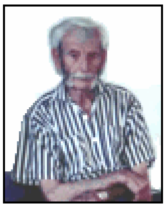
# A Practical Guide to 'Free Energy' Devices

Part D2: Last updated: 12th August 2006 Author: Patrick J. Kelly

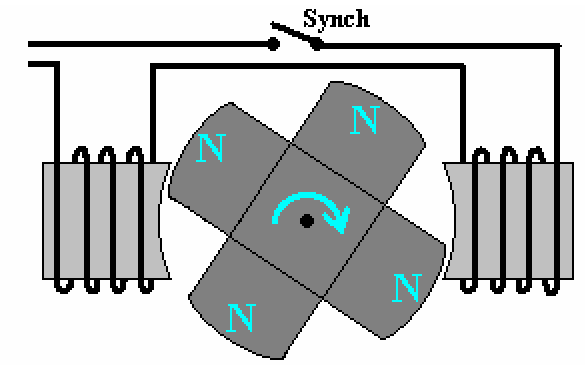
## 2. Energy can be captured via a strong and very brief magnetic pulse (continued)

Ed Gray snr., Robert Adams/Tim Harwood, Bill Muller, John Bedini, Bob Teal, etc.

**Robert Adams.** Robert Adams, an electrical engineer of New Zealand designed and built an electric motor using permanent magnets on the rotor and pulsed electromagnets on the frame of the motor. He found that the output from his motor exceeded the input power by a large margin.



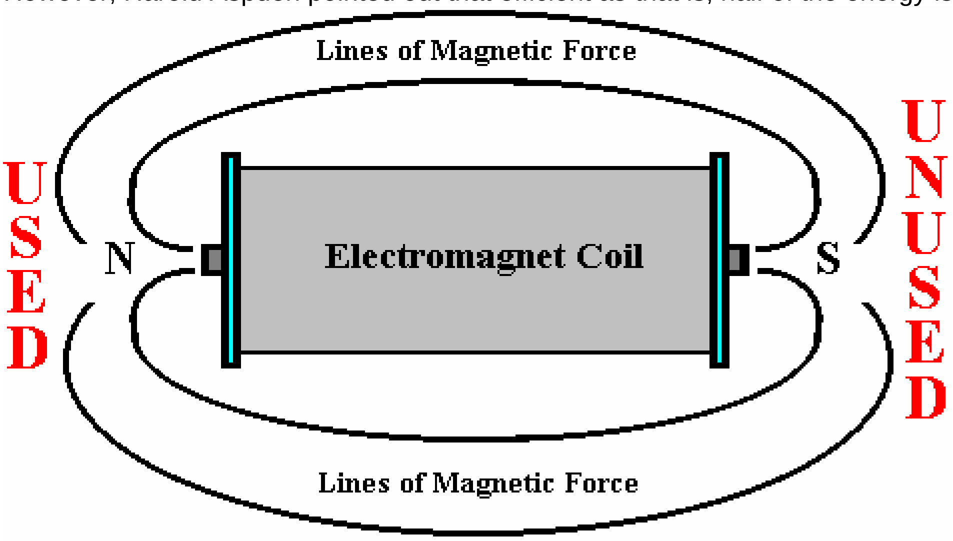
The diagram of his motor is:



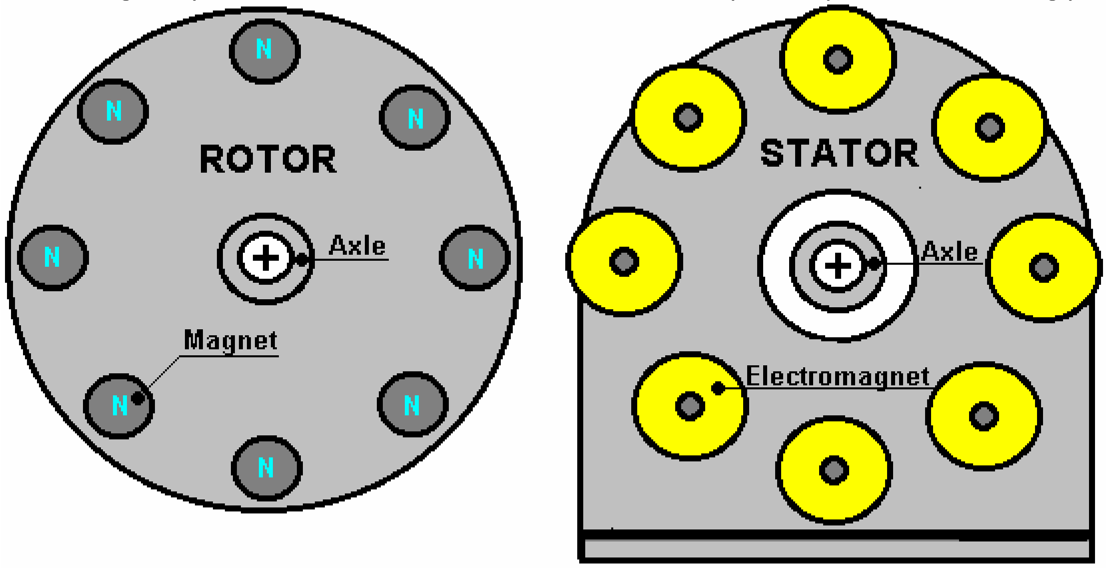

with all of the rotor magnets presenting a North pole to the electromagnets. The motor efficiency is high because the electromagnet pulses are timed so that the electromagnet has a South pole as the rotor magnet approaches it. This accelerates the rotor towards the electromagnet. The pulse is cut just as the rotor reaches the electromagnet.

Electromagnets reverse their magnetism briefly when the current is cut off. This motor utilises that feature by timing the current cut-off so that the electromagnet becoming a North pole pushes the rotor pole away, increasing the drive from a single pulse. To recap; the pulse causes the electromagnet to attract the rotor magnet as it approaches and then repels the rotor magnet just after it has passed by. This is very efficient use of the electrical power.

However, Harold Aspden pointed out that efficient as that is, half of the energy is still being wasted:

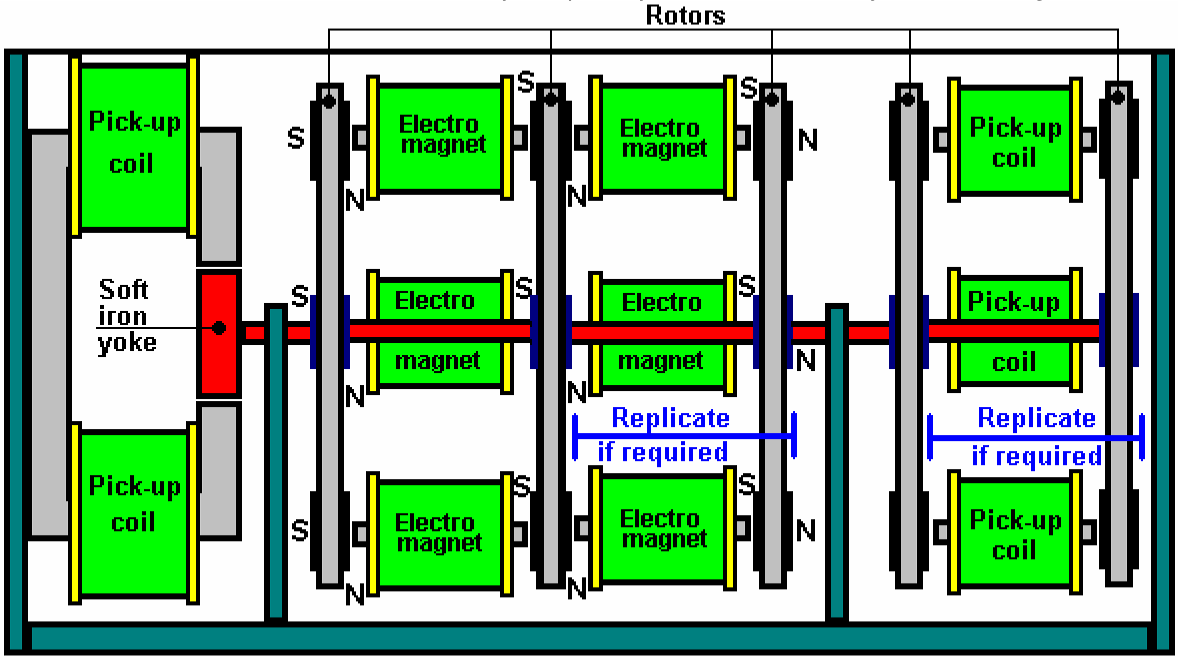


The Adams motor expends electrical energy when it powers the coils of the electromagnets and it uses **one** pole to drive the motor. The magnetic energy generated at the other end of the electromagnet is wasted. You can therefore double the turning force ("torque") of the motor for no additional use of current if you place the electromagnets parallel to the shaft of the motor and use two (or more) rotor disks holding permanent magnets:




The layout for the Adams/Aspden motor shown below suggests two different methods of generating an electrical output from the device. On the right, a bank of eight pick-up coils collect energy from the magnets passing them. Builders of these motors recommend that the pick-up coils are provided with their own magnet rotor, rather than using the outer sides of the rotors driven by the electromagnets, so that arrangement is shown here.

On the left, the motor shaft is used to rotate a rectangular soft iron yoke (shown in red). At one point in its rotation, this yoke almost completely bridges the gap between the ends of a powerful C-shaped magnet. When the yoke rotates a further ninety degrees, the width, rather than the length, of the yoke is presented to the magnet which creates a significant air gap between the ends of the C-shaped magnet. As this is a very much poorer magnetic path, the rotation causes a fluctuation in the magnetic flux passing through the magnetic circuit and this is collected by the pick-up coils wound on that magnet. The advantage of this arrangement is that there is almost no change in the load on the shaft, no matter how heavily the pick-up coils are loaded by current being drawn from them.




The power of an electromagnet increases with the number of turns of wire around its core. It also increases to a major degree as the current through the winding is increased. As the diameter of the winding increases, the length of wire needed for one turn increases directly in proportion to the diameter. As the resistance of the winding is proportional to the length of wire in the winding (you having already decided on the diameter of the wire), it follows that the magnetic effect for any given voltage applied to the winding, will be greater the smaller the diameter of the core.

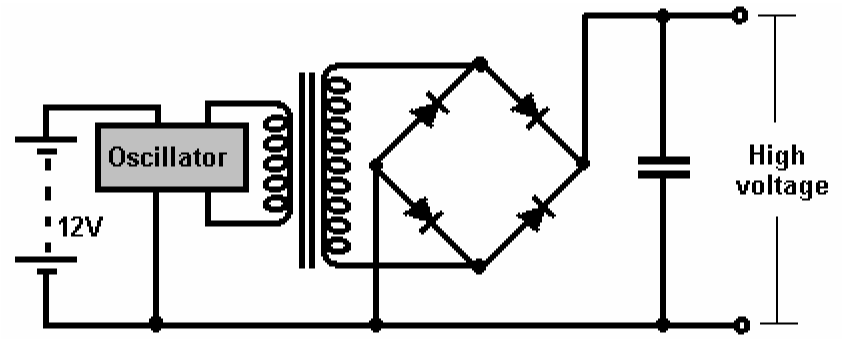
The electromagnet could have an air core, but it is far more effective with a soft iron core. The iron core loses power when pulsed due to eddy currents generated in the iron. The same effect applies to transformer frames, so they are constructed of thin sheets of metal, each insulated from its neighbours. It is suggested therefore, that the core of an electromagnet would be more efficient if it were not a solid piece of metal. Perhaps it would be best if it were constructed from wires cut to the appropriate length and insulated with lacquer which can withstand high voltages or failing that, enamel paint. If the central wire is longer than the others it effectively becomes a pointed core (in magnetic terms) and this concentrates the magnetic flux strongly. Alternatively, since the rotor magnets are probably wider than the electromagnet core, a flat screwdriver shape to the central core wires should be even more effective although more difficult to construct.

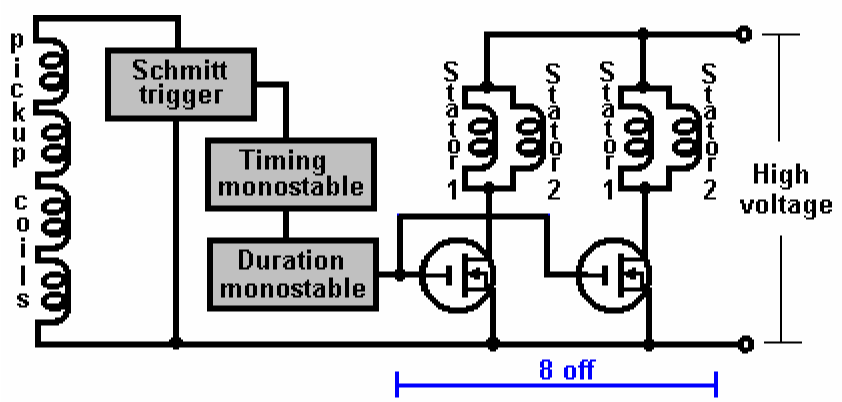
The number of electromagnets is a matter of personal choice. The sketch above shows eight electromagnets per stator, which gives the motor eight drive pulses per rotation. As shown, there can be as many rotors and stators in the motor as you choose. The gap between the electromagnet and the rotor magnets is of major importance and needs to be as small as it is practical to make it. The rotor can have any number of magnets from one upwards. If there is only one electromagnet then the spacing of the rotor magnets is not critical. If there is more than one electromagnet, then the spacing of the rotor magnets needs to match exactly, the spacing of the electromagnets so that when an electrical pulse is applied, there is a rotor magnet opposite each electromagnet.

The powering of the coils creates an attraction when each rotor magnet approaches and then cuts off to produce a repulsion as the rotor magnet passes the stator electromagnet. This timing can be taken directly from the pick-up coil bank as its voltage rises as the magnets pass by. This varying voltage waveform can be sharpened up by using a Schmitt trigger circuit. The exact synchronisation can be governed by two monostables, one to set the delay before the pulse starts and one to control the exact length of the pulse.

Alternatively, a separate movable pick-up coil can be used and its position adjusted to give optimum operation. Another variation is to use a hole through one rotor beside each magnet and positioning an LED to shine through the holes, on to an opto device, to mark the rotation position. A less efficient method is to use a Hall-effect magnetic detector to register the magnet position.

As the voltage applied to the electromagnets is crucial, it is worth stepping it up to a high level before applying it to the coils. A suggested arrangement is then:



There is a large amount of practical information on the construction of this type of motor at the web site http://members.fortunecity.com/freeenergy2000/adamsmotor.htm. For instance, Tim Harwood shares his experience having constructed many such motors and run many tests. A few of his observations are:

1. Ohm's Law does not apply to a correctly tuned Adams motor as the current flow is 'cold energy' rather than conventional energy being used. The greater the load on a properly set-up and tuned motor, the *colder* the stator coils and driving transistors become - the reverse of the situation for conventional energy where increased load requires increased current which produces *increased* heat. Small diameter wire can therefore be used for the electromagnet windings.

