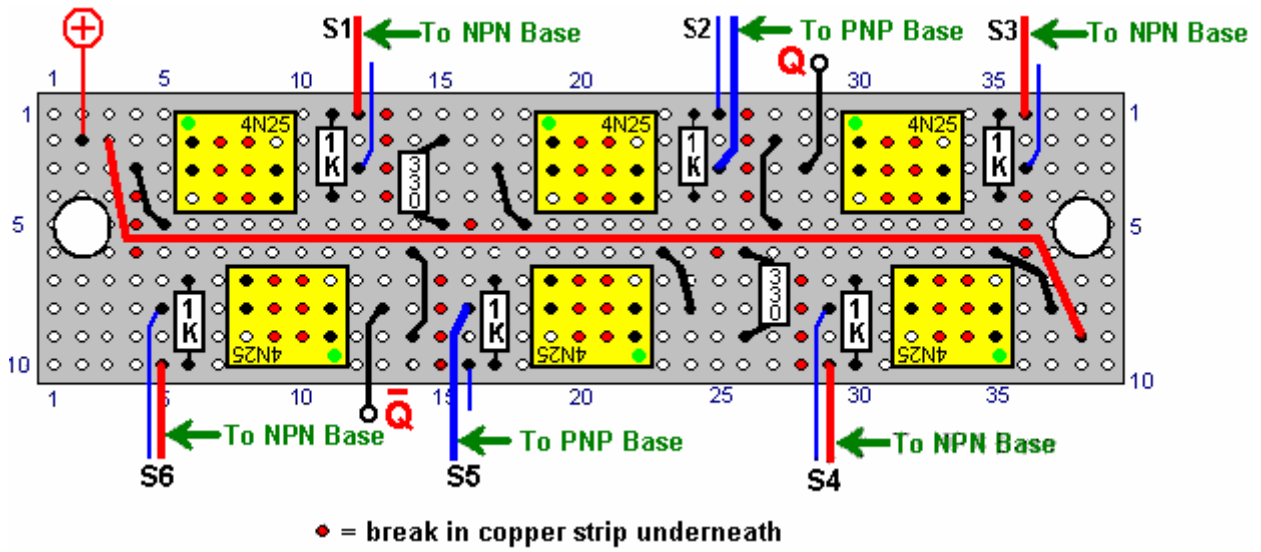


There should be a voltage drop of at least 10 volts (11.5 volts to 1.5 volts) across the resistor feeding the base of the transistors. If the transistor current is 10 amps and the gain 1,000, then 10 milliamps will be needed as the current into the base, so with a 10 volt drop the resistor should have a value of 1K. The current through the LED section of the opto-isolators is limited by a 330 ohm resistor, which can be positioned anywhere convenient in the chain as the same current passes through all of the LEDs inside the opto-isolators. The circuit diagram for each set of three opto-isolators could be:

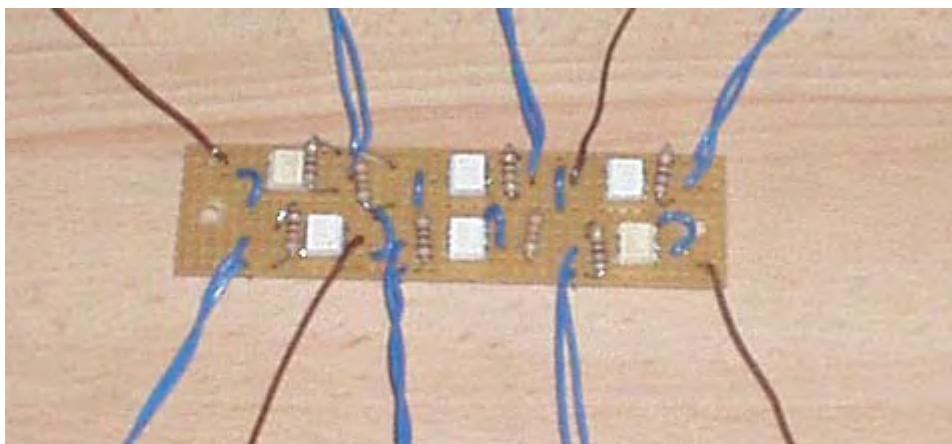


The first part of the circuit is now wired up to switch when the first chain of three opto-isolators is powered up to feed base current to the three power transistors. When this section is working correctly, then the board containing the first chain of three opto-isolators is extended to hold an identical additional chain of three opto-isolators as

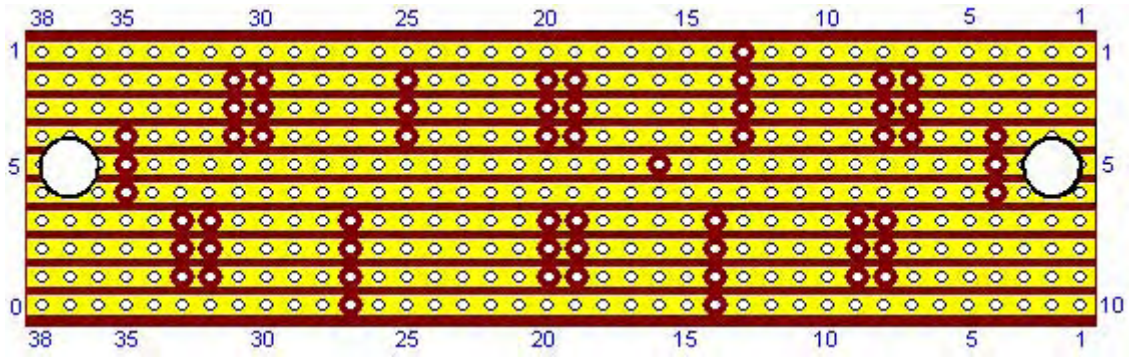
shown here:



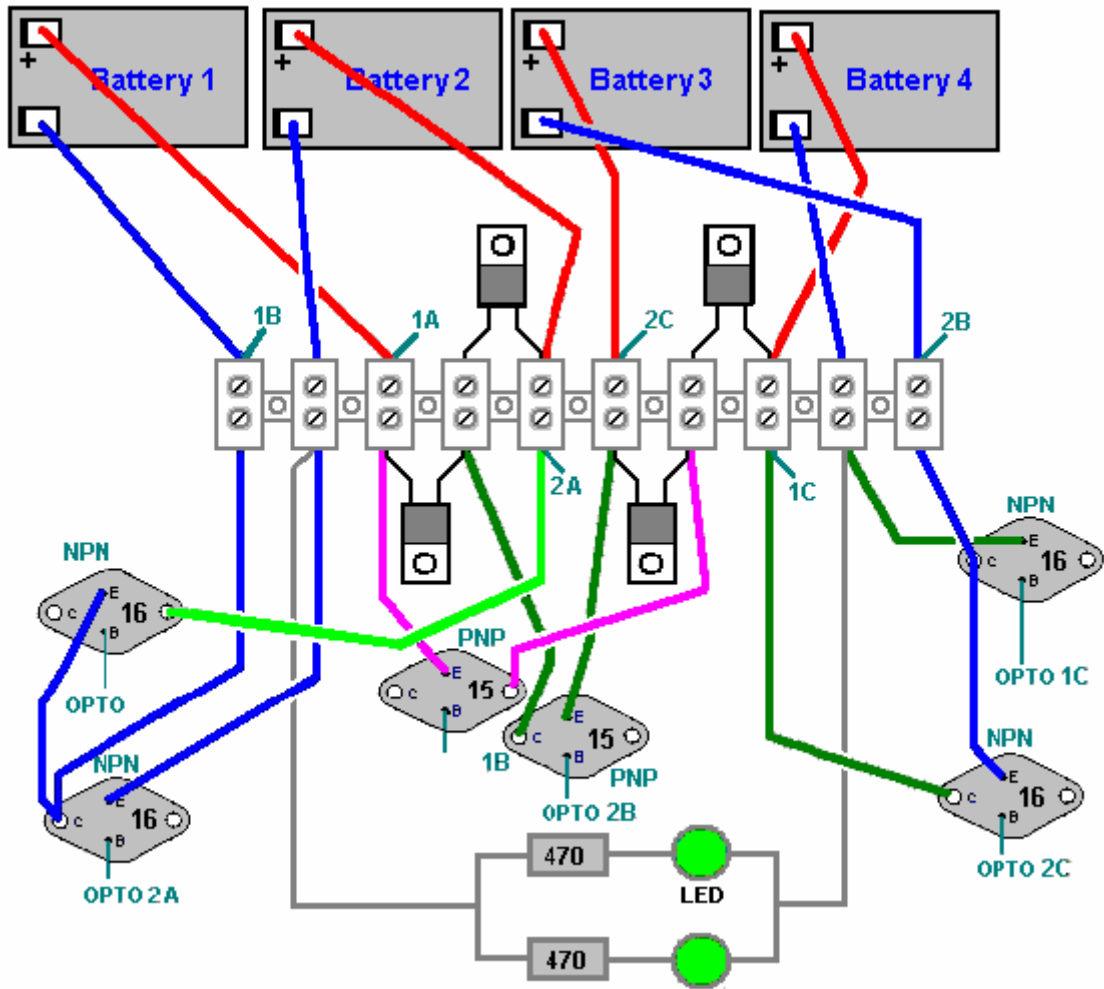
You will notice that for convenience, the physical layout is arranged so that the strip-board is just rotated through 180 degrees and the wiring diagram for the first three optois is used again for the second three.



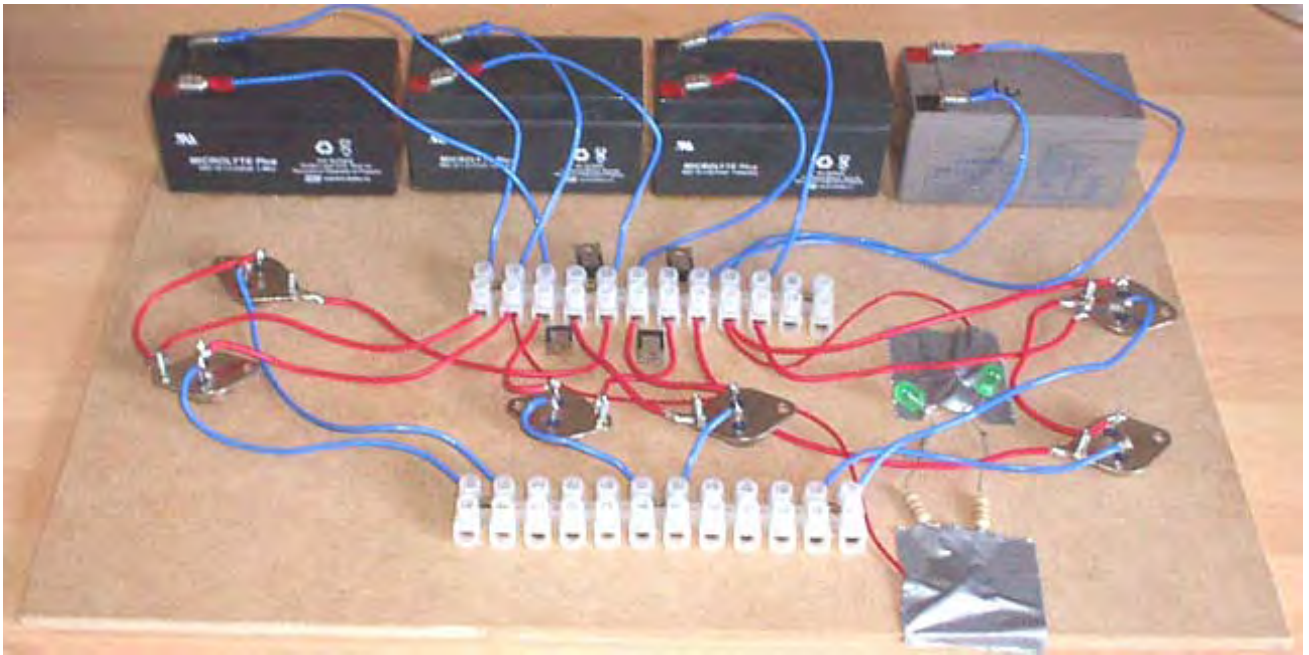
The underside of the board looks like this when turned over from left to right:



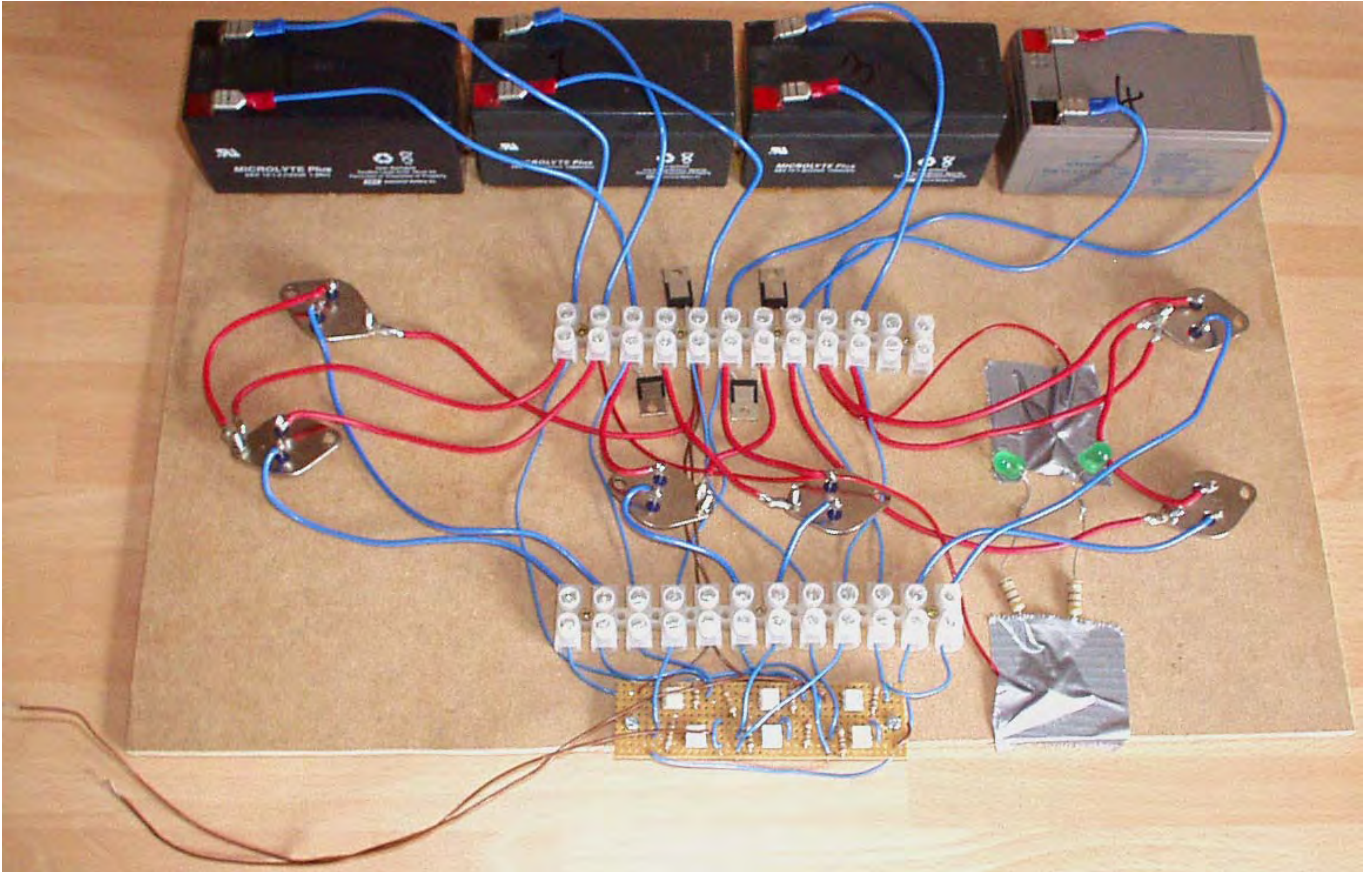
And with the power transistors wired in place and ready to receive the opto-isolator connections:



The two chains of opto-isolators now do the actual switching when they are powered up in turn. This spread-out simple layout makes testing and checking easy and no heat sinks are needed for low-current testing:



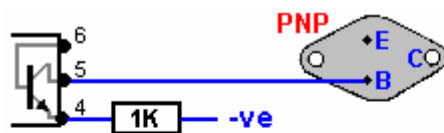
So with the opto-isolators wired in place, the switching is solid-state:



Here, when one of the brown wires, seen at the bottom left hand side of the picture, are touched to the minus terminal of battery 2, one LED lights up. Disconnecting the wire and touching with the minus terminal of battery 2 with the other wire, lights the other LED. Obviously, you **don't** connect both of the wires at the same time. It would be sensible to have a fuse on the positive lead coming from each of the batteries as this protects against accidental short-circuits and against the failure of any of the main power semiconductors.

In the picture above, most of the wires coming from the opto board appear to be connected via the lower terminal block. This is not the case as only the six leads coming from the base connections of the power transistors actually use the terminal block, while the other wires are just routed through the block as being the most direct way of reaching their connection points further in on the board.

It should be stressed that the opto-isolator connections are not random. These are not mechanical switches where it doesn't matter which way round the switch is connected. The optos are transistor junctions and the connections to the PNP transistors in the middle of the board are made the opposite way round to that for the NPN transistors. In other words, Pin 5 goes to the base of a PNP transistor so that it gets switched through to the negative side of the battery powering it, while Pin 4 goes to the base of an NPN as it needs to be connected to the positive side of the battery powering it:



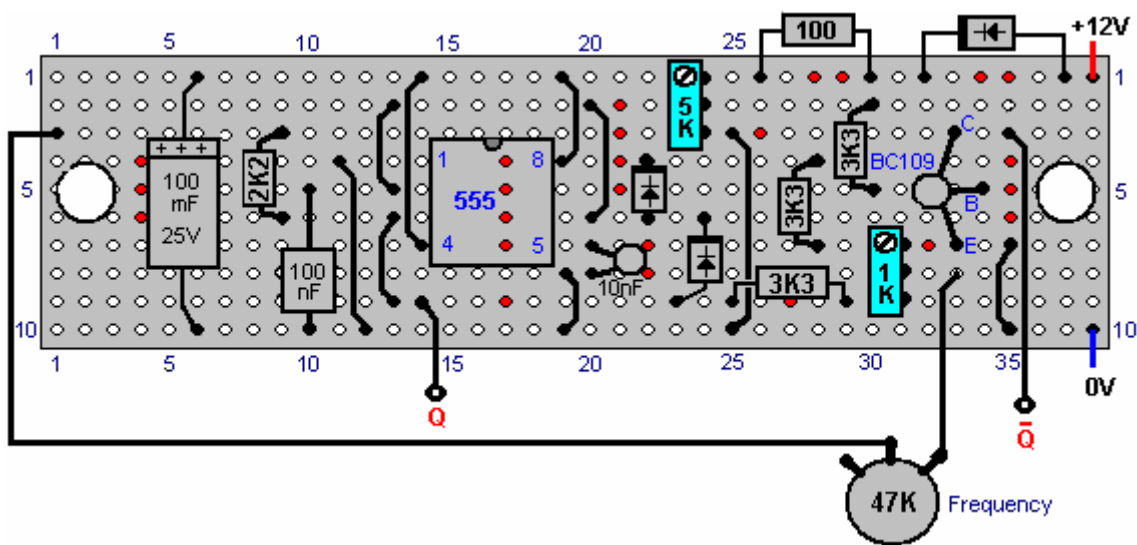
NOTICE THE DIFFERENT CONNECTIONS



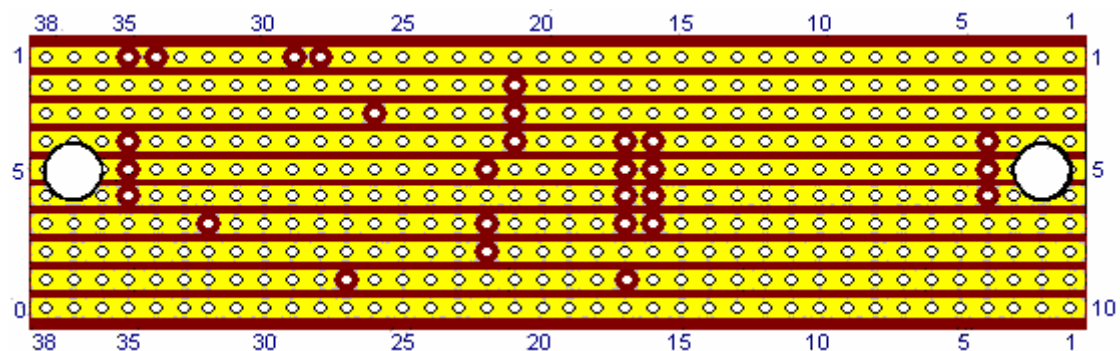
As well as paying attention to which wires go to the bases of the six transistors, it should be noted that if you wish, instead of having two wires running from the board to the positive supply for the board, that an alternative is to make the positive line connection for the second chain of opto-isolators physically on the board, as both chains are fed from the same voltage source, which for the moment, is battery 2.

When this stage is working correctly, the manual powering of the opto chains is replaced with a solid-state switching board to allow high-speed, reliable switching. There are various options for the design of this switching circuit. The initial design opts for simplicity and hopes that the opto-isolator switch-on and switch-off rates will be fast enough to make the overall circuit operate as desired, pulling excess energy from the local environment in spite of using 4N25 opto-isolators.

This may look a little strange with the collector of the output transistor not appearing to be connected to anything, but it connects to one of the chains of three opto-isolators with its built-in current-limiting series resistor. The normal Pin 3 output from the NE555 chip, connects directly to the other opto-isolator chain, so one will be switched off and the other one switched on at the same time. The timing resistor can be varied from 3.3K to 50.3K ohms and that combines with the 220nF capacitor to give switching in the required frequency range.



And the underside of the board when turned over from left to right, is:



Tuning of the Mark-Space preset resistor is initially set to its centre position and if the batteries start to develop different voltages, then it is adjusted slightly and running continued, aiming for exactly the same voltage on each battery. The batteries should be the same age and the same AHr capacity.

George Niculae - A Detailed Study of Steven Mark's TPU

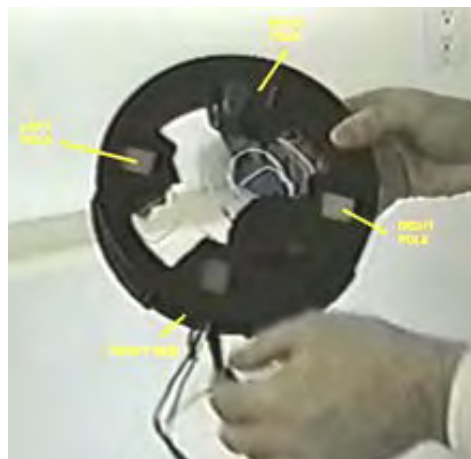
Here are some observations by George Niculae who says: This study will bring us closer to understanding the toroid of Steven Mark, but not all the way to total understanding. I have discovered the real construction behind

the TPU from hours and hours of frame by frame carefully and methodically watching SM videos. First, I have come to believe that the various TPU-like devices presented by Steven in his videos, are very different from each other. That is why there are so many different configurations, building plans, variants, opinions, topologies and implementations of Steven's TPU. The term "TPU" meaning Toroidal Power Unit is inappropriate, because the *principle of operation has nothing to do with the Toroidal shape*.

Steven Mark has chosen just to implement the principle inside Toroidal cores in order to capture most of the magnetic flux. The simplest and most "transparent" of Steven's devices is this one (the one that can be studied in detail):



So let's decide on a convention for naming the parts which we see in the device:



Many people say that Steven's TPU has 3 coils inside it...hmm...let's take a closer look. We can first note that there appears to be 4 segments, and therefore, there must be 4 coils.



1. Pretty obvious this one.



2. Same here



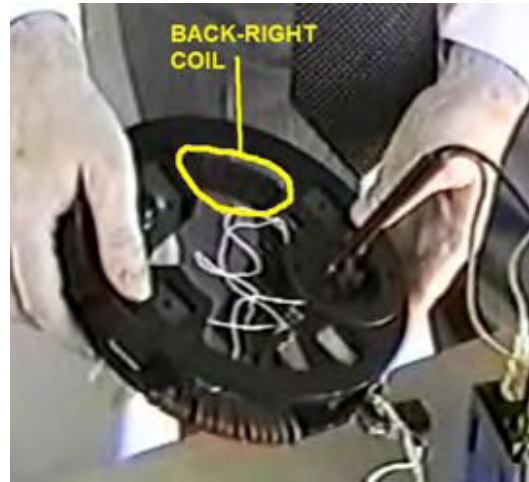
3. This one is obvious too



4. The fourth coil is a little difficult to see

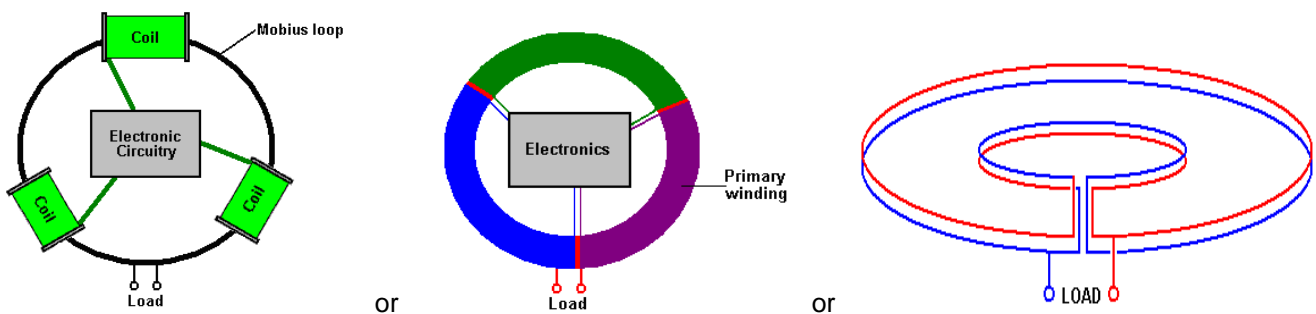


Yep. It's there all right.



Here is another view

OK. Let's summarise what we have seen so far. We seem to have some kind of a transformer with 4 coil windings and this one doesn't resemble in any way, the common conceptions of Steven's TPU construction:

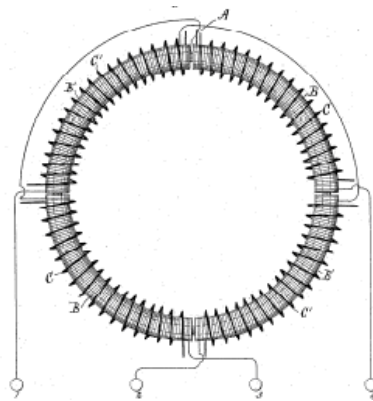


These are nowhere near the configuration which we are studying here. These configurations seem absurd to me! Where the heck do we ever see this type of arrangement in Steven Mark presentations? I haven't seen this anywhere! But hey, maybe the guys who say these things know better. *I ONLY KNOW WHAT I SEE. THE REST... IS SPECULATION.* Although in some cases educated guesses are acceptable.

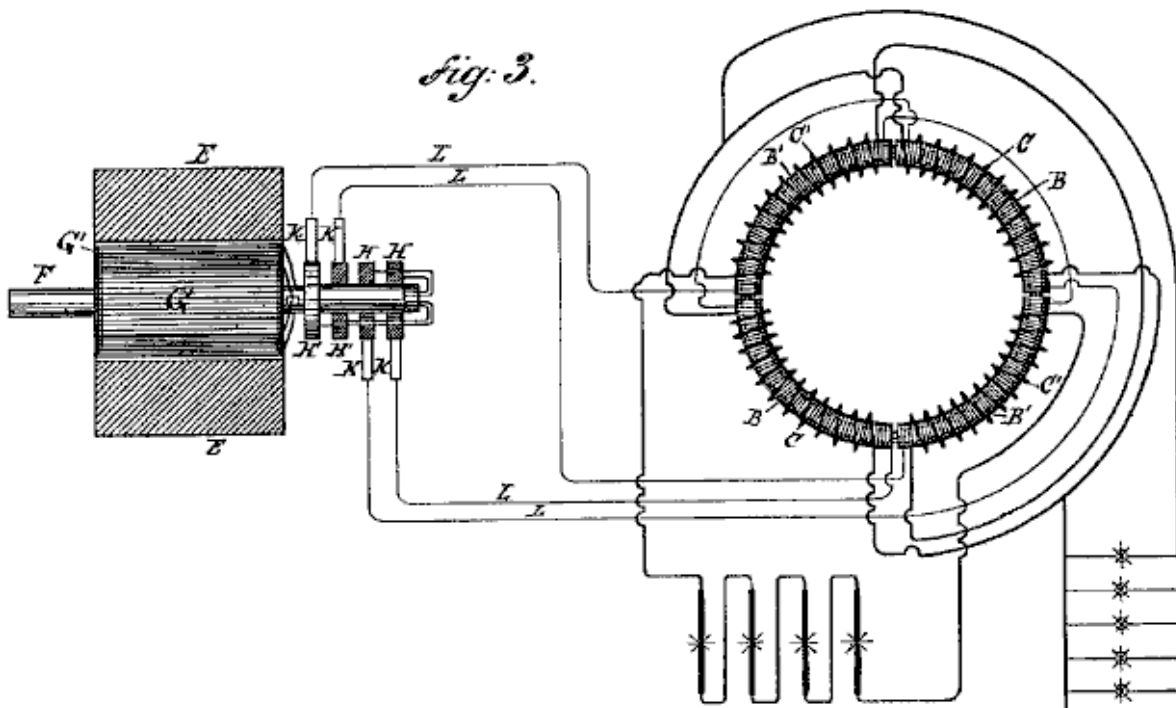


Ok. What do we know so far:

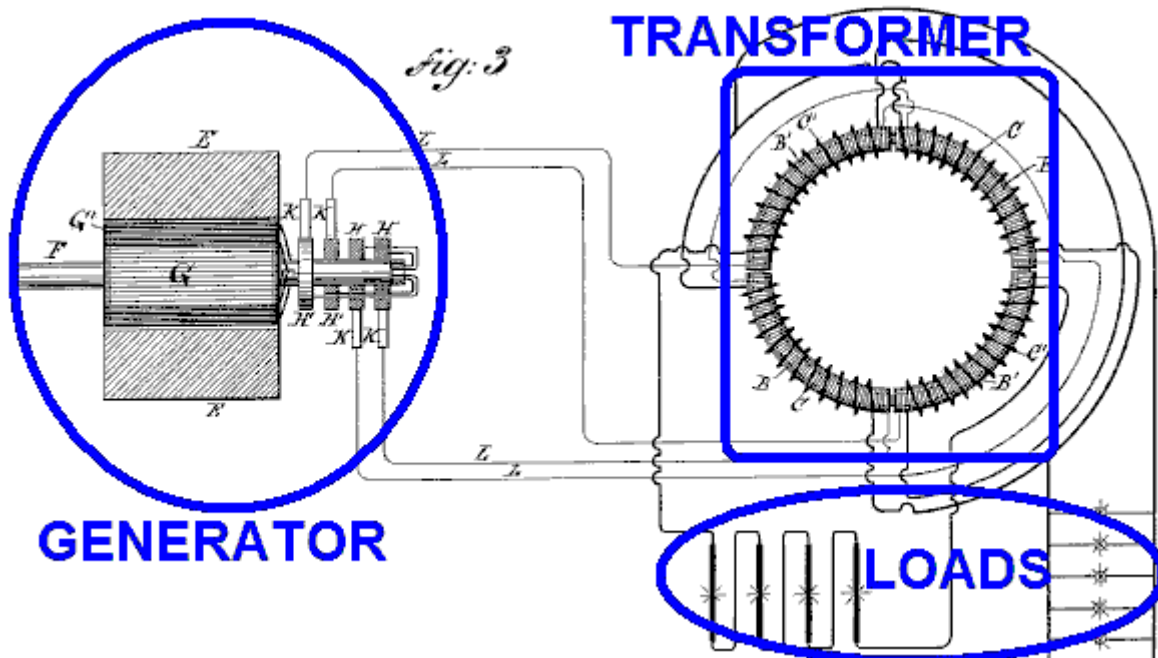
Some say that this "4-coil Steven Mark Toroidal-like transformer" is similar to Tesla Patent 381,970 "System of Electrical Distribution":



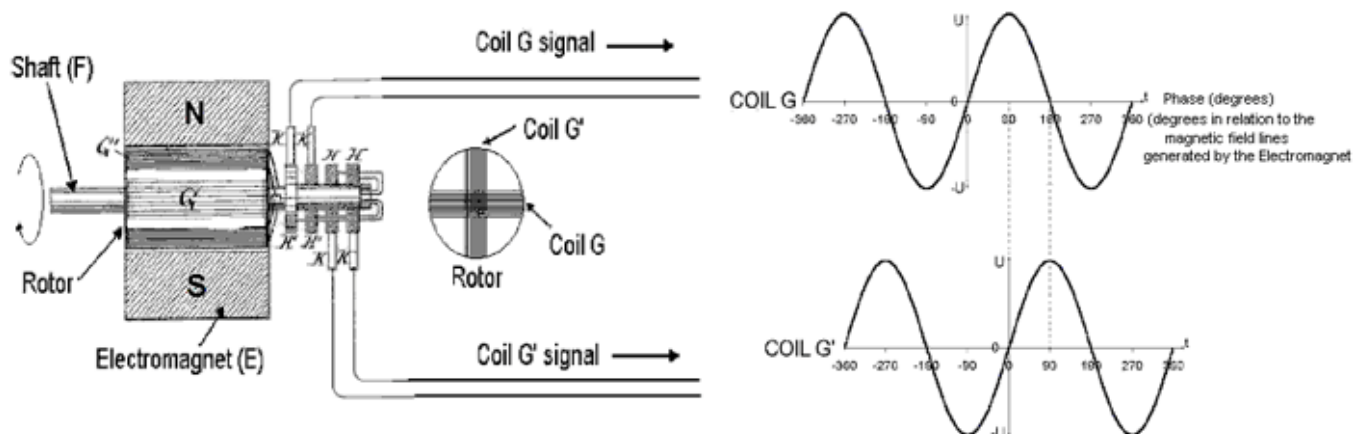
Hmm...Interesting...Looks similar. Let's take a closer look:



Ok, anyone who takes a look at this, might get confused by all these wires. Let's analyse what we have here, because it will help us a lot in figuring out how Steven's TPU works:

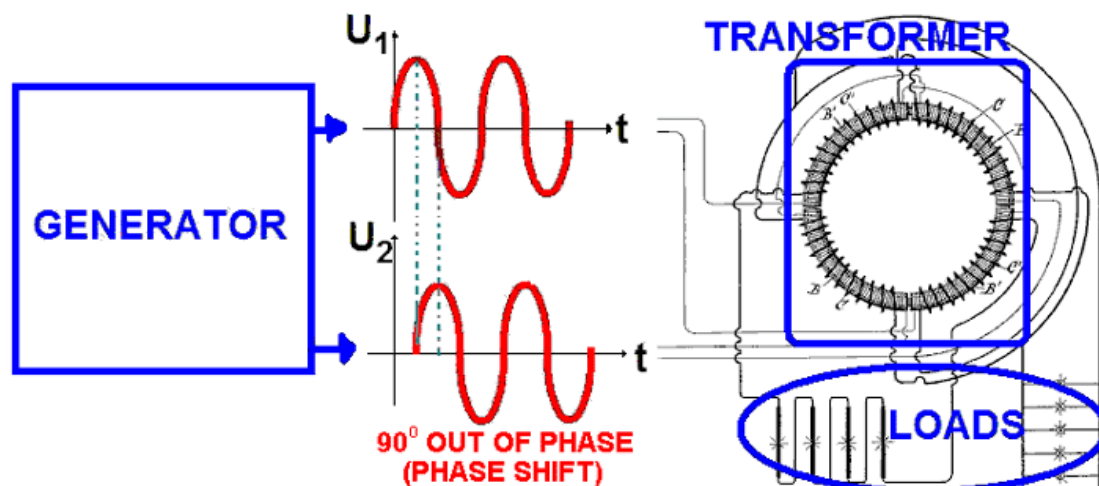


How does this work? Let us look at the generator:



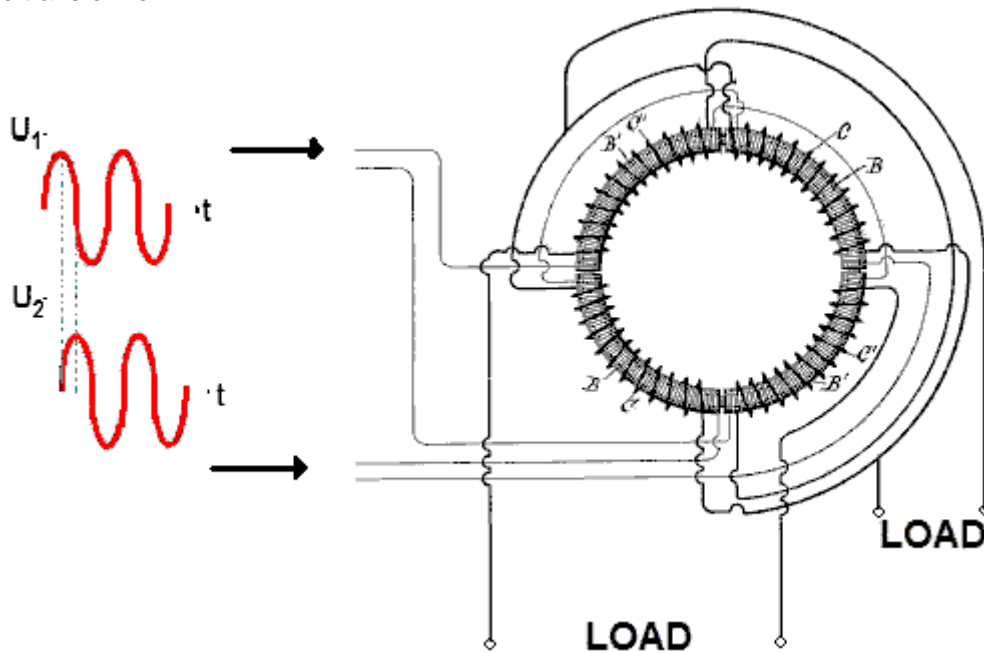
Let's quote Tesla: "...it will be observed that at a given point of time the coil G is in its neutral position and is generating little or no current, while the other coil, G', is in a position where it exerts its maximum effect" (US patent 381970 page 2, line 95)

So this generator has 2 coils perpendicular one to the other inside a simple N-S magnetic field (2 poles). The commutator has 4 contacts (from the 2 starts and 2 ends of the 2 coils) and there are 4 wires coming out of this generator. Simple stuff. As the generator spins, it outputs the waveforms in the right



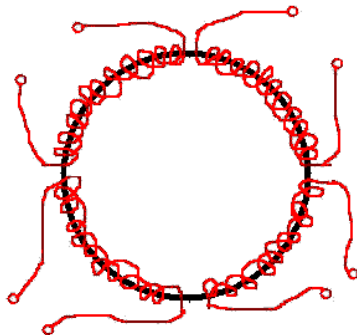
Just a two-phase electric generator...typical of Tesla...Nothing fancy here. Ok, so two signals 90° degrees out of phase from each other, going into the transformer. One signal is a sine and the other a cosine. So what happens then?

Let's look at the transformer:

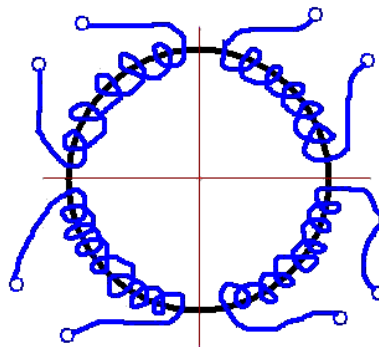


Let's simplify a little bit and take this Tesla transformer apart:

PRIMARY WINDINGS



SECONDARY WINDINGS



This is the basic configuration...so we have 8 coils here, and not 4, like in the TPU... This is important! This is the easiest place to start to understand how the TPU works! Ok, let's continue with harder stuff. So, the TPU has 4 windings, or does it have 8 ??? Let's take a closer look:



Hmm...not very clear... so let's look further:



Wow...what do we have there? It looks like 2 big thick heavy wire...could it be? Could it be a ... bi-filar coil?



It's definitely a bifilar coil !!!



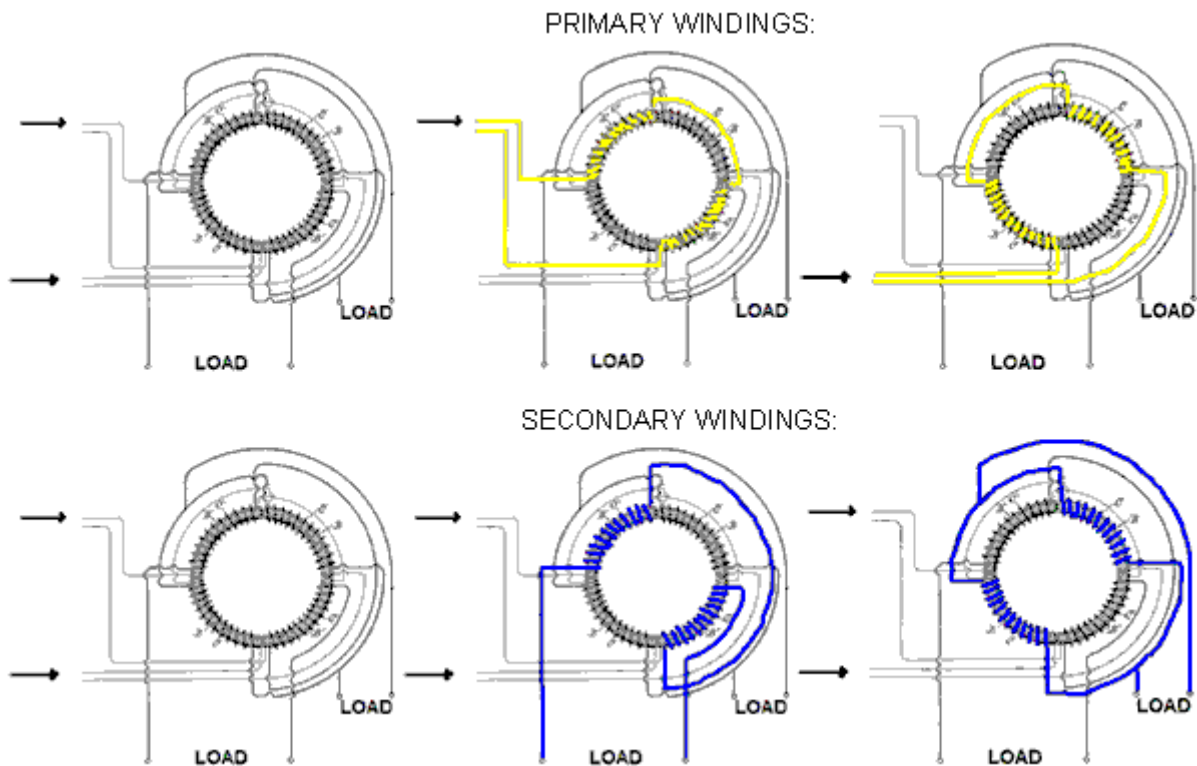
Here we can see that it is too thick to be only one wire. There must be two. Look closer and really pay attention! Each of the coils have 7 turns and they are definitely bi-filar coils! There will be no point in having just the left coils bi-filar, and the rest simple coils. It's got to be that all are bi-filar. It's the only way to make sense. It's got to be a balanced symmetrical system. It's an educated guess! I hope you agree. If you don't agree, then find a better quality video, take a closer look than I did, and prove me wrong.

So let's summarise what we **DO KNOW** so far:

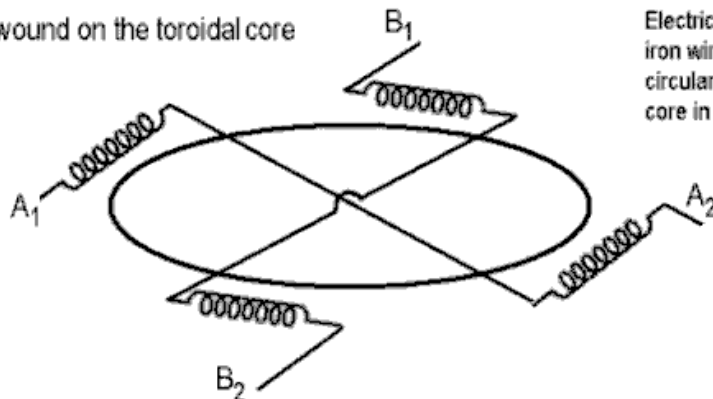


This is Tesla technology!

We need to study Tesla's patent number 381,970 in the most minute detail. So, let's see how Tesla's transformer works:



Coils are wound on the toroidal core

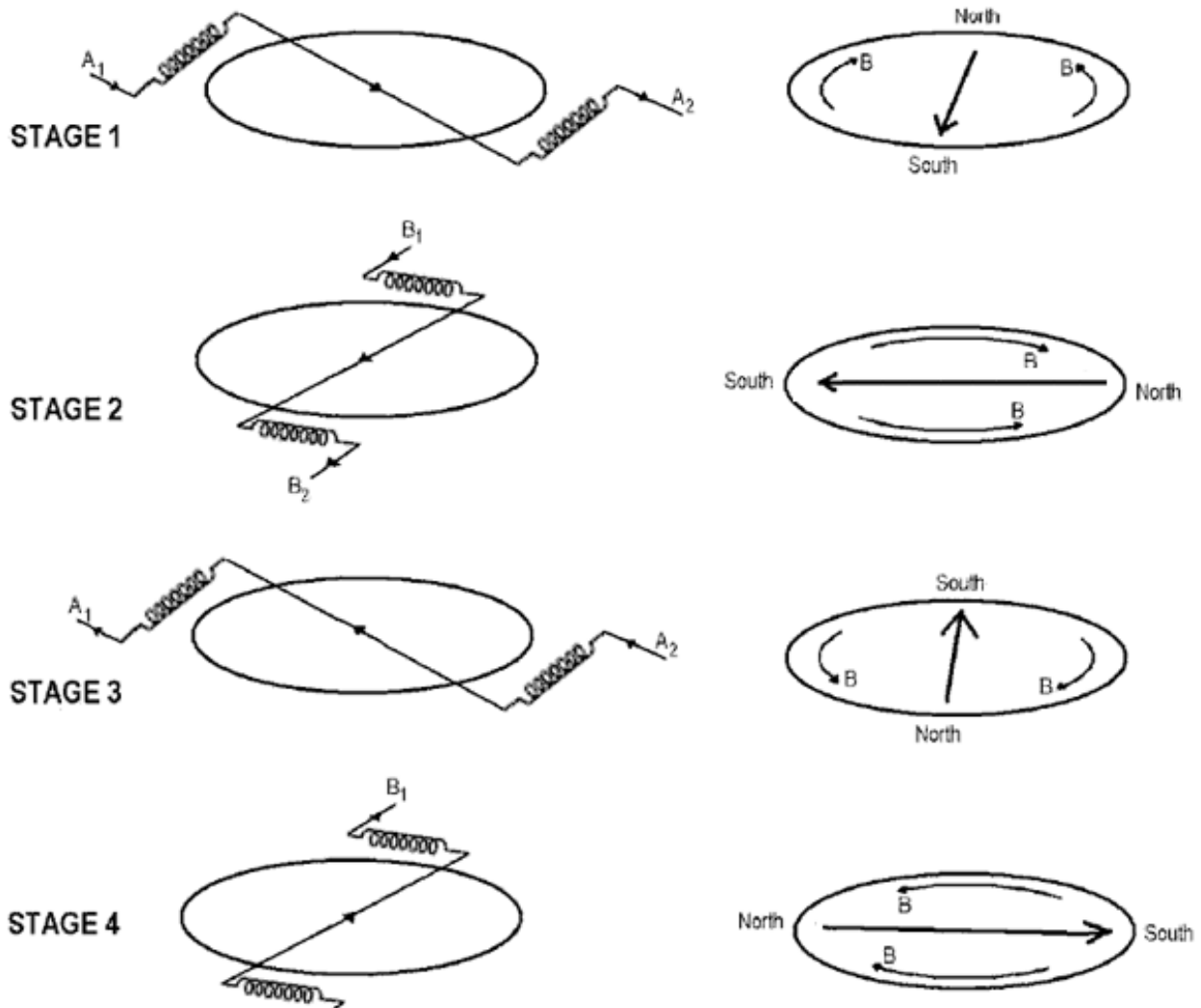


Electrical insulated soft iron wire wound in a circular coil acting as a core in short-circuit

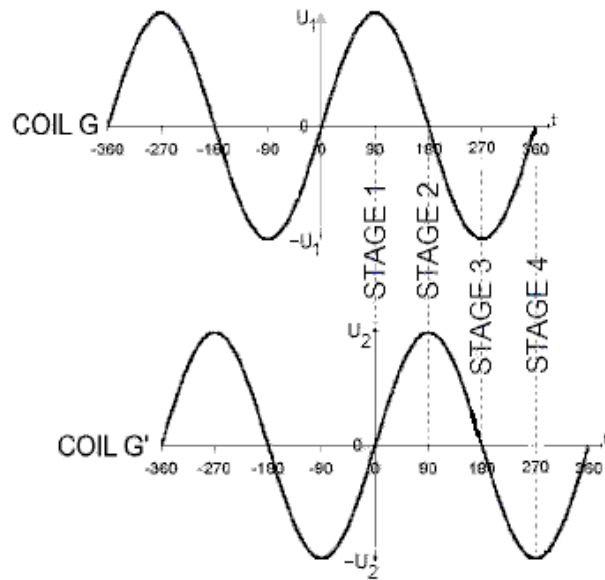
What is really interesting in this configuration is the way in which these coils are connected to each other. If we look closely, then we notice that they are connected in opposition to each other. So the magnetic flux created by these coils, is cancelling out...weird...How can a transformer work in such a way?

