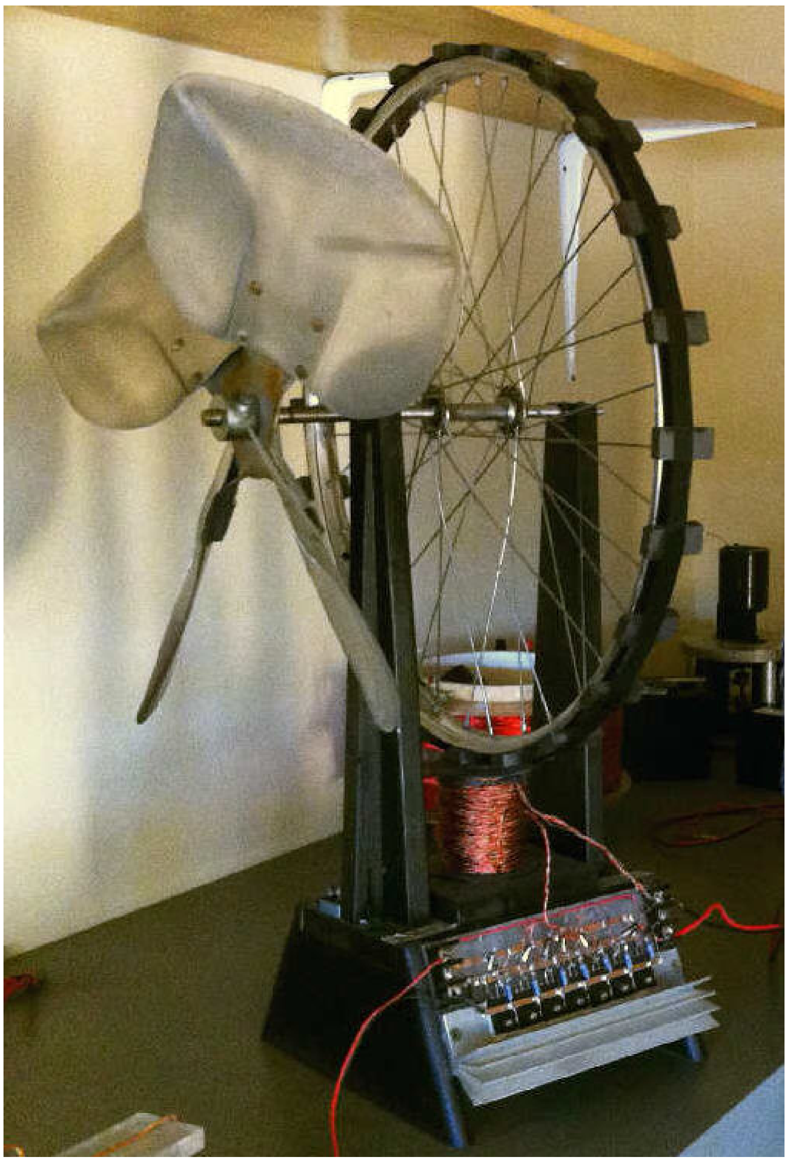
Bedini SG

The Complete Beginner's Handbook



Written by
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Adds clarification to a number of topics covered in the book, including "the direction of current flow" based on the convention used in the USA, the direction of winding the wire onto the coil and the different effects the clockwise and counter-clockwise methods produce, the difference between the repulsion and attraction "run modes", the wheel rim size and how it is measured, and the spool size for Shawnee's original science fair project.

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Newsletter

Before doing anything else, make sure to sign up for the free Energy Times newsletter at http://www.emediapress.com/energytimes.php. It looks like this:

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Foreword

I've known John since 1983. Ever since that time, he has been working on perfecting a "self-running" machine. Over the years we went our separate ways, but reconnected in December of 2000. Then, in 2004, I had the good fortune of working at his company. We were focusing mostly on developing battery chargers, but his many models of "energizers" were all over the shop.

In 2004, at the urging of Sterling Allan, we started releasing the plans for his basic energizer. Since then, thousands of experimenters have built models and run their own experiments. Dozens of forums and discussion groups have spontaneously formed to support this movement. Eight years later, there is so much information in these forums, and so many advanced ideas mixed with the basics, that it has become time to publish a definitive and "Complete Beginner's Handbook" on this project, to help support new people just getting involved.

John was just too busy to write it himself, so Aaron Murakami and I volunteered to bring this all together. John has been through the whole manual, and says that everything is presented correctly. We have tried to present the information accurately, in a simple, easy to learn way. We believe that with the publication of this book, the "debate" about how this machine operates is over.

This book tells how to build it, how it operates, and what it does to increase the amount of energy available from Nature. Please do what John says… "don't change anything" until you've built it correctly the first time. Then, let it run, and learn what it has to teach you about energy transformation and energy conservation. But most of all, enjoy yourself, and have fun.

Peter Lindemann (November 2012)

Introduction

"The only way of finding the limits of the possible
is by going beyond them into the impossible."
Arthur C. Clarke

John Bedini is one of the true "living legends" of the Free Energy movement. Starting from a very young age, John always wanted to build a self-running combination of an electric motor and an electric generator. Being told it was "impossible", even hundreds of times, did not deter him.

By 1984, John published his first book on the subject titled ***Bedini's Free Energy Generator***. In this book, John describes how to connect an ordinary electric motor to a specially designed "energizer" and switching circuit to produce a self-running machine that charges it's battery while running. Multiple working models were shown at a "Tesla Conference" in Colorado Springs, Colorado in the same year.

This first success did not produce the results that John was looking for. The large model shown at the conference was built by Jim Watson. Immediately after the conference, Jim's machine was "confiscated" and Jim was forced to take a multi-million dollar "pay-off" to quit working on it. Shortly thereafter, John was "roughed-up" in his own shop and told he would "buy gasoline for the rest of his life, or else....". For the next 17 years, John continued to work on his ideas, but only built toy-sized models and rarely showed them to anyone except close friends.

Then in 2001, a very interesting thing happened. The father of a 10 year old school girl, who worked in a shop a few doors down from John's shop, came over to ask for some help with his daughter's science fair project.

Having an interest in helping younger folks learn about his technologies, John coached the girl, named Shawnee Baughman, on how to build a small energizer, based on his designs.

The energizer that Shawnee built ran on a little 9 volt battery for over a week, all the while lighting up an LED and spinning a rotor at high speed. She even had a series of posters explaining why it worked.

10-year-old Shawnee Baughman with her award-winning science

The machine absolutely infuriated the science teachers, because they could not explain why the battery was not running down! But the other teachers and students loved it, and she won "Best of Show" by popular demand! This was the advent of what became known as the "Bedini School Girl" energizer or the "Bedini SG" for short.

News spread fast around the older internet boards and Jeane Manning, a journalist and writer for Atlantis Rising magazine, wrote an article about Shawnee's energizer, including other details about John Bedini's energy technologies and experiences. This article was called ***The Attractions of Magnetism, Could a Little Child Be Leading Us to a Free Energy Future?***

(You can read this article in it's entirety, as a copy of it is included in the back of this book on page 131.)

In the last 11 years, the Bedini SG has become the best known and most replicated Free Energy machine on the planet. For beginners in the field, it has become somewhat of a right-of-passage. Unless you have built one and learned what it has to teach, the nature of these discoveries will remain a mystery. It is quite simply THE project to start with.

Recently, John consolidated several of his energizer internet discussion groups into one new forum for people to visit and learn about his technology. You can visit or join this forum for free at http://energyscienceforum.com.

Although there is a huge data base of information on-line, where people can learn about this for free, a simple, authoritative book & video package has been requested for many years. The on-line forums contain a lot of experimental ideas and variations on a theme. But it is an awful lot of material to dig through. People getting involved for the first time now, just want to know how to do it right the first time. Hence, the release of this Complete Beginner's Handbook.

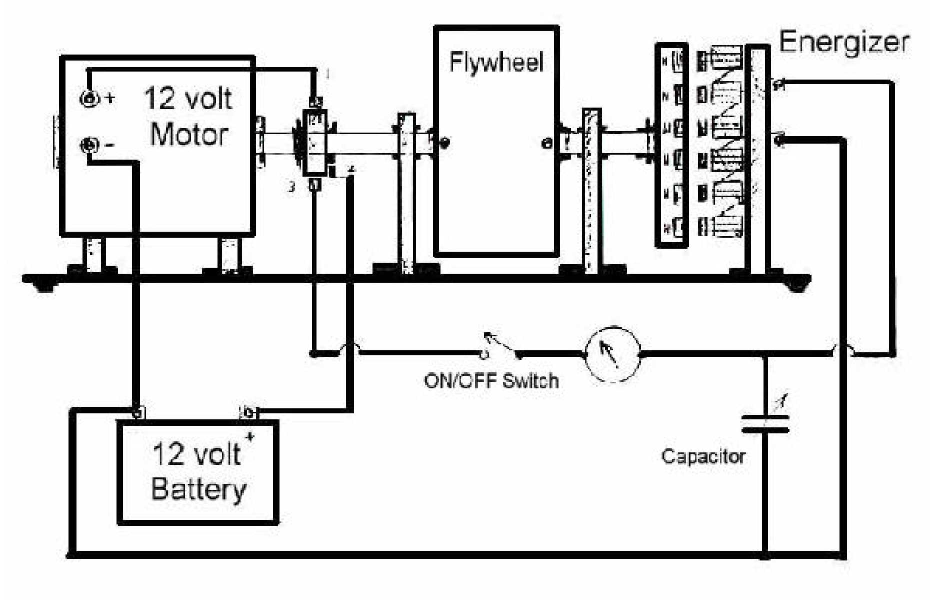
This book is what we all wanted to have in the early days. It explains the history, gives the schematics and parts lists, explains the theory, and reviews all of the variations of this amazing "do-it-yourself" project.
So, welcome to the club! We hope that the experience of learning about the Bedini SG is as rewarding and enriching for you as it was for us.

Peter Lindemann, D.Sc.
Aaron Murakami, BSNH

Chapter One

The Original "School Girl" Energizer

The design for John Bedini's first, successful, self-running machine was published in his 1984 booklet titled ***Bedini's Free Energy Generator***. It was a combination of an electric motor, a flywheel, a rotating switch, a battery, and a specially built electric generator he referred to as an "energizer".



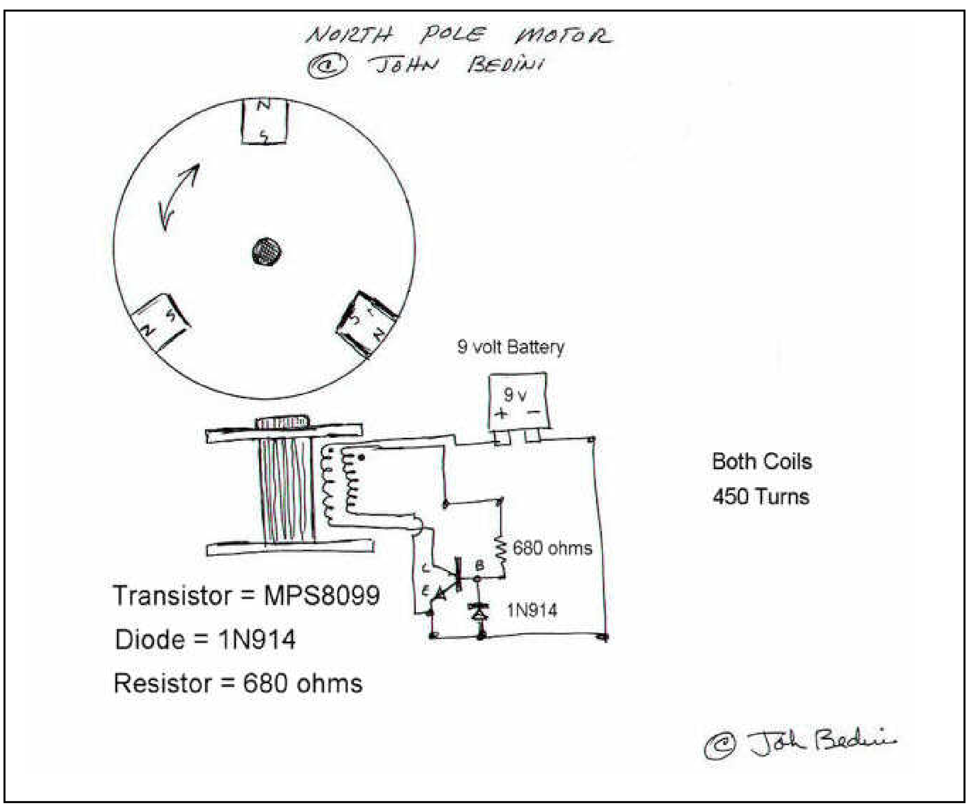
Bedini's 1984 Design

In spite of being threatened and told not to work on the technology, John continued to refine his ideas for the next 17 years. He understood that the secret of the machine was in the "energizer" and the switching method he had developed.

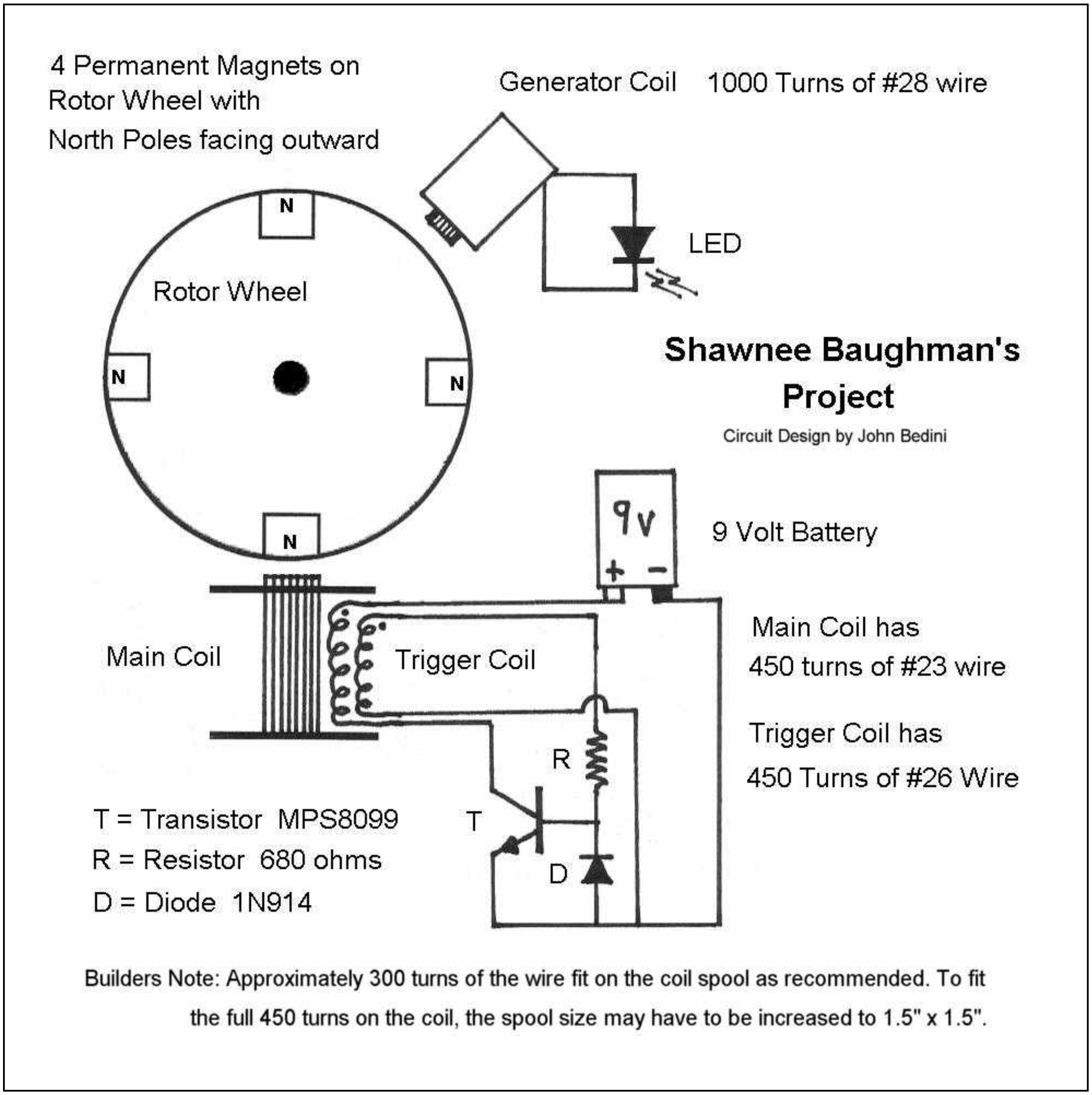
The energizer was a special generator that didn't slow down as much as a normal generator when electricity was coming out of it. The rotating switch allowed the battery to be charged part of the time, and then run the motor the rest of the time. As the years went by, John realized that if he could get the energizer to turn itself, he could eliminate the electric motor and really simplify the system. His experiments along these lines were very successful and by the time Shawnee Baughman came along, John had this new system working quite well.

The original energizer consisted of a wheel with a series of permanent magnets on it that would rotate in front of a number of coils of wire. As the magnets moved passed the coils, pulses of electricity would come out of the coils to charge the battery. But John also knew that the wheel could be made to turn if a pulse of electricity was put back into one of the coils at the right time. It was just a matter of developing the right switching method.

The new system consisted of an energizer, a battery, and a special timing circuit. That eliminated half of the components, including the electric motor, the rotary switch, and the flywheel. The new energizer consisted of a wheel with a few permanent magnets mounted on it, with one or two coils of wire mounted nearby. This is the system he taught Shawnee how to build. John called it the "North Pole Motor".



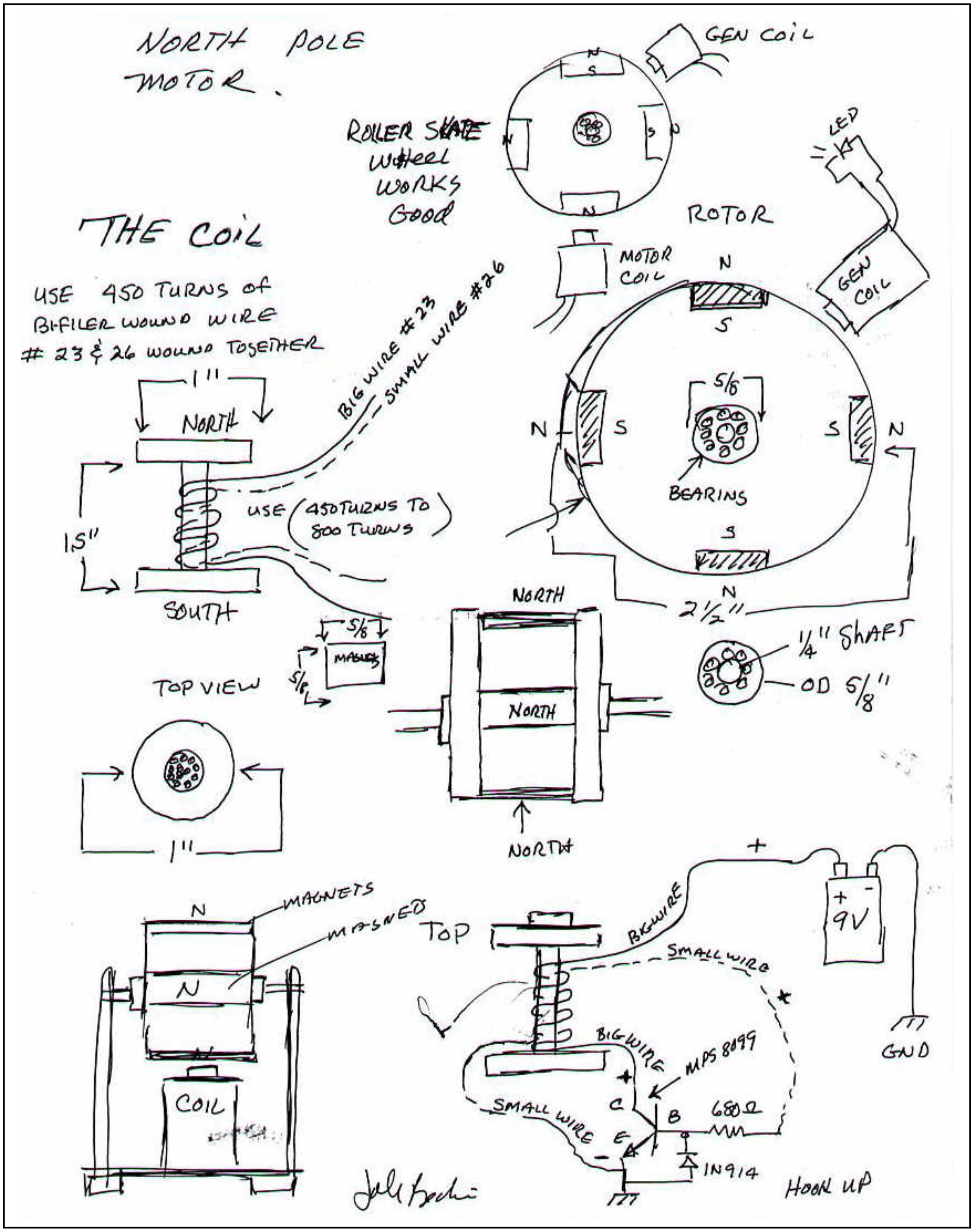
The only differences between his first drawing, shown above, and Shawnee's project were that Shawnee's rotor wheel had four magnets on it, and there was an extra generator coil mounted on the top that lit the LED.



John gave her lots of pointers on how to take a roller skate wheel and mount it on a little stand. Then he showed her how to mount the permanent magnets to the wheel so they wouldn't fly off when the rotor was spinning. He also showed her how to choose the wire, wind the coils and add some little iron wires into the coils to focus the magnetism.

Finally, he showed her how to wire everything together, and even solder the electronic components together so they would work properly. John showed her what to do, but Shawnee built everything herself!

Here is a copy of the complete worksheet that John gave her.



As you can see, this is a fairly simple little project. It can be built using a little frame to hold a roller skate wheel that has 4 small permanent magnets glued onto it. It also has two small coils of wire, a 9 volt battery and four electronic components: a MPS8099 transistor, a1N914 diode, a 680 ohm resistor and an LED. The question is, what is so special about this device that a 10 year old could win a school Science Fair with it?

What is special about it is **what it does**! And what it does is run a very long time on the battery without the battery running down. In fact, it probably runs at least 20 times longer than any other type of toy motor, AND it also lights up a little LED light while it's doing it.

What upset the science teachers, who were supposedly "overseeing" the Science Fair, is that Shawnee Baughman, a 10 year old student, was demonstrating a reality in Science that they knew nothing about! She was showing how to power an "electric motor" and a little light (LED) from a battery in a way that, apparently, was NOT discharging the battery! At least, it was not discharging the battery as fast as the science teachers thought it should be discharging, according to what they knew about "electrical science".

Their dilemma was that the little demonstration was apparently breaking the "Law of the Conservation of Energy" and they didn't understand why. After all, 10 year old girls are not supposed to know more about science than the teachers do. What they didn't know, is that John Bedini had been working on this "little demonstration" for over 20 years, and he was quite far along in his research and discovery process.

Actually, the machine demonstrates a whole new way to "transfer" energy, as well as a way to "conserve" or recover all of the energy that was not actually lost, or "used up" in the process. In this way, it actually "conserves" energy better than ordinary machines.

Chapter Two

Why Does This Work?

Clearly, the science teachers were "out of their element", so to speak. They didn't have enough equipment to know for sure, but they did measure the battery voltage, and it just wasn't going down fast enough to account for how long the demonstration was running. The battery appeared to have more energy in it than it was supposed to.

