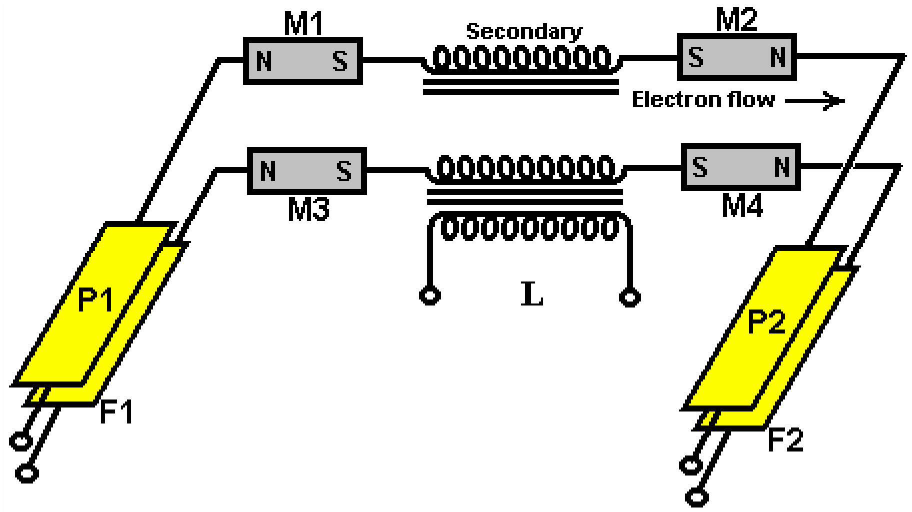


The secondary windings are both exactly equal and wound in a direction such that, on switching the primary coil on, the electrons in the secondary coil flow from P1 to P2 and from F1 to F2. This is the basic working arrangement. More of these double stages can be added to provide higher outputs.

Don Smith. One of most impressive developers of free-energy devices is Don Smith who has produced many spectacular devices, generally with major power output. These are a result of his in-depth knowledge and understanding of the way that the environment works. 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 form 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 of degraded as is common in conventional transformers.

BRIEF DESCRIPTION OF THE DRAWINGS

The Dipole at right angles, allows the magnetic flux surrounding it to intercept the capacitor plate, or plates, at right angles. The electrons present are spun such that the electrical component of each electron is collected by the capacitor plates. Essential parts are the South and North component of an active Dipole. Examples presented here exist as fully functional prototypes and were engineer constructed and fully tested in use by the Inventor. In each of the three examples shown in the drawings, corresponding parts are used.

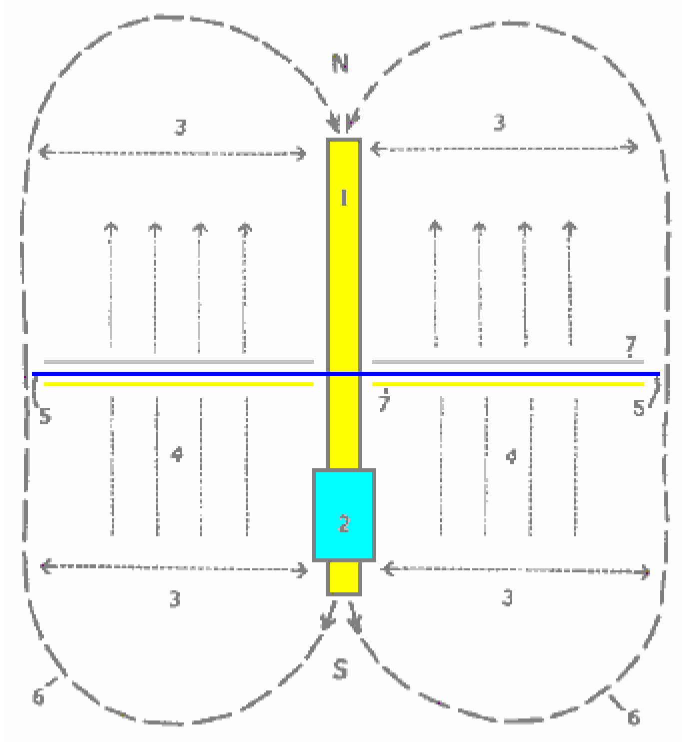


Fig.1 is a View of the Method, where **N** is the North and **S** is the South component of the Dipole.

Here, **1** marks the Dipole with its North and South components. **2** is a resonant high-voltage induction coil. **3** indicates the position of the electromagnetic wave emission from the Dipole. **4** indicates the position and flow direction of the corresponding Heaviside current component of the energy flow caused by the induction coil **2**. **5** is the dielectric separator for the capacitor plates **7**. **6** for the purposes of this drawing, indicates a virtual limit for the scope of the electromagnetic wave energy.

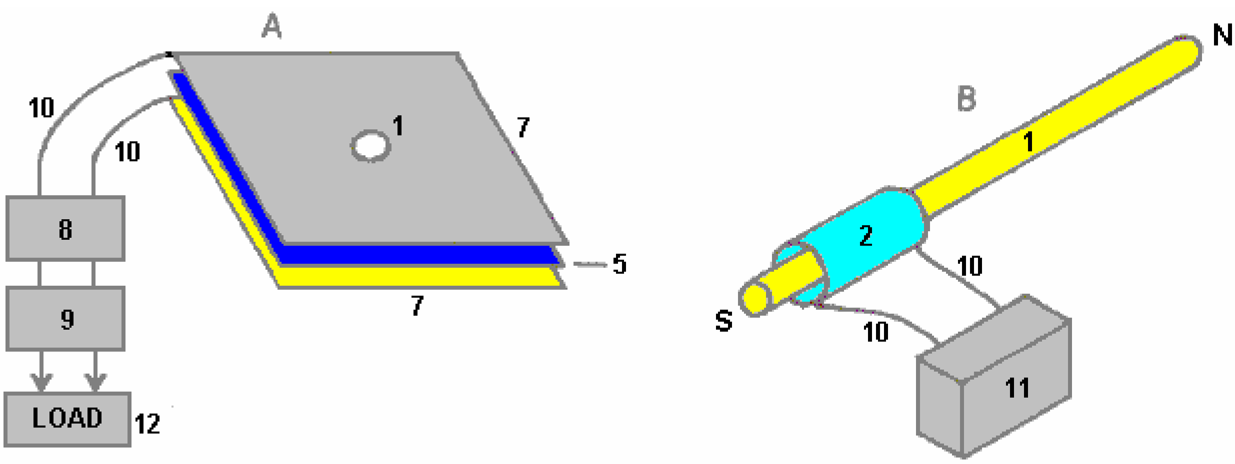


Fig.2 has two parts **A** and **B**.

In **Fig.2A** **1** is the hole in the capacitor plates through which the Dipole is inserted and in **Fig.2B** it is the Dipole with its North and South poles shown. **2** is the resonant high-voltage induction coil surrounding part of the Dipole **1**. The dielectric separator **5**, is a thin sheet of plastic placed between the two capacitor plates **7**, the upper plate being made of aluminium and the lower plate made of copper. Unit **8** is a deep-cycle battery system powering a DC inverter **9** which produces 120 volts at 60 Hz (the US mains supply voltage and frequency, obviously, a 240 volt 50 Hz inverter could be used here just as easily) which is used to power whatever equipment is to be driven by the device. The reference number **10** just indicates connecting wires. Unit **11** is a high-voltage generating device such as a neon transformer with its oscillating power supply.

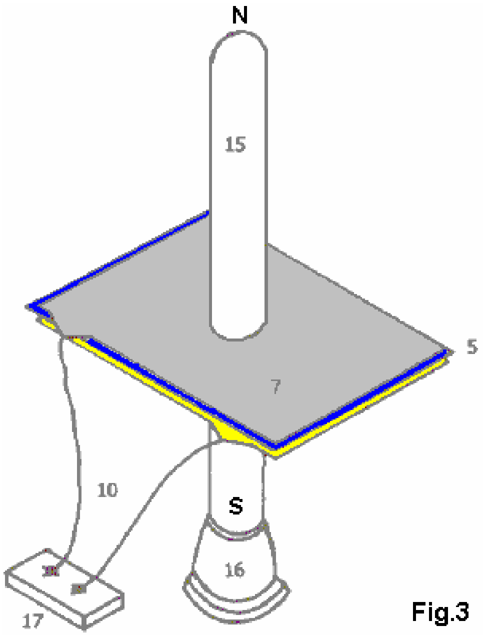


Fig.3

Fig.3 is a Proof Of Principal Device using a Plasma Tube as an active Dipole. In this drawing, **5** is the plastic sheet dielectric separator of the two plates **7** of the capacitor, the upper plate being aluminium and the lower plate copper. The connecting wires are marked **10** and the plasma tube is designated **15**. The plasma tube is four feet long (1.22 m) and six inches (100 mm) in diameter. The high-voltage energy source for the active plasma dipole is marked **16** and there is a connector box **17** shown as that is a convenient method of connecting to the capacitor plates when running tests on the device.

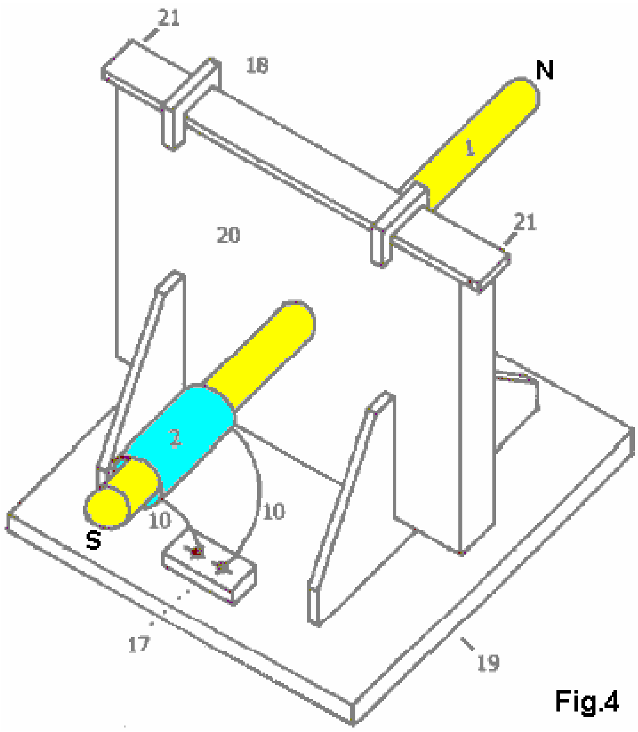


Fig.4

Fig.4 shows a Manufacturer's Prototype, constructed and fully tested. **1** is a metal Dipole rod and **2** the resonant high-voltage induction coil, connected through wires **10** to connector block **17** which facilitates the connection of it's high-voltage power supply. Clamps **18** hold the upper edge of the capacitor packet in place and **19** is the base plate with it's supporting brackets which hold the whole device in place. **20** is a housing which contains the capacitor plates and **21** is the point at which the power output from the capacitor plates is drawn off and fed to the DC inverter.

BEST METHOD OF CARRYING OUT THE INVENTION

The invention is applicable to any and all electrical energy requirements. The small size and it's high efficiency make it an attractive option, especially for remote areas, homes, office buildings, factories, shopping centres, public places, transportation, water systems, electric trains, boats, ships and 'all things great and small'. The construction materials are commonly available and only moderate skill levels are needed to make the device.

CLAIMS

1. Radiated magnetic flux from the Dipole, when intercepted by capacitor plates at right angles, changes into useful electrical energy.

2. A Device and Method for converting for use, normally wasted electromagnetic energy.

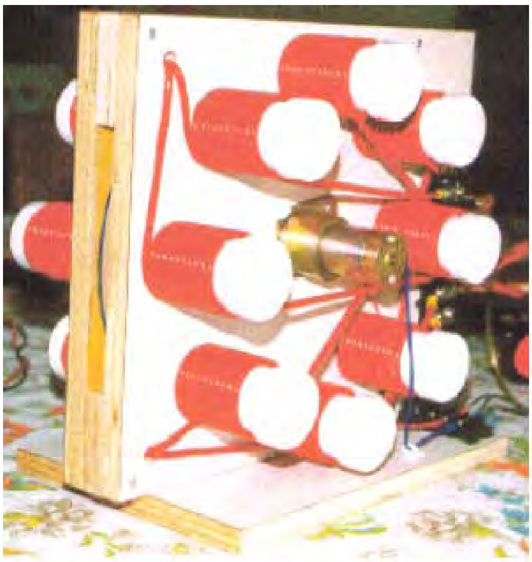
3. The Dipole of the Invention is any resonating substance such as Metal Rods, Coils and Plasma Tubes which have interacting Positive and Negative components.

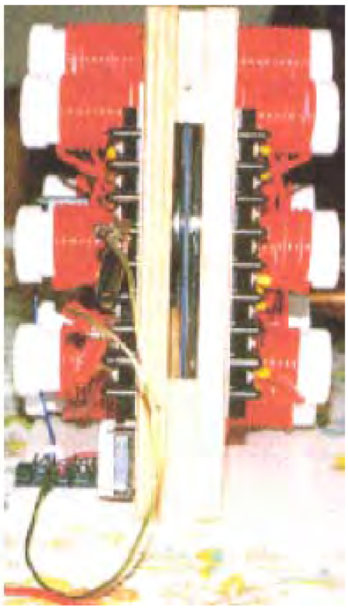
4. The resulting Heaviside current component is changed to useful electrical energy.