Well... your understanding of this depends on your expectation of how it must work... It will work... but the efficiency will be very, very poor. But Tesla knew all of these things and more, so then... he must have been looking for something else...he was exploiting and investigating an effect...

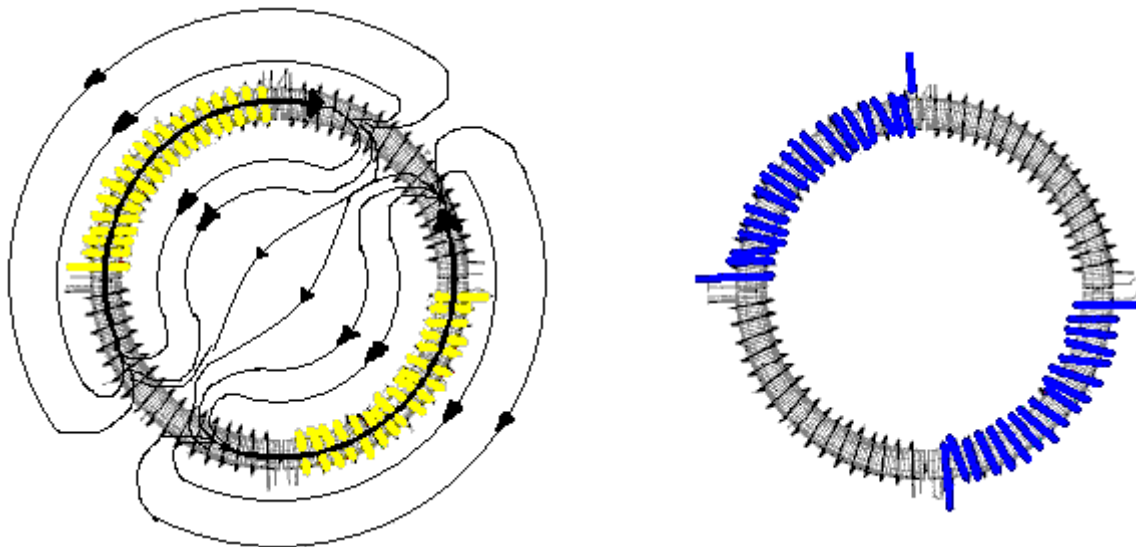
The Magnetic Flux vectors from these coils in operation looks like this:



And the firing stages of the Tesla transformer are:



A slightly more accurate representation of the magnetic field lines at one stage is is:



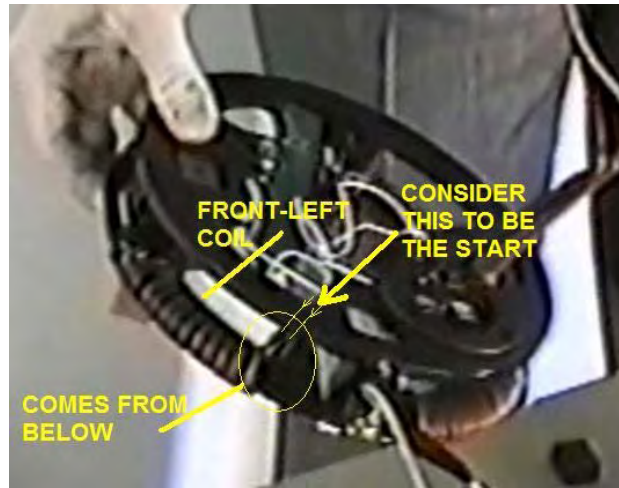
Now what happens is, that when you energise two opposite coils like this, you will get output power on their matching secondary coils. If you build a transformer like this, and short-circuit the secondary. See what happens!

What do you think will happen? Well...conventional education tells us that we will see a spark, and if we continue with the short-circuit, we could overheat and destroy the secondary winding. But not in this transformer...

This type is a so called "Lenz-less solid state generator". Meaning that no matter what you do to the secondary winding you will not affect the primary winding in any way! No matter how much power you extract from the secondary, the primary will never see it! It will not "see" a load connected to it! And even better - when you connect a load to the secondary...**THE INPUT POWER DECREASES!** Quite the reverse of what you would expect!!!

However, DON'T GET YOUR HOPES UP... because this is only half of the story. Here is the other disappointing half: even though this might seem like a huge COP, we are forgetting to take account of the power which the transformer itself consumes, even when no load is connected to the secondary.

This is interesting stuff, but in Steven Mark's TPU do we have this Lenz-less opposing magnetic flux/magnetic decoupling effect in the coils as seen in the Tesla patent? All of the 8 coils of Steven's TPU appear to be wired in series, one after the other in a chain. Let's take a closer look:



Ok, so the front-left coil starts from below and is wound clockwise, viewed from the front. This leads us to the logical deduction that it's end will exit the coil from the upper side of the coil:



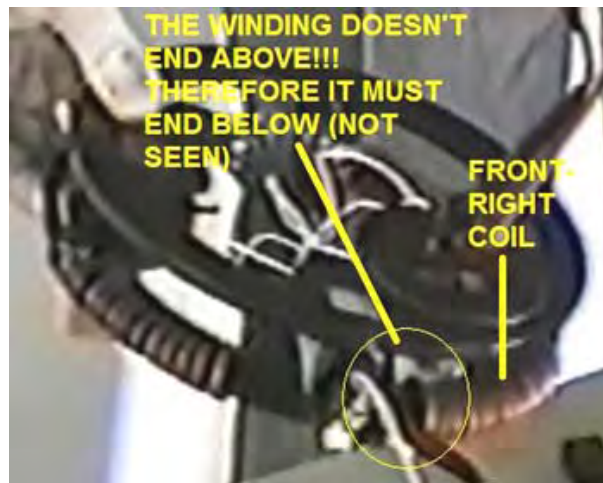
Now, look at the back-left coil:



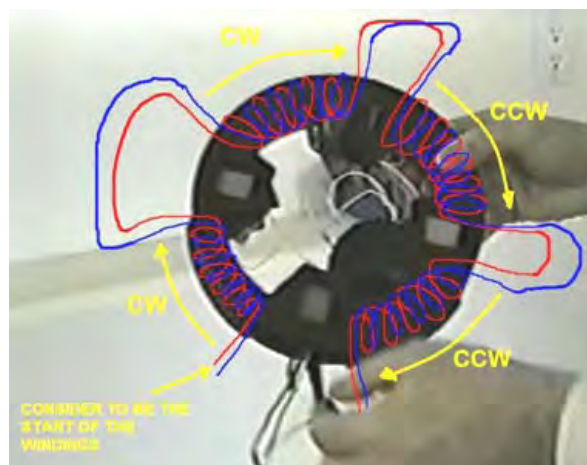
The back-left coil is wound in the same clockwise direction (if you start the windings of the toroid in a clockwise direction when viewed from above). Let's continue to investigate this:



This is very difficult to see, but he has changed the direction of the winding to counter-clockwise, if you consider the start to be where the wires come out of the device.



The front-right hand coil is wound in a counter-clockwise direction. It starts from above, and ends below. NOW WE KNOW ALL THE DIRECTIONS OF THE WINDINGS WITH A HIGH DEGREE OF CERTAINTY!! Let us summarise what we know so far:



As suspected, Steven is creating the effect we are after, by using opposing magnetic fluxes. Let us take a look at that bundle of wires in the middle of the TPU. Where do they connect to?



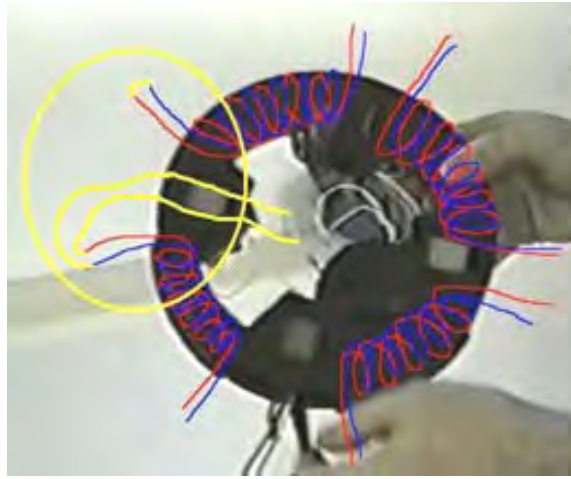
This is the toughest job, but we can clearly distinguish 2 wires connected to, or coming from, the right pole. How are these wires connected? To what? What other wires do we have here?



We could combine them like this:



This would be foolish, because the front-left hand coil would be rendered useless. Another combination could be:

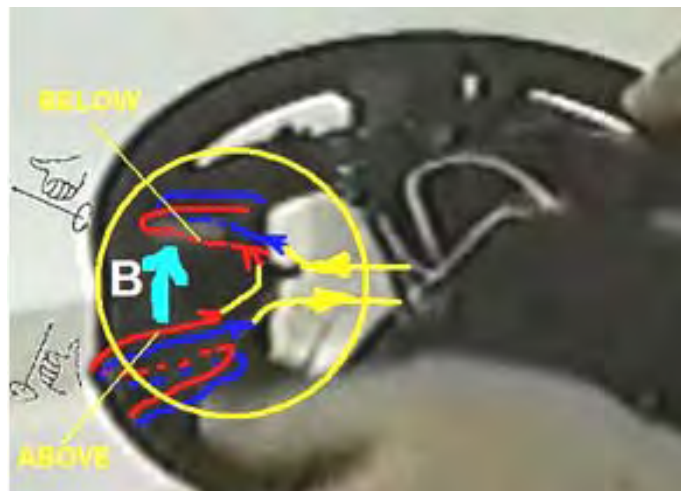


This would be ineffective also, because this time, the back-left coil will be redundant.

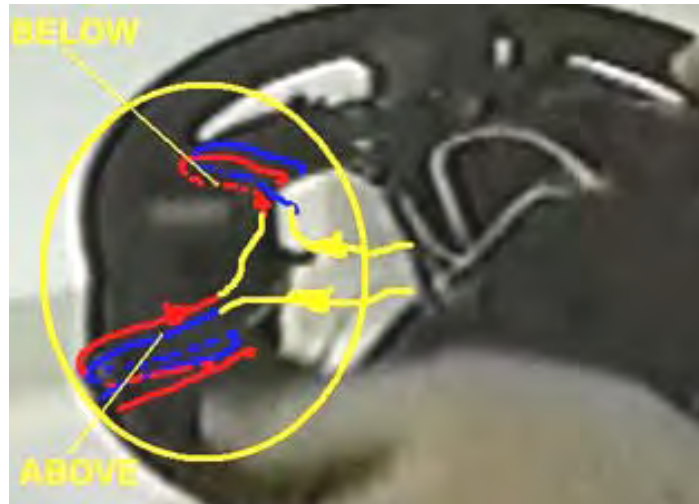
Other combinations could be like this:



In these configurations, we have two sub-possibilities, both ineffective, as we will see. The first sub-possibility is that the current flow through these 2 yellow wires is in opposite directions with one going and one coming. Regardless of which one's which, let's think also about how the **front left coil** enters into this junction, and how the **back-left coil** leaves this junction.

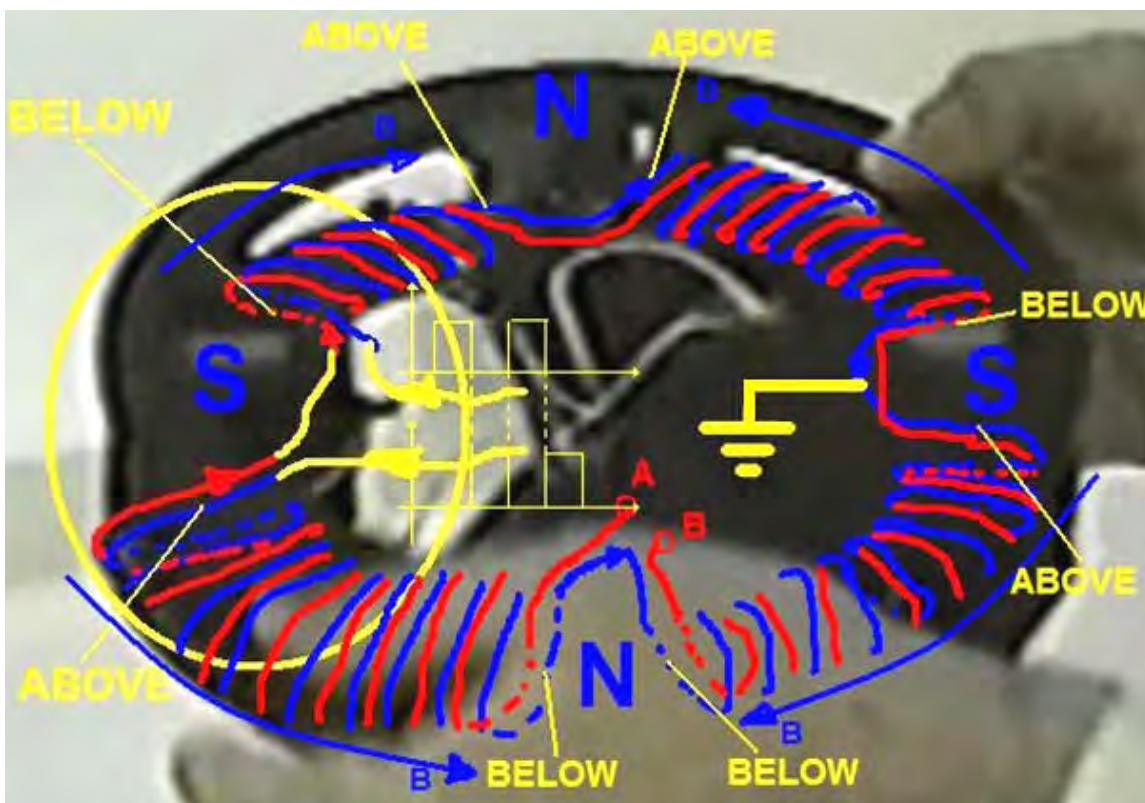


If the wires were connected like this, it would nullify our pole! So then what's the point in having the permanent magnet placed here??? Our coils don't create a magnetic pole here! So, this sub-possibility has to be wrong! The last incorrect sub-possibility is that the direction of the current flow through these 2 yellow wires is in the same direction.



If the wires are connected like this, then you might say: *what's the point in having 2 wires with the same current?*, **it can be just one**...and you are right. If so, then it's a median point. But what if it's not the same current? It could be 2 sequential pulsed currents, when one is on, the other is off and vice-versa.

If the wires are connected like this, then bear with me, because it gets a little complicated. To pulse two flip/flop currents through these two yellow wires, will mean that you will need a ground for them. The only possible symmetrical ground for them will be on blue wire in the **right pole**. Now, this is somehow peculiar, but the blue 4 coils (let them be primary coils) will generate 4 magnetic poles like so:



But this configuration has also to be wrong. Why? We will consider the blue coils to be our primary, then the red coils will be our secondary. Our primary fires first the back side of the TPU, then the front side of the TPU, and so on. By doing this, our secondary, due to not having any sort of connection at the back pole, will generate two equal voltages of same polarity at the A and B terminals. Due to the fact they have the same polarity at a particular time (either + or -), and equal voltage, there will be no voltage drop between them.

The only way to collect power from this type of red-secondary is to have a ground connection at the back-pole, because our voltage potential is created from this point.



But we cannot see any wire connected to the back pole. Therefore there is no possible way to generate an output from this red-secondary configuration.

THE ONLY REMAINING MOST LIKELY POSSIBLE CONFIGURATION WILL BE LIKE THIS:



This is straightforward. First we have reached the **point were we can say with certainty** that Steven is using a tapped median point on the left pole, therefore, regardless of the direction of the current in or out of these median points, he will have created 4 magnetic poles (at the front, back, left and right of the TPU).

How are the poles really oriented? How are the magnets oriented? How is he firing the coils? Let's study possible answers to these questions:

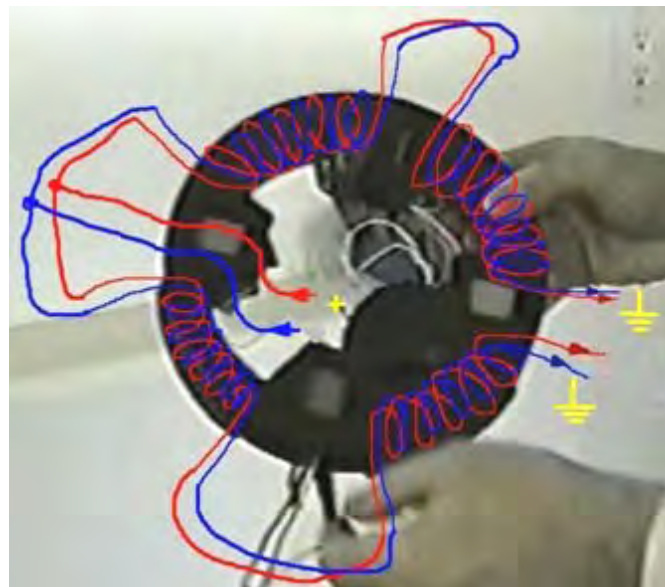
Steven says that his devices produces only DC. That to me seems pretty logical. Why? Well... because of the magnets which he places on the top slots of the TPU:



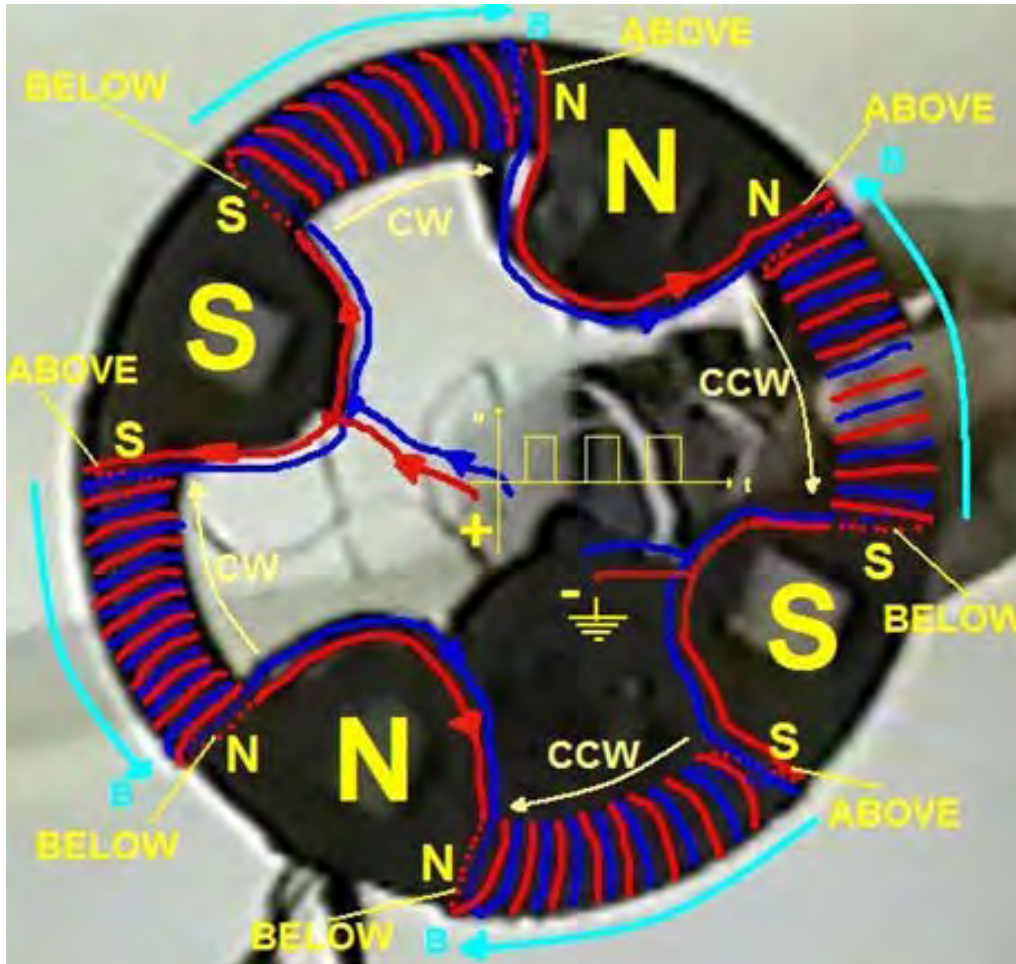
He is using two magnets one on the right hand pole and one on the left hand pole (conventional naming from the camera point of view, and from the wires that come out of the TPU).

If you are going to use permanent magnets, oriented like this, (with either south or north pole upwards or downwards), you must excite these coils ONLY WITH PULSED DIRECT CURRENT ! It's the only way it will work! Pulsed Direct Current is the only logical way!

So then, we definitely know he is pulsing the coils with DC...BUT HOW? Well...Here my research stumbled a bit. The most likely configurations are as follows:

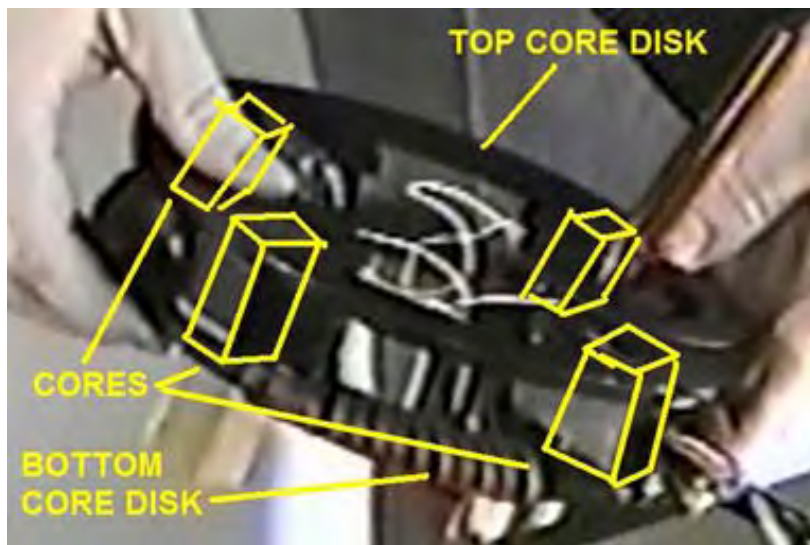


This would imply that we start from the left pole as the positive lead, but we will end up with 2 separate ground connections which must be connected together and form one ground. Therefore our final, and only possibility will look like this:



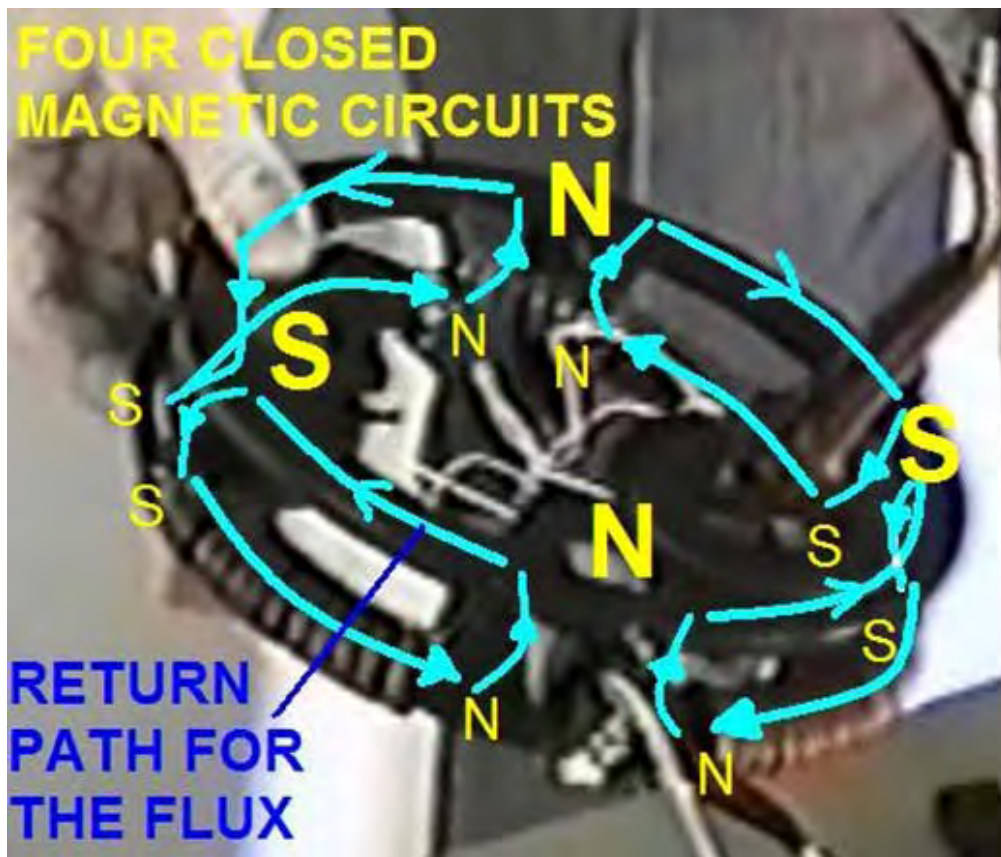
This could be one very possible configuration for a working model, but it still has a long way to go. I intentionally did not mention an obvious construction detail until now, indicating the reason why he build it in the way that he did.

If you haven't yet figure it out by now, let's think about this topology for a second. We know from the Tesla transformer that it is extremely inefficient due to the fact that more than 80% of the field created by the primary coils is situated outside of the core, and can't be tapped, (although there are some implementations which use a rotor, inside the Tesla Transformer). So how can we close all the magnetic field lines, to increase it's efficiency? That is the correct and right question! The answer was found by Steven Mark with his clever and ingenious design:



You probably think that I've made a mistake and that the front pole in fact has no core. That's true, there is a junction box there, but again, you get the picture.

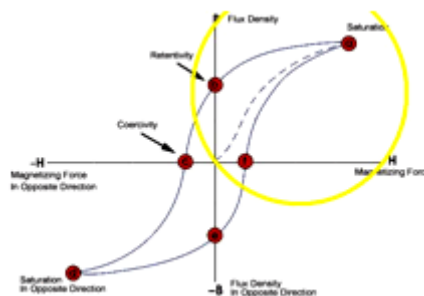
You might think that the top core disk is just for design. If so, then ...you are so wrong... it's actually what makes this design unique!! It's what makes it work! It's the key to **magnetic containment!** It's how Steven Mark figured out how to return the opposing magnetic flux lines in the Tesla transformer through another one on top! The top disk provides the return path for the opposing magnetic fields created by the coils!



If you don't believe that the above picture is correct, then, first you must realize that everything up to now has been pure, sane, healthy, rational, fine deduction. NOTHING SPECULATIVE! NO GUESSING! NOTHING LIKE THAT! Read again, how I come to this conclusion from the deductions I made until now. Then to prove me wrong you must first prove that the above statements I made above are wrong. But hey, if you know a better way, why don't you write it down, and share it?

With this configuration we can proudly say:
 Outside magnetic field? In theory? 0!
 Efficiency? In theory? 100% energy conversion.

So let's theorise a little bit now. If this configuration can have a core with a high permeability, then a primary winding and a secondary winding that generate such a field (four closed magnetic circuits), would have in theory above 98% efficiency. You might say that's ridiculous high and I'm forgetting about iron losses. No I'm not. Regarding this, iron losses are energy losses due to hysteresis magnetisation and demagnetisation of a ferrous metal. Right, but you have to remember that we are only working in the first quadrant of the hysteresis cycle!

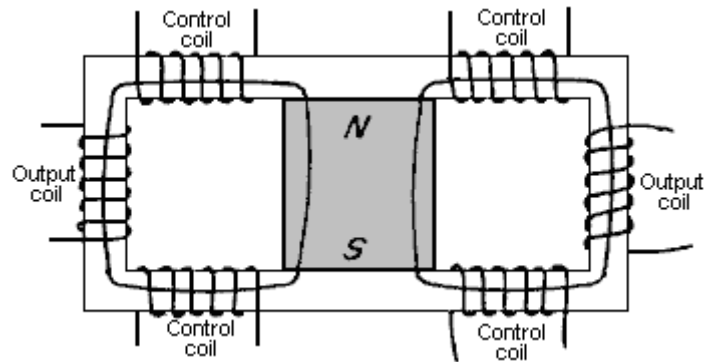


That means that we are not demagnetising the core! The core is in fact reaching magnetic saturation! It is always magnetised in one direction! That is another reason why we must place the magnets carefully always in one way. We shouldn't reverse them during experiments, because due to the high magnetic flux density, the retentivity of

the core will be at a high state. So if we change the direction, we have to spend extra energy to "reset" (reverse) it, that is in theory anyway.

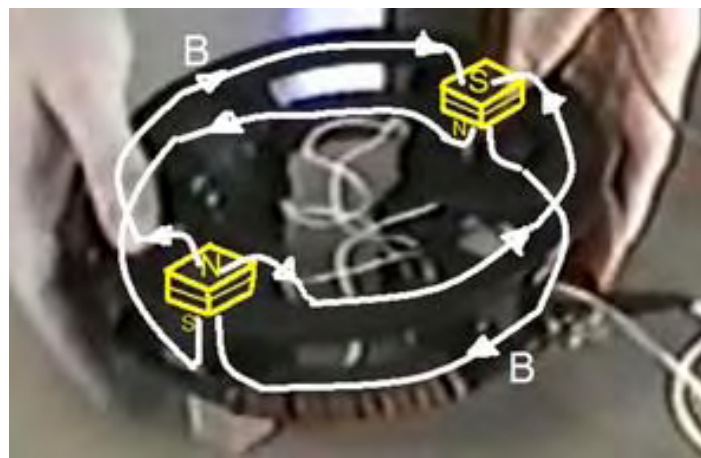
Now here's another theory, what if we can provide an already existing magnetic field, in the same configuration and direction as the flux generated by the coils, so that we can raise above 100% efficiency? Wouldn't that be something?

I have come to believe that the reason Steven Mark is using permanent magnets might be the same thing as Charles Flynn does in his Solid-State Electric Generator:



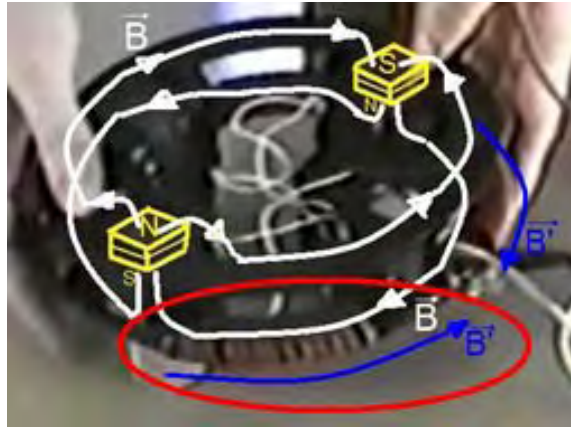
This is another transformer, but which has a magnet in the middle. What's the point? The point is to manipulate the opposing flux fields generated by the coils with these magnets, to "reinforce" the field created by them, and to spend a little less energy in creating a magnetic field once you have one already from the permanent magnet. The Charles Flynn generator works in a different manner, but Steven Mark's TPU is using magnets for the same reason.

If one of the TPU magnets has it's north pole facing upwards and the other magnet has it's south pole facing upwards, then the magnetic field created by them will bypass the front and back magnetic poles of the TPU:



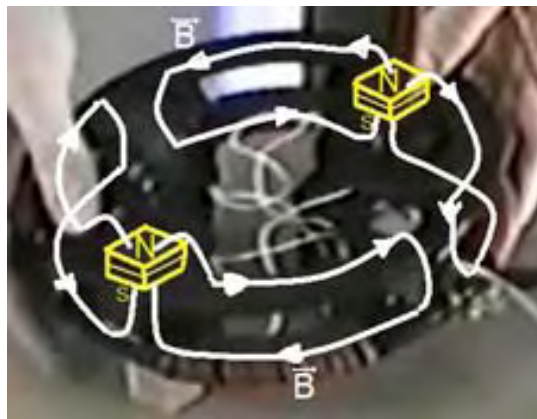
There will be just these two poles created by the magnets (two magnetic closed circuits).

This configuration must be wrong, because of the direction of the magnetic field from the magnets with this arrangement. Half of the magnetic field would oppose the magnetic field created by the coils. Remember how those fields are orientated:



The coils change their winding direction at the front and back pole, so we have two magnetic fields in opposition in these places, and one of them will be also oppose the field from the magnet.

But by using them in repulsive mode, and orienting them so that they both have similar poles facing in the same direction, then their fields will look exactly like the one's generated by the coils:



So now, we have determined with a high degree of certainty how he orients his magnets in the TPU! This is where this deductive, and certain study ends, but it's not over. If, like me, you feel drawn to this type of technology, then please continue the work which I have started here!

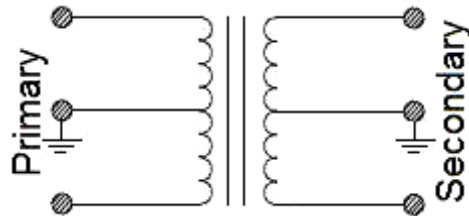
I am going to continue further, but from this point on, please be aware that I am going to guess a lot, so the certainty factor will be greatly reduced.

Firing the coils

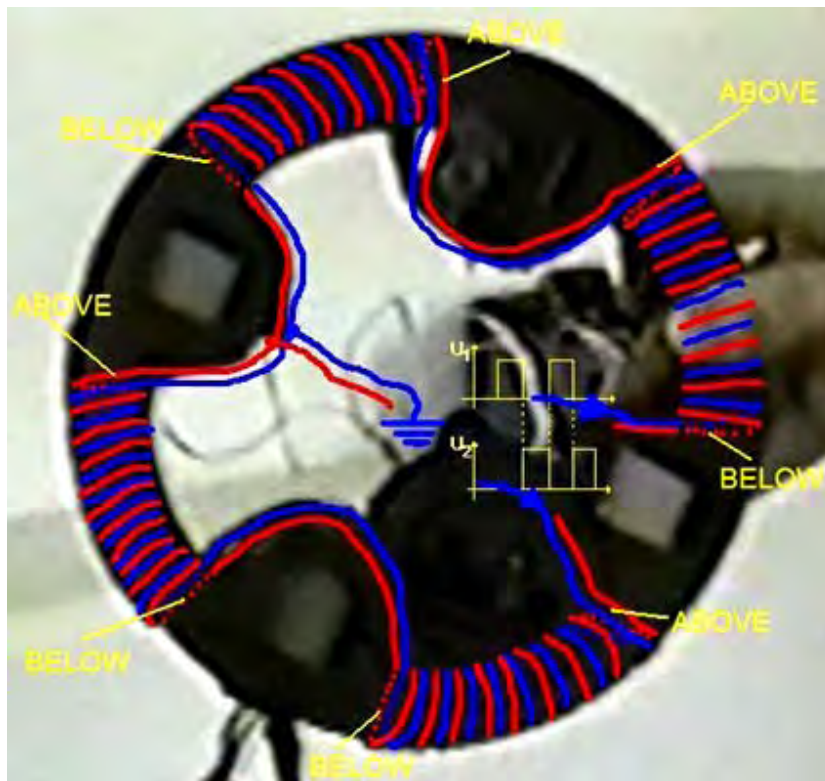
How is Steven exciting the coils? Well we do know for a fact that he is using pulsed DC, but how is he driving this type of pulsed current through the coils? Which connection points does he use? It seems most likely that he is using a square wave with sharp rising and falling edges (the so called "kicks"). Some say that he isn't using any type of control circuit board, and no integrated circuits. That seems most likely to me, because Steven says that his device is extremely simple. So let's keep things as simple as possible. (I'm not saying that having IC control board for a TPU is complicated).

I think that **there are no MOSFET's in his device!** Why? Well...think about it! If he were to use MOSFETs, then they would have to switch at least 100V at more than 10 Amps, judging by the wire gauge which he is using. He would also need a control circuit to drive the gates of these MOSFETs, and due to the closed feedback loop, and having no battery in the device, he would have to generate a low voltage and low current inside a some sort of feedback/coil that drives the gates in order not to burn those transistors out. But nothing which we have seen supports that! Therefore the supposition, that he is not using MOSFET transistors, is likely to be true (I'm not saying that with a high degree of certainty, as I could be wrong).

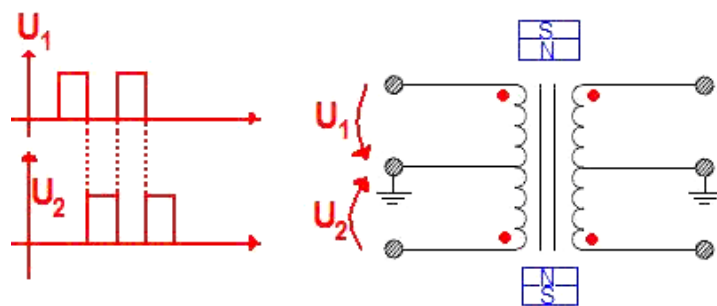
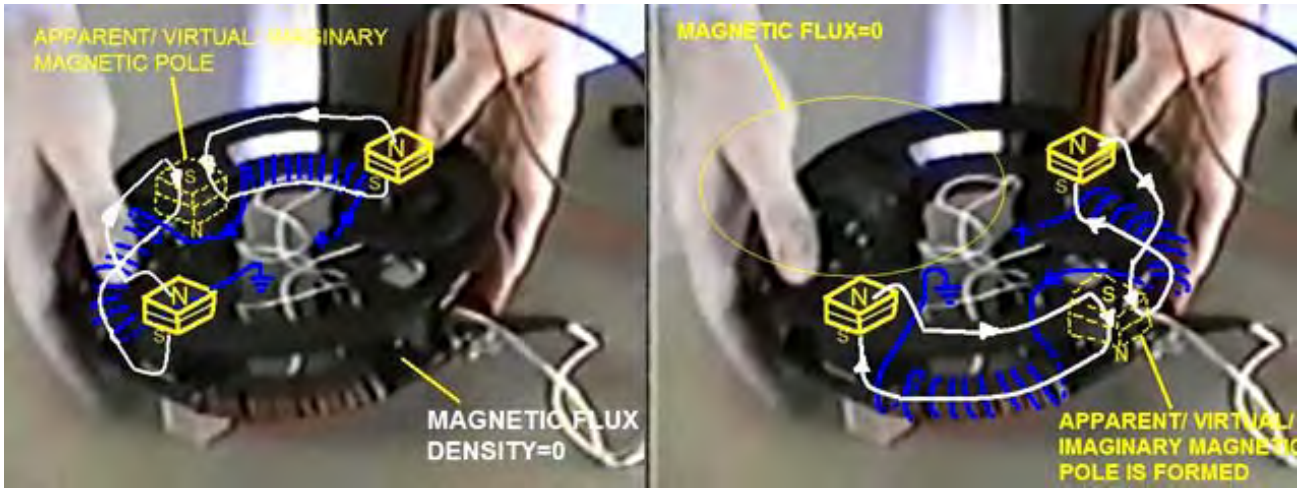
There is no feedback coil in this system, and that, I state as a fact. This system is balanced and symmetrical, and we have chosen for the sake of conventional knowledge of transformers, terms like "primary windings" and "secondary windings". But we know that we are dealing with a 1:1 ratio transformer, therefore the primary can be used as a secondary, and vice versa. You could swap them, because they are identical. That's a fact! We also know that this transformer has a median point in its secondary, and also its primary winding has a median point. Two median points in his transformer (at the left pole in the pictures):



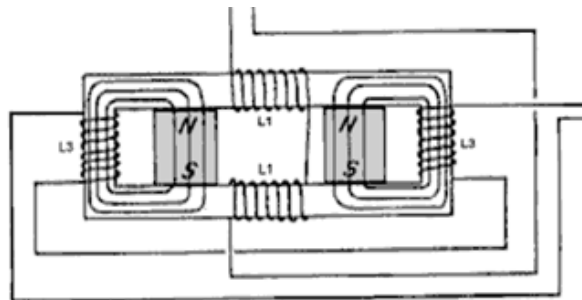
I believe that he is somehow using a common bistable/astable bipolar transistor circuit, with only two transistors. Why do I think that way, and could it be that simple? I believe so! I think he is using a flip-flop circuit to drive these coils:



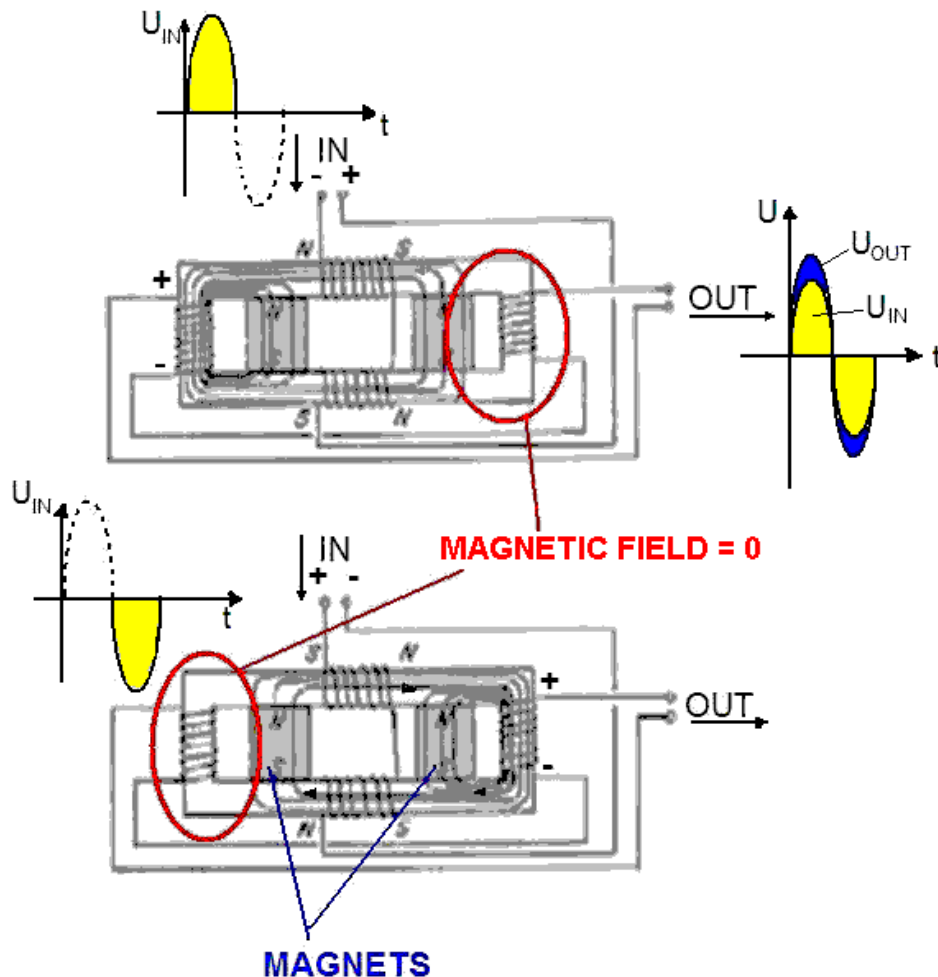
So in this arrangement the TPU should work like this:



This configuration is most like to be to operation of the TPU, because now it is very similar in operation to the **Charles Flynn Generator**:



It has a simple working principle:



When you understand how the Flynn generator works, then you will see that Steven's TPU is actually a better version of the same technology. Although this type of generator is working in AC, Steven's *TPU can't work like that* due to the coil winding direction at the front and back poles. Check the picture above, and you will realize that if you change the direction of the current through the TPU coils, then the 4 magnetic poles created around it will alternate and the magnet will vibrate, because one moment it is attracted by the flux inside the TPU, and the next moment it is repelled, so it can't work with sinewave AC! By implementing the Charles Flynn solid state generator in a toroid core, it becomes more efficient, due to providing a better magnetic flux containment construction.

This is the end of this research. Don't take everything which I said to be fact written in stone, but instead, judge for yourself. If you find these things presented here useful, fine, I'm glad that it helped someone.

Omissions from Chapter 8:

Arthur Cahill and John Scott

have patented a heat-pump system which draws heat energy from the surrounding environment and uses that energy to produce mechanical and/or electrical energy for powering a household. Why most people have a refrigerator they are generally not aware that it is a heat-pump and moves three times as much heat from inside the refrigerator compared to the necessary input power (COP=3 but could be up to COP=11 when used differently).

This heat-pump system appears to run without any form of energy input, but the energy comes indirectly from the sun heating the surrounding environment and there is no magic involved. Mind you, when the system runs and provides power, generally, without the need for any fuel, the user can be forgiven for thinking of it as a fuel-less or self-powered system even though strictly speaking, that is not the case. The inventors have made allowances for unusual conditions where environmental conditions can't provide the temperature difference needed to make the

system operate as intended. A liquid or gaseous fuel is provided along with a burner to provide the heat difference if those conditions are encountered.

Here is an extract from their patent:

Patent US 4,309,619

5th January 1982

Inventors: Arthur Cahill & John Scott

SOLAR ENERGY SYSTEM

ABSTRACT:

A dynamic, self-sustaining and self-perpetuating device for the production of motive force by combining cryogenic and thermodynamic principles into one system, keeping the systems separated, two open to atmosphere, the other closed, sealed, pressurised and using special compounded fluids, which when alternately exposed to the heat of atmospheric temperature, then, to the coldness of a liquid or air-cooled condenser, first evaporates, then condenses. Rapid expansion during evaporation produces a high pressure vapour which operates an engine and a generator, which are an integral part of the closed system. Rapid condensation drastically reduces back pressure on the aft side of the engine, and the engine operates on the difference between the two pressures, producing electricity, or, the engine can be used as a direct drive for vehicles or equipment. Built-in safeguards and alternatives are a part of the systems, assuring continued operation despite adverse conditions.

US Patent References:

2,969,637	Converting solar to mechanical energy	Jan 1961	Rowekamp
3,495,402	Power system	Feb 1970	Yates
3,995,429	Generating power using environmental temperature differentials	Dec 1976	Peters
4,110,986	Using solar energy carried by a fluid	Sep 1978	Tacchi
4,214,170	Power generation-refrigeration system	Jul 1980	Leonard

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a closed-cycle, sealed, pressurised, energy producing system, utilising the sciences of thermodynamics and cryogenics to convert liquid into gas, then back to liquid.

2. Description of the Prior Art

There is no exact prior art, as cryogenics have been used primarily for air conditioning and refrigeration purposes, and thermodynamic efforts have been directed in the area of low efficiency ocean thermal energy conversion systems. A few attempts have been made to combine some form of cryogenics and thermodynamics, without notable success, mainly using sea water for evaporation and condensing. While using no fuel and requiring little in the area of labour, these ocean thermal energy conversion systems are of necessity, low pressure systems and require large sea going platforms to support the huge turbines and heat exchangers which are necessary to produce reasonable electrical power, resulting in excessive capital costs for minimal electrical output, since such stations only have the ability to service a small portion of the populace along the seaboard. None of these contrivances serve or benefit the populace as a whole, while the whole bears the burden of financing through taxes, or government grants.

Proposals to heat gases and cool gases in an endeavour to improve the efficiency of home heating and cooling systems, have been previously advanced, some operating on the heat pump principle. All such previous proposals and inventions have had one thing in common, they all plug into the Utility Company's electric line to obtain the electricity necessary to run the system.

In cryogenics the knowledge that certain liquids, when heated, change into a high pressure vapour, which is the heart of all air conditioning and refrigeration systems, has been known for many years. Thermodynamics were pioneered by the 19th century French physicist Nicholas Carnot. Attempts have been advanced during the years to harness one or the other and sometimes both, for the purpose of heating and cooling, resulting in the invention of the heat pump in a much earlier year, but none of the systems yet devised for use by the general public have been able to operate without the use of an outside source of electricity, or, fuel, such as oil, or gas fired boilers, resulting in a considerable consumption of fuel and a cataclysmic effect on the earth's environment.

SUMMARY OF THE INVENTION

In accordance with the present invention, the device will operate in hot sunshine; on cloudy days without sunshine; during rainstorms; during snowstorms; during changes in temperature from day to night; during changes in seasons from winter, to spring, to summer, to fall; when it's cold, even below zero; for the power generated is that energy produced when a compounded fluid changes form, first to vapour, then back to liquid, by application of controlled temperatures within the sealed cycle. Thus, by combining cryogenics and thermodynamics into one system, keeping the two separated, one open to atmosphere and the other closed, sealed and pressurised, and by using fluids specifically compounded for the given area, or climate, these fluids, when exposed to atmospheric temperatures, in accordance with the kinetic theories of matter, gases and heat, provide the kinetic energy to operate an engine.

The condenser can be either liquid or air cooled, although for the embodiment depicted herein, the condenser is air cooled.

Generally speaking, there is up to an approximate 2.5 PSI increase associated with each degree of temperature rise in most cryogenic fluids and gases. However, using commercially available fluids, here are a few examples:

Temperature F.	Fluid	Pressure in psi.
125	R-22	280
125	R-500	203
125	R-502	299
125	R-717	293
80	R-13	521
80	R-22	145
80	R-500	102
80	R-502	160
80	R-700	128

You will notice that R-13 at 80° F. produces 521 psi., or 35.4 times atmospheric pressure and at 125° F. would produce thousands of psi. At 95° F. R-22 produces 185 psi., or a thrust on a five inch diameter piston of 3,633.4 pounds. Even at 30° F., with R-22 a thrust of 583.2 pounds is obtained. R-13 at 30° F. produces 263 psi. or 5,112.7 pounds of thrust on a five inch diameter piston. The pressures are there by using the Casco Perpetuating Energy System, utilising proprietary formulated liquids for the area and temperatures to be encountered. It is not intended that any of these mentioned fluids will be used in the present invention; the comparisons being made herein with popular and well known liquids, for comparison purposes only.