2. The cross-sectional area of each electromagnet core should be one quarter of the area of each rotor magnet.

3. The depth of the electromagnet winding should be the same as the maximum distance one rotor magnet can pull a paper-clip to itself.

4. Electromagnet wire of 24 AWG (0.511mm dia, about 25swg) is a suitable size for windings.

5. The stator windings in series should have a (presumably DC) resistance of about ten ohms.

6. He uses steel nails with a 3/8" head, 100mm shaft for the electromagnet cores. He selects these carefully from a large supply, to pick those with the best magnetic characteristics and which have a head slightly angled away from the official ninety degrees of a correctly manufactured head.

7. He finds that a electrical tape cover to both the electromagnet core before winding and outside the winding on completion, help the characteristics of the electromagnets.

8. He uses outward facing rotor magnets only and finds that having the South pole facing the electromagnets gives a slightly better result.

9. He tunes his motors using 12 Volts and then increases the voltage to 240 Volts.

10. If you use a Hall-effect semiconductor to trigger the timed pulses, he suggests buying several as they are very easy to damage.

11. The construction of the motor frame, supports, enclosure, etc. should avoid all magnetic materials as these can make the tuning difficult and they may block the tapping of 'cold' electricity.

12. It is important that the gap between the rotor magnets and the stator electromagnet cores does not exceed 1.5mm. A gap of 1.0 to 1.5mm works well but above that, the over-unity effect does not appear to occur. He has had outputs double that of the input for sustained periods. This he calls a "COP" of 2.0 - this web site is most definitely worth examining.

Harold Aspden and Robert Adams collaborated to develop and enhance Robert's motor design. They were awarded patent GB 2,282,708 in April 1995. This full patent forms part of this collection of documents and it is for an enhanced design which has one pole fewer in the stator than the number of poles in the rotor.

Practical details are included in the patent. For example, it is important for the width of the magnetic poles of the stator (viewed along the axle) to be only half as wide as the magnetic poles of the rotor. In fact, it can be an advantage for the stator poles to be less than half the width of the rotor poles. In the following diagrams, the magnetic poles of the stator are shown in blue and the magnetic poles of the rotor are shown in red.

With a motor of this type, it is important that the operational efficiency is as high as possible. In Fig.8 shown here, there are seven magnetic arms on the rotor, while there are eight electromagnets in the stator. This mis-match is important as this motor design operates by a stator magnet attracting a rotor magnet, and when the two line up, the stator electromagnet is pulsed to negate its magnetism. The mismatch in the number of poles causes any aligned pair of poles to have non-aligned poles $180^0$ away from them. This can be seen from the following diagram:

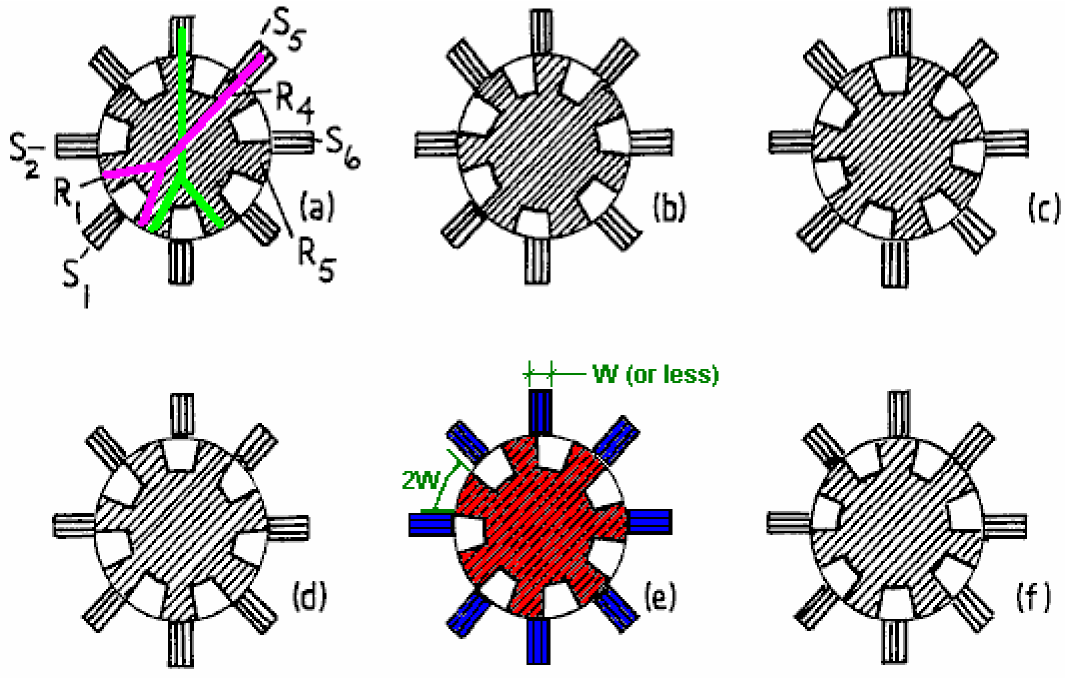



FIG.5

The suggested construction method for this motor is somewhat unusual, as shown here:

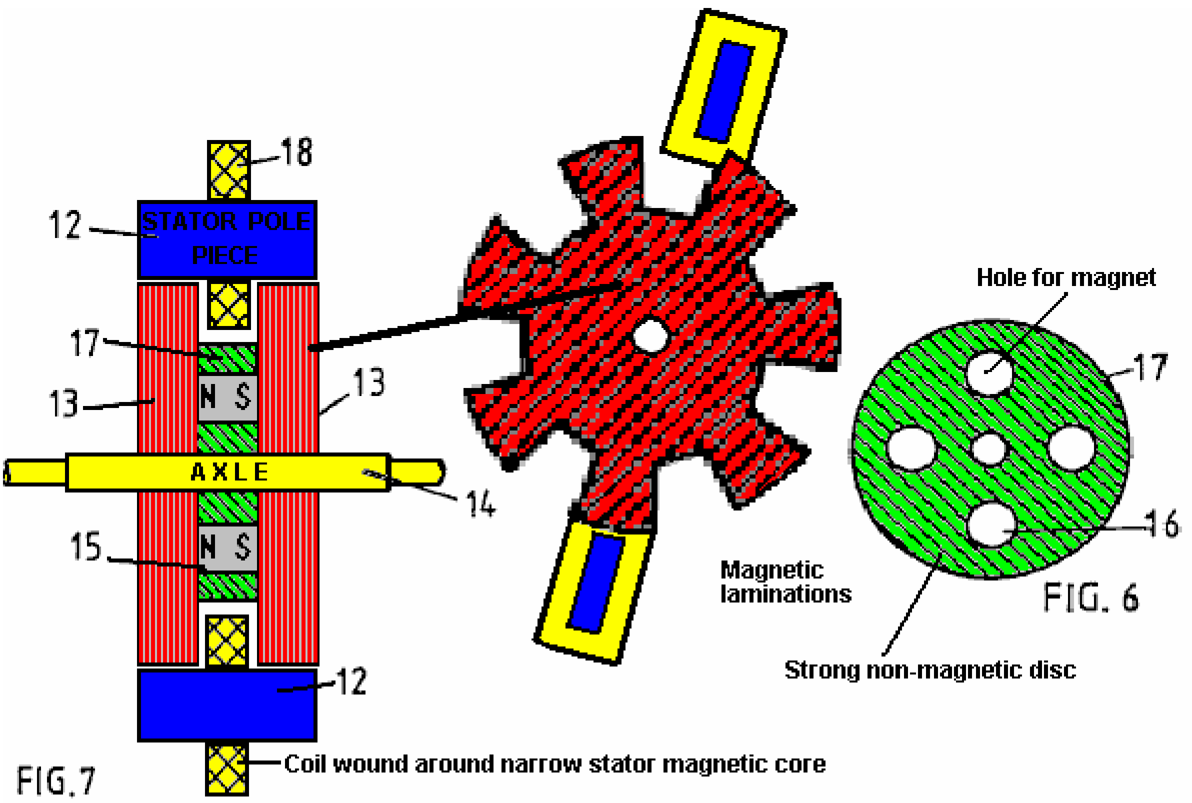



FIG.7

FIG. 6

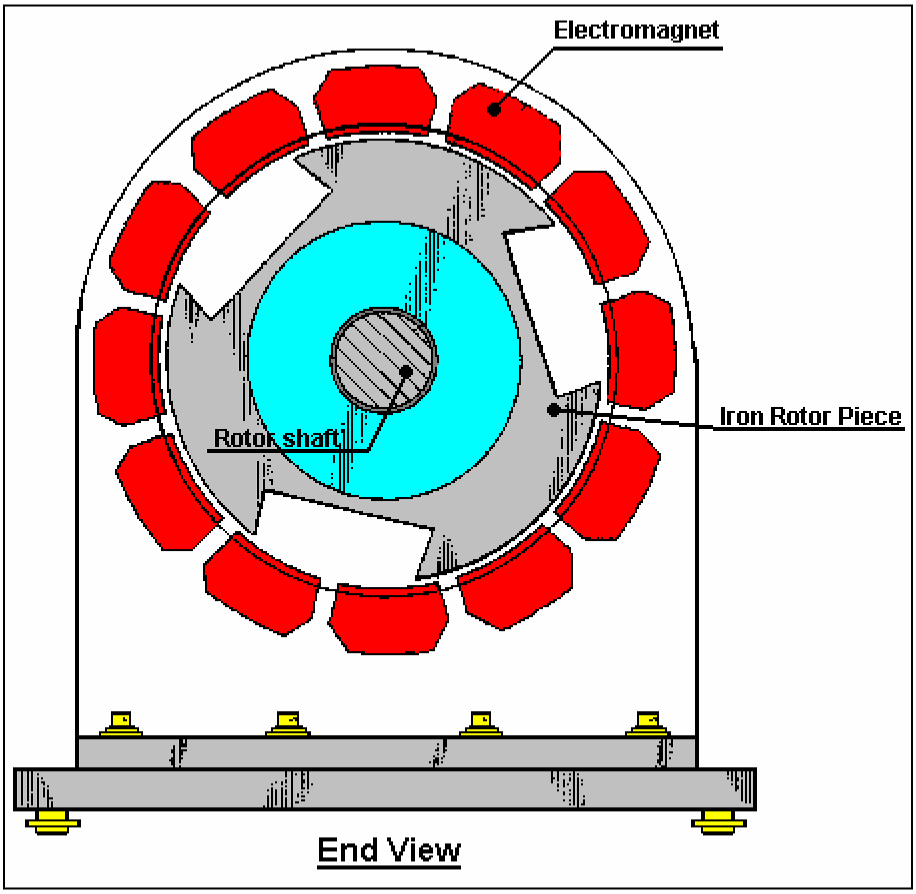
The magnetic poles of the rotor are built up from thin laminations insulated from the neighbouring laminations to prevent eddy current losses, and these laminations overlap the windings of the stator electromagnets. The diagram above only shows two of these electromagnets although there would typically be eight of them for a rotor with seven poles as shown. An interesting feature is the method of using four magnets embedded in the (green) supporting disc to provide the magnetism for the rotor laminations.

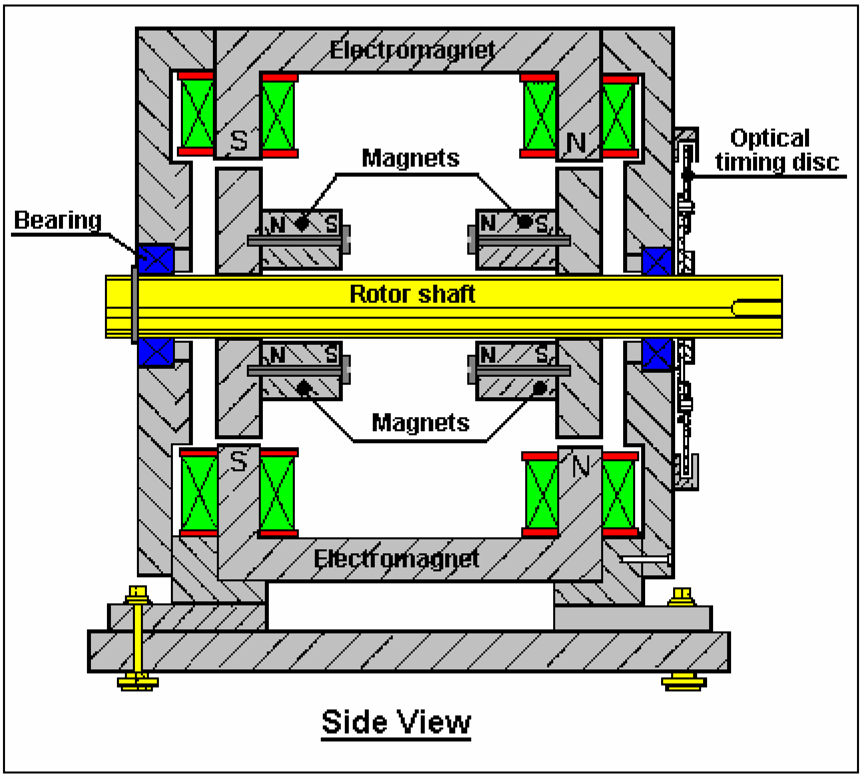
It is suggested by Harold and Robert, that this arrangement be considered to be a straight motor, used to power a conventional electrical generator, rather than using additional pick-up coils attached to the motor frame to generate electrical power as part of the device itself. Motors of this type have been recorded as producing output power which is seven times the input power. This is referred to as a "COP of 7.0" and is a clear indication of "over-unity" operation, which is supposedly impossible.

It should be remarked that having an output power greater than the input power is considered impossible, due to the "Law of Conservation of Energy". This is, of course, not true, as the "Law" (actually an expected result deduced from many measured observations) only applies to 'closed' systems and all of the 'over-unity' devices described here are not 'closed' systems. If the so-called "Law" applied to all systems, then a solar panel would be impossible, because when it is in sunlight, it produces a continuous electrical current. The power which you put in, is zero, the power coming out may well be 120 watts of electricity. If it is a 'closed' system, then it is impossible. Of course, it is not a 'closed' system as sunlight is streaming down on to the panel, and if you measure the energy reaching the panel and compare it to the energy coming out of the panel, it shows that the panel has an efficiency which is less than 20%.