Since it is, in fact, impossible to actually "break" any of the Natural Laws concerning how the Universe works, it is reasonable to ask:

1) How does the device operate?
2) What is the real energy balance of the machine's operation?
3) Is the machine demonstrating an "energy gain"?

Since this is a Handbook for beginners, there will be no attempt here to explain these processes in terms of established electrical engineering terminology, supported by mathematical formula. Rest assured, these exit. Instead, a series of illustrations with a verbal description will be presented which can be understood by enthusiastic hobbyists, as well as engineers.

The machine's operation does NOT break any rules which are well established in electrical engineering practice. It does break a number of ways that certain "Laws of Physics" have been generally interpreted, thereby demonstrating that these generally believed interpretations are not wholly correct. One of these is the "Conservation of Energy" rule.

John Bedini is a brilliant, yet classically trained electrical engineer and electronic circuit designer. He holds multiple patents on audio amplifier designs and holographic 3-dimensional sound processing methods, as well as advanced battery charging systems. The point is, he is a consummate professional engineer who routinely develops innovative solutions to complex engineering problems.

His development of multiple generations of "self-running" electro-mechanical machines is not an "accident". It is the result of decades of research and experimentation into "low drag" generator designs and how to charge a battery "very efficiently".

1) How does the device operate?

In order to clarify the operation of the "Self-Rotating Energizer" that John Bedini taught Shawnee Baughman how to build, I would first like to describe "what it is" and "what it is not".

Since the device operates on electricity and it mechanically spins during it's operation, most people think of it as an "electric motor". To be perfectly clear, the device IS NOT an electric motor. John has always, from the very first, referred to the device as a "self-rotating energizer" or simply as an "energizer". This distinction is extremely important if you are to understand this project.

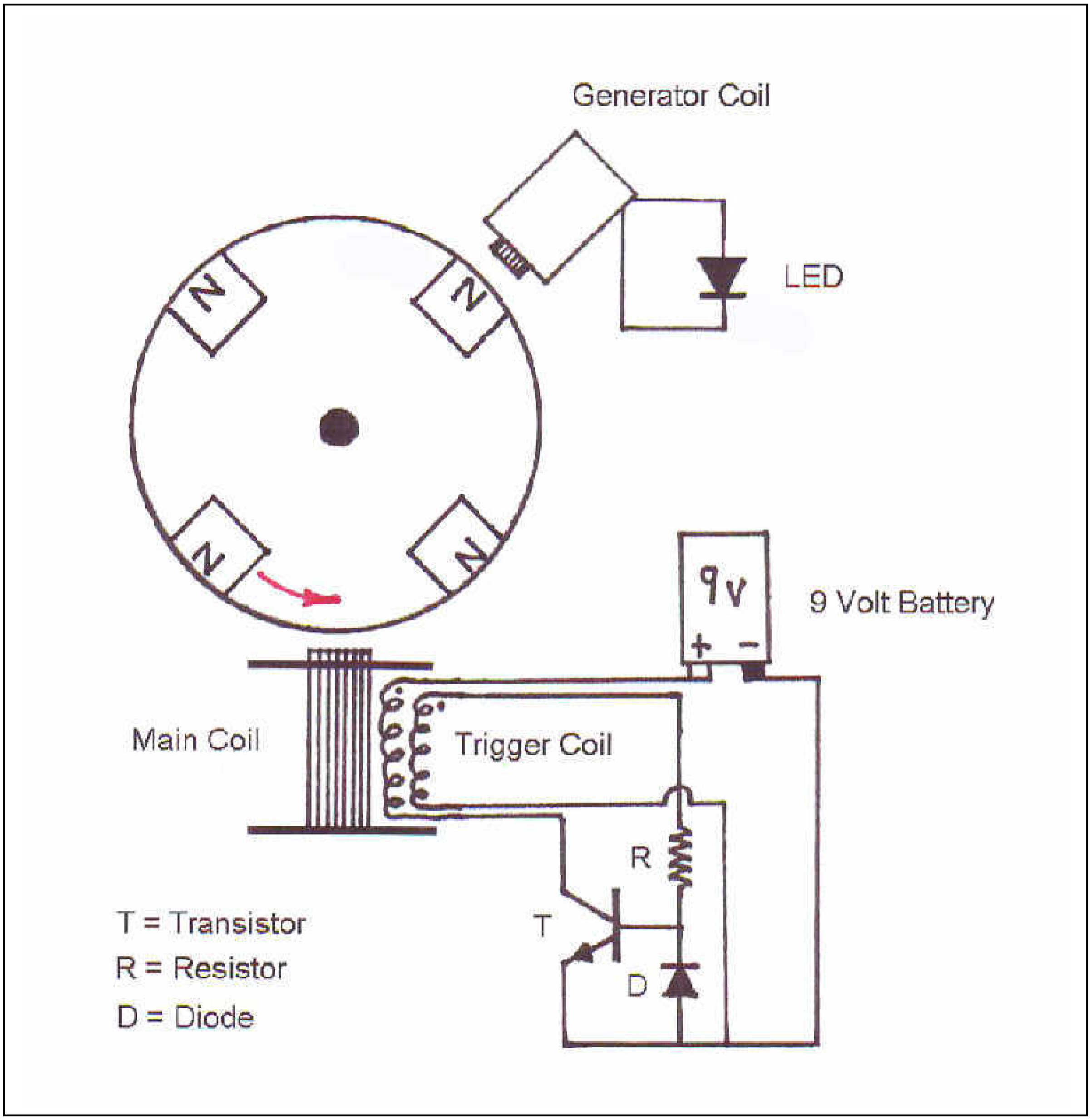
Electric motors are usually designed to power some other rotating device, like a pump or a compressor. This is NOT the primary purpose of the Bedini SG Energizer, as we will see shortly. It's true that it does spin and it does produce a small amount of mechanical energy. But the way it does this is very different than most electric motors and it's ability to power other mechanical loads is quite limited.

The true purpose of the device is to have a very specific effect on the battery that is powering it, and to keep itself rotating! This is what it does.

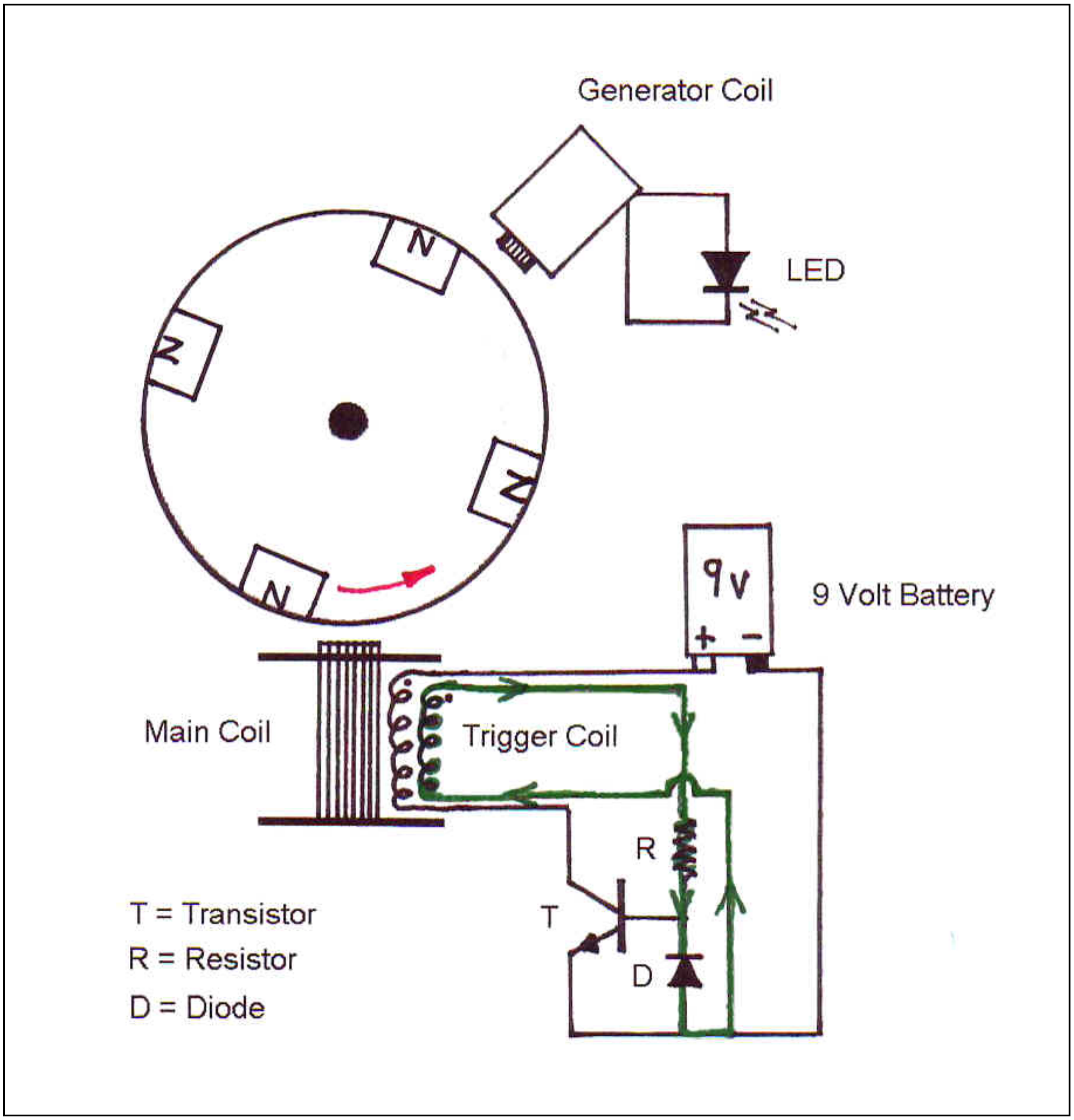
So, it is not an electric motor. Secondly, the model that Shawnee Baughman built is sized to simply "demonstrate" certain principles in electrical science.

In this sense, it is a "learning tool" and <u>not</u> a prototype for a "fuel-less power plant" that will power your home.

With this in mind, let us begin to understand how the device operates.

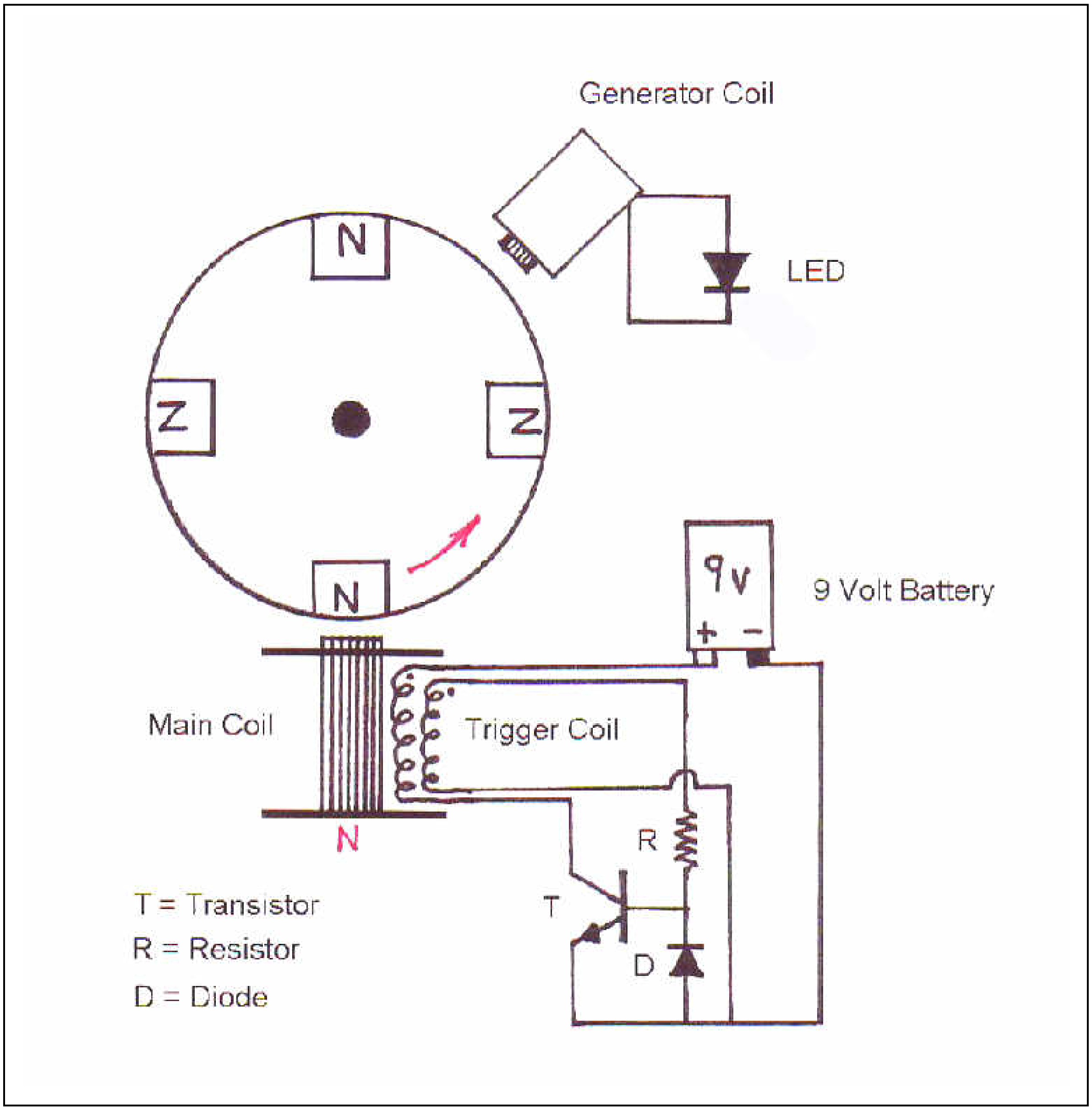


The Main Coil has some iron rods in the center of its structure and they participate in getting the process started. As one of the magnets on the wheel approaches the iron core of the Main Coil, it becomes attracted to the iron and so, it moves in the direction of the **RED ARROW**.

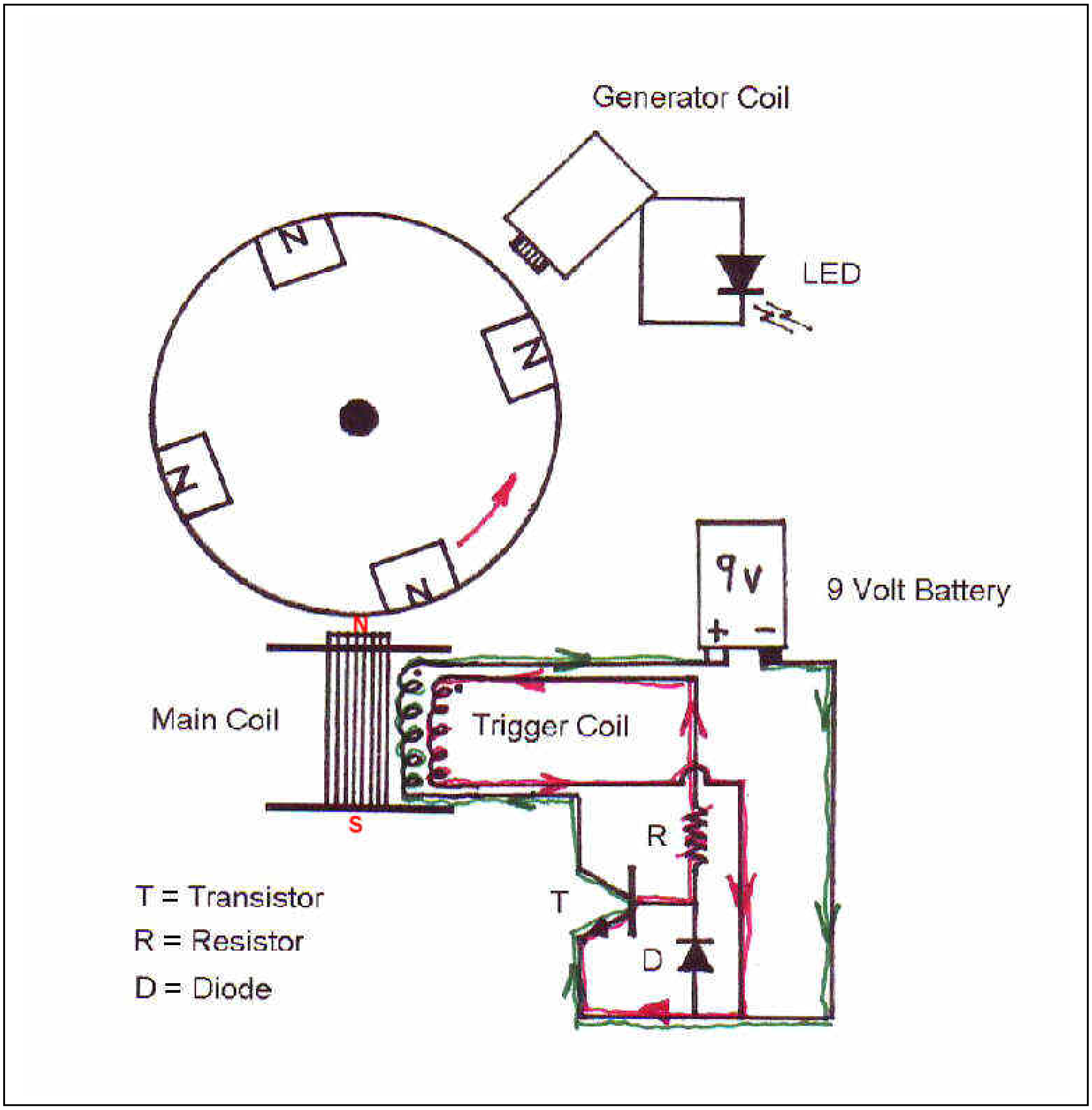


As the magnet gets closer and closer, the iron rods start to magnetize and as they do that, a small current is induced in the Trigger Coil winding that flows in the loop indicated by the **GREEN ARROWS**. With the coil wound "clockwise", this current flow is in the wrong direction to activate the transistor, so the transistor stays OFF during the approach of the magnet. This means that while the magnet is approaching the Main Coil, the transistor is OFF and no power is being drawn from the 9 volt battery.

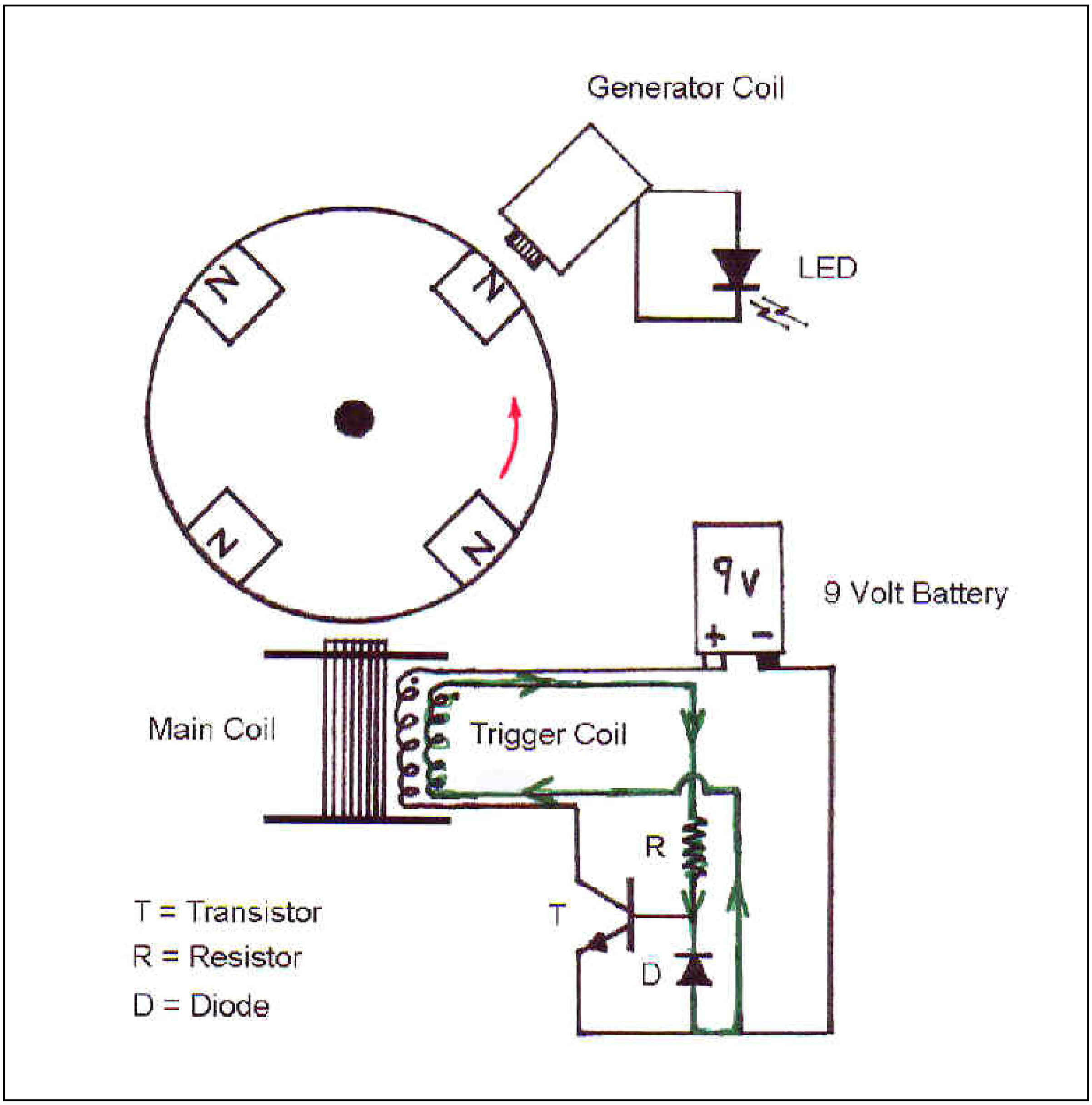
Mechanical energy is being produced and stored in the wheel, however.