****

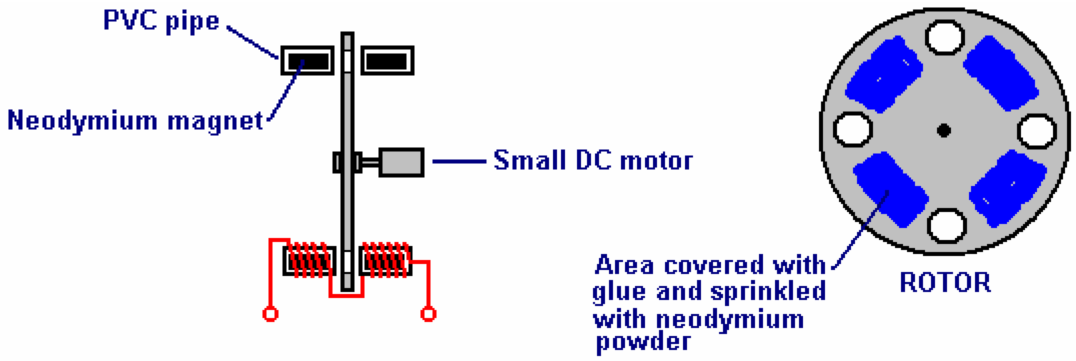
This patent does not make it clear that the device needs to be tuned and that the tuning is related to its physical location. The tuning will be accomplished by applying a variable-frequency input signal to the neon transformer and adjusting that input frequency to give the maximum output.

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. One of his devices is shown here:



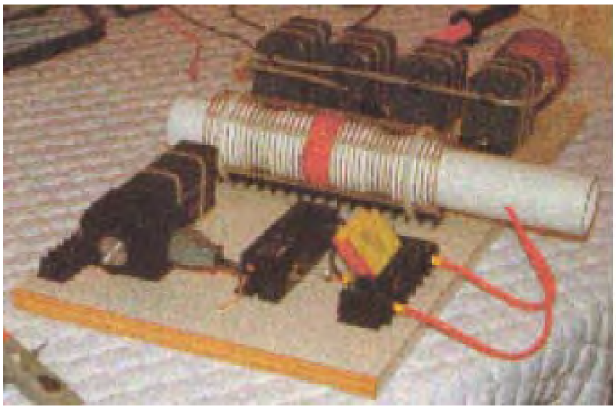


This is a small table-top device which looks like it is an experiment by a beginner, and something which would be wholly ineffective. Nothing could be further from the truth. Each of the eight coils pairs (one each side of the rotating disc) produces 1,000 volts at 50 amps (fifty kilowatts) of output power, giving a total power output of 400 kilowatts. It's overall size is 16" x 14.5" x 10" (400 x 370 x 255 mm). In spite of the extremely high power output, the general construction is very simple:



The device operates on a fluctuating magnetic field which is produced by a small low-power DC motor spinning a plastic disc. In the prototype shown above, the disc is an old vinyl record which has had holes cut in it. Between the holes is an area which was covered with glue and then sprinkled with powdered neodymium magnet material. It takes very little power to spin the disc, but it acts in a way which is very much like the Ecklin-Brown generator, repeatedly disrupting the magnetic field. The magnetic field is created by a neodymium magnet in each of the sixteen plastic pipes. It is important that the change in the magnetic flux between the matching magnets on each side of the disc is as large as possible. The ideal rotor material for this is "Terfenol-D" (tungsten zirconate) with slots cut in it but it is so expensive that materials like stainless steel are likely to be used instead. Please understand that all of Don's designs rely on resonant operation and so the coil impedance has to be matched to the pulse frequency used to drive the coil.

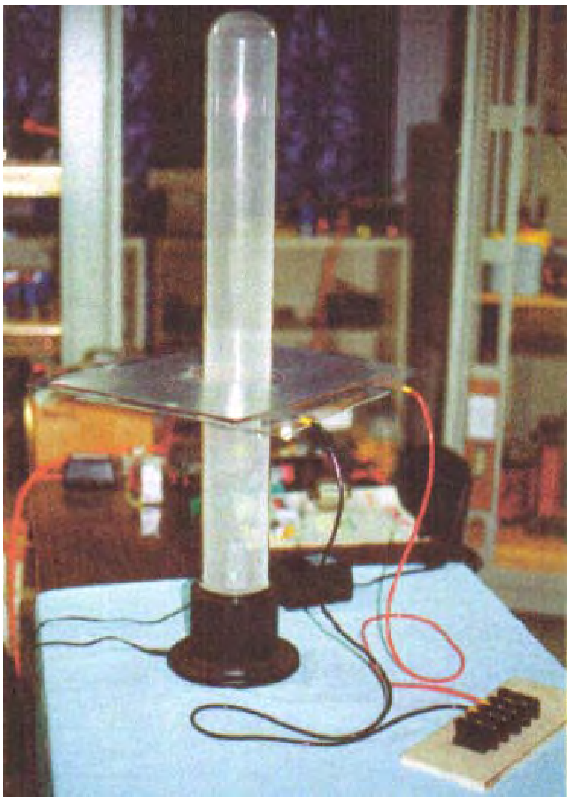
For Don Smith, this is not an exceptional device. The one shown below is also physically quite small and yet it has an output of 160 kilowatts (8000 volts at 20 amps) from an input of 12 volts 1 amp (COP = 13,333):



Again, 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 is the ground connection, the step-down isolation transformer and the varistor used to protect the load from over-voltage by absorbing any random voltage spikes which might occur, but more of these things later on when a much more detailed description of this device is given. Again, please understand that Don does not reveal all of the details of any of his designs, and he deliberately omits to mention various important details, leaving us to deduce what is missing from our own understanding of how these devices work.

The device shown above is a typical example of this with 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.

Another of Don's devices is shown here:



This is a larger device which uses a plasma tube four feet (1.22 m) long and 6 inches (100 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 realize 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 x 1,000 x 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.

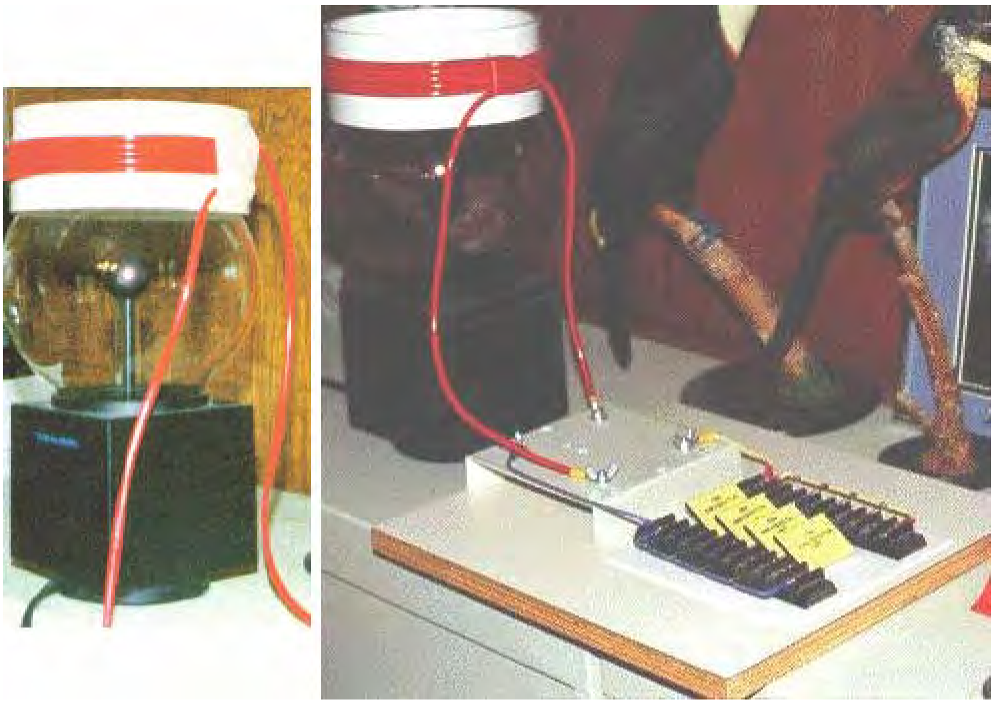
In coil systems, magnetic and amperage are one package. This suggests that electrons in their natural non-ionic state, exist as doublets. When pushed apart by agitation, one spins right (yielding Volts-potential electricity) and the other spins left (yielding Amperage-magnetic energy), one being more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

	Energy Available	Method of Storage	Common Unit	Units of Measure
Electrons	Electrical	Capacitor/Coulombs	Volts	Flux Units
	Spin / Gravity	Momentum	Torque	Ergs
	Magnetic	Coils/Amp. turns	Amperes	Flux Units Teslas, Gauss, Gammas, Oesteds
	Light	Laser	Lux , Photons/Gamma Rays	
	Impact / resistance			
	Heat	Various	Fahrenheit/Celsius	Temp

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. As Don points out that the output power increases with each turn of wire, it is distinctly possible that each of these strands acts the same as individual insulated turns which have been connected in parallel, so a 500-strand cable may well be far more effective than a cable with just a few strands).

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.

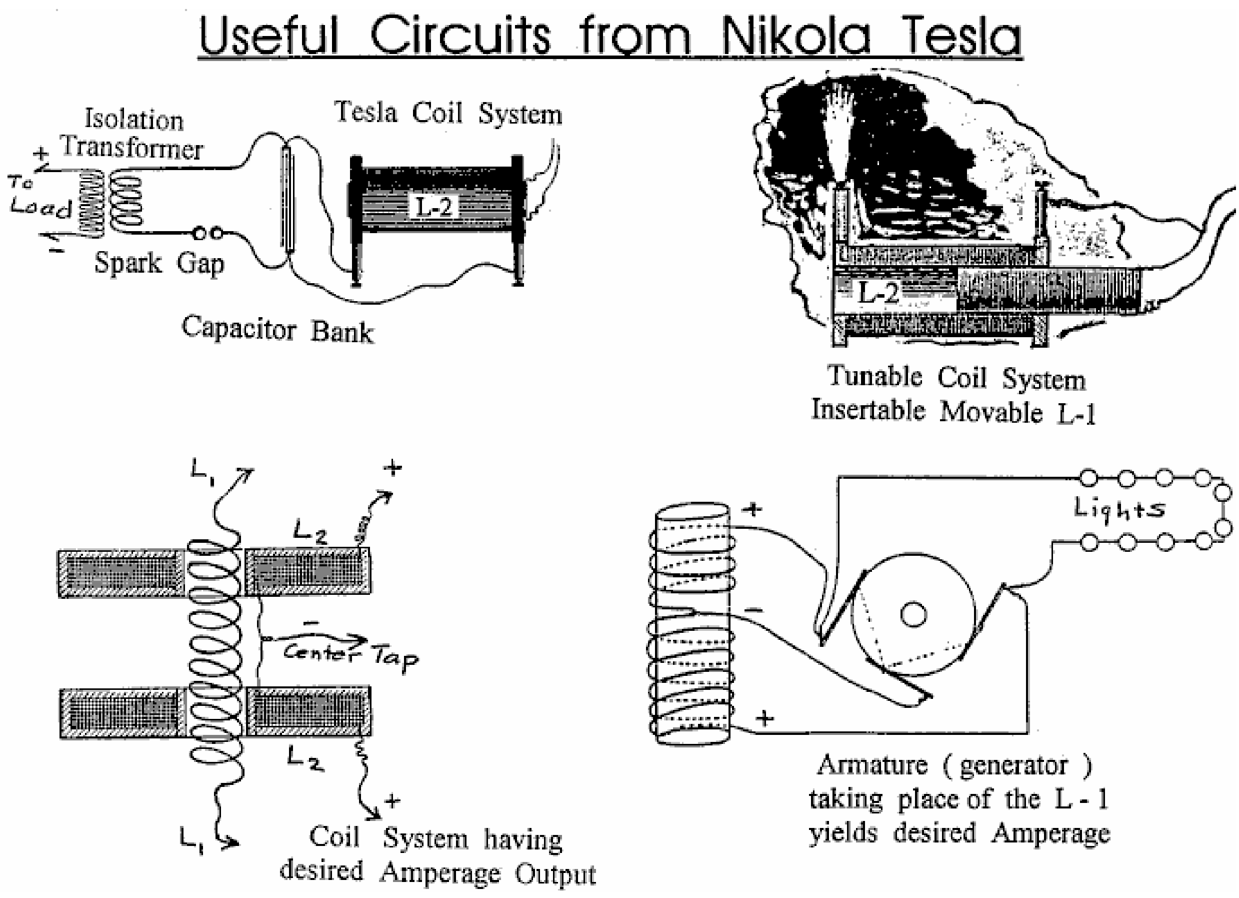
5. This will become the "L - 2" coil shown in the Circuits page.

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.



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 the 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.