The same situation applies to magnetic devices. Permanent magnets channel energy from the environment into any device which utilises them. As this is external power, a properly constructed magnetic device is capable of a performance which would be 'over-unity' if it were a 'closed' system. There are many devices which have a COP which is greater than 1.0, i.e. the output power exceeds the input power provided by the user. The objective of this set of documents is to make you aware of some of these devices, and more importantly, you alert you to the fact that it is perfectly possible to tap external energy and so provide power which appears to be completely free, in the same way that sunlight is 'free'.

**Teruo Kawai**. In July 1995, a patent was granted to Teruo Kawai for an electric motor. In the patent, Teruo states that a measured electrical input 19.55 watts produced an output of 62.16 watts. The main sections of that patent are included in this set of documents.

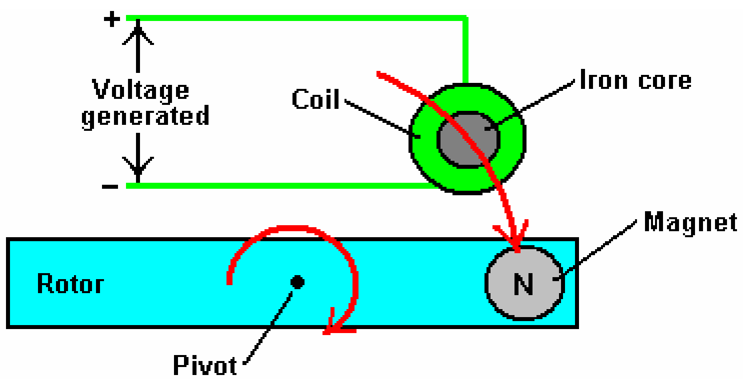





In this motor, a series of electromagnets are placed in a ring to form the active stator. The rotor shaft has two iron discs mounted on it. These discs have permanent magnets bolted to them and they have wide slots cut in them to alter their magnetic effect. The electromagnets are pulsed with the pulsing controlled via an optical disc arrangement mounted on the shaft. The result is a very efficient electric motor whose output has been measured as being in excess of its input.

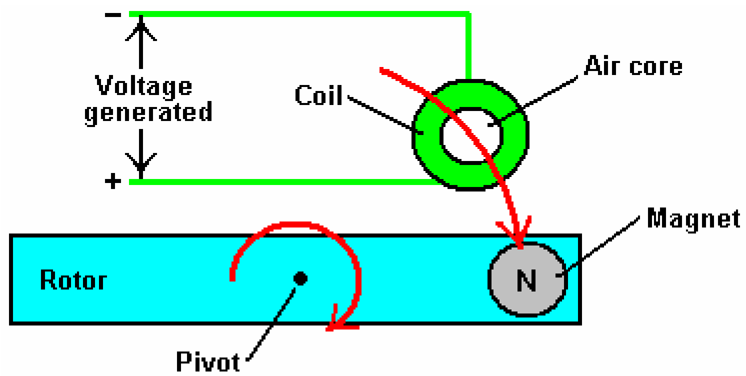
**The Butch Lafonte Motor / Generator.** Butch has designed an intriguing Motor / Generator system based on the balancing of magnetic and electrical forces. This clever design operates according to the following statements made by Butch:

1. If a magnet is moved away from an iron-cored coil, it generates a voltage:



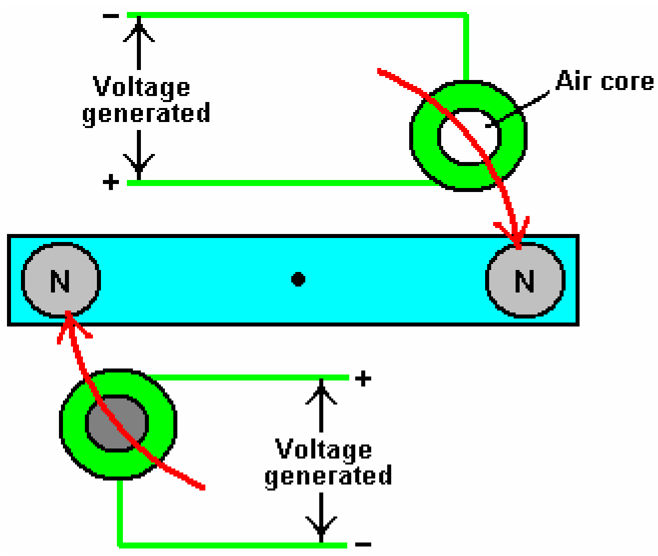

The voltage generated for any given magnet and speed of movement, is directly proportional to the number of turns of wire which make up the coil.

2. If a magnet is moved away from an air-cored coil, it also generates a voltage. However, the big difference is that the voltage is of the opposite polarity. In other words, the plus and minus connections are swapped over:

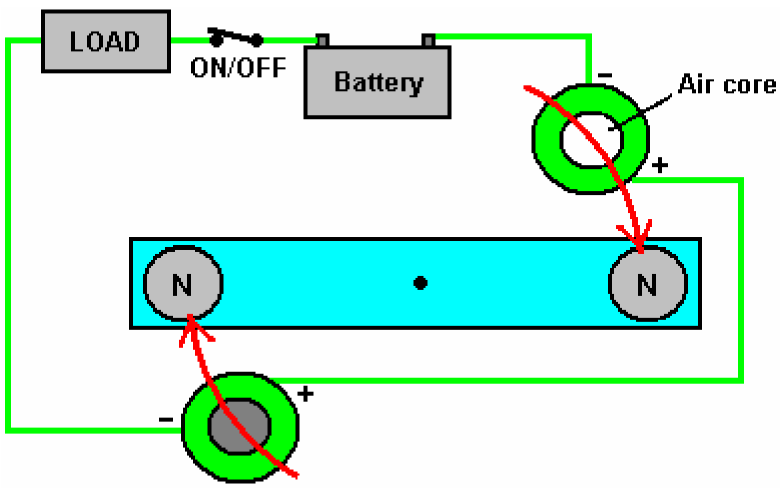



Again, the voltage generated for any given magnet and speed of movement, is directly proportional to the number of turns of wire which make up the coil.

So, if these two arrangements are joined together, they produce a system where the voltages cancel each other exactly, provided that the number of turns in each coil are adjusted to produce exactly the same voltages. The mechanical attraction and repulsion forces also balance, so the circuit can be arranged to have no net effect when the rotor is rotated:




It follows then, that this motor arrangement could be introduced into an existing circuit without affecting the operation of that circuit. The arrangement would look like this:

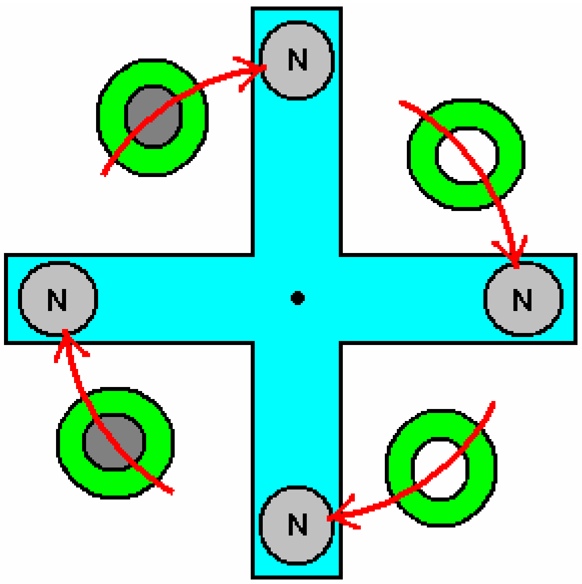


Here, there is no net electrical or magnetic drag on the rotor as the magnets move away from the coils. The battery supplies current to the load in the normal way and rotor arrangement has no effect on the operation of the circuit.

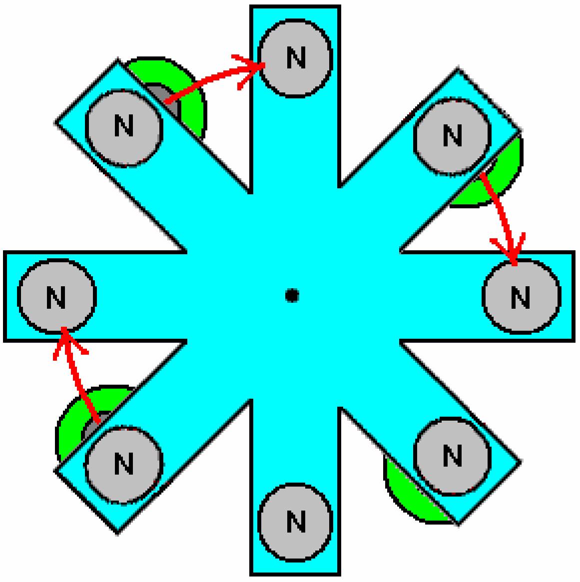
However, when the rotor reaches $100^{O}$ or so, past the coils, the On/Off switch can be opened. This leaves the rotor in an unbalanced condition, with there being an attraction between one magnet and the iron core of one coil. There is no matching repulsion between the other magnet and the air core of the other coil. This produces a rotational force on the rotor shaft, keeping it spinning and providing useful mechanical power which can be used to generate additional power. This extra mechanical power is effectively free, as the original circuit is not affected by the inclusion of the rotor system.

From a practical point of view, to give high rotational speed and long reliable life, the On/Off switch would need to be an FET transistor with electronic timing related to the rotor position.

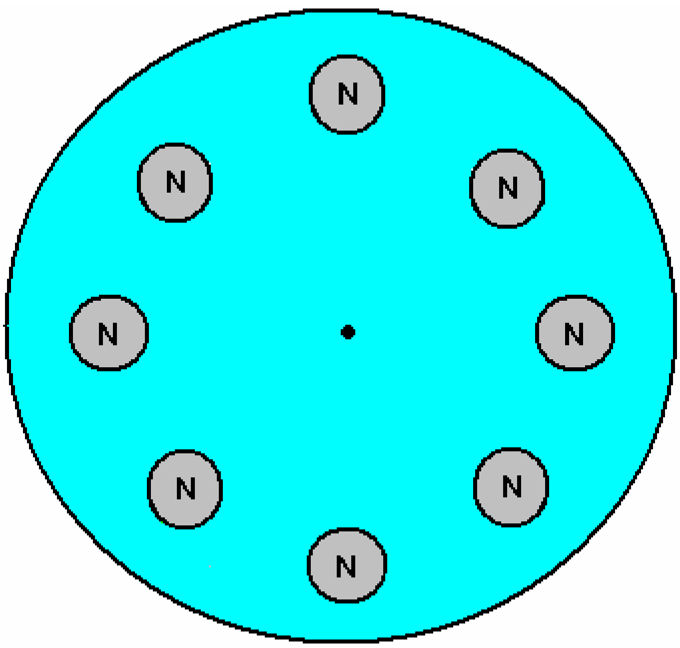
There is no need for the rotor to have only two magnets. It would be more efficient if it had four:



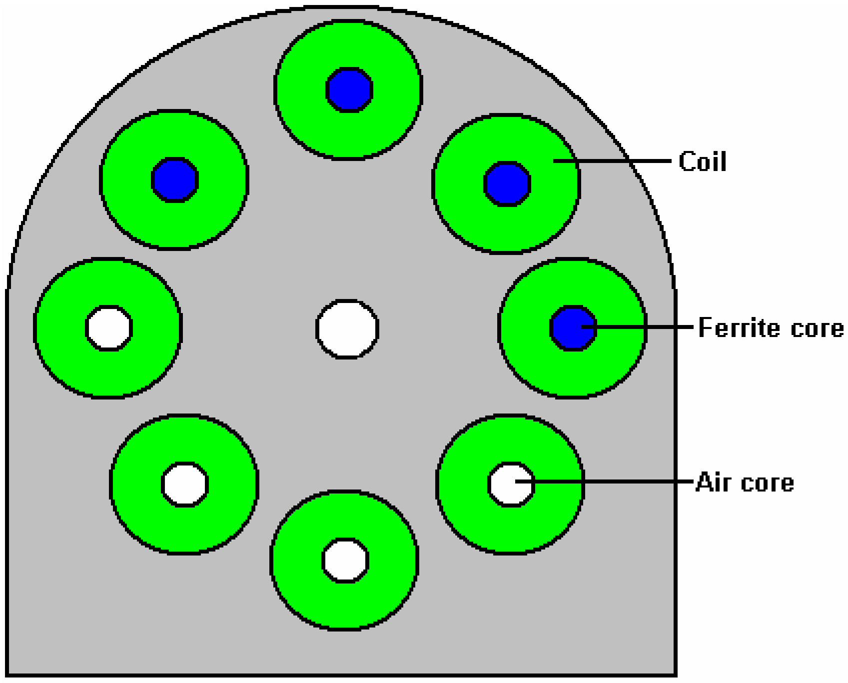

Or better still, eight:



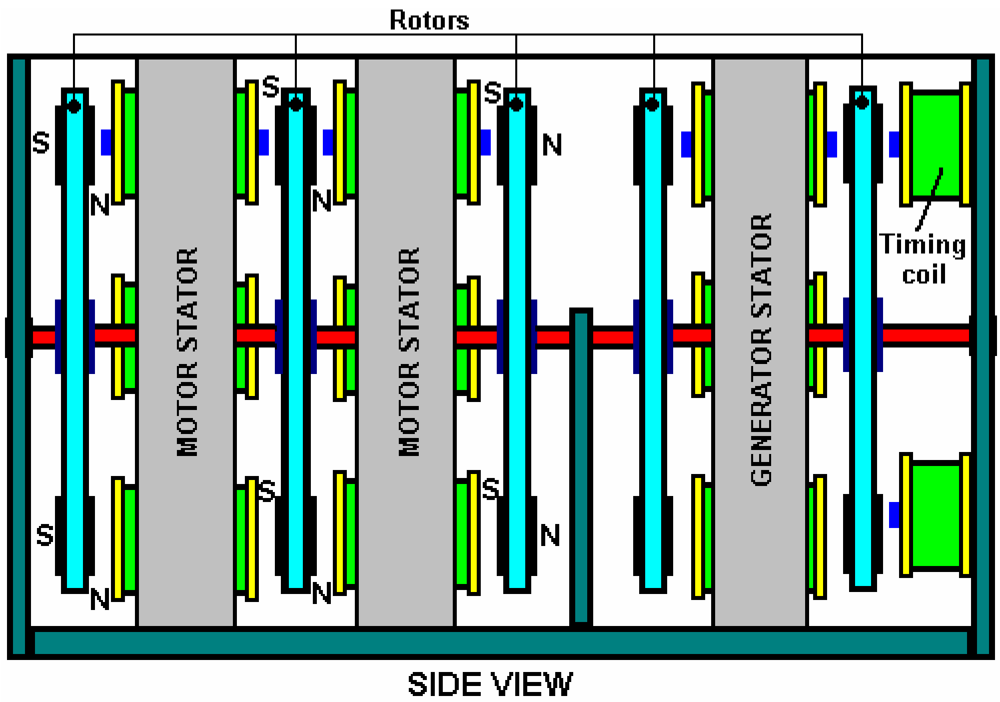

And if you are going to have eight, there is no need to have the V-shaped cut-outs which just create turbulence when spinning, so make the rotor circular:




And the stator supporting the coils matches the rotor:

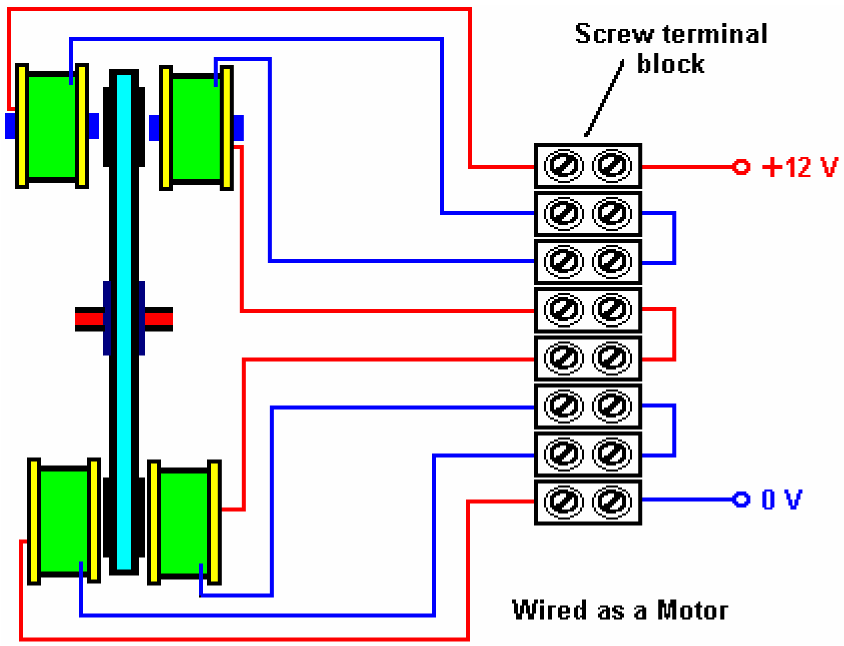



Ferrite is a better material for the cores of the coils.  The stators go each side of the rotors and the hole in the middle of the stators is to give clearance for the shaft on which the rotors are mounted:

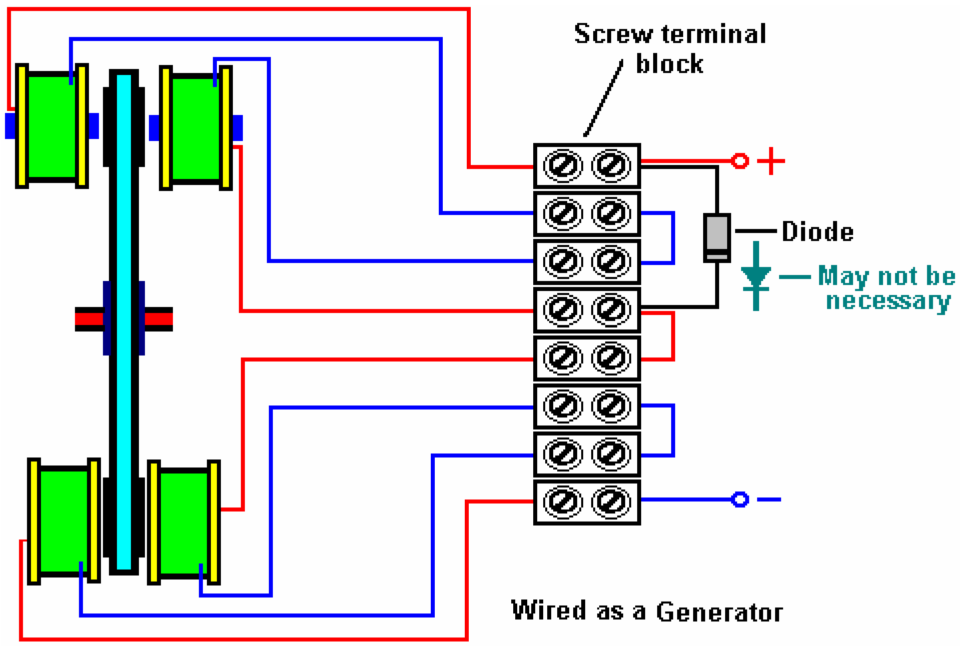



A system of this type needs accurate timing which is solely related to the rate of rotation.  This is best arranged by the use of a bistable multivibrator as described in the accompanying Electronics Tutorials.  You will notice the two Timing Coils shown at the right hand side of the diagram above.  These are used to toggle the bistable On and Off and they are adjustable in position so that both the On and the Off can be set very precisely.  The output of the bistable is set to switch an FET transistor On and Off to give circuit switching which is not affected by either the switching rate or the number of times the switch is operated.

The Rotor / Stator combination can be wired to act as either a driving Motor or an electrical Generator.  The difference is the addition of one diode:




With this arrangement, for each rotor, all four pairs of Cored coils are wired in parallel across each other, and all four Air-cored coils are wired in parallel across each other. To improve the clarity, the above diagram shows only one of the four pairs, but in reality, there will be four wires coming into the left hand side of each of the screw terminals.




In the case of the Generator arrangement, you have the option to connect each of the four pairs in parallel as in the Motor arrangement or to connect them in series. Connected in parallel, the coils can sustain a greater current draw, while if connected in series, they provide a higher voltage. The voltage could be further increased by increasing the number of turns on each coil.

It is difficult to see why the diode is included in the above Generator circuit. It would appear to clamp the output of the upper pair of coils to 0.7 volts. I have asked Butch why this diode is included but to date have not received an answer.

Further details of this Motor / Generator can be seen on the web site:
http://www.theverylastpageoftheinternet.com/ElectromagneticDev/lafonte/lafonte.htm

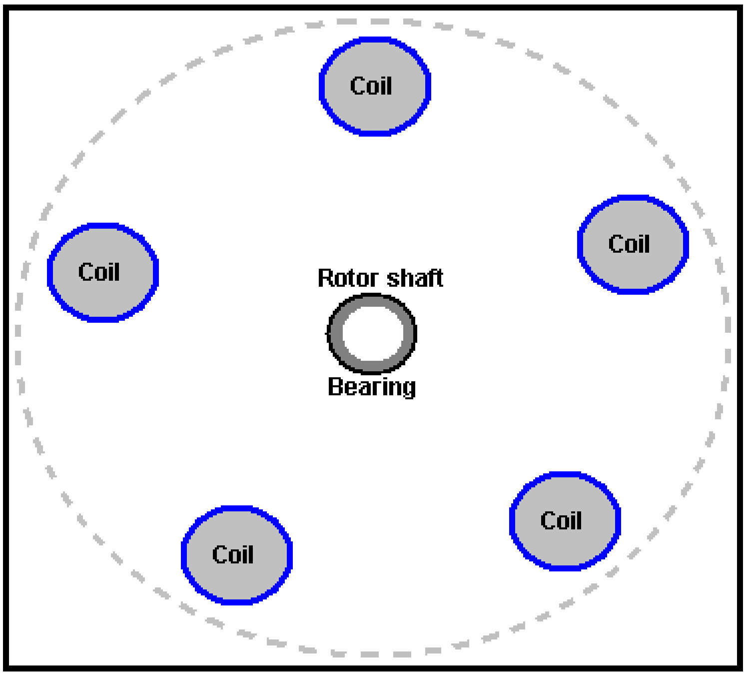
**The Muller Motor**.

Bill Muller who died in 2004, produced a series of very finely engineered devices, the latest of which he stated produced some 400 amps of output current at 170V DC for 20 amps at 2V DC drive current. The device both generates its own driving power and produces an electrical power output. Bill's device weighed some 90 kilos and it requires very strong magnets made of Neodymium-Iron-Boron which are expensive and can easily cause serious injury if not handled with considerable care. It should be noted that Ron Classen shows his experimental attempt to replicate a scaled-down version of this motor on the web site www.theverylastpageoftheinternet.com/ElectromagneticDev/Ron_Classen/index.htm and he reports that he spent in excess of US $3,000 in construction and so far, has only achieved an output power of about 66% of the input power.

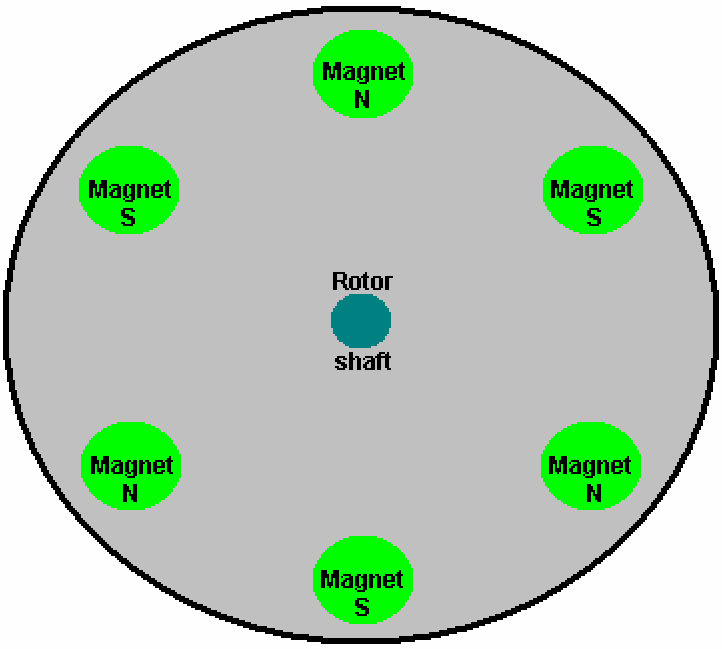
However, I have no doubt that Bill Muller achieved exactly what he claimed. So here are as many details as I have been able to locate on the construction of his latest device.

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

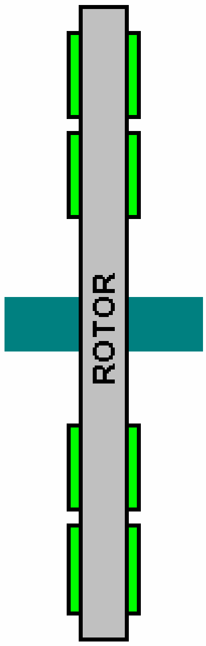
In order to make it easier to follow, the diagrams below show just five coil pairs and six magnets, but much larger numbers are normally used in an actual construction of the device, typically sixteen magnets.



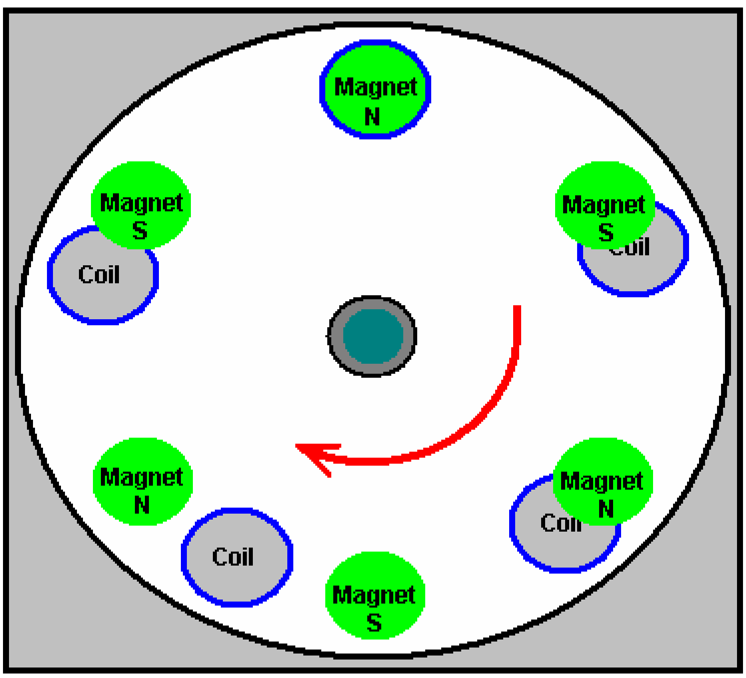

Stator (2 required)



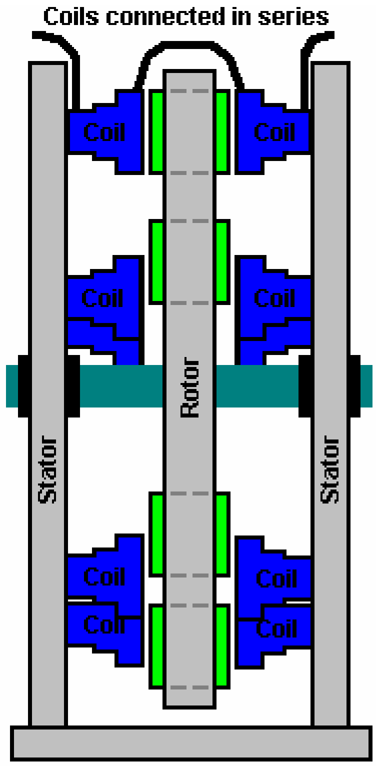

Rotor  (1 required)