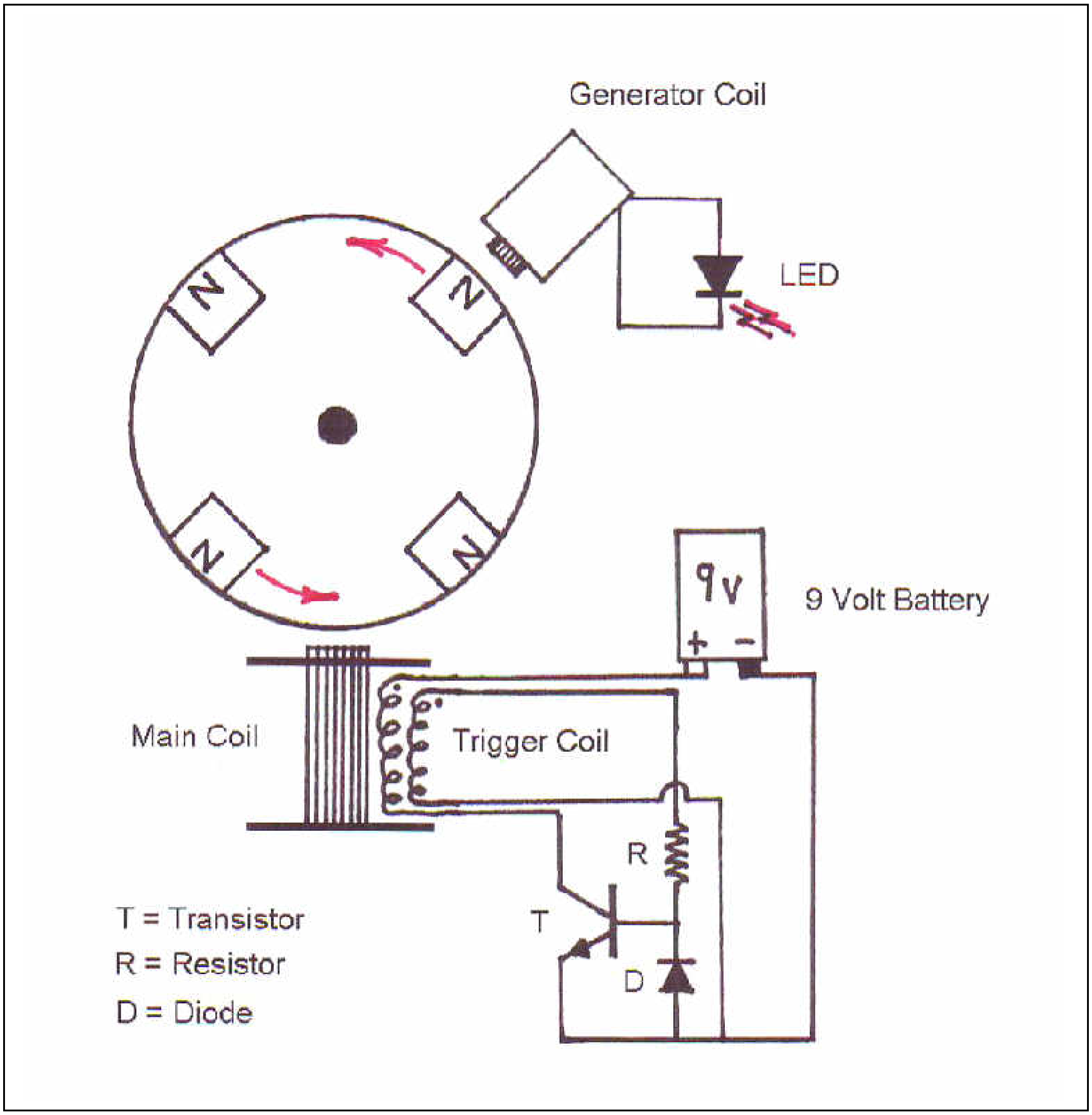
When the magnet gets to the position where it is directly above the iron core of the Main Coil, a number of things happen. First of all, the iron reaches its maximum level of magnetization, which has been rising steadily as the magnet approached. This "change of magnetic flux" is what has been inducing the current in the Trigger Coil loop. So, when the magnetization reaches it's peak, the "change" of magnetic flux stops, and therefore, the current flowing in the Trigger Coil loop stops, as well. At this point, the magnet on the wheel has magnetized the iron in the Main Coil so that it is "attracted" to it. That means that there is an induced magnetic field in the iron with a South Pole facing the wheel and a North Pole facing down.



Now, the action really starts. The magnet on the wheel has been attracted to the iron and has stored some momentum, so it slips passed the alignment point with the iron core. Just as it does this, the magnetic field in the iron starts to drop, and that "change of magnetic flux" induces a current flow in the Trigger Coil loop that is in the opposite direction of what it was before, indicated by the **RED ARROWS**. This event now activates the Transistor to turn ON, causing a flow of current from the 9 volt battery to flow through the Main Coil, indicated by the **GREEN ARROWS**. The current from the battery now forces the magnetic field in the iron to reverse, so that it's North Pole is now facing the wheel. This North Pole from the Main Coil now pushes the North Pole of the magnet on the wheel away, re-enforcing its established direction of rotation. This process continues until the iron core of the Main Coil reaches its maximum magnetization, based on the current flow from the 9 volt battery. At that instant, there is no more "change of magnetic flux" and so the induced current flowing in the Trigger Coil loop stops. This abruptly shuts off the Transistor, which in turn, stops supporting the magnetic field in the Main Coil, and so, the magnetic field must collapse and induce a current in the Trigger Coil, as indicated below by the **GREEN ARROWS**.

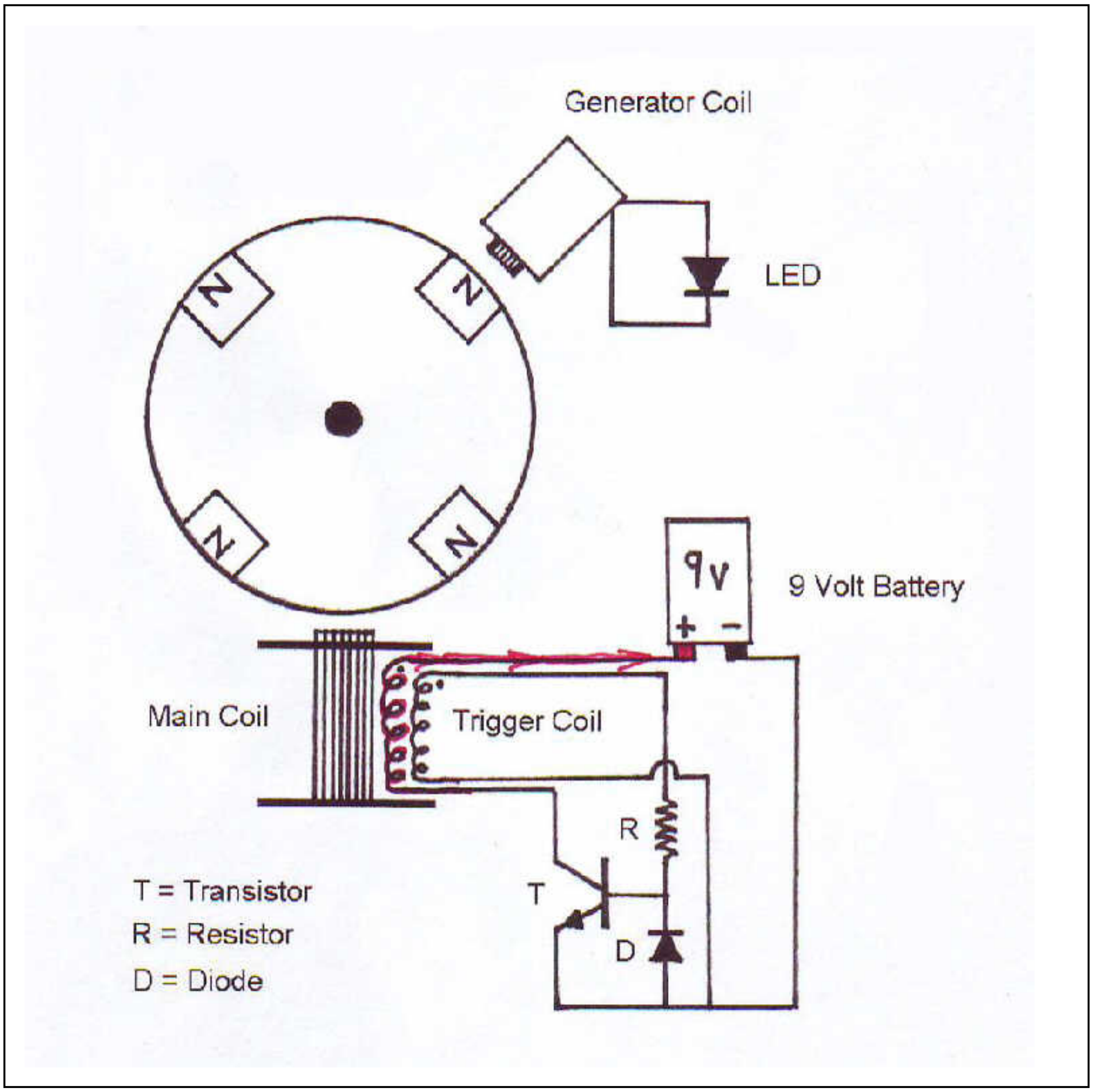


Meanwhile, the other magnet is approaching the generator coil, and is also being attracted to the small amount of iron there. As that magnet slips passed the generator coil, a current is induced that lights up the LED for a single flash. As the rotor speeds up and these flashes happen more often, the LED appears to be ON all of the time.



At this point in the diagram, the cycle is about to begin again, but this is NOT the end of the explanation of the operation of this machine. Even though most "self-respecting" electrical engineers will be quite pleased to believe that everything has been explained already, the problem is that if this was all that was taking place, the demonstration would run for about 6 hours on the 9 volt battery. This is what the science teachers thought, and why they were confused when it ran for closer to 5 days!

So, the machine continues to run because the battery is being recharged by a process that has NOT been explained yet. Granted, everything explained so far IS HAPPENING and can be measured on test equipment. But there is ONE MORE thing that is happening that is much more difficult to quantify, and this is it.



When the transistor turns OFF, and even before the current starts to flow in the trigger winding to dissipate the energy of the collapsing magnetic field, a high voltage spike, consisting of a longitudinal wave of pure potential, travels from the Main Coil winding back to the positive terminal of the 9 volt battery along one wire. The event is over in a few microseconds, but its effect on the battery is profound.

It completely reverses the flow of the heavier ions in the battery and slows the accumulated "discharge rate" of the battery by over 95%! This allows the battery to run the "toy demonstration" at least 20 times longer then the battery normally would.

This phenomenon, first reported by Nikola Tesla in the 1890's, is called "Radiant Energy" and it's appearance demonstrates aspects of electrical science that few researchers have understood. Lucky for us, John Bedini spent 20 years experimenting and teaching himself about this process until he understood it so well he could teach it to a 10 year old school girl.

2) What is the real energy balance of the machine's operation?

When measured by conventional methods, the "efficiency" of the machine is miserable! Production of mechanical energy is less than 20% of the energy measured coming from the battery. Energy available from the magnetic field collapse is dissipated in the Trigger Coil loop. All losses considered, an over-all 20% efficiency for the machine seems quite generous. This puts it "on par" with a gasoline engine, which is terrible! Actually, we'll discuss this in more detail in a later chapter.

3) Is the machine demonstrating an "energy gain"?

Not really, as described above. This is where almost everybody misses the boat. The "energy gain" is showing up <u>IN THE BATTERY</u> because of what the machine is doing to it. The energy gain is not measurable in the performance of the machine using conventional testing procedures.

Chapter Three

Optimizing Energy Recovery

Actually, "electrical science" is well aware of the little voltage spike that appears in a circuit when an energized coil of wire is disconnected from it's source of current. This phenomena is generally considered to be:

1) a nuisance that
2) can damage electronic components in the circuit
3) unless it is gotten rid of somehow.
4) It is also generally believed to have no significant amount of energy associated with it, other than the "over-voltage" condition it may momentarily produce.

In this project, we will consider this little voltage spike to be:

1) of the highest importance to understand
2) and to take advantage of it
3) for the recovery of it's real, yet under-appreciated, energy content.

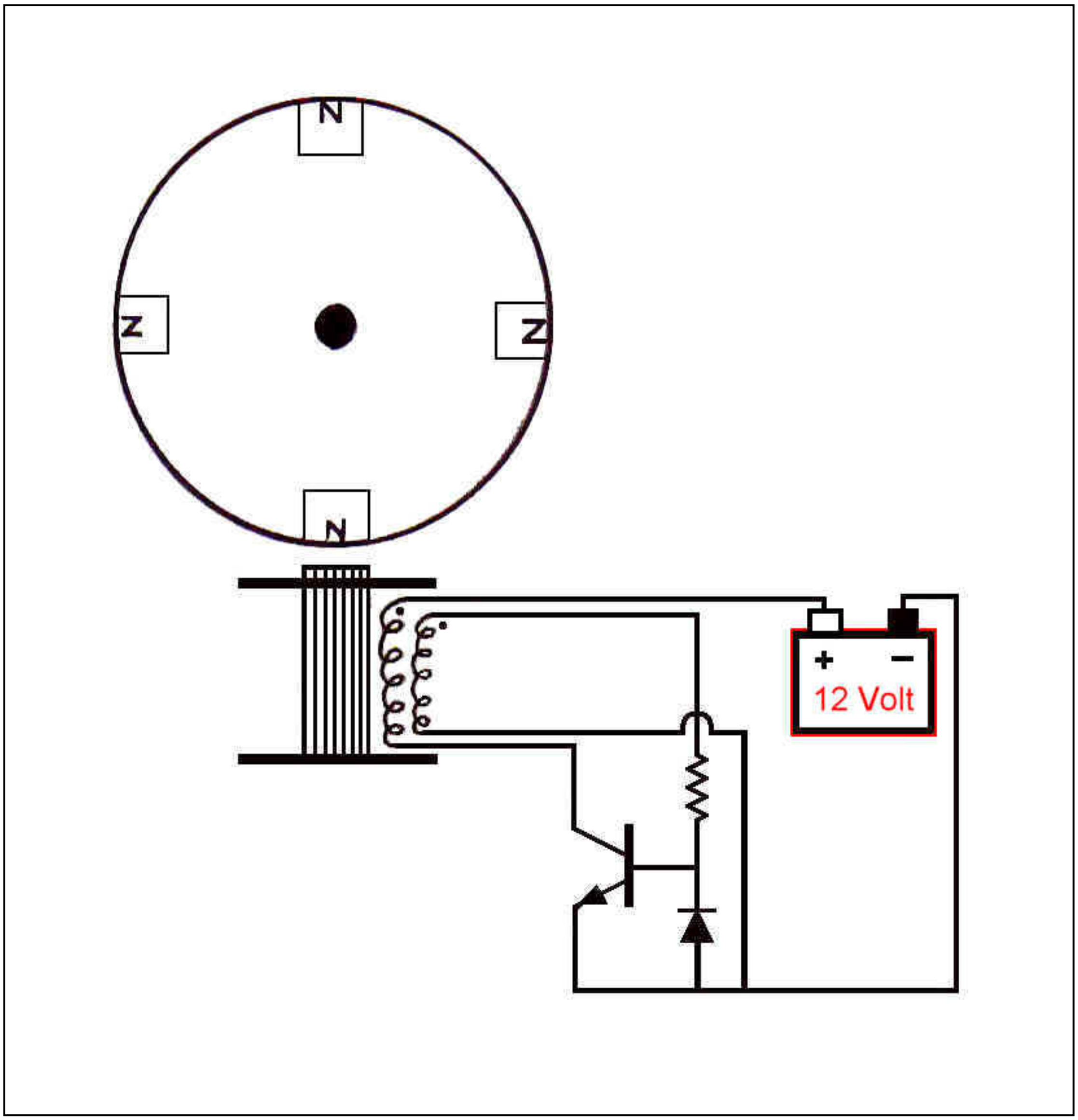
Except for this one difference concerning the significance and character of the voltage spike event, this project conforms to all other classical electrical engineering and circuit design methods. So, let's look at the energy recovery methods in this situation as we scale the project up to the next level.

Scaling Up the Electrical System

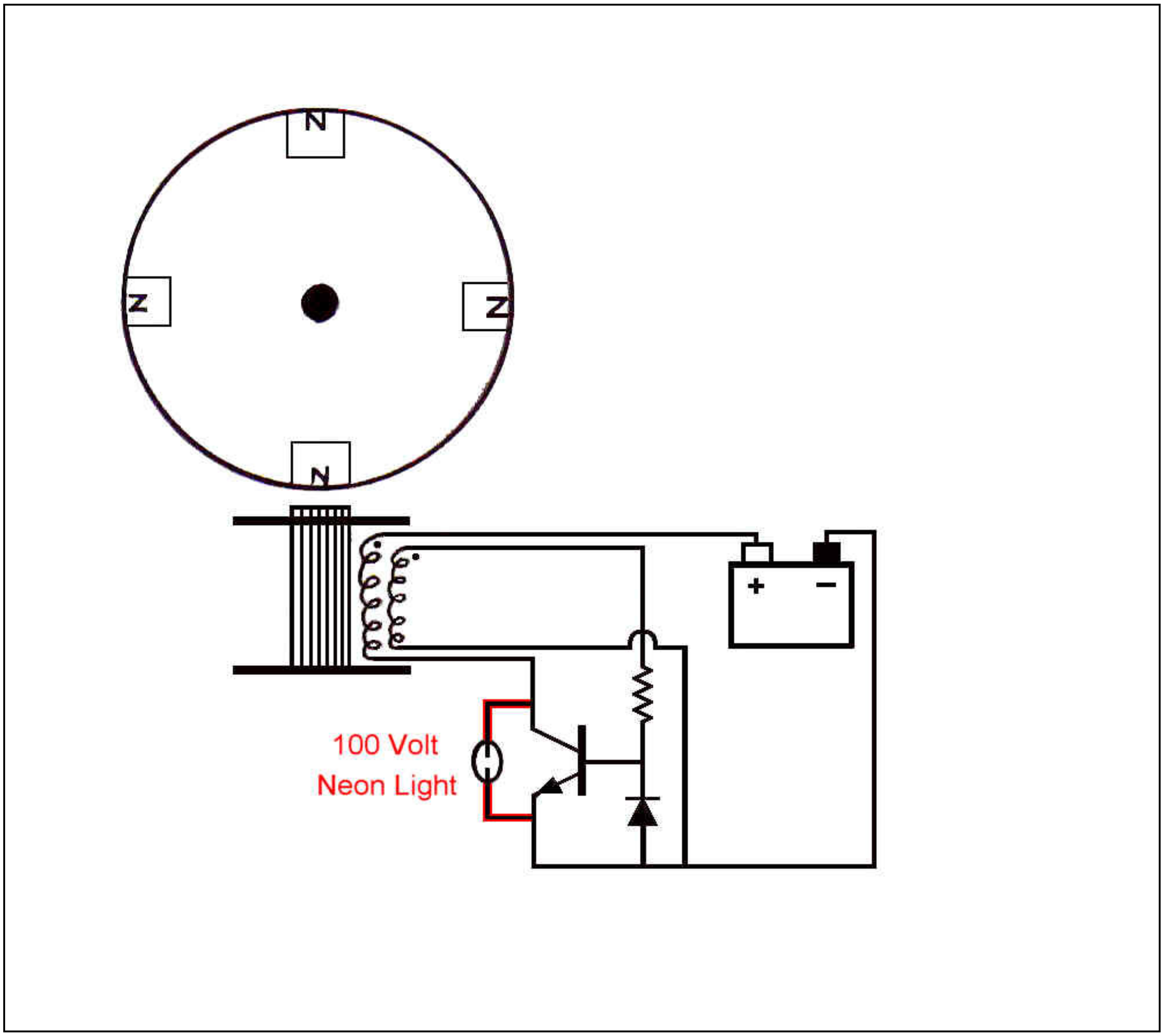
In Shawnee's model, the rotor wheel was about 2½ inches in diameter and the circuit ran on a 9 volt transistor battery. The Main Coil was 1 inch in diameter and 1½ inches tall. When the transistor turned off, the voltage spike was channeled back to the battery the model was running on to lengthen it's run-time.

This process works fairly well at this size and with these components. But when you start making the Main Coil larger, the voltage spike event starts becoming much more difficult to manage. Instead of simply spiking the battery, it also tends to start burning out the transistor. In order to allow for these conditions and make larger models, the following changes to the basic circuit must be made.

The first change is to switch from the little 9 volt battery to a more powerful 12 volt, rechargeable battery.

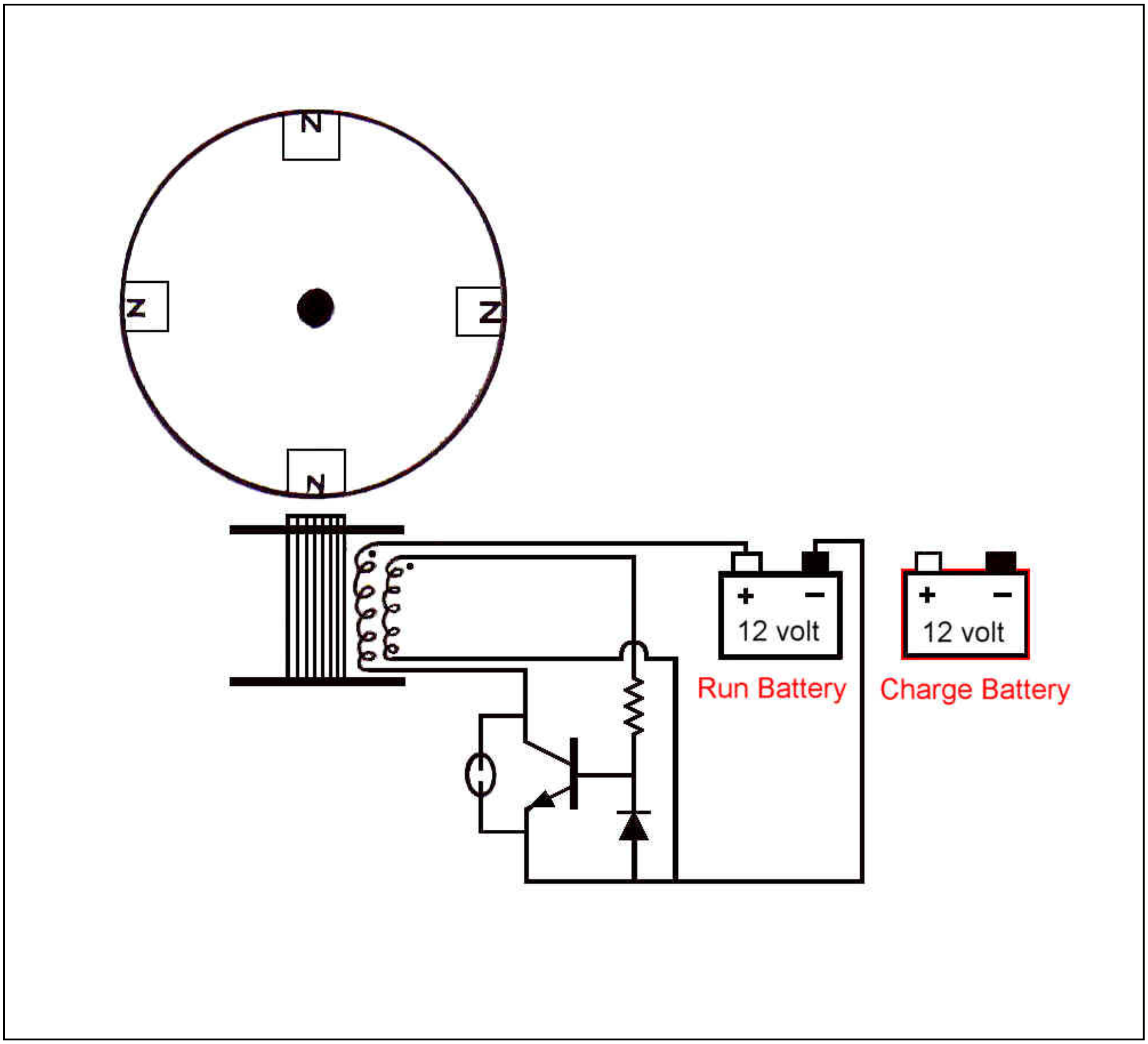


The next change is to ADD a component that protects the transistor, as a safety precaution, in case the voltage spike is not directed to the proper place. That extra component, in this case, is a NEON LIGHT bulb that completes the circuit if the voltage rises to about 100 volts.