THE INVENTION

The present invention relates to a device to supply pollution free power to operate a generator for the producing of electrical power, or, to supply power as a direct drive to a shaft, transmission, clutch, differential or the such, the invention being independent of outside sources of power such as electricity supplied by a Public Utility Company. This is not to be considered perpetual motion, as will be explained later in the text.

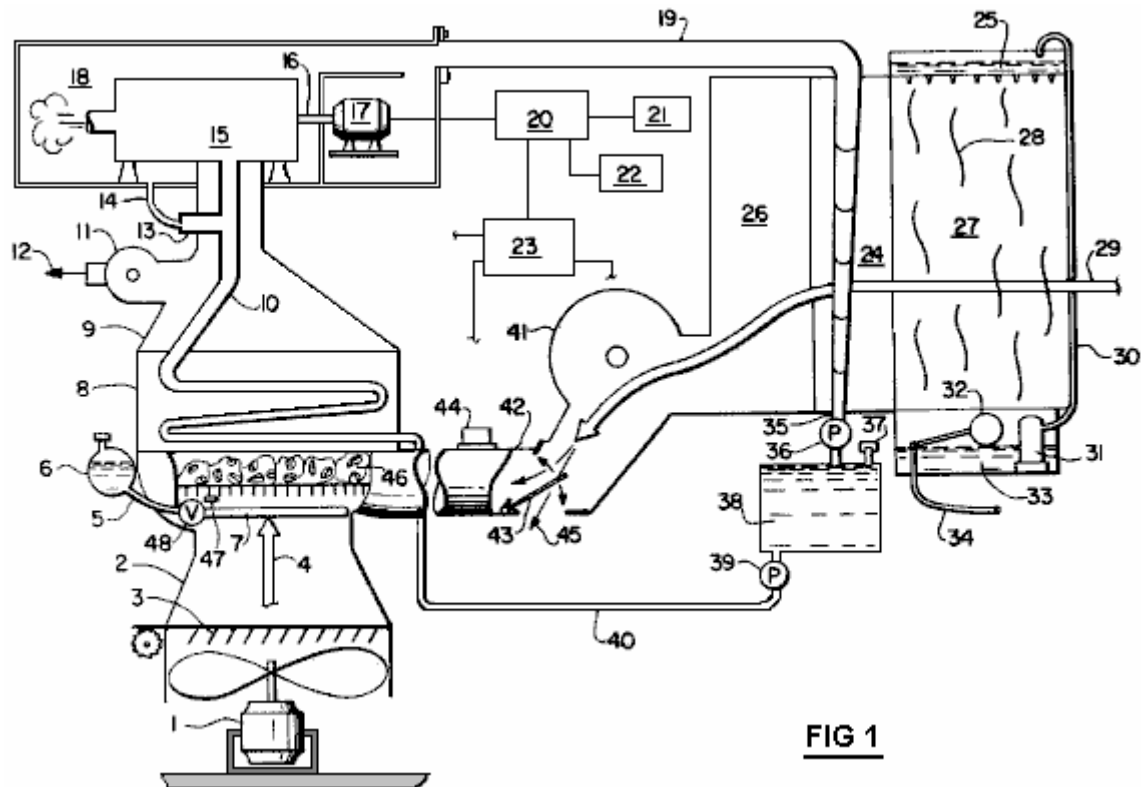


FIG 1

Fig.1 is a partially sectioned schematic view of the system:

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

In the drawing, **Fig.1**, the invention is shown in a preferred embodiment for home use. The liquid pump **39**, pumps the cryogenic fluid from the pressurised liquid reservoir **38**, into liquid line **40**, where the fluid gravity feeds into flash boiler **8**. Pump **39** also prevents back pressure from flash boiler **8** from entering the pressurised liquid reservoir **38**, and since the pressure within steam line **10** and liquid line **40** are equal, the cryogenic fluid gravity feeds down liquid line **40** into steam line **10**. The fins on flash boiler **8** are heated to atmospheric temperature by air stream **4**, which converts the fluid within steam line **10**, inside flash boiler **8** into high pressure steam. To maintain the pressure during the passage of steam to the engine **15**, steam line **10** from flash boiler **8** is housed inside the oven **9**, which is exhausted when necessary by discharge **12** from centrifugal blower **11**. Constant temperature within oven **9** and flash boiler **8** is maintained by the admission of fresh atmosphere via air stream **4** passing through the finned flash boiler **8** and up through oven **9**. Centrifugal blower **11** is thermostatically controlled to exhaust air within oven **9** which has cooled below a predetermined temperature. Any excess pressure within steam line **10** is by-passed through check valve **13** and bleed line **14** into the exhaust collector box **18**, thus, a pressurised, closed system is maintained, which, once charged, unless an accident damages or ruptures a line, should not have to be replenished. Pressure within the exhaust collection box **18** will be less than the inlet pressure from steam line **10** to engine **15**, because the condenser **24** is at a lower pressure, as is steam return tube **19**, than PSI input to engine **15** from steam line **10**, thereby creating a suction on the back of the exhaust collector box **18**.

Airstream **29**, which has been cooled by evaporator cooler **27**, flows over the finned surfaces of condenser **24**, instantly lowering the temperature of the steam within condenser **24** below a predetermined condensation point, thus turning the steam back to a liquid, such conversion and instant reduction of volume within condenser **24** causing a pressure reduction at the back of engine **15**. This condensed liquid drains down into liquid coil return **35**, where it is immediately pumped into the pressurised liquid reservoir **38** by liquid pump **36**.

While under pressure in pressurised liquid reservoir **38**, the fluid is maintained in a liquid state regardless of exterior temperature, until it is re-circulated back into the system by liquid pump **39**, through liquid line **40** to flash boiler **8**, where it again converts into steam.

The capacity of evaporator cooler **27** and packing **28** is sufficient to cool intake air stream **29** to a predetermined temperature below atmospheric temperature at any given time, even with humidity rise at night, or during rainstorms, or just during high humidity weather. This temperature differential is maintained as the atmospheric

temperature rises and falls, with an anti-freeze liquid being added to the water in the evaporator cooler when temperatures drop below 32° F., to keep it from freezing.

Additional warm air to augment air stream 4 is obtained by directing the warm air exhaust collected in hot exhaust air collector 26, by centrifugal blower 41, through T-assembly 42. Air flow through T-assembly 42 is directed and controlled by the warm air control mechanism 44, which regulates flow-damper 43 to either exhaust through exit 45 into the atmosphere, or alternatively, recirculate air flow 29 through restricted-T 42, thereby compressing and further heating air flow 29 before injecting it through flash boiler 8. Warm air control mechanism 44 also controls fan 1 and louvers 3, selecting the optimum heat from either T-assembly 42 or variable-Venturi 2, to perpetuate the system.

The evaporator cooler 27 has an inlet water pipe 34 which supplies cold water from the normal house water supply, or well, (neither shown). The bottom water reservoir 33 is kept at a constant level of water by float valve 32. The water is pumped by pump 31 up tube 30 into the top water reservoir 25, where it runs through the perforated bottom of reservoir 25 down on to the packing 28, keeping packing 28 constantly wet, which cools air flow 29 as it is drawn through packing 28 and over the fins of condenser 24 by the partial vacuum in the hot exhaust collector 26, such partial vacuum being created by centrifugal blower 41 exhausting the air from the hot exhaust air collector 26 slightly faster than air flow 29 can replace it.

As long as there is warmer air on the flash boiler 8 side of the system than the cooler condenser 24 side of the system, this device will continue to operate and produce electricity and/or power. The heat recirculating system and the use of three separate, distinct sub-systems within the system, one sealed, permits the system to perpetuate itself. As mentioned above, this device is not to be considered perpetual motion, for somewhere in the ranges of temperature differentials and weather conditions, there may be a no-man's land where the system could shut down, then the variable venturi 2, in conjunction with motor and fan 1 and louvers 3, will come into use automatically upon a signal from warm air controller 44 and 12 voltage controller 23, and be used for a period of time. Motor and fan 1 forces an air stream 4 upward through the variable Venturi 2, with air stream 4 controlled by warm air controller 44 and 12 volt controller 23, adjusting louvers 3. As air stream 4 is forced through the restriction of variable Venturi 2, air stream 4 is compressed as it funnels up the narrowing walls of the variable Venturi 2, such compression causing the air to heat, thus overcoming possible deadlocked or identical temperatures between the condenser 24 and air flow 4. This slight temperature rise in air stream 4 will enable the system to perpetuate itself until the atmospheric temperature itself changes enough to permit a continued operation. Since fan and motor 1 is run by battery power from 12 volt supply 23, even though the batteries are constantly being charged during operation, the batteries may become exhausted because of an extended time the fan and motor 1 are run, then, or, if for any other reason the system starts to run down, a small burner 7, operating on liquid or gaseous fuel 6, through line 5 and valve 48, is ignited by spark mechanism 47 and supplies the heat necessary to support and perpetuate the system until atmospheric temperature and condensing temperature permits the system to operate normally. Fired clay heat retainers 46 are arranged on the grate within burner 7, to retain heat.

The cryogenic system is charged by filling with liquid under pressure through fill pipe 37. Re-charging, if necessary, is done the same way. Engine 15 turns drive shaft 16, which turns generator 17, producing electrical power (110V or 220V) via electric control system 20 which passes the electricity into three channels:

One: To 12-volt controller 23, to run the electrical parts of the system and keep the batteries charged.

Two: To the house 22, to supply the electricity with which to cook, run appliances, light, heat and cool the home.

Three: All remaining electricity is channelled through utility meter 21 into a local utility company's electrical line for sale and use elsewhere.

Omissions from Chapter 7:

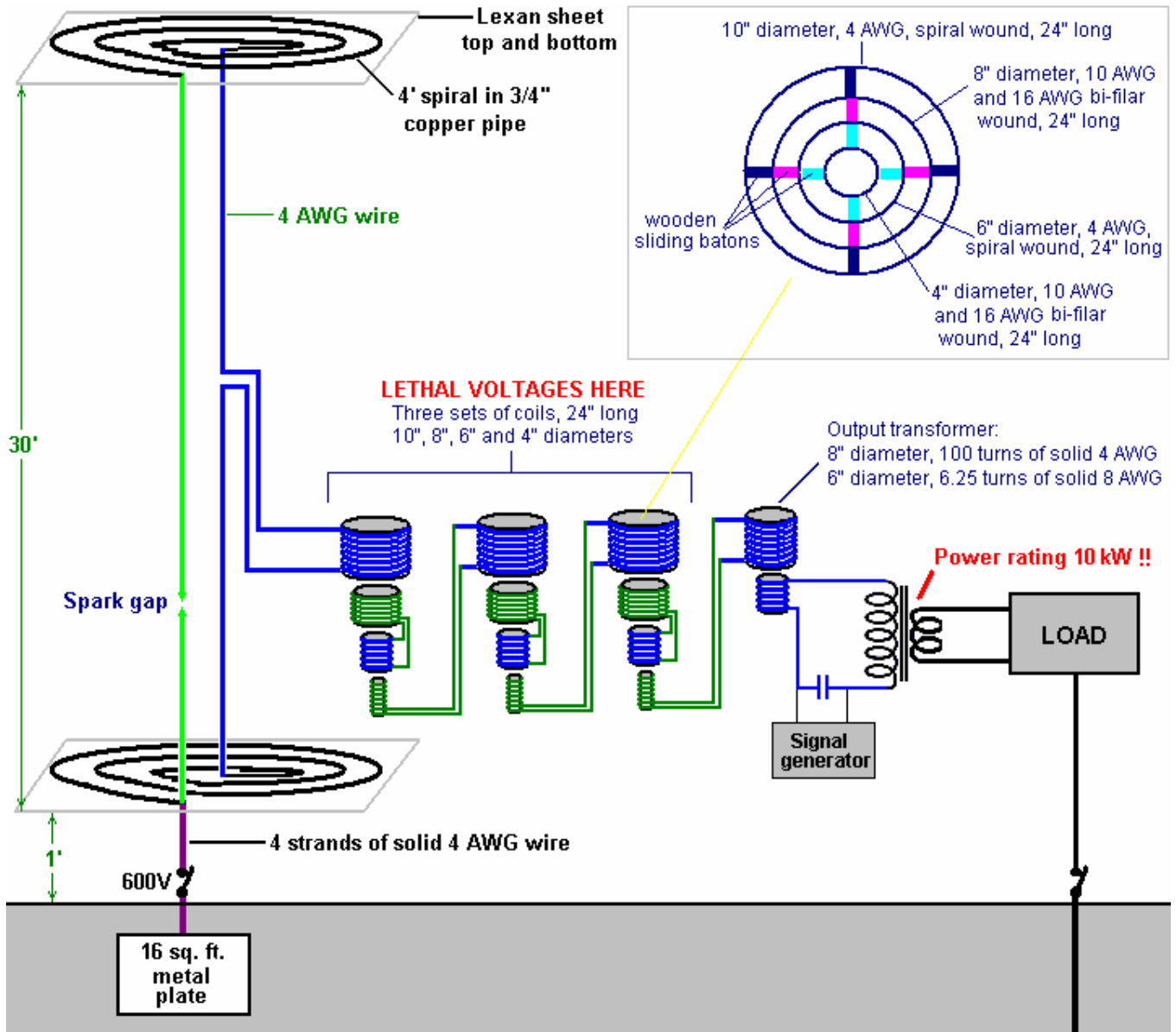
Lawrence Rayburn's TREC Aerial

There is a powerful aerial system which has been developed by Lawrence Rayburn of Canada. Initially, Lawrence intended to market kits to make it easy for people to replicate his aerial design which was providing him with ten kilowatts of power. However, Lawrence shelved that idea as he decided that the risk to users was just too high. He was also concerned that the aerial/earth combination might attract lightning strikes, causing considerable local damage. So, it is VERY important that you understand that this is a dangerous and potentially LETHAL aerial system which is quite capable of killing you if you are careless. If you are not already experienced in working with high-voltage/high-current devices, then this is NOT something for you to experiment with, and anyone who does fool around with this design does so wholly at his own risk as this material is presented "for

information purposes only” and there is **no** recommendation whatsoever that you should actually construct one of these aerial systems.

The technique used is quite different from the other aerial systems mentioned earlier in this chapter. Here, the objective is to create a tuned, resonant cavity reaching up to the ionosphere where there is a massive amount of excess energy supplied by the sun.

The tuning mechanism consists of two spirals of 3/4-inch (20 mm) copper pipe wound so that they cover a four foot (1220 mm) diameter area. These spirals are covered above and below with a sheet of Lexan plastic. The diameter of the copper pipe is important and smaller diameter should not be used even though it would be much easier to bend into shape. Actually, bending the large-diameter copper pipe is unlikely to be an easy task. Presumably, a pipe-bending machine would be used and a conical spiral produced and then the cone flattened to form the flat spiral. The spiral has even spaces between the turns, at all points along it's length.



The two spirals are mounted, one vertically above the other with thirty feet (9145 mm) between them and the lower spiral being one foot (305 mm) above the ground. This means that this aerial system is only suited to people who can erect a structure of this height without inconveniencing neighbours or contravening local planning regulations.

The tuneable cavity is created by connecting the innermost ends of the two spirals together using 4 AWG wire which has a 5.19 mm diameter copper core. The outer end of the lower spiral is then connected to a large ground plate buried two feet (600 mm) below the surface of the ground, with four separate strands of the 4 AWG wire.

An adjustable spark gap is used. It can be positioned in the vertical wire between the two spirals, or in the middle of an extra 4 AWG wire run vertically between the outer ends of the two spirals. The power take-off is from the middle of the central vertical wire.

The cavity is tuned by sliding coils inside each other. This arrangement not only tunes the cavity but it also steps down the very high aerial voltage and raises the available current at the same time. This is where the danger comes in. The intermediate parts of this step-down tuning arrangement can have voltages of 600 volts at high current, and those voltages can easily kill you, which is why this is NOT a system for beginners and why Lawrence did not go ahead with selling kits for this aerial system.

The aerial output is fed into a final step-down transformer and a 50 Hz (cycles per second) or 60Hz signal from a signal generator is used to modulate the incoming power and allow it to be used with normal mains equipment which may need that frequency of AC. Resistive heaters and lights don't need AC or care about the frequency of any AC which they are fed.

The tuning of the system is very sharp and whatever is being used as the load affects the tuning. The wire used for the tuning array is insulated, single solid-core copper wire. 4 AWG has a core diameter of 5.19 mm, 8 AWG has a core diameter of 3.26 mm, 10 AWG has a core diameter of 2.59 mm and 16 AWG has a core diameter of 1.29 mm. Page 1 of the Appendix shows other characteristics for these wires. These heavy wires are an essential part of this design.

You will notice that two separate earth connections are needed for this aerial system. The second earth connection should be a long copper rod driven deep into the ground and some distance away from the buried plate earth. For the separation of two earth connections, ten metres (eleven yards) is generally considered to be a reasonable distance between them. The main earth is a 4-foot x 4-foot plate buried exactly under the lower spiral and the connection runs to the centre of that plate.

It is suggested that the spark-gap be constructed using copper-clad carbon welding rods, mounted in a nylon housing which allows the gap to be adjusted with a **nylon** screw. Remember that this is not a connection which you can disconnect from the power supply when making connections or adjustments. Also, on one occasion when a 500-watt light bulb was connected across the spark gap, it burned out instantly with a bright flash of light. This system is not a toy so thick rubber gloves and rubber footwear should be used.

The 4 AWG copper wires can be connected to the copper rods forming the spark electrodes, using copper pipe clamps. A tapered nylon rod could be used to adjust the spark gap screw while keeping well away from the copper. The spark gap should start at a one-inch (25 mm) gap and adjusted to no less than a half-inch gap. The spark gap and it's adjusting gear should be enclosed in a weather-proofing container and it has been suggested that it could be an advantage to fill that container with helium gas.

Please remember that coils, such as those in the tuning section of this system, have capacitance as well as inductance. The coil insulation is a dielectric and you standing on the ground form a good earth connection, so please don't imagine that you can't get a serious shock from handling an insulated coil carrying high-voltage high-frequency AC current, and in one implementation after modulation in the mixer at 60 hertz the pre-output transformer was measured at 3496 volts!

If you are not experienced in working with high-voltage circuitry, and still decide to try building and using this circuit, then please put your affairs in order and pre-pay your funeral expenses before you start building. (That statement is not intended to be humorous).

It is said that if the upper spiral is positioned at a height of just four feet (1200 mm) then the output is much lower and suited to charging a battery bank. As far as I am aware, this system has not been replicated and so there has been no practical feedback on building or using it.

The TREC appears to be not unlike the Patent Application US 2008/0191580 from Harold Deyo:

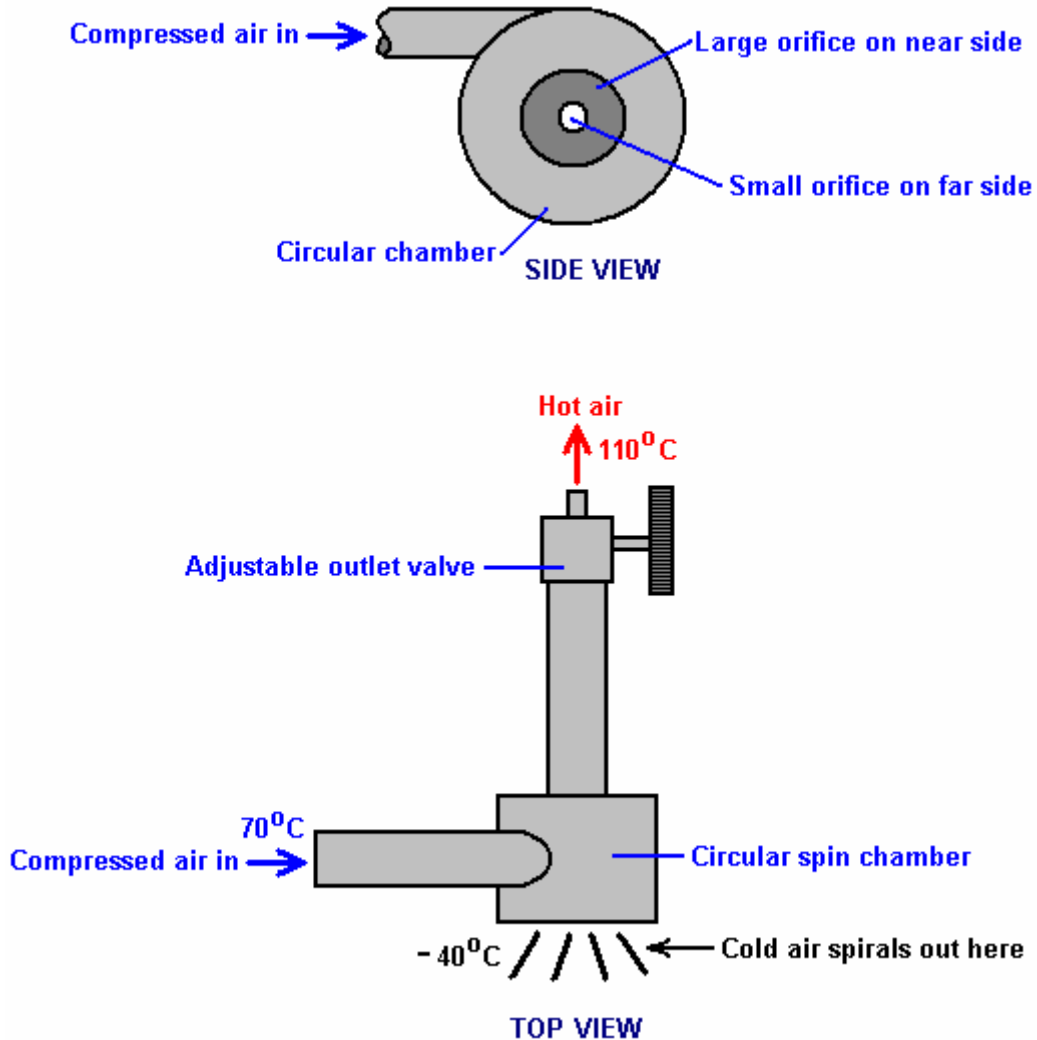
Omissions from Chapter 8:

The Vortex Tube

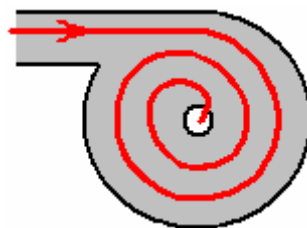
The Leroy Rogers patent shows how the practical details of running an engine on compressed air can be dealt with. What it does not show is background details of the actual energy flows and the effects of compressing air

and then letting it expand. These things are not normally encountered in our daily lives and so we do not have an immediate intuitive feel for how a system like these will operate. Take the effects of expansion. While it is quite well known that letting a compressed gas expand causes cooling, the practical effect is seldom realised.

The web site http://www.airtxinternational.com/how_vortex_tubes_work.php show the details of a “vortex tube” which is a completely passive device with no moving parts:



This device does things which you would not expect. Compressed air at a temperature of, say, seventy degrees Centigrade is fed into the circular chamber where the shape of the chamber causes it to spiral rapidly as it exits the tube:



There is an energy gain in a vortex, as can be seen in a hurricane or tornado, but the really interesting thing here is the dramatic change in temperature caused by the change in pressure as the air expands. The ratio of heat gain to heat loss is controlled by the ratio of the sizes of the openings, which is why there is an adjustable nozzle on the small opening.

The air exiting through the large opening is much higher volume than the air exiting through the small opening and it expands very rapidly, producing a massive drop in temperature. The density of this cold air is now much higher than the air entering the vortex chamber. So there has been both a drop in temperature and an increase in density. These features of the expansion are made use of in the Leroy Rogers engine design, where some of the expanded air exhaust of the engine is compressed and passed back to the main air storage tank. While the compressor does raise the air temperature as it pumps the air back into the tank, it does not reach its original temperature instantly.

This results in the air temperature inside the tank dropping as the engine operates. But, the lowered tank temperature causes an inflow of heat from its immediate environment, raising the overall tank temperature again. This warming of the chilled air causes the tank pressure to increase further, giving an energy gain, courtesy of the local environment. It is important to understand that it takes less energy to compress air than the kinetic energy which can be generated by letting that compressed air expand again. This is a practical situation, courtesy of the local environment and is not a breach of the law of Conservation of Energy. It is also a feature which has not yet been exploited to any great degree and which is just waiting to be used by any adventurous inventor or experimenter.

The Clem Engine

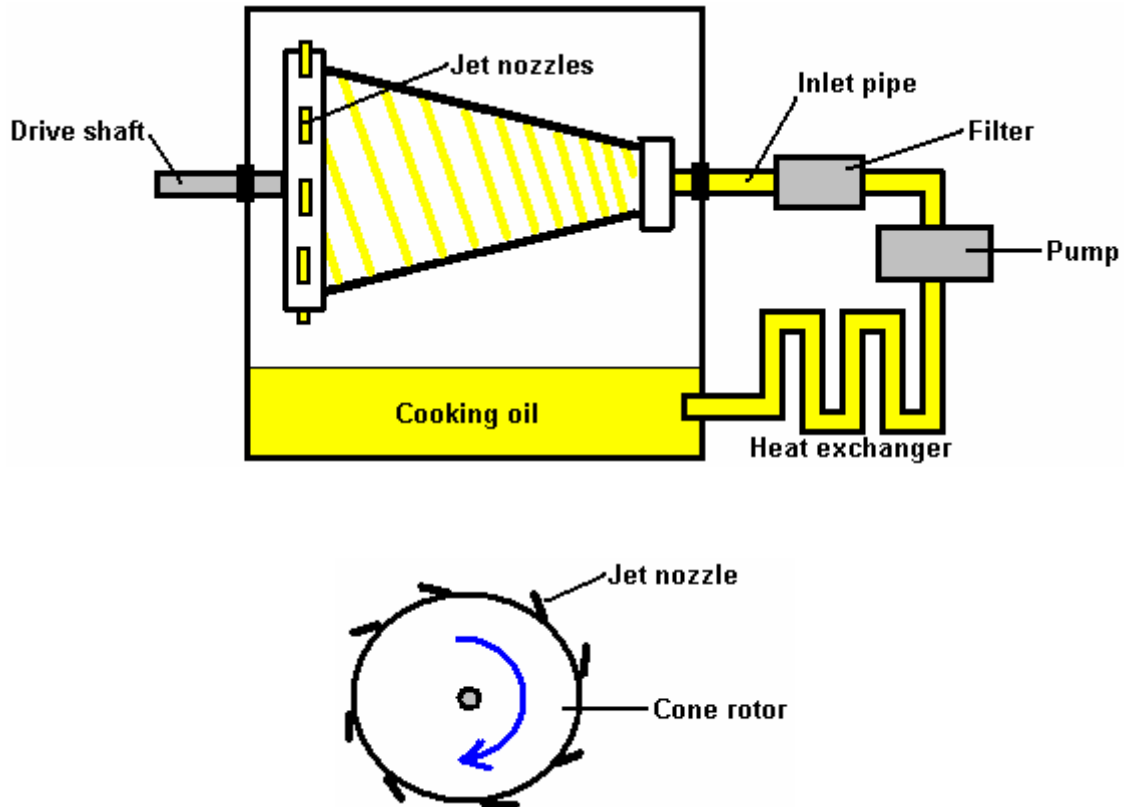
This engine is based on an entirely different principle, and one which is not spoken about very often. Hurricanes or "twisters" as they are sometimes called, are large rotating air masses of incredible power which develop in hot areas which are more than eight degrees North or South of the equator. The distance from the equator is essential as the rotation of the Earth is needed to give them their initial spin. They usually develop over water which is at a temperature of twenty-eight degrees Centigrade or higher as that allows the air to absorb enough heat energy to get started. That is why there is a distinct "hurricane season" in these areas, since at certain times of the year the ocean temperature is just not high enough to trigger a hurricane.

What is not generally realised is that a hurricane develops excess energy due to its swirling circular movement. The generation of this extra power was observed and documented by Viktor Schaubberger of Austria, who also used his observations to great effect. I think that what Schaubberger says makes some people uncomfortable as they seem to think that anything "unorthodox" has to be weird and too peculiar to be mentioned. This is rather strange as all that is involved here is a simple observation of how our environment actually works. A hurricane is wider at the top than at the bottom and this concentrates power at the base of the swirling mass of air. This tapered rotation is called a "vortex" which is just a simple name to describe the shape, but any mention of "vortex power" (the power at the base of this rotation) seems to make many people uncomfortable which is most peculiar.

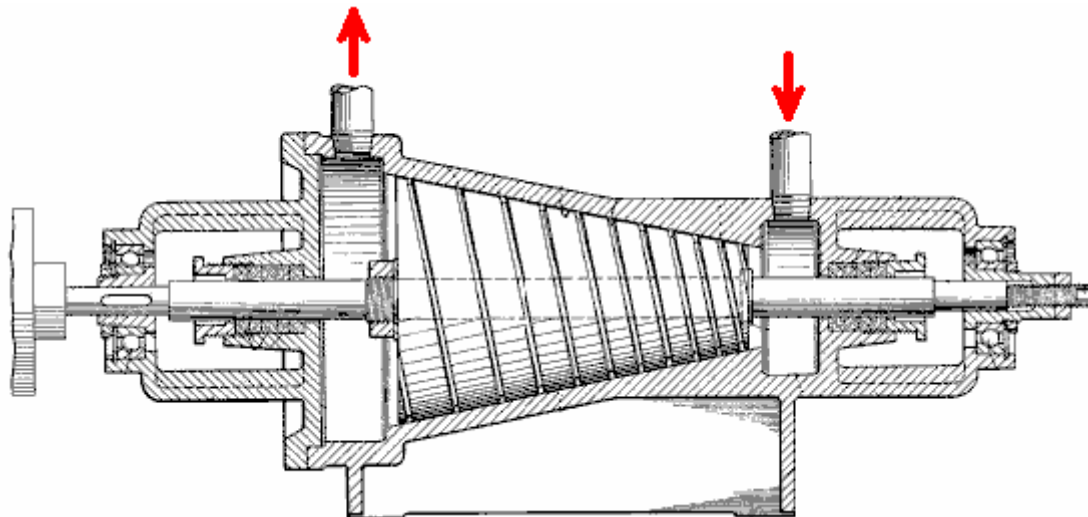
Leaving that aside, the question is "can we use this energy gain from the environment for our own purposes?". The answer may well be "Yes". Perhaps this principle is utilised by Richard Clem. In 1992, Richard Clem of Texas, demonstrated a self-powered engine of an unusual type. This engine, which he had been developing for twenty years or more, weighs about 200 pounds (90 kilos) and generated a measured 350 horsepower continuously over the full period of a nine-day self-powered test. Although this engine which runs from 1,800 to 2,300 rpm is especially suited to powering an electrical generator, Richard did install one in a car, and estimated that it would run for 150,000 miles without any need for attention and without any kind of fuel. Richard said that his prototype car had reached a speed of 105 mph. Just after receiving funding to produce his engine, Richard died suddenly and unexpectedly at about 48 years of age, the death certificate having "heart attack" written on it as the cause of death. Remarkably convenient timing for the oil companies who would have lost major amounts of money through reduced fuel sales if Richard's motor had gone into production.

The motor is unusual in that it is a rotary turbine style design which runs at a temperature of 300⁰F (140⁰C) and because of that high temperature, uses cooking oil as its operational fluid, rather than water as the oil has a much higher boiling point. To a quick glance, this looks like an impossible device as it appears to be a purely mechanical engine, which will definitely have an operating efficiency which is less than 100%.

In broad outline, the oil is pumped through a pipe and into the narrow end of the cone-shaped rotor. The engine is started by being rotated by an external starter motor until it reaches the speed at which it generates enough power to be sustain its own operation. The rapid spinning of the cone, causes the oil to run along spiral grooves cut in the inner face of the cone and exit through angled nozzles placed at the large end of the cone:



The operating pressure produced by the pump is 300 to 500 psi. Richard did not attempt to patent his engine as US Patent 3,697,190 "Truncated Conical Drag Pump" granted in 1972 as a liquid-asphalt pump is so close in detail that Richard felt that there was insufficient difference for him to be granted a patent:



There appears to be considerable scope for anyone who wishes to build or manufacture this engine and it is capable of acting as a heater as well as device for producing mechanical power. This suggests that water purification could be an additional "extra" option for this engine.

Prof. Alfred Evert of Germany has produced an analysis of the operation of the Clem Engine and turbines in this general category. His website <http://evert.de/indefte.htm> has this to say:

07.05. Centrifugal-Thrust-Engine

Objectives

Several different versions of air-drive engines have been described in the previous chapters. One which is particularly powerful, is the "Suction-Cylinder-Engine" when driven by compressed air. Water-drive engines

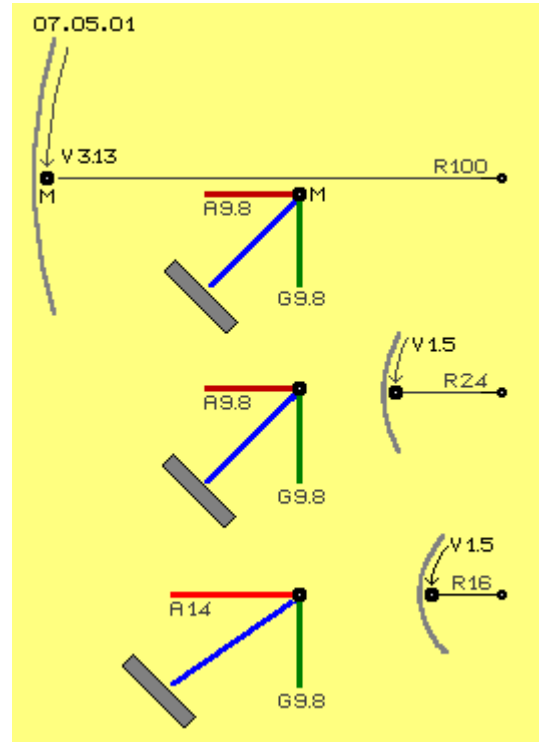
require a much more complex arrangement of closed circuits due to the strong centrifugal forces caused by using such a dense working-medium.

This new concept of the “Centrifugal-Thrust-Engine” shows that centrifugal forces can contribute to turning momentum. Initially, however, we need to discuss some general points of view concerning the inertia of rotating systems.

Gravity and Centrifugal Forces

First, consider the movement of a mass (a sphere or body of water) moving in a circular path around the inside wall of a hollow cylinder. Centrifugal forces always press radially outwards while Gravitational forces always act straight downwards. **Figure 07.05.01** shows diagrams of three situations.

A partial plan view of such a cylinder is shown in grey. This cylinder has a radius of 100 cm (**R100**). Along its inner wall, mass **M** is moving at a speed of 3.13 m/s (see arrow **V3.13**). This mass is continuously pushed inwards by the cylinder. This inward acceleration **A** can be calculated by the formula **Speed squared divided by Radius**, in this case, with 3.13 m/s at a radius of 1 m, acceleration **A** = (3.13)² / 1 = 9.8 m/s².



Matching that inward acceleration is the outward centrifugal force of that mass. That centrifugal force (**A9.8**) is shown as the red vector in the diagram. Gravitational acceleration is also about 9.8 m/s², and is shown here as the green vector (**G9.8**) in the diagram, acting vertically downwards. The resulting force is shown as the blue line in the diagram. If the cylinder wall were replaced by the inside surface of a cone with a 45 degree inclination, then the mass would rotate at the same speed, maintaining a constant height.

Now, consider the middle diagram. Here, the radius distance to the wall is only 24 cm (**R24**) and the mass is only moving at 1.5 m/s (**V1.5**). The inward, or “centripetal” acceleration produced is $A = 1.5^2 / 0.24$ which is 9.8 m/s² so, here again, the centrifugal force (**A9.8**) corresponds to acceleration under gravity (**G9.8**). Consequently, the diagram of the resolution of forces matches that of the previous diagram.

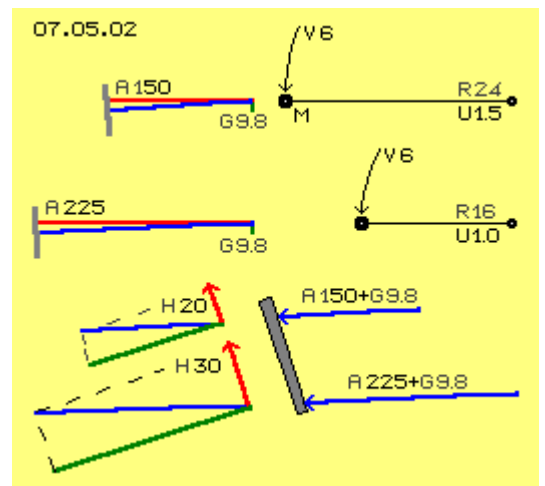
So whenever a mass completes one rotation in exactly one second, the centripetal (inward) acceleration is the same as acceleration under gravity. At a radius of 1 m, the circumference is about 3.13 m and so the speed is about 3.13 m/s for one rotation per second. At a radius of 0.24 m, the circumference is about 1.5 m and so one rotation per second requires a speed of 1.5 m/s, and so identical results are produced. Whether this happens to be a pure coincidence or due to some other cause, is discussed later in the section entitled “Aether Physics”.

In the lowest section of **Figure 07.05.01**, a rotation at this same speed of 1.5 m/s (**V1.5**), but this time at the shorter radius of, say, 16 cm (**R16**) produces a stronger inward acceleration given by $A = 1.5^2 / 0.16$ which works out at about 14 m/s². As the force diagram shows, this results in the mass rotating along a circular track which is higher up than the previous tracks. This can be seen in action when coffee in a cup is being stirred vigorously.

Lifting-Force

Now consider **Figure 07.05.02** which illustrates the effects of imposing higher rotational speeds on a mass. The radius of 24 cm (**R24**) and of 16 cm (**R16**) are now each propelled at the higher rate of 6 m/s (**V6**). The inward “centripetal” acceleration is correspondingly greater and is given by the equation $A = 6^2 / 0.24$ which works out at about 150 m/s² (**A150**) and about 225 m/s² (**A225**) respectively.

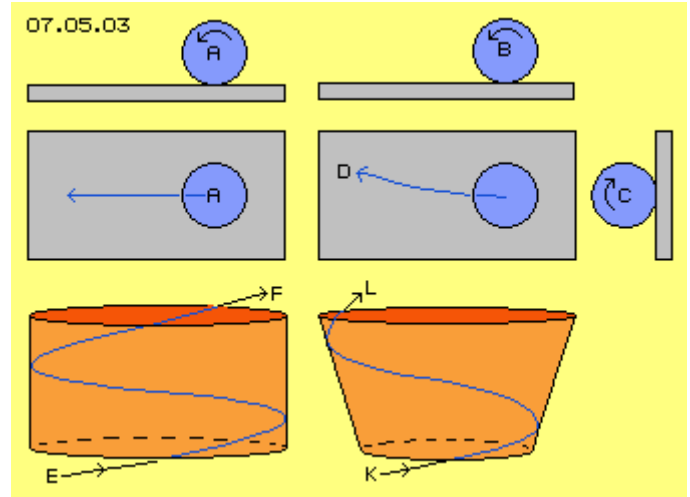
In both of these cases, the centrifugal force is substantially greater than the gravitational force (shown as the short green near-vertical vector marked as **G9.8**) and so the resulting net forces (shown in blue in the diagram) are much closer to the horizontal than before. These masses will therefore rotate at a constant height when moving along the inner face of a cone which has much steeper walls (shown in grey).



The lowest diagram of **Figure 07.05.02** shows the situation where these forces press against a less steeply sloping wall (shown in grey). The wall resists this pressure by pressing back at right angles to its surface (dark green vectors). Consequently, the remainder of the nearly horizontal centrifugal force produces an upward component (**H20** and **H30**, shown in red), parallel to the sloping face of the wall. Depending on the speed of the mass and the angle of inclination of the wall, this upward force causes an acceleration of the mass, upwards along the wall. In these examples, that acceleration is about 20 to 30 m/s². In our example of coffee being stirred in a cup, the faster the stirring and the more angled the sides of the cup, the larger the amount of coffee which spills over the lip of the cup. Notice that part of this centrifugal force becomes a component which acts in a direction opposite to gravity. In our example, the 6 m/s (six revolutions per second or 360 rpm), produces a lifting-force which is much greater than the force of gravity.

Spiral Tracks

In **Figure 07.05.03**, the diagrams on the left hand side show sphere **A**, which might be a bowling ball, rolling in a straight line from right to left on a flat, horizontal surface. The plan view presented immediately below, shows that the movement of the sphere is a straight line. However, as shown at the bottom left of the Figure, if the sphere is projected at an angle, into a vertical cylinder, then it follows an upward helical track from **E** to **F** in the diagram. The path followed is similar to a screw thread inside a nut or on the outside of a bolt. This same path would be followed if the moving object were a jet of water rather than a solid sphere.



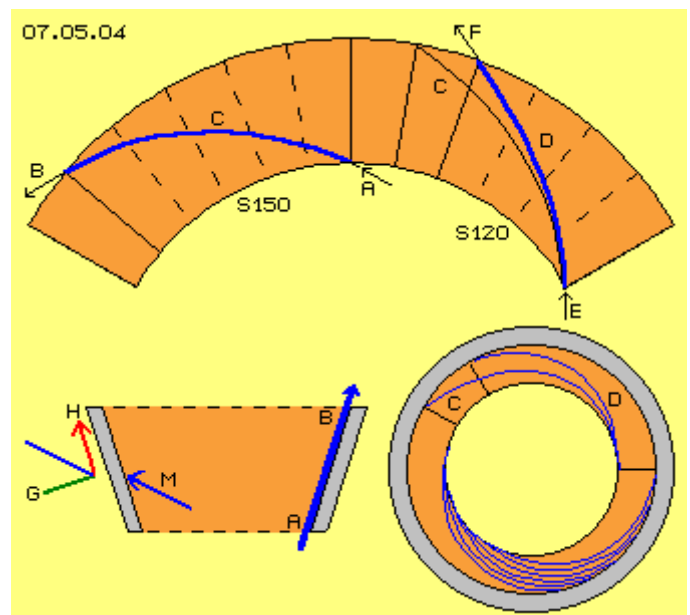
The corresponding three diagrams on the right hand side of **Figure 07.05.03** show the situation for the sphere if instead of a vertical cylinder, it is projected into an inverted cone shape. In this instance, the path followed is a spiral curve starting at point **K** and continuing to point **L**. When this movement is shown on a flat surface, you will notice that the sphere rolls in a curve towards point **D**.

This shows clearly that there is an additional sideways force **C** acting on the sphere, causing this curved path. This has the effect that when the sphere is projected into the cone shape, it exits at point **L** with a greater upward angle than that with which it enters the cone at point **K**. This effect is also seen if a jet of water is used rather than a sphere or bowling ball. It should also be realised that as the sphere runs upwards along the inside surface of the cone, that its path gets progressively steeper the further it rolls.

Steeper, Shorter and Faster

In **Figure 07.05.04** the inner surface of the cone of **Figure 07.05.03** is shown opened out to form a flat surface. The cross-lines shown are positioned to indicate each 30 degree strip of the conical surface. If a jet of water is projected into the lower edge of the cone at point **A**, at an angle of 30 degrees, then it will exit from the top of the cone at point **B** some 150 degrees later (sector **S150**). The angle of exit is also 30 degrees and the spiral track **C**, shown in blue, is the path followed during its constant, steady rise through the cone.

The blue line **D** shows what happens when a jet of water is projected into the cone. It enters the lower edge of the cone at an angle of 30 degrees as before, but this time the water velocity is greater. As a result of this higher velocity, the water now exits from the upper edge of the cone at a steeper angle of about 35 degrees. That track **D** runs within a sector of the cone which spans only 120 degrees (**S120**) and so the track followed is shorter, steeper and covered more quickly than the jet of water flowing along the previous track **C**.



The diagram at the bottom right hand side of **Figure 07.05.02**, shows the cone as seen from the top. Track **C** with its constant rate of rise is shown, as is the steeper and shorter track **D**. The far side of the cone, shows several paths which indicate how the water flows if the angle of entry at the bottom of the cone, is increased in steps.

The diagram at the bottom left shows the cross-sectional view of the section of cone used in this discussion. It shows how the water enters at the bottom edge, moves along the inner wall and exits from the upper edge of the cone. The vector **M** shows the diagonal thrust of the water against the wall of the cone. This is the direct equivalent of the two forces **G** (against the wall) and **H** (upwards along the wall). Force **H** is much greater here than with the earlier example where the rate of upward movement was constant.

Provisional Result

In this first section, only well-known facts have been mentioned. However, an understanding of these examples and their points of view will be important during the following discussion:

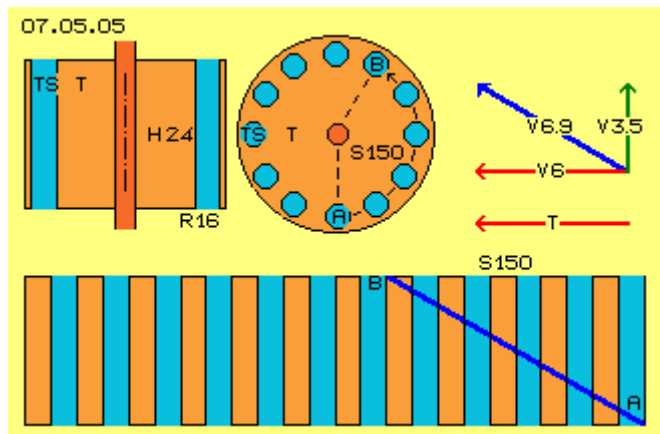
We have noted that:

- Centrifugal force equals that of gravity for one rotation per second.
- A mass at this velocity maintains a constant height on a wall inclined at 45 degrees.
- If the mass moves faster than that, it rises up the inner wall.
- The lifting force increases with increased velocity and/or wall slope and
- The track along the inner wall surface becomes increasingly steeper.
- The mass moves with increasing speed as it progresses towards the outer edge of the cone.

The “Centrifugal-Thrust-Engine” is based on the principle that a hollow cone-shaped cylinder is a ‘passive element’. Additionally, a working medium flowing along it’s stationary inner wall, is an ‘active element’. These key properties are now discussed in the following section:

Rotor-Cylinder

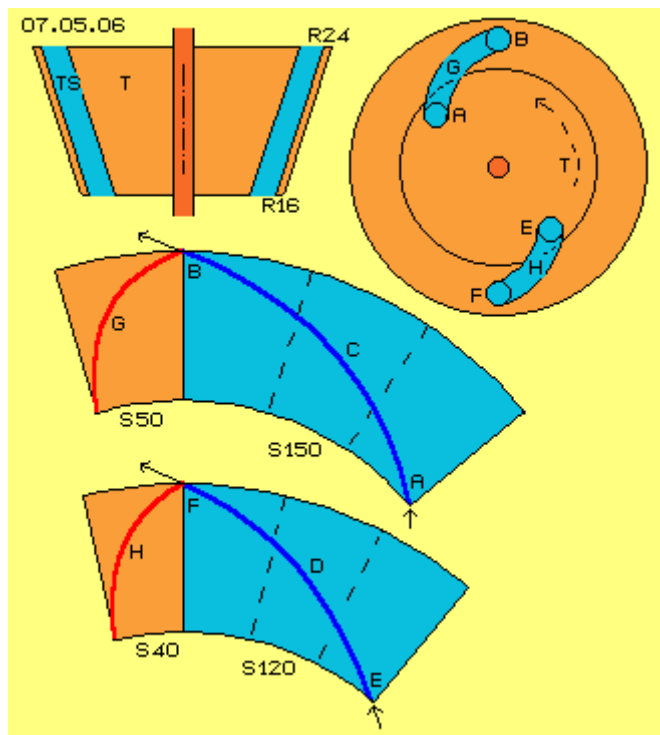
Figure 07.05.05 shows a representation of a turbine **T**. Initially, this is shown as a round cylinder. At the top left hand side of the diagram, a vertical cross-section is shown, and to the right of that is the view from above. The diagram at the bottom of the Figure shows the inside wall of the cylinder opened out and laid on a flat surface. The cylinder in this example has a radius of 16 cm (**R16**) and a circumference of 1 metre. Circular pipes are positioned vertically around the circumference to act in a similar way to turbine-blades (**TS** shown in blue). Here, twelve of these pipes are shown, each parallel to the system axis and running in a straight line from bottom to top.



A 6 m/s jet of water enters the bottom of these pipes at an upward angle of 30 degrees. Due to the rotation of the cylinder drum, the water moves along the diagonal path **A** to **B**. As explained earlier, the water has a horizontal velocity component marked in red in the diagram as **V6**, and because of the angle of entry of the water, there is a vertical speed of about 3.5 m/s (shown in green and marked as **V3.5**). The water flowing in these pipes actually flows in a spiral path diagonally upwards, following the path shown by the blue line running from **A** to **B**. If the height of the cylinder is 24 cm (**H24**), then the water moves around through the whole of sector **S150** during its upward flow through the vertical pipes.

Rotor-Cone

At the top left hand side of **Figure 07.05.06** a conical cylinder turbine **T** is shown. The pipes running up the inside of the cone are set with a 16 cm radius at the lower edge of the cone (**R16**) and 24 cm radius (**R24**) at the top of the cone. These pipes therefore have a curved shape as they run the inside face of the cone. These pipes can be thought of as performing the same function as turbine blades in a jet engine.



In the same way as before, a jet of water is fed at upward angle of 30 degrees into the bottom of the pipes. Unlike the previous case, the jet of water

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does not strike the walls of the pipes at their lowest point because the water is entering parallel to a diagonal wall. In this case, as before, the overall height of the cylinder is 24 cm. The track taken by the water will be exactly the same as the previous track, running from **A** to **B** shown in the previous diagram, and again spanning a sector of 150 degrees (**S150**).

The central diagram of **Figure 07.05.06** shows the conical cylinder surface laid out flat. The dark blue curve **C** shows the path taken by the jet of water as it spirals upwards and outwards from **A** to **B**, within the sector **S150** shaded in blue. Interestingly, since the cone circumference at the outlet level is longer than at the inlet level (having 24 cm and 16 cm lengths respectively), The cone actually rotates at a greater speed than the speed of the water. This means that the water accelerates as it passes up through the curved pipes inside the cone (although that is not the intended job of any turbine).