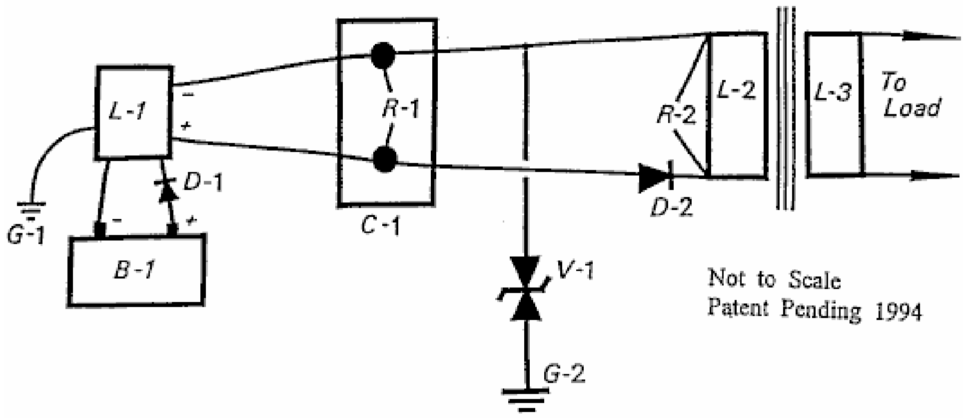
An earth grounding is desirable, acting as both a voltage-limiter and a transient spike control. Two separate earths are necessary, one at the Power Factor Capacitor and one at the input side of the isolation transformer. Off-the-shelf surge arrestors / spark gaps and varistors having the desired voltage/potential 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, Resister 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 milliheneries
R = resistance in ohms

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

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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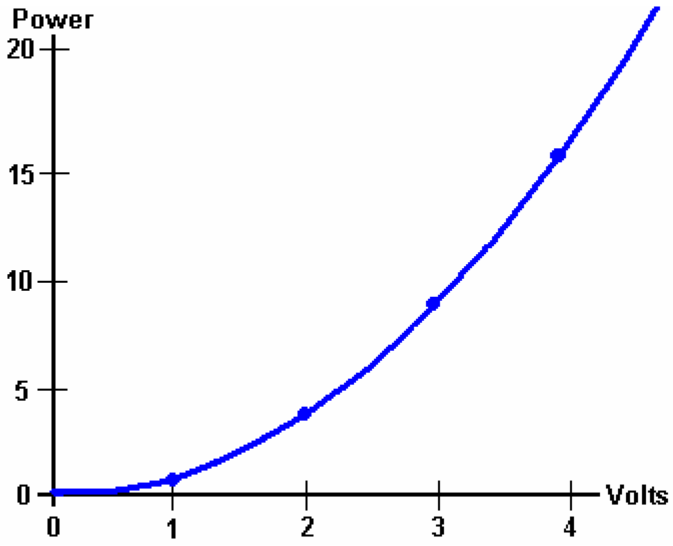
I am most definitely not an expert in this area. However, it is probably worth mentioning some of the main points which Don Smith appears to be making. There are some very important points being made here, and grasping these may make a considerable difference to our ability to tap into the excess energy 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: $\mathbf{W = 0.5 \times C \times V^2 \times Hz}$ 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: $\mathbf{W = 0.5 \times L \times A^2 \times Hz}$ 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: $\mathbf{W = 0.5 \times C \times V^2 \times (Hz)^2}$ 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.

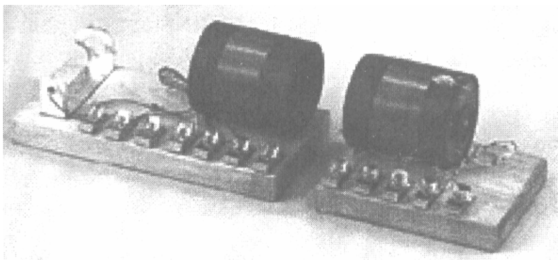
However, if we want to extract energy from the environment, then we should go for high voltage and high frequency. Then, when high power has been extracted, if we want a low frequency suited to electric motors, we can pulse the already captured power at that low frequency.

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.

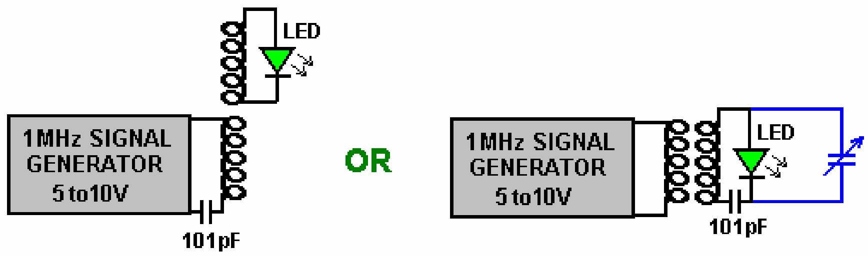
The magnetic effect which we want to create is a ripple in the zero-point energy field, and ideally, we want to create that effect while using very little power. Creating a dipole with a battery which has a Plus and a Minus terminal or a magnet which has North and South poles, is an easy way to do create 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" supplied by The Science Source, Maine. This kit demonstrates 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.



If you get the Science Source educational kit, then there are some details which you need to watch out for. The unit supplied to me had 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:

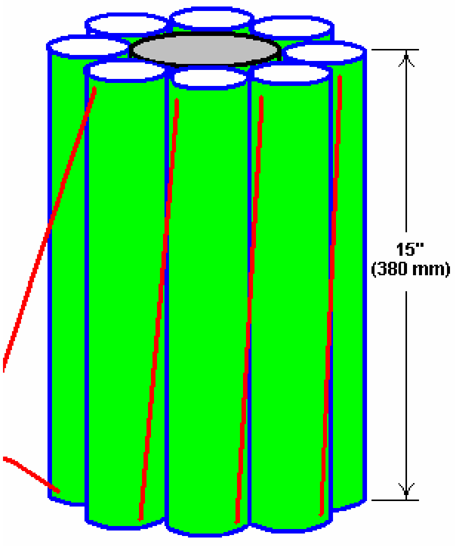


Before you buy the kit, it is not mentioned that in order to use it, you need a signal generator capable of producing a 10-volt signal at 1 MHz. The coil has a DC resistance of just 1.9 ohms but at a 1 MHz resonant frequency, the necessary drive power is quite low.

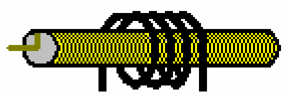
A variable capacitor is mounted on the receiver coil tube, but the one in my kit made absolutely no difference to the frequency tuning, nor was my capacitance meter able to determine any capacitance value for it at all, even though it had no trouble at all in measuring the 101 pF capacitor which was 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 head where a domed head 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 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:

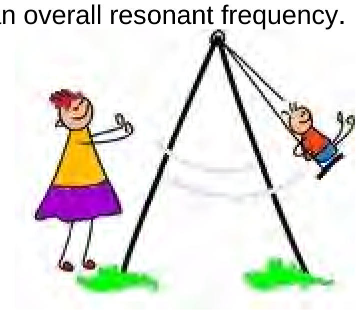


Don points to an even more clearly demonstrated occurrence of this effect in the Tesla Coil. In a typical Tesla Coil, the primary coil is much larger diameter than the inner secondary coil:



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 it's 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 detracts from 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, 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 !!").

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 x 12 / (26.67 x 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.

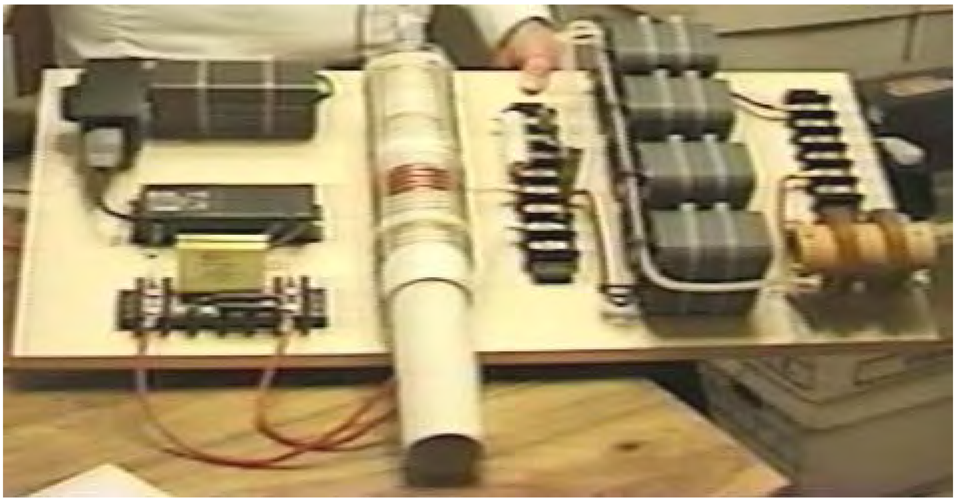
5. Connect to the start of the coil. To determine the exact resonant point on the coil, a measurement is made. Off-the-shelf multimeters are not responsive to high-frequency signals so a cheap neon is used instead. Holding one wire of the neon in one hand and running the other neon wire along the outside 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.

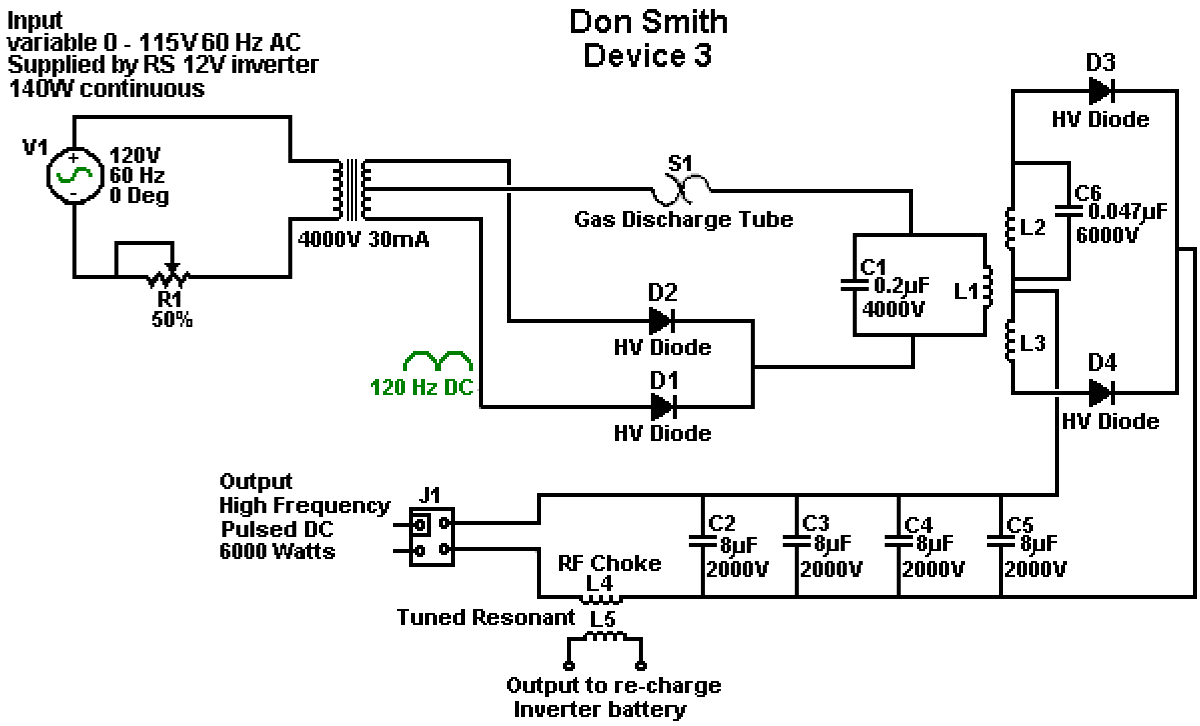
7. Construction of the L - 1 input coil has been suggested as having 10 turns. The length of the wire in this coil is not critical. If a 2-inch diameter PVC pipe was used for the L - 2 coil, then the next larger size of PVC pipe can be used for the L - 1 coil former. Cut a 10-turn length of the pipe (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.

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

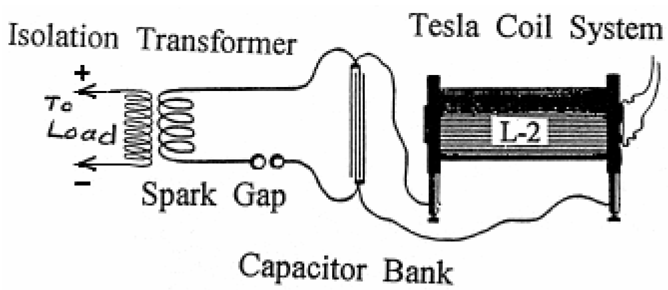


I have recently been passed a copy of Don’s circuit diagram for this device, and it is shown here:



This circuit diagram contradicts what Don says in his video presentations as the output matches the photographs which show the four output capacitors wired in parallel. It appears that while using the prototype shown above as an example of the construction, in the videos Don is actually describing a later version of the circuit. The 4000V 30mA transformer shown in this circuit diagram, is a neon-tube driver module which steps up the voltage and raises the frequency to about 35 kilohertz.

There is always a tendency to think of a 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 as it is in this circuit. 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:



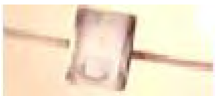
With Don's arrangement, it can be a little difficult to see why the capacitor is not short-circuited by the very low resistance of the few turns of thick wire forming the L1 coil. Well, it would do that if we were operating with DC, but we are most definitely not doing that as the output from the neon-tube 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 AC "impedance" (effectively, it's AC resistance) is what counts. Actually, the “C1” capacitor and the L1 coil being connected across each other have a combined "impedance" 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, although 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 and Don specifies just 140 watts of continuous current for the inverter specification.

The neon-tube (or "gas-discharge" 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 4,000 volts at a frequency of 35,100 Hz (sometimes written as 35.1 kHz). The term "Hz" stands for "cycles per second". It should be noted, however, that since Don bought his neon-tube driver module, the design of many of those modules has been altered to include protection circuitry which is liable to prevent the module operating properly in this circuit. It might be worth considering building your own solid-state circuit as shown later on in this chapter. If you do that, then you have full control of the frequency and the output and are not dependent on anyone else's circuit design.