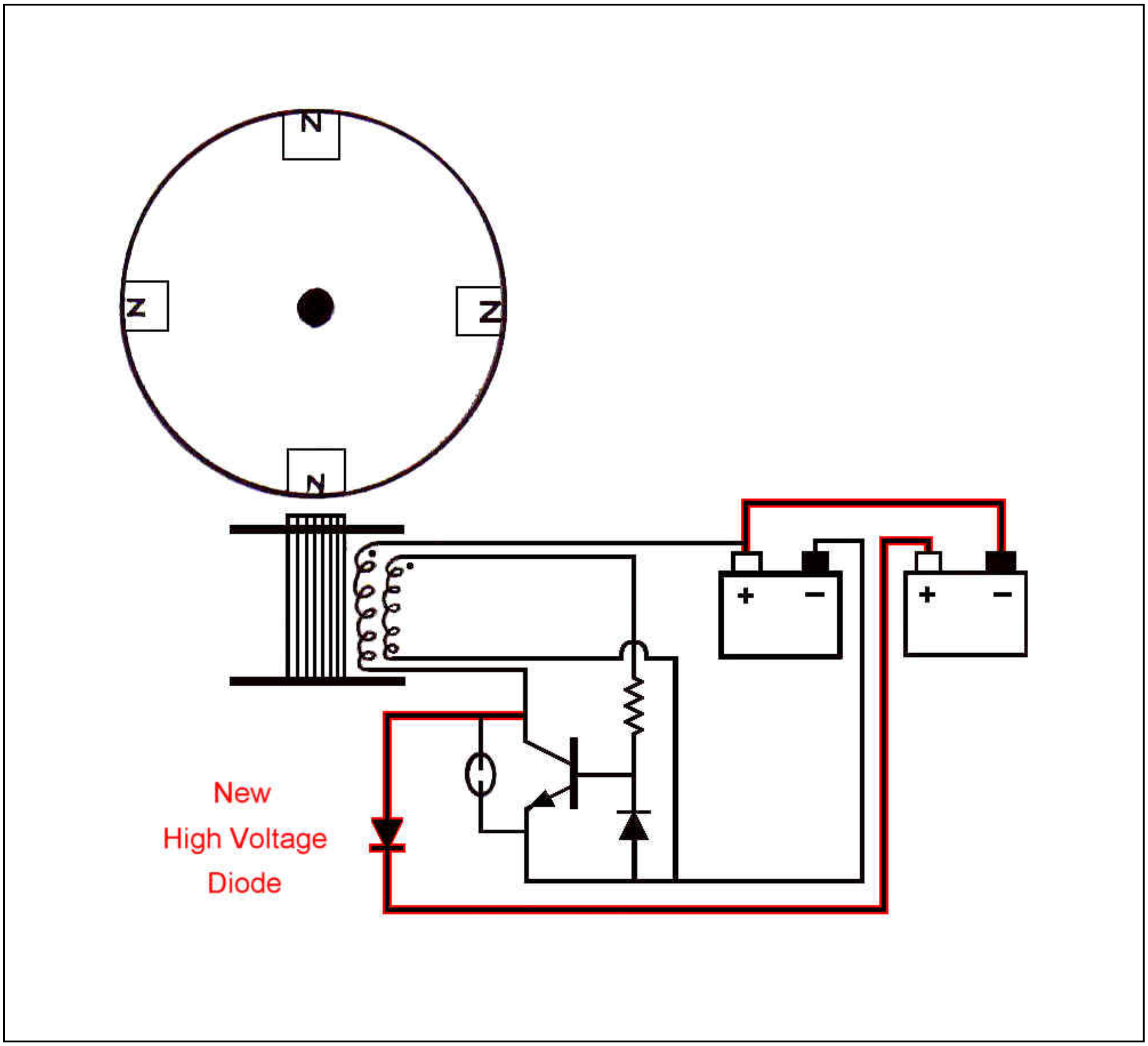
As you can see, the NEON LIGHT is placed directly across the output terminals of the transistor that is turning the coil ON and OFF from the battery. This way, when the transistor turns OFF, the voltage spike can create a temporary pathway back to the battery AFTER the voltage rises high enough to turn the NEON LIGHT ON. Otherwise, when the Neon Light is OFF, no circuit connection is being made.

The next change is to ADD a SECOND BATTERY to take best advantage of the Voltage Spike. You see, batteries don't really perform very well when they are being "charged" and "discharged" rapidly and repeatedly. So, the best way to take advantage of this is to RUN the machine from one battery, and to CHARGE a second battery with the voltage spikes.



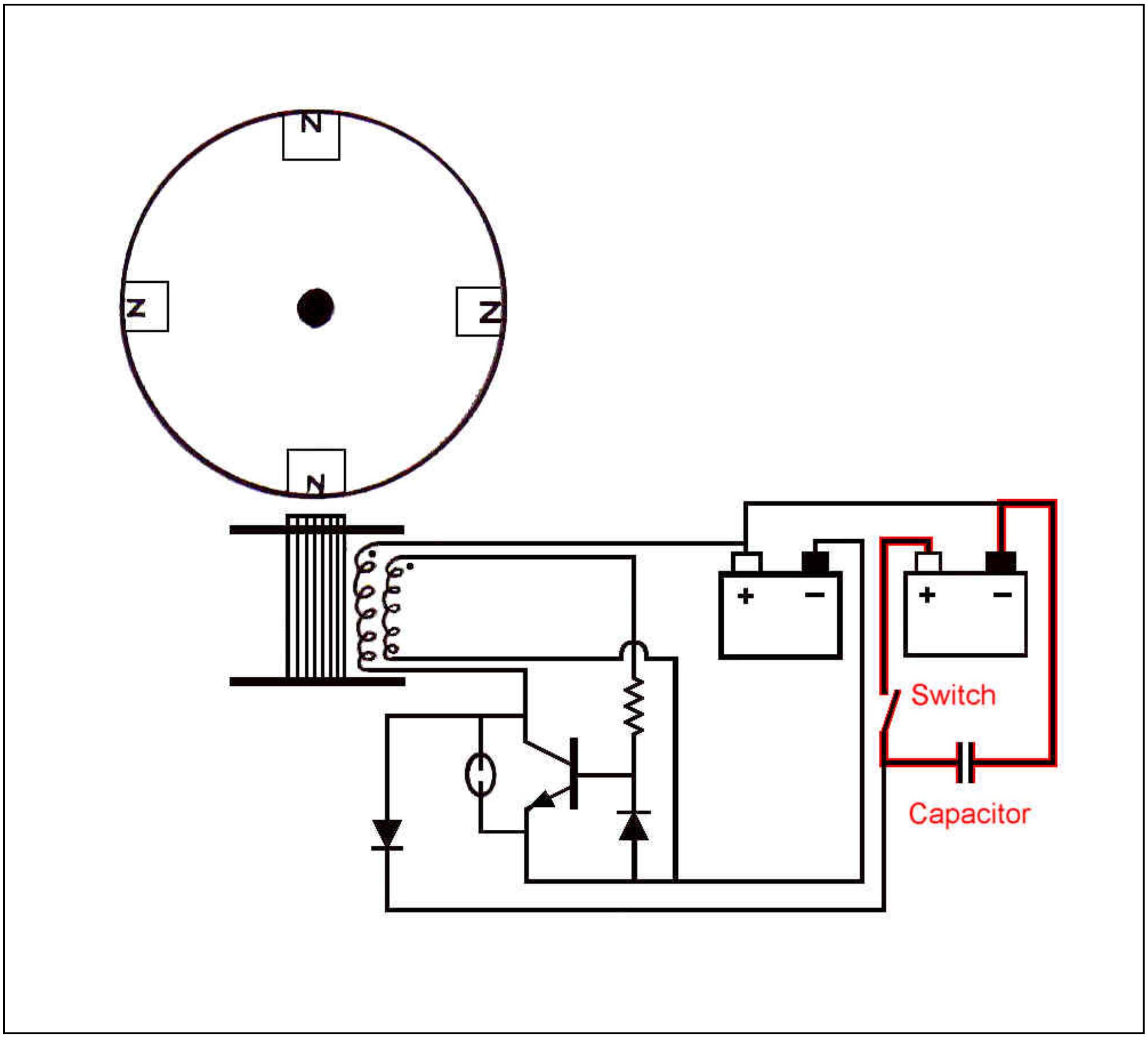
By adding a second battery to the circuit, one battery can now Run the system and the second battery can now be CHARGED by the system at the same time. This allows both batteries to operate at their highest levels of efficiency.

The next change is to ADD the extra wire to connect the new Charge Battery, as well as a NEW, High Voltage DIODE to direct the voltage spikes to this second battery.



The first diode in the circuit is needed to conduct currents in the trigger coil loop around the transistor when they were produced in the reverse direction. The new Diode must block currents from the second battery from discharging through the Main Coil. But it must also direct the voltage spike FROM the Main Coil back to the second battery whenever the Main Coil is disconnected from the RUN Battery after the transistor turns OFF. To do this without burning out, this New Diode must be rated for HIGHER VOLTAGES than the first diode.

So, this is the classic circuit for charging the second battery DIRECTLY from the discharges of the Main Coil. It works extremely well, but it also demonstrates an unusual phenomenon. Most Physicists and Electrical Engineers believe that all electricity is the same, and that electricity does NOT exhibit "quality" differences, only differences in quantity. In order to charge the second battery with a "quality" of electricity that is compatible with other methods of charging, one last modification must be made.



Here, we ADD a capacitor and a switch. Now, the voltage spikes from the Main Coil can be collected in the capacitor when the switch is open and periodically delivered to the battery when the switch is temporarily closed.

When all of these changes are made, it brings us to the quintessential Bedini Mono-Pole Energizer circuit that is extremely similar to the diagram shown in US Patent #6,545,444, issued in April of 2003. [A copy of this patent is in the back of this book, on page 89.]

In this chapter, I have purposely not given you any circuit component values or part numbers, because I want you to understand the basic circuit functions first. So this is the fundamental method of operating the self-rotating energizer and recovering as much of the electricity as possible. The circuit is stable and capable of safe operation with coils approximately 3½ inches in diameter and 4 inches high.

So this covers the section on the recovery of Electrical Energy in the machine. When the circuit is tuned properly, the CHARGE Battery is charging at about the same rate as the RUN Battery is discharging, so the system can run for a long time if the batteries are periodically switched.

Mechanical Energy Production

At this point, electrically, the machine is almost 100% efficient, primarily because of how well the CHARGE Battery is recovering its charge. But there is more! The rotor of the machine is spinning, and producing some mechanical energy, as well.

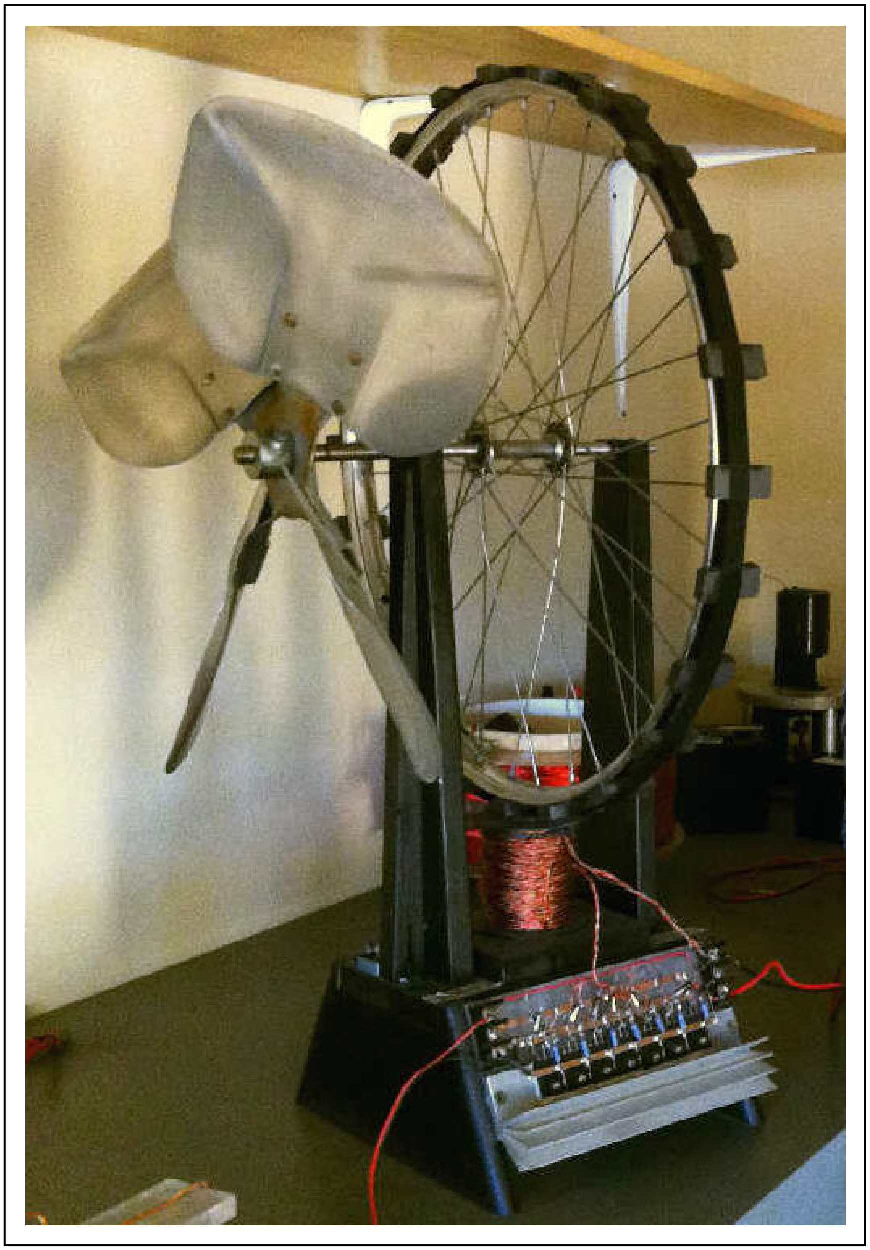
It is the <u>combined</u> electrical and mechanical energy outputs that exceed the electrical energy input.

So, what can be done to the machine to enhance it's ability to make even more mechanical energy? As it turns out, there are a number of design features that can be changed to accomplish this.

For this Beginner's Manual, I'd like to focus on just two primary features, one is "rotor wheel diameter" and the other is "timing".

When I worked at John's shop in 2004, I tested every model he had with a dynamometer, to measure how much mechanical energy each model produced. Without fail, machines with the same electrical circuits produced more mechanical energy as the rotor wheel's got larger. The best one in the shop at the time was the model with the "bicycle wheel" rotor.

The other feature is the "timing". In other words, "when does the coil turn ON and how does it act on the rotor magnets"? This process will be discussed in detail in Chapter 6.



Chapter Four

Electronics 101 for the Bedini SG

You may have noticed that the electronic circuits that are a part of this project are expressed in symbolic form. This chapter of the book is for you beginners who are not familiar with the symbols used to produce a representation of the circuit, which is called a "schematic diagram". But this chapter is also used to explain the functions of the SG circuit, so please don't skip ahead if you think you know the basics already.

This chapter will cover just the bare necessities for you to work with this project. If you would like to learn more about electronics, at a beginner's level, I highly recommend the book:

Getting Started in Electronics, by Forrest Mims, which you can purchase from this website: Forrest Mims or by going to Amazon.com.

OK, let's get started. There are nine different electronic parts that have been used in the circuits discussed in the preceding chapters. They are:

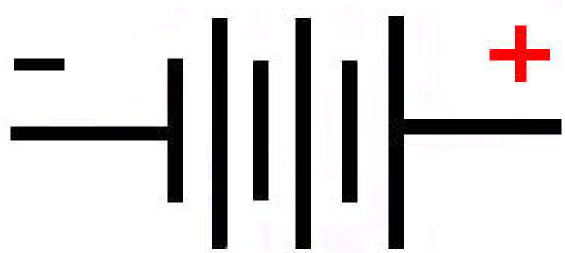
1. a Battery
2. a Coil
3. a Transistor
4. a Resistor
5. a Diode
6. a Capacitor
7. a LED
8. a Neon Light
9. a Switch

In the following nine sections, I will show you what each of these components looks like, tell you what it does in the circuit, and introduce you to it's symbol, so you can understand how it connects to the other components.

<u>The Battery</u> is the source of electric power used by the circuit. While the original Bedini SG built by Shawnee Baughman used a small 9 volt alkaline battery, all of the models you will be working with will use a rechargeable lead-acid type of battery. These can be sealed, like a "gel-cell" battery, or the more typical type of openable cell batteries, like you may use in your automobile. We recommend that you use the lead-acid type of battery that has openable cells like the one illustrated here.

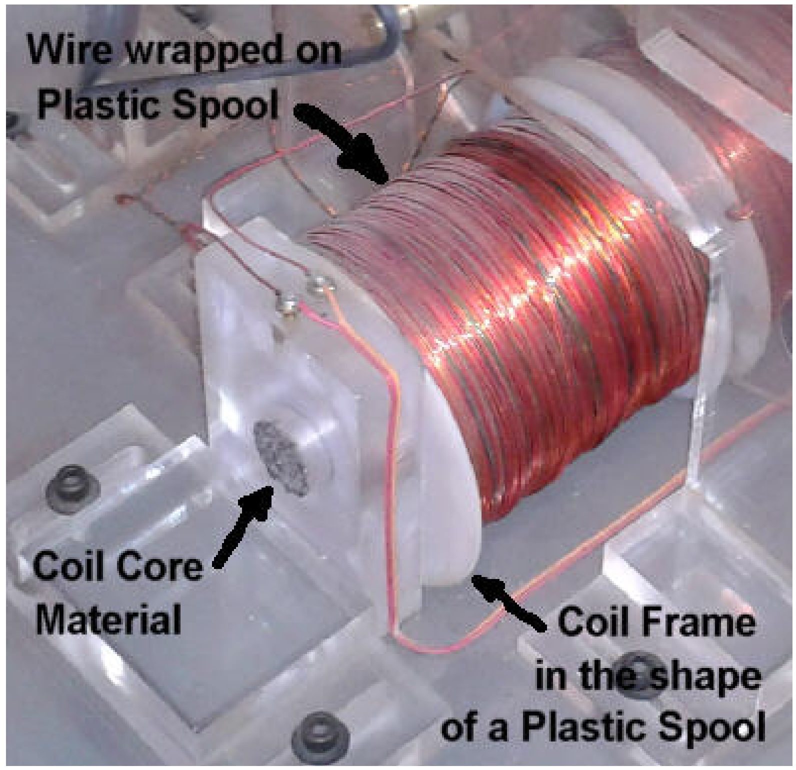
The reason for choosing a battery like this is that they are more difficult to damage when you are learning experimental charging methods. They are also relatively inexpensive and can run your experimental energizer for between 12 and 24 hours at a time.

The symbol shown here is how a battery is indicated in a schematic diagram. The parallel lines indicate the battery plates. The short lines represent the Negative Plates and the long lines represent the Positive Plates of the battery.

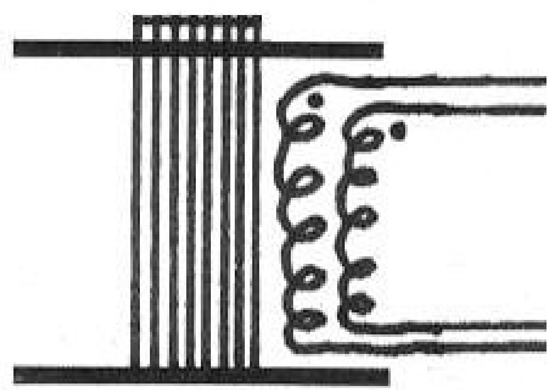


Symbol for a Battery

<u>The Coil</u> is the component in the circuit that produces a magnetic field when electricity flows through it. It consists of a plastic coil frame, sometimes called a "spool", one or more lengths of wire wrapped around this frame, and a material in the center of the frame to channel the magnetic field.



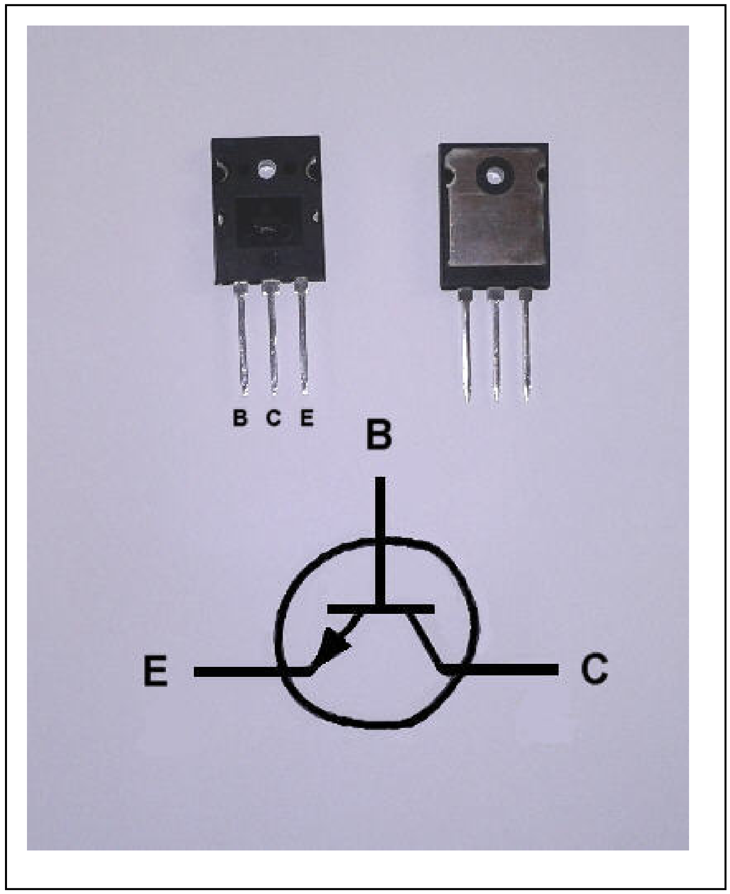
The coil frame is quite often in the shape of a "spool" with an open center section. This way, wire may be wound around the outside of the spool and held together by the plastic disks on each end, while the open center may be filled with a material that will channel the magnetic field. Here we see an image of a coil illustrating these features.



Symbol for Wire Coil

Here is the symbol for the Coil element in a schematic diagram. You can see the three features, including the Frame, the Core in the center, and the Wires, which show the turns symbolically as little squiggles. The dots near the top of the coils indicate that these are the same "ends" of the coil for two separate windings.

The Transistor is a "semi-conductor" device that has a complex function to regulate the circuit. Actually, it connects two parts of a circuit so that one part can regulate what the other part is doing. In this case, we are using the Transistor as a "switch" that has no moving parts, something that can turn the electricity ON and OFF when we want it to. [Transistors can also be used to perform other more complex functions, such as amplification.]

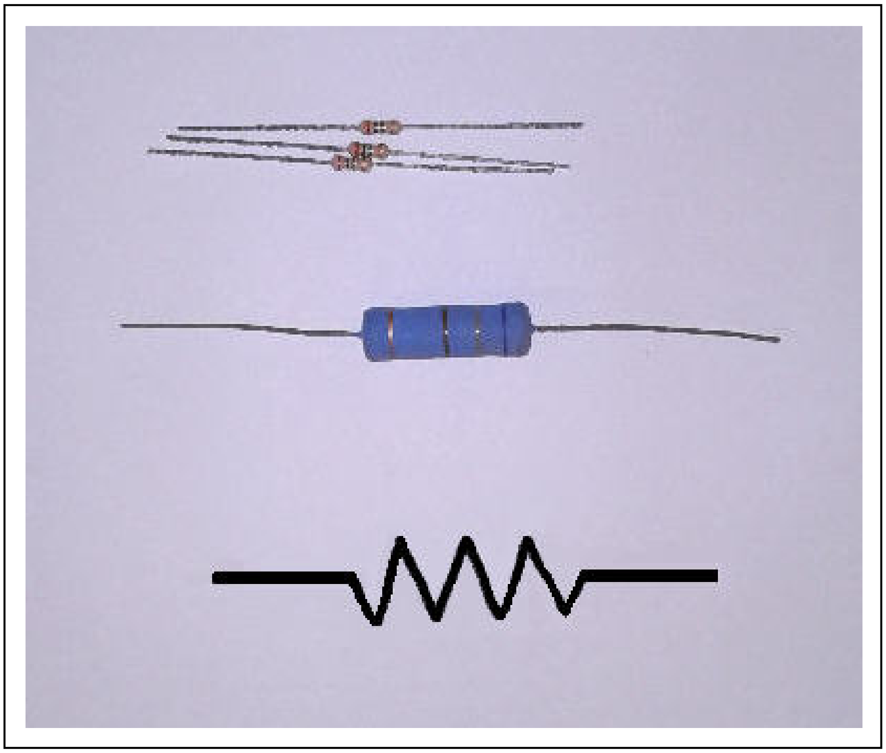


This image shows a typical "power" transistor from both the top and the bottom. As you can see, it has a square "case" with a mounting hole near one end. It also has three connections coming out that all must connect to the circuit. The symbol to the left shows these three connections, and labels them B, C, and E. These letters stand for the Base, Collector, and Emitter.