As shown in the top right hand diagram, the pipes inside this conical turbine need to be curved backwards in the opposite direction to that in which the turbine rotates. These pipes are curved to follow the path shown in red and marked **G** which is contained within the 50 degree sector **S50**.

As stated earlier, the water flowing in these pipes presses against the outer wall, due to centrifugal force. Once the water speed is great enough, the water gets lifted upwards by its own motion. If the pipes allow that additional upward motion, then the water will exit from the top of the pipes at a more acute angle than the angle of entry at the bottom of the pipes.

The bottom diagram shows a design arrangement where the water enters at an angle of 30 degrees (point **E**), and exits at the same 30 degree angle (at point **F**). With this arrangement, the water travels along a shorter, steeper path **D** in a narrower sector of just 120 degrees (**S120**). Due to this shorter path, the pipe follows a different curve, such as the one shown in red and marked **H** in the diagram. The pipe itself, is contained in a sector of just 40 degrees (**S40**).

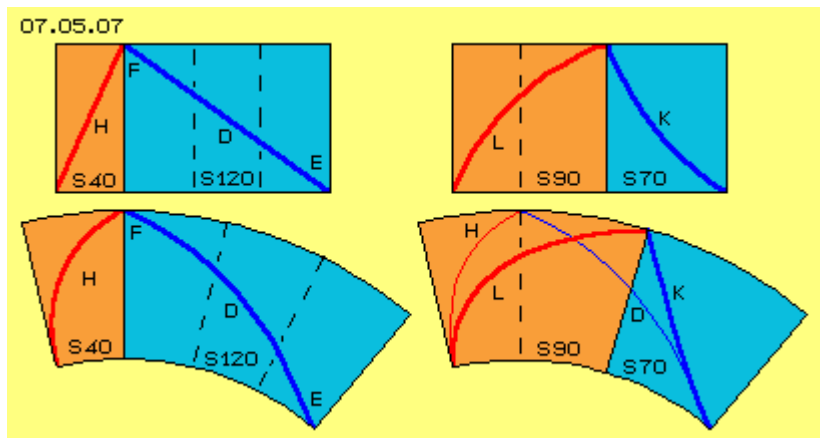
The diagram at the top right hand side of the Figure, show this short pipe run. The water enters at point **A** and flows upwards through the pipe marked **G**, to exit at point **B**. Notice that the pipe curves away from the direction of rotation. This is because the pipe acts something like a jet engine and the direction of thrust is in the opposite direction to the direction of the jet of water coming out of the pipe. The pipe shown in this illustration covers a sector of 50 degrees. However, remember that the water flowing in that pipe covers a sector of 150 degrees due to the rotation of the turbine cone. The lower pipe **H** shows the other design and it spans just 40 degrees. Water in that pipe flows upwards from **E** to **F** and passes through 120 degrees due to the rotation of the turbine cone, and it also flows faster and reaches its outlet earlier. These different pipes are only shown on a single turbine cone for illustration purposes, as any turbine construction will have all of its pipes constructed to one design or the other and not a mix of the two shapes.

Turbine-Blades

On the left hand side of **Figure 07.05.07**, shown in red, is the 'neutral' track **H** of the actual water flow when crossing a cylindrical sector of 40 degrees (**S40**). Also shown in the top left hand diagram, (shown in dark blue) is the corresponding steep track **D** followed by the water when it flows across a cylindrical sector of 120 degrees (**S120**). In the lower left hand diagram, the corresponding paths for the flows across a conical turbine surface are shown.

However, if the flowing water is to be used to generate a driving force on the turbine cylinder or cone, then the diagrams on the right hand side of the Figure show the necessary arrangement. To achieve this aim, the pipes carrying the water need to be curved to a greater degree. Here, the curve of the pipes is increased by, say, an arbitrary additional 50 degrees to give a total of 90 degrees, as indicated by the curves marked **L** (shown in red) within sector **S90**.

Correspondingly, track **K** (shown in blue) is curved more sharply upwards with its sector reduced to a width of just 70 degrees (**S70**). This amount is the previous 120 degrees, reduced by our arbitrary 50 degrees. The upper right hand side diagram shows the design for a cylindrical turbine while the diagram below it shows the design for a conical turbine. The thin lines **H** and **D** show the original curves which would not apply any turning force to the turbine pipes were the water to flow through them. These paths could



be called the 'neutral' tracks as they do not impart any thrust, and it takes the greater curvature shown by the thick lines to actually drive the turbine.

Cone-Wall and Cone-Turbine

The lower section of **Figure 07.05.08** shows the cross-section of turbine **T** which has a radius of 24 cm (**R24**) at its upper edge and a radius of 16 cm (**R16**) at its lower edge and which has a height of about 24 cm (**H24**). Below the main conical turbine (shown below the dotted line) there is an inlet section marked as **TE** and which has an additional height of 12 cm (**H12**), and which tapers down to a radius of 12 cm (**R12**).

In the previous example, the general arrangement of the turbine-blades **TS** (shown in red), being curved pipes inside turbine, was discussed. In this example, grooves are formed the outer surface of the turbine cone. These grooves, or indentations, are open on the outside and the turbine cone is housed inside a cylindrical outer housing shown in grey and designated as **KW**. This outer wall supports an inner conical housing (not shown) and the turbine rotor revolves inside that conical housing.

Water (shown as light blue) fills the space between the turbine rotor and the outer conical housing. The water is bounded on one side by the smooth wall of the outer housing and on the other by the saw tooth shaped vertical grooves which form the turbine "blades".

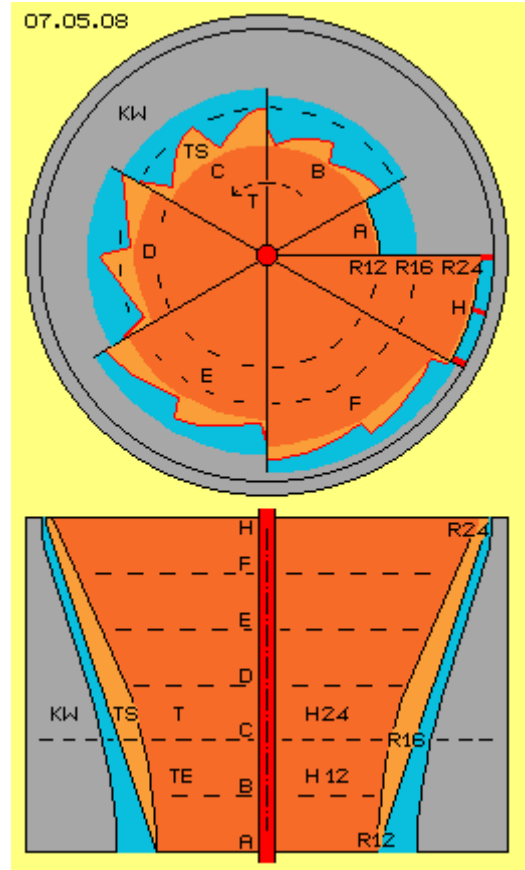
This example is needed to explain the curvature of the grooves at the surface of the cone. Unlike standard turbines, water flows from a short radius inlet, to a much larger radius outlet. Water can't accelerate to reach the greater speed needed at the longer radius, so normal turbines have the water flowing from the longer radius inward towards the shorter radius. This causes deceleration of the water flow to generate torque. Consequently, our design here appears 'wrong' in conventional terms, and seems to make no sense in normal applications. This 'wrong' design only makes sense when using a cone-like rotor with its saw tooth-like blades.

Sawtooth-Blades

Mechanical turning momentum (torque) is generated by flows which press against one side of the turbine blades. Commonly, turbines have blades where a groove is effectively created between two successive blades. In effect, the driving pressure of a turbine is applied to one face of this virtual groove. With this arrangement, the leading face represents the "pressure" side and the trailing face represents the "suction" side. The generation of torque is based on the difference of pressure between these two wall faces. This pressure difference is maximised if there is no suction side at all, that is, when there is no pressure at all on the "suction" side. This is possible along the surfaces of a cone-shaped turbine which has saw tooth-like grooves as already described.

These turbine "blades" have a pressure-side which faces in a radial direction relative to the direction of rotation. Each groove has a 'bottom' or inner side which faces in a tangential direction. Water flow which moves diagonally outwards effectively flows parallel to that inner face. The pressure-side plus the inner-side, form the contours of an asymmetric saw tooth shaped groove. Each inner-side extends from the inner edge of the pressure-side to the outer edge of the following pressure-side. These triangular shaped grooves effectively have no backside wall.

In **Figure 07.05.08**, the cross-sectional view shows several axial levels marked with the dotted lines **A** to **H**. The plan-view diagram shown at the top of the Figure indicates where these levels extend horizontally. At inlet level **A**, the radius is 12 cm and a ring-shaped cross-sectional surface is available for water to enter between the round turbine face and the round cone-shaped wall of the housing (drawn here across a sector of 30 degrees).



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Further up, these tooth-shaped blades extend further out of surface of the turbine cone. At point **B**, the inner edge still has a radius of nearly 12 cm, while the outer edge extends further into the ring-shaped groove. Here for example, twelve turbine “blades” are shown, and in the 60 degree sector **B**, there are of these “saw-teeth”.

Level **C** marks the junction between the turbine-inlet area (**TE**) the main body of the turbine (**T**). The turbine “teeth” at this level have a radius of 16 cm and this level has the deepest grooves. This sector of 60 degrees has two of these teeth **TS**.

Further up, the outer circumference becomes greater and the notches become longer. If the cross-sectional area for water flow were to remain constant, then the notches would need to be correspondingly shallower. In sectors **D**, **E** and **F**, which again span a 60 degree sector, two turbine-blades are shown each sector.

As sector **H** covers only 30 degrees, it contains just one tooth. this top level, which has a radius of 24 cm, is located the turbine outlet, where water should exit, forming a homogenous flat jet. Consequently, the contours of the turbine rotor grooves should be ring-shaped. Also, the water which previous ran along the inner side of a cone-shaped wall, now is contained in a space between that wall and the inner turbine cone. These surfaces can effectively be a nozzle and this long groove can have additional divider walls (shown as thick red lines), to enlarge the pressure-surfaces in area.

Winding Staircase

Figure 07.05.09 attempts to give the impression of the spiral arrangement of the previously described tooth-shaped notches running around the surface of the turbine cone. The cone-like mountain shape has faces **A** running all around it. These faces start at a low angle and then become steeper as they rise higher. Each of these has a vertical wall **B** alongside it, formed by the side of the next innermost face. These faces are not visible at the right hand side of the diagram as their downward slopes are hidden from view.

For clarity, in this diagram the cone is shown inverted, and so the direction of rotation appears clockwise, but in reality, when in its correct position, the rotation will be counter-clockwise. Notice in the upper diagram, that the incoming water **D** hits these faces at nearly a right-angle, providing substantial thrust in the direction of the arrows.

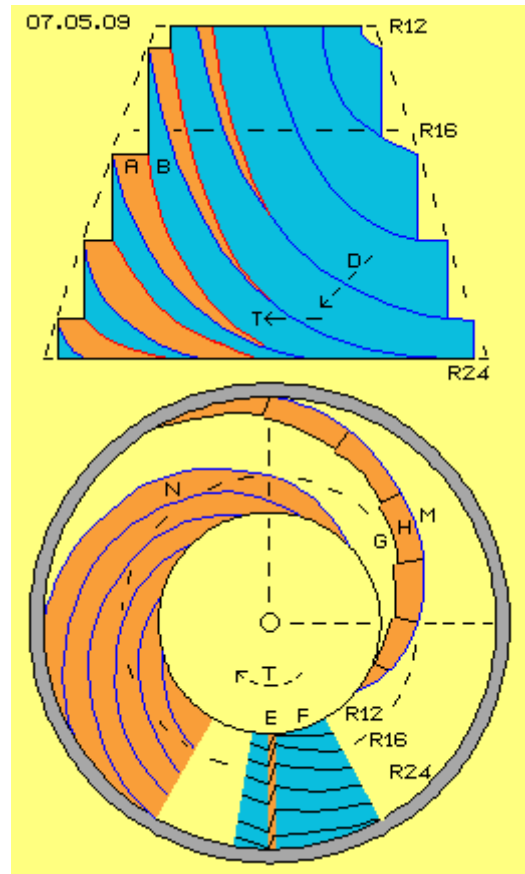
As the lower diagram shows the top view of the inverted cone it has the appearance of a conical hill. At points **E** and **F**, lines are marked which indicate the height of the saw tooth shaped indentations in the surface of the cone. The lines at **E** represent the pressure-side, while at **F** the inner side indicates only the slope surface and thus no ‘suction-side’ exists.

Now these indentations are not arranged to run straight down but are shifted as shown in the diagram at point **G**. Previous vertical indentations **E** now create the pressure-wall **H**, which corresponds to the previous indentation **A** in its spiral path. The inner-walls **F** of the earlier indentations thus create the surface **M** through their vertical walls **B**. In effect, the whole hill is built from these successive ‘winding staircases’, which admittedly actually don’t have any stairs. These paths spiral upwards with progressively smaller radius and increasing steepness.

At point **N** in the diagram, part of several of these spiral pathways is shown. Here, the vertical walls between them are visible only as small blue curves. The whole of the surface area of this turbine cone is a pressure-side because of these spiral surfaces running all around it. Like diagonally falling rain, water flows all around the surfaces of that hill in its downward flow, and anywhere it is forced to turn right it generates a rotational force on the turbine cone. Remember that this machine has a cone-shaped housing which ensures that the water flows exactly in its intended path.

Crossing Flows

To summarise, in **Figure 07.05.10** the complete 360 degree surface of the cone is shown four times one below the other. Since the wide part of the cone has a radius of 24 cm it has a circumference of about 150 cm (**R24** and **U150**), while the narrow part has a radius of 16 cm and hence a circumference of about 100 cm (**R16** and **U100**).



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The length of the side-surface is about 24 cm (**H24**). Using this example with these dimensions, the upward flow is along the indentations in the cone and along the walls of the cone.

The angle of entry of the water at the narrow circumference was assumed to be 30 degrees. Maintaining this steady angle would cause the water flow to cover an angular sector of about 150 degrees, exiting at that same angle. Due to the centrifugal force of water striking the wall at an angle, an upward force is generated which causes the water to follow a steeper track and exit after crossing a sector which spans only 120 degrees or so (**S120**) and exit at an increased angle of about 35 degrees. That track **D** (drawn in blue) is shown several times in the top diagram.

Water flowing in indentations will follow this track. However, this water can't follow the faster moving wider circumference at the top of the cone. In order to achieve the 'neutral-force' track for the complete path across the cone, the indentations need to have an increased backward curvature of one third. This indentation track **H** is shown in red and is contained within a sector of 40 degrees (**S40**) and this path is also drawn several times in the top diagram.

In order to have the turbine generate a mechanical turning force, the indentations need to be curved backwards more strongly. Here, for example, that sector was extended to cover 90 degrees (**S90**) so water is channelled outwards faster, and exits after covering only 70 degrees (**S70**). In the second diagram that indentation **L** (shown in red) and water track **K** (shown in blue) are drawn several times.

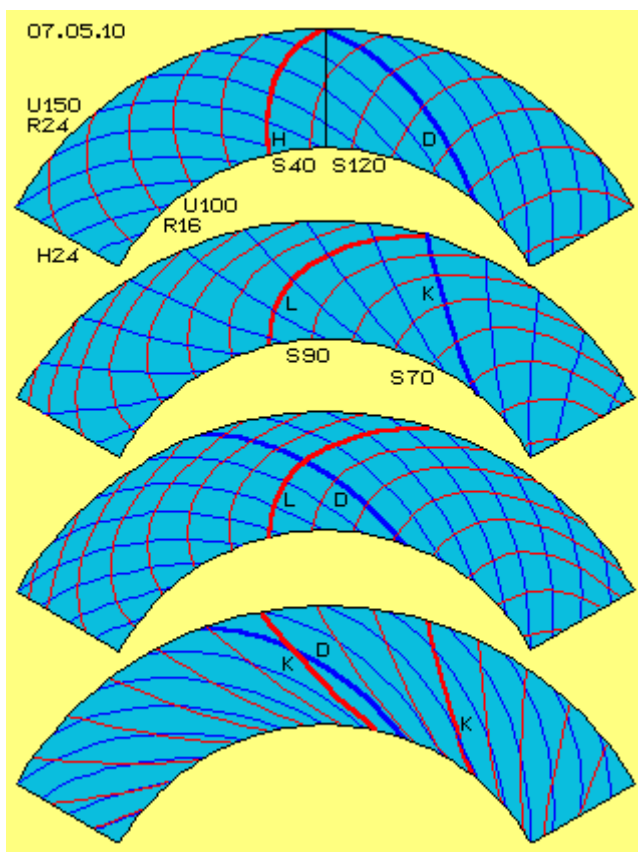
The indentations of the turbine are shown here as saw tooth-like notches which are open on their outer side. This arrangement results in two separate flows: on the one hand, there is forced flow within the indentations and on the other hand there is the free flow of water on the wall of the cone. In the third diagram, these indentations **L** (shown in red) are drawn several times as are the tracks of the free-flowing water **D** (shown in blue). These two paths cross each other at an angle of about 90 degrees.

Because free-flowing water projected upwards is slow for the turbine-surface which is moving rather fast, but the water movement will be fast enough if flows along the indentations **L** which are curved backwards as shown in the bottom diagram. In this diagram, both track **D** (shown in blue) taken by the free-flowing water and the indentation-forced track **K** (shown in red) are shown. Again, both flows are drawn several times and it can be seen clearly that these paths cross each other at an acute angle. The free-flowing water 'brushes' across the water which is flowing forwards in the indentations. It does this in the direction of rotation and this causes the water flowing in the indentations to start revolving.

Water within the indentations becomes redirected backwards and transfers its inertia to the pressure-sides of the indentations, thus decelerating its forward motion. This water still has centrifugal force, but the further out it progresses, the faster the pressure-sides run away ahead of it. This water which is flowing 'too slowly' can only apply pressure to the walls if they were much more strongly curved backwards, and even in that case it would only be by a small angle which would impart practically no additional turning momentum.

Also, free-flowing water can't keep up with the faster movement of the turbine at its larger exit circumference. However, the outward water flow is easily fast enough to fill the grooves with water and produce additional rotation around its longitudinal axis. This revolving-water-cylinder effectively works like a gear wheel as it applies the pressure of the free flowing water on to the pressure-sides of the grooves. The water flowing along the cone-wall is not pressed into the grooves, and so it is not redirected and its forward motion is not decelerated. So the centrifugal forces of that free-flowing water can go on contributing to the turning momentum of the turbine, but only indirectly, by driving that water-cylinder within the grooves.

Spin inside the Grooves



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Figure 07.05.11 shows sections of the area between the cone wall **KW** (shown in grey) and the turbine cone **T**. Free-flowing water moves alongside the cone wall, moving upwards and outwards. At the surface of the turbine, the turbine blades **TS** (light shading) are arranged in the shape saw tooth-like notches. Water flowing within these grooves guided outwards along the ever steepening track. Turning momentum is generated by the redirection of this part of water flow.

On the pressure-sides of these grooves, there is also the additional pressure of the free flowing water **B**. This component of the water flows along a path which is not so steep and so it moves faster in the direction of rotation, i.e. sweeps over the grooves. This generates a revolving movement **C**, in the water flowing inside the grooves. This increases the pressure on the pressure-sides of the grooves. So, this free-flowing component of the water flow, contributes indirectly to the turning momentum of the turbine.

The diagram at the lower left hand side of the Figure is a sketch of the outlet at the top of the turbine. The inner wall of the cone is curved slightly inwards as shown. This guides the free-flowing component of the water flow into the grooves. It should also be noted that as this part of the water is redirected, it is also decelerated which contributes further to the turning momentum of the turbine.

At the lower right hand side of the Figure, both the cross-sectional and longitudinal views of the outlet are shown. Here, the groove is no longer saw tooth-like but instead it has a constant width, and this causes the water to exit in a continuous jet. The groove here is rather wide and could well be divided by the introduction of additional blades **ZS**, which would allow the water pressure to be applied to a greater surface area.

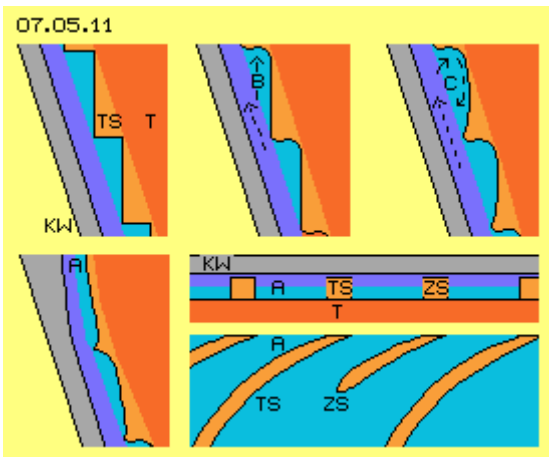
To summarise; with this arrangement, not all of the water flow is forced into the grooves and immediately redirected and decelerated. The free-flowing parts of the water are allowed to move in its natural direction and under the influence of the centrifugal forces they follow a steeper path as they flow outwards and upwards. Moving along this track causes the water to cross over the water flowing in the grooves. This in turn, causes the water in the grooves to rotate as it flows upwards and this additional revolving movement add to the torque being generated by the water flow. Finally, as it nears the outlet, the free-flowing component of the water is directed into the grooves and this redirection causes a deceleration which adds even further to the rotational drive of the turbine.

One further beneficial effect which is easily overlooked, is the fact that the water in each groove forms a long stretch of rotating water. This length of rotating water rotates faster in the upper sections of the groove and a twisting vortex of this type generates a strong suction which pulls the water entering the turbine inlet, strongly upwards towards the outlet of the turbine. This has been described in detail in earlier chapters and is further discussed later on in this document.

Cross-Sectional Surfaces

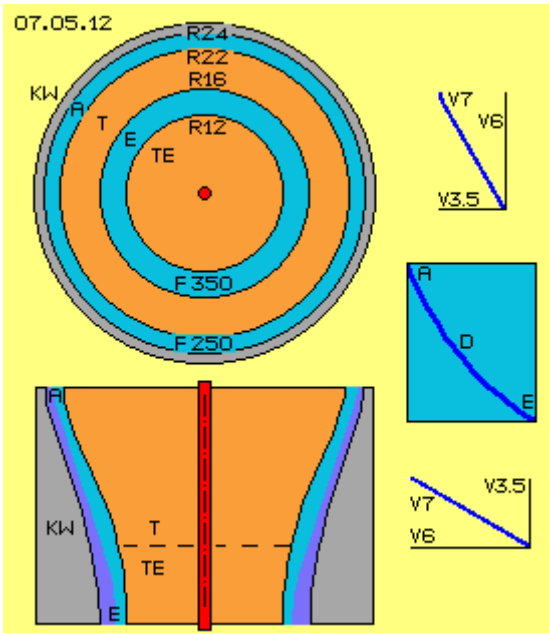
The lower diagram of **Figure 07.05.12** shows a cross-sectional view through a cone-shaped turbine **T**, which has it's intake extended downwards by an additional section **TE**. Between the turbine and the conical wall **KW** (shown in grey), water flows from the intake at the bottom **E** and exits at the upper outlet **A**. This flow has two components. The first, which is shown in dark blue, flows freely along the conical wall. The second, which is shown light blue, flows in the grooves or indentations formed by saw tooth-like turbine "blades".

The upper diagram in the Figure shows a schematic cross-sectional representation of the plan view of this turbine. The ring-shaped water outlet **A** is shown in light-blue. This outlet is formed between the inside of the conical housing, which has a 24 cm radius at this level, and the cone which a 22 cm radius. These are marked as **R24** and **R22** respectively, and between them a 2 cm wide outlet is formed, with a cross-sectional surface area of about 290 cm² (**F250**). Also shown in light blue, is the ring-shaped inlet **E**, formed between a radius of 16 cm and one of 12 (**R16** and **R12**), and so is 4 cm wide, with a cross-sectional area of about 350 cm² (**F350**).



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On the right hand side of the Figure is shown the previous curve **D** (shown in dark blue), which represents the track of the water flowing in the grooves. Water enters the turbine along its lower edge, at an angle of about 30 degrees and exits from the top of the turbine at an angle of about 60 degrees. Free-flowing water also enters the underside of the turbine at a very low angle and flows upwards until near the outlet it is directed into the grooves where it also exits the turbine at that same steep angle.

In the example above, it was assumed that the inlet water speed was about 7 m/s (**V7**), i.e. entering at an angle of 30 degrees while moving in the horizontal direction at about 6 m/s (**V6**), the same speed that the turbine is moving at that level. The inlet, water has a vertical rate of movement of about 3.5 m/s (**V3.5**). If we were to assume that the water speed at the outlet is also 7 m/s, due to it's steep exit angle of 60 degrees, it's horizontal velocity will be only 3.5 m/s. However, it actually exits at a vertical speed of 6 m/s (see the vector-graphs).

Within pipes, the linear speed of flow is inversely proportional to the cross-sectional area of the pipe. In our particular case, due to the rotational component of motion, the flow also depends on the 'gradient' of the flows, and not just the speed of movement in the axial direction. If water exits at the top at 6 m/s through an opening with a cross-sectional area of 250 cm², then if the inlet flow has a vertical speed of only 3.5 m/s, then it would require an inlet cross-sectional area of about 430 cm², so our cross-sectional area of only 390 cm² is a little too small.

Suction Effect through Centrifugal Force

It was mentioned above, that centripetal (inward) acceleration is stronger than the acceleration under gravity at relatively low speeds within a radius as narrow as this. Since centrifugal force increases with the square of the speed, the outward pressure is a multiple of the weight of the water. With the inclination of the conical housing wall shown here, about one third of this force results in an upward push along that wall.

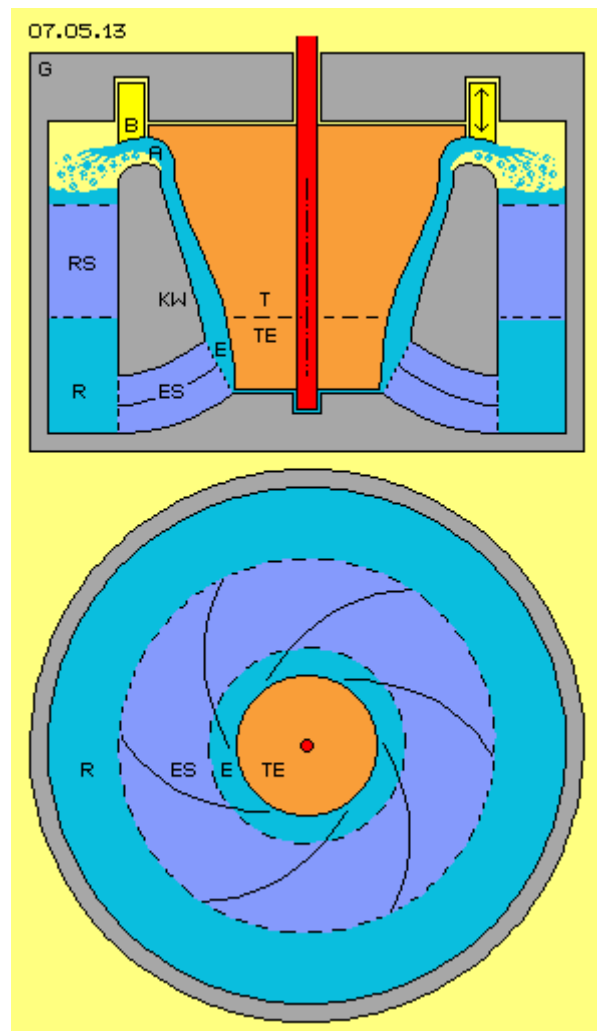
Because of this, the upward water flow gets shifted on to an increasingly steeper track and consequently it exits from the turbine outlet at a rather acute angle. But if the cross-sectional area of the intake is too small, then a sufficient mass of water is prevented from flowing into the turbine and the upward movement is hindered. This causes the free-flowing component of the water to move along a flatter track, which again results in increased centrifugal forces. So, finally, an inlet with too small a cross-sectional area creates enormous suction forces and the inlet water is pulled upwards very strongly.

The turbines described in previous chapters, could only use the flows generated by pumps. With an air-driven machine, it is possible to generate areas of relative void into which air particles move through their own normal molecular movements. Autonomous acceleration up to the speed of sound is possible with a minimum of input energy.

Water is not compressible, so pressure is transmitted through water immediately. Suction pressure also acts immediately with no delay. Consequently, if the water in the upper areas of the turbine is pushed upwards by centrifugal forces, these forces also exert an upward pull on the water lower down in the turbine. So unlike all of the machines described earlier, in this turbine, flows are generated based on the effects of centrifugal force alone. Experiments with similar machines has confirmed that more water was pulled upwards than gravity would have been able to move downwards when acting on the same mass of water, even when just simple cones with plane surfaces were used.

Pump-Turbine Hybrid

Turbines of this type can also work as a pump. If the cone is driven around, then it will cause the surrounding water to rotate. At the housing's conical wall, water gets lifted through the centrifugal force. That 'pump' has no forward-facing surfaces and so it can't affect the pressure. The water is presented with vertical walls in close proximity to 'winding staircases' which move continuously dragging the water into rotation. The higher that the water is lifted, the greater the cone radius encountered, and the greater the centrifugal forces which it experiences.



As the rotational motion increases, the lifting force-component become stronger and the water gets pressed into the diagonal surfaces of the grooves, and the turning momentum is achieved which allows the pump to become self-powering and no longer needing any input power to continue operating. If the speed of rotation continues increasing, and turbine-mode is achieved, then, if the turbine is not loaded it will accelerate automatically until the water can't enter the inlet any faster or alternatively, until the turbine self-destructs.

Safety first: Avoiding Liability

In **Figure 07.05.13**, the previous discussed elements are shown installed in housing **G** (shown in grey) along with some additional elements. The most important new component is the 'sluice-valve' **B** (shown in yellow). This is a ring-shaped device which can be raised or lowered (as shown on the right hand side of the diagram), to control the water flow, and if necessary, bring the device to a complete standstill in the event of uncontrolled self-acceleration.

If preferred, that control valve can be of different construction and installed elsewhere. A definite requirement of any piece of equipment of this type is the ability to guarantee complete safety during operation. It should be remembered that centrifugal forces increase with the square of the speed, which means that the rapid rotation of a mass of just one kilogram can generate a loading on the housing wall of several tons. Part of this enormously enlarged force is converted into turning momentum.

I have only described movement principles in general, and how some constructional elements could be designed. However, it must be made completely clear, that I accept no responsibility or liability for the actual construction or use of any such machines. The complete responsibility for all risks, rests solely with whoever decides to actually construct or operate any such machine.

Circuit

As described in detail above, water (shown in light blue) is sucked in through inlet **E** into the area of the turbine-inlet designated **TE**. This water then flows both upwards and outwards, flowing inside saw-tooth-like turbine-grooves positioned close to the conical wall of the outer housing **KW**. Approaching the exit point, the water is deflected into a groove which runs all around the turbine cone, so that at outlet **A**, in **Figure 07.05.13** a steady, flat jet of water is ejected outwards. This water flies into the air-filled area shown shaded light yellow, and falls under gravity as indicated by the blue points. The level of the water in that backflow area **R**, is only a few centimetres below the level of outlet **A**, so water is lifted against gravity through only a small height.

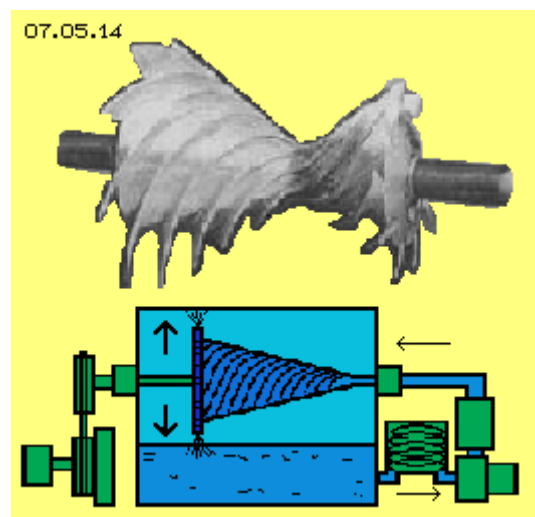
The water flow exiting the turbine does so at a relatively steep angle, and that flow moves relatively slowly relative to the already spinning turbine cone. When flowing downwards, the water should generate some faster rotational movement, guided by correctly curved fins, marked here as 'backflow-stator' **RS** (shown in dark blue). The conical wall is attached to the housing by these cross-beams.

In the lower diagram, at the backflow-area, an 'inlet-stator' **ES** (shown shaded in dark blue) is marked and through these fins water is directed again into the turbine intake area. As explained earlier, suction, generated by centrifugal forces, pulls the water upwards. That water does not flow straight upwards but rotates as it moves upwards and rotational acceleration forces are generated.

The inlet area is divided by six appropriately curved fins, as indicated in the plan-view schematic diagram at the bottom of the Figure. These conduit sections could have vertical dividers if so desired. The shape (or any equivalent design of conduit) produces the necessary rotation and angle of water flow needed at the turbine inlet.

Example: Mazenauer and Clem

Experienced readers will be familiar with the engine of Hans Mazenauer and the working engine of Richard Clem. These are detailed in my "Ether-Physics" book in chapter 05.10: 'Tornado-Motor' and in my 2005 chapter entitled 'Auto-Motor'. these, I concentrate on working out the suction-effect of twisting flow within the indentations, while here in this design the 'Centrifugal-Thrust-Engine', enormous centrifugal forces are used.



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Mazenauer did use air-driven double-cones as shown in the upper illustration of **Figure 07.05.14**. This did accelerate unaided from a stationary start right up to a speed which caused it to self-destruct. Most unfortunately, Mazenauer was financially ruined by these experiments, and so was unable to complete his work successfully. Mazenauer used a double-cone, where the large part (shown on the left hand side of the illustration) worked as a

turbine while the small part functioned as a pump. During operation, air got moved in inward-turning and outward-turning vortices, overlaid by twist flows within the grooves.

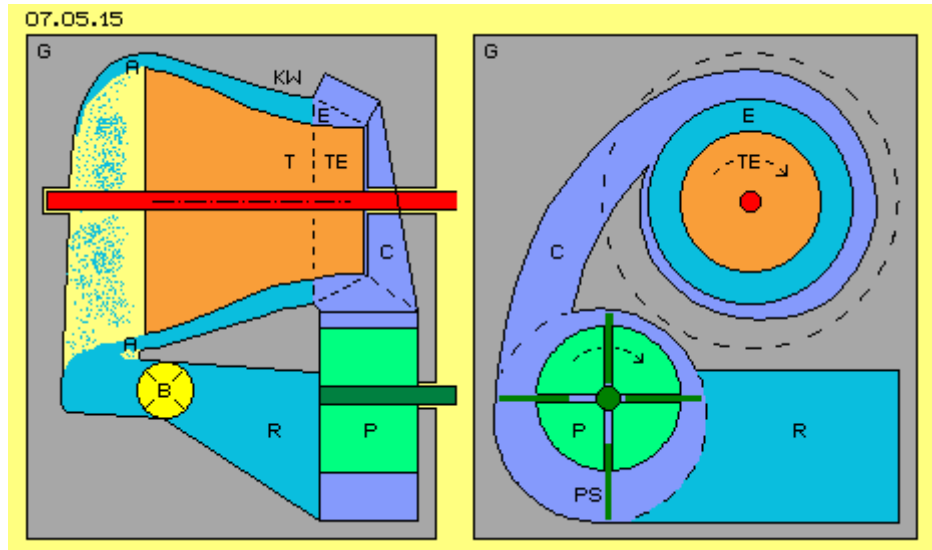
However, a pump of this type which has the driving medium flowing from the outside towards the inside will not be very effective. What is needed is a turning vortex which moves towards the turbine intake and this is better generated by stationary fins of the previously shown inlet-stator (at least when using water as working medium).

Clem based his engine design on an asphalt-pump, and without the slightest doubt, he ran his car without consuming any common fuel. Based on known sketches and pictures, he did use a cone with grooves arranged with rather small gradients (see the lower diagram). However a working-medium which flows in grooves is 'stirred' by the pattern of its own movements. While that is an advantage for heating asphalt, it meant that Clem had to dissipate surplus heat, and because of the high temperatures generated he used oil as his working medium. As shown by my analysis above, much steeper indentations combined with much better angles, generate far greater torque. In addition, Clem's grooves were rather small and did not present large surfaces with strong resistance to the driving medium.

As is the case here, the centrifugal forces of water movement is utilised, and the turning momentum is achieved by pressure applied to the turbine surfaces. For this reason, the grooves need to expose only their pressure-sides, on which flows can produce the best effect. So, unlike these examples from Mazenauer and Clem, my analysis indicates that 'grooves without suction-sides' shaped by these saw tooth-like turbine-paths, are very advantageous.

Horizontal Shaft

When using a horizontal shaft version of an engine of this type, some additional components and details are needed to implement the design. This arrangement is an interesting variation and it can be in the form shown in **Figure 07.05.15**. Here, the conical wall **KW** (shown shaded in grey), turbine **T** and the turbine inlet **TE** are similar to those already discussed. At the outlet **A** however, water now falls downwards (as indicated by the blue dots) through the air-filled area (shaded in light yellow) into the reservoir. As in the previous example, at the outlet there is a safety-valve **B** (shown in yellow) which is installed to control the flow.



Water flows into the backflow tank **R** (shaded light blue). From there, it is guided towards inlet **E** via pump **P** (shown shaded green) and the snail-conduit **C**. This inlet-conduit is arranged diagonally, so that water enters the space between the conical housing wall and the turbine cone at the angle required for the operation of the turbine.

The pump is installed fairly low down in the water tank as it is only used when starting the turbine from standstill. Once the turbine is running, the turbine creates sufficient suction to maintain the water flow without the need for the application of any external power. The water pump just turns idly when the turbine is running, rotated by the water flow caused by the suction created by the rotation of water inside the conical turbine section. It is actually possible to boost the rotational speed of the turbine by powering the pump and thus boosting the mass flow through the turbine.

In principle, any pump could be used in this position. In this example, the schematic shows a 'slide-pump' **P** with its eccentric shaft and radial-moving pump blades **PS** (shown in dark green). The advantage of this kind of pump is that it has a precisely known volume contained within it's chambers and that exact volume is transported during each revolution. Hence, the pumped volume is exactly proportional to the pump revolutions.

Small Constructional Volumes

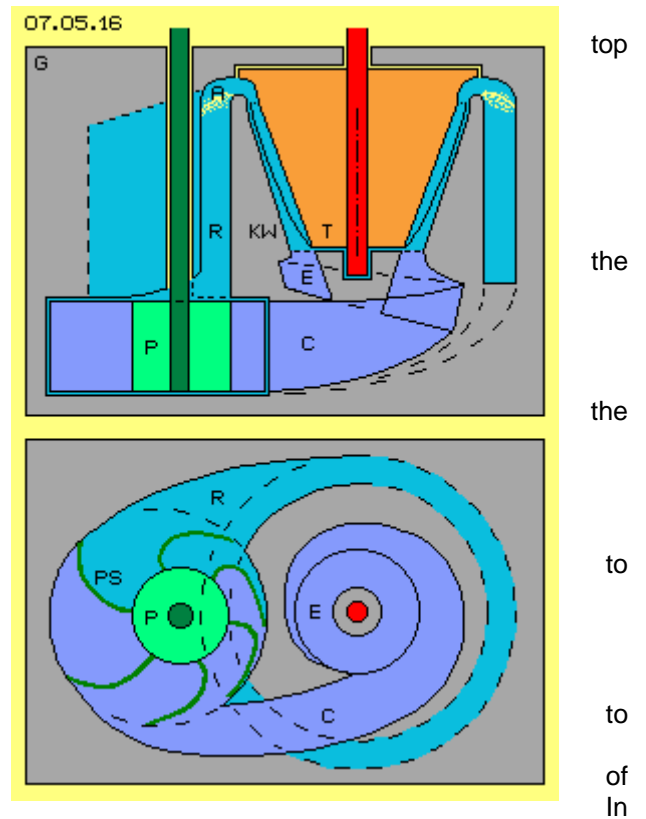
A turbine engine of this type with a horizontal shaft, could be installed in vehicles to provide the mechanical drive via a standard clutch and gear transmission. On the other hand, since electricity has so many different uses, this engine could readily be used to drive an electrical generator. The electricity produced by such an arrangement could readily be used for both powering a pump and it's control units. Mind you, electrical generation can also be achieved quite easily with a vertical shaft turbine.

In general, we tend to think that a larger throughput volume will be needed to produce a greater level of performance. Here, however, the performance is based on centrifugal forces and inward acceleration and since these are inversely proportional to the radius, the usual idea that performance increases with increasing size, just does not apply. At any given speed, the centrifugal force at a small radius is much greater than at a large radius, and the vertical lifting component is also correspondingly stronger in smaller turbines.

The turbine **T** shown in **Figure 07.05.16**, has a wide exit-level radius of only 18 cm. The conical inner surface of the housing **KW** (shown in grey) angles downwards in a straight line to a snail-like inlet-area **E**. Water exits from the of the turbine through outlet **A** and flows back down through the backflow-conduit **R**. This backflow winds spirally downwards and enters pump **P** (shaded green) which pushes it through conduit **C** back into the snail-like inlet at the base of the turbine. The path of the water through the turbine and subsequent backflow conduit is shown here shaded in light blue, while the water path within pump and the turbine inlet is shaded in dark blue.

The pump shown in this schematic diagram is an impeller type of pump which operates in a similar way to the previously mentioned slide-pump where each revolution of pump represents a known volume of water throughput. This turbine is controlled by the revolutions of the pump. When the pump is stationary it operates very nearly the same as a stop-valve. In addition, the suction produced by flow at the conical wall has an effect back through the inlet the pump. When the turbine is running, the pump effectively acts as a 'moderator' which does not require much in the way of energy input.

It is also possible for all of the internal space of the turbine be filled with water, including the area at outlet **A**, thus producing a completely closed circuit of water. This design turbine could also be arranged to have a horizontal shaft. In addition, this general principle of combined movements can be applied to most variations of turbine design.



Impossible?

We now come to the question which is often asked, namely, "why does this machine work at all?". Without any shadow of doubt, when spun at a high rate of revolutions per minute, a one-kilogram mass produces literally tons of pressure on the inner walls of a surrounding cylinder. Given cone-shaped inner walls, there is not the slightest doubt that a flowing mass of water will press outwards from a narrow radius towards a wider radius. Also, without question, is the fact that this flow can generate mechanical turning momentum via turbine-blades as a side-effect. What needs to be determined through experiment, is the optimum energy draw-off and distance between the turbine cone and the conical inner wall of the housing. What is absolutely certain is that the turbine will not require the entire kinetic energy produced to power itself.

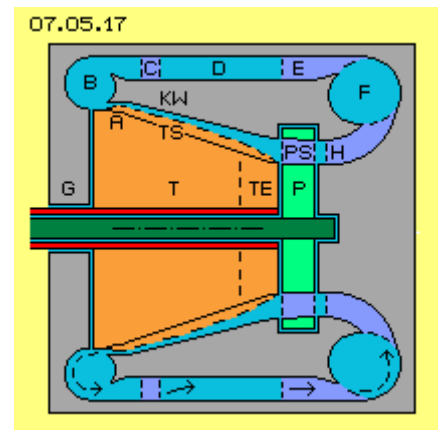
Because water has 'cohesive consistency', any flow along the conical wall produces a suction effect on the water below it. This means that the flow-pressure is like flow-suction and so produces a closed flow-circuit. Backflow must be organized with the lowest level of friction losses and should be 'force-neutral', requiring no energy input to function as required. It is important that the water being channelled to the narrow radius inlet does not oppose the centrifugal forces operating the turbine.

When these design parameters are applied, a steady circuit flow with excess energy generation is possible. The dynamic pressure of the 'water-fall' of the water (which has considerable weight) is converted into mechanical turning momentum, and after that the water must continue its flow in an 'energy-neutral' way as it is guided inwards to the inlet-area. Various constructional measurements were given in the above example of how this motion principle operates. However, it should be realised that those measurements were just presented as an illustration of the principles involved and many alternative dimensions may be used when a turbine of this type is being constructed. The following design also illustrates an effective working design.

Outlet and Water-Cylinder

In **Figure 07.05.17**, a horizontal axis turbine **T** is shown which has tooth-like turbine-blades **TS** as part of the cone. The main cone of the turbine is extended by the turbine inlet section **TE**. Opposite these surfaces is the hollow-cone of the conical housing wall **KW** (shown in grey) and it is attached to the main housing **G** (also shown shaded in grey). Water, (shown in light blue) flows between these surfaces in a rotating motion. This physical construction and operational movement is the same as in the previous examples.

In the previous examples of construction, it was suggested that the flow along the side cone-wall was directed into the turbine grooves just before exiting from the turbine cone. For this to be effective, it is necessary to have an adequate flow in the outlet region. Only practical experiments can determine what percentage of the free-flowing water is the most effective to directed into the turbine grooves this point. For example, this diagram shows a design of outlet **A** where all of the water at the cone wall can flow off freely. Here, cone ridges produce a smoothly curving water flow across the surface of turbine cone.



A new constructional element in this design is shown as ring **B** which runs all the way around the upper edge of the turbine cone. Water enters this 'round pipe' tangentially and does a U-turn of some 180 degrees. Previously, it was shown that water left the outlet at an angle of about 60 degrees, so water will enter this pipe by a spiral track. No matter what the angle of entry is, the water will exit from the 'round half-pipe' tangentially because of it's own motion generating centrifugal force (so, as drawn here, it will move towards the right hand side).

Sharp redirections like these ones, normally produce turbulent flows with corresponding major friction losses. This is because within any normal pipe bend, the inner flow path around the bend is much shorter than the outer flow path around the bend. But, in this case, there is no inner part of any such narrow bend, and the water keeps rotating in a cylindrical movement as it flows. Within these water-cylinders, flow layers of different radius and different turning-speeds balance out without friction. This 'all-around' pipe with the water rotating inside it, acts like a ball-bearing, so the flow from the outlet and the redirection of water towards the inlet is achieved with the minimum of frictional losses.

Axial Backflow

The conical inner wall **KW** (shaded in grey) needs to be attached to the outer parts of the housing **G** (also shown shaded grey) with spike-rods **C** (shown in dark blue). The backflow-conduit is positioned all the way around the turbine, and it has a ring-shaped cross-sectional area. The water in this conduit flows with a rotational angle of about 60 degrees, so these cross-beams should be shaped like fins to push the flow into a somewhat greater angular flow of about 75 degrees, towards the right.

The cross-sectional area of the ring-shaped backflow-conduit **D** (light blue) is relatively large, so there is little friction at it's surface. Water will move relatively slowly towards the right when in that conduit. This area represents a 'buffer' for the water flow as water there can move towards the right, adjusting it's rate of rotation as it flows along.

Another new constructional element here are the fins **E** (shown in dark blue), which function like a stator. Unlike the previous examples, here the flow is directed into a straight axial flow direction (from left to right without any rotation). In the backflow-conduit **D**, the water is still moving with a more or less spiral track. Consequently, the left hand ends of fins **E** should be rounded to avoid any frictional losses, while the right hand edges of these fins should end sharply.

Unlike the few cross-beams **C**, about 12 to 18 cross-beams **E** should be installed. The cross-sectional area of the conduits becomes less, so the water accelerates accordingly. Unlike the previous enlargement of the cross-sectional area, this narrowing does not affect resistance. Water is now directed parallel to the system axis by these fins **E**. The water there is not rotating around the system axis and so does not have any centrifugal force acting radially outwards from the system axis.

Centripetal Backflow

Like ring **B** which runs all the way around, we now have ring **F** (shaded in light blue). Water enters tangentially into this ring, flows radially inwards towards the system axis and then leaves this ring via conduit **H** (shaded in dark blue) towards the turbine cone. As within ring **B**, here too, the water flow in ring **F** is rotational, and here again, the relatively sharp redirection occurs without significant frictional losses, practically like a ball-bearing.

As the water moves, at all times it's centrifugal force is directed on to the wall at right angles to the wall. Because of the direction of this centrifugal force, the water flows off ring **F** in a tangentially inward direction. The volume of

the ring reduces the further inwards it goes but it opens further as it approaches conduit **H** allowing additional space for movement. Thus, water is directed inwards to the smaller radius at the system axis and this motion is not opposed to the direction of the centrifugal forces which are radial to the system axis.

Water from ring **F** now runs in an axial direction towards the turbine inlet. However, the inlet water needs to be rotating around the system axis when it reaches the inlet to enable the necessary centrifugal forces to be produced. Consequently, the water needs to enter the space between the turbine cone and the inside wall at an angle of about 30 degrees through the turbine inlet. That redirection of flow, (inwards and towards right side of the diagram) to become a rotational flow (around the system axis and towards the right) is achieved by conduit **H**. Fins are installed in this section, directing the water from ring **F** radially inwards. These fins are gently curved in the direction of system rotation, so water is guided by slight angular deflections towards the turbine inlet **E**, ending up with the required 30 degree angle.

Pump and Control

Before water reaches the turbine intake area, it flows through pump **P** (shaded green). It's pump-blades **PS** (dark blue) are arranged at right angles to the previously mentioned fins, to produce an angle of 60 degrees opposite to the direction on rotation of the turbine. During normal operation, this pump 'idles' within that diagonal flow. Suction of the water at conical wall reaches back diagonally through the pump to conduit **H**, and from there, radially into ring **F** and so to it's inlet **E**.