In this circuit, Don lowers the 4,000 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, 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, spark gap in it and the line is also earthed. This device is commonly used as a lightning strike protection component but it is an active component in Don's circuit and it lights continuously when the device is running. It looks like this:

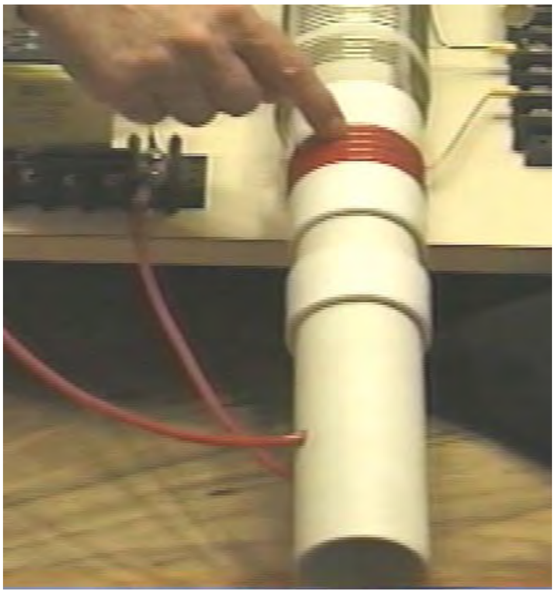


Please note that when an earth connection is mentioned in connection with Don Smith's devices, we are talking about an actual wire connection to a metal object physically buried in the ground, whether it is a long copper rod driven into the ground, or an old car radiator buried in a hold like Tariel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

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 have attention paid to them.

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 with the "C6" tuning capacitor across it. 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.

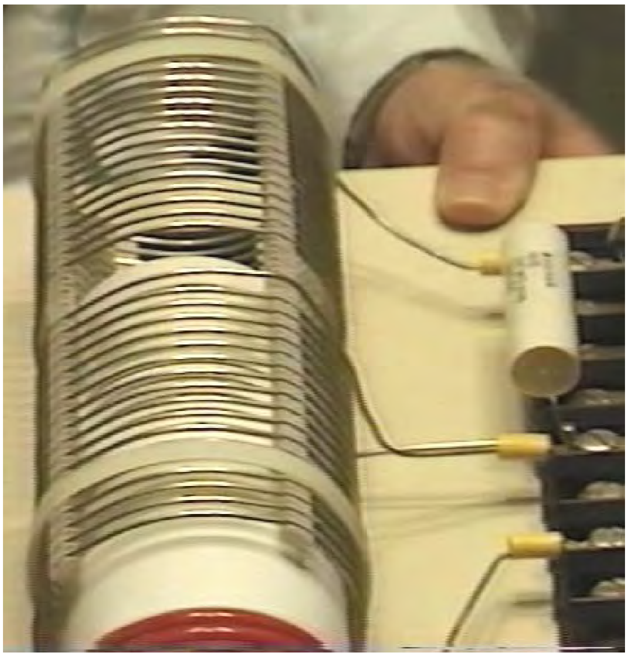
A rule of thumb followed by most Tesla Coil builders is to have the same weight of copper in the L1 and L2 coils, which means that the wire of the L1 coil is usually much thicker than the wire of the L2 coil. If the L1 coil is to be one quarter of the length of the L2 coil, then we would expect the cross-sectional area of the L1 coil to be four times that of the wire of the L2 coil (as the area is proportional to the square of the radius, and the square of two is four, so doubling the wire diameter gives four times the cross-sectional area of the copper wire).



Don uses a 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. Don has taken this coil and unwound four turns at the centre 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.

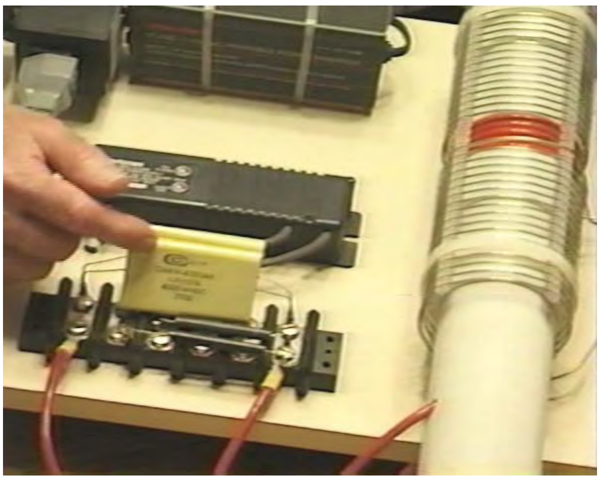
You will notice that Don has placed a plastic collar on each side of the winding, matching the thickness of the wire, in order to create a secure sliding operation inside the outer "L2" coil, and the additional plastic collars positioned further along the pipe provide further support for the inner coil.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

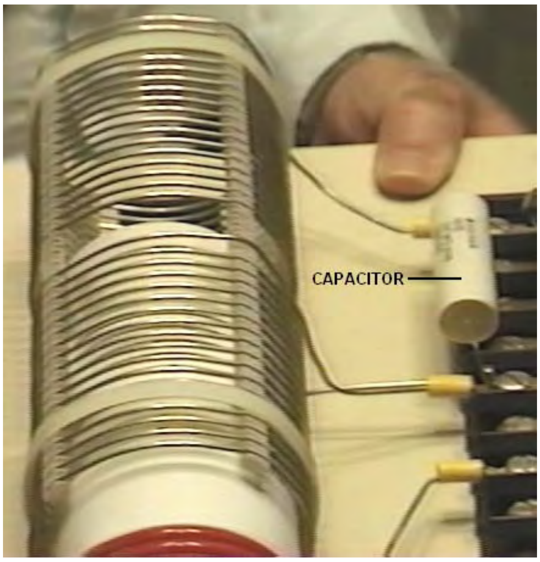
One point which Don stresses, is that the length of the wire in the "L1" coil and the length of wire in the "L2" coil, must be an exact even division or multiple of each other (in this case, the "L2" wire length in each half of the "L2" coil is exactly four times as long as the "L1" coil wire length).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

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":

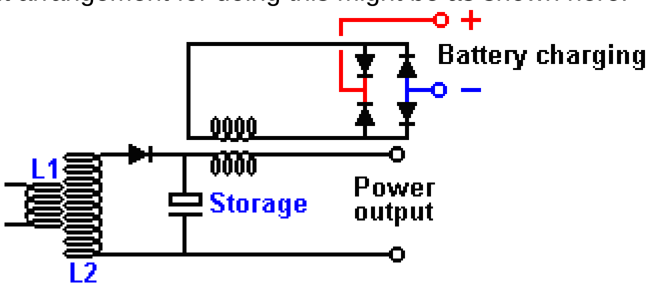


There are various ways of dealing with the output from the "L2" coil in order to get large amounts of conventional electrical power out of the device. The method shown here uses the four very large capacitors seen in the photograph. Don remarks that he has to be very careful to keep the voltage to the neon-tube driver circuit turned down in order to avoid getting more than 2,000 volts on these output storage capacitors.

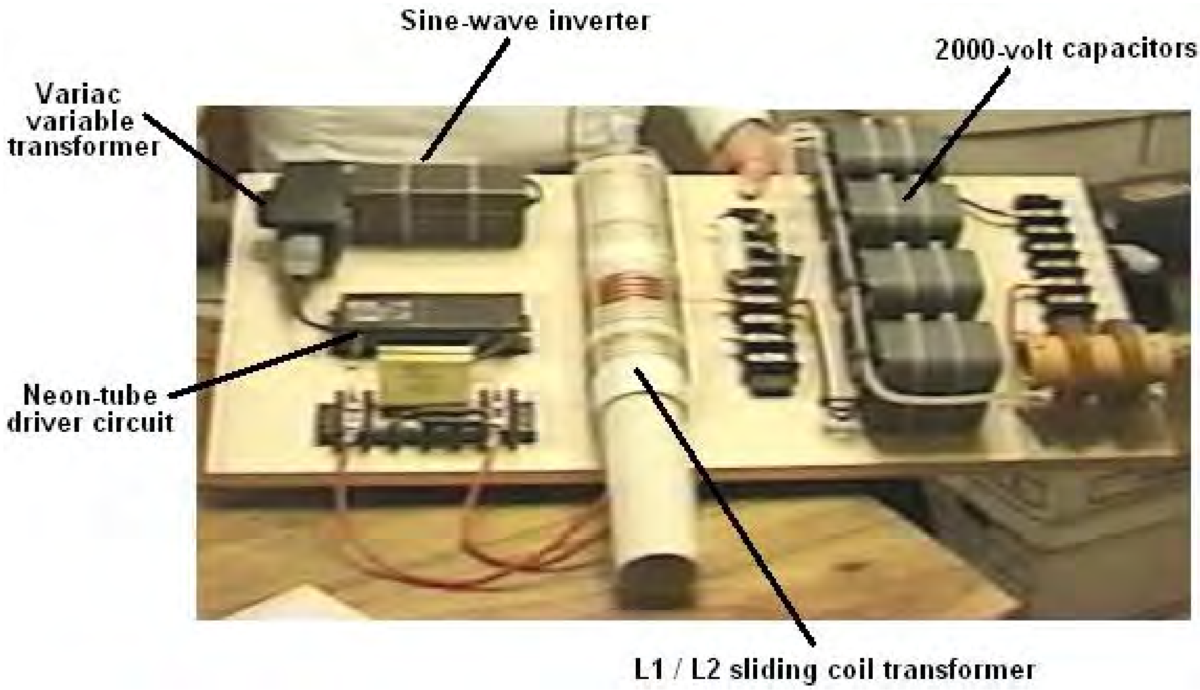
This capacitor bank is fed through two diodes which are rated for high voltage operation. In the build shown in the photographs and the circuit diagram, the output is rated at 2,000 volts and 6,000 watts, in which case, the output diodes have to be able to handle 3 amps continuously, but at start-up when the capacitor bank is fully discharged that current may well be exceeded while the capacitor bank charges up.

When the circuit is running, the storage capacitor bank behaves like a 2,000 volt battery which never runs down and which can supply 3 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.

The output current flows through the left hand winding on the brown cylindrical former, and that induces a current in the right-hand winding. This additional current is used to provide charging power for the battery used to drive the inverter. A possible circuit arrangement for doing this might be as shown here:



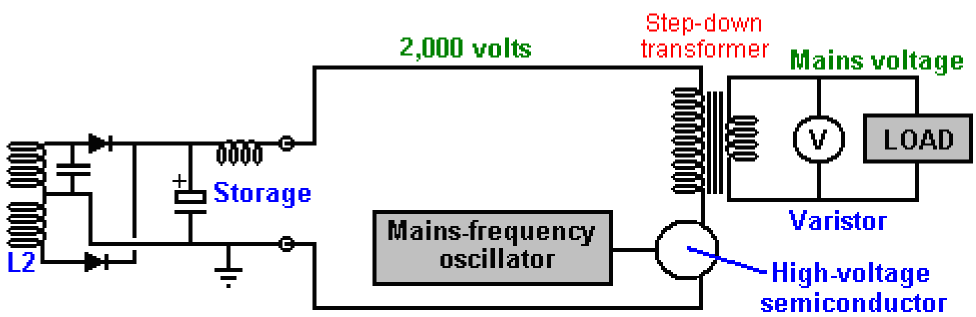
The DC output produced by the four diodes can then be used to charge the driving battery, and the power level produced is substantially greater than the minor current drain from the battery. Consequently, it is a sensible precaution to pass this current to the battery via a circuit which prevents the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

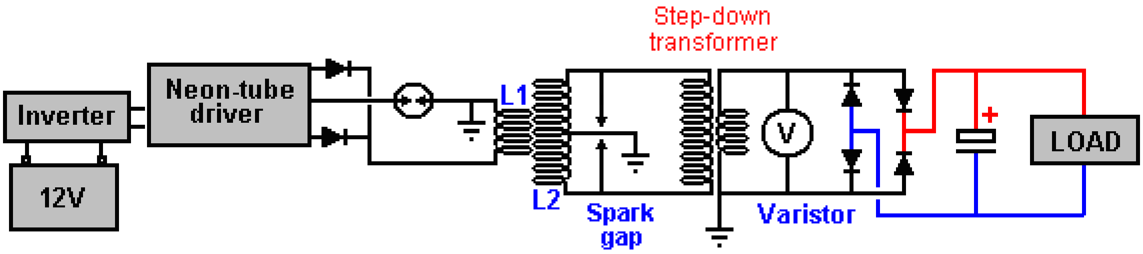
It may also be necessary to use an earthed screen around the device in order to prevent radio frequency emissions. The remainder of the circuit is not mounted on the board, possibly because there are various ways in which the required end result can be achieved. The one suggested here is perhaps the most simple solution:



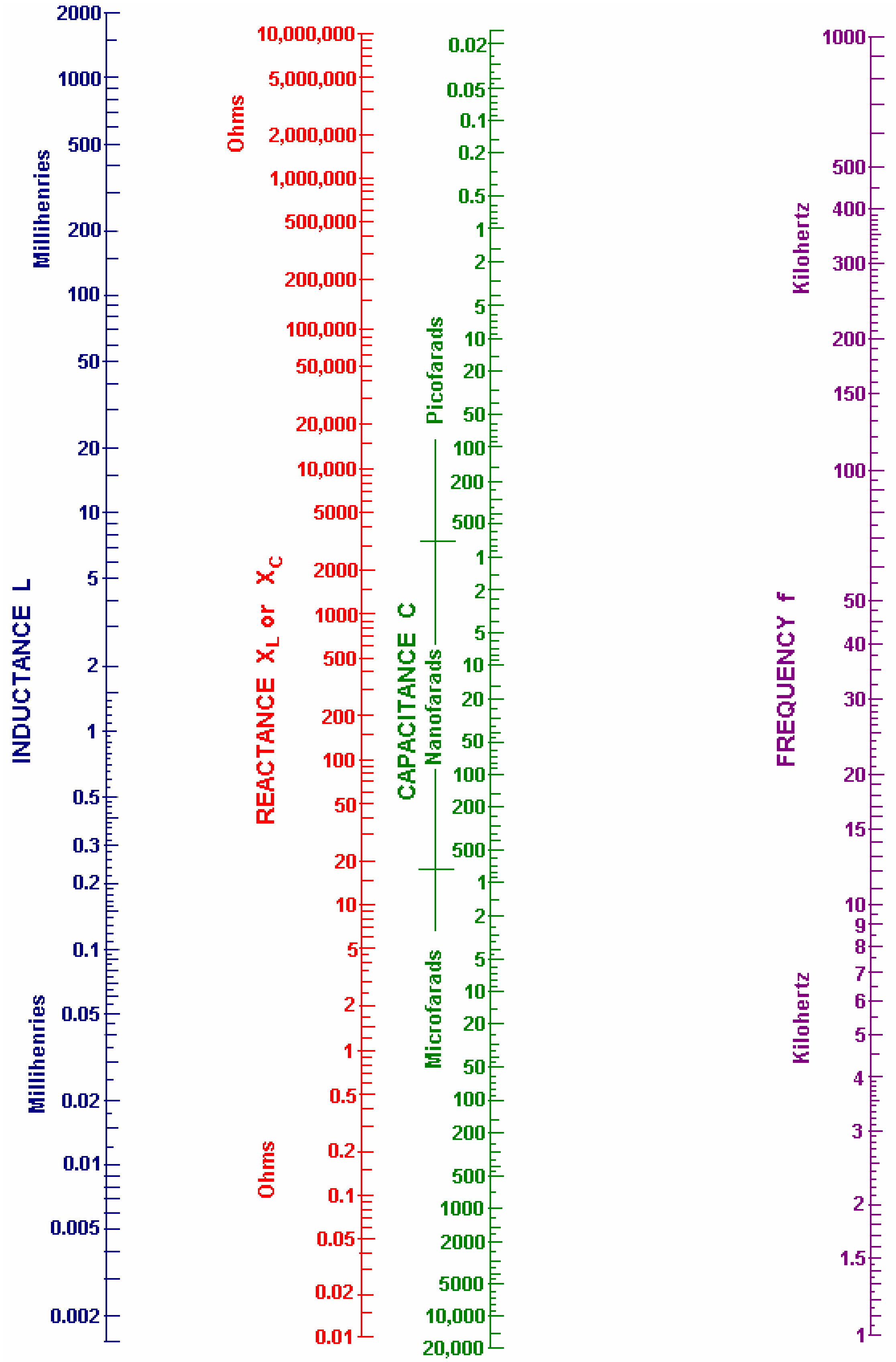
The voltage has to be dropped, so an iron-cored mains-frequency step-down transformer is used to do this. To get the frequency to the standard mains frequency for the country in which the device is to be used, an oscillator is used to generate that particular mains frequency. The oscillator output is 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 2,000 volts, though admittedly, that will be a current which will be very much lower than the final output current, due to the higher voltage on the primary winding of the transformer. When using this circuit, the available power will be limited by the current handling capabilities of this output transformer, so a custom-wound unit with heavy-duty wire and a substantial frame will be needed to provide the full six kilowatts of power.

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

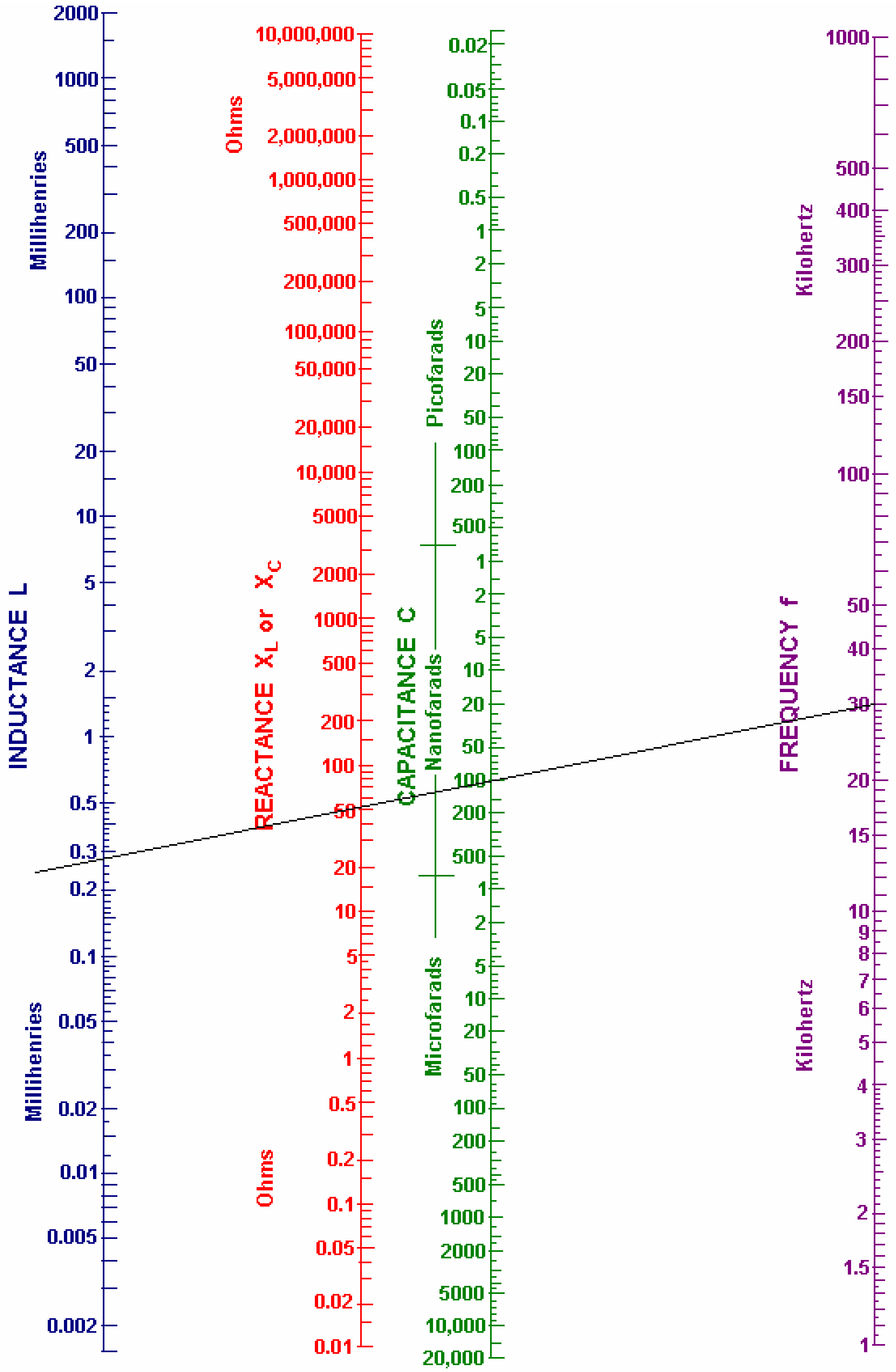


As many people will find the nomograph chart in Don's pdf document very difficult to understand and use, here is an easier version:



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

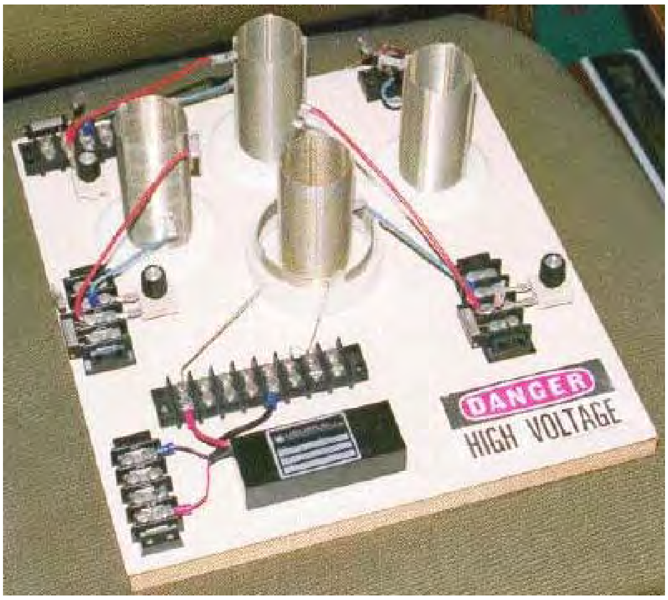
Suppose that your neon-tube driver is running at 30 kHz and you are using a capacitor of 100 nF (which is the same as 0.1 microfarad) and you want to know what is the AC resistance of your capacitor is at that frequency. Also, what coil inductance would have that same AC resistance. Then the procedure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

Another device of Don's is particularly attractive in that 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.

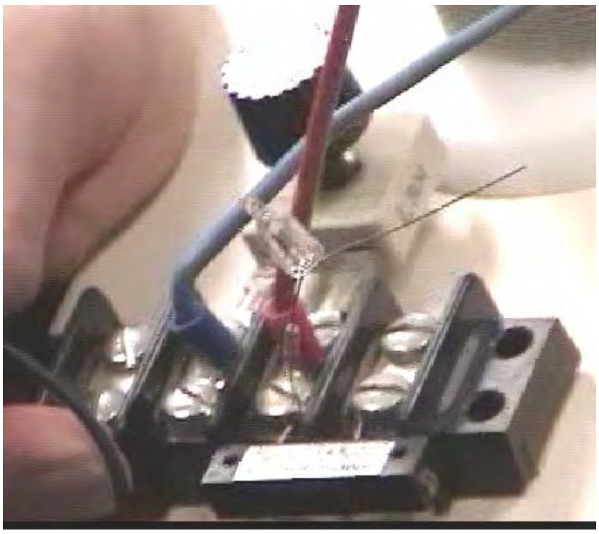


The coil in the centre of the board is a power transmitter made from a Tesla Coil constructed from two Barker & Williamson ready-made coils. Three more of the inner coil are also used as power receivers. The outer, larger diameter coil is a few turns taken from one of their standard coils and organised 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. Again, it appears to have five turns:

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.

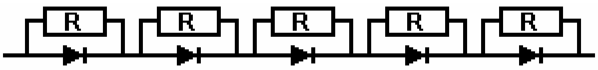



As there are very slight differences in the manufactured coils, each one is tuned to the exact transmitter frequency and a miniature neon is used to show when the tuning has been set correctly.

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.

Various questions from readers indicate that the operation of AC circuits is not really understood, so electronics experts can skip this next section.

AC Circuits. This is a lightweight introduction to Alternating Current circuits and pulsed DC circuits for people who have not read Chapter 12 which is an electronics tutorial. Let me say again, that I am mainly self-taught, and so this is just a general introduction based on my present understanding.

Alternating Current, generally called “AC” is called that because the voltage of this type of power supply is not a constant value. A car battery, for instance, is DC and has a fairly constant voltage usually about 12.8 volts when in it’s fully charged state. If you connect a voltmeter across a car battery and watch it, the voltage reading will not change. Minute after minute it says exactly the same because it is a DC source.

If you connect an AC voltmeter across an AC power supply, it too will give a steady reading, but it is telling a lie. The voltage is changing all the time in spite of that steady meter reading. What the meter is doing is **assuming** that the AC waveform is a sine wave like this:

and based on that assumption, it displays a voltage reading which is called the “Root Mean Square” or “RMS” value. The main difficulty with a sine wave is that the voltage is below zero volts for exactly the same length of time as it is above zero volts, so if you average it, the result is zero volts, which is not a satisfactory result because you can get a shock from it and so it can’t be zero volts, no matter what the arithmetical average is.

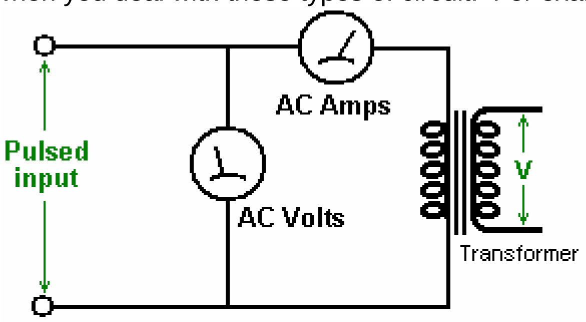
To get over this problem, the voltage is measured thousands of times per second and the results squared (that is, the value is multiplied by itself) and then those values are averaged. This has the advantage that when the voltage is say, minus 10 volts and you square it, the answer is plus 100 volts. In fact, all of the answers will be positive, which means that you can add them together, average them and get a sensible result. However, you end up with a value which is far too high because you squared every measurement, and so you need to take the square root of that average (or "mean") value, and that is where the fancy sounding "Root Mean Square" name comes from – you are taking the (square) root of the (average or) mean value of the squared measurements.

With a sine wave like this, the voltage peaks are 41.4% higher than the RMS value which everyone talks about. This means that if you feed 100 volts AC through a rectifier bridge of four diodes and feed it into a capacitor the capacitor voltage will **not** be 100 volts DC but instead it will be 141.4 volts DC and you need to remember that when choosing the voltage rating of the capacitor. In that instance I would suggest a capacitor which is made to operate with voltages up to 200 volts.

You probably already knew all of that, but it may not have occurred to you that if you use a standard AC voltmeter on a waveform which is **not** a sine wave, that the reading on the meter is most unlikely to be correct or anywhere near correct. So, please don't merrily connect an AC voltmeter across a circuit which is producing sharp voltage spikes like, for instance, one of John Bedini's battery pulsing circuits, and think that the meter reading means anything (other than meaning that you don't understand what you are doing).