There are thousands of different types of transistors that perform hundreds of different kinds of functions in different circuits. The kind shown here, and the kind we will use for this project, is a NPN Bi-polar Junction Transistor.

In use, the transistor in this circuit will be acting like an ON/OFF switch. The Emitter is connected to the Negative of the Battery, the Collector is connected to the Main Coil, and the Base is connected to the part of the circuit that tells the transistor when to turn ON and when to turn OFF. Exactly "how" the transistor performs these functions is beyond the scope of this tutorial. You may find that information in the ***Getting Started in Electronics*** manual recommended earlier.

<u>The Resistor</u> is a passive component that regulates how much electric current moves through that part of the circuit. It has two connections fitted to either end of a cylindrical body. It can be hooked up to the circuit in either direction.



Resistors come in hundreds of sizes and are rated for the amount power flowing through them, as well as for their resistance to current flow, which is rated in units called Ohms.

The symbol for the resistor is shown as a wavy line that resembles the teeth of a saw blade.

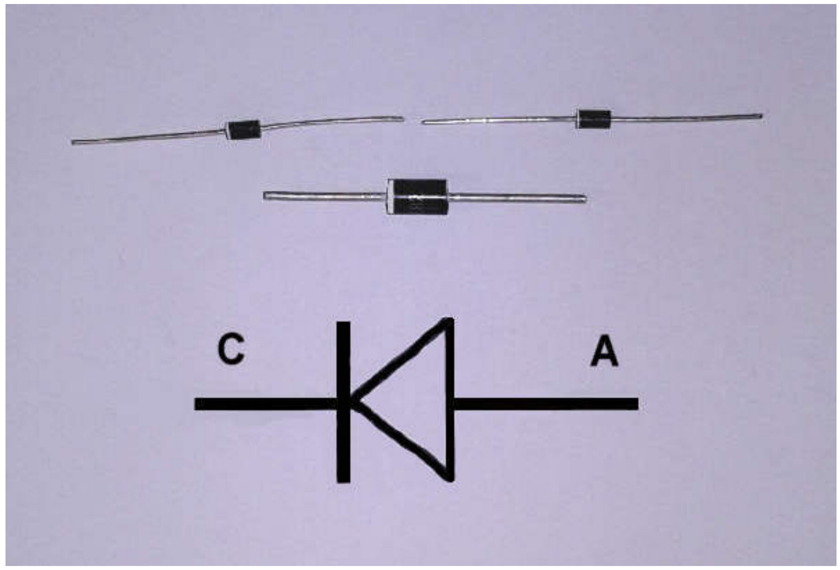
The three small resistors shown at the top of the picture are typical ¼ watt resistors, used in many electronic devices. You may be able to see some colored stripes on them. These stripes represent a code which reveals the resistance value of the component.

The larger blue resistor is a typical 2 watt device. It's color code, starting from the right side is blue-yellow-brown-gold. This means that the resistor has a resistance value of 640 Ohms, and is guaranteed to be within 5% of that value.

This last gold line is the one that represents the 5% "tolerance" value. Many electronic components have these tolerances ratings, because it is impossible to mass produce components that have exactly the same values.

The Diode is a component that only allows electricity to flow ONE WAY in the circuit. It acts like a valve that is open to electricity flowing in one direction, but if it tries to go backwards, the valve shuts and prevents the electricity from coming back. It does this with no moving parts, using a special semi-conductor junction, like ½ of a transistor.

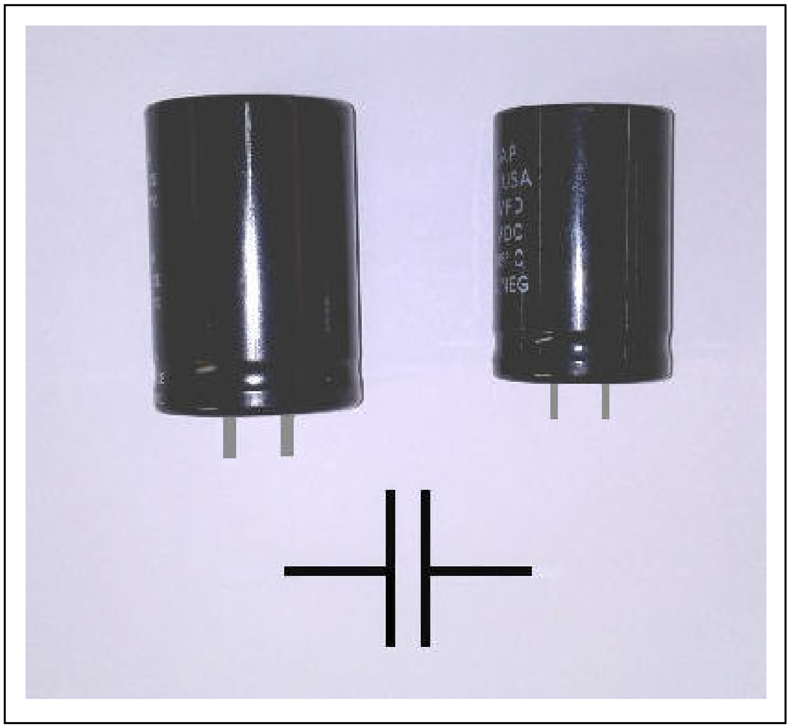
Because the diode passes electricity in one direction and blocks it in the other direction, it is very important to install diodes in a circuit correctly. Whereas Resistors operate the same in both directions, Diodes do not!



Diodes usually appear as a small cylinder with a wire coming out of each end. Diodes will usually show the symbol, or a single stripe at one end of the cylinder, as the examples in the picture shows. One end of the diode is called the "Cathode" (C) and the other end is called the "Anode" (A). Electricity will flow through the device when the Cathode is "more negative" than the Anode, OR if the Anode is "more positive" than the Cathode. The stripe indicates the Cathode end of the Diode.

The symbol for the Diode looks like an arrow pointing at a solid line. Remarkably, the direction of flow of electricity through the Diode is in the opposite direction of this arrow. The reason for this is that the symbol for the Diode was invented when it was believed that electricity flowed from Positive to Negative. After it was discovered that electrons have a Negative charge, and their flow was really from Negative to Positive, it was too late to change the symbol. So, **electron currents** flow through the Diode in the opposite direction of the way the arrow is pointing.

The Capacitor is a component that stores electricity. Whereas a battery stores electricity in a chemical form, the capacitor stores the electricity as an electrical stress across a material called the "dielectric". Because no chemical changes have to happen for electricity to move into or out of a capacitor, it means that a capacitor can be charged and discharged very quickly, almost instantaneously, in fact.



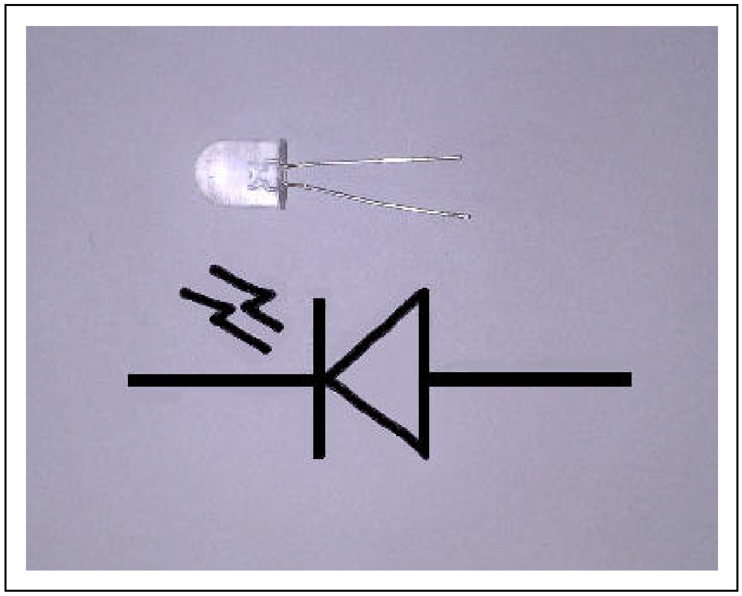
Capacitors come in many shapes and sizes, from as small as a little resistor, all the way up to the size of a garbage can. These two capacitors are about one inch in diameter.

The symbol for a Capacitor is two parallel lines facing each other, with wires coming out. These parallel lines represent the "plates" of the capacitor and the space between the lines represents the dielectric material that separates them. So, a typical capacitor has two contacts and connects to a circuit in two places.

Capacitors are rated both for how high a voltage they can store, but also for how much energy they can store, which is called "capacity". The capacity of a Capacitor is usually rated in units called "microfarads", although very large devices are now also rated in "farads".

Some Capacitors are "polarized", like a Diode, and need to be connected to a circuit in the right way. Others are not polarized and can be connected to a circuit in either direction. Polarized Capacitors are usually marked with a stripe on the negative terminal or on the side of the label.

<u>The LED</u> (Light Emitting Diode) is a special diode that works as a light source. Actually, most semi-conductor junctions produce some light when they operate, but LEDs are designed to maximize the light producing function.



The symbol for the LED is the same as for a Diode, except that it also has two little squiggly lines next to it, indicating that light is coming out of the diode.

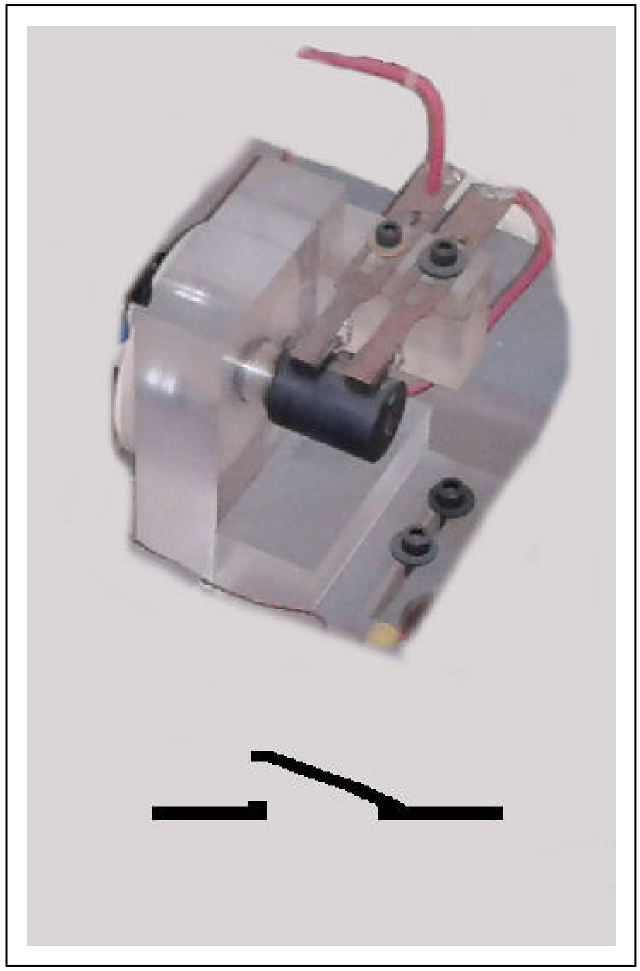
Like all other Diodes, the LED only allows electricity to move through it in one direction. And, like all other Diodes, the LED has a Cathode and an Anode and must be connected to the circuit correctly to operate.

<u>The Neon Light</u> is a specialty lighting device where two electrodes are placed near each other in an enclosed space that contains a small amount of Neon gas at very low pressure. It usually takes about 100 volts to make a neon bulb light up.

The symbol for the Neon Light mimics it's internal structure, where two parallel electrodes are surrounded by an enclosure.

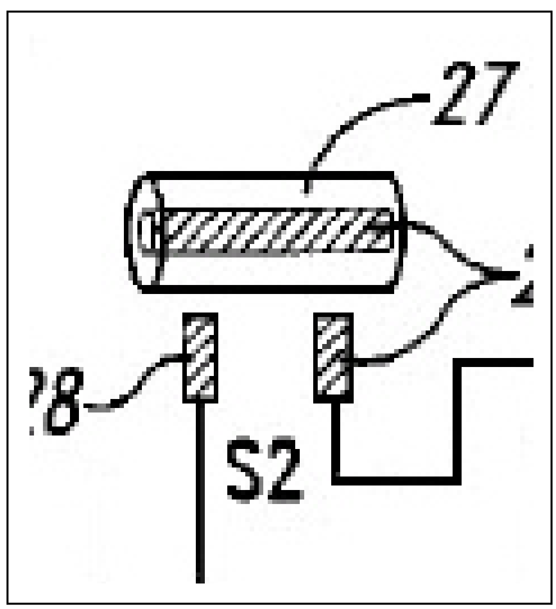
Neon Lights can run on either AC or DC and are rated for both the voltage needed to light them up, as well as for how much power they use, measured in milli-watts.

The Switch is any device that allows a temporary contact between two sections of a circuit. Most of us use switches everyday, to turn ON appliances, lights, fans, stove elements and other things. We even have many automatic switches that turn things ON and OFF based on pre-set conditions, like the thermostat in our house, or the refrigerator and freezer.



In the Bedini SG Project, the Switch is used to discharge the Capacitor into the Battery after it has been charged to a certain level by the discharges of the Main Coil.

The generic symbol for a switch is the one shown here, where a wire is interrupted with a section connected to one end and the other end is hovering over the wire. This represents a break in the wire that can be closed to complete the connection.



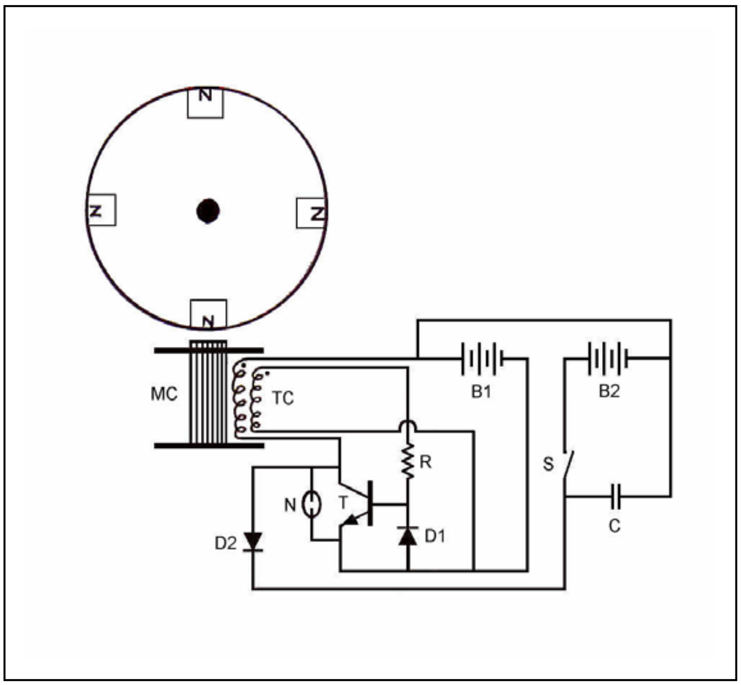
To the right is an image taken from John Bedini's US Patent #6,545,444. It shows the same roller wheel and two brush contacts in symbolic form as the top picture shows as a real model.

So, anything that works to make a momentary contact, periodically, will discharge the Capacitor into the Battery and keep the system operating.

<u>Reading a Schematic Diagram</u> is pretty easy, once you understand how circuits are laid out. In general, circuits usually have at least three parts. They are best described as Power, Control, and Output.

The Power section of the circuit consists of a "power supply", and the part of the circuit that power is being supplied to. The Control section of the circuit is the part that tells the power section "what to do" and "when to do it". The Output section delivers the results of the other two sections.

An example of a circuit is a home music system. The Power comes from the wall plug and is convert into the power needed by the circuit. The Control function starts with the music signal stored in the recording and transfers it to the power section. The Output is the speaker system where you can listen to the music at a controllable volume.



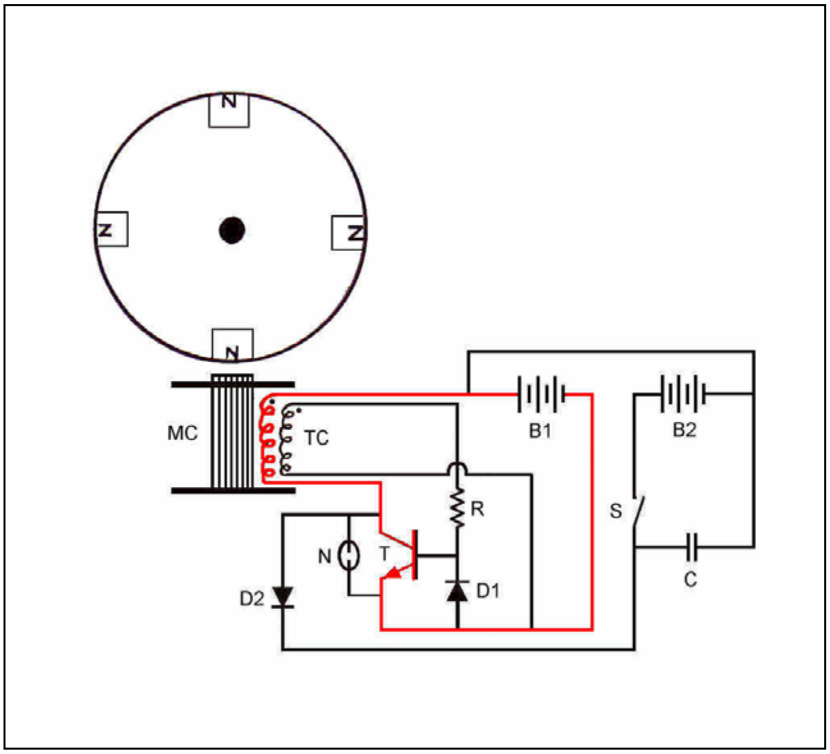
So here is the schematic diagram of the simplest form of our project. Notice, I have used the symbols I talked about earlier in this chapter and labeled each component with a simple letter, or letter and number designation. All of the lines that connect between the labeled components represent wires.

So, let's review the components of this circuit.
B1 is the "first battery" or the battery the system runs on. It is the beginning of the circuit, and functions as the "primary power supply". When trying to figure out how a circuit works, always start by trying to identify the power supply first. B2 is the "second battery" or the battery the system charges. Since this is the end result of the circuit, B2 also represents the Output, and in this case, the actual end of the circuit.

The other components include the Transistor (T), the Resistor (R), Diodes (D1 and D2), the Neon Light (N), the Capacitor (C), and the Switch (S).

OK. Let's look at the **Power Section** of this circuit. We have already identified B1 as the power supply, and the beginning of the circuit. So, what does the "power supply" supply power to? In this case, it supplies power to the Main Coil (MC) through its connection to Transistor (T).

In the diagram below, I have highlighted this section of the circuit in **RED**. Tracing the flow of electron current from the Battery (B1) we see that it flows out of the Negative terminal, follows the wire to the Emitter of Transistor (T), comes out the Collector of Transistor (T), follows the wire up to the bottom of Main Coil (MC), flows through Main Coil (MC) and comes out the top, then follows the wire back to the Positive Terminal of Battery (B1).

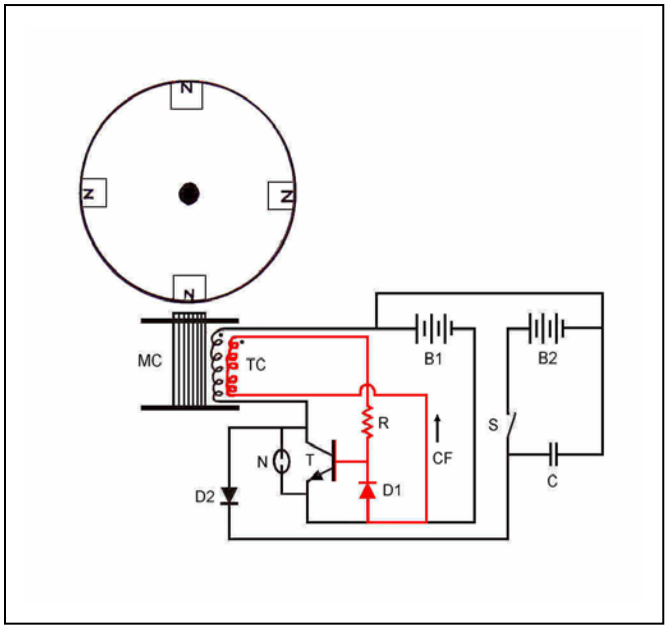


Read the paragraph above and look at the drawing of the circuit diagram to the right until you understand that they represent the exact, same set of ideas. If you need to, refer back to the earlier descriptions of the battery and the transistor, do that too.

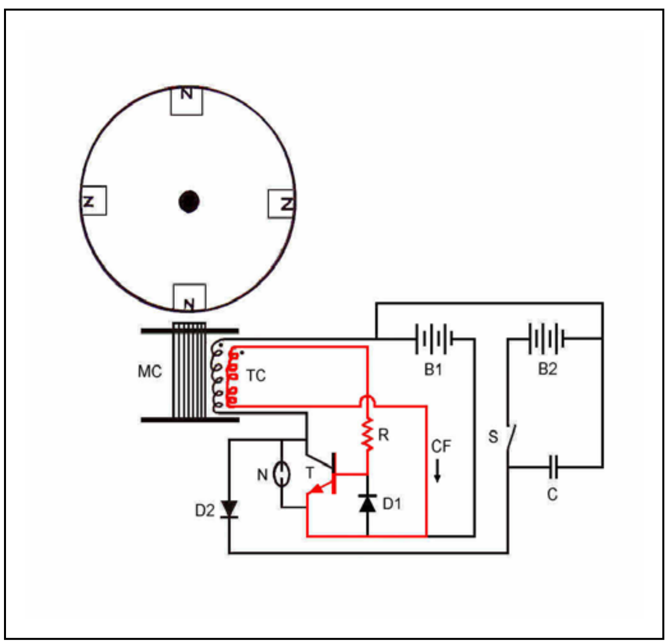
This is the power section of the circuit for this project. When this function happens, the Main Coil (MC) is being magnetized, and the magnet on the rotor wheel is being pushed away. It is the only time when electricity is coming out of Battery (B1) and the only time when the system is consuming any energy that counts as an "input".

Even though this is the Power Section of the circuit, it too has the three main functions of Power, Control and Output. The power comes from the Battery (B1). The Control is provided by Transistor (T), and the Output, or the end effect, is the production of a magnetic field when the electric current flows through Main Coil (MC).

Next, let's look at the **Control Section** of this circuit. This is the part of the circuit that tells the Transistor (T) when to turn ON and when to turn OFF.