Side view

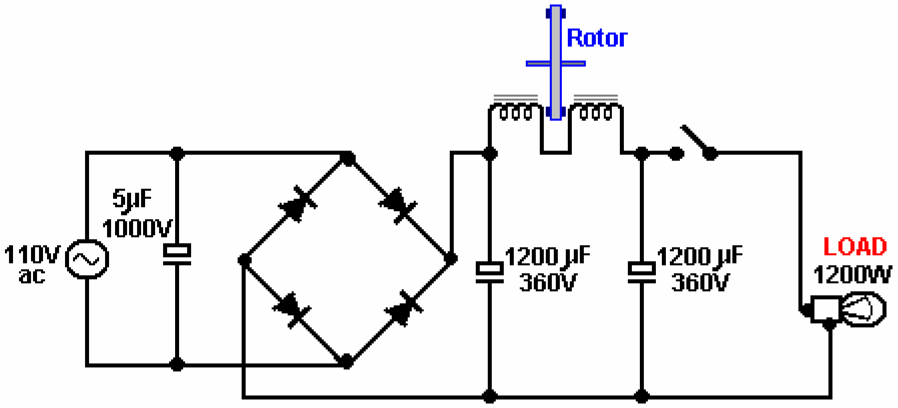



Coil / Magnet relative spacing

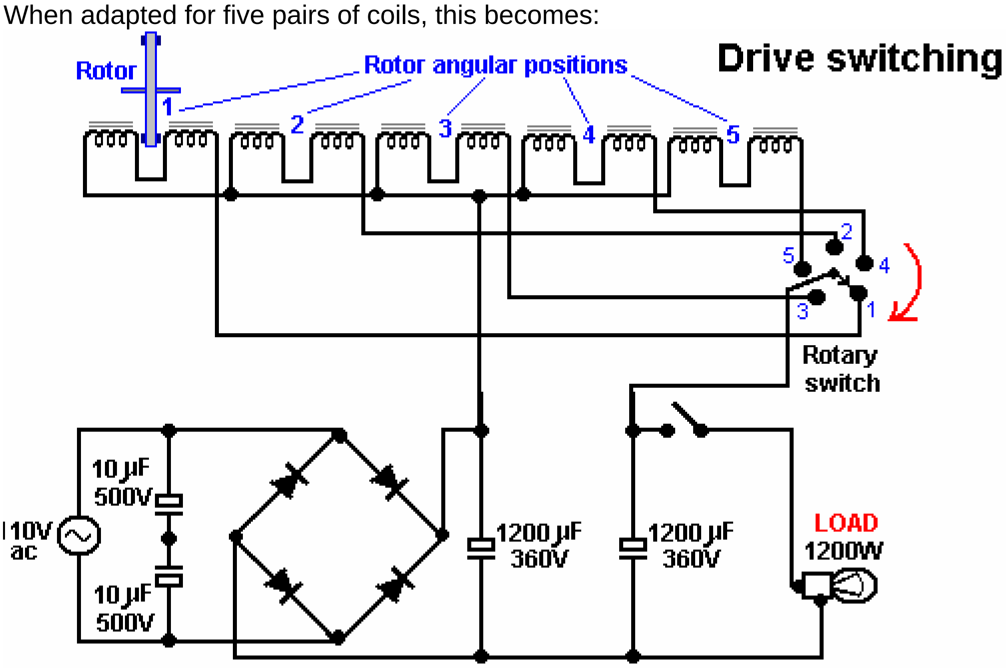



Side view

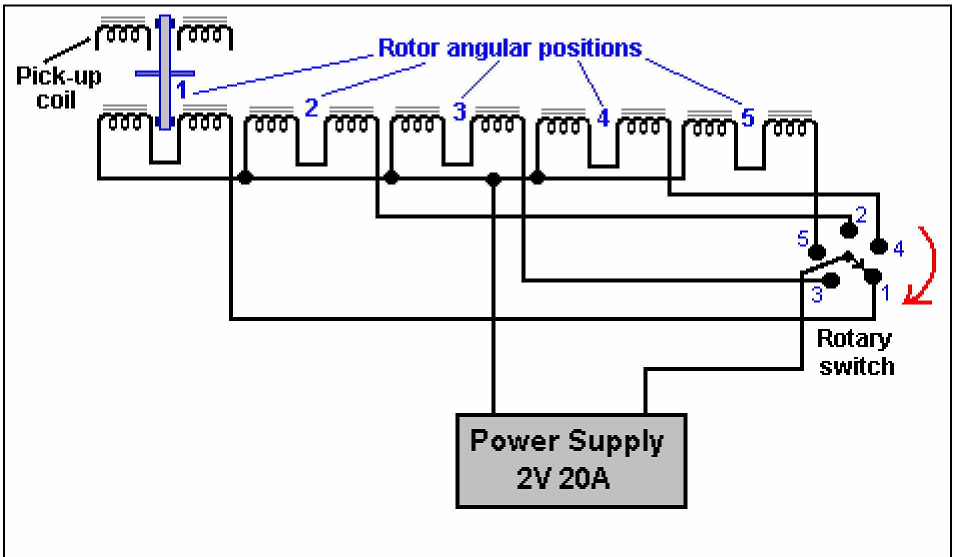
If AC mains voltage is used then the drive wiring may be as shown here:



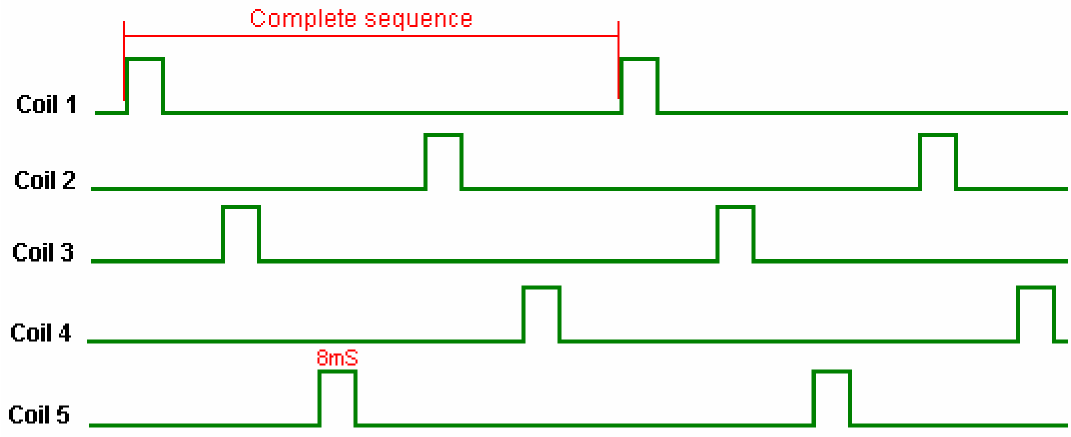

When adapted for five pairs of coils, this becomes:



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




Drive switching

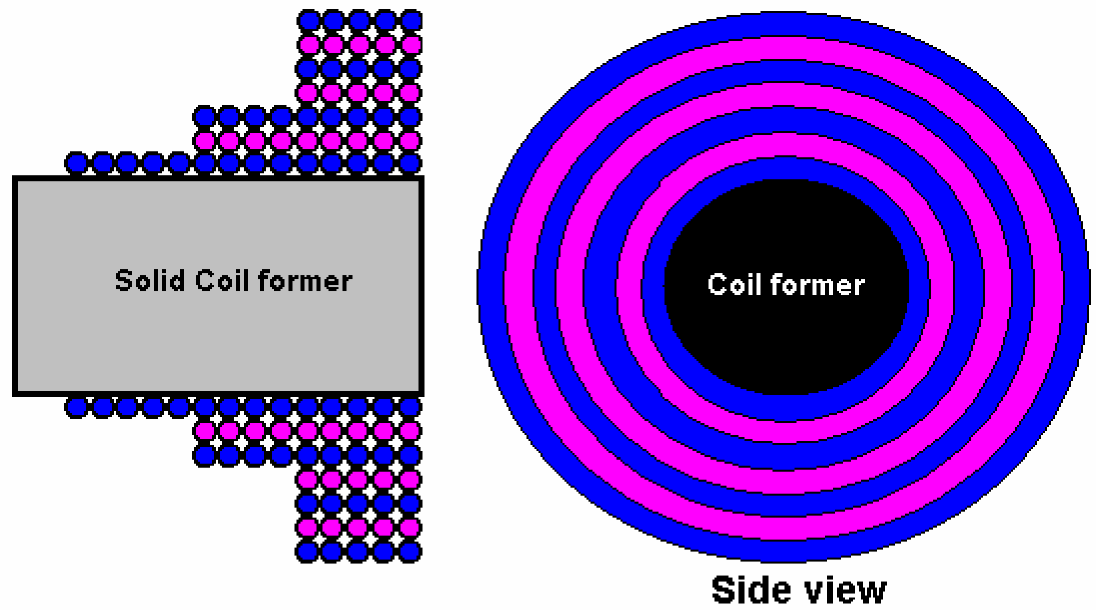



Drive-pulse sequence

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

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

It is essential that Neodymium-Iron-Boron magnets are used for this device as they are about ten times more powerful than the more common ferrite types. Bill used sixteen magnets in the 30 - 50 MegaGaussOerstedt energy density range, constructed in China, they held their magnetism unaltered for eight years of use. The air gap between the coils and the magnets is 2 mm. Bill used a computer chip to generate the switching sequence, but it is likely that straightforward drive circuit can be built using standard discrete electronic components. The output from each coil is passed through a full-wave bridge to give DC, before being added to the output from the other coils. A typical Muller motor would have 16 magnets and 15 coil pairs. The solid coil formers were made from 'amorphous metal' and are 2 inches (50 mm) in diameter and 3 inches (75 mm) long. Bill used a special mix of 'black sand' (probably magnetite granules) encased in epoxy resin, but an alternative is said to be hard steel - the harder the better. The coil core material is said to be very important and his construction was said to be free of any hysteresis eddy currents. The coils are wound from #6 AWG (SWG 8) or #8 AWG (SWG 10) wire and are formed in an unusual fashion as shown here:



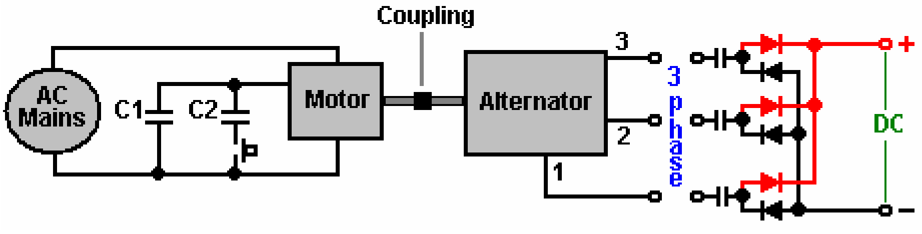

The winding turns are all made in the same direction. The first layer has 14 turns, the next two layers have 9 turns each, and the remaining four layers have 5 turns each, which gives a total of 52 turns. The coils are used in pairs, being wired in series, with one of each pair being on the opposite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

The rotor is constructed of non-magnetic material and spins at about 3,000 rpm. This device has the potential to output 35 kW of excess power when constructed in the size described, which has a rotor diameter of 660 mm with the magnets centred on a circle of 570 mm. In the demonstration which produced 35 kW of power, only five out of the intended thirty pairs of pick-up coils had been constructed. It is predicted that the output would be 400 horsepower if all thirty pairs of pick-up coils were in place. Predictions of this nature need to be borne out in a demonstration before they can be considered valid. Please be aware of the size of this item of equipment. I personally, would not be able to pick up a device of this weight, but would need mechanical lifting equipment to move it. It can, of course, be constructed in a scaled down size which will have a scaled down electrical output.

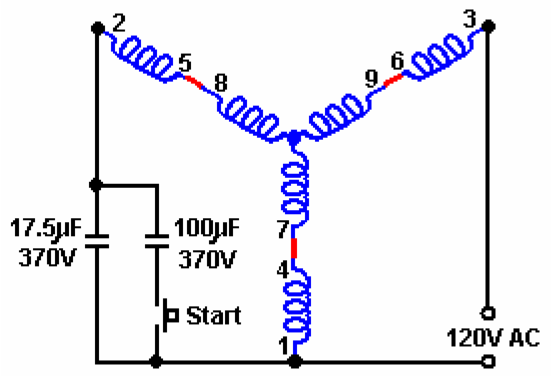
Let me stress that handling magnets of this strength has its dangers. Should you take a magnet in your hand and inadvertently move your hand near a loose steel item, then your hand is liable to become trapped between the magnet and the steel object. This may result in serious damage to your hand. Great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

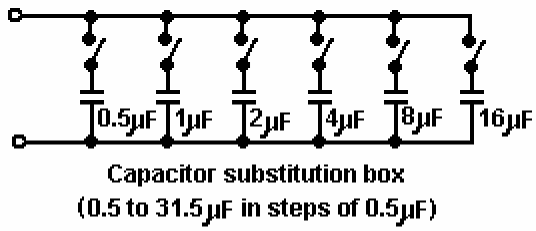
The official web site for this system is www.mullerpower.com which you may find difficult to display unless you have the MacroMedia software installed on your computer. An alternative information site on the constructional details is http://www.theverylastpageoftheinternet.com/menu/muller.htm which shows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

**The RotoVerter**. Designed by Hector D Peres Torres of Puerto Rico, this system has been reproduced by several independent researchers and has been show to produce at least 10 times more output power than the input power. The web site www.theverylastpageoftheinternet.com/ElectromagneticDev/arkresearch/rotoverter.htm has details on how to construct the device. The outline details are as follows:




The output device is an alternator which is driven by a three-phase mains-powered, 3 HP to 7.5 HP motor (both of these devices can be standard 'asynchronous squirrel-cage' motors). The drive motor is operated in a highly non-standard manner. It is a 240V motor with six windings as shown below. These windings are connected in series to make an arrangement which should require 480 volts to drive it, but instead, it is fed with 120 volts of single-phase AC. The input voltage for the motor, should always be a quarter of its rated operational voltage. A virtual third phase is created by using a capacitor which creates a 90-degree phase-shift between the applied voltage and the current.




The objective is to tune the motor windings to give resonant operation. A start-up capacitor is connected into the circuit using the press-button switch shown, to get the motor up to speed, at which point the switch is released, allowing the motor to run with a much smaller capacitor in place. Although the running capacitor is shown as a fixed value, in practice, that capacitor needs to be adjusted while the motor is running, to give resonant operation. For this, a bank of capacitors is usually constructed, each capacitor having its own ON/OFF switch, so that different combinations of switch closures give a wide range of different overall values of capacitance. With the six capacitors shown above, any value from 0.5 microfarad to 31.5 microfarad can be rapidly switched to find the correct resonant value. These values allow combined values of 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, .....by selecting the appropriate switches to be ON or OFF. Should you need a value greater than this, then wire a 32 microfarad capacitor in place and connect the substitution box across it to test higher values step by step to find the optimum value of capacitor to use. The capacitors need to be powerful, oil-filled units with a high voltage rating - in other words, large, heavy and expensive. The power being handled in one of these systems is large and setting one up is not without a certain degree of physical danger. These systems have been set to be self-powered but this is not recommended, presumably because of the possibility of runaway with the output power building up rapidly and boosting the input power until the motor burns out.

The Yahoo EVGRAY Group at http://groups.yahoo.com/group/EVGRAY/ has more than 450 members many of whom are very willing to offer advice and assistance. Hector also contributes this Group and he answers direct questions on setting up the system. A unique jargon has built up around this device, where the motor is not called a motor but is referred to as a "Prime Mover" or "PM" for short, which can cause confusion as "PM" usually stands for "Permanent Magnet". RotoVerter is abbreviated to "RV" while "DCPMRV" stands for "Direct Current Permanent Magnet RotoVerter". Some of the postings in this Group may be difficult to understand due to their highly technical nature and the extensive use of abbreviations.

To move to some more practical construction details for this system. The motor (and alternator) considered to be the best for this application is the "Baldor EM3770T" 7.5 horsepower unit. The specification number is 07H002X790, and it is a 230/460 volts 60Hz 3-phase, 19/9.5 amp, 1770 rpm, power factor 81, device.