You will, hopefully, have learned that power in watts is determined by multiplying the current in amps by the voltage in volts. For example, 10 amps of current flowing out of a 12 volt power supply, represents 120 watts of power. Unfortunately, that only holds true for circuits which are operating on DC, or AC circuits which have only resistors in them. The situation changes for AC circuits which have non-resistive components in them.

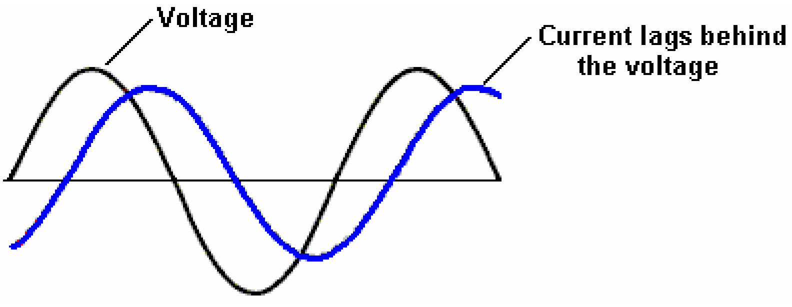
The circuits of this type which you are likely to come across are circuits which have coils in them, and you need to think about what you are doing when you deal with these types of circuit. For example, consider this circuit:



This is the output section of a prototype which you have just built. The input to the prototype is DC and measures at 12 volts, 2 amps (which is 24 watts). Your AC voltmeter on the output reads 15 volts and your AC ammeter reads 2.5 amps and you are delighted because 15 x 2.5 = 37.5 which looks much bigger than the 24 watts of input power. **But**, just before you go rushing off to announce on YouTube that you have made a prototype with COP = 1.56 or 156% efficient, you need to consider the real facts.

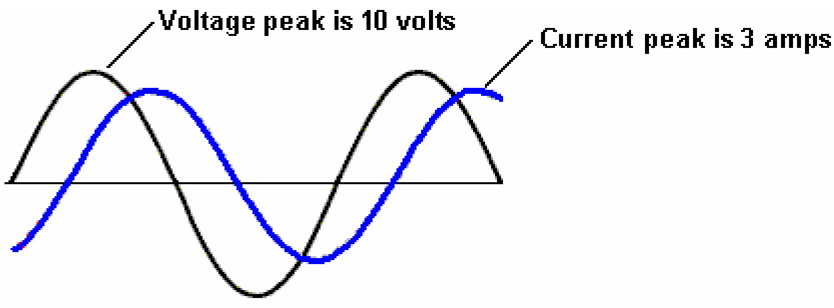
This is an AC circuit and unless your prototype is producing a perfect sine wave, then the AC voltmeter reading will be meaningless. It is just possible that your AC ammeter is one of the few types that can accurately measure the current no matter what sort of waveform is fed to it, but it is distinctly possible that it will be a digital meter which assesses current by measuring the AC voltage across a resistor in series with the output, and if that is the case, it will probably be assuming a sine wave. The odds are that both readings are wrong, but let's take the case where we have great meters which are reading the values perfectly correctly. Then the output will be 37.5 watts, won't it? Well, actually, no it won't. The reason for this is that the circuit is feeding the transformer winding which is a coil and coils don't work like that.

The problem is that, unlike a resistor, when you apply a voltage across a coil the coil starts absorbing energy and feeding it into the magnetic field around the coil, so there is a delay before the current reaches it's maximum value. With DC, this generally doesn't matter very much, but with AC where the voltage is changing continuously, it matters a great deal. The situation can be as shown in this graph of both voltage and current:

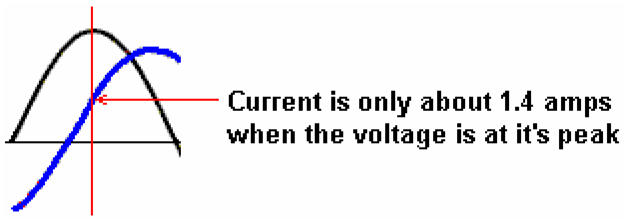


At first, this does not look like any great problem, but it has a very significant effect on the actual power in watts. To get the 37.5 watts output which we were talking about earlier, we multiplied the average voltage level by the average current level. But these two values do not occur at the same time and that has a major effect.

As this can be a little difficult to see, let's take the peak values rather than the averages as they are easier to see. Let's say that in our example graph that the voltage peak is 10 volts and the current peak is 3 amps. If this were DC we would multiply them together and say that the power was 30 watts. But with AC, this does not work due to the timing difference:

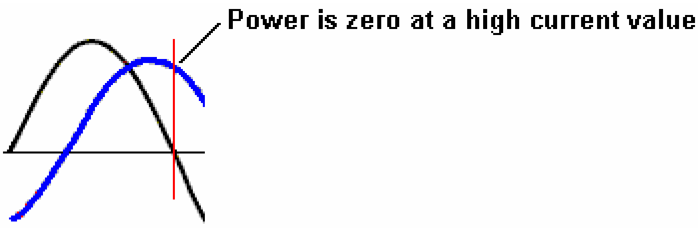


When the voltage is peaking, the current is nowhere near it's peak value of 3 amps:



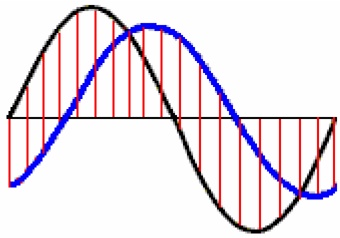
As a result of this, instead of getting our expected peak power at the top of the voltage peak, the actual power in watts is very much lower – less than half of what we were expecting. Not so good, but it gets worse when you look at the situation more closely. Take a look at what the voltage is when the current crosses the zero line, that is, when the current is zero. The output power is zero when the current is zero but this occurs when the voltage is at a very high value:

The same goes for when the voltage is zero. When the voltage is zero, then the power is also zero, and you will notice that this occurs when the current is at a high value:



The power is **not** the average current multiplied by the average voltage if there is a coil involved in the circuit – it will be less than that by an amount known as the "power factor" and I'll leave you to work out why it is called that.

So, how do you determine what the power is? It is done by sampling the voltage and current many times per second and averaging those combined results:



Both the voltage and the current are sampled at the times indicated by the vertical red lines and those figures are used to calculate the actual power level. In this example, only a few samplings are shown, but in practice, a very large number of samples will be taken. The piece of equipment which does this is known as a wattmeter as it measures watts of power. The sampling can be done by windings inside the instrument, resulting in an instrument which can be damaged by overloading without the needle being anywhere near full deflection, or it can be done by digital sampling and mathematical integration. Most digital sampling versions of these meters only operate at high frequencies, typically over 400,000 cycles per second. Both varieties of wattmeter can handle any waveform and not just sine waves.

The power company supplying your home, measures the current and assumes that the full voltage is present during all of the time that the current is being drawn. If you are powering a powerful electric motor from the mains, then this current lag will cost you money as the power company does not take it into account. It is possible to correct the situation by connecting one or more suitable capacitors across the motor to minimise the power loss.

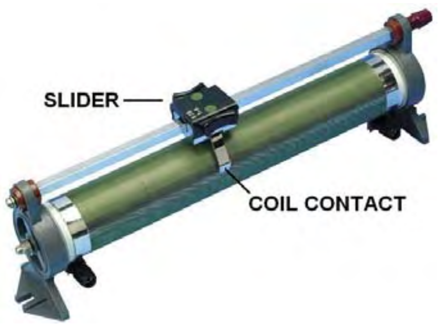
With a coil (fancy name "inductor" symbol "L"), AC operation is very different to DC operation. The coil has a DC resistance which can be measured with the ohms range of a multimeter, but that resistance does not apply when AC is being used as the AC current flow is **not** determined by the DC resistance of the coil. Because of this, a second term has to be used for the current-controlling factor of the coil, and the term chosen is "impedance" or for people who like to make everything sound unduly complicated "reactance". I will stick with the term "impedance" as it is clear that it is the feature of the coil which "impedes" AC current flow through the coil.

The impedance of a coil depends on it's size, shape, method of winding, number of turns and core material. It also depends on the frequency of the AC voltage being applied to it. If the core is made up of iron or steel, usually thin layers of iron which are insulated from each other, then it can only handle low frequencies. You can forget about trying to pass 10,000 cycles per second ("Hz") through the coil as the core just can't change it's magnetic poles fast enough to cope with that frequency. A core of that type is ok for the very low 50 Hz or 60 Hz frequencies used for mains power, which are kept that low so that electric motors can use it.

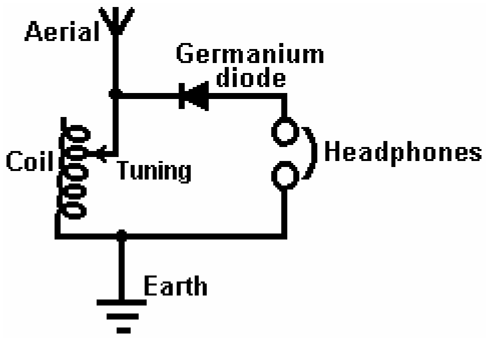
For higher frequencies, ferrite can be used for a core and that is why some portable radios use ferrite-rod aerials, which are a bar of ferrite with a coil wound on it. For higher frequencies (or higher efficiencies) iron dust encapsulated in epoxy resin is used. An alternative is to not use any core material and that is usually referred to as an "air-core" coil. These are not limited in frequency by the core but they have a very much lower inductance for any given number of turns. The efficiency of the coil is called it's "Q" (for "Quality") and the higher the Q factor, the better. The resistance of the wire lowers the Q factor.

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:

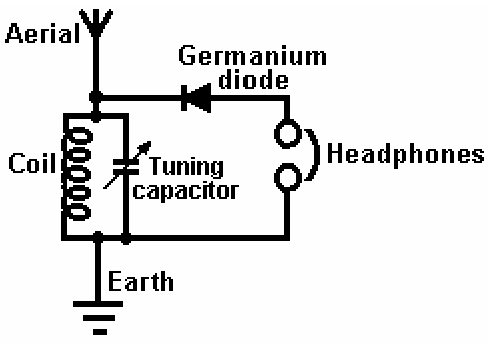


These have a coil of wire wound around a hollow former and a slider can be pushed along a bar, connecting the slider to different winds in the coil depending on it’s position along the supporting bar. The terminal connections are then made to the slider and to one end of the coil. The position of the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

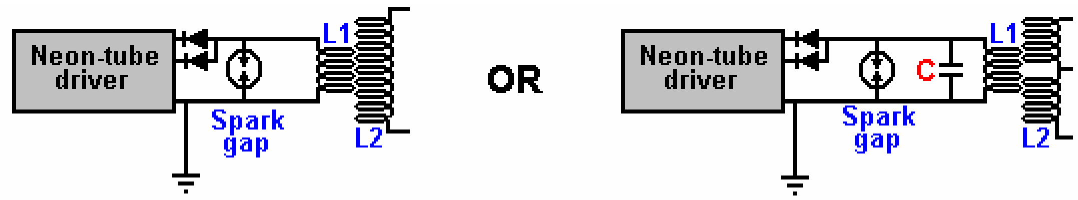
This system was soon changed when variable capacitors became available as they are cheaper to make and they are more compact. So, instead of using a variable coil for tuning the radio signal, a variable capacitor connected across the tuning coil did the same job:



While the circuit diagram above is marked “Tuning capacitor” that is actually quite misleading. Yes, you tune the radio receiver by adjusting the setting of the variable capacitor, **but**, what the capacitor is doing is altering the resonant frequency of the coil/capacitor combination and it is the resonant frequency of that combination which is doing exactly the same job as the variable coil did on it's own.

This draws attention to two very important facts concerning coil/capacitor combinations. When a capacitor is placed across a coil "in parallel" as shown in this radio receiver circuit, then the combination has a very high impedance (resistance to AC current flow) at the resonant frequency. But if the capacitor is placed "in series" with the coil, then there is nearly zero impedance at the resonant frequency of the combination:

This may seem like something which practical people would not bother with, after all, who really cares? However, it is a very practical point indeed. Remember that Don Smith often uses an early version, off-the-shelf neon-tube driver module as an easy way to provide a high-voltage, high-frequency AC current source, typically, 6,000 volts at 30,000 Hz. He then feeds that power into a Tesla Coil which is itself, a power amplifier. The arrangement is like this:



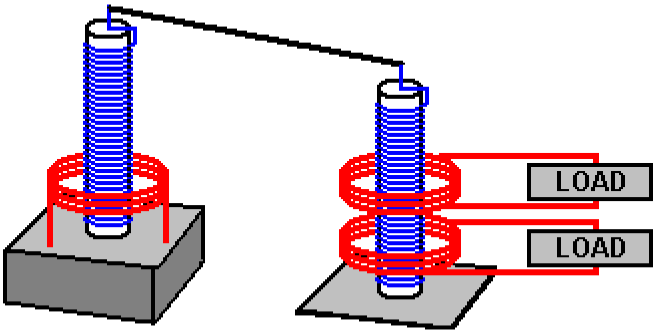
People who try to replicate Don's designs tend to say "I get great sparks at the spark gap until I connect the **L1** coil and then the sparks stop. This circuit can never work because the resistance of the coil is too low".

If the resonant frequency of the **L1** coil does not match the frequency being produced by the neon-tube driver circuit, then the low impedance of the **L1** coil at that frequency, will definitely pull the voltage of the neon-tube driver down to a very low value. But if the **L1** coil has the same resonant frequency as the driver circuit, then the **L1** coil (or the **L1** coil/capacitor combination shown on the right, will have a very high resistance to current flow through it and it will work well with the driver circuit. So, no sparks, means that the coil tuning is off. It is the same as tuning a radio receiver, get the tuning wrong and you don't hear the radio station.