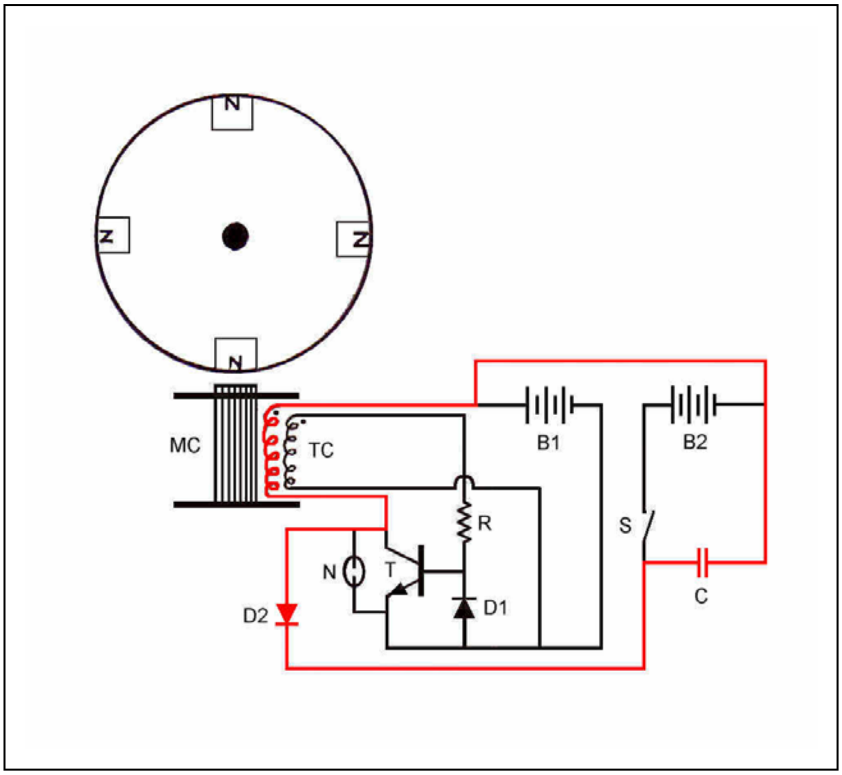
The power to operate this part of the circuit comes from the fluctuating magnetic field in the coil and its ability to generate electricity in the Trigger Coil (TC). The control section of this circuit consists of both the Resistor (R) and the Diode (D1). The output of this section of the circuit is the proper set of conditions to activate the Base of Transistor (T) so that it turns ON and OFF at the right time to run the Power Section properly.



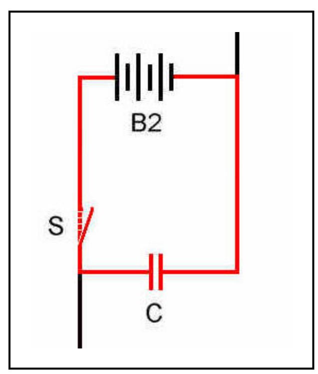
The rising and falling of the magnetic field in the coil core produces an AC wave in the Trigger Coil (TC). When the current flow (CF) follows the path shown in the first diagram, the Transistor is OFF. When the current (CF) follows the path shown in the second diagram, the Transistor is ON.

The **Output Section** of the circuit is next. After the Transistor (T) turns OFF, the current supplied by Battery (B1) stops supporting the magnetic field in the Main Coil (MC). When this happens, the magnetic field must collapse. In doing so, it induces a burst of electrical energy in Main Coil (MC) that can be re-collected. Capturing this energy is one of the main reasons for learning about this project.

The Output Section of the circuit is shown in **RED** in this diagram. So, the collapsing of the magnetic field in the Main Coil (MC) is the power supply for the Output Section. With the Transistor (T) turned OFF, the only pathway left open is through Diode (D2) and around to charge up Capacitor (C).



Diode (D2) is the control component in this section of the circuit. It allows the discharge of the energy in Main Coil (MC) to divert around the Transistor (T) and also facilitates the charge in Capacitor (C) to build up without discharging. The charging of Capacitor (C) is the desired, end result of this section of the circuit.

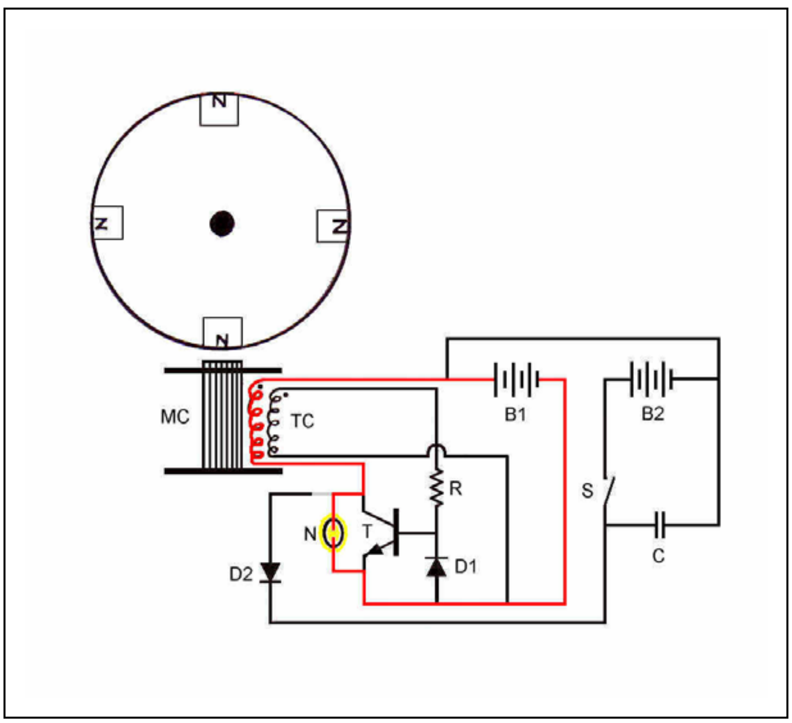


Of course, the final Output is for the Capacitor (C) to discharge into Battery (B2), as shown when Switch (S) closes temporarily. In this section, Capacitor (C) is the power source, Switch (S) is the control device, and the charging of Battery (B2) is the end result, the final Output, and the last operation of the circuit.

In Summary, the circuit works like this. A quantity of electricity is taken from Battery (B1) and used to produce a magnetic field in Main Coil (MC). That magnetic field is used to create a mechanical action upon the magnet on the wheel. After this operation is finished, the energy in the magnetic field is discharged. The electricity produced by the discharge of the magnetic field is then captured in the Capacitor (C). As multiple discharges of the Main Coil (MC) accumulate, the voltage in Capacitor (C) rises high enough so that the excess electricity can be transferred to Battery (B2).

This sequence of events produces what Nikola Tesla referred to as a "shuttle circuit" where electricity is transferred from location to location, but never allowed to "ground out", dissipate, or be lost entirely. This method represents the true meaning of "Energy Conservation".

There is one other possible operation of the circuit, and that is the **Safety By-Pass** through the Neon Light. When the magnetic field collapse happens in Main Coil (MC), the energy MUST discharge SOMEWHERE! If, for any reason, it is prevented from discharging through Diode (D2) as shown on the previous page, a secondary path must be available to dissipate this energy, or Transistor (T) will be damaged.

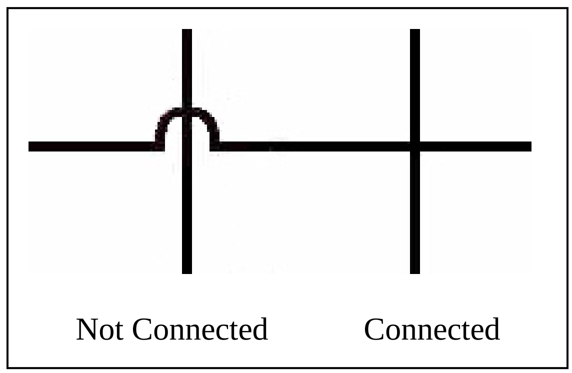


This Safety By-Pass circuit is outlined in **RED** here. When the Main Coil (MC) discharges its energy and the pathway to Diode (D2) is not available, Neon Light (N) will light up, forming a new, temporary connection back to the Main Coil

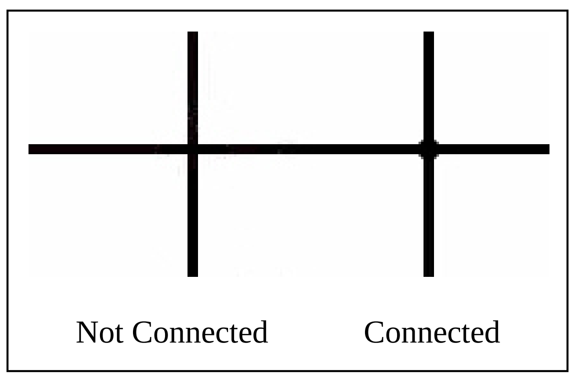
(MC) through Battery (B1). While this is not the preferred way to recollect this energy, it does allow the energy to be safely dissipated without damaging Transistor (T) by subjecting it to a very high voltage spike.

Hopefully, by now, you have a pretty good idea about how this circuit works, and how to read a schematic diagram. You'll need to know all of this stuff as you move into the next chapter, where you will find complete instructions on how to build your very own model of the Bedini SG.

But before we do that, there is one more, minor detail about reading schematic diagrams that I would like to bring to your attention. That issue relates to how best to symbolically represent when "wires cross each other and connect" and "when wires cross each other and DO NOT connect". Unfortunately, there are TWO methods to express these different situations, and it’s a little confusing if I don't show you both methods.



The first method is the method I have been using in the schematic diagrams in this book. As shown in this first drawing, the image on the left that looks like the horizontal line is looping over the vertical line, represents where the two wires cross each other in the diagram, but ARE NOT electrically connected. The image on the right that looks like the lines form a cross represent where the two wires come together in the diagram and ARE electrically connected.



The second method is used in some of the patents in the back of the book and looks like this. The image on the left, where the lines cross, represents where two wires cross over each other in the diagram, but ARE NOT electrically connected. The image on the right, where the lines cross with a round DOT over-laying the cross, represents where two wires come together in the diagram and ARE electrically connected.

So, when reading a schematic diagram, it is helpful to quickly determine which method is being used, or you may misinterpret the circuit.

Which Way does Electricity Flow?

People have been doing practical things with electricity since Ben Franklin invented the "Lightning Rod" back in 1749. His concept was that the earth (ground) was Negative and the stormy sky had a Positive quantity of electricity. It appeared that when lightning struck, it moved from the sky towards the ground. So, the convention developed that electricity flowed like heat, from the location that had an excess (Positive) to the location that had less (Negative).

When the Electron was discovered by Joseph J. Thomson in 1897, it was found to hold a "negative charge". This lead to the "Electron Current Theory" of electricity which postulates that electricity is the flow of electrons. This explanation assumes that electricity flows from Negative to Positive. For the last 115 years, people have believed both explanations.

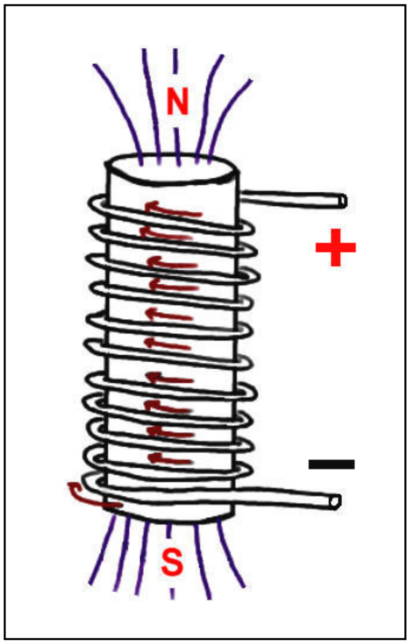
At this point, Electron Current Theory is taught mostly in North America, and Conventional Theory is taught in Europe and Asia. Regardless of which theory may be right or wrong, all of the circuit explanations in this book use the **Electron Current** model and assume that the electric currents are flowing from **Negative to Positive** in the circuit.

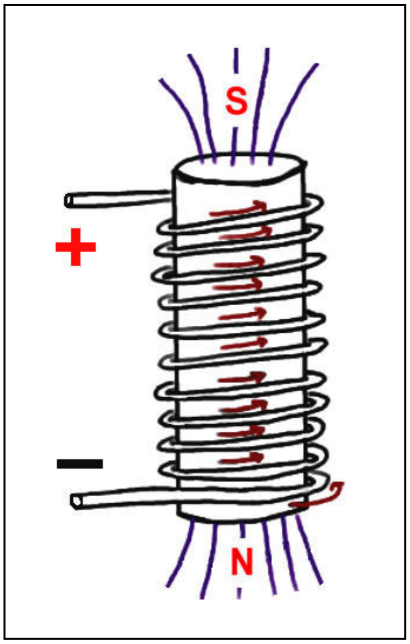
[Author's Note: If you were taught Conventional Theory, please realize that all of the explanations in this book are not "wrong".]

Which Way does Magnetism Flow?

Magnetic fields also flow between the poles of the magnet. Some people believe that they flow from the North Pole to the South Pole. Some people believe they flow from the South Pole to the North Pole. And still others believe that energy flows from both poles and re-enters the magnet in the center, at the so-called "neutral line". Maybe in the next 100 years, our understanding of magnetism will sort all of this out.

One thing that we do know about magnetic fields is how to make either a North Pole or a South Pole appear where we want in an electric coil.





In the drawings to the right, the two methods of winding are shown. Viewed from the top of the coil, the first example shows the current entering from the bottom, winding around the magnetic core in a clockwise direction, and exiting at the top. This current flow and clockwise winding produces a North Pole at the top and a South Pole at the bottom.

The second example shows the opposite arrangement. Viewed from the top, the second example shows the current entering from the bottom, winding around the magnetic core in a counter-clockwise direction, and exiting at the top. This current flow and counter-clockwise winding produces a South Pole at the top and a North Pole at the bottom.

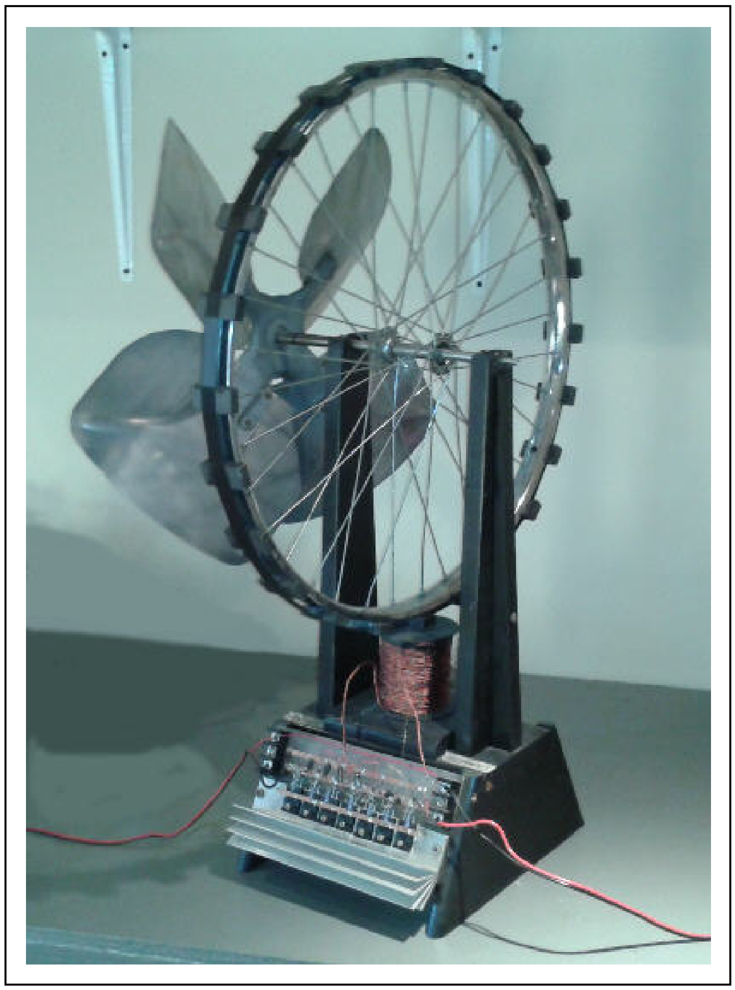
Reversing the direction of the current flow in either case will also reverse the polarity of the magnetic field.

OK. You now know more about this project than any of us ever did before we built our first model. It's time for you to build your own Bedini SG!

Chapter Five

Building the Bicycle Wheel Energizer

The goal of this project is for YOU to build a machine which has a positive, net energy gain! We refer to this as a "Co-efficient of Performance greater than One" or simply COP>1 for short. While this is POSSIBLE, it is not magical or automatic. In order to actually accomplish this, your model still needs to be built both correctly and accurately. The purpose of this project is for you to "see for yourself" that Nature allows this energy gain, and that the way Physics is taught concerning the "Conservation of Energy" is not correct. If you follow these instructions, AND you use your own "common sense", you will succeed.



As the picture shows, the unit consists of a base and Frame that holds all of the other parts in place, a Wheel with 24 magnets mounted on it that is free to turn with low friction, a Coil with 8 separate strands of wire on it, and a Circuit that consists of 7 transistors, 7 resistors, 14 diodes, 7 neon bulbs, and 2 batteries.

On the following pages, each of these sections of the project will be discussed in detail. Follow the directions correctly, and Good Luck!

So, here is the basic list of materials you will need:

1. The entire **frame** can be made from one piece of wood 12" x 48" x .75". When you purchase this, make sure that the board is straight and flat. It should be REAL WOOD, and not plywood or particle board. The unit shown is also painted black. It you are planning to finish the wood after you build the frame, decide how you are going to do that. You will also need some wood glue and some screws to fasten the pieces together after you have cut them to the right shape.
2. The **wheel** is a 20" bicycle wheel used for the front of the bike. Any wheel of this type may be used, metal or plastic, standard or metric, spoked or solid. John's original unit used a steel rim with standard bicycle wheel spokes. You may simply mount the bicycle wheel to the frame using the internal bearings in the wheel. If you want to drive an external load, like a fan blade or a timing wheel, you will also need a piece of straight, machine grade shaft and a set of bearings to mount in the frame. The shaft and bearings should have the same diameter, such as .375 inches or 1 cm.
3. The **coil** is made from a plastic spool that is 3.25 inches high, 3.5 inches in diameter, with a central cylinder of .75 inches in diameter. This spool is wound with 8 wires that are twisted together. 7 of these wires are #20 magnet wire 130 feet long, and the 8th wire is #23 magnet wire 130 feet long.
4. The **circuit** consists of 7 MJL21194-G transistors; 7 470 Ohm, 1 Watt resistors; 14 1N4007 Diodes; and 7 NE-2 neon lights. All of these components can be purchased from Mouser Electronics.

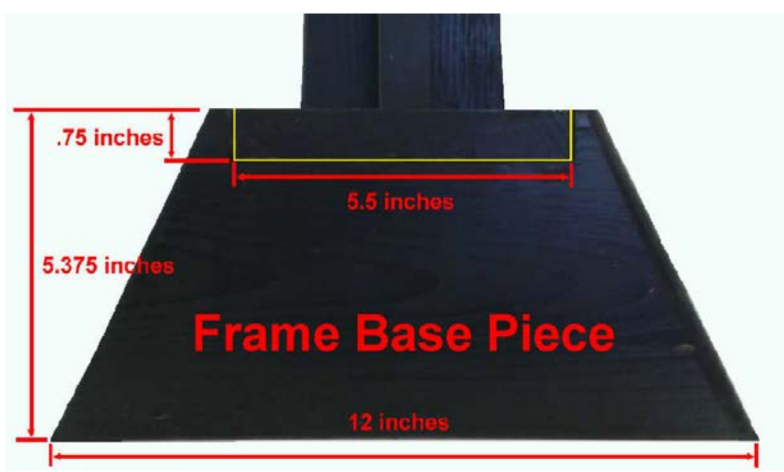
You will also need various tools, a soldering iron, some electrical solder and flux, bearings, a piece of machine grade shaft about 1 foot long, 24 (1" x 2" x .5") permanent magnets made from Ceramic 8 material, an aluminum plate to act as a heat sink for the transistors, and various types of wire.

The following directions allow you to make a replica of John's Original Bicycle Wheel model with the simplified output circuit that puts the discharges of the coil directly into the second battery. (Like on page 29.)

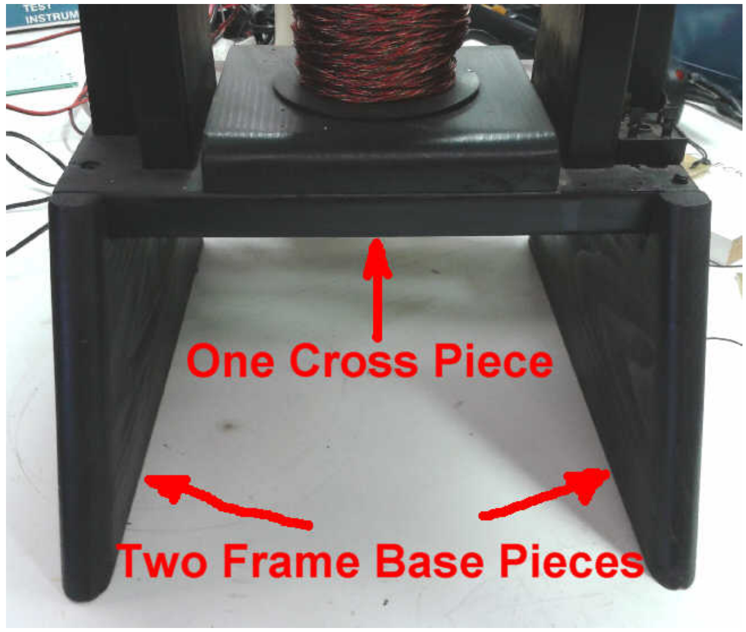
The Frame is any physical structure that holds all of the parts in place while providing a stable base so the machine may operate safely without tipping over. The following directions give the dimensions of the parts of the frame that John used for his model so that it can be duplicated exactly. That said, any design of a frame that produces a solid structure, a wide and stable base, as well as a firm holder for the wheel, the coil, and the circuit will work just fine.

John's model has a frame made of wood. It consists of 8 pieces connected together. They are: 2 pieces that form the base, a single cross piece with a second piece on it to raise the level of the coil, and then 2 uprights to hold the wheel in place with 2 smaller uprights to stabilize them. In total, 8 pieces of wood ¾ of an inch wide, cut to the right shapes and joined together with glue and screws.

The Frame Base Piece is 12 inches across the bottom and about 7 inches across the top. Both side edges are cut on a slant and sanded to produce a rounded appearance. The top has a section cut out of it to hold the Cross Piece, shown here as the area marked out in Yellow.



Here is another photo of the base, shown from the rear. It shows how the 2 Frame Base Pieces are held together by the Cross Piece, as well as how the extra piece is used to raise the level of the Coil. It also shows how the Upright Supports are mounted on the Cross Piece.



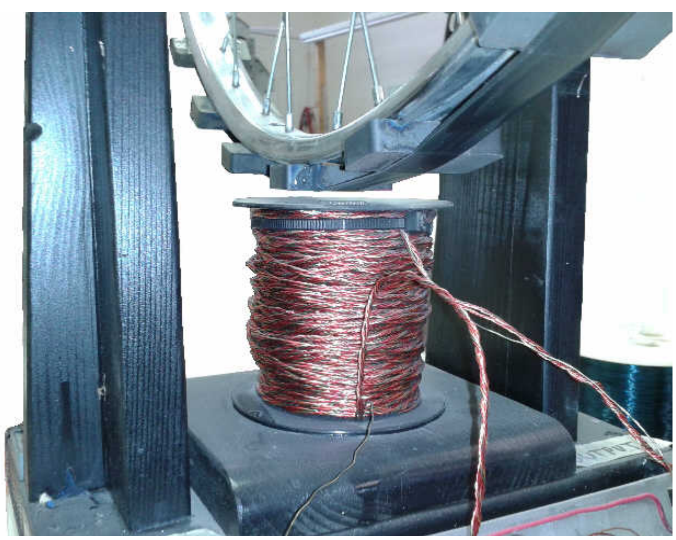
The Cross Piece is a simple rectangle shape 5½ inches wide and 10 inches long. It is glued and screwed into the cut-out sections of the upper edges of the 2 Frame Base Pieces to form the solid base upon which everything else is mounted.