The Baldor web site is www.baldor.com and the following constructional photographs are presented here by kind permission of Ashweth Dasien of the EVGRAY Group.

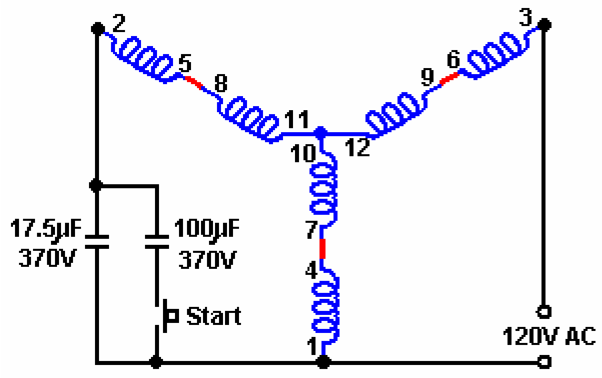
The end plate of the drive motor needs to be removed and the rotor lifted out.  Considerable care is needed when doing this as the rotor is heavy and it must **not** be dragged across the stator windings as doing that would damage them.

The second end-plate is then removed and placed on the opposite end of the stator housing.

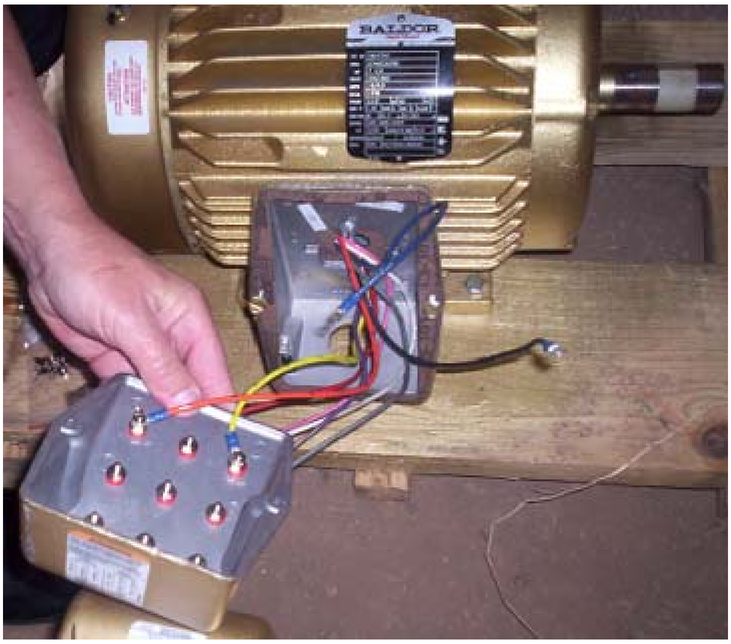
The fan is removed as it is not needed and just causes unnecessary drag, and the rotor is inserted the opposite way round to the way it was removed.  That is, the housing is now the other way round relative to the rotor, since the rotor has been turned through 180 degrees before being replaced.  The same part of the shaft of the rotor passes through the same end plate as before as the end plates have also been swapped over.  The end plates are bolted in position and the rotor shaft spun to confirm that it still rotates as freely as before.

To reduce friction to an absolute minimum, the motor bearings need to be cleaned to an exceptional level.  There are various ways of doing this.  One of the best is to use a carburettor cleaner spray from your local car accessories shop.  Spray inside the bearings to wash out all of the packed grease.  The spray evaporates if left for a few minutes.  Repeat this until the shaft spins perfectly, then put one (and only one) drop of light oil on each bearing and do not use WD40 as it leaves a residue film.  The result should be a shaft which spins absolutely perfectly.

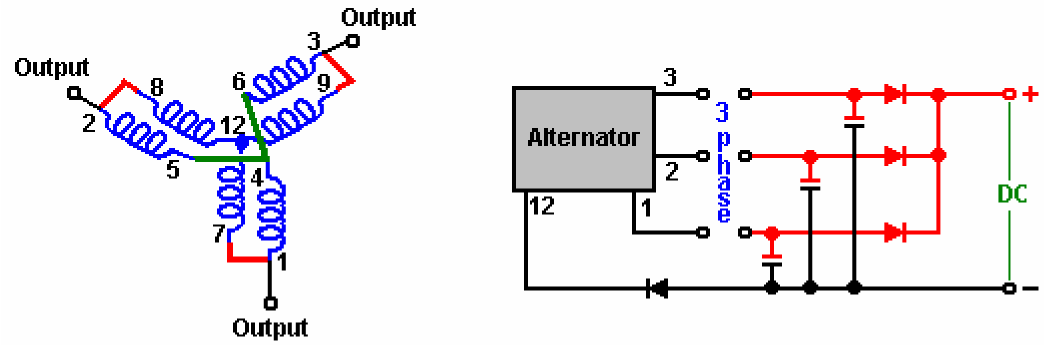
The next step is to connect the windings of the two units.  The motor (the "Prime Mover") is wired for 480 volt operation.  This is done by connecting winding terminals 4 to 7, 5 to 8 and 6 to 9 as shown below.  The diagram shows 120 volts AC as being the power supply.  This is because the RotoVerter design makes the motor operate at a much lower input than the motor designers intended.  It this motor were operated in the standard way, a 480 volt 3-phase supply would be connected to terminals 1, 2 and 3 and there would be no capacitors in the circuit.



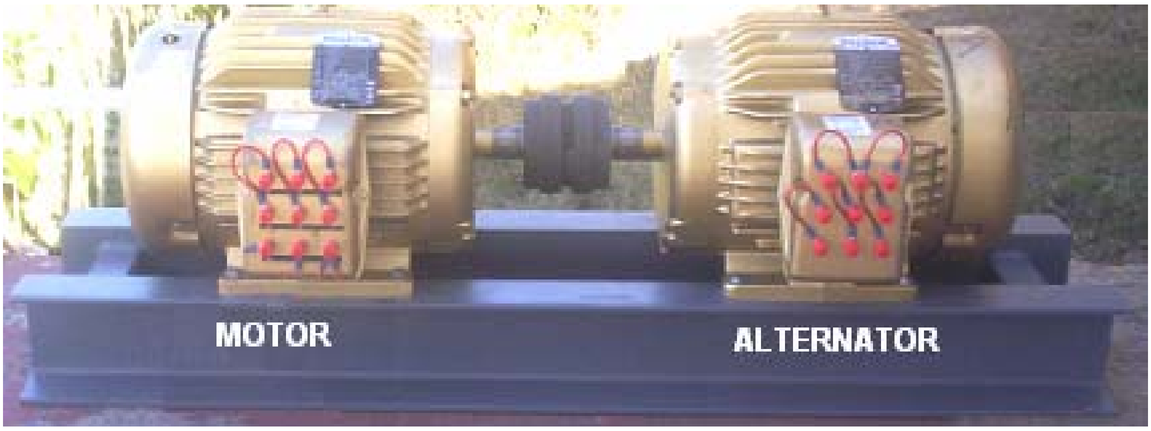

It is suggested that the jumpering of the motor windings is more neatly done by removing the junction box cover and drilling through it to carry the connections outside to external connectors, jumpered neatly to show clearly how the connections have been made for each unit, and to allow easy alterations should it be decided to change the jumpering for any reason.




The same is done for the unit which is to be used as the alternator. To increase the allowable current draw, the unit windings are connected to give the lower voltage with the windings connected in parallel as shown below with terminals 4,5 and 6 strapped together, 1 connected to 7, 2 connected to 8 and 3 connected to 9. This gives a three-phase output on terminals 1, 2 and 3. This can be used as a 3-phase AC output or as three single-phase AC outputs, or as a DC output by wiring it as shown here:



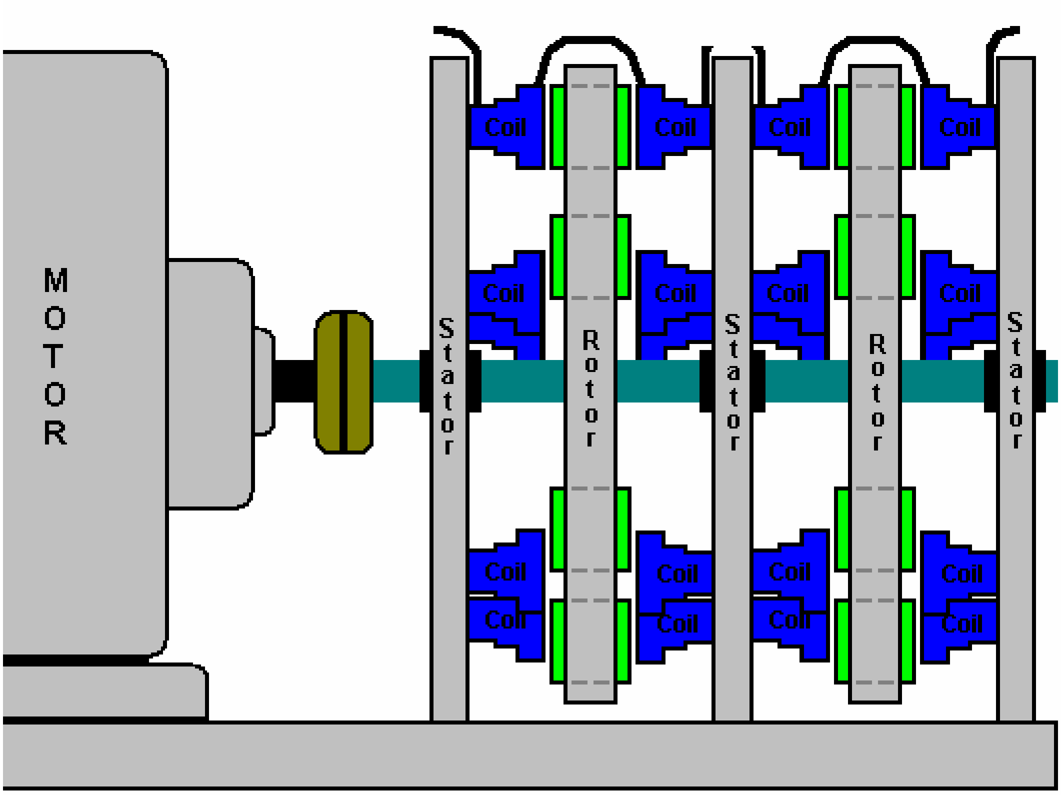

The motor and the alternator are then mounted securely in exact alignment and coupled together. The switching of the direction of the housing on the drive motor allows all of the jumpering to be on the same side of the two units when they are coupled together, facing each other:



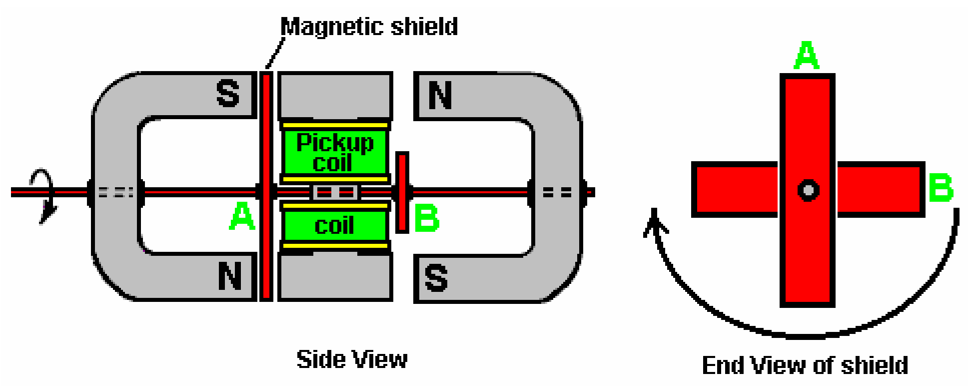

The input drive may be from an inverter driven from a battery charged via a solar panel. The system how needs to be ‘tuned’ and tested. This involves finding the best ‘starting’ capacitor which will be switched into the circuit for a few seconds at start-up, and the best ‘running’ capacitor. Help and advice is readily available from the EVGRAY Group as mentioned above.

To summarise: This device takes a low-power 110 Volt AC input and produces a much higher-power electrical output which can be used for powering much greater loads than the input could power. The output power is much higher than the input power. This is free-energy under whatever name you like to apply to it. One advantage which should be stressed, is that very little in the way of construction is needed, and off-the-shelf motors are used. Also, no knowledge of electronics is needed, which makes this one of the easiest to construct free-energy devices available at the present time. One slight disadvantage is that the tuning of the “Prime Mover” motor depends on its loading and most loads have different levels of power requirement from time to time.

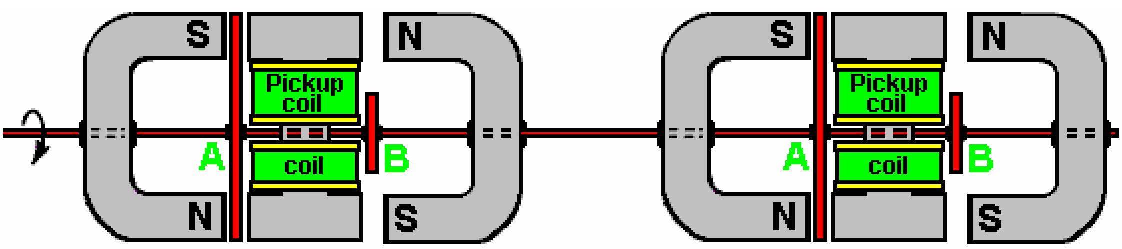
It is not essential to construct the RotorVeter exactly as shown above, although that is the most common form of construction. The Muller Motor mentioned earlier, can have a 35 kilowatt output when precision-constructed as Bill Muller did. One option therefore, is to use one Baldor motor jumpered as the “Prime Mover” drive motor and have it drive one or more Muller Motor style rotors to generate the output power:



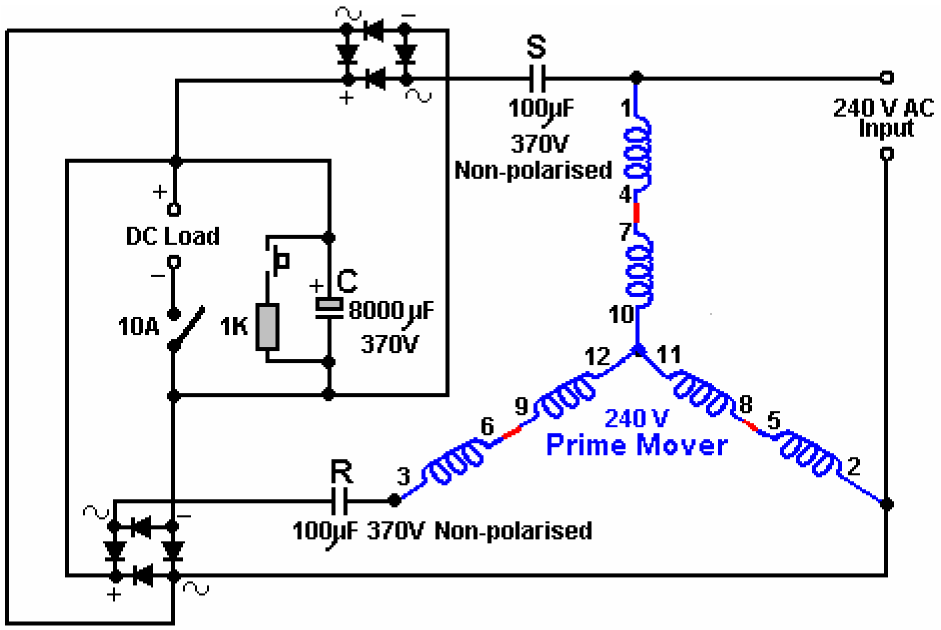

As the objective is to increase the output power and attempt to keep the motor loading as even as possible to make it possible to tune the motor power input as close to the "sweet" resonant point of its operation, another alternative springs to mind. The output power generator which has the least variation in shaft power for changes in electrical output, namely the Brown-Ecklin generator as described in another document in this set:




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



**Phil Wood**, another member of the EVGRAY enthusiast Group has come up with a very clever circuit variation for the RotoVerter system. His design has a 240 volt Prime Mover motor driven with 240 volt AC. The revised circuit now has automated start-up and it provides an extra DC output which can be used to power additional equipment. His circuit is shown here:




Phil specifies the diode bridges as 20 amp 400 volt and the output capacitor as 4000 to 8000 microfarads 370 volt working. The ON/OFF switch on the DC output should be 10 amp 250 volt AC working. The circuit operates as follows:

The charge capacitor "C" needs to be fully discharged before the motor is started, so the press-button switch is pressed to connect the 1K resistor across the capacitor to discharge it fully. If you prefer, the press-button switch and resistor can be omitted and the switch to the DC load closed before the AC input is applied. The switch must then be opened and the AC connected. The starting capacitor "S" and capacitor "R" both operate at full potential until capacitor "C" begins to charge. As capacitor "C" goes through its charging phase, the resistance to capacitors "R" and "S" increases and their potential capacitance becomes less, automatically following the capacitance curve required for proper AC motor operation at start-up.

After a few seconds of run time, the output switch is operated, connecting the DC load. By varying the resistance of the DC load, the correct tuning point can be found. At that point, the DC load resistance keeps both of the capacitors "R" and "S" operating at a potentially low capacitance value.

The operation of this circuit is unique, with all of the energy which is normally wasted when the AC motor is starting, being collected in the output capacitor "C". The other bonus is where a DC load is powered for free while it keeps capacitors "R" and "S" in their optimum operating state. The DC load resistance needs to be adjusted to find the value which allows automatic operation of the circuit. When that value has been found and made a permanent part of the installation, then the switch can be left on when the motor is started (which means that it can be omitted). If the switch is left on through the starting phase, capacitor "C" can be a lower value if the DC load resistance is high enough to allow the capacitor to go through its phase shift.

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

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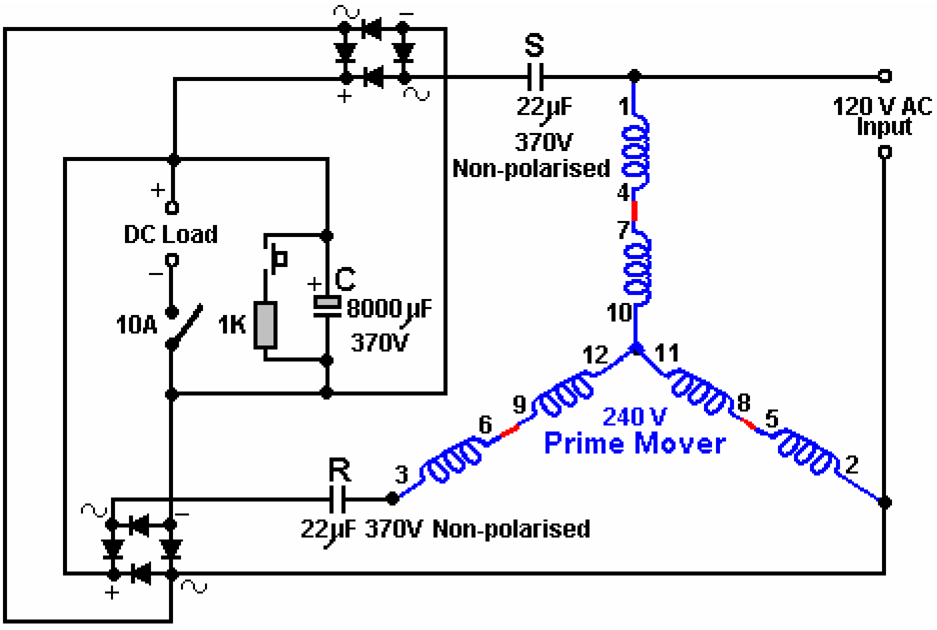
The circuit will need different capacitors for operation with a 120 Volt AC supply. The actual values are best determined by testing with the motor which is to be used, but the following diagram is a realistic starting point:




The 120 V AC motor runs very smoothly and quietly drawing only 20 watts of input power.

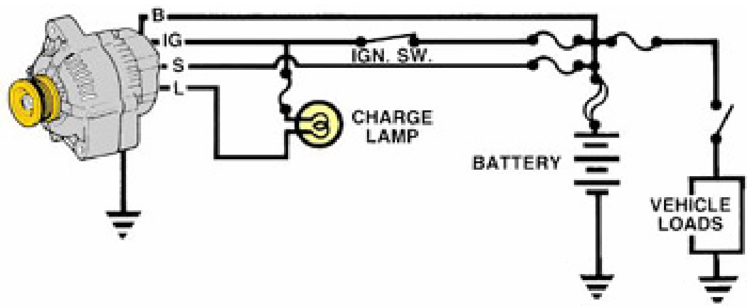
It is felt that some specific information on alternators would be helpful at this point. My thanks goes to Professor Kevin R. Sullivan, Professor of Automotive Technology, Skyline College, San Bruno, California, who has given his kind permission for the reproduction of the following training material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

## *UNDERSTANDING THE ALTERNATOR*

**The Charging System**

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

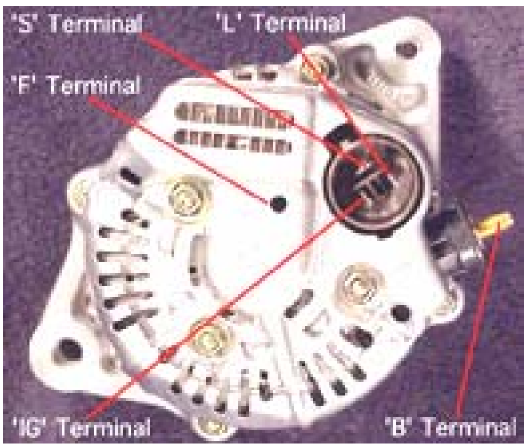
**The Charging System Circuit**




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

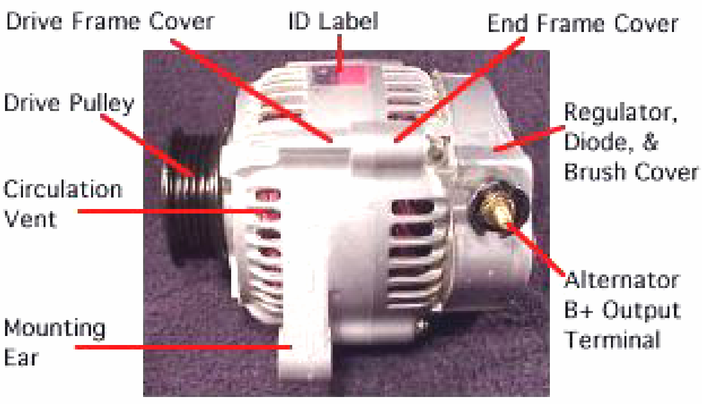
'**B**' is the alternator output wire that supplies current to the battery.
'**IG**' is the ignition input that turns on the alternator/regulator assembly.
'**S**' is used by the regulator to monitor charging voltage at the battery.
'**L**' is the wire the regulator uses to ground the charge warning lamp.

**Alternator Terminal ID's**




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

**The Alternator Assembly**




<u>Alternator Overview:</u>

The alternator contains:

A rotating field winding called **the rotor**.

A stationary induction winding called **the stator**.

A diode assembly called **the rectifier bridge**.

A control device called **the voltage regulator**.

Two **internal fans** to promote air circulation

**Alternator Design**

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

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

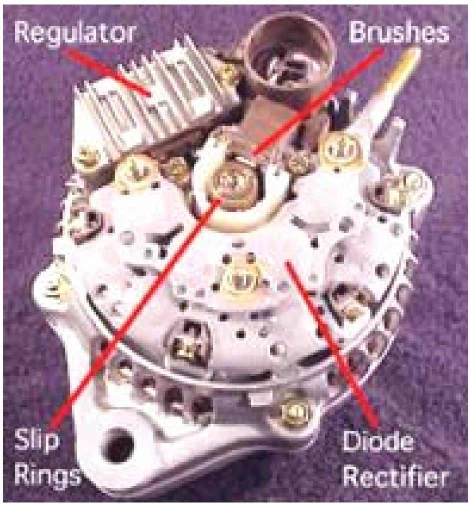
However, today's practice is to replace the alternator as a unit, should one of it's internal components fail.

Drive Pulley

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

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

**Inside the Alternator**




Removal of the rear cover reveals:

**The Regulator** which controls the output of the alternator.

**The Brushes** which conduct current to the rotor field winding.

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

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

**Brushes**

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

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

**Electronic IC Regulator**

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

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

**Diode Rectifier**

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

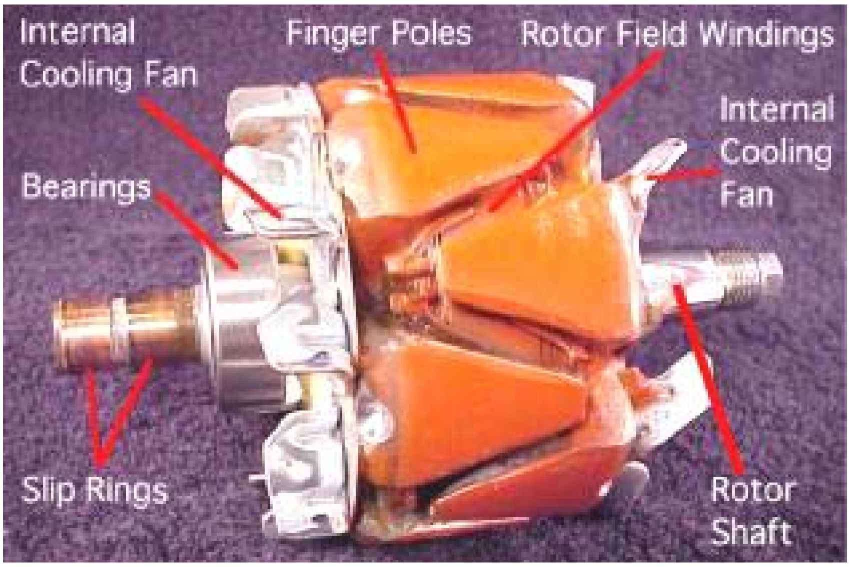
Six or eight diodes are used to rectify the AC stator voltage to DC voltage.  Half of these diodes are used on the positive side and the other half on the negative side.

**Inside the Alternator**


Opening the case reveals:

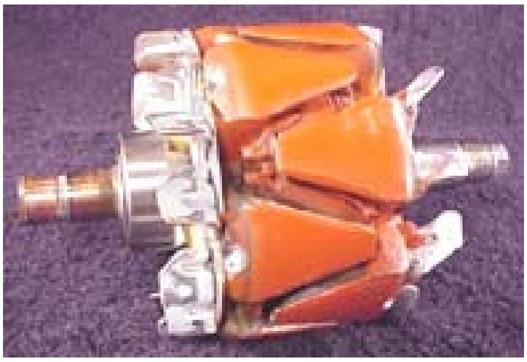
The **rotor winding assembly** which rotates inside the **stator winding**.  The rotor generates a magnetic field and the stator winding develops voltage, which causes current to flow from the induced magnetic field of the rotor.

**The Rotor Assembly**



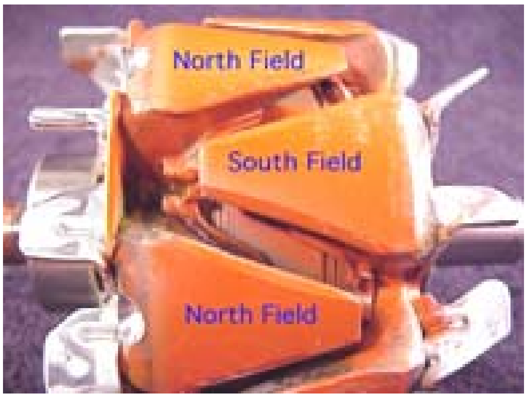
A basic rotor consists of an **iron core**, a **coil winding**, two **slip rings**, and two claw-shaped **finger pole pieces**. Some models have support bearings and one or two internal cooling fans.