So because of the resulting thrust-forces along the cone-wall, water is pushed from the turbine outlet **A** into backflow-conduit **D**. On the other hand, because of the general flow within the closed circuit, water is dragged into turbine-inlet **E**. Because the water within fins **E** and ring **F** and first part of fins **H**, is not rotating around the system axis, no centrifugal forces hinder that radially inward movement. So this redirection of water exhibits almost no resistance to the flow.

The pump has important control-functions. Under normal operation, the pump turns at the same speed as the water flow. If greater performance is required, then the pump is powered up and it accelerates the water flow, speeding up the water jet feeding the turbine inlet which immediately creates an enhanced level of thrust.

Alternatively, if the rate of rotation of the pump is reduced, the intake water jet is reduced in effectiveness, reducing the centrifugal forces, which reduces the performance of the turbine. If the pump is stopped completely, then water flows into the turbine in the reverse direction, thus lowering the turning momentum to zero.

That pump is therefore in effect, a 'control' device which starts the system, controls it's running mode, deals with brief additional performance demands and can be used to bring the system to a halt. Once more, let me point out that the system is self-accelerating provided that it is not loaded excessively. It is absolutely vital to establish the maximum rate of revolution of the turbine and to prevent this value from being exceeded. Let me again point out that this document only presents the theoretical considerations needed for the general design of such machines, however, all responsibility for any risks involved in actually producing or using any such machines resides exclusively with the people who construct or operate them.

Compact and Perfect

A turbine of the type described here might have the following dimensions: A cylinder with an outer diameter of about 60 cm. A turbine-outlet which has a radius between 18.5 cm and 20 cm and a cross-sectional area of about 180 cm². If water exits from this outlet at 6 m/s in the axial direction, then the mass-throughput will be about 100 Kg per second (with a pipe of 15 cm diameter and water flow of 100 litres per second - about 20 Km/h). Pump-blades at the turbine inlet having a radius between 10 cm and 15 cm giving a cross-sectional area of about 360 cm² producing an axial water flow of 3.5 m/s. This throughput is achieved by a rotational rate of only 600 rpm.

Anybody can make calculations estimating the performance of this compact engine. Unlike any other known machine and unlike any of the other designs presented, this 'Centrifugal-Thrust-Engine' utilises these enormous centrifugal forces, not only for generating mechanical turning momentum but also for automatically creating a continuous, steady circulation of the working medium.

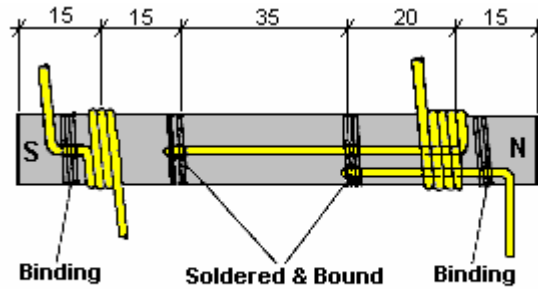
Naturally these general design principles need to be optimised until perfectly designed versions become available commercially. It is possible that all of the internal combustion engines currently in use in vehicles, will be replaced by this zero-consumption engine and, of course, a wide range of other power requirements will also be met by this design of turbine.

Omissions from Chapter 9:

Hans Coler

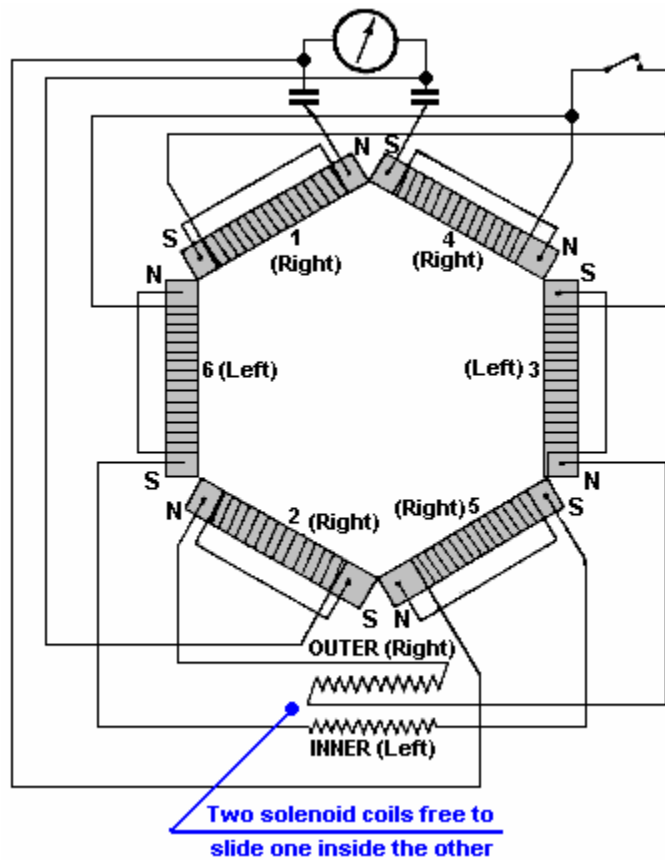
A German naval captain called Hans Coler invented a COP>1 generator in 1925. He called this device the 'Stromerzeuger' and for a few watts from a dry battery it provided 6 kW continuously. He was refused development support because it was "a perpetual motion machine".

Hans also invented a passive device which he called the 'Magnetstromapparat'. His unit required very careful and slow adjustment to get it operating but when it started it continued on test in a locked room for three months of continuous operation. Nobody, including Hans, seems any too sure how this device works but it is presented here in case you wish to research it further. It comprises six bar magnets wound as shown here. Some are wound in a clockwise direction when looking at the North pole and these are called "Right" those wound in an anticlockwise direction are called "Left":

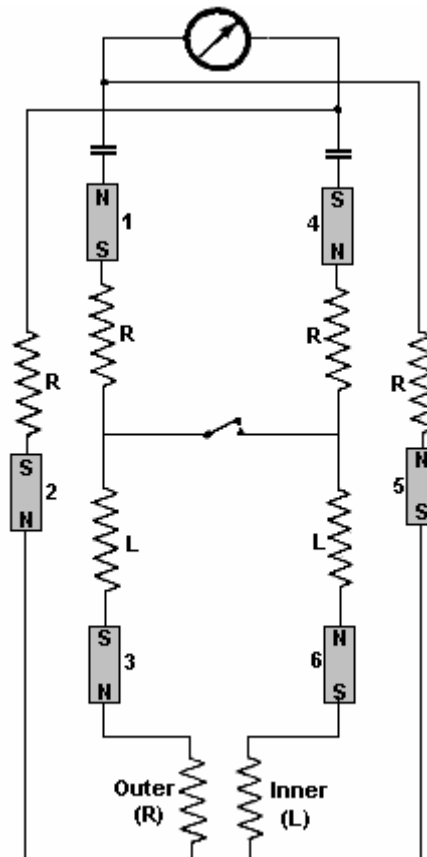


Note: There is paper insulation between magnet and coil

These six magnets are arranged in a hexagon and wired as shown here:



And the schematic diagram is:



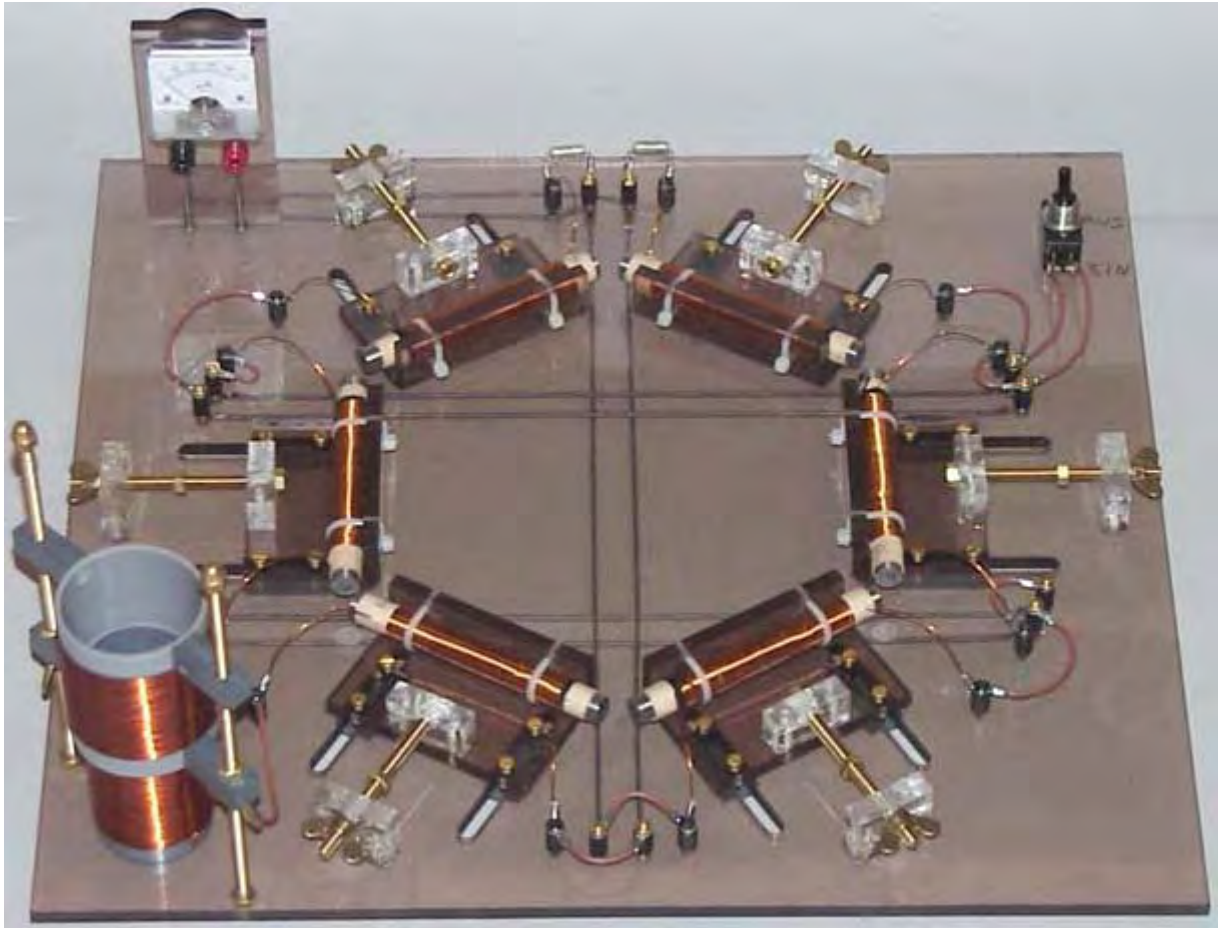
One extremely interesting feature of this passive device is that it has been witnessed producing 450 mV for several hours; it was capable of developing up to 12 Volts. The witnesses were quite sure that it was not picking up radio or mains input. So, what was it picking up? With magnets as the key component, it seems clear that it is the zero-point energy field which is being accessed, but clearly, the access represents a vanishingly small percentage of the actual power available

To operate the device, the switch is left in the open position, the magnets are moved slightly apart and the sliding coil set into various positions with a wait of several minutes between adjustments. The magnets are then separated still further and the coils moved again. This process is repeated until at a critical separation of the magnets, a voltage is developed. The switch is now closed and the process continued more slowly. The voltage then builds up to a maximum which is then maintained indefinitely. The position of the apparatus in the room and the orientation of the device had no effect on the output.

The magnets were selected to be as nearly equal in strength as possible and the resistance of the magnet and coil were checked after winding to make sure they were as nearly equal as possible (about 0.33 ohms).

As far as I am aware, nobody has managed to produce a successful replication of either of the Hans Coler devices, which is a pity since it seems clear that these devices have the potential to indicate the nature of the zero-point energy field and possibly, how it may be tapped efficiently.

A very neat construction of the Coler 'Magnetstromapparat' by an unknown German experimenter is shown below - I'm afraid without permission as I have no idea who he is or how to contact him to ask his permission. The quality of workmanship is impressive and the result is a very professional looking device. Notice the sliding coil arrangement at the bottom left with one coil being positioned closely inside another and held in place where the experimenter chooses:



Joseph H. Cater

Joseph has produced a most impressive body of information in his books "The Awesome Life Force" and "The Ultimate Reality". These books are expensive and as they are copyright 1984 publications, I am not allowed to provide you with a copy. Google books have a partial copy of the "Awesome Life Force" at:

<http://books.google.com/books?id=q7y6WBZWDsoC&printsec=frontcover&dq=awesome+life+force&cd=1#v=onepage&q&f=false>

and "the Ultimate Reality" at:

<http://books.google.com/books?id=ySsNiCPUPecC&printsec=frontcover&dq=the+ultimate+reality+cater&cd=1#v=onepage&q&f=false>

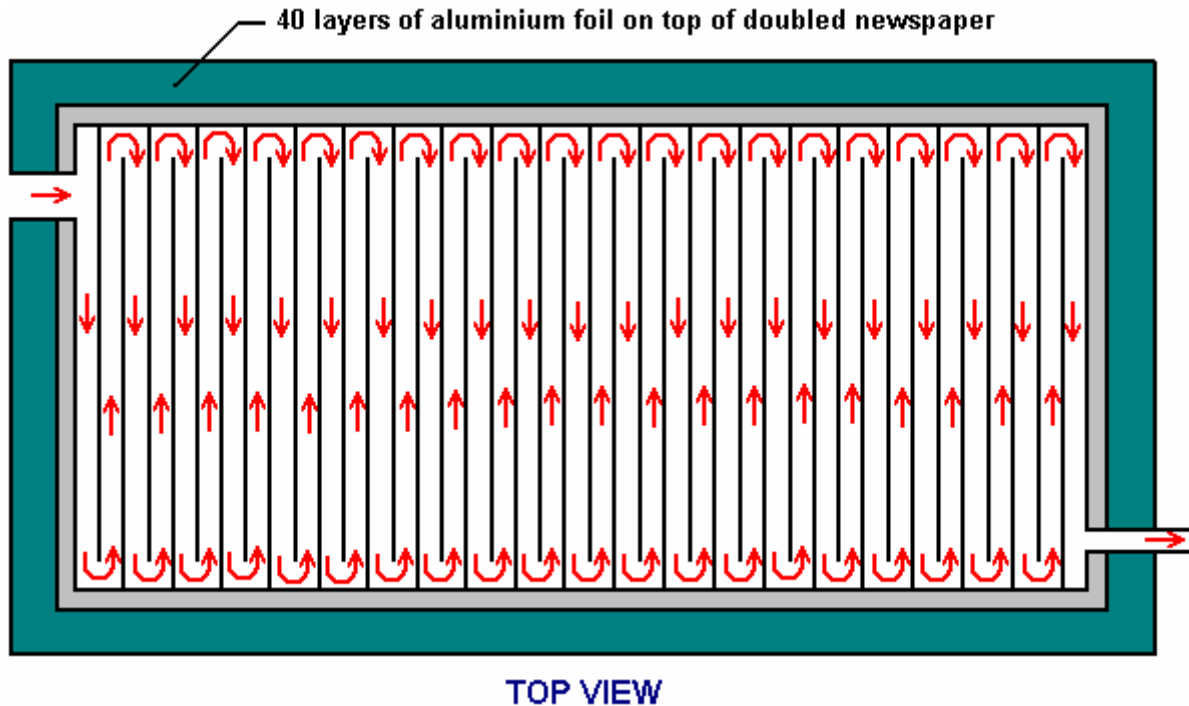
I have not constructed and tested the following device, nor do I know anyone who has. As the following information is not widely known, that is understandable. If you do build this device and find it to perform as described, would you please let me know as feedback of that kind is most useful.

Mr Cater describes this invention as: "a simple device which can be easily and cheaply constructed by any back yard handyman without the need for any special tools. This device can put free-energy within the grasp of everyone". Mr Cater says that this device will let any internal combustion engine run without fuel, and no changes to the engine are needed. The engine can be installed in a vehicle or used for driving an electrical generator. Mr Cater describes two different versions of this device. With either version, the larger the number of layers, the more effective the device becomes and forty layers are suggested as being a practical number. A box of sufficient size is covered with forty alternate layers of aluminium foil and paper. Two thicknesses of newspaper for each layer of aluminium foil should work well, the outermost layer being non-metallic and held in place with a generous amount of masking tape.

Version 1: The box has an air inlet and an air outlet, with non-metallic baffles between them to make the air circulate through the whole of the inside of the box. The box should have a volume of about 1.5 cubic feet (42.5 litres) and a one-inch (25 mm) flexible pipe can be used to connect the box to the air intake of the vehicle. As a box of this size will not fit in the engine compartment it can be located anywhere in the vehicle and the flexible pipe run through to the engine. Copper foil can be used instead of aluminium foil. The actual construction

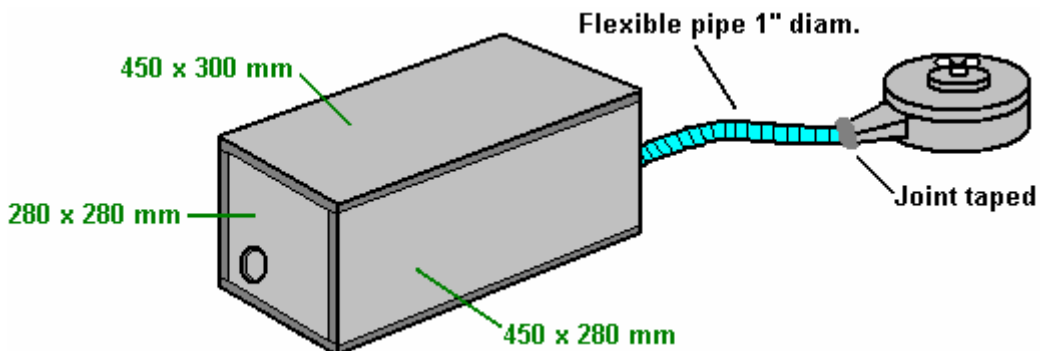
suggested is for a box size 12" x 12" x 18" (300 x 300 x 450 mm) constructed from acrylic and containing forty baffles.

For either version, the box needs to be robust as it has to withstand the stresses caused by the partial vacuum created by the engine's intake strokes. With metric construction using 10 mm thick acrylic, this would require two pieces 450 x 300 mm to form the top and bottom, and two pieces 450 x 280 mm for the sides, and two end pieces 280 x 280 mm. Mr Cater suggests the use of epoxy resin to join the pieces together, but the supplier of the acrylic can supply a specialist bonding liquid which makes two pieces of acrylic merge together so that there is no actual joint as such, just a continuous piece of acrylic with a right-angle bend in it. The construction is like this:



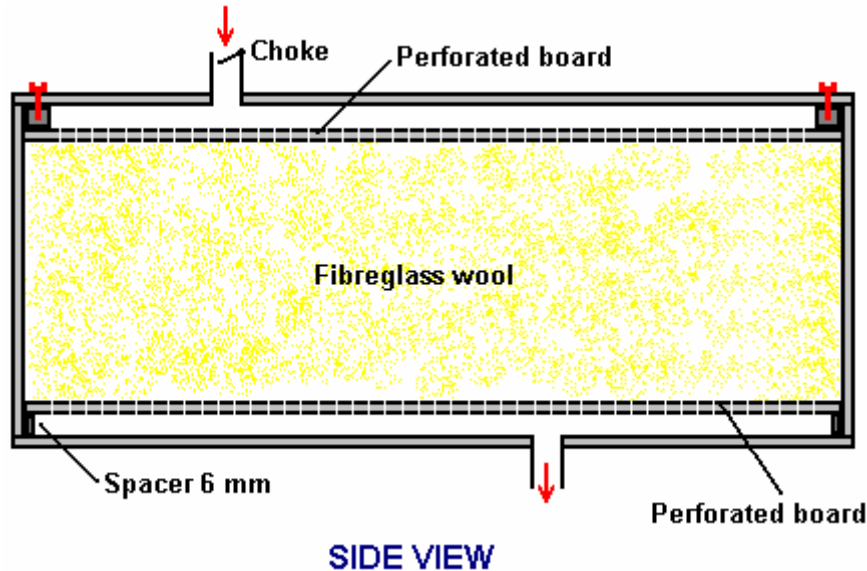
and the outlet pipe is connected directly to the carburettor if there is one, or to the air intake if there is not, so that all of the incoming air has to pass through the box. Mr Cater specifies 40 baffles inside the box and his diagram shows them running along the length of the box instead of across the width as shown above. Given the dimensions stated and lengthwise baffles, that would leave just 7 mm for an air passage plus a baffle, with 3 mm baffles that leaves only 4 mm for the air passage and while that represents an air-flow area of 1,120 sq. mm. as opposed to 500 sq. mm. for the outlet pipe, the air-flow passage length is 18 metres long and has forty hairpin bends in it and that is going to cause some constriction to the air flow. Whether or not some constriction is desirable is not at all clear.

Placing the baffles across the width, and still using 3 mm thick baffles, gives an air-passage width of 7.5 mm and a passageway area of 2,100 sq. mm. which is a substantial increase over the original 1,120 sq. mm. It reduces the flow path to 11 metres and that may not be desirable. If you decide to construct one of these devices, then the choice of baffle direction is yours. When securing the layers of aluminium foil and newspaper around the whole surface of the box (except for the air intake hole and the air outlet pipe) Mr Cater suggests using spots of ordinary glue and then wrapping the outside in masking tape.



In order to show how the box pieces fit together, the diagram above does not show the layers of aluminium and newspaper surrounding the box on each of the six sides. The joint between the flexible pipe and the air filter can be sealed with duct tape.

Version 2: Is supposed to be easier to construct and more effective in operation. In this arrangement the box is made in the same way and to the same dimensions, but the baffles are replaced by well-packed fibreglass wool sandwiched between two boards, each of which have been drilled with 300 holes 1/16" (1.5 mm) evenly spaced over the area of the board:



The perforated boards are kept clear of the top and bottom of the box by 6 mm spacers run around the edge of the box and completely sealed along all of their edges. In the diagram above, the 40 layers of aluminium foil and newspaper are not shown. The fibreglass wool is packed tightly around the edges of the box so that the air is forced to flow through it and can't bypass the fibreglass by flowing around the edges of the packing. The main body of the fibreglass wool is arranged to be loose enough for the air to flow through it.

What is shown as a "choke" on the air intake is there to allow the incoming air to be shut off completely in order to deal with a situation where the engine doesn't stop even when the ignition is switched off.

Mr Cater says: "In the above construction, it must be emphasised that the proper packing of the fibreglass wool is of major importance. It must be packed to the extent that the passage of air begins to be seriously restricted. Up to this point, the tighter it is packed the better. The more fibreglass wool, the greater the exposure of the air as it flows through and the greater the dispersion of the air which is a vital factor. If this is not followed, failure will more than likely result. The box should be constructed so that the top can be removed easily." Mr Cater does not say why the top of the box needs to be removable, but presumably it is to allow for the packing density to be altered until the device is working well.

Omissions from Chapter 10:

Dealing with the Vehicle Computer

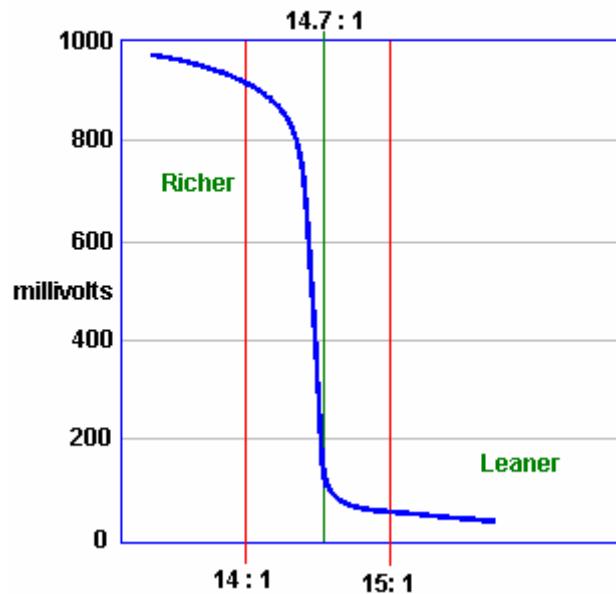
When an mpg. improving device such as an electrolyser is fitted to a vehicle, the result does not always produce better mpg. figures. Older vehicles which are fitted with a carburettor will see an immediate improvement. This is not the case for more recent vehicles which come with computer control of the fuel sent to the engine.

When an electrolyzer is attached to the engine, it causes the fuel burn inside the cylinders to be greatly improved, with a corresponding improvement in engine performance. Unfortunately, the fuel computer is expecting the same amount of unburnt oxygen to come out of the engine, and when it doesn't detect it, the computer increases the fuel flow rate in an attempt to get back to it's normal, inefficient method of running. That action cancels the mpg improvement produced by the electrolyzer unless something is done to adjust the operation of the computer.

In the most simple terms, most vehicles which have an Electronic Control Unit ("ECU") to control the fuel flow are fitted with one of two types of exhaust sensor. The majority have a "narrowband" sensor while the remainder

have a “wideband” sensor. The ideal mix of air to fuel is considered to be 14.7 to 1. A narrowband sensor only responds to mixtures from about 14.2 to 1 through 14.9 to 1. The sensor operates by comparing the amount of oxygen in the exhaust gas to the amount of oxygen in the air outside the vehicle and it generates an output voltage which moves rapidly between 0.2 volts where the mixture is too lean, and 0.8 volts when it passes below the 14.7 to 1 air/fuel mix point where the mixture is too rich (as indicated by the graph shown below). The ECU increases the fuel feed when the signal level is 0.2 volts and decreases it when the signal voltage is 0.8 volts. This causes the signal voltage to switch regularly from high to low and back to high again as the computer attempts to match the amount of “too lean” time to the amount of “too rich” time.

Sensor Output Graph



A simple control circuit board can be added to alter the sensor signal and nudge the fuel computer into producing slightly better air/fuel mixes. Unfortunately, there is a severe downside to doing this. If, for any reason, the fuel mix is set too high for an extended period, then the excess fuel being burnt in the catalytic converter can raise the temperature there high enough to melt the internal components of the converter. On the other hand, if the circuit board is switched to a mix which is too lean, then the engine temperature can be pushed high enough to damage the valves, which is an expensive mistake.

Over-lean running can occur at different speeds and loads. Joe Hanson recommends that if any device for making the mix leaner is fitted to the vehicle, then the following procedure should be carried out. Buy a “type K” thermocouple with a 3-inch stainless steel threaded shank, custom built by ThermX Southwest of San Diego. This temperature sensor can measure temperatures up to 1,800 degrees Fahrenheit (980 degrees Centigrade). Mount the thermocouple on the exhaust pipe by drilling and tapping the pipe close to the exhaust manifold, just next to the flange gasket. Take a cable from the thermocouple into the driver’s area and use a multimeter to show the temperature.

Drive the vehicle long enough to reach normal running temperature and then drive at full speed on a highway. Note the temperature reading at this speed. When a leaner mix is used, make sure that the temperature reading under exactly the same conditions does not exceed 180 degrees Fahrenheit (100 degrees Centigrade) above the pre-modification temperature.

David Andruczyk recommends an alternative method of avoiding engine damage through over-lean fuel/air mixtures, namely, replacing the narrowband oxygen sensor with a wideband sensor and controller. A wideband oxygen sensor reads a very wide range of Air/Fuel ratios, from about 9 to 1 through 28 to 1. A normal car engine can run from about 10 to 1 (very rich) to about 17.5 to 1 (pretty lean). Maximum engine power is developed at a mix ratio of about 12.5 to 1. Complete fuel combustion takes place with a mix of about 14.7 to 1, while the mix which gives minimum exhaust emissions is slightly leaner than that.


Unlike narrowband sensors, wideband sensors need their own controller in order to function. There are many of these units being offered for sale for retro-fitting to existing vehicles which have just narrowband oxygen sensor systems. David’s personal recommendation is the Innovate Motorsports LC-1 which is small, and uses the very reasonably priced LSU-4 sensor. This wideband controller can be programmed. Most controllers have the ability

to output two signals, the wideband signal suitable for running to a gauge or new ECU, plus a synthesised narrowband signal which can feed an existing ECU. The trick is to install a wideband sensor, with the LC-1 controller and then reprogram it to **shift** the narrowband output to achieve a leaner mix as shown here:

Actual Air/Fuel Mix	Wideband Output	Original Narrowband Output	Shifted Narrowband Output
9 to 1	9 to 1	Mix is too Rich	Mix is too Rich
10 to 1	10 to 1	Mix is too Rich	Mix is too Rich
11 to 1	11 to 1	Mix is too Rich	Mix is too Rich
12 to 1	12 to 1	Mix is too Rich	Mix is too Rich
13 to 1	13 to 1	Mix is too Rich	Mix is too Rich
14 to 1	14 to 1	Mix is too Rich	Mix is too Rich
14.6 to 1	14.6 to 1	Mix is too Rich	Mix is too Rich
14.8 to 1	14.8 to 1	Mix is too Lean	Mix is too Rich
15 to 1	15 to 1	Mix is too Lean	Mix is too Rich
15.5 to 1	15.5 to 1	Mix is too Lean	Mix is too Lean
16 to 1	16 to 1	Mix is too Lean	Mix is too Lean
18 to 1	18 to 1	Mix is too Lean	Mix is too Lean

This system allows you to set the narrowband "toggle point" very precisely on an exact chosen air/fuel ratio. This is something which it is nearly impossible to do accurately with a circuit board which just shifts a narrowband oxygen signal as you just do not know what the air/fuel ratio really is with a narrowband sensor.

However, for anyone who wants to try adding a circuit board to alter a narrowband sensor signal to produce a leaner mix on a vehicle, the following description may be of help. It is possible to buy a ready-made circuit board, although using a completely different operating technique, from the very reputable Eagle Research, via their website: <http://www.eagle-research.com/products/pfuels.html> where the relevant item is shown like this:



DON'T WANT TO
BUILD IT?
JUST INSTALL AND GO!

ORDER THIS DEVICE

Note: The EFIE Device is a plastic covered circuit board that can be applied 'as is' OR you can put it in a box with a switch and LED's as per the EFIE Manual.

EFIE DEVICE

We now sell completely assembled EFIE device. All you have to do is hook it up and drive!

The EFIE connects directly to your oxygen sensor and is compatible with ALL oxygen sensors.

The EFIE allows you to retain all your power and performance while taking advantage of increased mileage.

No matter what fuel saver device or method you use on your fuel injected vehicle, you'll need the EFIE to unleash the full potential of the fuel saver.

The EFIE alone can save 5% - 10% on your fuel bill, simply by 'leaning' your fuel mixture. We do not consider it as a fuel saver on it's own. It is designed as an ASSIST for fuel savers.

Vehicles with more than one oxygen sensor need an EFIE on each oxygen sensor.

Note: Your actual mileage gains will depend on the capability of the fuel saver(s) you apply to your vehicle.

SKU ER1-78-0020

This unit generates a small voltage, using a 555 timer chip as an oscillator, rectifying the output to give a small adjustable voltage which is then added to whatever voltage is being generated by the oxygen sensor. This

voltage is adjusted at installation time and is then left permanently at that setting. Eagle Research also offer for sale, a booklet which shows you how to build this unit from scratch if you would prefer to do that.

I understand that at the present time, the purchase price of this device is approximately US \$50, but that needs to be checked if you decide to buy one. Alternatively, instructions for building a suitable equivalent circuit board are provided later on in this document.

If you wish to use a circuit board with a narrowband oxygen sensor, then please be aware that there are several versions of this type of sensor. The version is indicated by the number of connecting wires:

Those with **1** wire, where the wire carries the signal and the case is ground (zero volts)

Those with **2** wires, where one wire carries the signal and the other wire is ground.

Those with **3** wires, where 2 (typically slightly thicker) wires are for a sensor heater, and
1 for the signal while the case is ground.

Those with **4** wires (the most common on current model cars), where there are

2 (slightly heavier) for the sensor heater,

1 for the signal, and

1 for the signal ground.

(Sensors with **5** wires are normally wideband devices.)

Look in the engine compartment and locate the oxygen sensor. If you have difficulty in finding it, get a copy of the Clymer or Haynes Maintenance Manual for your vehicle as that will show you the position. We need to identify the sensor wire which carries the control signal to the fuel control computer. To do this, make sure that the car is switched off, then

For **3** and **4** wire sensors:

Disconnect the oxygen sensor wiring harness,

Set a multimeter to a DC voltage measurement range of at least 15 volts,

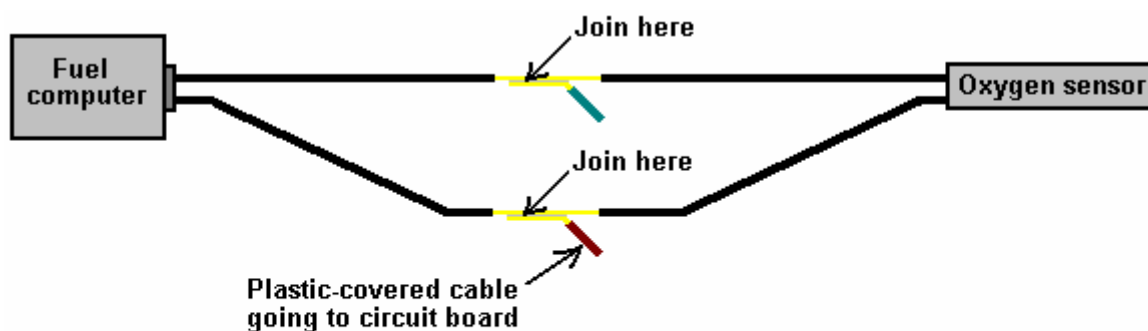
Turn on the ignition and probe the socket looking for the two wires that provide 12 volts.

These are the heater wires, so make a note of which they are,

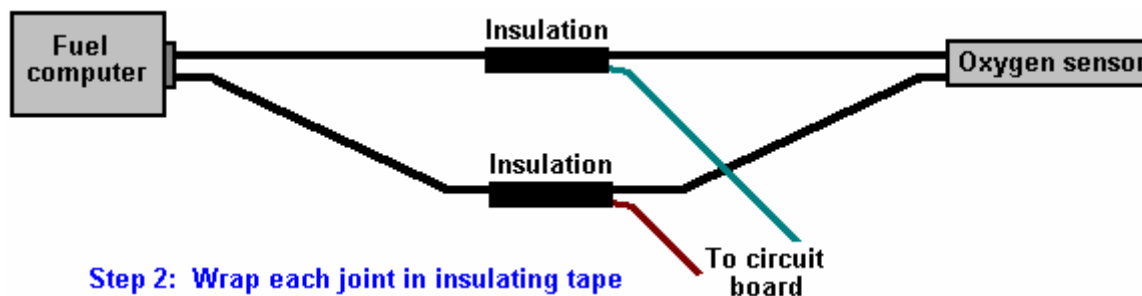
Shut the ignition off, and reconnect the oxygen sensor.

The two remaining wires can now be treated the same as the wires from a 2-wire sensor, one will carry the sensor signal and one will be the signal ground (for a single wire sensor, the signal ground will be the engine block). Jesper Ingerslev points out that the Ford Mustang built since 1996 has 2 oxygen sensors per catalytic converter, one before the converter and one after. Some other vehicles also have this arrangement. With a vehicle of this type, the circuit board described here should be attached to the sensor closest to the engine.

Find a convenient place along the wires. Don't cut these wires, you will cut the sensor wire here at a later time, but not now. Instead, strip back a small amount of the insulation on each wire. Be careful to avoid the wires short-circuiting to each other or to the body of the vehicle. Connect the DC voltmeter to the wires (the non-heater wires). Start the engine and watch the meter readings. When the engine is warmed up, if the oxygen sensor is performing as it should (i.e. no engine check lights on), the voltage on the meter should begin toggling between a low value near zero volts and a high value of about 1 volt. If the meter reading is going negative, then reverse the leads. The black multimeter lead is connected to the signal 'ground' (zero volts) and the red lead will be connected to the wire which carries the signal from the sensor. Connect a piece of insulated wire to the stripped point of the sensor wire and take the wire to the input of your mixture controller circuit board. Connect a second insulated wire between the signal 'ground' wire, or in the case of a 1-wire sensor, the engine block, and the circuit board zero-volts line. Insulate all of the stripped cables to prevent any possibility of a short-circuit:



Step 1: Remove a small piece of insulation and join the new cable to the original wire without cutting the original wire



More specific detail

However, the situation is by no means a simple one which allows a single simple adaption which will work on every vehicle for many years. Les Pearson has been investigating this situation in depth for three years along with a friend who is an Electronics Engineer. Having built and tested EFIEs, the oxygen sensor circuit shown below, several versions of MAP controllers, coolant/air temperature hacks, professional systems, etc. and discovered that many vehicle ECUs ("Electronic Control Units") learnt to adapt to the new conditions and return to the highly inefficient excess fuel injection condition. This return to the original fuel injection is different for each design of ECU and there are many different designs.

Les says: "To understand the solution, first you have to understand the dilemma with all the other ECU control tricks. The EFIEs, MAP adjusters, temp hacks etc. do get good results for a short time, and then the performance deteriorates again. Why should this be? It is because the ECU learns to deal with the new situation with them in place. This is because the ECU knows that the feedback from most of it's controls, and sensor's are not linear, nor should they be. All of the electronics, and adjustment methods used by the Hydrogen On Demand people are linear, and that is not an adequate way to deal with the problem.

For example, we may add a couple of hundred millivolts to the oxygen ("lambda") sensor signal in order to return an unduly rich signal to the ECU, and so make it respond with a lower level of fuel injection. This makes the ECU think that the Air/Fuel Ratio is say, 15:1 or 20:1. Now the mass air maps are all wrong, we need to show less air so that the ECU adds less fuel in order to match the fuel trims. We now need to adjust the ignition timing to take advantage of this combustion change. The problem is that all the EFIEs, MAP/MAF adjusters, and attempts at changing timing by manipulating air temp are a static fixed offset, producing just a single change.

An Air/Fuel Ratio of 20:1 is not appropriate under moderate or heavy acceleration when you don't, and usually can't, add enough hydroxy gas to allow for these conditions. A set 15% to 20% leaner setting across the entire fuel map is not appropriate at all loads, and engine speeds. Adding 50 to 75 degrees F to the air temp is not appropriate when the outside air is already at 110 degrees F. The ECU knows this and makes appropriate changes to it's long-term settings, and so it cancels out the changes which our electronic additions have made.

While it may be OK for an experimenter, and mechanic with all the tools at his disposal to play with these techniques, and retune his engines every week or so in order to get great mileage, it is not realistic to expect the average person to do this. The cost in equipment alone, would undermine any fuel savings. Also, most people don't even change their oil at appropriate intervals.

This was my train of thought as I pondered a solution, and began searching. My search was for a control solution which could firstly, alter the air-flow readings, lambda readings, and ignition timing and secondly, respond to changes in engine speed and engine load. To my surprise I found several products already on the market which are capable of doing this, and which have been available for quite some time. People in the engine-tuning industry have been using them for years. They are custom programmable, piggy-back chips. Several companies make them, and while most do not advertise O2 ("lambda") sensor control, many are quite capable of altering it.

We became a distributor for one brand which seemed to be the best fit for our purposes, and we began testing. The results are perfect. We started with an 2002 Saturn SL. The average mpg for this car started at 26 mpg (highway and city combined). We installed the chip, tested several tuning methods, and found the one which worked best. The car now averages 44-46 mpg. This is not special 'grandma driving' to try, and coax a few extra miles per gallon. This is a courier vehicle for a local printer, and it is driven daily like it was stolen. We have all the same benefits of increased torque (pulling power), better throttle response, etc. The car has been driven around for three months now with our programmed chip installed, and it achieves the mid-40s in mpg all of the time. there are no code changes needed, no start-up problems, no driving problems of any kind whatsoever. If

you weren't told, you would never know that hydroxy gas was being added, except for the fact that you can go over 500 miles on a single tank of fuel.

The only problem is that this is definitely not a do-it-yourself solution. You need a laptop computer with proprietary software to tune the chip, and the scanning, and diagnostic equipment to know when you have it tuned correctly. However, I have thought of a do-it-yourself solution. It still requires you to buy a few electronic kits, and you need a lot of know-how, but we are circumventing a highly sophisticated control architecture, so anyone who thinks it will be easy, is delusional. The main item is a Digital Fuel Adjuster or "DFA" kit from JayCar electronics based in Australia. Their website is <http://www.jaycar.com>. The adjuster kit number is KC5385, and you have to have the hand controller to program it, that kit number is KC5386. At the present time, the Adjuster kit costs USD \$49.50, and the controller kit is USD \$39.50. The adjuster doesn't have an enclosure supplied, but the controller does. You need one controller and two adjusters. The controller can be reused to program multiple adjusters. Once you have the kits, it will take several days of soldering to build them, and it is definitely not a beginner's first-time project.

After the two adjusters and the controller have been built, the first one is wired in to the MAP/MAF sensor signal as shown in the instructions guide. Next the second DFA is used on the oxygen sensor signal. If there are two oxygen sensors, then the DFA is wired through the common ground for the upstream sensors ONLY. This places the voltage offsets in tandem, which makes it unnecessary to use two DFAs (or EFIEs for that matter) for "lambda" control. Now control has been established over fuel maps, and a "lambda" control which is responsive to engine load has been achieved. I believe that these kits also come with an option to make them responsive to rpm.

For ignition timing, the temperature offsets will probably still be necessary, but now you have a fuel control which if tuned properly, the ECU will not learn its way around. I have found that the maps for "lambda" control are very simple. Tune for the leanest Air/Fuel Ratio appropriate at very low loads, and richen up a bit in increments as the load increases. As you get close to full throttle, but before you switch to open-loop operation, your lambda offset should be zero (the stock setting). To tune the air-flow or fuel maps, watch the OBD II scan gauge, and decrease the MAP signal so that your short term fuel trim ("STFT" on a scanner) is no greater than about $\pm 7\%$ at each load interval. Drive for about 20 minutes, and check that your long term fuel trim ("LTFT") never goes beyond the "7s" either. Now the ECU cannot "see" your changes because the fuel map, and lambda readings "agree" at every load range.

The Jaycar kits are not as sophisticated as the chip sets, but they are about 20% of the cost, if you want to put the time and effort into them. The adjuster itself simply adds to, or subtracts from, whatever voltage runs across them, and it can be set to change that offset value in correspondence to whatever voltage value is present at the signal input pin. You would of course put your TPS signal to the signal input pin. The device itself is very versatile, and could be used for many different applications. If you wanted to use one to control a Pulse-Width Modulator attached to a cell, then that would be possible and it would provide a variable gas rate that responds to changes in engine load. I hope you can put this to good use, and feel free to spread the word around. Perhaps you know someone who could build a similar device or give us a schematic to build one, after looking at a JayCar kit. The only drawback to the kits is that rpm sampling gets a little complex, and while I don't think it is absolutely necessary, it would be beneficial. Although the kits have only 125 data points between the "closed", and "fully open" throttle settings, and do not interpolate between data points, they seem to work very well. The professional chip sets have 96,000 data points between CT ("Closed Throttle"), and WOT ("Wide-Open Throttle"), and they do logically interpolate between set data points. The professional chip sets run about \$650 USD programmed, and installed.

I plan to market a pre-programmed chip capable of making **any** hydroxy system work. While I plan to have a profitable venture with the professional pre-programmed architecture, I also believe in the open source do-it-yourself community, which is where I got started. The chips I plan to sell will be a 'plug and play' device. You send me the info on the type of vehicle you are modifying, and the efficiency data of your cell, and I'll be able to send you a chip that will make your ECU work with those conditions. The Do-it-yourself version would be quite time consuming but, would work for less than one quarter of the price.

I think that the "more is better" hydroxy gas idea that a lot of people are stuck in, is seriously flawed. There is definitely a point of diminishing returns. I tune most systems to deliver about 1 lpm. The lower the amperage you can do this at, of course the better. I have found that not only does it take more amperage to produce higher volumes at a less effective rate of return, but it does not add much to the efficiency of the "boosting". With the cells which I build I get 1 lpm of hydroxy gas at about 8 to 10 amps. I'm using direct DC with a 5-cell, 6 plate array, similar to a "Smack's Booster", but with better plate isolation in the bath. We've spent thousands developing fancier, and slightly more efficient cells. We've used PWMs to get better production, and be able to attenuate gas production with duty cycle. We had a really, really advanced system. Then I applied Occam's razor to it. We can make enough gas to support ultra-lean combustion above fairly low load conditions - so what good

is it to be able to decrease when you barely make enough already? The PWM does help, and is relatively inexpensive so we kept that component if the customer wants, but we don't change the duty cycle.

The 6 plate "Smacks" style cell works fine. It is small, easy to build, and is efficient enough for the production we need. Engine control was the biggest issue. I can get great mileage with just a little hydroxy gas, if I can control what fuel table the ECU looks at every load range, and rpm. The problem with EFIEs, and MAP/MAF adjusters is that they tell the computer to look at inappropriate fuel tables at higher load ranges. The ECU picks up on that, adjusts it's long-term fuel trims, and goes back to an unmodified state. If I can make the ECU look at very lean tables at cruise, and then more or less unmodified tables at higher loads it never "sees" the trick. Since we only make enough hydroxy gas to affect low loads anyway, that is all I need to be concerned with. You could think of it as an ultra-lean cruise mode: when you aren't at low cruise you aren't changing anything. When you are cruising you are running at a very lean Air-Fuel Ratio. So far, it works great.

The super fancy system that used a PWM with a duty-cycle controlled by our chip, and made up to 3 lpm at 20amps would have cost over USD \$2500 just for the parts, and equipment to cover production cost, and turn a profit, and it only gained us about 10% efficiency. The system we are working on now should be less than USD \$1500 as a 'turn-key' system. Our little Saturn just came back at 88mpg on a carefully driven run with this system. It typically gets high 40s to mid 50s in mpg under normal driving conditions.

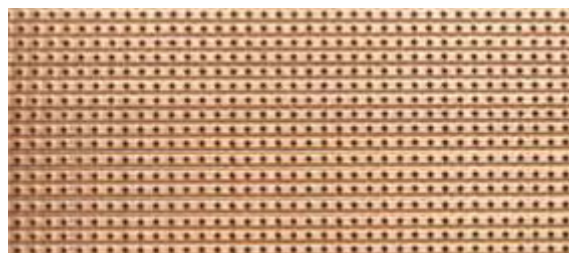
I have tried adding just 0.6 lpm or so, and letting the ECU trim out to compensate. This has given me mixed results. Sometimes I can get 25% to 30% reduction in consumption, and sometimes it makes no difference at all. It has a lot to do with the ECU's programming, and the driver's habits. I don't really know why it doesn't work all the time theoretically it should. The hydroxy gas makes the petrol more volatile so you should be getting more energy per gram of fuel. That should correlate to higher exhaust gas temperatures, and the ECU should see that and take away some fuel, but sometimes it does just the opposite. The ECU sees a lean condition due to increased Exhaust Gas Temperature at the manifold, and lower temperature at the catalytic converter, and so it richens up the air-fuel mix.

Another possible option that I have not explored would be an EFIE designed to change it's output to a set voltage controlled by the vehicle's throttle position sensor. The challenge here is that it is not a linear change. The steps between load sites would not be equal. They would need to be able to be manually set for what the application needed. The DFAs allow you to do this, and can add voltage just like an EFIE. You can use one DFA for MAP/MAF control, and one for oxygen sensor control. So even with a modified EFIE you would need a DFA or something similar to provide non-linear MAP/MAF control". You can contact Les at lespearson@hotmail.com.

Construction

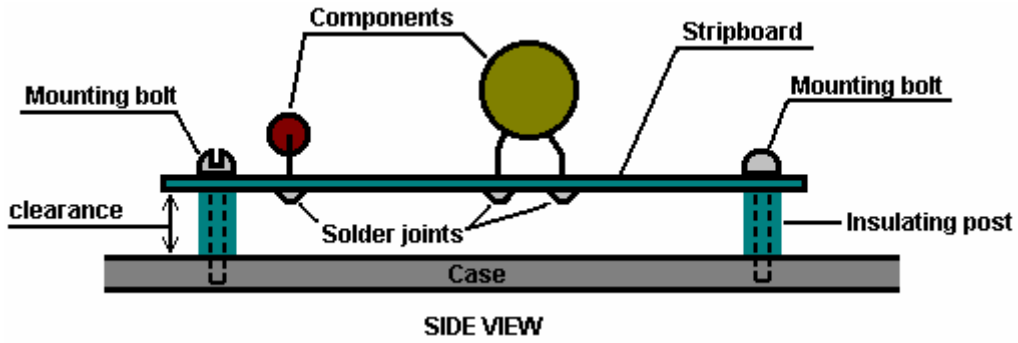
If you wish to build an oxygen sensor controller circuit, then here is a suggestion as to how you might do it. This description assumes very little knowledge on the part of the reader, so I offer my apologies to those of you who are already expert in these matters. There are many different ways to design and construct any electronic circuit and each electronics expert will have his own preferred way. In my opinion, the way shown here is the easiest for a newcomer to understand and build with the minimum of tools and materials.

The circuit shown here, is taken from the website <http://better-mileage.com/memberadx.html>, and is discussed here in greater detail. This circuit can be constructed on a printed circuit board or it can be built on a simple single-sided stripboard as shown here:



Stripboard (often called "Veroboard"), has copper strips attached to one side of the board. The copper strips can be broken where it is convenient for building the circuit. Component leads are cut to length, cleaned, inserted from the side of the board which does not have the copper strips, and the leads attached to the copper strips using a solder joint. Soldering is not a difficult skill to learn and the method is described later in this document.