The Upright Supports are made from the same wood material that is ¾ of an inch thick. There are two of these Upright Supports, one on either side of the coil. The main piece is 15¾ inches high, 3¾ inches wide at the bottom and 1¾ inches wide at the top. There is also a cut-out at the top to hold the bearings that support the shaft. The secondary Uprights are 15 inches high, 1 inch wide at the bottom and ⅛ inch wide at the top. These secondary Uprights are glued and screwed onto the main Upright Supports to add stability and lessen "side-to-side" movements.

These Upright Supports are connected to the Cross Piece with glue and are screwed up from the bottom. Any changes to this design that accomplish the same objectives are acceptable and allowed.

The Wheel is made from a bicycle wheel rim. While any rim from the front wheel of a bicycle will do, the one John used is from a "26 inch" bicycle tire. The exact dimension of the wheel rim is 22 inches, measuring from the outside of the rim on one side to the outside of the rim on the other side.

The precise dimension of the wheel is NOT critical. The wheel can be spoked or solid, steel, aluminum or plastic, English dimensions or Metric. What is important is that the wheel is perfectly round, well balanced, and rotating in a good set of bearings with low friction.



24 permanent magnets, measuring 1 x 2 x .5 inches, made from Ceramic #8 material, are mounted around the rim with a uniform 3 inch spacing between them. All magnets should have the NORTH POLE facing outward.

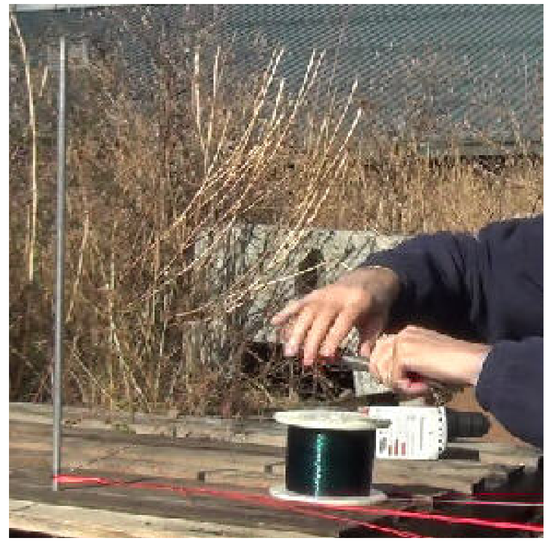
If you use a standard steel rim, the magnets will stick to the metal. Even so, once you have determined the exact placement positions for the magnets, they should be GLUED to the rim. After the glue dries, a layer of STRAPPING TAPE should be wound around the entire wheel, to prevent any magnet from flying off during operation.

The wheel should be held by the Upright Support Pieces so that the clearance between the magnets and the top of the Coil is about ⅛ of an inch, as shown in the photo above.

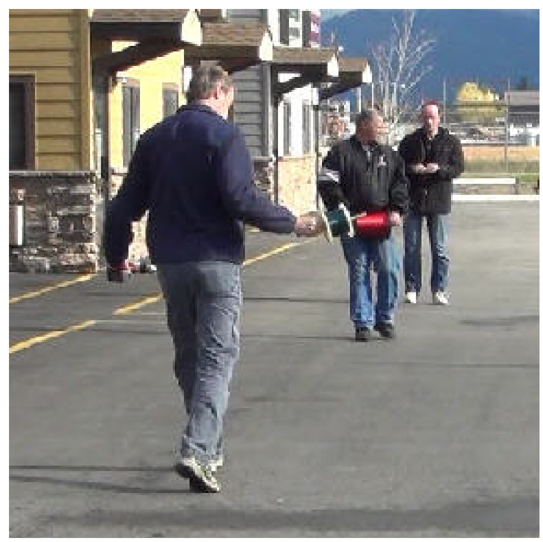
This spacing can be accomplished either by adding spacers below the coil or by having an adjustment at the top of the Upright Support Pieces so that the shaft holding the wheel can be raised or lowered as needed. This picture shows a close-up of the hub of John's model. You can see that the internal bearings in the wheel have been removed and a piece of shaft material has been inserted. This shaft turns with the wheel and is supported by the external bearings shown in the fore-ground. This allows John's model to rotate a fan blade during operation.

The wheel can also be operated using the bearings that come with it inside the hub. In that case, the threaded connectors that come out of the wheel hub simply need to be supported by the Upright Support Pieces and held in place by nuts and washers.

The Coil is the next major component, and possibly the most difficult to make. It consists of a plastic spool with 8 lengths of wire wrapped around it. Although that sounds simple enough, there is a specific method to this that must be followed in order to achieve the best results.



The Coil consists of 8 strands of wire that are each 130 feet long. John's original Bicycle Wheel Energizer used 7 strands of #23 wire and 1 strand of #26 wire. This is acceptable for this project. However, it has been determined that 7 strands of #20 wire and 1 strand of #23 wire actually works better, and is recommended.



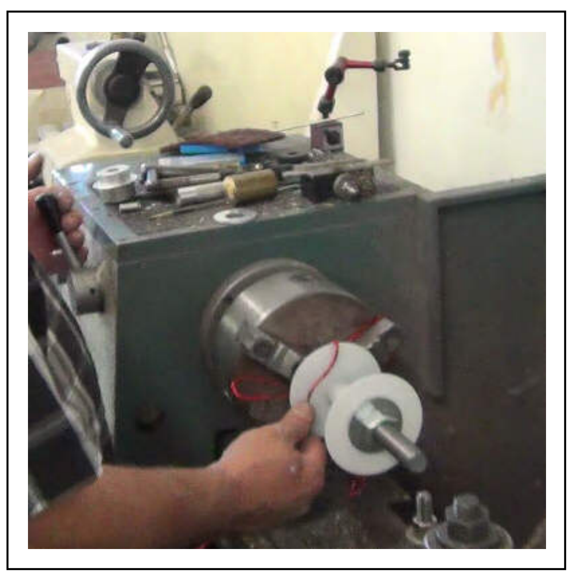
The first thing to do is purchase the wire you are going to use. You will need at least 910 feet of the larger wire, cut into 7 lengths of 130 feet each, and 130 feet of the smaller wire. [Wire suppliers are listed in the Appendix of this book.]

Next, establish an anchoring post to attach the wires to, as shown in the top photo, so they can be measured out. Measure out all 8 strands of wire by unreeling them from their spools, as shown in the second photo. When all 8 strands are measured out, tie them off to an "eye-bolt" and tighten the eye-bolt into the chuck of a portable drill, as shown in the last photo here.

Next, from the eyebolt, stretch all of the wires back toward the anchor post and re-attach them to the anchor post so that each wire is exactly the same length. You'll see why this is important in the next picture.

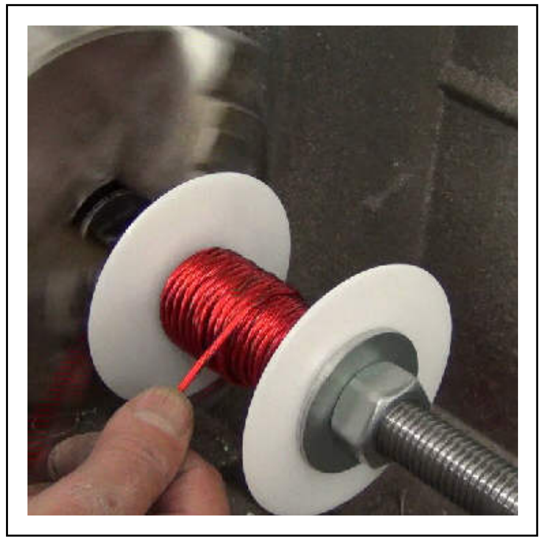
Next, use the portable drill to TWIST the wires together along their length to make an 8 wire cable. You can see in the photo to the right that the trigger winding is **BLUE** and the cable has been twisted until there is about "one twist per inch" along the length. You should also be able to see by my finger that one of the wires is sticking out a little bit from the twisted bundle. This happened because one of the wires was a little bit longer than the rest after the stretching operation. While a few of these twist imperfections are OK, doing the previous step carefully is important.

After the cable is twisted, it should be hand-wound up on a temporary spool, as shown in the photo to the right.



The next operation is to wind the coil. In the photo to the right, you can see John has taken the white plastic spool and put a large bolt through it, cinched it down with a nut and a washer, and mounted it in the chuck of a power lathe. The start of the cable is looped over the edge nearest the lathe and the lathe is going to rotate "clockwise" in this photo, or away from John. This will be the "bottom" of the coil.

Here you can see the winding process is moving forward. The cable should be laid down in tight, neat rows and smooth layers, in the best way possible.



It is also permissible to wind this coil by hand, but it is much more difficult to keep all of the rows tight and the layers smooth, and finishing it out without at least a manual winding jig and an assistant.

In the next photo, the coil has been wound to the end of the cable. John has purposefully ended the winding process with the cable at the outer end of the spool. This will be the "top" of the coil.

The next process is to secure the cable in the spool so it won't unravel when you let go of it. Up until this time, a constant tension has been maintained on the cable and the spool to wind the cable tightly.

While still holding the cable, John applies some "super-glue" to the last windings, where the cable will be coming out of the coil.

Make sure that the "super-glue" sets properly and is holding the winding in place before letting go of the cable. This operation creates the primary "strain relief" of the cable on the spool and keeps it from coming apart.

After the gluing operation is done, the secured wire is bent back around the spool, and a few layers of black tape are applied to further secure the final windings. Again, this is the "top" of the coil. With the layer of black tape applied, the top of the coil is always easy to identify, from now on.

At this point, the coil is removed from the lathe and the bolt is removed from the center of the spool.

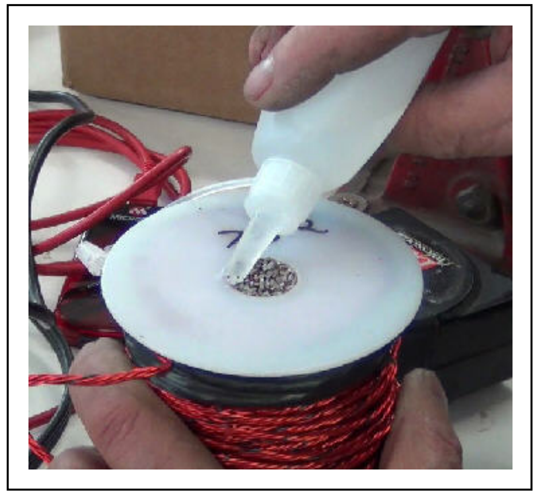
The next operation involves filling the core of the spool with the iron "welding rod" sections, as shown in the photo to the right. These are 1/16th inch diameter R45 iron welding rods, cut to 4½ inch lengths. You will need about 150 of them.

The coil is placed "top down" on a flat work surface and the welding rod sections are inserted into the central core hole until it seems like no more will fit. Then, one at a time, one more rod is carefully hammered in until no more rods can be inserted, even by force.

It's important that all of the rods are cut to the same length so that they all come through to an equal height on the "other end" of the coil, which is going to be the "top" of the coil that faces the magnets on the wheel.

Every single step needs to be done carefully to produce the best results.

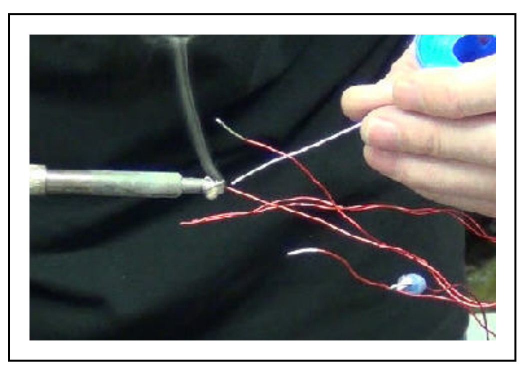
After all of the welding rods have been inserted, the coil can be turned over so the top is exposed again. Make sure to place the coil, which is now standing up on the rods still sticking out the bottom, on a piece of disposable cardboard.



Next, apply "super-glue" around the edges of the rods and all across the surface of the rods, waiting a few minutes and then doing it again. You will see that some of the glue seeps all of the way down through the stack onto the cardboard. Make sure all of the rods are securely glued in place.

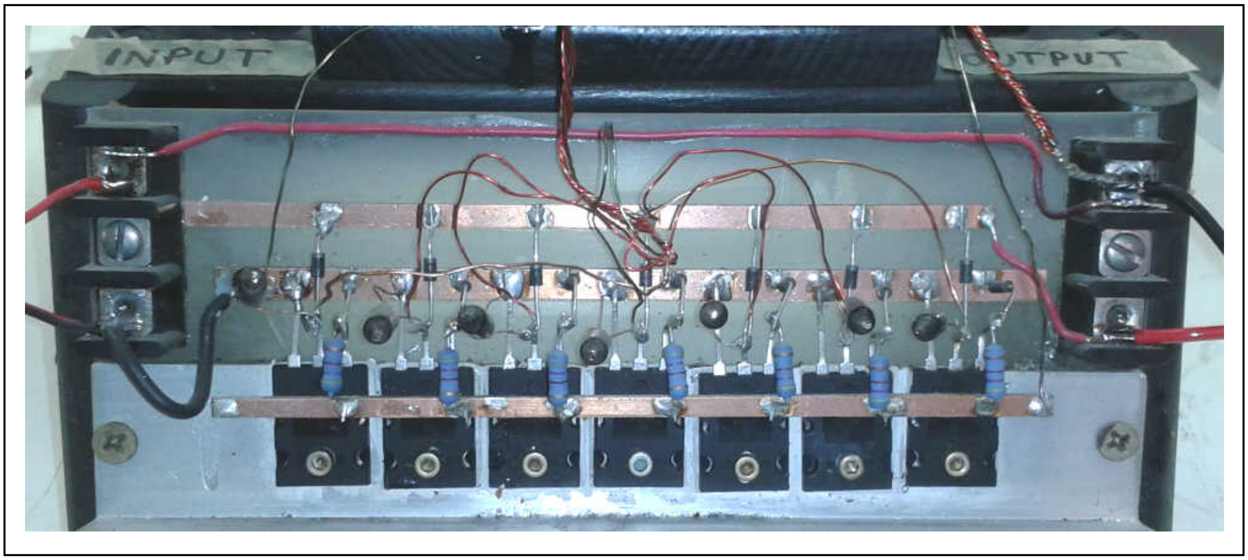
This process is really important, because you do not want one of these iron rods to rise up and impact a magnet on the wheel when it is spinning fast during operation.

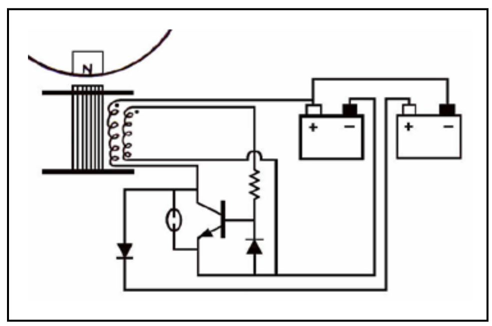
So, here is a close-up photo of the "top" of the coil. This makes a coil that is wound in the "counter-clockwise" direction. When you get this far, you should be really proud of yourself! You have finished "making" the coil!



The final operation is to prepare the tips of the wires to be electrically connected to the rest of the circuit. This photo shows the ends of the wires being coated with a layer of solder. This process, however, should not be done until the wires are cut to proper length during final assembly.

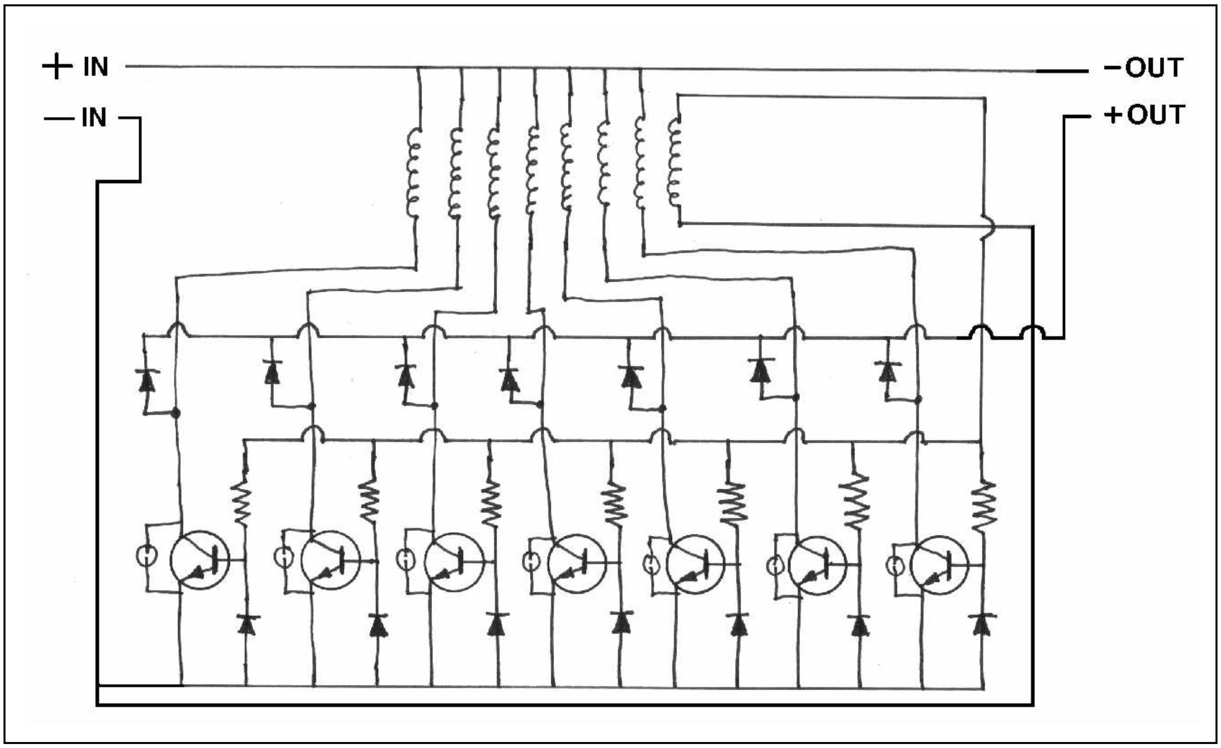
The Circuit consists of the electronic components wired together to control what is happening at the coil. All of the schematic diagrams you have seen so far show a single Main Coil and a single Trigger Coil. Obviously, we just wound a coil with 8 wires on it, so something is different. What is different is that the Bicycle Wheel Energizer uses a coil that has 7 Main Coil windings on it, along with a single Trigger Coil winding.
Here is a close-up photo of John's model:





What you are looking at in the photo above is 7 circuits like the diagram to the right, where for each of the Main Coil wires there is a transistor, a neon bulb, a resistor, and two diodes. The wires going to the Run Battery are on the terminal block on the left side, labeled INPUT. The **RED** wire goes to the battery Positive and the **BLACK** wire goes to the battery Negative. The wires going to the Charge Battery are on the terminal block on the right side, labeled OUTPUT. Again, the **RED** wire goes to the battery Positive and the **BLACK** wire goes to the battery Negative. Notice that the **RED** input wire connects directly to the **BLACK** output wire AND all 7 of the wires from the top of the Main Coil windings over at the OUTPUT terminal block. Then, the wires from the bottom of the coils are separated and each one goes to a transistor collector.

So, here is the complete schematic, as it is shown in the photo above:



There are dozens of ways to lay this out, but the one's that work the best keep all of the components close to each other and use the shortest possible paths to connect the parts.

The transistors are mounted on a sheet of aluminum with a thermal insulator between it's back and the aluminum. Heat Sink Grease should be applied to both sides of the insulator. This allows the transistors to keep cool during operation and remain electrically insulated from each other.

So, here is the Parts List for making the circuit. All these parts are available from Mouser Electronics and Radio Shack in the USA, or on-line.

Transistor: MJL21194-G	Mouser Part # = 863-MJL21194G
Thermal Insulators	Mouser Part # = 739-A15038003
Heat Sink Grease	Radio Shack Part # = 276-1372
Diodes: 1N4007	Mouser Part # = 512-1N4007
Resistor: 470 Ohm, 1 Watt	Mouser Part # = 294-470-RC
Neon Lamp	Mouser Part # = 606C2A

You should buy extras of all of the parts, in case you run into trouble building the circuit. So, buy at least 10 of the transistors and thermal Insulators, at least 20 of the diodes, and 10 each of the resistors and neon bulbs. You can purchase the parts right on the Mouser website. One 6 gram tube of the Heat Sink Grease from Radio Shack should be enough.

Make sure that all of your solder joints are produced by a good, hot flow of solder to each component. If the solder doesn't flow to the pieces easily, you may need to apply more solder flux to the joint before re-heating. When you are done, retrace the circuit and compare it to the schematic diagram again to make sure everything is connected correctly.

Final Assembly of the unit is the last step. By now, you should have the frame, the wheel with the magnets on it, the coil and the circuit all built and ready. The next step is to mount the coil on the frame. You may have noticed that the iron welding rods are sticking down past the bottom the coil. This is to help secure the coil to the frame.

Drill a hole ¾ of an inch in diameter into the middle of the Cross Piece of the frame and directly between the two Upright Supports. When you mount the wheel on the Uprights, you want the bottom magnet to be directly over the top of the coil. So play around with these components in order to make sure that their final, secured location is in direct alignment with each other. When everything is decided, glue the coil to the Cross Piece of the frame (using Silicone Glue) and align it so the wires come out on the side that will become the front.

Next, mount the Circuit you have built to the front of the Frame Base Pieces, so the circuit is easy to work on and close to the wires coming from the coil. Your set-up should look something close to the picture on page 49.

After both the coil and the circuit are mounted to the frame, it is time to wire them together. The wires coming out of the top and bottom of the coil should all be cut to the same length. Make sure that length is sufficient for all of the bottom wires to reach a transistor.

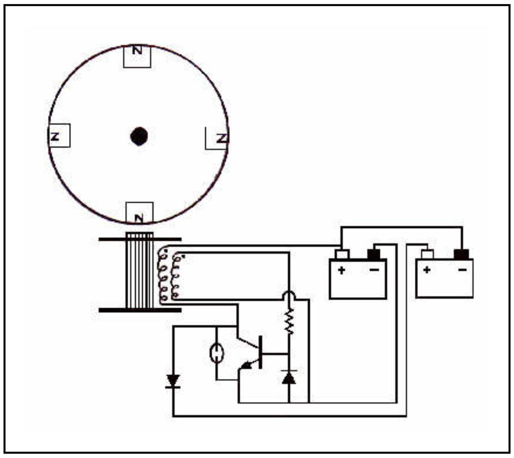
At each end, the Trigger Coil wire (smaller diameter wire) should be separated from the rest of the wires. Make sure that the Trigger Coil wires connect to the circuit in the correct places, according to the schematic. NOTE: If the Trigger Coil wires are connected to the circuit incorrectly, the Energizer will NOT operate. Everything MUST be wired correctly.

Next, make sure that each of the Main Coil wires coming from the bottom of the coil is connected to one of the Transistor Collectors. Also, solder all 7 wires coming from the top of the coil together, and connect them to the common between the two batteries.

After you have mounted and wired the coil and the circuit together, it's time to mount the Wheel on the Upright Supports. Hopefully, you have already determined the exact mounting location for the Wheel and Bearings, so now is the time to secure them in place. At this point, you are almost done!

The last operation is to connect two sets of wires to the INPUT and OUTPUT terminal blocks so your Bedini SG Energizer can be connected to it's batteries. We usually use "alligator clips" on the ends of these wires for easy connecting and disconnecting. We recommend that you color code the alligator clips to be **RED** for the Positive wires and **BLACK** for the Negative wires. We also recommend that you clearly mark which wires are for the INPUT and which wires are for the OUTPUT, as the photo of the circuit on page 62 shows.