This is very nicely demonstrated using simple torch bulbs and two coils in the YouTube video showing good output for almost no input power: http://www.youtube.com/watch?v=kQdcwDCBoNY and while only one resonant pick-up coil is shown, there is the possibility of using many resonant pick-up coils with just the one transmitter.

It should be stated that people have tried to replicate the devices which Don has described and have not been successful. Consequently, they believe that Don's presentations are a hoax and that he has never had any device which worked as he claimed. That is a rather doubtful conclusion to draw as the only certain thing which can be concluded is that they failed in their attempt. It is my experience that some people who attempt replications do not seem to have the 'knack' or perseverance needed to reach a successful result, while others do have what it takes. For example, many people tried to replicate Stan Meyer's water-splitter which he called his "Water Fuel Cell" or "WFC" for short, and they did not succeed. Dave Lawton in Wales decided to produce a replication and he had zero success for a whole month of effort. After a month of trying, his cell suddenly bust into substantial gas production, showing that the electrode pipes had to be "conditioned" before the cell would work properly. Most people would have given up long before the month was up, and declared that the WFC was a hoax. As a result of Dave's efforts and his generous sharing of what he did (in chapter 10), many people have now been very successful in replicating Stan Meyer's design. So, I will leave it up to you to decide if Don Smith's devices are a hoax. It should be understood, that there is no particular reason why anyone who was successful with Don's designs would necessarily tell me. Most will never even have heard of me.

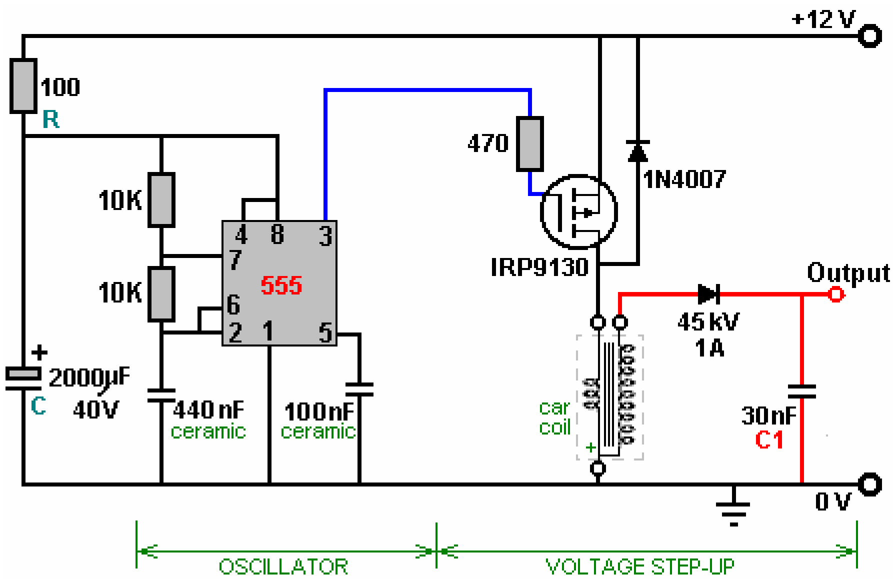
Bearing that in mind, I have been told of one man who used his common sense and produced an impressive result. He used a Tesla Coil as the driving force, and then used a second Tesla Coil back-to-back with the first one, to step the high voltage back down again. Doing that, he was able to light a series of powerful light bulbs from the "L1" output coils. He also confirmed that doubling the voltage, quadrupled the power output, verifying what Don said. He also found that adding additional coils with bulbs to the output Tesla Coil, did not increase the input power at all, did not cause any of the existing light bulbs to shine any less brightly, and yet lit the additional bulbs. That would appear to be confirmation of Don's statement that any number of magnetic copies of the original oscillating magnetic field of the first Tesla Coil, can provide a full-power electrical output without requiring any additional input power. I'm no expert, but my understanding of the arrangement is:



As the large diameter coil is exactly one quarter the length of the smaller diameter coil, there is an automatic resonance of both when the applied frequency is just right. As the first narrow coil is identical to the second narrow coil, they are also automatically resonant together. Again, as the large coils which feed the loads are exactly one quarter the wire length of the narrow coils, they also resonate at the common frequency and at that frequency, the input power is at its minimum while the output power is at its maximum. The spike at the top of each of the narrow coils is connected with a wire to channel the generated power from the first Tesla Coil to the second one.

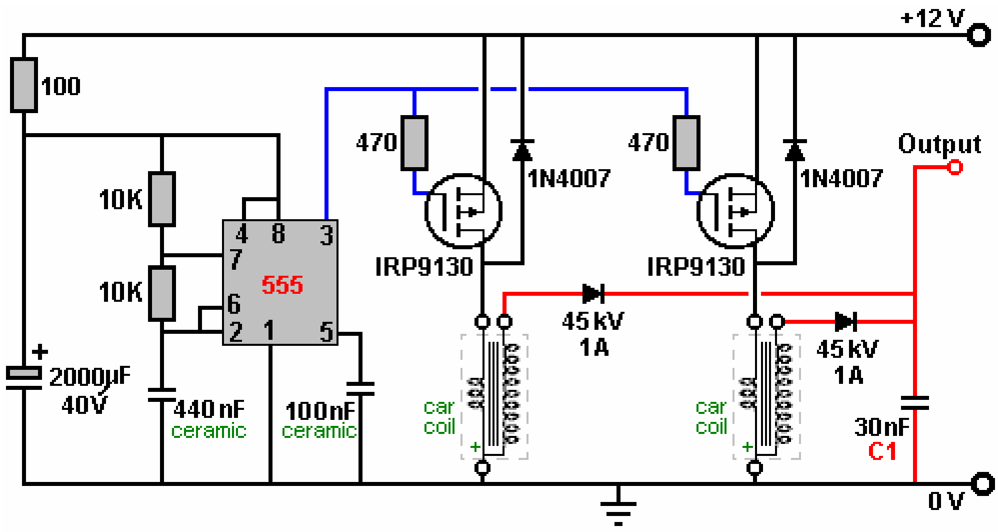
As some readers may feel that there is some "black magic" about the neon-driver circuit used by Don to drive the Tesla Coil section of his circuitry and that if a suitable unit could not be purchased then the circuit could not be reproduced or tested, it seems reasonable to show how it operates and how it can be constructed from scratch:

The circuit itself is made up of an oscillator to convert the 12-volt DC supply into a pulsating current which is then stepped up to a high voltage by a transformer. Here is a circuit which has been used for this:

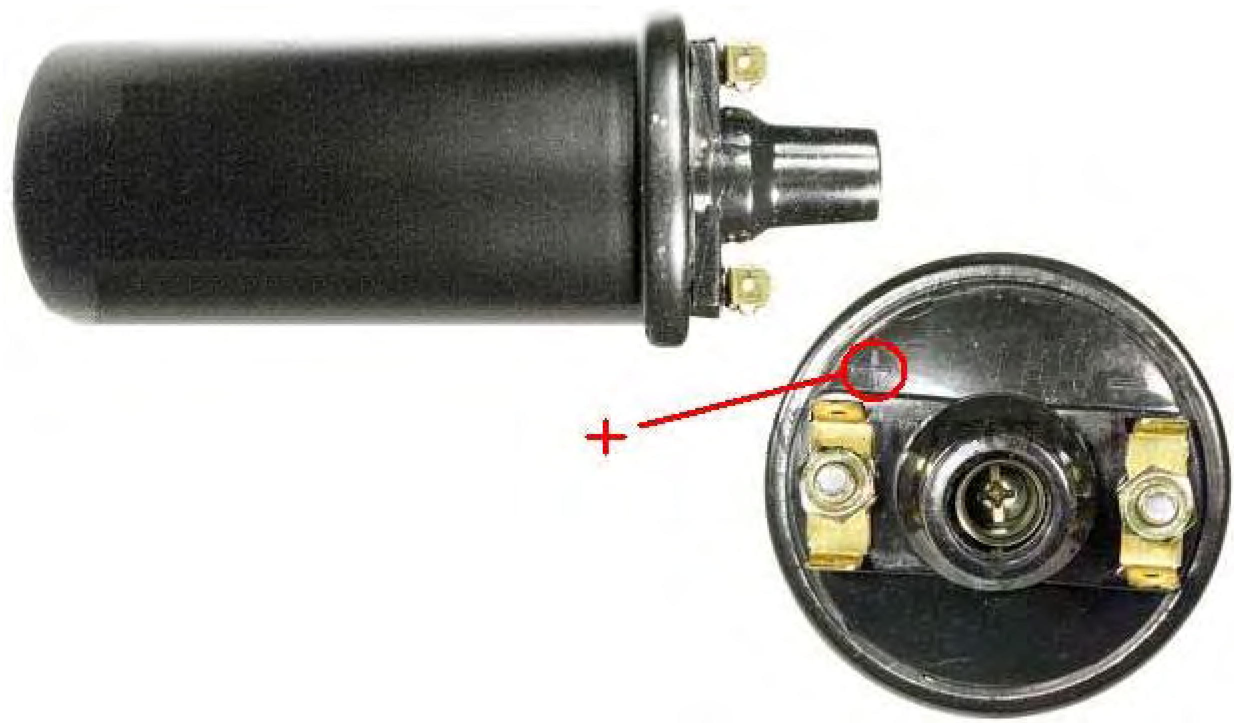


The supply for the 555 timer chip is protected against spikes and dips by the resistor "R" and the capacitor "C". The 555 timer chip acts as an oscillator or "clock" whose speed is governed by the two 10K resistors feeding the 440 nF capacitor. The step-up transformer is an ordinary car coil and the drive power to it is boosted by the IRP9130 FET transistor which is driven by the 555 chip output coming from it's pin 3.

The output from the (Ford Model T) car coil is rectified by the diode, which needs to have a very high voltage rating as the voltage at this point is now very high. The rectified voltage pulses are stored in a very high-voltage capacitor before being used to drive a Tesla Coil. As a powerful output is wanted, two car coils are used and their outputs combined as shown here:

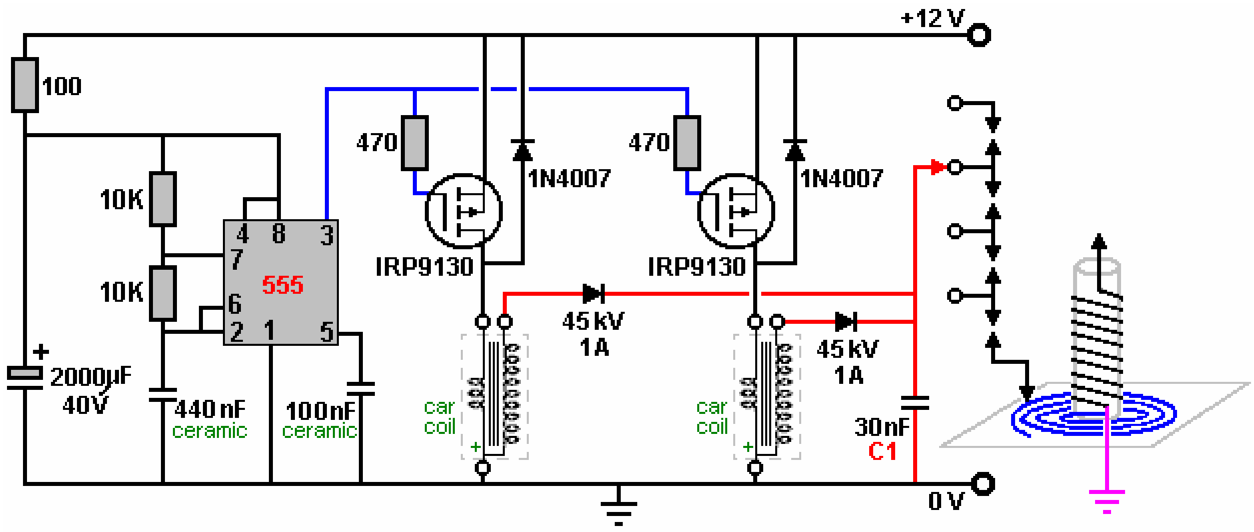


You will notice that the car coil has only three terminals and the terminal marked "+" is the one with the connection common to both of the coils inside the housing. The coil may look like this:

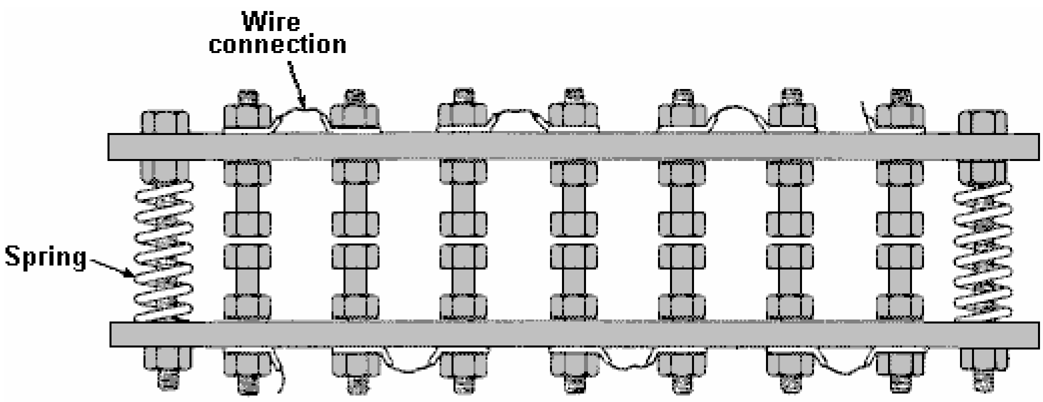


and the "+" is generally marked on the top beside the terminal with the two internal connections running to it. The circuit described so far is very close to that provided by a neon-tube driver circuit and it is certainly capable of driving a Tesla Coil.