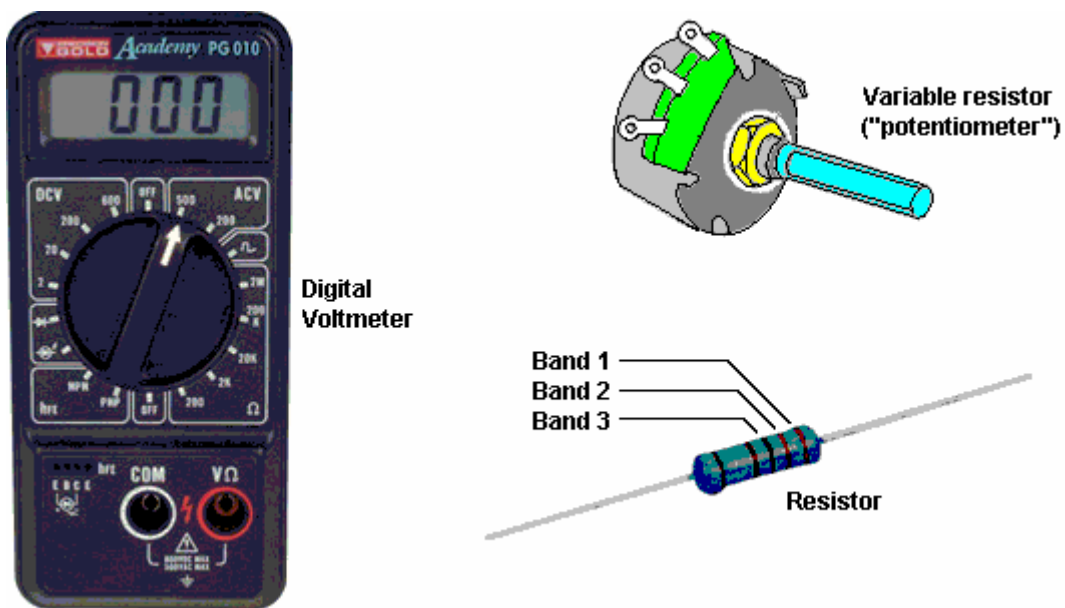
When all of the components have been attached to the stripboard and the circuit tested, then the board is mounted in a small plastic case as shown here:



Insulating posts can be made from a short pieces of plastic rod with a hole drilled through its length. The mounting bolt can self-tap into a hole drilled in the case, if the hole is slightly smaller than the diameter of the bolt threads. Alternatively, the holes can be drilled slightly larger and the bolt heads located outside the case with nuts used to hold the board in place. This style of mounting holds the circuit board securely in place and gives some clearance between the board and the case.

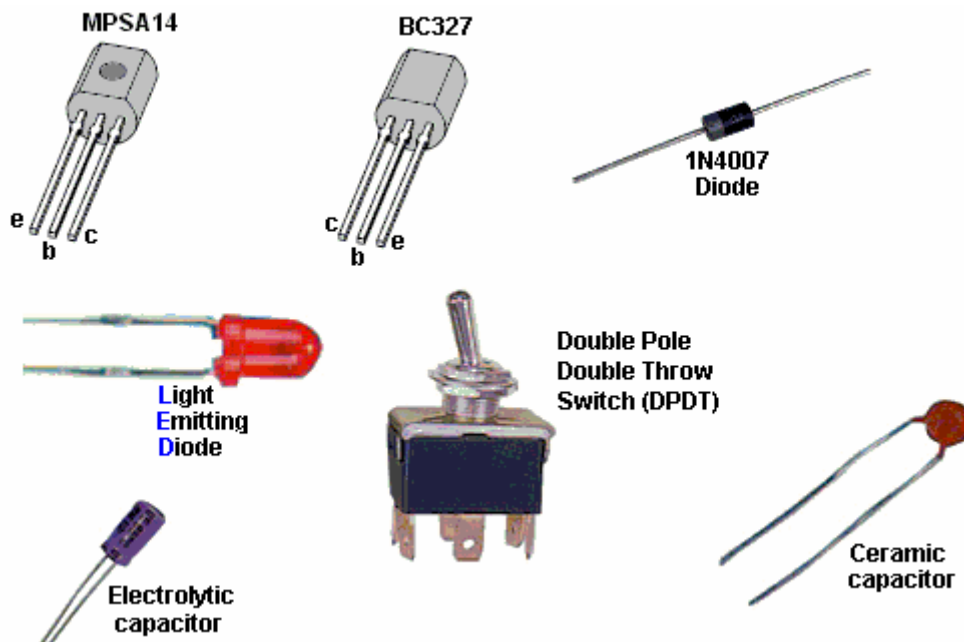


You will need building equipment, namely, a soldering iron, a 12 volt power supply such as a battery pack and an accurate digital volt meter for this project. If the 12 volt supply is a main-powered unit, then it needs to be a well-filtered, voltage-stabilised unit. Lastly, you will need a variable voltage source that can go from 0 to 1 volt to imitate the output from the vehicle's oxygen sensor when testing the completed circuit board. This is simple enough to make, using a resistor and a variable resistor.



A series of components will be needed for the circuit itself. These can be bought from a number of different suppliers and the ordering details are shown later in this document. Shown above is a resistor. The value of the resistor is indicated by a set of three colour bands at one end of the body. The reason for doing this rather than just writing the value on the resistor, is that when the resistor is soldered in place, its value can be read from any angle and from any side. The component list shows the colour bands for each of the resistors used in this circuit. If you want more information on basic electronics, then read the Electronics Tutorial which can be found at <http://www.free-energy-info.co.uk /Chapter12.pdf>

Other components which you will be using, look like this:



The MPSA14 and the BC327 devices are transistors. They each have a “Collector”, a “Base” and an “Emitter” wire coming out of them. Please notice that the two packages are not identical, and take care that the right wire is placed in the correct hole in the stripboard before soldering it in place.

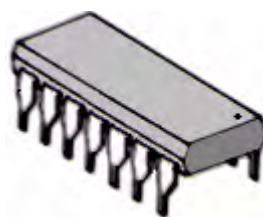
The 1N4007 diode has a ring marked at one end of the body. The ring indicates the flat bar across the symbol as shown on the circuit diagram, and in that way it identifies which way round the diode is placed on the stripboard.

The Light-Emitting Diode (the “LED”) will be familiar to most people as it is used so extensively in equipment of all types.

The toggle switch has six contacts - three on each side. The centre contact is connected to one of the two outer contacts on its side, which one, depends on the position of the switch lever.

The two capacitors (which are called “condensers” in very old literature) look quite different from each other. The electrolytic capacitor has its + wire marked on the body of the capacitor, while the ceramic has such a small value that it does not matter which way round it is connected.

The main component of the circuit, is an integrated circuit or “chip”. This is a tiny package containing a whole electronic circuit inside it (resistors, capacitors, diodes, whatever,). Integrated circuit chips generally look like this:



A very common version of this package has two rows of seven pins each and it goes by the grandiose name of "Dual In Line" which just means that there are two rows of pins, each row having the pins in a straight line. In our particular circuit, the chip has eighteen pins, in two rows of nine.

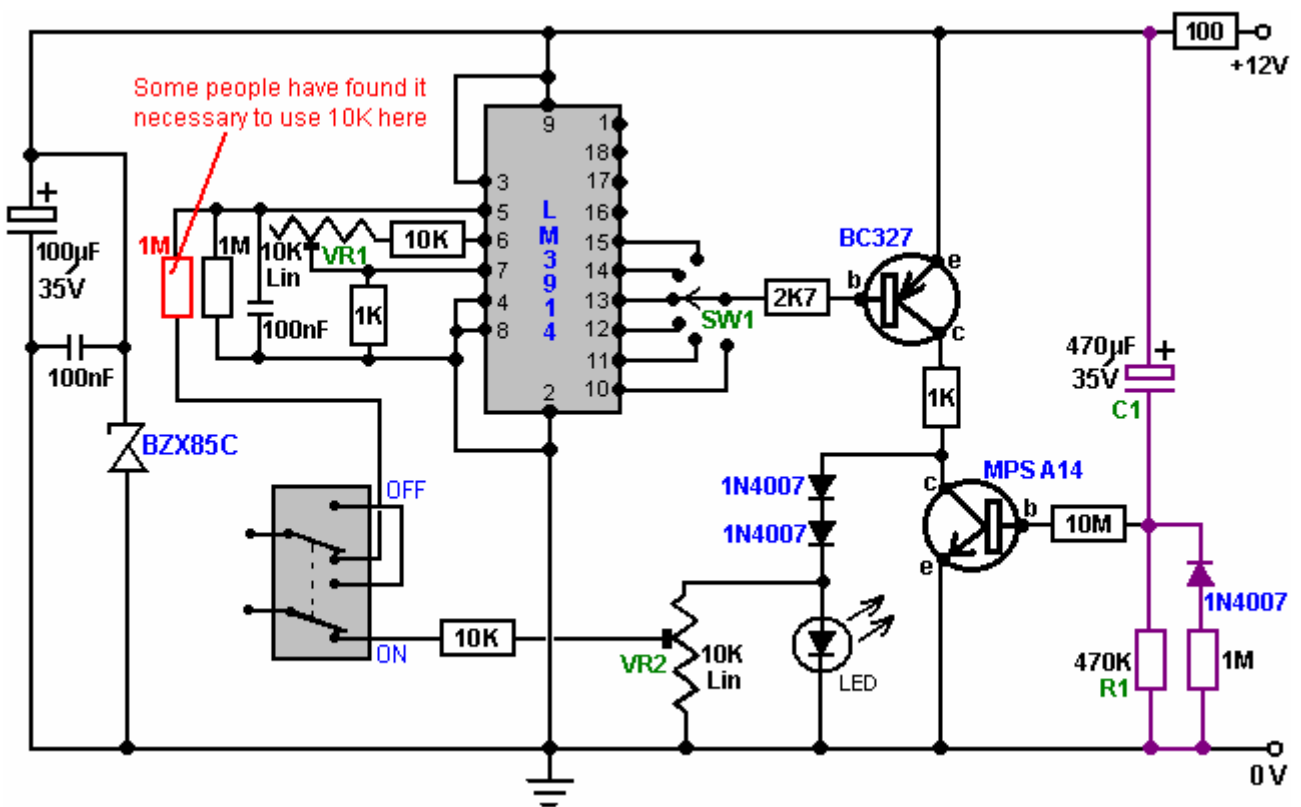
Now to the circuit itself. If you find it hard to follow, then take a look at the electronics tutorial on the web site as it shows the circuit diagram symbol for each component and explains how each device works.

The circuit contains three capacitors, eight resistors, two diodes, one LED, one IC chip, two transistors, one toggle switch and two types of component not yet described, namely: two preset resistors and one rotary switch.



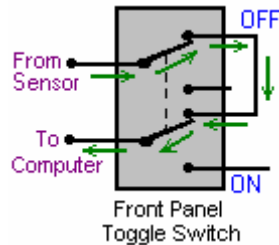
The preset resistor is very small and is adjusted using a flat bladed screwdriver. It is used for making an adjustable setting which is then left unchanged for a long time. The Rotary switch has a central contact which is connected to a row of outer contacts in turn when the shaft is rotated from position to position. The switch shaft is made of plastic and so can easily be cut to the length needed to make a neat installation, and the knob is locked in place by tightening its grub screw against the flat face of the shaft, although some knobs are designed just to push tightly on to the shaft. There is a wide range of knob styles which can be used with this switch, so the choice of knob is dictated by personal taste.

This is the circuit diagram:



Electronic circuits are normally “read” from left to right, so we will look at this circuit that way. The first components are the 100 microfarad, 35 volt electrolytic capacitor with the tiny 100 nF capacitor across it. These are put there to help iron out any variations in the voltage supply. The BZX85C zener diode is a 24-volt type and it protects the integrated circuit from voltage spikes coming along the +12-volt line from other equipment in the vehicle, preventing the circuit from being fed more than 24 volts for even a fraction of a second as that would damage the integrated circuit.

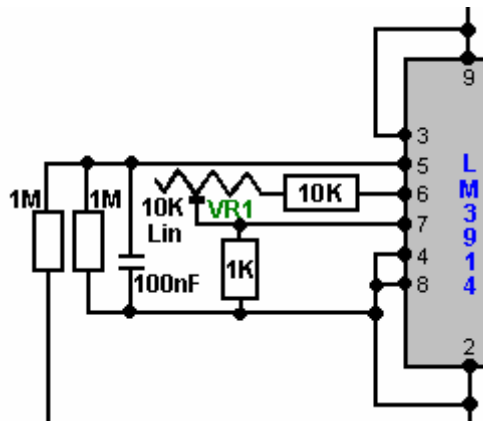
The next item is the On/Off dashboard switch. When switched to its Off position as shown here:



the connection from the oxygen sensor is passed straight through to the vehicle’s fuel computer, bypassing the circuit board completely. This switch allows the whole circuit to be switched Off should you want to do this for any reason.

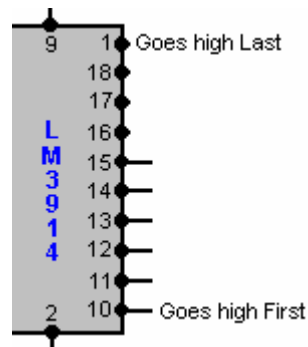
In it’s On position, as shown in the circuit diagram, the varying voltage signal coming from the oxygen sensor is passed into the circuit, and the output voltage from the circuit is passed back to the fuel computer, instead of the original sensor voltage. This allows the circuit to manipulate the voltage sent to the fuel computer.

The next set of components (four resistors, one ceramic capacitor and one preset resistor) shown here:



are needed to feed the incoming sensor voltage to the Integrated Circuit chip, and make the chip operate in the way that we want, (the chip manufacturer allows more than one way for the chip to work). You can just ignore these components for now, just understand why they are there.

The Integrated Circuit chip has ten outputs, coming out through Pins 1 and 10 through 18 inclusive:



If the input voltage coming from the oxygen sensor is low, then all of these ten outputs will have low voltages on them. When the input voltage rises a little, the voltage on Pin 10 suddenly rises to a high value, while the other output pins still have low voltages.

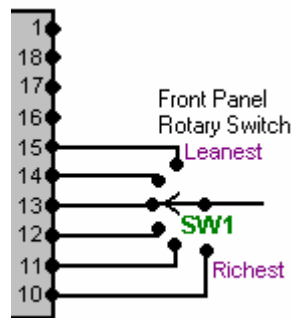
If the input voltage rises a little higher, then suddenly the voltage on Pin 11 rises to a high value. At this point, both Pin 10 and Pin 11 have high voltage on them and the other eight output pins remain at low voltage.

If the input voltage rises a little higher again, then suddenly the voltage on Pin 12 rises to a high value. At this point, Pin 10, Pin 11 and Pin 12 all have high voltage on them and the other seven output pins remain at low voltage.

The same thing happens to each of the ten output pins, with the voltage on Pin 1 being the last to get a high voltage on it. The circuit is arranged so that Pin 10 provides the output signal for the richest air/fuel mixture for the vehicle, and the mix gets progressively leaner as the output on Pins 11, 12, ... etc. are selected to be fed to the fuel computer.

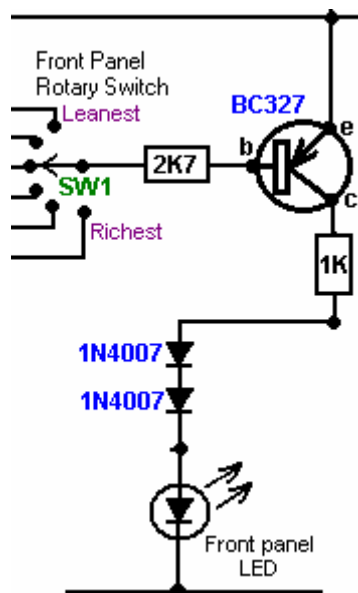
As there is the possibility of engine damage if the fuel mix is too lean, only six of the outputs are taken on into the circuit. However, if the engine is being fed hydroxy gas from an electrolyzer to improve both the miles per gallon performance and reduce emissions to zero, then it is likely that the engine will run cooler than before and engine damage is most unlikely to occur. It is quite safe to leave the remaining output pins of the Integrated Circuit chip unconnected. However, if this unit is to be used with the Nitrogen Hydroxide cell described in the D18.pdf document, then it is quite safe to connect Pins 16, 17, 18 and 1 and set the rotary switch to ten positions.

The output pin to be used by the remainder of the circuit is selected by the rotary switch mounted on the dashboard:



A standard single-pole rotary wafer switch has twelve positions but the switch operation can be restricted to any lesser number of positions by placing the end-stop lug of the switch just after the last switch position required. This lug comes as standard, fits around the switch shaft like a washer, and is held in place when the locking nut is tightened on the shaft to hold the switch in place. The lug projects down into the switch mechanism and forms an end-stop to prevent the switch shaft being turned any further. With six switch positions, the circuit provides five levels of leaner air/fuel mix which can be selected. This should be more than adequate for all practical purposes.

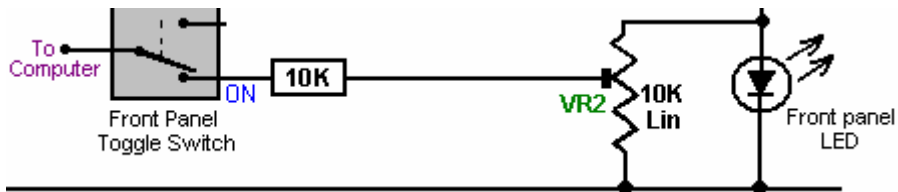
The next section of the circuit is the BC327 transistor amplifier stage which provides the output current for the fuel computer:



Here, the switch “SW1” connects to one of the output pins of the Integrated Circuit. When the voltage on that pin goes low, it causes a current to flow through the transistor Base/Emitter junction, limited by the 2.7K (2,700 ohm) resistor. This current causes the transistor to switch hard On, which in turn alters the voltage on its Collector from near 0 volts to near +12 volts. The 2.7K resistor is only there to limit the current through the transistor and to avoid excessive loading on the output pin of the IC.

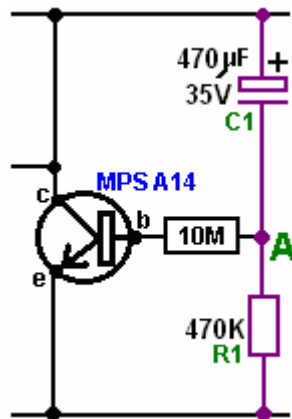
The transistor now feeds current to the LED via the two 1N4007 diodes and the 1K (1,000 ohm) resistor. This causes the Light Emitting Diode to light brightly. The 1K resistor is there to limit the amount of current flowing through this section of the circuit.

Part of the voltage across the LED is fed back to the fuel computer:



By moving the slider contact on the preset resistor “VR2”, any output voltage can be fed to the fuel computer. This voltage can be anything from the whole of the voltage across the LED, down to almost zero volts. We will use VR2 to adjust the output voltage when we are setting the circuit up for use. In this circuit, VR2 is acting as a “voltage divider” and it is there to allow adjustment of the output voltage going from the circuit to the fuel computer.

The final section of the circuit is the MPSA14 transistor and its associated components:



This circuit is a timer. When the circuit is first powered up (by the vehicle’s ignition key being turned), the 470 microfarad capacitor “C1” is fully discharged (if it isn’t, then the oxygen sensor will already be hot). As it is discharged and one side is connected to the +12 volt line, then the other side (point “A”) looks as if it is also at +12 volts. This provides a tiny current to the Base/Emitter junction of the MPSA14 transistor, through the high resistance 470K (470,000 ohm) resistor. The MPSA14 transistor has a very high gain and so this tiny current causes it to switch hard on, short-circuiting the LED and preventing any voltage developing across the LED.

As time passes, the tiny current flowing through the MPSA14 transistor, along with the tiny current through the 3.9M (3,900,000 ohm) resistor “R1”, cause a voltage to build up on capacitor “C1”. This in turn, forces the voltage at point “A” lower and lower. Eventually, the voltage at point “A” gets so low that the MPSA14 transistor gets starved of current and it switches off, allowing the LED to light and the circuit to start supplying an output voltage to the fuel computer. The purpose of the section of the circuit is to shut off the output to the fuel computer until the oxygen sensor has reached it’s working temperature of 600 degrees Fahrenheit. It may be necessary to tailor this delay to your vehicle by altering the value of either “R1” or “C1”. Increasing either or both will lengthen the delay while reducing the value of either or both, will shorten the delay.

We want the time delay to occur if the engine is off for some time, but not to occur if the engine is switched off only briefly. For this to happen, it is suggested that a diode is placed across the timing resistor. This will have no effect when the circuit is powered up, but it will discharge the capacitor when the circuit is powered down. We can slow down the rate of discharge by putting a high-value resistor in series with the discharge diode and that would make the circuit:

Circuit Operation:

Now that we have looked at each part of the circuit separately, let us look again at the way that the circuit operates. The main component is the LM3914 integrated circuit. This device is designed to light a row of Light Emitting Diodes ("LEDs"). The number of LEDs lit is proportional to the input voltage reaching it through its Pin 5. In this circuit, the integrated circuit is used to provide a reduced voltage to be fed to the fuel computer, rather than to light a row of LEDs. When the operating switch is set in its ON position, the sensor voltage is fed to Pin 5 through a 1 megohm resistor.

The sensitivity of this circuit is adjusted, so that when 500 millivolts (0.5 volts) is applied to Pin 5, the output on Pin 10 is just triggered. This is done by adjusting the 10K linear preset resistor "VR1" while placing a test voltage of 500 millivolts on Pin 5. This LM3914 Integrated Circuit is normally switched so that it samples the sensor voltage. The LM3914 chip provides ten separate output voltage levels, and the circuit is arranged so that any one of several of these can be selected by the rotary switch "SW1". These output voltages range from 50 millivolts on Pin 1 to 500 millivolts on Pin 10, with each output position having a 50 millivolt greater output than its neighbouring pin. This allows a wide range of control over the sensor feed passed to the fuel computer.

The input resistor/capacitor circuit provides filtering of the sensor signal. Because this circuit draws very little current, it is easily knocked out of correct operation through its input line picking up stray electrical pulses produced by the engine, particularly the vehicle's ignition circuit. When the exhaust sensor heats up, the signal becomes cleaner and then the circuit starts operating correctly. The circuit includes a delay so that after start up, the output is held low for a few minutes to simulate a cold sensor. The sensor must be operating correctly before we send signals to the computer. The most common problem, if we don't have this delay, is that the output will be high simply from the noise on the signal line. The computer will think the sensor is working, because it is high, and will cut back the fuel to make the signal go low. If that were to happen, we would end up with an over-lean fuel input to the engine, producing very poor acceleration.

The front panel LED is not just to show that the device is operating, but forms a simple voltage regulator for the output signal to the computer. When the engine is warmed up and running normally, the LED is lit when the output is high, and not lit when the output is low, so this LED should be flashing on and off.

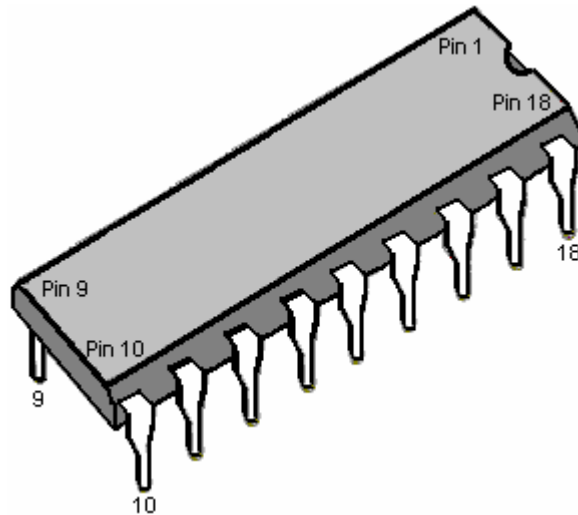
The earth connection for the oxygen sensor is the exhaust system, which is firmly bolted to the engine. The computer earth is the vehicle body. A difference of just 0.5 volts can make a large difference to the mixture. If the engine is not securely earthed to the vehicle body, then a voltage difference can exist between the two, and in this situation a voltage difference of just 0.5 volts would normally go unnoticed. We can't afford to have that sort of voltage difference when trying to control the mixture accurately, so some investigation and adjustment is needed.

To do this, start the engine, switch the headlights on to high beam, then measure the voltage between the engine and the body. Use a digital volt meter. Any more than 50 millivolts (0.05 volts) means that there is a bad earth connection which need cleaning and tightening. Modern cars usually have more than one connection so look around. If you have trouble achieving a really good connection, then earth your circuit board directly on the engine rather than connecting it to a point on the bodywork of the vehicle. The most important item is to have a good quality signal voltage coming from the sensor, since the operating range consists of quite low voltages. The components and tools needed for building this circuit are shown later, but for now, consider the setting up and testing of the unit so as to understand better what is needed.

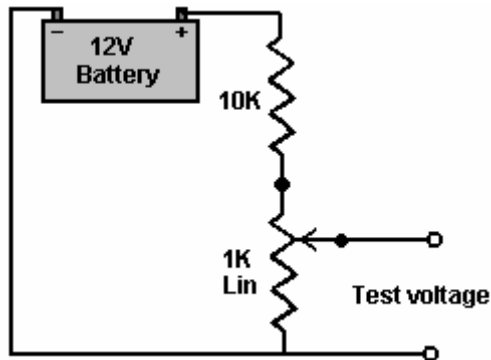
Adjusting on the Bench

When the circuit has been constructed to the testing stage, that is, with all components in place except for the timing capacitor "C1", and before the power is turned on, plug the Integrated Circuit chip into its socket mounted on the board. Be very careful doing this as the chip can be destroyed by static electricity picked up by your body. Professionals wear an electrical earth wrist strap when handling these devices, so it would be a good idea to touch a good earth point such as a metal-pipe cold water system just before handling the chip.

It is vital that you install the IC chip, the correct way round or it may be damaged. The circuit board layout shows which way round it goes. The chip has a semi-circular indentation at one end to show which end is which, so be careful that the indentation is positioned as shown on the board layout in the section which shows how the board is built. Some manufacturers use a dot rather than a semi-circular indentation to mark the end of the chip which has Pin 1 in it.



Make up the test voltage device. We need something to give us an adjustable voltage in the range 0 to 1 volt. A very easy way to get this is to use a 10K resistor and a 1K variable resistor (called a “potentiometer” by some people) and connect them across the 12 volt battery, as shown here:



This gives us a voltage in the correct range when the shaft of the variable resistor is turned. Power up the circuit board by switching the 12 volt battery through to the board. Adjust the test-voltage source to 500 millivolts (0.5 volts) and apply it to the board’s input (where the sensor connection will be made when it is installed in the vehicle). Set the switch to the “Richest” position, that is, with the switch connected to Pin 10 of the chip.

Now, using a flat-blade screwdriver, adjust the sensitivity control preset resistor “VR1” so that the output LED is just lit. Leave the preset resistor in that position and adjust the test voltage lower and higher to test that the LED turns on and off in response to the varying voltage at the input to the circuit. The LED should come on at 0.5 volts, and go off just below 0.5 volts. The other outputs, which can be selected by the rotary switch “SW1”, will be about 50 millivolts lower for each position of the switch away from it’s “Richest” setting on Pin 10.

Now, with the output high and the LED lit, use a flat-bladed screwdriver to adjust the preset resistor “VR2” to set the output voltage being sent to the computer to about 1.0 volts. When this has been set, lower the input voltage so that the LED goes out. The output voltage should now be at zero volts. If this is what happens, then it shows that the circuit is operating correctly.

If this board is not in place, the sensor will cause the fuel computer to make the fuel mixture richer so as to maintain a 500 millivolt voltage from the sensor. With the circuit in place and set to its “Richest” setting, exactly the same thing happens. However, if the rotary switch is moved to its next position, the fuel computer will maintain the fuel feed to maintain a 450 millivolt output, which is a leaner fuel-to-air mixture. One step further around and the fuel computer will make the mix even leaner to maintain a 400 millivolt output from the circuit board, which the fuel computer thinks is coming from the exhaust oxygen sensor.

If your circuit board does not operate as described, then power it down and examine the circuit board again, looking for places where the solder connections are not perfect. There may be somewhere where the solder is bridging between two of the copper strips, or there may be a joint which looks as if it is not a good quality joint. If you find one, don’t solder anywhere near the IC chip as the heat might damage the chip. If necessary, earth yourself again, remove the chip and put it back into the anti-static packaging it came in, before repairing the board. If the components are all correctly positioned, the copper tracks broken at all the right places and all

solder joints looking good and well made but the board still is not working correctly, then it is likely that the IC chip is defective and needs to be replaced.

Next, install the delay capacitor "C1". Set the test voltage above 500 millivolts and turn the power on again. It should take about three minutes for the LED to come on. If you want to shorten this delay, then change the timing resistor "R1" for a resistor of a lower value. To lengthen the delay, replace the timing capacitor "C1" with a capacitor of larger value. If you find that the oxygen sensor heats up quickly, then you can reduce the length of the delay. Having too long a delay is not ideal, since the computer will be adding extra fuel to make the mixture richer.

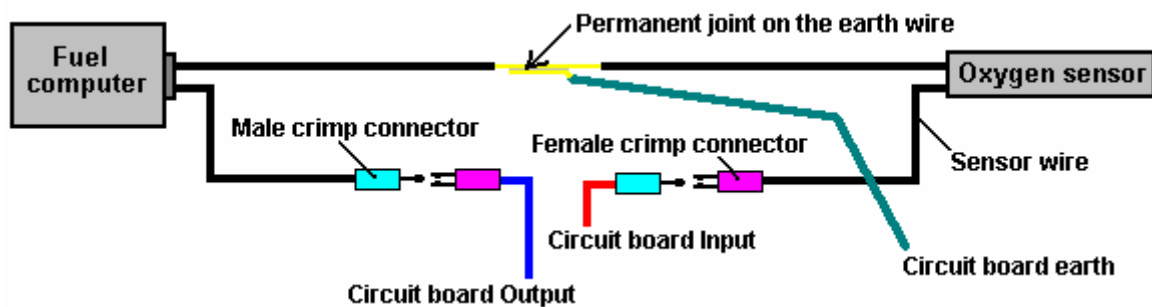
It is suggested that the rotary switch should be set to have only six switch positions (by moving it's end-stop lug washer), so initially, connect the IC chip output pins 10 through 15 to the switch. You can choose to connect the wires to the switch so that the mixture gets richer when you turn the knob clockwise, or if you prefer, you can wire it in the reverse order so that the mixture gets richer when you turn the knob counter-clockwise.

Testing in the Car

You can now test the device in the vehicle but don't install it yet. Look in the engine compartment and locate the oxygen sensor. If you have difficulty in finding it, get a copy of the Clymer or Haynes Maintenance Manual for your vehicle as that will show you the position. If your vehicle has two sensors, then select the one nearest to the engine. If your sensor has five wires running to it, then it is a "wideband" sensor which measures both the oxygen content and the amount of unburnt fuel, and unfortunately, the type of circuit described here will not control it.

Start the vehicle and allow the oxygen sensor to warm up for a couple of minutes. Remember that there is a delay built in to the circuit, so after a few minutes you should see the LED start to flash. Rev the engine and the LED will stay on. When you release the throttle, the LED will go out for a while. A flashing LED is what you want to see. The rate of flashing will be somewhere between 1 and 10 times per second, most likely around 2 per second. Confirm that the LED goes out when you switch off the circuit board On/Off switch mounted on the dashboard.

Now comes the exciting bit, cutting the oxygen sensor wire and inserting the controller. Turn the engine off and cut the wire in a convenient place. Use crimp connectors on the wire ends. Use a matching pair on the wire which you just cut, in case you need to reconnect it, as shown here:



When set up like this, the male connector furthest on the left could be plugged into the female connector furthest on the right and the circuit board removed. Be sure to insulate the sensor and fuel computer plug/socket connections to make quite sure that neither of them can short-circuit to any part of the body. There is no need to insulate the earth connection as it is already connected to the body of the vehicle. Although not shown in the diagram, you could also put a male and female crimp connector pair on the earth cable. If your sensor has only one wire coming from it, then your best earth connection is to a solder-tag connector placed under a bolt on the engine. If you do that, be sure to clean all grease, dirt, rust, etc. off the underside of the bolt head and the area around the bolt hole. Push a paper towel into the bolt hole before doing this to make sure that no unwanted material ends up in the bolt hole and use wet-and-dry paper to really clean the surfaces. The objective here is to make sure that there is a very good electrical connection with shiny metal faces clamped firmly together.

Installing the Controller

Now, install the circuit board in the vehicle. For the 12 volt supply, find a connection which is switched on and off by the vehicle's ignition switch. Don't drive the car yet, do this test in the driveway. With the front panel switch in it's "Off" position, start the car and check that it runs normally. Set the front panel rotary switch to the Richest position (connected to the IC's Pin 10) and switch the circuit board toggle switch to it's "On" position. The car is now running with a modified oxygen sensor signal although the mixture is still the same. The vehicle performance

should be completely normal. Drive the vehicle with this setting for a while to prove that the system is working reliably before changing to any of the lower settings. When you are satisfied that everything is in order, try the next leanest setting on the rotary switch and see how it runs.

It is important that there should be no hesitation in the engine performance and no knocking or “pinking” as that is an indication that the mix is too lean and the engine is liable to overheat. This circuit is intended for use with an electrolyzer, so your electrolyzer should be set up and working for these tests. The electrolyzer will tend to make the engine run cooler and offset any tendency towards overheating.

Building the Circuit Board

Although the above information has been presented as if the board has already been built, the actual construction details have been left until now, so that you will already have an understanding of what the circuit is intended to do and how it is used.

It is likely that you will know somebody (neighbour, friend, relative,...) who has the necessary equipment and skills. If so, borrow the equipment, or better still, recruit the person to help with the construction. It is very likely that anybody owning the equipment would be very interested in your project and more than willing to help out.

However, the rest of this document will be written on the assumption that you cannot find anybody to help and have had to buy all of the necessary equipment. This project is not difficult to build, so you will almost certainly be successful straight off.

The tools which you will need, are:

1. A soldering iron with a fine conical tapering tip (probably 15 watts power rating)
2. Some “Multicore” resin solder. This is special solder for electronics construction work and is quite different from plumber’s solder which is not suitable for this job.
3. A pair of long-nosed pliers (for holding component wires when soldering them in place)
4. Something for cutting and cleaning wires and stripping off insulation coverings. I personally prefer a pair of “nail” scissors for this job. Others prefer a pair of wire cutters and some sandpaper. You get whatever you feel would be the best tool for doing these tasks.
5. A 1/8 inch (3 mm) drill bit (for making bolt holes in the stripboard and for breaking the copper strips where needed) and a 3/8 inch (9 mm) drill and bit for mounting the switches on the plastic box.
6. A coping-saw or similar small saw for cutting the rotary switch shaft to the optimum length.
7. A small screwdriver (for tightening knob grub screws).
8. A crimping tool and some crimp connectors.
9. A multimeter (preferably a digital one) with a DC voltage measuring range of 0 to 15 volts or so.
10. (Optional) a magnifying glass of x4 or higher magnification (for very close examination of the soldering)

Soldering

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 an Integrated Circuit 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.

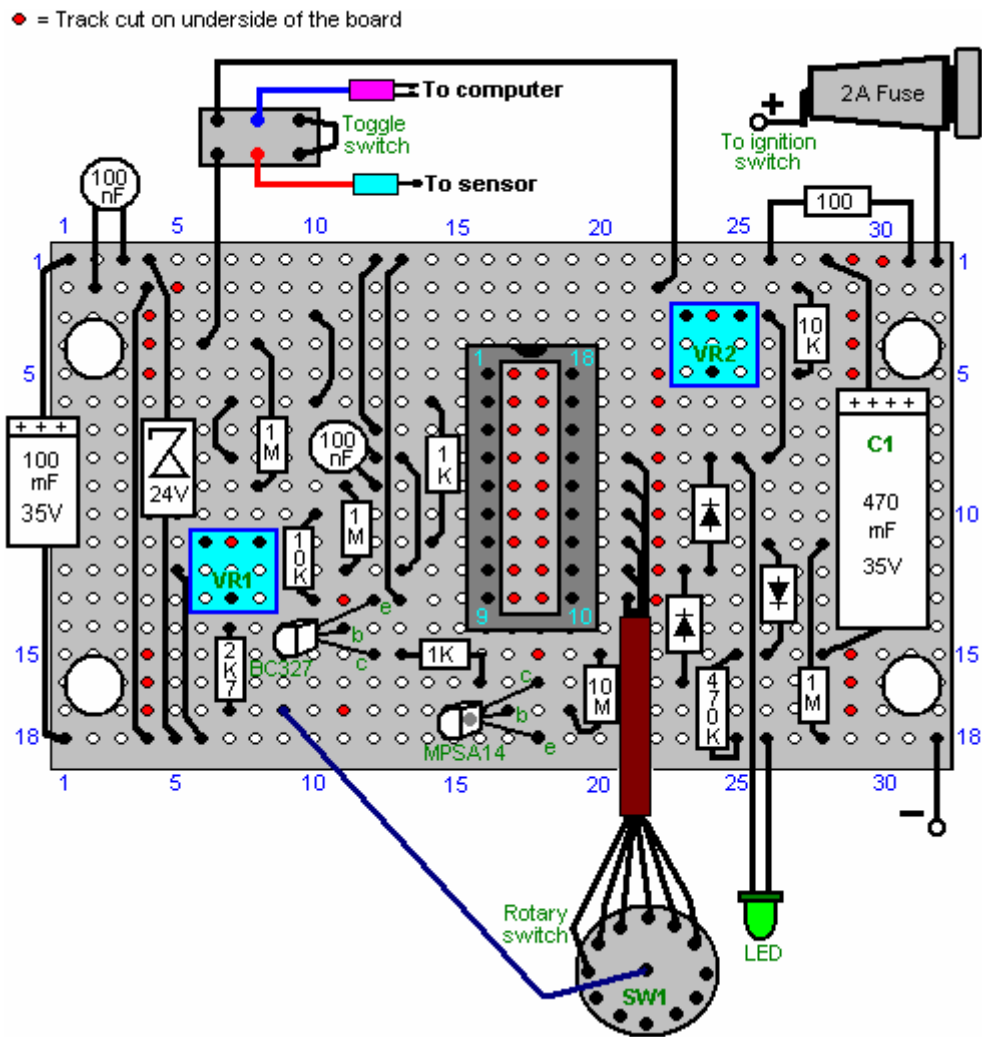
Soldering is an easily-acquired skill. Multi-cored solder is used for electronic circuit soldering. This solder wire has flux resin contained within it and when melted on a metal surface, the flux removes the oxide layer on the metal, allowing a proper electrical and mechanical joint to be made. Consequently, 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.

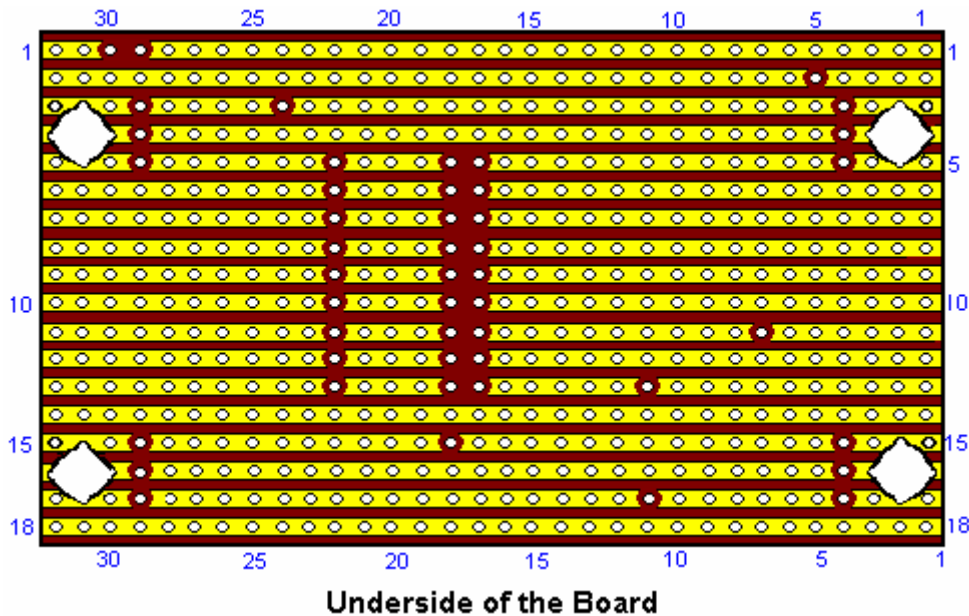
A good solder joint will have a smooth shiny surface and pulling any wire going into the joint will have no effect as the wire is now solidly incorporated into the joint. Making a good solder joint takes about half a second and certainly not more than one second. You want to remove the soldering iron 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 stripboard 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.

Nowadays, the holes in the stripboard are only 1/10 inch (2.5 mm) apart and so the gaps between adjacent copper strips is very small indeed. If you solder carefully, there should be no problem. However, I would recommend that when the circuit board is completed, that you use a magnifying glass to examine the strip side of the board to make quite sure that everything is perfectly ok and that solder does not bridge between the copper strips anywhere. Before powering up the circuit, double-check that all of the breaks in the copper strips have been made correctly. Here is a possible layout for the components on the stripboard:



If this board is turned over horizontally, the underside will look like this:



This shows where the breaks in the copper strips need to be made using a 1/8 inch (3 mm) drill bit.

To construct this circuit, cut a piece of stripboard which has 18 strips, each with 32 holes. That is a board size of about two inches (50 mm) by just over three inches (85 mm). Mount the components on the board, working from one end as the installation is easier if you have a clear board to work across. If you are right-handed, then start at the left hand side of the board and work towards the right, installing all components as you go. If you are left-handed, then mount the components starting with the right hand side of the board and working towards the left hand side.

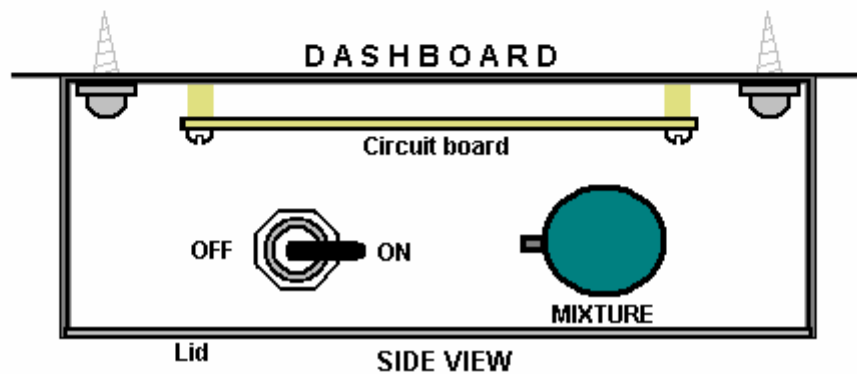
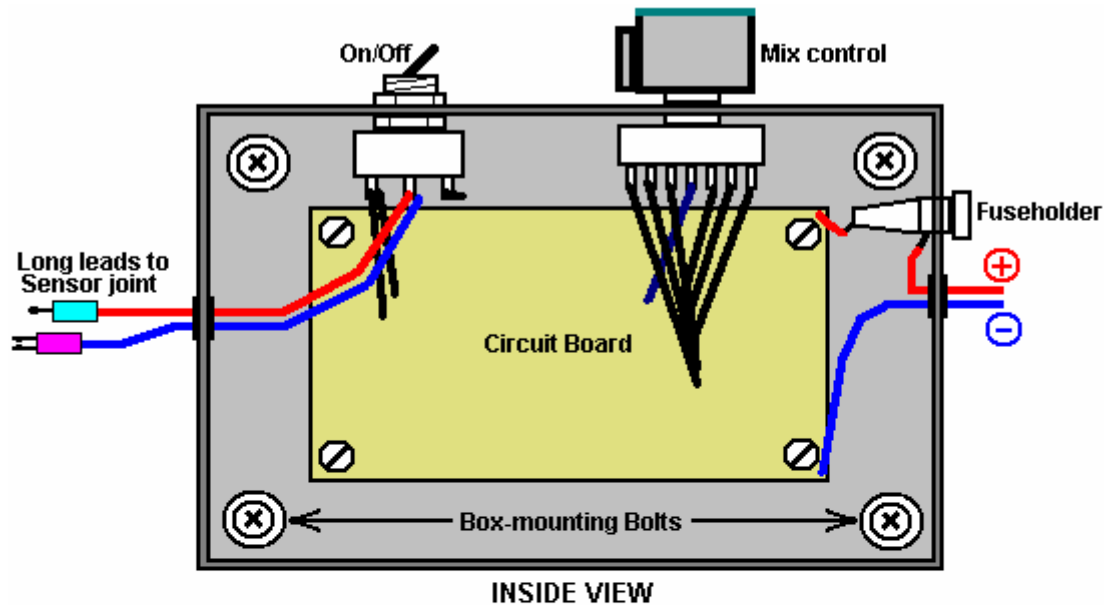
Having said that, it is probably easier if you put all of the wire jumpers in place as the first step. The best wire for this is solid core wire of the type used in telephone wiring, as it is easy to cut, easy to remove the insulation and it lies flat on the board, clear of all of the other holes. So, start with the wire jumpers and then install the electronic components working across the board.



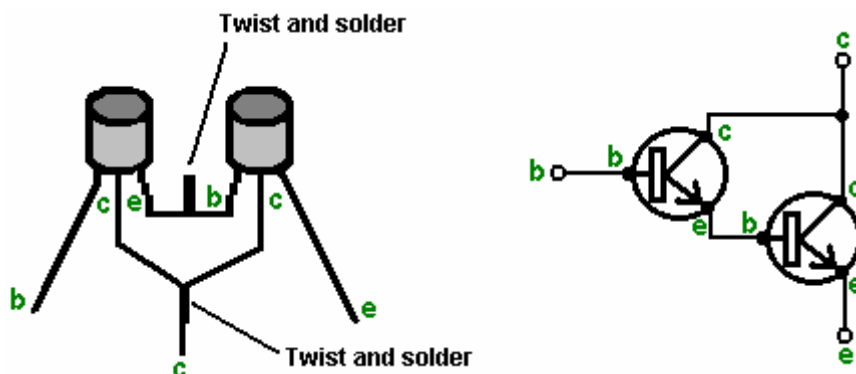
The jumper wires lie flat on the board, and like the other components, have about 2 mm of clean wire projecting through the copper strip before the solder joint is made.

The wires coming off the board should be of the type which have several thin wires inside the insulation, as these are more flexible and withstand the vibration of a vehicle in motion, better than solid core wire. If you have just one reel of wire, then be sure to label the far end of each piece mounted on the board, the moment you have soldered it in place. These labels will help avoid errors when mounting in the case, if you do not have different coloured wires.

The completed circuit board can be mounted in a small plastic box of the type which has a lid held in place by screws. It may be convenient to screw or bolt the case to the underside of the dashboard and then screw the lid in place, covering the mounting screws:



The components in this circuit are not critical and any near-match alternatives can be used. In the event that the MPSA14 Darlington-pair transistor is not available, then two general-purpose high-gain silicon transistors like the BC109 or 2N2222A can be substituted. Just connect them like this:



The emitter of the first transistor is connected to base of the second and the two collectors are connected together. If the transistors have metal cases, then make sure the emitter/base connection cannot touch either case as the cases are often connected internally to the collectors. If each transistor has a gain of only 200, then the pair will have a combined gain of 40,000 times. That means that the base current need only be 40,000 times less than the collector current of the second transistor.

The BC327 transistor can be replaced by almost any other silicon PNP transistor in this circuit as the gain does not need to be great and the power rating is very small. The following is a list of the main electronic components needed for the construction of this circuit as described here. There are several suppliers who are able to supply all of these components and the most suitable depends on where you are located. If there is any difficulty, try an internet search, and if that fails, ask for help in one or more of the Yahoo enthusiast groups such as 'watercar', 'hydroxy' or any of the electronics Groups.