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



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

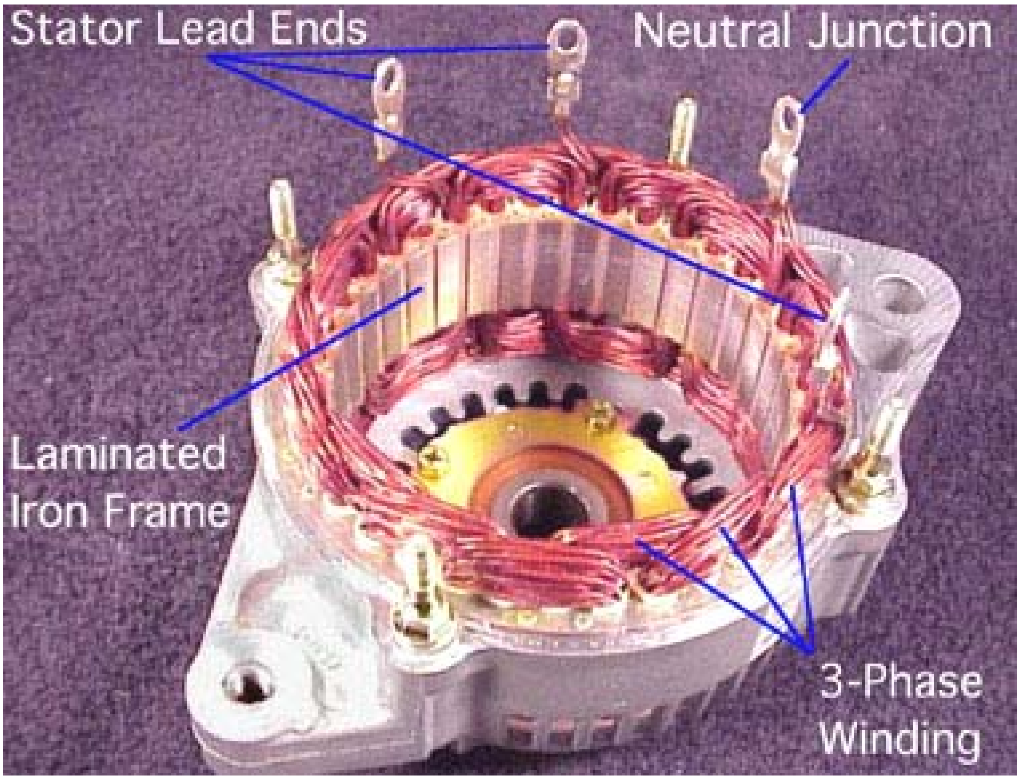
**Alternating Magnetic Field**




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

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

**Stator Winding**

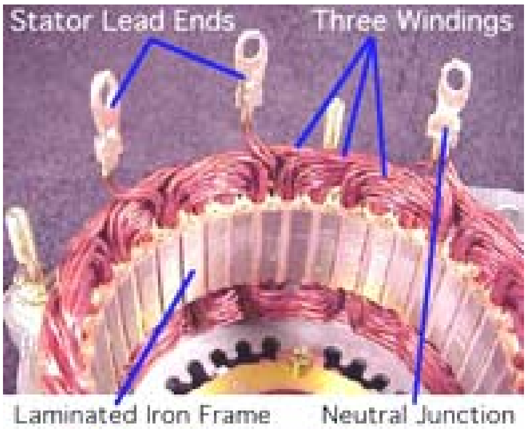



The stator winding looks like the picture above.

**Rotor / Stator Relationship**

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

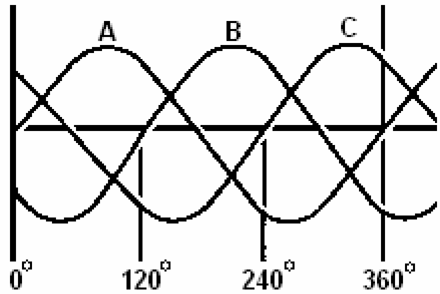
**Stator Windings**




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

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

<u>3-Phase Windings</u>



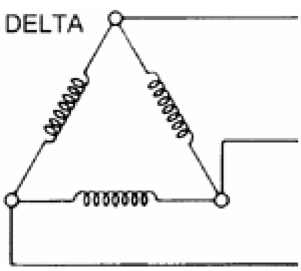

The stator winding has three sets of windings. Each winding is formed into a number of evenly spaced coils around the stator core.

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

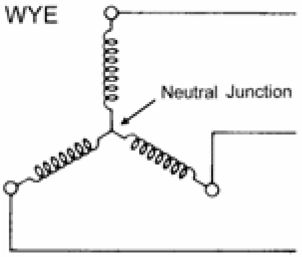
These waves add together to make up the total AC output of the stator. This is called three-phase current.

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

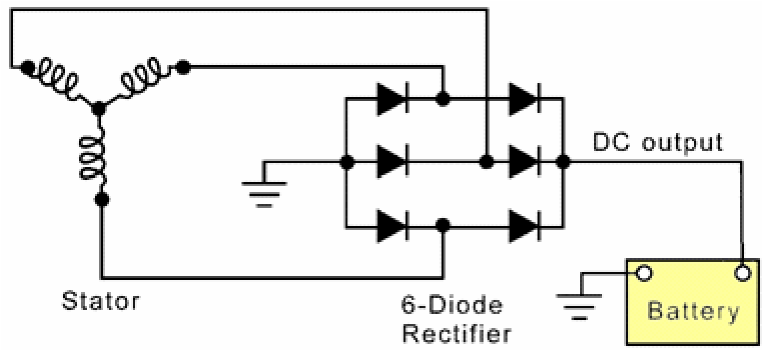
Stator Designs



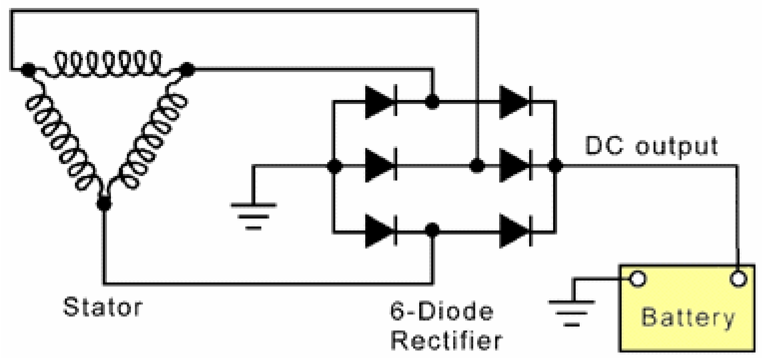

Delta-wound stators can be identified by having only three stator leads, and each lead will have the same number of wires attached.




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

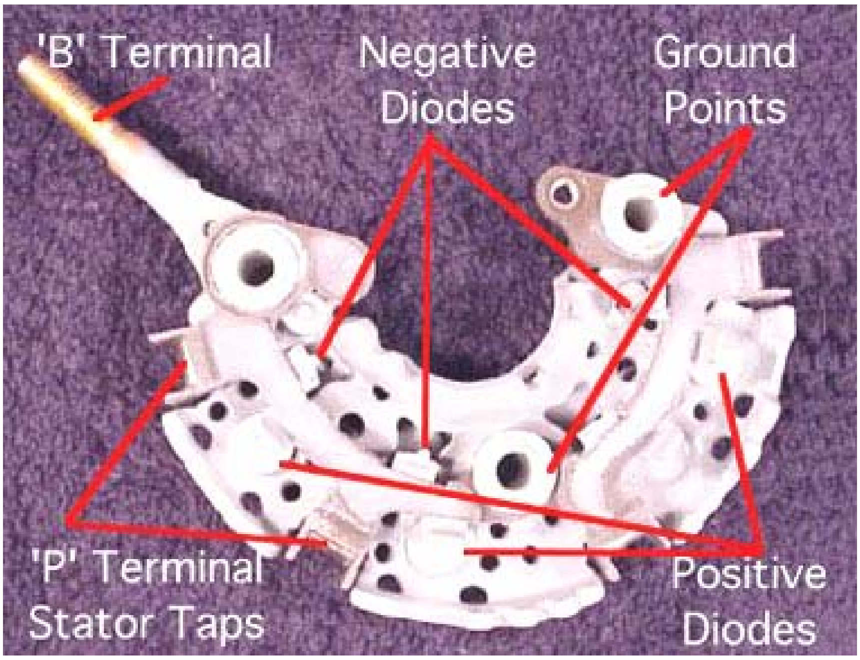



Wye-wound stators have three windings with a common neutral junction. They can be identified because they have 4 stator lead ends. Wye wound stators are used in alternators that require high-voltage output at low alternator speeds. Two windings are in series at any one time during charge output.

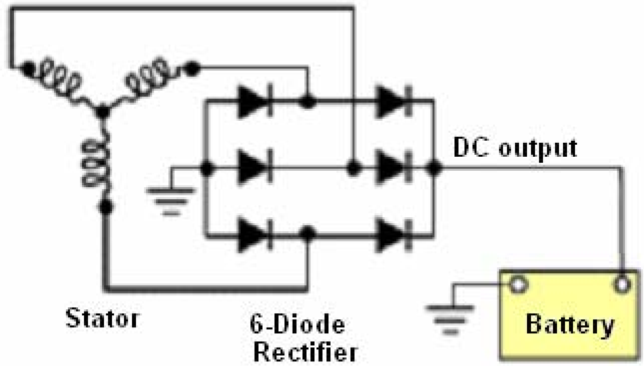



Delta-wound stators can be identified because they have only three stator lead ends. Delta stators allow for higher current flow being delivered at low RPM. The windings are in parallel rather than in series as the Wye designs have.

Diode Rectifier Bridge Assembly



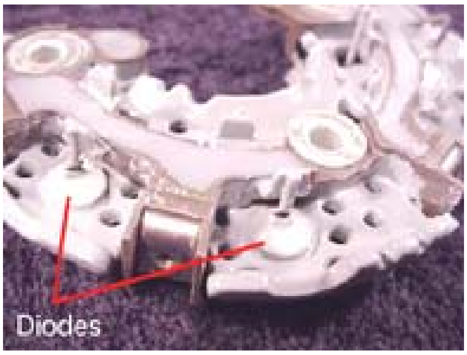

Rectifier Operation:




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

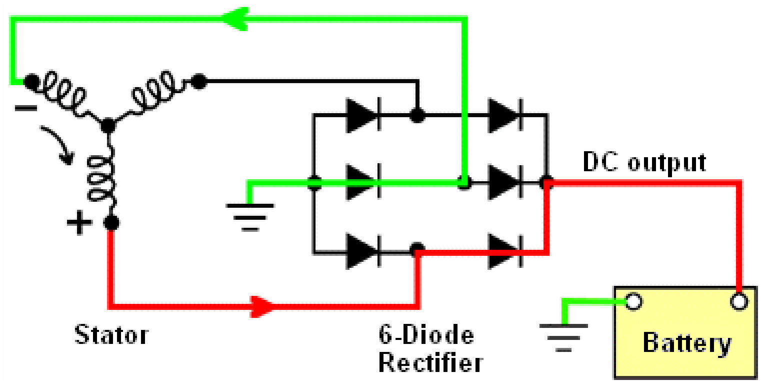
Diodes used in this configuration will redirect both the positive and negative parts of the AC voltage in order to produce a better DC voltage waveform. This process is called 'Full - Wave Rectification'.

**Diodes**

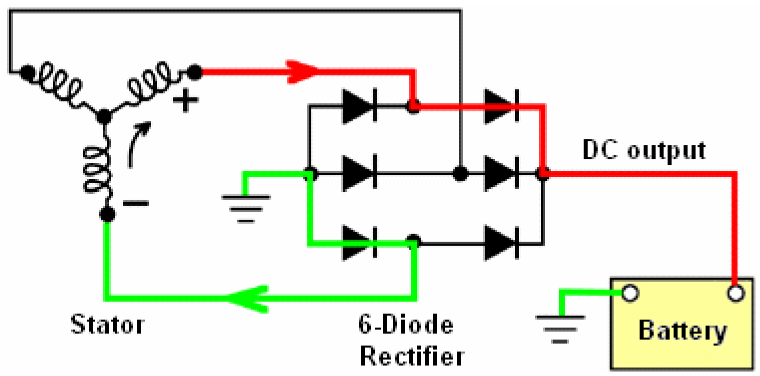



Diodes are used as one-way electrical check valves. They pass current in only one direction, and never in the other direction. Diodes are mounted in a heat sink to dissipate the heat generated by the current flow. Diodes redirect the AC voltage and convert it into DC voltage, so the battery receives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

Rectifier Operation:

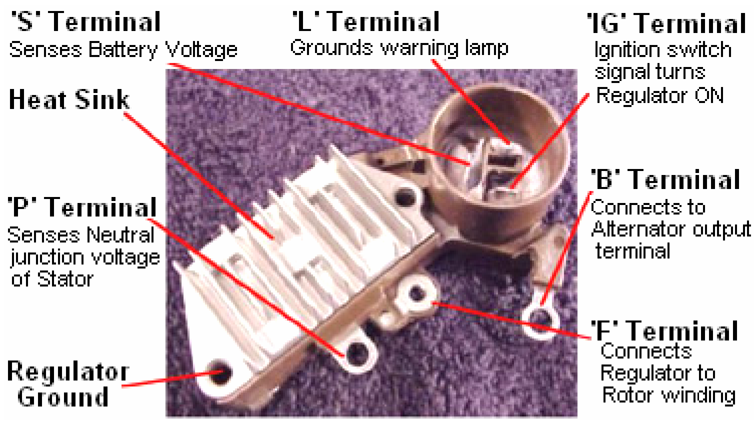



The red path is the positive current passing through the rectifier as it goes to the positive battery terminal. The path shown in green completes the circuit.




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

**Electronic Regulator**



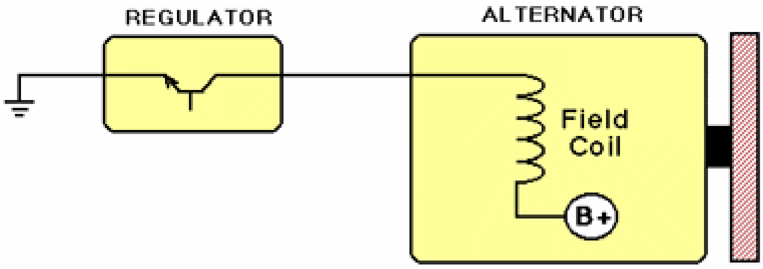

The regulator attempts to maintain a set charging voltage. If the charging voltage falls below this point, the regulator increases the field current, which strengthens the magnetic field, resulting in a raising of the alternator output voltage.

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

Regulator Types:

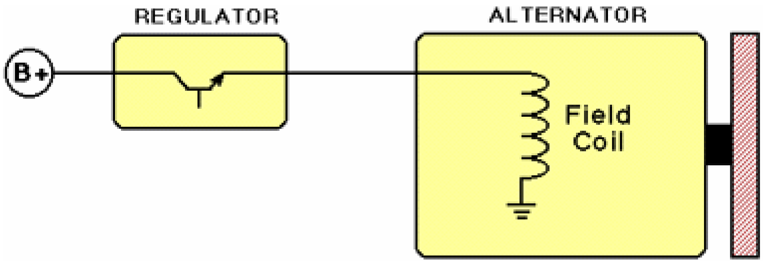
Two regulator designs can be used. The first type is:

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

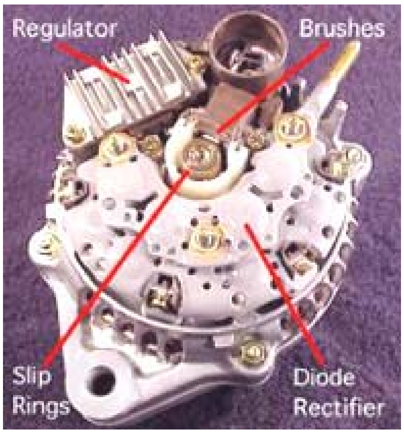



The second type is:

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




**The Working Alternator**




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

The **rotor** produces a magnetic field.

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

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