There are several different way of constructing a Tesla Coil. It is not unusual to have several spark gaps connected in a chain. This arrangement is called a "series spark gap" because the spark gaps are connected "in series" which is just a technical way of saying "connected in a row". In the chapter on aerial systems, you will see that Hermann Plauston uses that style of spark gap with the very high voltages which he gets from his powerful aerial systems. These multiple spark gaps are much quieter in operation than a single spark gap would be. One of the possible Tesla Coil designs uses a pancake coil as the "L1" coil as that gives even higher gain. The circuit is as shown here:



The connection to the pancake coil is by a moveable clamp and the two coils are tuned to resonance by careful and gradual adjustment of that connection. The series spark gap can be constructed in various ways, including using car spark plugs. The one shown here uses nuts and bolts projecting through two strips of a stiff, non-conducting material, as that is much easier to adjust than the gaps of several spark plugs:



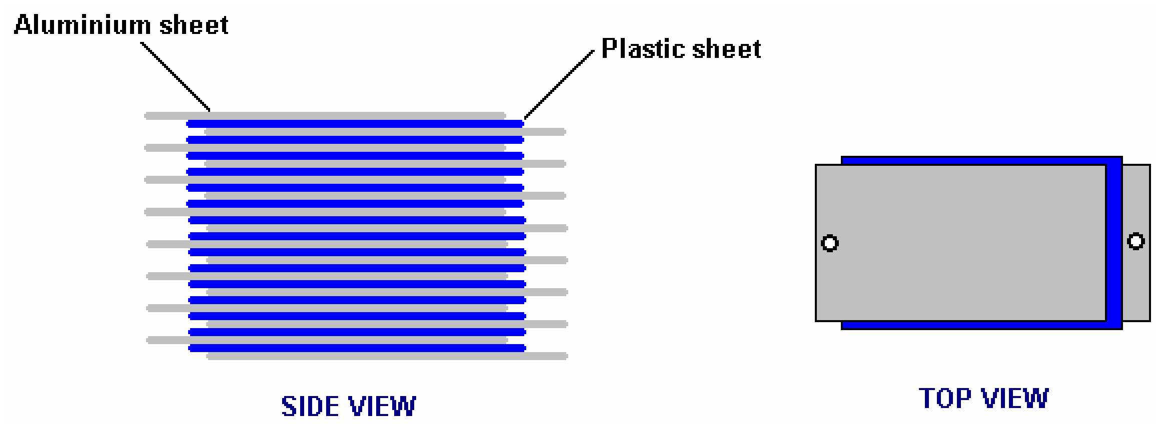
Tightening the bolts which compress the springs moves the bolt heads closer together and reduces all of the spark gaps. The electrical connections can be made to the end tags or to any of the intermediate wire connection straps if fewer spark gaps are required in the chain.

Let me remind you again that this is not a toy and very high voltages will be produced. Also, let me stress again that if you decide to construct anything, then you do so entire on your own responsibility. This document is only provided for information purposes and must not be seen as an encouragement to build any such device nor is any guarantee given that any of the devices described in this eBook will work as described should you decide to attempt to construct a replication prototype of your own. Generally, it takes skill and patience to achieve success with any free-energy device and Don Smith's devices are some of the most difficult, especially since he admits quite freely that he does not disclose all of the details.

The output capacitor marked "C1" in the circuit diagram above has to be able to handle very high voltages. There are various ways of dealing with this. Don dealt with it by getting very expensive capacitors manufactured by a specialist company. Some home-based constructors have had success using glass beer bottles filled with a salt solution. The outside of the bottles are wrapped in aluminium foil to form one of the contacts of the capacitor and bare wires are looped from deep inside each bottle on to the next one, looping from the inside of one bottle to the inside of the next one, and eventually forming the other contact of the capacitor. While that appears to work well, it is not a very convenient thing to carry around. An alternative is just to stand the bare bottles in a container which is lined with foil which forms the second contact of the capacitor.

One method which has been popular in the past is to use two complete rolls of aluminium foil, sometimes called "baking foil", laying them one flat, covering it with one or more layers of plastic cling film and laying the second roll of foil on top of the plastic. The three layers are then rolled up to form the capacitor. Obviously, several of these can be connected together in parallel in order to increase the capacitance of the set. The thicker the plastic, the lower the capacitance but the higher the voltage which can be handled.

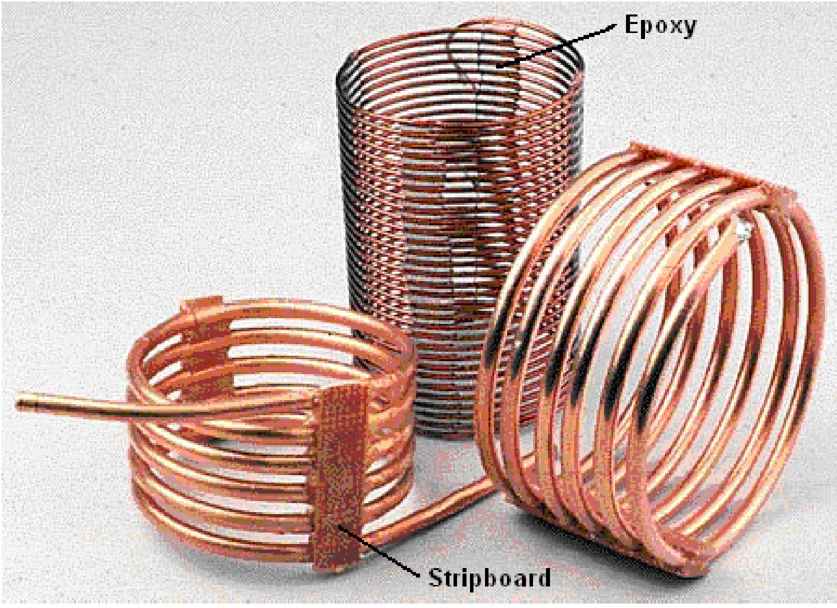
The November 1999 issue of Popular Electronics suggests using 33 sheets of the thin aluminium used as a flashing material by house builders. At that time it was supplied in rolls which were ten inches (250 mm) wide, so their design uses 14" (355 mm) lengths of the aluminium. The plastic chosen to separate the plates was polythene sheet 0.062 inch (1.6 mm) thick which is also available from a builders merchants outlet. The plastic is cut to 11 inch (280 mm) by 13 inch (330 mm) and assembly is as follows:



The sandwich stack of sheets is then clamped together between two rigid timber sheets. The tighter that they are clamped, the closer the plates are to each other and the higher the capacitance. The electrical connections are made by running a bolt through the projecting ends of the plates. With two thicknesses of plastic sheet and one of aluminium, there should be room for a washer between each pair of plates at each end and that would improve the clamping and the electrical connection. An alternative is to cut a corner off each plate and position them alternatively so that almost no plate area is ineffective.

As Don Smith has demonstrated in one of his video presentations, Nikola Tesla was perfectly correct when he stated that directing the discharge from a Tesla Coil on to a metal plate (or in Don's case, one of the two metal plates of a two-plate capacitor where a plastic sheet separates the plates just as shown above), produces a very powerful current flow onwards through a good earth connection. Obviously, if an electrical load is positioned between the plates and the earth connection, then the load can be powered to a high level of current, giving a very considerable power gain.

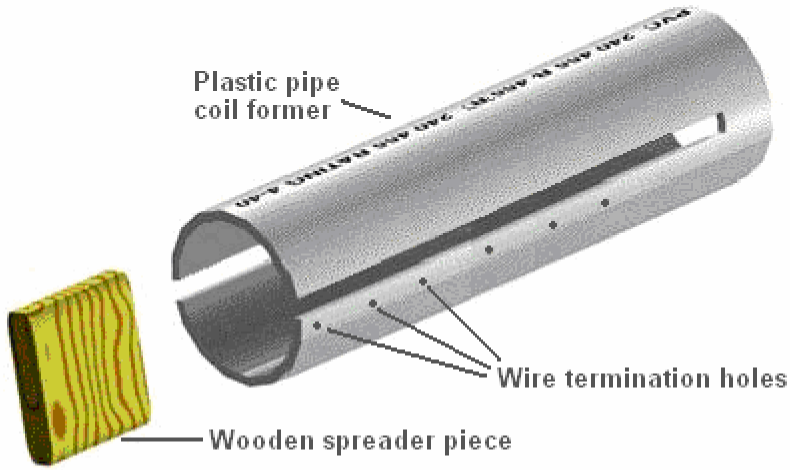
Coil Construction: The Barker & Williamson coils used by Don in his constructions are expensive to purchase. Some years ago, in an article in a 1997 issue of the “QST” amateur radio publication, Robert H. Johns shows how similar coils can be constructed without any great difficulty. The Electrodyne Corporation research staff have stated that off-the-shelf solid tinned copper wire produces three times the magnetic field that un-tinned copper does, so perhaps that should be borne in mind when choosing the wire for constructing these coils.



These home-made coils have excellent “Q” Quality factors, some even better than the tinned copper wire coils of Barker & Williamson because the majority of electrical flow is at the surface of the wire and copper is a better conductor of electricity than the silver tinning material.

The inductance of a coil increases if the turns are close together. The capacitance of a coil decreases if the turns are spread out. A good compromise is to space the turns so that there is a gap between the turns of one wire thickness. A common construction method with Tesla Coil builders is to use nylon fishing line or plastic strimmer cord between the turns to create the gap. The method used by Mr Johns allows for even spacing without using any additional material. The key feature is to use a collapsible former and wind the coil on the former, space the turns out evenly and then clamp them in position with strips of epoxy resin, removing the former when the resin has set and cured.

Mr Johns has difficulty with his epoxy being difficult to keep in place, but when mixed with the West System micro fibres, epoxy can be made any consistency and it can be applied as a stiff paste without any loss of it’s properties. The epoxy is kept from sticking to the former by placing a strip of electrical tape on each side of the former.



I suggest that the plastic pipe used as the coil former is twice the length of the coil to be wound as that allows a good degree of flexing in the former when the coil is being removed. Before the two slots are cut in the plastic pipe, a wooden spreader piece is cut and it’s ends rounded so that it is a push-fit in the pipe. This spreader piece is used to hold the sides of the cut end exactly in position when the wire is being wrapped tightly around the pipe.

Two or more small holes are drilled in the pipe beside where the slots are to be cut. These holes are used to anchor the ends of the wire by passing them through the hole and bending them. Those ends have to be cut off before the finished coil is slid off the former, but they are very useful while the epoxy is being applied and hardening. The pipe slots are cut to a generous width, typically 10 mm or more.

The technique is then to wedge the wooden spreader piece in the slotted end of the pipe. Then anchor the end of the solid copper wire using the first of the drilled holes. The wire, which can be bare or insulated, is then wrapped tightly around the former for the required number of turns, and the other end of the wire secured in one of the other drilled holes. It is common practice to make the turns by rotating the former. When the winding is completed, the turns can be spaced out more evenly if necessary, and then a strip of epoxy paste applied all along one side of the coil. When that has hardened, (or immediately if the epoxy paste is stiff enough), the pipe is turned over and a second epoxy strip applied to the opposite side of the coil. A strip of paxolin board or strip-board can be made part of the epoxy strip. Alternatively, an L-shaped plastic mounting bracket or a plastic mounting bolt can be embedded in the epoxy ready for the coil installation later on.

When the epoxy has hardened, typically 24 hours later, the coil ends are snipped off, the spreader piece is tapped out with a dowel and the sides of the pipe pressed inwards to make it easy to slide the finished coil off the former. Larger diameter coils can be wound with small-diameter copper pipe.

The coil inductance can be calculated from:

Inductance in microhenrys $L = d^2n^2 / (18d + 40l)$

Where:
d is the coil diameter in inches measured from wire centre to wire centre
n is the number of turns in the coil
l is coil length in inches (1 inch = 25.4 mm)

Using this equation for working out the number of turns for a given inductance in microhenrys:

$$n = \frac{\sqrt{L(18d + 40l)}}{d}$$

Kwang-jeek Lee. There is a most interesting patent application from Mr Lee in which he shows clearly how arranging a resonant circuit which is placed between the power supply and the load which is being powered by that power supply, can have a spectacular effect. His patent application may be a little difficult for some to follow in detail, and if that is the case then please just pay attention to the overall effect as described by him here:

Patent Application US 2008/0297134 12th April 2008 Inventor: Kwang-jeek Lee

CIRCUIT FOR TRANSMITTING AMPLIFIED RESONANT POWER TO A LOAD

ABSTRACT
A circuit for transferring amplified resonant power to a load is disclosed. The circuit transfers amplified resonant power, which is generated in an inductor of a conventional transformer when serial or parallel resonance of a conventional power supply is formed. This amplified power is transferred to a load through the conventional transformer. The circuit comprises of: a power supply for producing and supplying voltage or current; a power amplifier for generating amplified resonant power using the voltage or current; and a power transferring unit for transferring the amplified resonant power to the load using a transformer

TECHNICAL FIELD
The present invention relates to a power amplifier circuit and its power transferring capabilities. More particularly, this invention relates to a circuit which can transfer amplified resonant power, to a load through a conventional transformer, the power being generated by an inductor of a conventional transformer when serial or parallel resonance of a conventional power supply is formed.

BACKGROUND ART
An electric power supply produces electric power and supplies that electric power to a load which is connected directly to it. An example of such an electric power supply is an electric generator. When such an electric