Component	Qty	US Supplier	Code
Black plastic box with lid, size about 4" x 3" x 2"	1	Radio Shack	270-1803
Stripboard: 18 strips, 32 holes	1	Electronix Express	0302PB16
Double Pole Double Throw toggle switch	1	Radio Shack	275-636
Fuseholder, panel mounting, 1.25"	1	Radio Shack	270-364
Fuse, 2 amp slow-blow 1.25"	1	Radio Shack	270-1262 ?? (3 A)
Rotary wafer switch, 12-way single pole	1	Electronix Express	17ROT1-12
Knob for the rotary switch	1	Radio Shack	274-424
LED, any colour, 5 mm diameter	1	Radio Shack	276-041
IC socket, 18 pin DIL	1	Radio Shack	276-1992
Miniature preset resistor, 10K linear	2	Radio Shack	271-282
LM3914 LED bar driver Integrated Circuit	1	Electronix Express	LM3914
BC327 PNP transistor	1	Electronix Express	2N2905
MPSA14 Darlington pair transistor	1	Electronix Express	MPSA14
1N4007 Diode or equivalent	3	Radio Shack	276-1103 (2 pack)
BZX85C zener diode, 24 volt version	1	Electronix Express	1N5359
470 microfarad, 35 volt (or higher) axial lead aluminium foil electrolytic capacitor	1	Radio Shack	272-1018
100 microfarad, 35 volt (or higher) axial lead aluminium foil electrolytic capacitor	1	Radio Shack	272-1016
100 nF (0.1 microfarad) ceramic disc capacitor	2	Radio Shack	272-135 (2 pack)
10 megohm 1/4 watt carbon resistor (Bands: Brown,Black,Blue)	1	Radio Shack	271-1365 (5 pack)
1 megohm 1/4 watt carbon resistor (Bands: Brown,Black,Green)	3	Radio Shack	271-1356 (5 pack)
470K 1/4 watt carbon resistor (Bands: Yellow,Purple,Yellow)	1 or 1	(Radio Shack) Radio Shack	use two 1M in parallel or 271-1133 (5 pack 1/2 watt)
10K 1/4 watt carbon resistor (Bands: Brown,Black,Orange)	1	Radio Shack	271-1335 (5 pack)
2.7K 1/4 watt carbon resistor (Bands: Red,Purple,Red)	1	Radio Shack	271-1328 (5 pack) [use 3.3K]
1K 1/4 watt carbon resistor (Bands: Brown,Black,Red)	2	Radio Shack	271-1321 (5 pack)
100 ohm 1/4 watt carbon resistor (Bands: Brown,Black,Brown)	1	Radio Shack	271-1311 (5 pack)
Connecting wire: stranded and solid core		Local supplier	

Electronix Express <http://www.elexp.com/index.htm>

Radio Shack <http://www.radioshack.com/home/index.jsp>

And for a UK supplier:

Component	Qty.	European Supplier	Code
Black plastic box with lid, size about 4" x 3" x 2"	1	ESR	400-555
Stripboard: 18 strips, 32 holes	1	ESR	335-010
Double Pole Double Throw toggle switch	1	ESR	218-028
Fuseholder, panel mounting 31 mm	1	ESR	187-115
Fuse, 2 amp 31 mm	1	ESR	190-220
Rotary wafer switch, 12-way single pole	1	ESR	210-012
Knob for the rotary switch	1	ESR	060-22X
LED, any colour, 5 mm diameter	1	ESR	711-540
IC socket, 18 pin DIL	1	ESR	110-180
Miniature preset resistor, 10K linear	2	ESR	998-310
LM3914 LED bar driver Integrated Circuit	1	ESR	LM3914
BC327 PNP transistor	1	ESR	BC327
MPSA14 Darlington pair transistor	1	ESR	MPSA13
1N4007 Diode or equivalent	3	ESR	1N4007
BZX85C zener diode, 24 volt version	1	ESR	726-240
470 microfarad, 35 volt (or higher) axial lead aluminium foil electrolytic capacitor	1	ESR	810-104
100 microfarad, 35 volt (or higher) axial lead aluminium foil electrolytic capacitor	1	ESR	810-096
100 nF (0.1 microfarad) ceramic disc capacitor	2	ESR	871-061
10 megohm 1/4 watt carbon resistor (Bands: Brown,Black,Blue)	1	ESR	906-610
1 megohm 1/4 watt carbon resistor (Bands: Brown,Black,Green)	3	ESR	906-510
470K 1/4 watt carbon resistor (Bands: Yellow,Purple, Yellow)	1	ESR	906-447
10K 1/4 watt carbon resistor (Bands: Brown,Black,Orange)	1	ESR	906-310
2.7K 1/4 watt carbon resistor (Bands: Red,Purple,Red)	1	ESR	906-227
1K 1/4 watt carbon resistor (Bands: Brown,Black,Red)	2	ESR	906-210
100 ohm 1/4 watt carbon resistor (Bands: Brown,Black,Brown)	1	ESR	906-110
Reel of multi-strand connecting wire 6 amp Red	1	ESR	054-112
Reel of multi-strand connecting wire 6 amp Blue	1	ESR	054-116
Reel of solid core (or local phone wire)	1	ESR	055-111

ESR <http://www.esr.co.uk> Tel: 01912 514 363

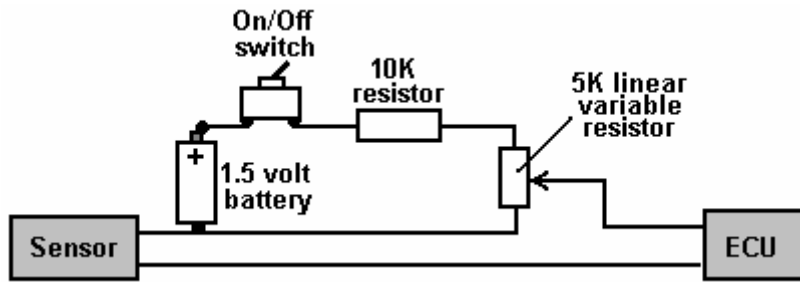
While the components listed above are the parts needed to construct the electronics board, the following items may be needed in addition when testing and installing the board in a vehicle:

Component	Use
Rubber or plastic grommets	To protect wires from rubbing against the edges of the holes in the box
Crimp "bullet" connectors	Male and female, one pair for each sensor wire cut
Mounting bolts, nuts and spacers	To hold the circuit board securely, clear of the box.
Double-sided adhesive tape	For mounting the box on the dash. Alternatively, hardware items for this.
Fuse-box connector	For connecting to the fuse box to give an ignition-switched 12V supply
10K resistor and 1K Linear variable resistor	For bench testing with voltages of up to 1 volt, if these components are not already to hand
Multimeter	For general checking of voltages, continuity, etc.

I should like to express my sincere thanks to the various members of the 'watercar' Group who provided the technical information and patient support which made this document possible.

An alternative:

As the signal coming from the oxygen sensor to the vehicle's ECU fuel computer needs to be raised slightly to allow for the much cleaner exhaust produced when a booster is being used, an alternative solution has been suggested and tested. The idea is to add a small, adjustable voltage to the signal already coming from the oxygen sensor. This voltage can be from a single 'dry-cell' battery and adjusted with a variable resistor:



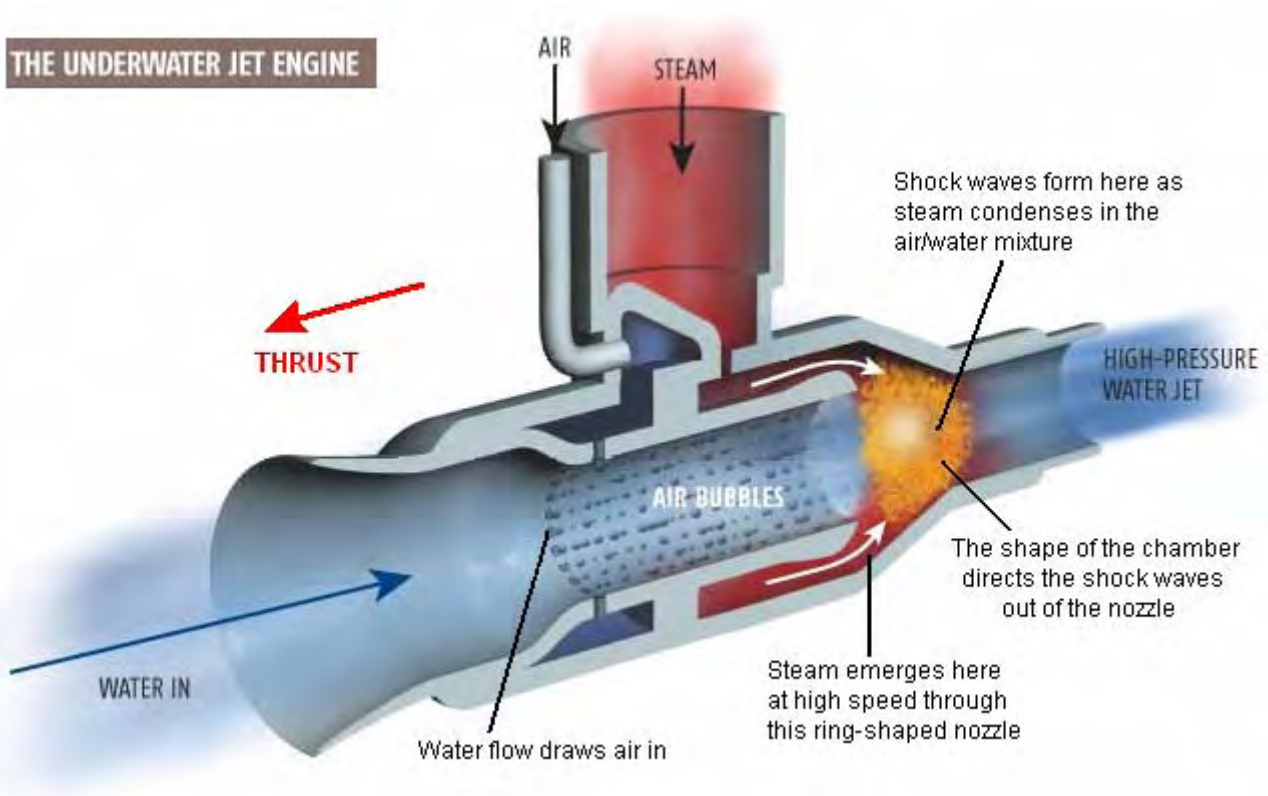
The circuit shown here allows a voltage anywhere from zero to 0.5 volts to be added to the oxygen sensor signal. This must **not** be done unless a booster is running. Using it without a booster is liable to lead to engine overheating and possible valve damage. This, of course, applies to the previous oxygen sensor signal adjusting circuit as well.

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 adaptation nor as providing any kind of guarantee that an adaptation 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.

Omissions from Chapter 11:

Condensation-Induced Water Hammer

There is another little-known effect which has a high potential for being a useful technique, and this is the water hammer effect produced by the sudden condensation of steam. Under suitable conditions, the effect can be harnessed to provide motive power.



One of the techniques which has been used is shown above. Here, steam under 55 psi pressure is forced into a tubular structure through a ring orifice. That steam then passes through a doughnut-shaped nozzle where it hits a

stream of heavily aerated water. The bubbles in the stream of water are drawn in by the venturi effect of the water flow past small apertures in the tube. The result is a rapid series of water hammer shock waves which, because of the shape of the shock wave chamber, boost the water as it exits from the tube. This produces a thrust in the opposite direction, effectively forming a jet engine which is particularly suited to water-borne vessels. In the diagram shown above, the device shown is designated as an Underwater Jet Engine. The diagram is from the web display at:

http://www.newscientist.com/data/images/ns/cms/dn3321/dn3321-1_843.jpg and is copyright of the New Scientist.

Further information on this form of energy can be found at:

<http://www.kirsner.org/pages/condInduceWatHamText.html> and

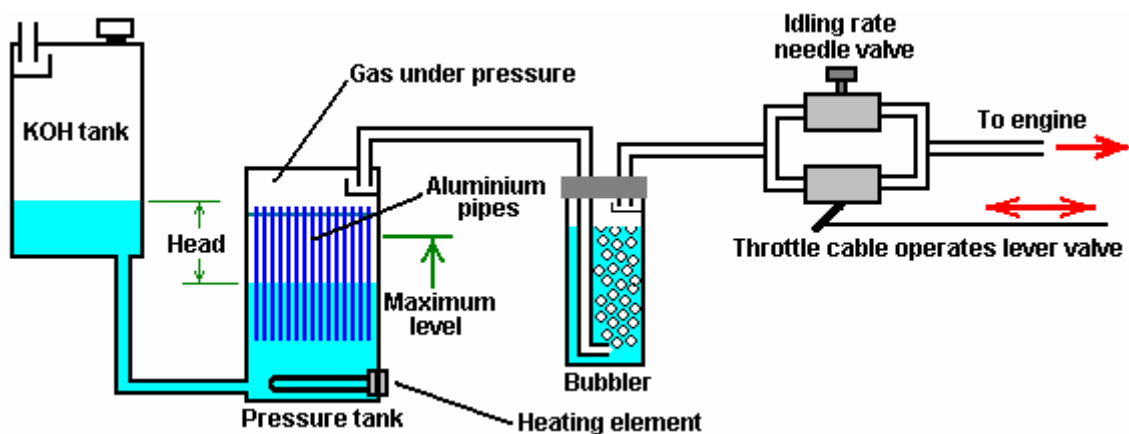
<http://www.energeticforum.com/renewable-energy/3093-condensation-induced-water-hammer>

Omissions from Chapter 13:

Hydrogen from Aluminium

Since 2003 Rothman Technologies of Canada have been running a 12 HP petrol motor on hydrogen produced by a chemical process. This is a cheap process in which metal is consumed and so, although of great interest, this is not a 'free-energy' engine. A recent patent application by William Brinkley proposes a system where aluminium pipes are consumed by a 25% solution of Potassium Hydroxide heated to 180 degrees Fahrenheit. William remarks on the non-polluting nature of the system, but this is not really so in that a very large amount of energy has to be put into producing the aluminium metal in the smelting and refining process, and the pollution is just moved from the end user to the industrial plant, and much more importantly, the aluminium oxide produced is **highly toxic** and causes a wide range of serious illnesses including Alzheimer's. Francis Cornish of the UK has a system where electrolysis of water is combined with a chemical process consuming aluminium wire. The system works well, but I have reservations about using consumables which tie you to industrial manufacturing, also concerns about the reliability of mechanical feed systems when they are being used by non-technical people (most car drivers). There is also the issue of removing and recycling the chemical residue generated by the process.

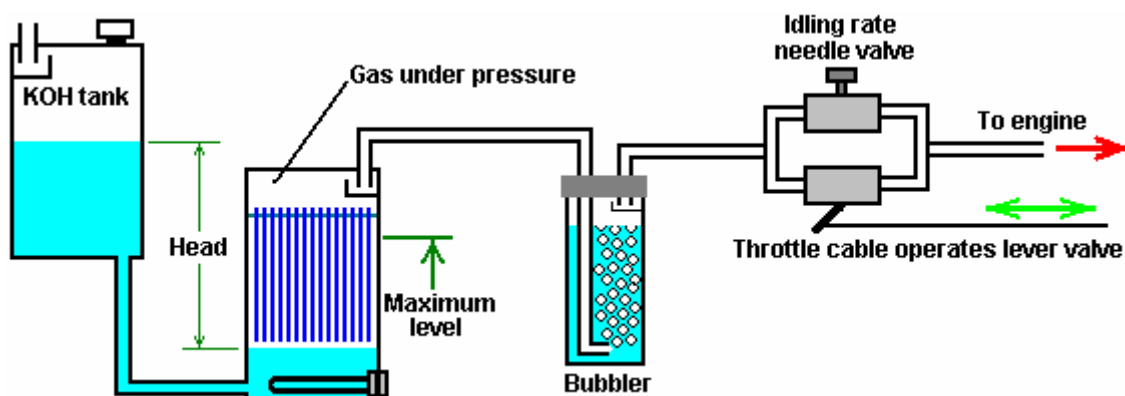
I personally am not keen on chemical processes and I do NOT recommend that you construct anything based on the following description. However, it might be possible to adapt the Brinkley system so that it operates with no moving parts:



Here, there is a header tank containing a 25% mixture of Potassium Hydroxide (KOH) in water. This tank is positioned higher than the pressure tank where the hydrogen gas is generated and the venting pipe is protected by a baffle. The venting pipe should provide an outlet to the air outside the vehicle or building which contains the system.

Initially, the KOH solution in the pressure tank is heated by the heating element, but when the process gets started, it generates heat to maintain the chemical reaction. The gas generation then builds up pressure in the strongly-built pressure tank. The raised pressure pushes some of the KOH solution back into the header tank, against gravity. This reduces the area of aluminium exposed to the KOH solution and reduces the rate of gas production. This effectively creates an automated gas production rate control which has no moving parts.

If the rate of gas taken by the engine increases, that lowers the pressure in the pressure tank, allowing more KOH solution to run into the pressure tank, increasing the rate of gas production. When the engine is stopped completely, then the KOH solution gets pushed into the header tank until all gas production stops, as shown here:



This looks as if the pressure tank is under considerable pressure, but that is not so, as the header tank is open to atmospheric pressure. I have concerns about controlling purely chemical processes rapidly enough for practical use. The above system would be more suited to a fixed engine, such as an electrical generator, where the gas requirement does not fluctuate greatly. The KOH tank shown above should be large enough to contain all of the KOH solution in case the gas production just does not stop when it should. The vent from the header tank should be capable of venting excess hydrogen with no possibility of it ponding on a ceiling and forming an explosive mixture with air. As far as I am aware, the above system has never been constructed and it is just shown here for discussion purposes.

Only 5 pounds per square inch of pressure is needed for electrolyser systems to feed a car engine satisfactorily, so a relatively low pressure is quite satisfactory, provided that the piping is of reasonable internal diameter. It should be remembered that the car engine will be applying a slight vacuum through the bubbler. As with all of these systems, it is vital that at least one bubbler is used between the gas production and the engine, to guard against flashback from the engine ignition if faulty ignition should occur. All bubblers should have a tightly fitting pop-off cap which can ease the effect of an explosion, and they should contain only a small amount of gas. The method of connection to the engine and the necessary timing adjustments are shown and explained in Chapter 10.

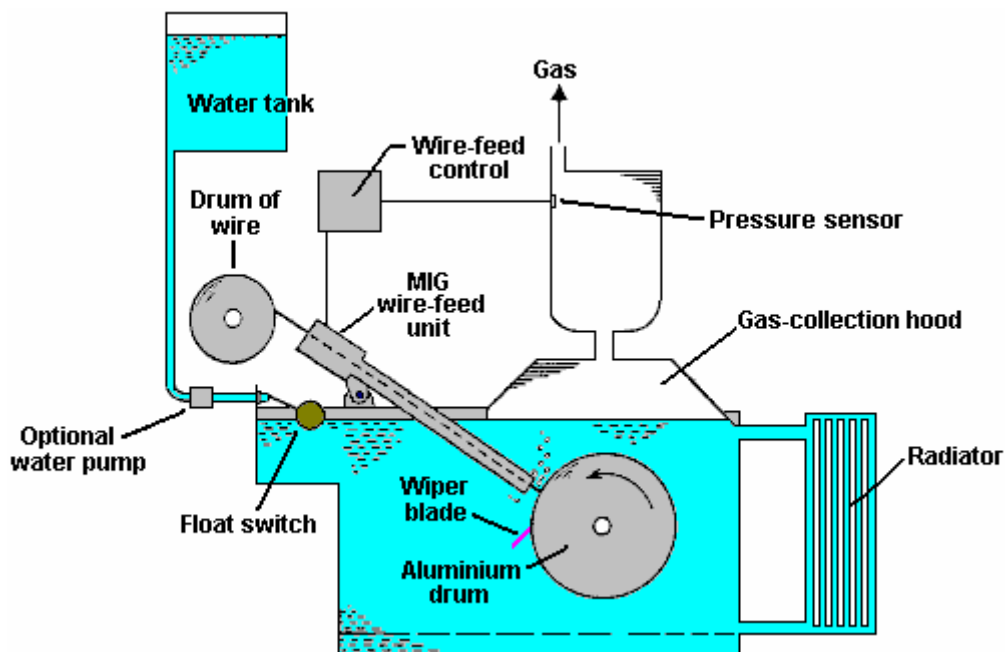
Francois Cornish

The method of using aluminium for a fuel in an on-demand hydrogen system for vehicle propulsion has been presented in detail by several people. One of the best known is the 1987 US Patent 4,702,894 by Francois Cornish, where he uses a feed mechanism for aluminium wire to maintain an underwater electrical arc which raises the water temperature high enough to make the aluminium react with the water. The rotating drum is made of aluminium but as it has a much larger thermal capacity than the aluminium wire being fed towards it, the drum temperature is much lower than that of the wire. As a result of this, the wire reaches the temperature required to make the aluminium react with the water. The chemical reaction releases hydrogen and converts the aluminium wire to aluminium oxide powder, which settles on the bottom of the tank, passing through a grid just above the bottom of the tank.

The bubbles of hydrogen gas released by the reaction tend to stick to the rotating aluminium drum, so a wiper blade is provided to sweep the bubbles off the drum. The bubbles then rise to the surface of the water and are directed into the gas collection chamber by a funnel located above the arc. If the engine demand drops and the pressure in the gas collection tank rises, a sensor located in the tank causes the wire-feed control electronics to stop the wire feed which cuts off the gas production.

At first glance, a system like this appears to have limited appeal. It uses aluminium wire which requires manufacturing by a process which uses substantial amounts of energy and while a vehicle using hydrogen produced by this method will generate very little pollution, the pollution occurs at the point of manufacture. Also, the device uses a mechanical wire feed and any device of that nature will need regular maintenance and may not be 100% reliable. In addition, the aluminium oxide powder will have to be cleaned out of the generating tank on a routine basis.

But, having said all that, the system has some very significant advantages. It does not use any fossil fuel (directly). It can be readily installed in a vehicle and the consumption of aluminium wire is surprisingly low. Figures quoted indicate that typical consumption is of the order of 20 litres of water, plus one kilogram of aluminium used to cover 600 kilometers distance (1 pound per 170 miles). This is probably a good deal cheaper than using fossil fuel to drive the vehicle. However, the aluminium oxide produced by this system is a serious pollutant as it is **highly toxic**, producing a wide range of serious illnesses, including Alzheimer's. The system is set up like this:

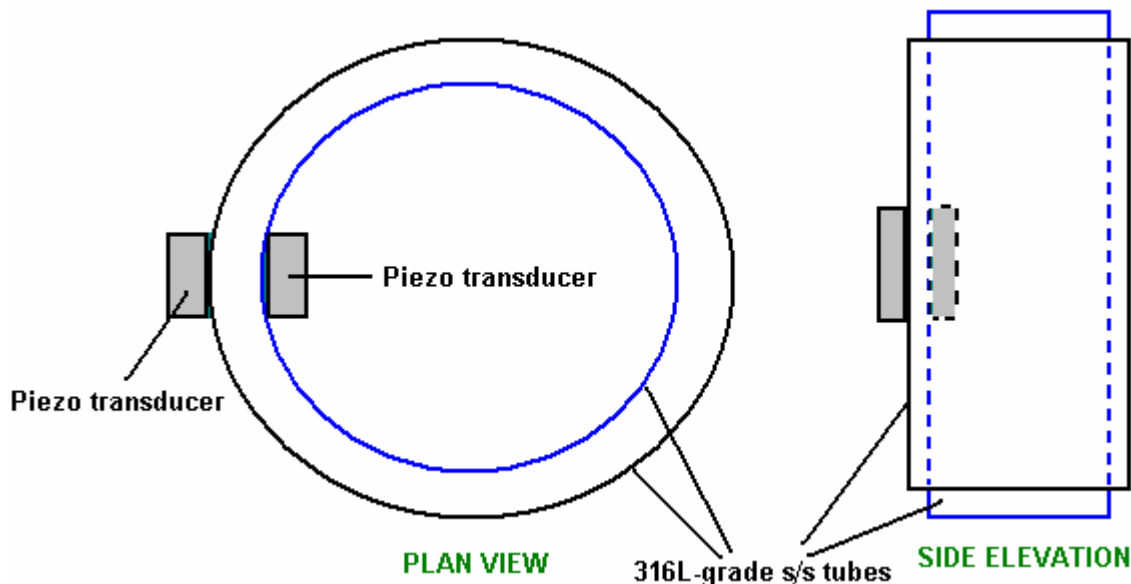


Another system of interest is the self-powered electrolysis system of the 1992 US Patent 5,089,107 granted to Francisco Pacheco where sacrificial anode plates of magnesium and aluminium are placed in seawater opposite a stainless steel cathode. Electrical power is generated and hydrogen produced on demand. There is also surplus electrical power available to run a standard electrolyser if so desired.

An Ultrasonic System

I have been told (by a completely unproven source) of a very high-performance water-splitting system which produces enough hydroxy gas to power a vehicle engine while only drawing 3 milliwatts at 3 volts which is a mere 9 milliwatts of power. I have never seen one of these units, and I have no evidence that the system works, other than word of mouth, so please treat the following entry as just a suggestion rather than a matter of hard fact.

The system is so interesting and simple that it is very attractive. Basically, you have two stainless steel pipes placed in a bath of tap water:



The objective is to get two stainless steel tubes resonating together at the same frequency. That is, they should both produce the same “musical” note when suspended on a thread and tapped. As the inner tube is smaller diameter, it will have a higher note than the larger diameter tube if they are the same length, so for them to match, it would be necessary for the inner tube to be longer, or the outer tube have a slot cut in it as Stan Meyer did and which is discussed in Chapter 10.

The piezo transducers are presumably glued to the cylinders, perhaps as shown above, and they are fed with a 2.24 MHz signal. The tubes need to resonate with the electronics signal, so they are ground down very slowly and carefully until they do resonate. This will presumably be at a much lower harmonic of the electronics signal, one in the standard ultrasonics range. Presumably, there will be three spacers top and bottom, maintaining the gap between the tubes. If the frequency were down in the mains region of about 50 Hz or 60Hz, then the device would just act as a water heater of the type designed by Peter Davey. At ultrasonic frequencies, the result is quite different as cavitation bubbles form in the water. A highly respected textbook on ultrasonics points out that these cavitation bubbles have a positive charge on one side and a negative charge on the other side and these charges cause electrolysis of the water surrounding the bubbles. Lots of bubbles - lots of hydroxy gas produced. So, background theory supports the possibility of this device working, however, I am not aware of anyone who has attempted to replicate it.

What we have not been told is:

1. The size, length and thickness of tubes which work well.
2. The gap between the tubes.
3. The specific transducers used in the prototype.
4. What type of spacers were used.
5. Where and how the transducers were fixed to the cylinders.

However, even without this information, this could be an interesting investigation project using absolutely minimal power at trivial voltage levels.

The High-power Motionless Generator of Clemente Figuera

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. He has avoided the performance-killing Lenz Law magnetic feedback by careful arrangement of the windings of a combined set of transformer windings. Avoiding the Lenz Law effect produces a spectacular performance where the current drawn from the secondary windings has no effect on the current flowing in the primary windings. There is also, no back-EMF in the primary coils as current flows continuously in just one direction when passing through both halves of the primary winding. The very clever method used by Clemente makes the strength of the current in the two halves of the primary to oscillate with one side repeatedly having first much more current and then far less current than the other half. This generates alternating current in the secondary windings, current which can be drawn off and used for useful work, powering lights, heaters, motors, etc. It should be remembered that in 1908 Figuera did not have access to the electronic components available to

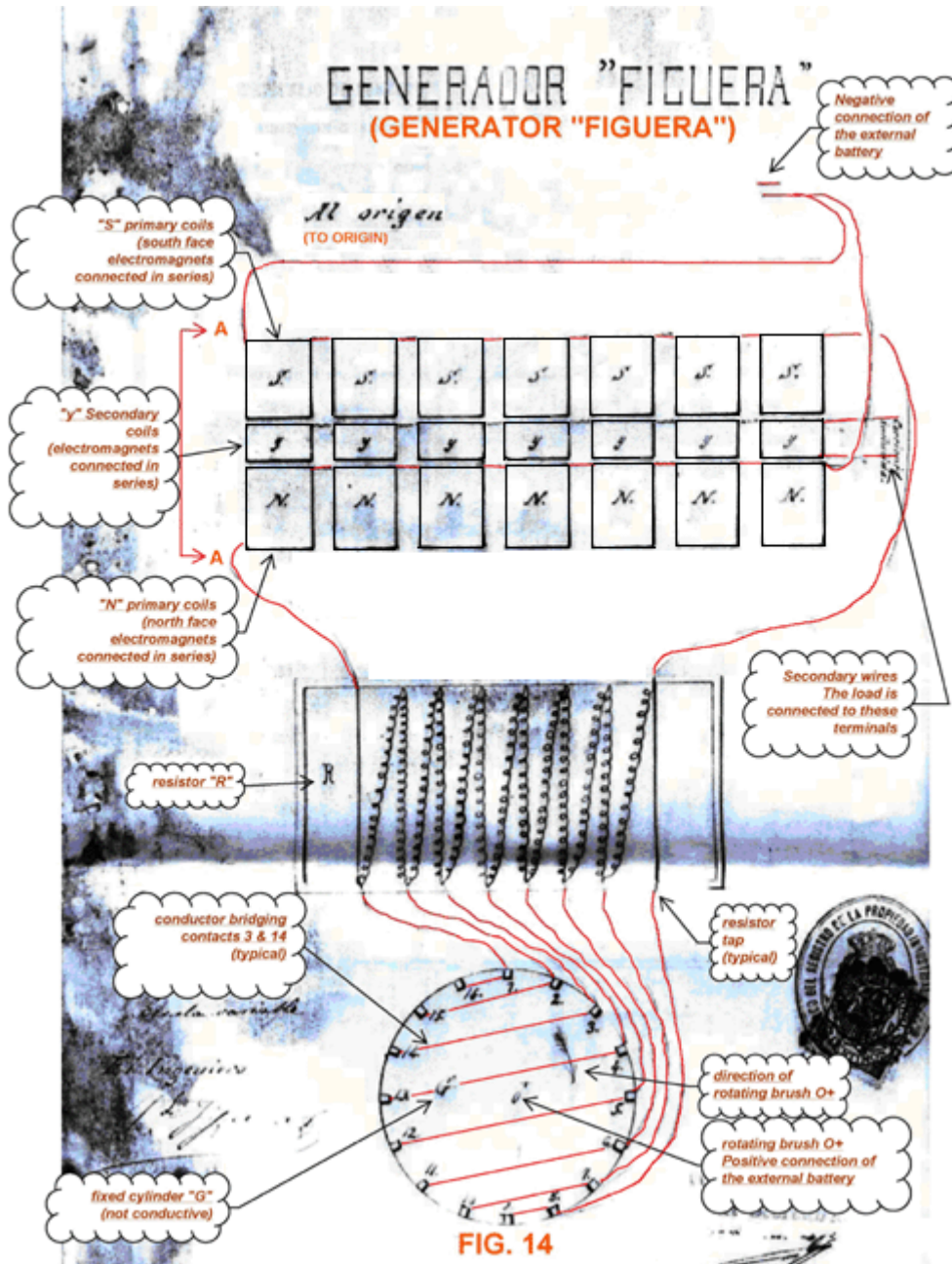
us today and that explains why he built his generator in the way which he patented. The following information comes from a man who wishes to remain anonymous. On 30th October 2012, he made the following comments about his repair to a Figuera patent which was missing some of the content. He says:

CLEMENTE FIGUERA AND HIS INFINITE ENERGY MACHINE

I heard of Clemente Figuera for the first time from one of the Tesla articles. In 1902 the Daily Mail announced that Mr. Figueras (with an "s"), 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. The newspaper article says that "He claims to have invented a generator which can collect the electric fluid, to be able to store it and apply it to infinite purposes, for instance, in connection with shops, railways and manufacturers. He will not give the key to his invention, but declares that the only extraordinary point about it is that it has taken so long to discover a simple scientific fact. Señor Figueras has constructed a rough apparatus by which, in spite of its small size and its defects, he obtains 550 volts, which he utilises in his own house for lighting purposes and for driving a 20 horse-power motor. Señor Figueras is shortly coming to London, not with models or sketches, but with a working apparatus. His inventions comprise a generator, a motor, and a sort of governor or regulator, and the whole apparatus is so simple that a child could work it." [Taken from "Perpetual Motion – A History of an Obsession"].

I was in one of the forums when someone mentioned Clemente Figuera and provided some links to documents referring to his work [1]. In one of the documents, I found what looks to be the only page showing sketches from one of his patents. After restoring the faint lines which show the wire connections, I was very surprised to see the similarities between the embodiment of Mr. Figuera's drawing and one of my own for over-unity transformers.

I was very eager to read any information about Mr Figuera's work and the operation of his 'Infinite Energy Machine'. It looks very suspicious that the pages describing the most important part of the machine have been 'lost'. I then decided to just figure this machine out for myself.



PJK Note: after extensive experimentation and testing, assisted by members of the forum which he set up, the following material is a 2015 upgrade on his original text, due solely to the core shape used when constructing the components of the Figuera transformer. It is recommended that in spite of eddy current losses, the electromagnet cores be solid rather than laminated which loses a good deal of the cross-sectional area of the core. Also, please note that it is strongly suspected that having seven sets of electromagnets side-by-side as shown is very important as having the coils side-by-side makes them interact and there are multiple phase-shift changes in having these twenty-one coils close together.

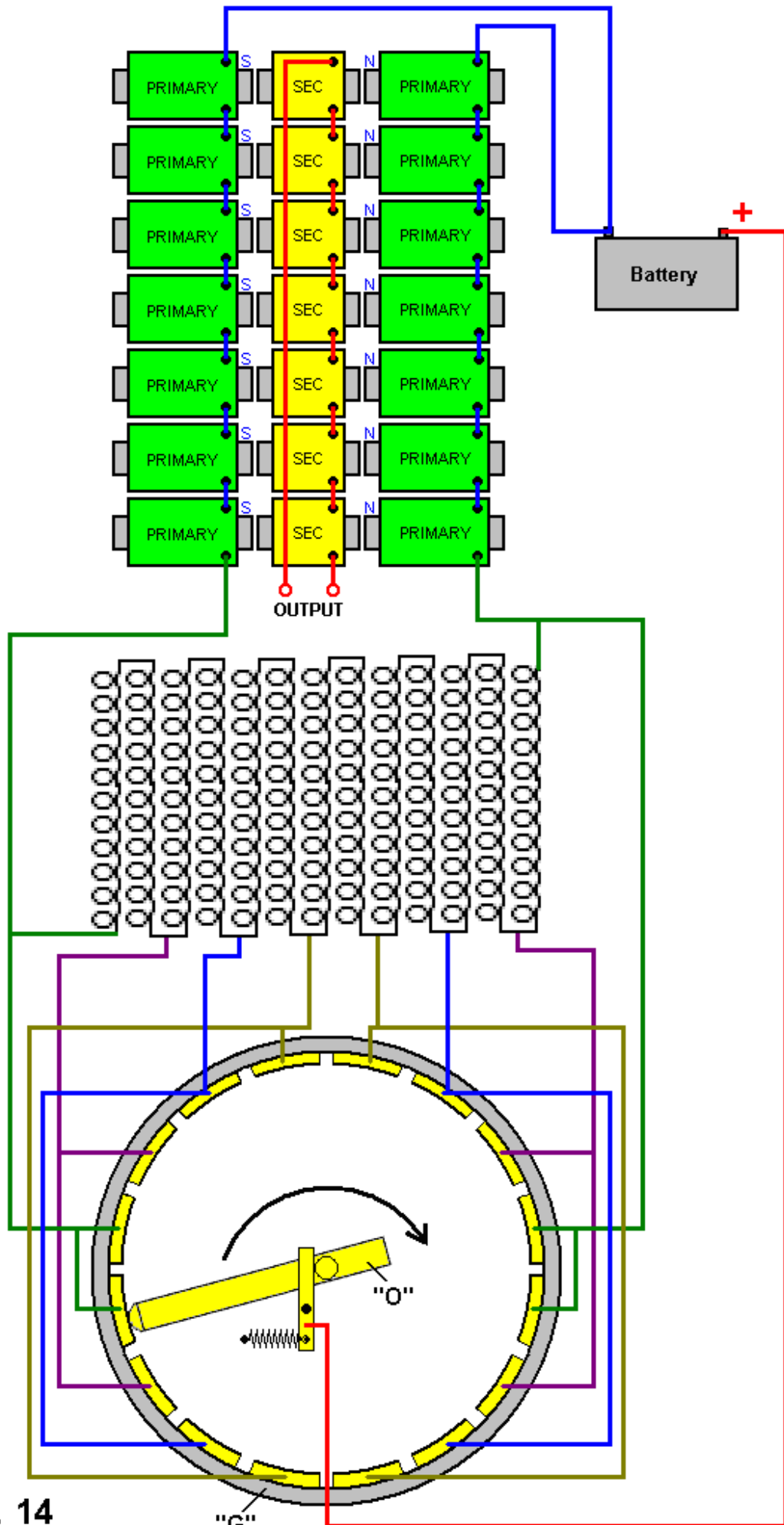


Fig. 14

"G"

Please note that the rotating contact brush needs to be a "Make Before Break" type. That is, it needs to bridge across the gap between adjacent stator contact strips so that there is no sparking due to the current flow being interrupted.

According to Mr. Figuera, an over-unity transformer can be built without using permanent magnets, and based on a very simple concept. Figuera's generator consists of three rows of electromagnets, where each row is connected in series. The rows of "S" and "N" electromagnets function as the primary of the transformer, while the remaining electromagnets, located in the centre, function as the transformer secondary. The "S" and "N" stand for South and North poles, respectively. The apparatus includes a resistor "R" having multiple taps connected to a type of distributor formed by a cylinder "G" and brush "O". The brush "O" rotates inside the cylinder "G" changing the connection to the resistor taps. When the brush "O" rotates around the eight taps, it generates two stepped half-cycle sine waves which are 90° out of phase with each other. I suggest that Fig.14 is the wiring diagram as originally disclosed by Mr. Figuera in his patents. The most significant component of the system is the arrangement of the electromagnets shown in figure 14.

References:

- [1] <http://orbo.es/>
http://www.bibliotecapleyades.net/tesla/esp_tesla_27.htm
http://www.alpoma.net/tecob/?page_id=8258

Our thanks are due to the anonymous contributor who produced the above information on the work of Clemente Figuera whom I had never heard of before. Recently, the forum member 'hanlon1492' of the overunity.com forum http://www.overunity.com/12794/re-inventing-the-wheel-part1-clemente_figuera-the-infinite-energy-machine/#.UXu9gzcQHqU has shared a translation of Figuera's complete 1908 patent, lodged just days before he died, and it is reproduced here with thanks to 'hanlon1492' for his work and for freely sharing the results:

PATENT by CLEMENTE FIGUERA (year 1908) No. 44267 (Spain)

Ministry of Development General Board of Agriculture, Industry and Commerce. Patents of Invention. Expired. Dossier number 44267. Instruction at the request of D. Clemente Figuera. Representative Mr. Buforn. Presented in the register of the Ministry in the 31st October 1908, at 11:55 received in the negotiated in the 2nd November 1908.

ELECTRICAL GENERATOR "FIGUERA"

BACKGROUND

If we rotate a closed circuit inside a spinning magnetic field, with the closed circuit positioned at right angles to the lines of magnetic force, a current will be induced in the closed circuit for as long as there is movement, and the sign of that induced current will depend on the direction in which the closed circuit moves.

This is the basis of all magnetic machines and electric dynamos from the original, invented by Pixii, in France and later modified and improved by Clarke to reach the design of the current dynamos of today.

The principle on which this theory is based, has the unavoidable need for the movement of either the induction circuit or the magnetic circuit, and so, these machines are considered to be a transformer of mechanical work into electricity.

PRINCIPLE OF THE INVENTION

Considering carefully what happens in a dynamo in motion, we see that the coil turns of the induction circuit approach and move away from the magnetic centres of the magnets or electromagnets, and those turns, while spinning, pass through sections of the magnetic field of different magnetic strengths, because, while the maximum magnetic strength is in the centre of the core of each electromagnet, this action weakens as the induction coil moves away from the centre of the electromagnet, only to increase again when it is approaching the centre of another electromagnet with opposite sign to the first one.

Because we all know that the effects seen when a closed circuit approaches and moves away from a magnetic centre are the same as when the circuit is motionless and the magnetic field increased and decreased in intensity, since any variation of the magnetic flow traversing a circuit produces an induced electrical current. Then, consideration was given to the possibility of building a machine which would work, based, not on the principle of movement as current dynamos do, but based on the principle of increasing and decreasing the strength of the magnetic field, or the strength of the electrical current which produces it.

The voltage from the total current of the current dynamos is the sum of all of the induced currents generated in every turn of the induction coils. Therefore it does not matter if these induced currents were generated by rotating the induction coils, or by varying the magnetic flux which passes through them. In the first case, a greater amount of mechanical work is required than the amount of electricity generated, while in the second case, the force needed to produce the variation of magnetic flux is so insignificant that it can easily be taken from the output generated by the machine.

Up to the present day, no machine based on this principle has been constructed for the production of large electrical currents, and which among other advantages, has overcome the necessity for motion and so, the energy needed to produce it.

In order to attain the production of large industrial electrical currents, using the principle that electrical current can be provided by just changing the flow of magnetic flux through an induction circuit, the above disclosure should be sufficient, however, as this operating principle needs to be embodied in a practical machine, there is a need to describe it in order to fully disclose how to carry out a practical application of this principle.

This principle is not new since it is just a consequence of the laws of induction stated by Faraday in the year 1831: what it is new and claimed in this patent, is the application of this principle to a machine which produces large industrial electrical currents and which, up to now, has only been obtained by transforming mechanical work into electricity.

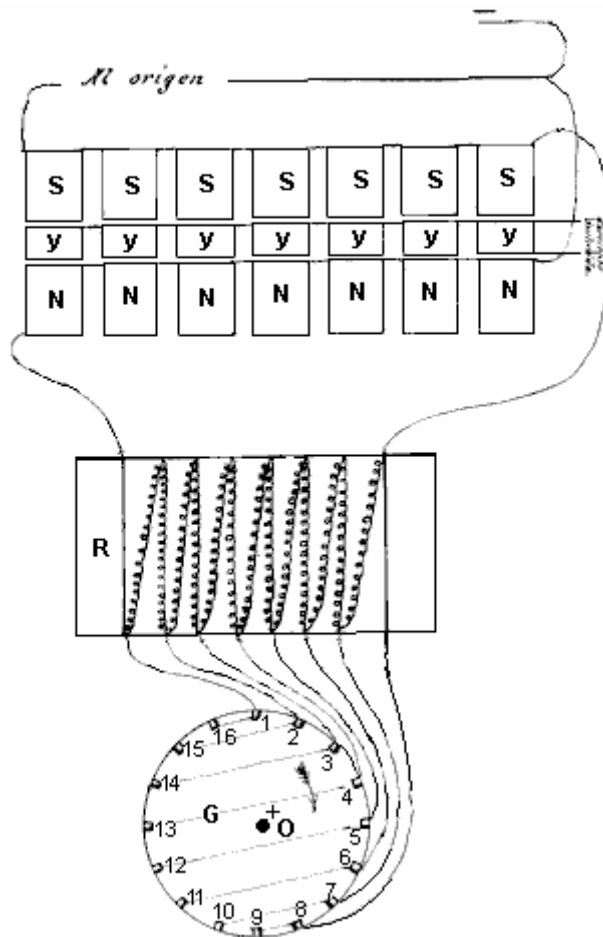
We will therefore, provide a description of a machine based on the above principle disclosed in this patent; but it must be understood, and what is sought is the patent for the application of this principle, that all machines built based on this principle, will be included in the scope of this patent, whatever the form and way that has been used to make the application.

DESCRIPTION OF GENERATOR OF VARIABLE EXCITATION “FIGUERA”

The machine is comprised of a fixed inductor circuit, consisting of several electromagnets with soft iron cores enhancing induction in the induction circuit, which is also fixed in position and motionless, and which is composed of several coils, accurately positioned. As neither of the two circuits spin, there is no need to make them round, nor leave any space between one and the other.

Here what it is constantly changing is the intensity of the excitatory current which drives the electromagnets and this is accomplished using a resistance, through which circulates a operating current, which is taken from one power source and passed through one or more electromagnets, thus magnetising one or more electromagnets. When the current is higher, the magnetisation of the electromagnets is increased, and when it is lower, the magnetisation is decreased. Thus, varying the intensity of the current, varies the magnetic field which crosses through the induction circuit.

To assist in understanding this idea, it is convenient to refer to the attached drawing which is no more than a sketch intended to assist in understanding the operation of the machine built to implement the principle outlined above.



Suppose that electromagnets are represented by rectangles marked '**N**' and '**S**'. Located between their poles is an induction circuit represented by the line of small rectangles marked '**y**'. A resistor '**R**', drawn here in a simple form to help understanding of the entire system. Shown as '+' and '-', is the excitation power, drawn from an external source. As can be seen in the drawing, the different sections of this resistor connect with the commutator bars embedded in a stationary cylinder of insulating material. A sliding-contact brush '**O**', which always connects with more than one contact, rotates, carrying the excitation current. One of the ends of the resistor is connected to the electromagnets **N**, and the other end of the resistor is connected to the electromagnets **S**. Half of the terminals of the resistor go to half of the commutator bars of the cylinder. The other half of these commutator bars are connected directly to the first set of commutator bars.

The operation of the machine is as follows: the brush **O** rotates inside cylinder **G** and is always in contact with two of the commutator bars. When the brush is touching contact **1** the current, flowing from the external source passes through the brush and powers electromagnets **N** to their maximum level of magnetisation, but the current passing through electromagnets **S** is insufficient to magnetise them because the whole of resistance **R** is too great to allow sufficient current to magnetise them. Therefore, the **N** electromagnets are fully powered while the **S** electromagnets are not sufficiently powered to be magnetised.

When the brush connects with contact **2**, the whole of the current will not flow through electromagnets **N** because it has to pass through part of the resistor. Consequently, some current will pass through the electromagnets **S** because it has to overcome less resistance than in the previous case. This same reasoning applies to the case when brush **O** connects with each of the different contacts around the first semicircle. Then the brush **O** starts to connect with the commutator contacts in the other half, each of which are directly connected to their corresponding commutator contacts in the first half. In short, the resistor has the function of a current-splitter, powering either one set of electromagnets or the other set of electromagnets repeatedly. It can be seen that electromagnet sets **N** and **S** operate in a complementary manner, because while the first set is being progressively powered up, the other set is being progressively powered down. This sequence is repeated continuously causing an orderly a constant variation of the magnetic fields passing through the induction circuit.

This action can be maintained by just the simple rotation of a brush or group of brushes which rotate in a circle inside cylinder **G** driven by a small electric motor.

As indicated by the drawing the current, once it has flowed through the electromagnets, returns to the power source where it originated. A small part of the output current from this device can be used to provide the 'external' excitation power mentioned above, thus making the machine self-exciting and to provide the current to operate the small motor which moves the brush causing the switching. Once started with an external power source, that external power source can be removed and the machine will continue to work indefinitely without any external power source.

This invention is really new, very daring, and above all, has huge technical and industrial consequences in all areas. This patent was not applied for until a working machine based on these principles had been built, thus proving the concept to be sound and practical.

ADVANTAGES OF THE ELECTRICAL GENERATOR "FIGUERA"

1. The completely free production of DC or AC electric current of any voltage which can be used for:
 - a. Providing a driving force.
 - b. Production of light.
 - c. Production of heat.
 - d. All other existing uses of electricity.
2. There is no need whatsoever for a driving force of any kind or chemical reactions or fuel consumption.
3. Needs little or no lubrication.
4. Is so simple that it can be easily operated by anyone.
5. Does not produce smoke, noise, or vibration when operating.
6. Indefinite operational life.
7. Has a wide range of uses: home management and industrial.
8. Easy construction.
9. Cheap to produce and market

NOTE

A 20-year patent is requested for a "NEW GENERATOR OF ELECTRICITY, so-called "FIGUERA" of variable excitation, designed to produce electrical currents for industrial applications without using either driving force, nor chemical reactions. The machine is essentially characterised by two series of electromagnets which form the inductor circuit, between whose poles induction coils are placed. Both the induction and inductor circuits remain motionless and yet are able to produce a current induced by the constant variation of the intensity of the magnetic field forcing the excitatory current (coming at first from any external source) to pass through a rotating brush which, in its rotation movement, connects with the commutator bars or contacts of a ring distributor or cylinder whose contacts are connected to a resistor whose value varies from a maximum to a minimum and vice versa, according with the commutator bars of the cylinder which operates, and for that reason the resistance is connected to the electromagnets N by one of its side, and the electromagnets S at the other side, in such a way that the excitatory current will be magnetising successively with more or less strength, the first electromagnets, while, simultaneously decreasing or increasing the magnetisation in the second set, determining these variations in intensity of the magnetic field, the production of the current in the induced, current that we can use for any work for the most part, and of which only one small fraction is derived for the actuation of a small electrical motor which rotates the brush, and another fraction goes to the continuous excitation of the electromagnets, and, therefore, converting the machine to become self-exciting, being able to remove the external power which was used initially to excite the electromagnets. Once the machinery is in motion, no new force is required and the machine will

continue in operation indefinitely.

All in accordance with the described and detailed in this report and as represented in the drawings which are attached.

Barcelona, the 30th of October, 1908. Signed: Constantino de Buforn.

The Figuera design was implemented more than a hundred years ago, and so Clemente did not have any semiconductors available to him, and so he used a motor-driven commutator arrangement to produce the electrical switching which he needed.

While I am in no way opposed to mechanical switching, especially where prototypes are concerned, there has to be an advantage in using solid-state switching, and while I am by no means an expert in that field, the following suggestions might be useful for experienced circuit builders.

In spite of the wire-wound resistor bank having only eight connection points, the switching has to have sixteen outputs due to the backwards and forwards switching sequence which is used. A solid-state 16-way switching module can be constructed from two CD4017 Divide-by-Ten integrated circuits like this:

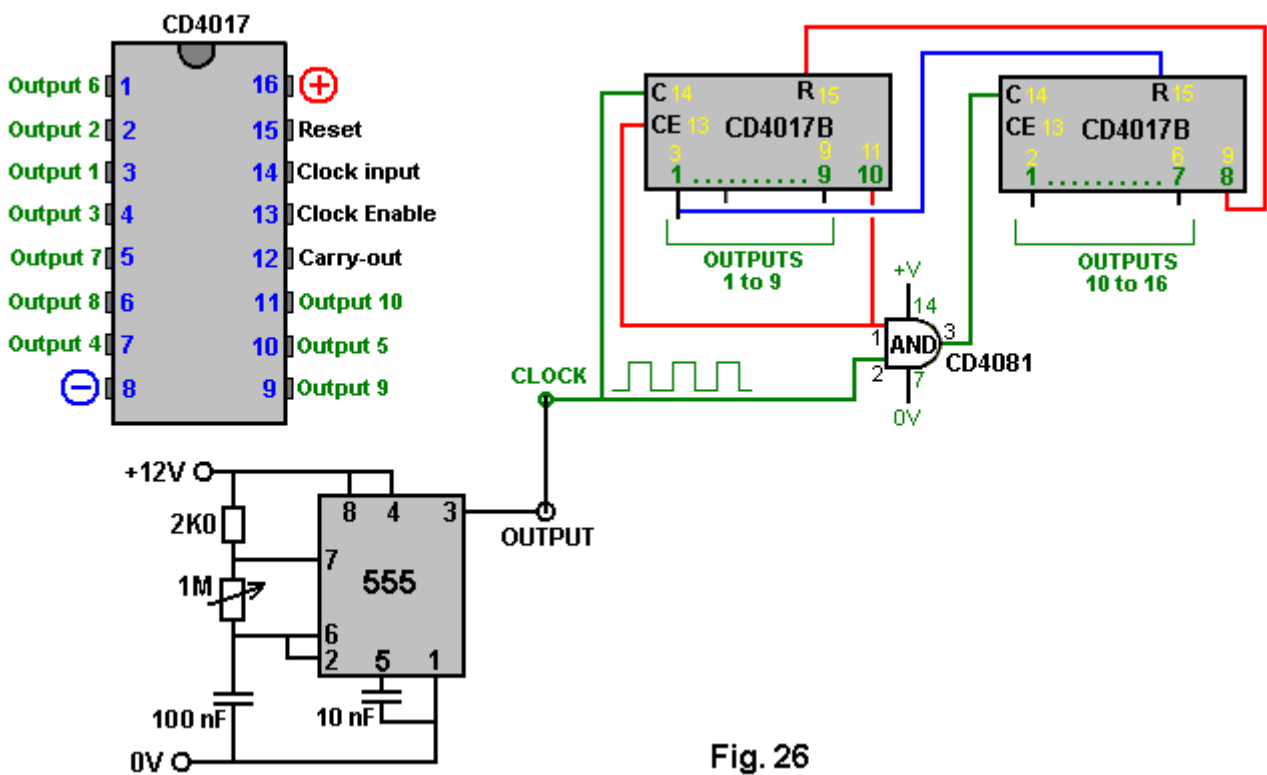


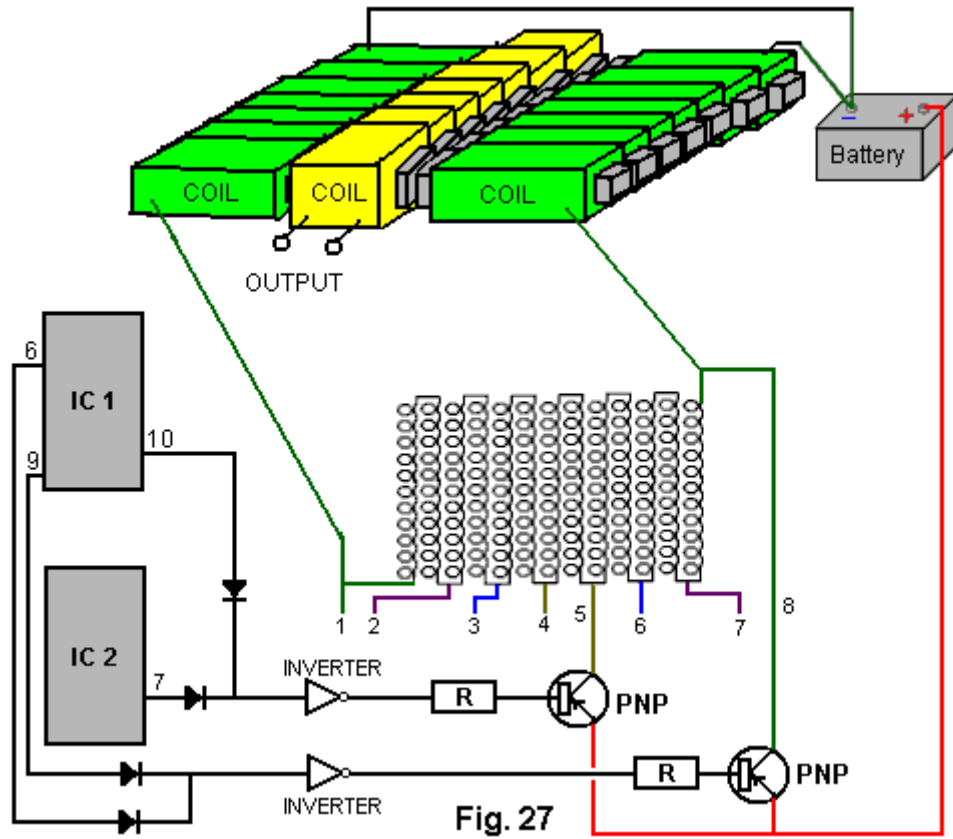
Fig. 26

This arrangement gives sixteen outputs in sequence, so two outputs need to be connected together in order to match the mechanical switching which Clemente used. Presumably, it would not be advisable to connect two outputs directly together, and so an isolation diode (say, a 1N4148 type) would be required on each output. Please note that the pin connections shown here have been revised as it appears that in this circuit, the output pin 3 of the second 4017 chip does not function as expected:

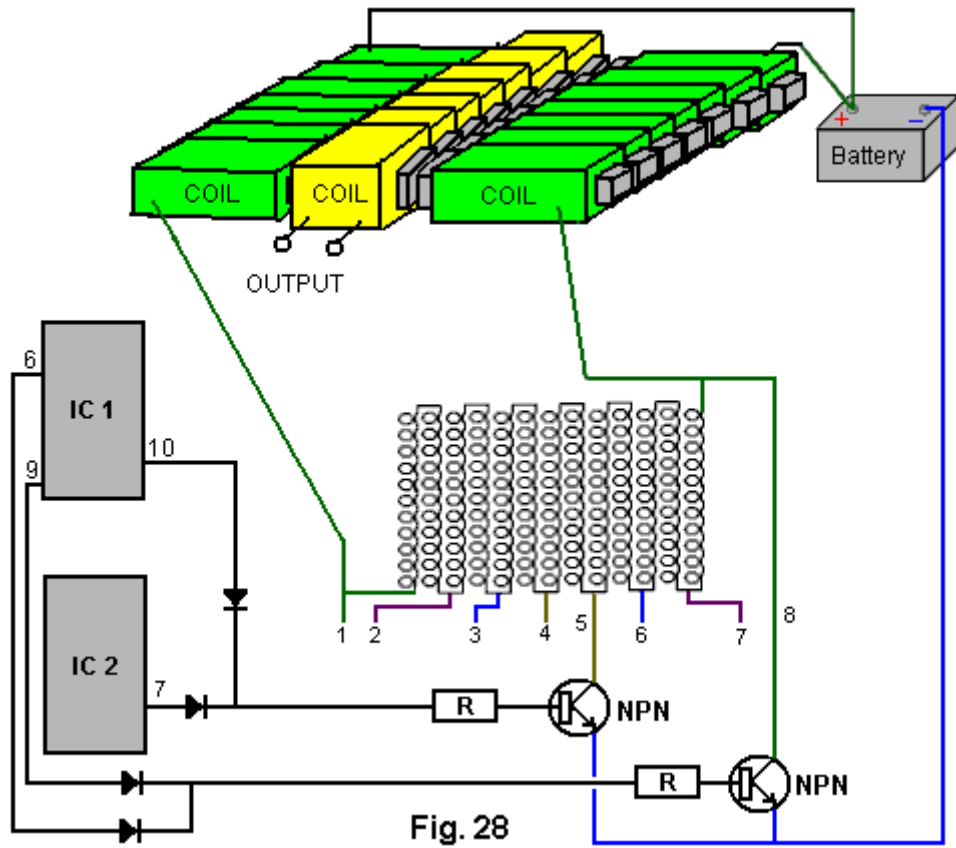
Output Number	Chip and Pin Nos	Paired with Output	Resistor Connection Point
1	Chip 1 Pin 3	16 (Chip 2 pin 6)	1
2	Chip 1 Pin 2	15 (Chip 2 pin5)	2
3	Chip 1 Pin 4	14 (Chip 2 pin1)	3
4	Chip 1 Pin 7	13 (Chip 2 pin 10)	4
5	Chip 1 Pin 10	12 (Chip 2 pin7)	5
6	Chip 1 Pin 1	11 (Chip 2 pin 4)	6
7	Chip 1 Pin 5	10 (Chip 2 pin 2)	7
8	Chip 1 Pin 6	9 (Chip 1 pin 9)	8
9	Chip 1 Pin 9		

10	Chip 2 Pin 2		
11	Chip 2 Pin 4		
12	Chip 2 Pin 7		
13	Chip 2 Pin 10		
14	Chip 2 Pin 1		
15	Chip 2 Pin 5		
16	Chip 2 Pin 6		

Eight power transistors can be used to energise each resistor connection point in the sequence required. As mechanical switching was used by Clemente, it really did not matter which way round the battery connections were made. We can match his switching exactly by using PNP power transistors (or possibly, P-channel FETs) which would make the arrangement like this (with just two of the eight connections being shown):



Or you can reverse the battery for the easier NPN option:

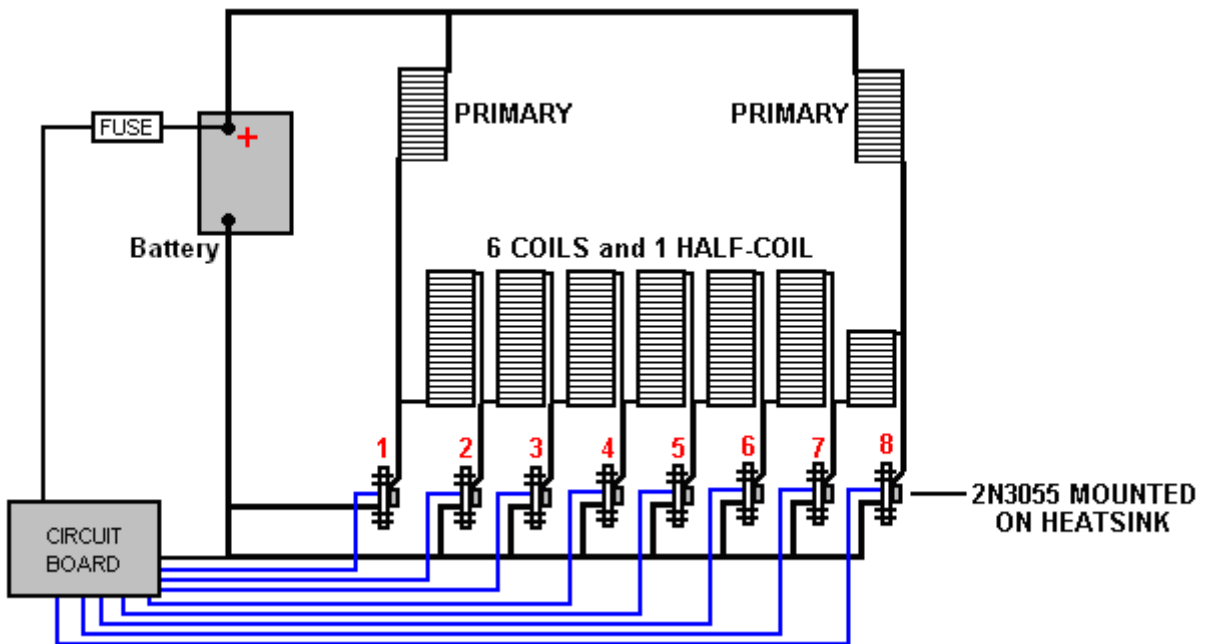
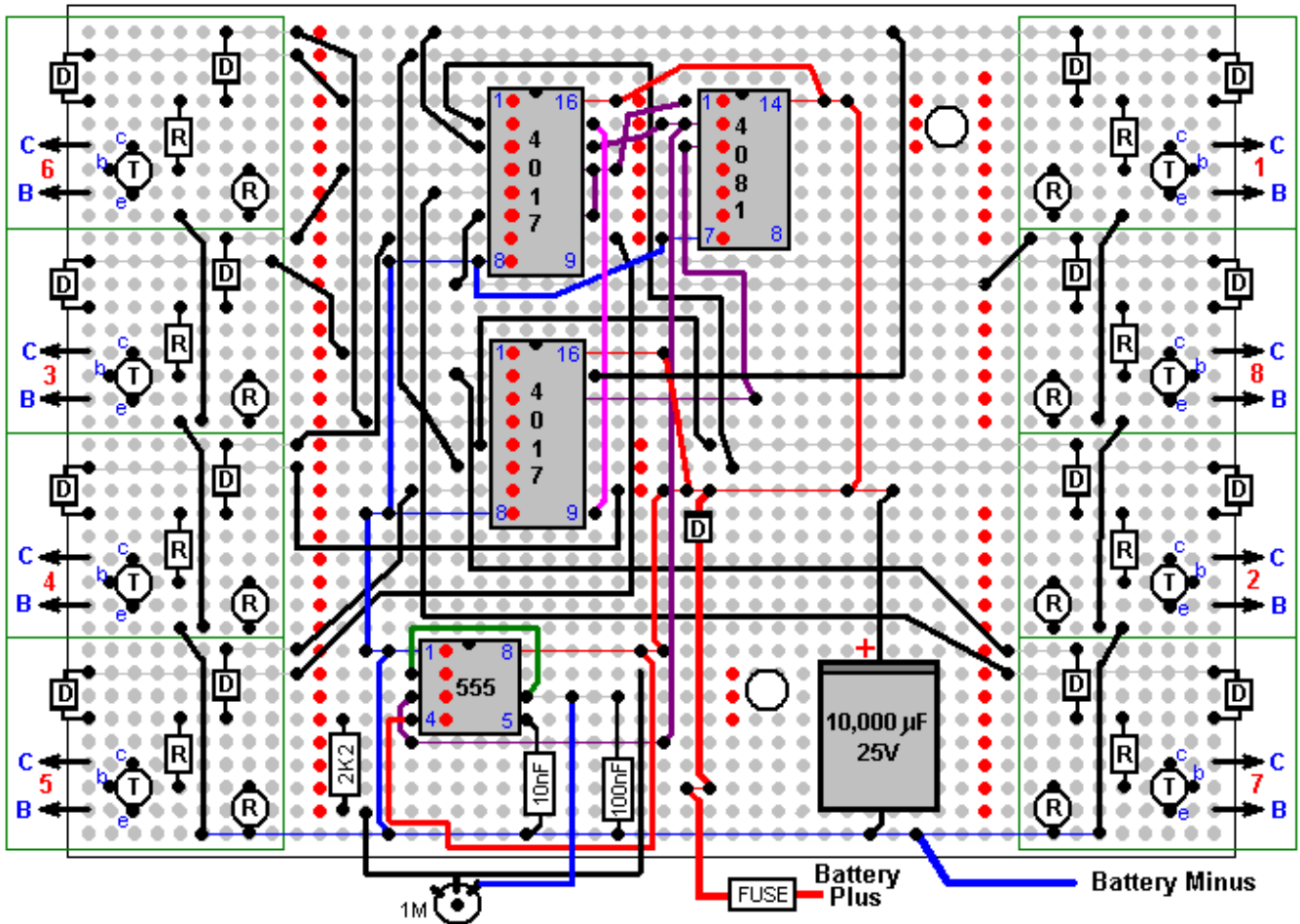


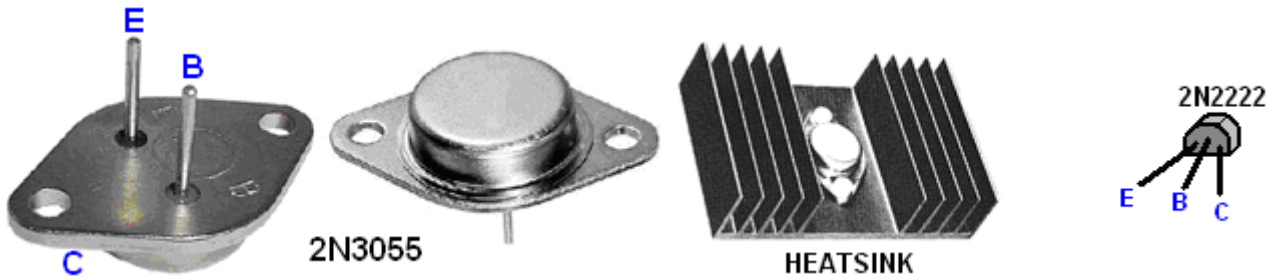
I have been asked by an electronics novice to show a possible construction form for this sort of circuit. I am not particularly good at that sort of thing, but here are a couple of diagrams of a non-optimised layout for a standard size of common stripboard:

T = 2N2222 Transistor D = 1N4001 Diode R = 4.7K Resistor

→ C = Connection to 2N3055 Collector → B = Connection to 2N3055 Base

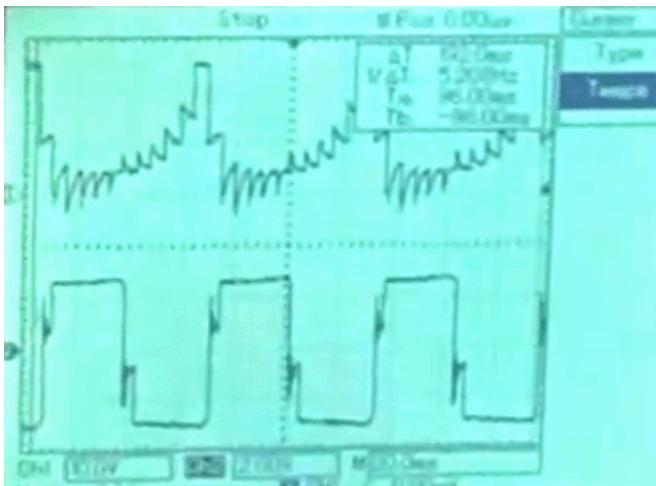
• = Break in the copper strip on the underside of the board



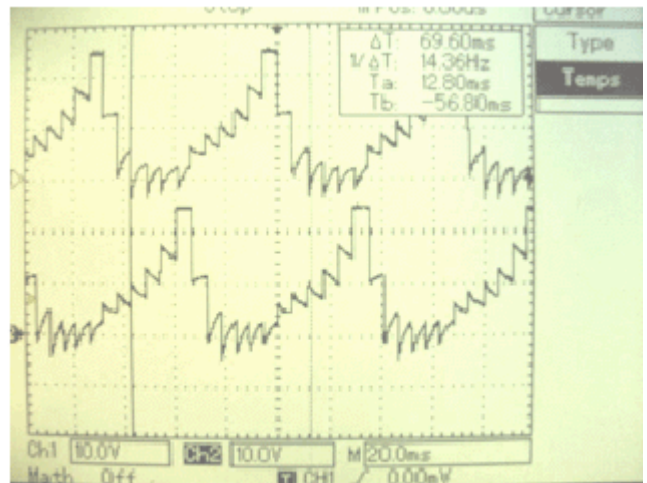


Experienced experimenter 'Woopy' has posted a video of a quick experiment to test the working principle of this Figuera design. It is at <http://www.youtube.com/watch?v=HIOGEnKpO-w&feature=g-u-u> and in it, he short-circuits the secondary winding, showing that the input power is totally unaffected by the current draw from the secondary.

He shows some very interesting oscilloscope shots:



One primary and the secondary output



Both primaries, showing their phases

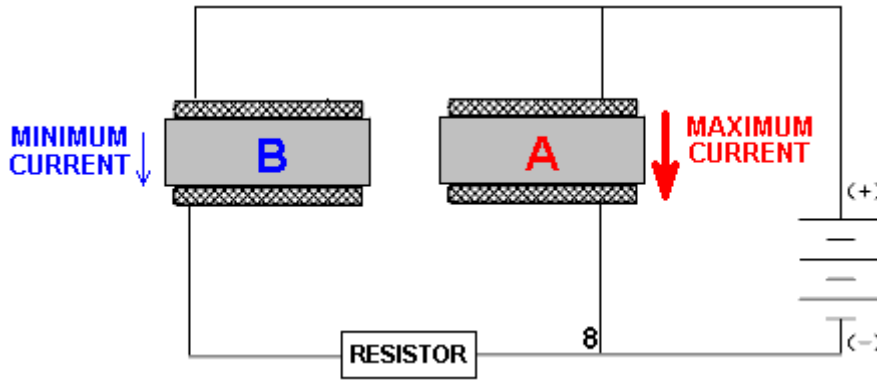
The first screen shot surprises me as it shows clearly that the output is actually an excellent square wave while I would have expected it to be a sine wave as it is coming from a coil which has inductance. The second shot shows very clearly, how the two banks of primary electromagnets operate out of phase with each other thanks to Woopy's mechanical 6-way switching arrangement. It is reported that Mr Figuera ran a 20-horsepower motor with his prototype and if that motor were fully loaded, then that is 15 kilowatts of power, easily enough to power a household.

Please bear in mind that if the electromagnets are made from iron, whether laminated or not, that iron restricts the frequency, probably to 500 Hz or less, and so it is necessary to keep the frequency that low if using a solid-state circuit to drive the transformer. For 60 Hz output with mechanical switching, requires the motor to run at 3,600 rpm which is fairly fast although definitely achievable. Also, the output power will be limited by the current handling capacity of the wire in the secondary winding. The first page of the Appendix shows the current capacities for the standard AWG and swg wire sizes.

Because this Figuera design is so important, being low-voltage, high power and not needing tuning I have recently been asked to explain it in greater detail and suggest some component values for people starting to experiment with it. I am not an electronics expert, and so my suggestions need to be taken as just that, namely, suggestions for a possible starting point for experimentation.

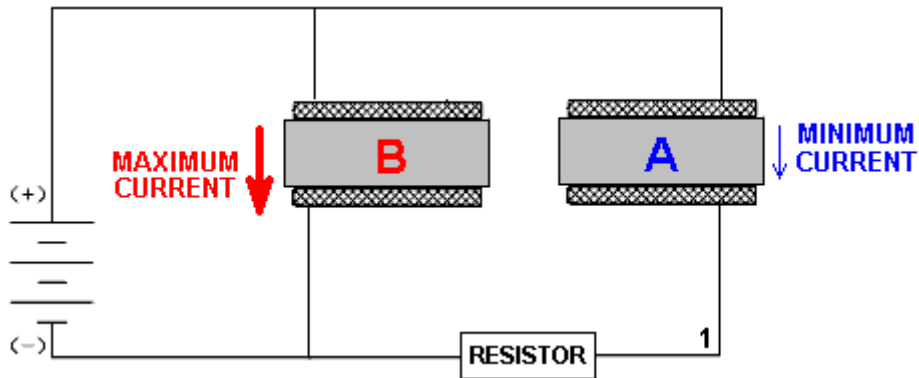
The first point is that the two halves of the primary winding of the transformer become electromagnets when current flows through their windings. The strength of an electromagnet increases as the current flow increases. Large current: strong magnet. Small current: weak magnet.

Clemente Figuera's circuit is arranged so that the current through the windings is made to vary so that when one magnet is strong, the other one is weak. It works like this:



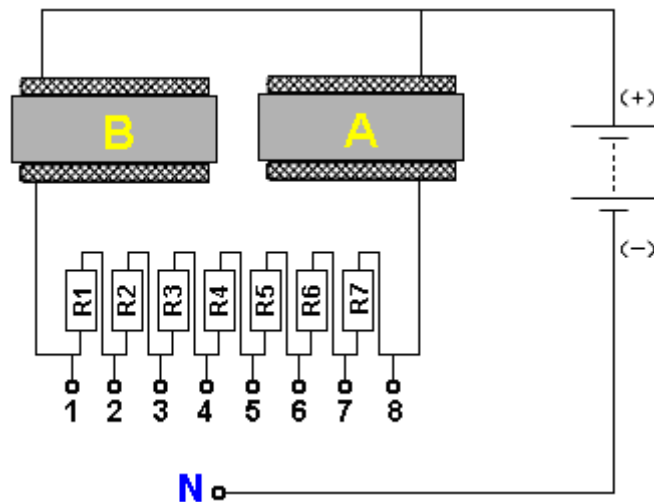
When the mechanical (or transistor) switching connects the battery to point '8' in the previous diagrams, we get the situation shown above. Current from the battery flows directly through the right-hand electromagnet "A", making it the strongest magnet that it can be at that battery voltage. The electromagnet "B" on the left gets current flow from the battery all right, but that current is reduced because it has to flow through the resistor.

When the switching changes and the battery is connected to point "1" in the previous diagrams, we get this arrangement:



Here, electromagnet "B" is free of the resistor and gets its maximum possible current, making it the strongest magnet which it can be at that battery voltage, while electromagnet "A" has its current reduced by the resistor getting in the way, making it the weakest magnet it can be when the system is running.

If we switched between these two positions, we would get a square wave style of operation, but Clemente did not do that. Instead, he split the resistor into seven parts (if Fig.14 is drawn correctly, one part having only half the resistance of the other parts). This makes the arrangement like this:



When the battery negative "N" is connected to point "2", then the current flow through electromagnet "B" is hindered by resistor R1, but the current flow through electromagnet "A" is hindered by resistors R2 and R3 and R4

and R5 and R6 and R7, which together, have a far higher resistance than R1 on its own. This makes the current flow through electromagnet "B" far greater than the current flow through electromagnet "A".

When the battery negative "N" is connected to point "3", then the current flow through electromagnet "B" is hindered by resistor R1 and resistor R2, but the current flow through electromagnet "A" is hindered by resistors R3 and R4 and R5 and R6 and R7, which together, have a far higher resistance than resistors R1 and R2. This makes the current flow through electromagnet "B" still greater than the current flow through electromagnet "A".

When the battery negative "N" is connected to point "4", then the current flow through electromagnet "B" is hindered by resistors R1, R2 and R3, and the current flow through electromagnet "A" is hindered by resistors R4, R5, R6 and R7, which together, have a higher resistance than resistors R1, R2 and R3. This makes the current flow through electromagnet "B" somewhat greater than the current flow through electromagnet "A" (nearly a balanced flow as resistor R7 is only half the value of each of the other resistors).

When the battery negative "N" is connected to point "5", then the current flow through electromagnet "B" is hindered by resistors R1, R2, R3 and R4, while the current flow through electromagnet "A" is hindered by resistors R5, R6 and R7, which together, now have a lower resistance than resistors R1, R2, R3 and R4. This makes the current flow through electromagnet "B" somewhat less than the current flow through electromagnet "A".

When the battery negative "N" is connected to point "6", then the current flow through electromagnet "B" is hindered by resistors R1, R2, R3, R4 and R5, while the current flow through electromagnet "A" is hindered by resistors R6 and R7, which together, now have a much lower resistance than resistors R1, R2, R3, R4 and R5. This makes the current flow through electromagnet "B" much less than the current flow through electromagnet "A".

When the battery negative "N" is connected to point "7", then the current flow through electromagnet "B" is hindered by resistors R1, R2, R3, R4, R5 and R6, while the current flow through electromagnet "A" is hindered by resistor R7, which has a very much lower resistance than resistors R1, R2, R3, R4, R5 and R6 together. This makes the current flow through electromagnet "B" very much less than the current flow through electromagnet "A".

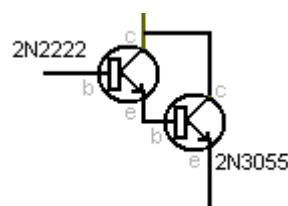
Clemente has arranged the battery switching sequence to be to points 1, 2, 3, 4, 5, 6, 7, 8, 8, 7, 6, 5, 4, 3, 2, 1, repeating over and over again. This makes the connections to points 1 and 8 to be twice as long compared to the connection times for the intermediate points, giving a sine-wave shape rather than a sawtooth shape.

There is current flow through both electromagnets at all times. The current flow is never broken although, as you can see, the intensity of the current flow varies all the time with each electromagnet getting stronger than the other one repeatedly.

The mechanical switching used by Clemente will work perfectly well, although there will be motor noise and wear on the switch contacts. A solid state version will be silent, more reliable and much longer lasting. There are many different way to build most electronic circuits and each builder will have his own favourite way of constructing the circuit. This Figuera circuit does not specify the battery voltage and so some people will want to use a twelve volt battery. As many FET transistors need as much as ten volts in order to switch on properly, a twelve volt supply is probably a little low for them, and so I suggest using the older bipolar transistors.

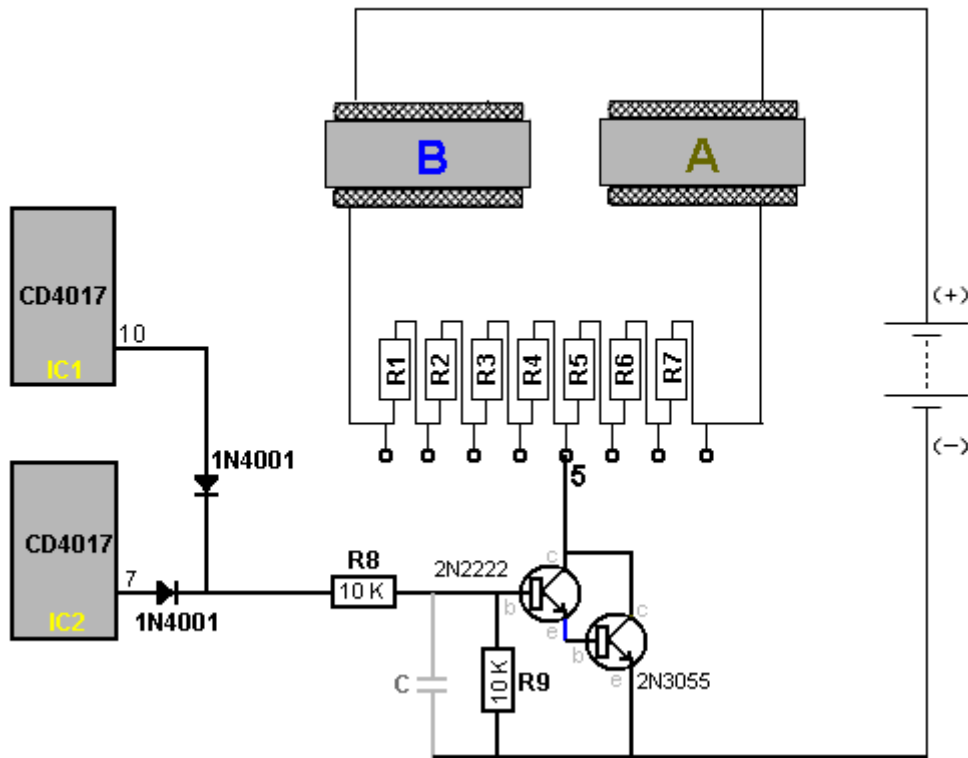
As the transistor has to carry the current which passes through the electromagnets, it needs to be able to handle considerable current flow. The very common 2N3055 transistor can do that (as can many other suitable transistors). The switching rate is very, very slow for a transistor and so speed is not an issue. The voltage is very low, and so that is not an issue either and so the 2N3055 transistor is definitely a possible choice.

In common with most high-power transistors, the current gain is low being between 20 and 30 typically. That means that to switch it on properly, a current of one twentieth of the switched current has to be fed into the base of the transistor. That base current is too high to be convenient, so we can raise the transistor gain to around 6000 by adding in a low-power transistor such as the 2N2222 transistor. The two transistors are connected together in a configuration called a 'Darlington Pair' which looks like this:



In this arrangement, the two Collectors are connected together, while the Emitter of the 2N2222 transistor feeds into the Base of the 2N3055 power transistor. With a high gain of six thousand or so for our transistor pair, we

need to limit the current flowing through their combined Base-to-Emitter junction, and so we introduce a current limiting resistor R8 in the following circuit suggestion:



The 10K resistor value shown would limit the transistor current to about nine amps, while a 4.7K resistor would allow around eighteen amps. Each transistor pair is only on for one eighth of the time, but the 2N3055 transistors need to be mounted on a heat-sink. If a single metal plate is used as a heat-sink for all eight 2N3055 transistors, then mica washers (available from the supplier of the transistors) must be used between each transistor and the plate because the Collector of each 2N3055 transistor is its metal case and in this circuit, the Collectors do not connect to a common point. The mica washers pass heat but not electricity. Separate heat-sinks can, of course, be used.

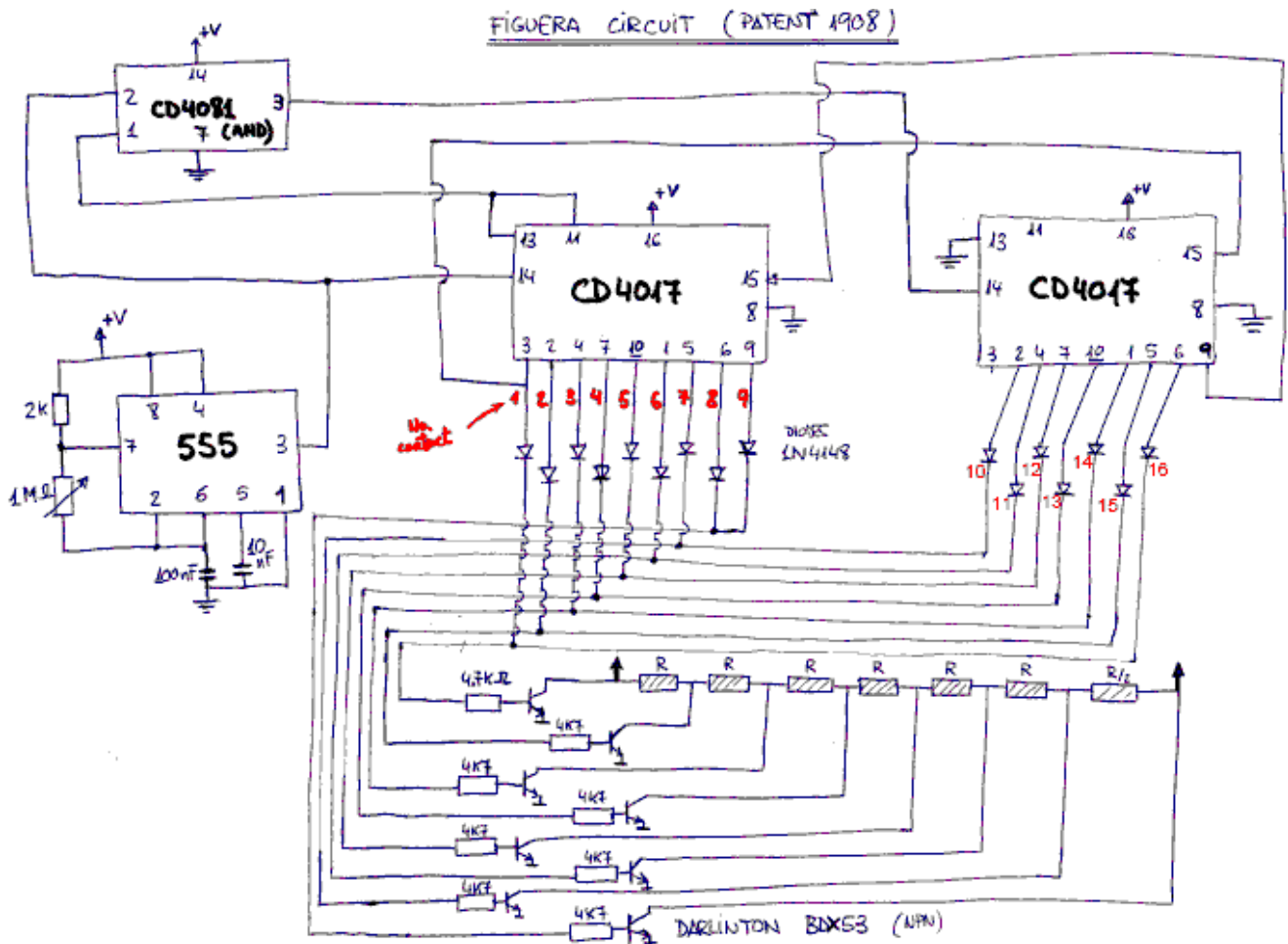
The capacitor "C" in the above circuit diagram will probably not be needed. The switching needs to maintain a constant current flow through both electromagnets. I would expect the 4017 chip switching to be fast enough to allow this to happen. If that proves not to be the case, then a small capacitor (probably 100nF or less) can delay the switch-off of the transistors just long enough to allow the next transistor in the sequence to be switched on to provide the required 'Make-Before-Break' switching.

As indicated in the table above, the 4017 pins which feed the transistor pairs through the 1N4148 (or similar) diodes are:

- IC1 pin 3 and IC2 pin 6 for resistor connection point 1.
- IC1 pin 2 and IC2 pin 5 for resistor connection point 2.
- IC1 pin 4 and IC2 pin 1 for resistor connection point 3.
- IC1 pin 7 and IC2 pin 10 for resistor connection point 4.
- IC1 pin 10 and IC2 pin 7 for resistor connection point 5.
- IC1 pin 1 and IC2 pin 4 for resistor connection point 6.
- IC1 pin 5 and IC2 pin 2 for resistor connection point 7.
- IC1 pin 6 and IC2 pin 9 for resistor connection point 8.

This Figuera design is very attractive as it uses only simple, readily available materials, low voltage and does not require difficult tuning. It also has the potential to be self-powered if part of the output is used to provide a voltage-stabilised power supply for the input power and the remaining output power can be kilowatts if the wire diameters chosen can carry that much current. Chapter 12 explains electronic circuitry in more detail.

A contributor who wishes to remain anonymous does not like the circuit arrangement shown above and prefers this circuit which he has built and tested:



The NPN Darlington transistor BDX53 in this circuit is not available everywhere around the world and if that is the situation in your area, then using a 2N2222 transistor feeding a 2N3055 (or TIP3055) transistor as shown originally will work just the same. Worth checking out is: http://www.alpoma.net/tecob/?page_id=8258

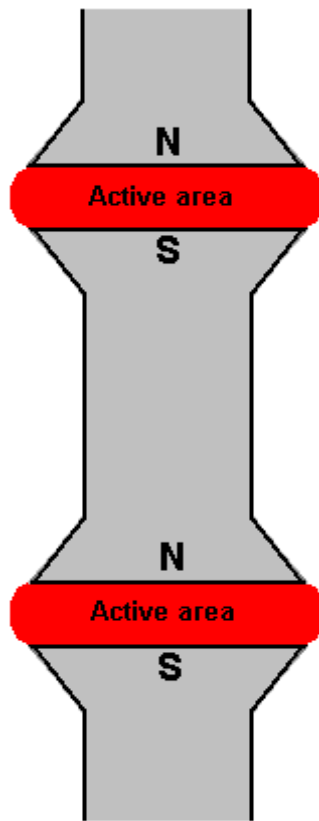
Other Figuera Designs

Other patents from Clemente Figuera show his understanding of Lenz-Law-free operation which allows performances where the output power exceeds the input power. For example, the Spanish patent 30376 of 5th September 1902 from Figuera and Pedro Blasberg, which is, of course, an earlier patent than the one discussed above, shows a Lenz Law free generator which only needs a small amount of power to spin the axle of the generator.

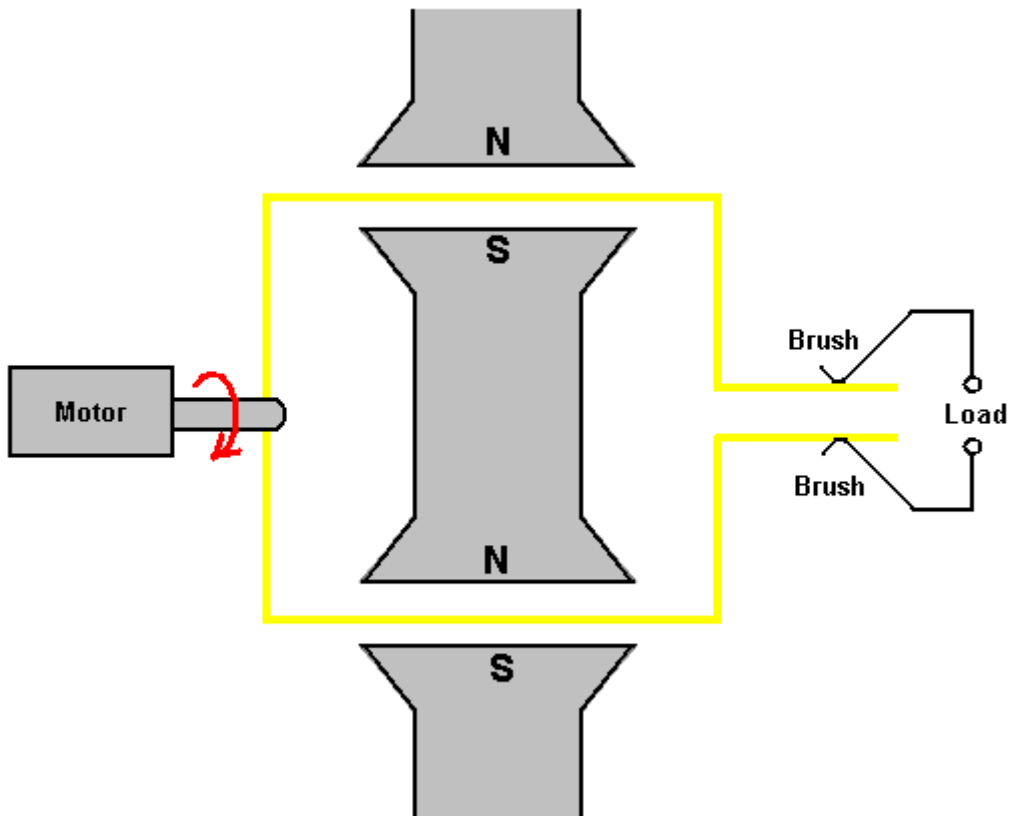
The patent points out that in a standard generator, it is not difficult to spin the 'armature' rotor if no current is being drawn from the output coils even though they are wound on an iron core. When an output current is drawn, that current converts the iron rotor into a magnet which is difficult to spin because it is attracted to the magnetic iron stator which is causing the rotor to spin.

To avoid this drag which hinders the rotor movement, the patent appears to say that the iron in the rotor should be omitted and the metal of the stator should definitely be of a type which magnetises easily but which does not retain its magnetism as soon as the influencing magnetic field is removed. People seem to think that using steel is allowable, but magnetisable steel becomes a permanent magnet when it is placed in a strong magnetic field and the patent stresses that no magnetism should remain in the metal when the magnetic field is removed.

Figuera describes the situation in this way. He points out that the active magnetic area between three magnetic components of a stator is like this:

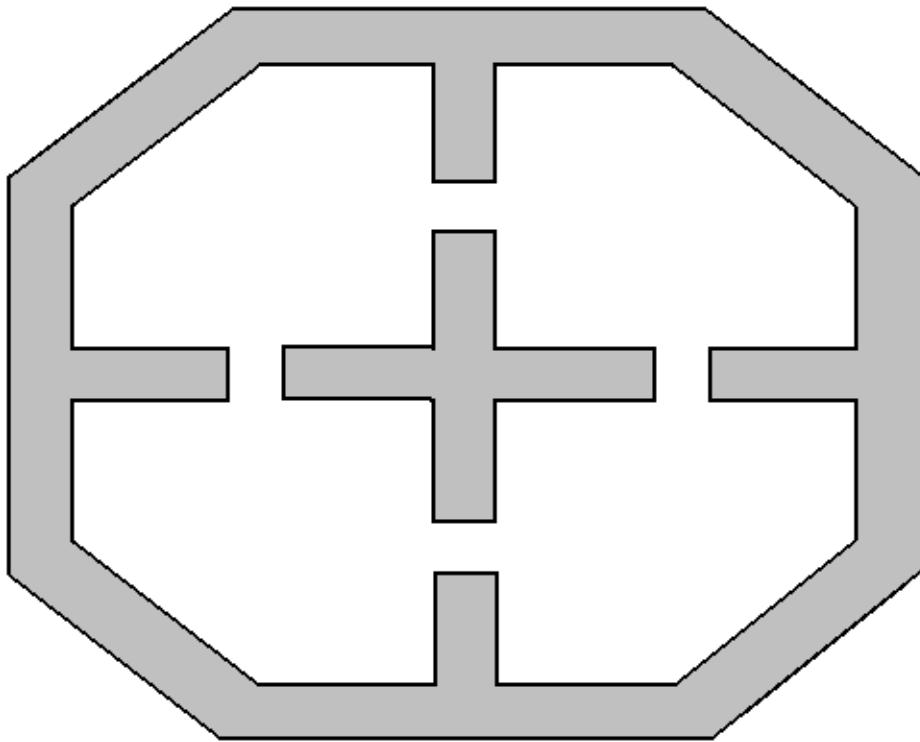


Here, the stator pieces have magnetic poles which attract each other, causing a strong magnetic flow across the air gap between the magnetic components. He then proposes that a small motor spins a series of copper wire loops so that they pass through the active area continuously.

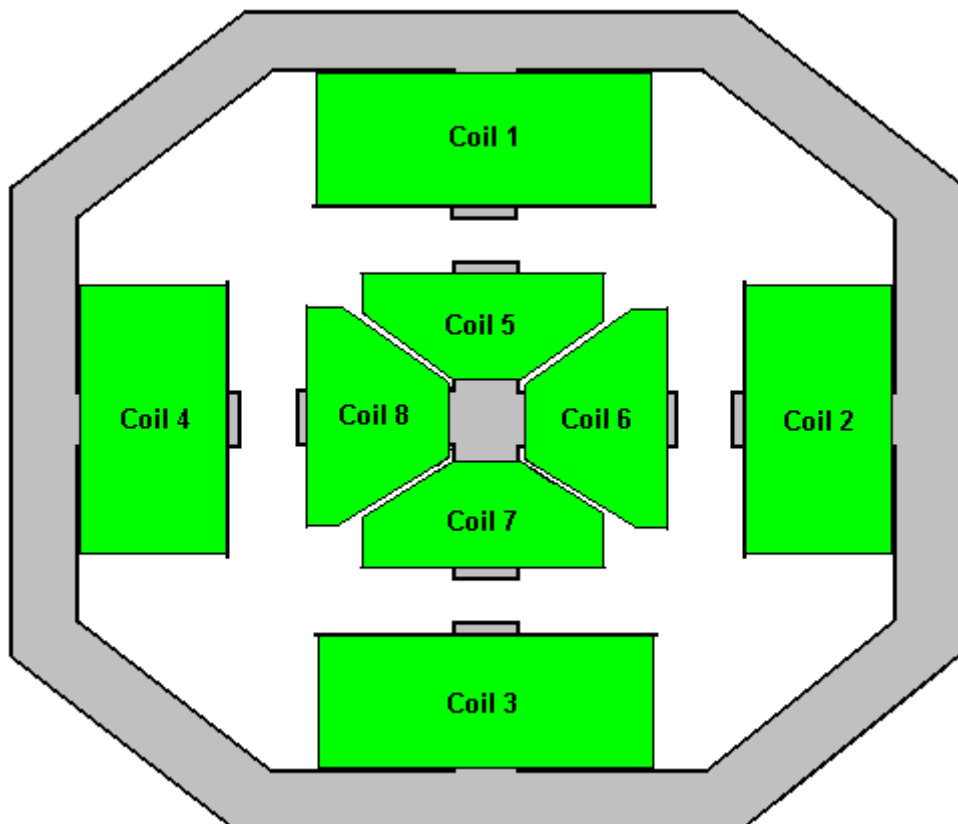


I do not know whether or not this results in avoiding the drag effect experienced by most generators, but it appears certain that the drag effect will be reduced dramatically. This patent is important in that it shows how Figuera is thinking about the problem.

Figuera then moves on to motionless operation in his Spanish patent 30378 also of 5th September 1902, In this patent he proposes a motionless stator composed of two pieces shaped like this:

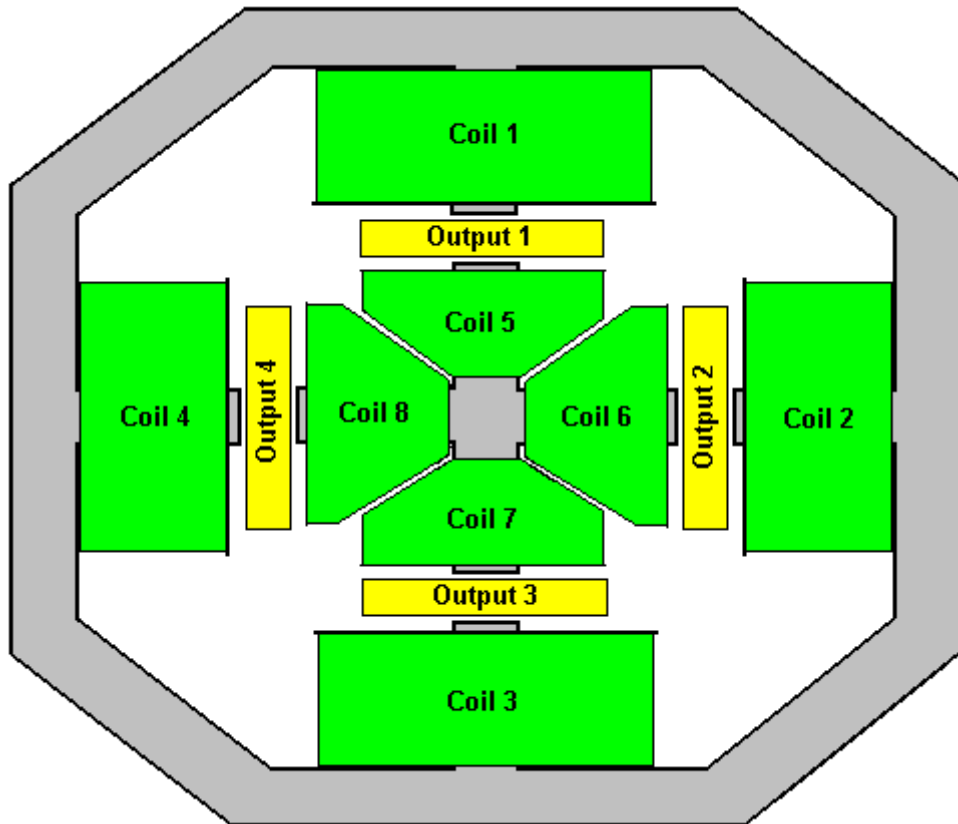


These pieces then have coils placed on the arms:



There is no real need to use conical coils like Figuera shows if the frame is made slightly larger, although at high power levels it could involve raising the core weight considerably, although the frame does not actually carry the power of the generator.

The coils are then interconnected so as to give a North (seeking) pole opposite a South (seeking) pole across each gap. The coils are all connected in series so that when Alternating Current is applied to the chain of coils, the magnetic field across the gaps is always the optimum N-S magnetic flow. For replications nowadays, I imagine that developers would wind these eight coils as bi-filar coils as those were devised by Tesla specifically for generating a more intense magnetic field in situations like this. Finally, air core coils of many turns are positioned in the magnetic gaps like this:



With this arrangement, increased current draw from the four output coils should have little or no effect on the input power passing through the eight electromagnet coils. The output coils can be used individually or connected in series for greater voltage or in parallel for greater current.

Patrick Kelly
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