So, this is the END of the Beginner's Build Project. You have built the "Self-rotating Energizer". This design takes the discharges of the Main Coil windings and applies them directly to the second battery, like the diagram to the right. Even though we have discussed charging and discharging of a capacitor as the final step, this requires advanced skills to implement.



This circuit is sometimes called the Bedini SSG Energizer, which refers to the "Simplified School Girl" circuit. Charging and discharging the capacitor mechanically requires the fabrication of a rotating commutator and brush system that can only be built with a small machine shop lathe. Charging and discharging the capacitor using solid-state electronic timers and switches requires more knowledge of electronics. So, this is as far as Beginner's usually get using normal levels of skill with basic tools.

[The Bedini SG, Book 2 will cover the methods for charging and discharging capacitors, as well as the theory of why this further increases the efficiency of the battery charging process. The Bedini SG, Book 3 will cover adding a "low-drag" generator to recover as much of the mechanical energy as possible, to further increase battery charging for the same input. The end result will be a "stand alone" battery charging system and a demonstration of the principles for an independent home power supply.]

The best kind of **batteries** to use for your Energizer are small, lead-acid type batteries because they are inexpensive and charge well with the system. The little "Lawn and Garden" battery type works well.

Operating Instructions:

It's time to "fire up" your new Bedini SSG Energizer for the first time. OK!

1) First, connect the "Charge Battery" to it's **Positive** and **Negative** wires using the alligator clips. (Always hook the OUTPUT up first.)
2) Second, connect the "Run Battery" to it's **Positive** and **Negative** wires using the alligator clips. When you connect the second wire to the INPUT you should hear a faint "thump" sound from the machine. That is the circuitry recognizing the power available from the run battery with the momentary energizing of the Main Coil and immediate TURN OFF of the transistors. After this, everything should be quiet.
3) Third, give the Wheel a spin and the system should slowly accelerate up to operating speed. Even when fully connected to both batteries, the Energizer will not start rotating on it's own. It must be started manually.

4) If everything is working well at this point, it is time to test the "Safety By-pass" system. To do this, just disconnect one of the wires from the Charge Battery on the OUTPUT. Immediately, all 7 of the Neon Lights should come on, and the sound of the machine should get louder. Re-connect the Charge Battery again and the Neon Lights should turn OFF and the machine should run quietly again. **Be careful** when you do this, as a "Shocking Level" of high voltage is available on the alligator clips. Remember, it takes more than 100 volts to light up the Neon Lights!

De-Bugging Errors:

If your system behaved like the description above, you have correctly built your machine. If your machine DID NOT run, some error has occurred somewhere during assembly, either in building the circuit or in wiring it to the coil. Since it is impossible to anticipate all of the possible errors that could happen, please go back through your circuit and see if you can find the problem yourself. If you can't, then go into one of the Internet Forums for SG Builders and describe your problem. The best one is the Beginners Forum at Energy Science Forums. You may have to register to post.
http://www.energyscienceforum.com/bedini-monopole-3-beginners/
Someone there may know exactly what to do in your situation.

*******SAFETY DISCLAIMER*******

Always use safety glasses and have adequate ventilation while soldering, as fumes may be produced that have toxic compounds in them.

You, the builder and user, bear the responsibility for your own safety in building, testing, and using a Bedini SG or Bedini SSG. The risks include, but are not limited to, high voltage output from the coil that could shock you, a high speed spinning wheel that could cause injury if you touch it while running, magnets that may fly off the rotor at high speed if they are not secured properly, or possible explosion risk by sending high voltage impulses directly to a battery. By building this machine, you acknowledge the risks involved in its operation and accept those risks as a result. Under no circumstances will A & P Electronic Media, the authors of this book, or the inventor or assignee of the patents for this machine, be liable for direct, consequential, or incidental damages arising from the use of the Bedini SG or Bedini SSG, and in particular, the model YOU build. You accept these terms by building and using any machine or device discussed in this book.

OK, your system works. Congratulations!!!! Now you can start running it and charging batteries. We also recommend that you get yourself a couple of Digital Multi-Meters so you can monitor your battery voltages. Take notes, and watch what happens as the batteries charge and discharge. To get an idea of what other experimenters have done, visit YouTube and do a search for "bedini motor" or "bedini sg".

You have your "teaching tool" now! It's time to learn the truth about how energy can be transferred and conserved in a circuit at the same time, thereby multiplying the amount of energy available.

Chapter Six

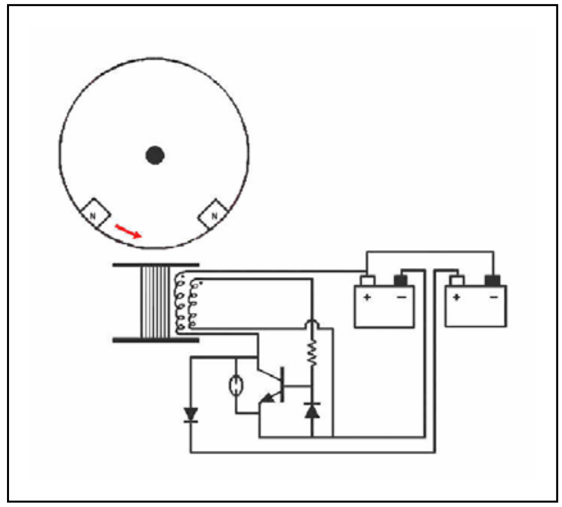
The Two Modes of Running

The idea that there are actually two modes of running this machine will be new to most people. Previously released material has disclosed two circuits for running the device. These two circuits include the "self-triggered" circuit disclosed here, as well as the "forced triggered" circuit, generally referred to as the "Bedini-Cole Switch".

This chapter discloses, for the first time, that there are two, separate and distinct operational modes that can be elicited from the "self-triggered" circuit. Since the main difference between them is in how they produce the mechanical energy, they will be referred to as the "repulsion mode" and the "attraction mode". Both modes work, and John has produced models with COP>1 using both modes. The "attraction mode" does work better, though.

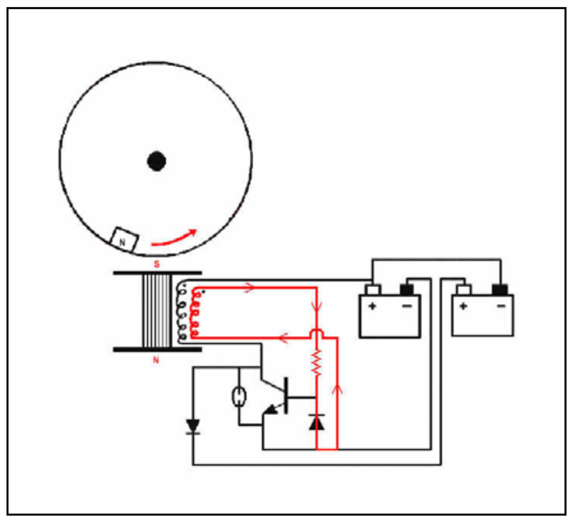
Here's what happened. Most of John's early machines had coils that were wound on his lathe. This method, as shown in the previous chapter, produces a coil with a "counter-clockwise" winding. When John and Peter started making models in 2004, using the "twisted strand" coils, they switched to a hand winding method for winding the coils. This method held the spool still and the wire was looped "over and around" the spool. This produced a "clockwise" winding. Both worked, and so the difference went un-noticed for a while.

When we finally decided to figure out "where the magnet is when the transistor turns on", we developed a "timing light" system to determine when everything was happening. The timing method was somewhat complicated, so we didn't build it into every model. The first two models we put it on had the clockwise, hand wound coils on them. The timing lights clearly showed that the transistor turned ON right after the magnet went passed the coil. So, the "repulsion mode" became the standard design and explanation of how the machine worked.

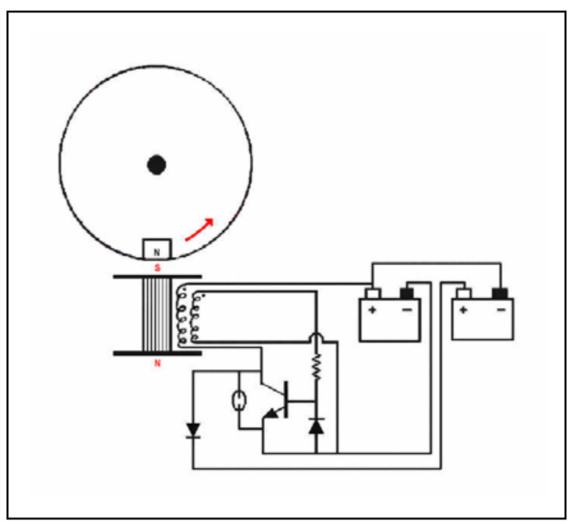


Here is a short re-cap of the Repulsion Mode of operation. Much of this was discussed in Chapter Two.

The cycle starts when one of the magnets is closer to the coil than another and begins to be attracted to the iron in the core. The wheel will turn in either direction, and does NOT effect the operation of the circuit.

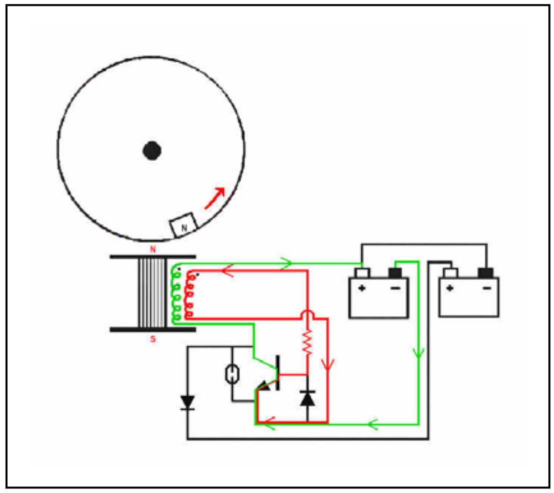


As the magnet approaches the coil, it starts to magnetize the iron core and this "change in magnetic flux" begins to induce a current in the Trigger Winding in the direction of the RED ARROWS. Since this current is in the wrong direction to activate the Transistor, the Transistor stays OFF, and no power is used from the Battery while the magnet approaches the coil.

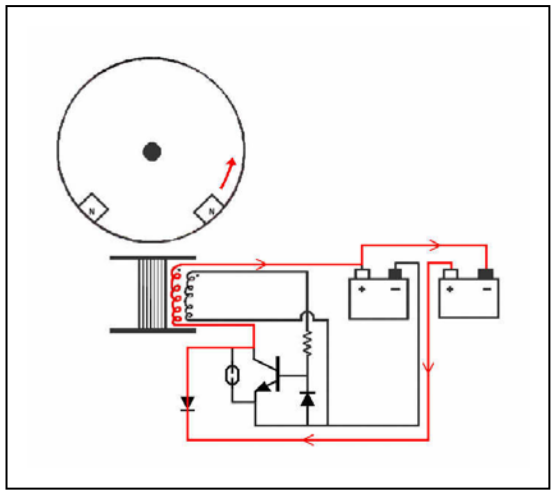


When the magnet is directly over the top of the coil, the permanent magnet has induced it's field into the coil core as much as it can. At this point, the "change in magnetic flux" that was inducing the current in the Trigger Winding stops rising, and so the current in the Trigger Coil also stops flowing.

The attraction of the magnet to the coil has produced some momentum on the wheel, so it slips past the top of the coil.

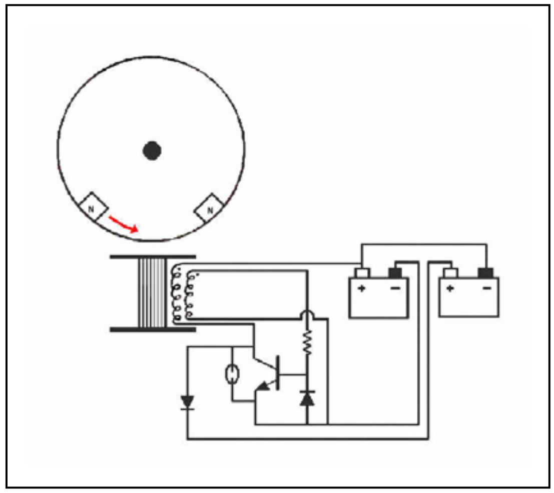


As this happens, the magnetic flux in the coil core starts to drop, and so it induces a current in the Trigger Coil in the opposite direction. This turns ON the Transistor and allows current from the Battery to flow through the Main Coil, as show by the **GREEN ARROWS**. This current from the Battery now reverses the magnetic field in the coil core and produces a "repulsion force" on the magnet on the Wheel, re-enforcing it's direction of rotation. As soon as the magnetic field reaches it's maximum strength, based on the current delivered from the Battery through the Main Coil, the "change in magnetic flux" in the coil core stops inducing a current in the Trigger coil, and the Transistor shuts OFF. As soon as the Transistor shuts OFF, the magnetic field collapses, and this rapid change of magnetic flux induces a current in the Main Coil that discharges it's energy into the Second Battery.

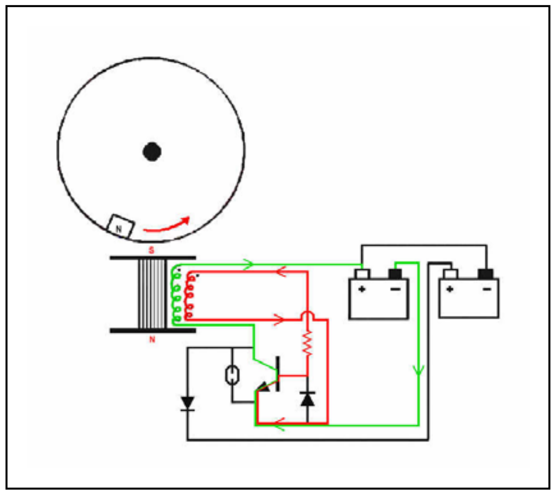


So, this is the basic operation of the "Repulsion Mode" for the machine, and the general method of operation that has been taught for the last 8 years. In that time, the problem has been that most models built by people have not produced the same level of results that John's early models produced. When everything was looked at again carefully, it was finally noticed that the machines that produced the best results all had the "counter-clockwise" coils. We decided to see if any of the experimenters would report the discovery from their own experiments, but no one did.

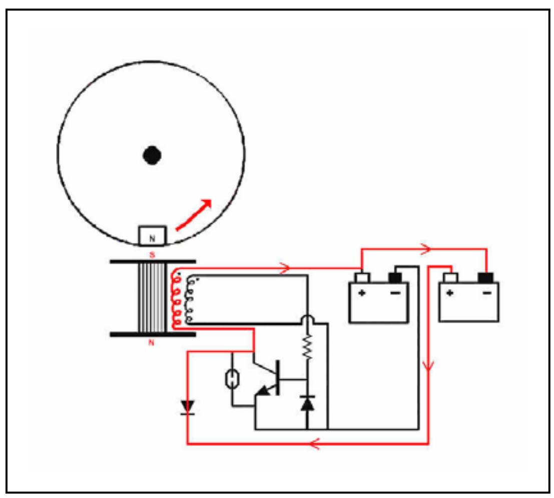
The Attraction Mode of Running



This method of running the machine is identical to the Repulsion Mode except that the Coil is wound in the opposite direction. So, the circuit is the same and all of the magnets on the Wheel have their North Pole facing out.



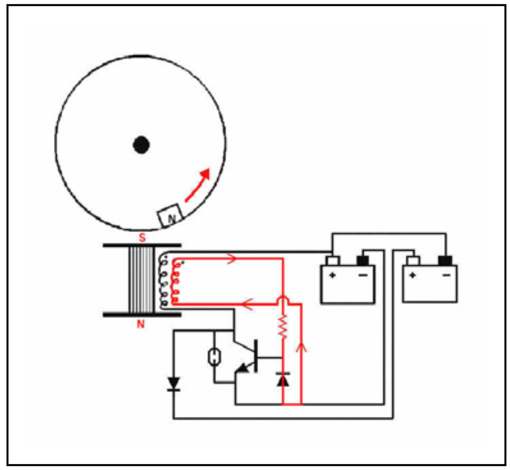
The process starts the same way, when one magnet gets closer to the coil than another. This produces an attraction force on the Wheel. Like before, this approaching magnet induces a magnetic field in the coil core. But now, with the coil wrapped in the opposite direction, this induces a current in the Trigger Coil that turns the Transistor ON immediately.



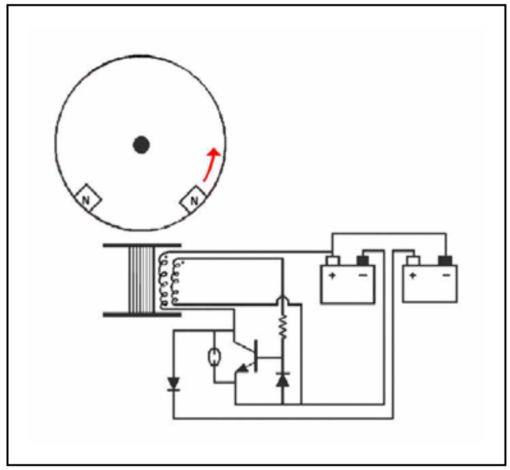
Now, when the current flows from the Battery to the Main Coil, it produces a South Pole at the top, and this re-enforces the induced field and makes the South Pole of the coil even stronger. This attracts the North Pole magnet on the Wheel with a much stronger force, while also re-enforcing the current flow in the Trigger Winding, keeping the Transistor ON.

When the magnet on the wheel arrives at the top of the coil, the magnetic flux stops changing, the Trigger Coil shuts the Transistor OFF, and the Main Coil discharges into the second Battery.

With the collapse of the magnetic field in the Main Coil, the North Pole of the magnet on the wheel is attracted to the coil much less, and so it proceeds out of the field with all of the stored momentum it accumulated during the attraction period.



As the magnet on the Wheel continues to move away, eventually, the combined voltage produced in the Main Coil and the Trigger Coil drops below the level necessary to recover the energy to the second Battery, at which point the last bit of discharge is dissipated in the Trigger Winding.



The magnet then proceeds to the point where the process begins again.

There are a number of reasons why the Attraction Mode works slightly more efficiently than the Repulsion Mode.

These include the following:

1. In the Repulsion Mode, energy from the Battery is used to reverse the magnetic field in the Main Coil. This amount of energy cannot be recovered when the magnetic field collapses. Since the magnetic field never reverses in the Attraction Mode, this loss of energy does not occur.
2. In the Attraction Mode, the mechanical force applied to the Wheel is the highest just before the Transistor turns OFF. In the Repulsion Mode, the mechanical force applied to the Wheel is the lowest just before the Transistor turns OFF. Therefore, the Attraction Mode makes better use of the full current moving through the Main Coil to produce mechanical energy on the Wheel.

Directions, Kits, and Conversions

There was never any intent to obscure the difference between these two running modes. When the first set of Plans and Parts Lists were published in 2004, it was not accompanied by any circuit theory. This Beginner's Handbook is the first attempt to publish both a complete set of plans and a complete explanation of the operations of the circuit in one volume.

The instructions for building your own model, covered in Chapter 5, give you the directions to build a model that runs in the Attraction Mode.

The Kit Models that are being offered for sale, referenced in Chapter 8, all run in the Attraction Mode.

If you currently have a Bedini SG or Bedini SSG model that runs in the Repulsion Mode and you would like to CONVERT it to run in the Attraction Mode, you may do so by making ONE of the following changes to your existing machine.

1. You may replace the existing coil that is wound in the clockwise direction with a coil that is wound in the counter-clockwise direction, and wire the unit the standard way.
2. You may use your existing coil, but reverse all of the connections, so that the wires coming from the top of the coil go to the transistor collectors and the wires from the bottom of the coil go to the positive of the Battery. The two Trigger wires must be reversed, as well.
3. You may leave all of the electronics unchanged, and reverse the magnets on the Wheel so the South Poles face out.

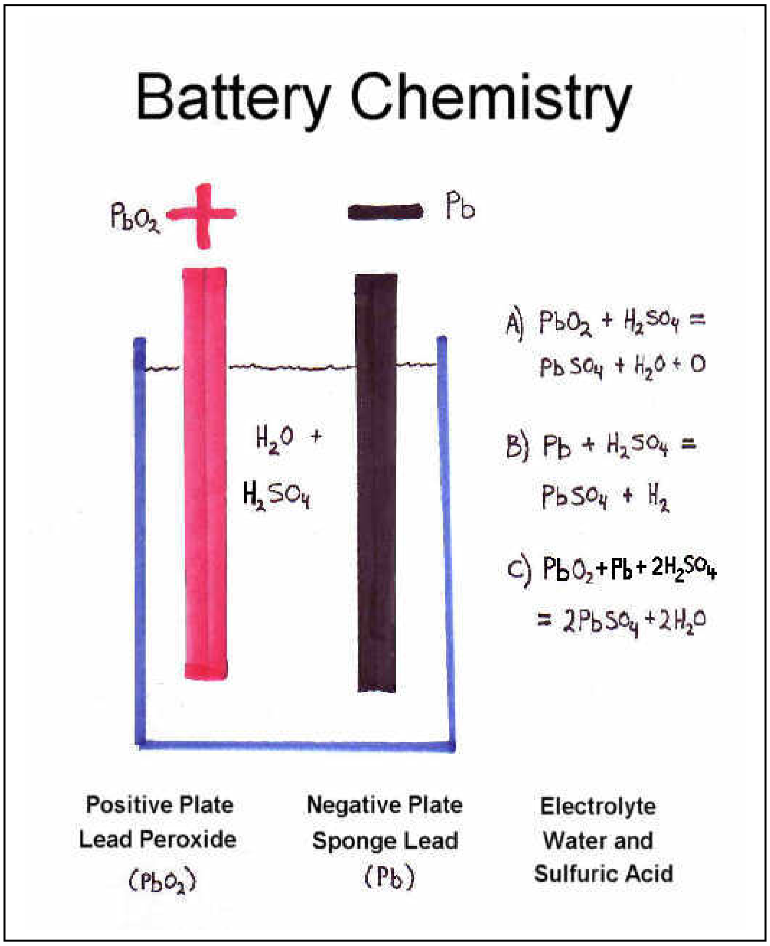
Any ONE of these changes will convert a Repulsion Mode machine into an Attraction Mode machine.

Now you understand both running modes and how to produce them.

Battery Chemistry Made Easy

This Beginner's Handbook would not be complete without a little bit of discussion about what goes on inside the battery. After all, this is one of the main places where the energy gain shows up in this project, so knowing a little bit about "battery chemistry" is a good idea.

The physical construction of a battery is fairly simple. It consists of a outer, plastic case, a positive plate made of Lead Peroxide, a negative plate made of pure lead, and a liquid solution of water and acid called the electrolyte.



This diagram shows the construction of a single cell of a lead-acid battery. It produces about 2 volts. When 6 of these cells are connected together so that their voltages add up, it forms a 12 volt battery.

The term "battery" comes from the old military terminology where a group of large guns, like cannons or mortars, were arranged together to form a group. That group of guns was referred to as a "battery of guns" and its military effect was much larger than that of a single cannon or mortar. Modern electrical batteries are also more effective when multiple electro-chemical cells are used together.

The following image explains what happens when electricity is taken out of a battery. The formulas, a, b, and c, are a symbolic expression of the same information that the words are describing.

(a). At the Positive Plate: Lead peroxide and sulphuric acid produce lead sulphate, water, and oxygen, or:

$$\text{(a).}\quad PbO_2 + H_2SO_4 = PbSO_4 + H_2O + O$$

(b). At the Negative Plate: Lead and sulphuric acid produce lead sulphate and Hydrogen, or:

$$\text{(b).}\quad Pb + H_2SO_4 = PbSO_4 + H_2$$

The oxygen of equation **(a)** and the hydrogen of equation **(b)** combine to form water, as may be shown by adding these two equations, giving one equation for the entire discharge action:

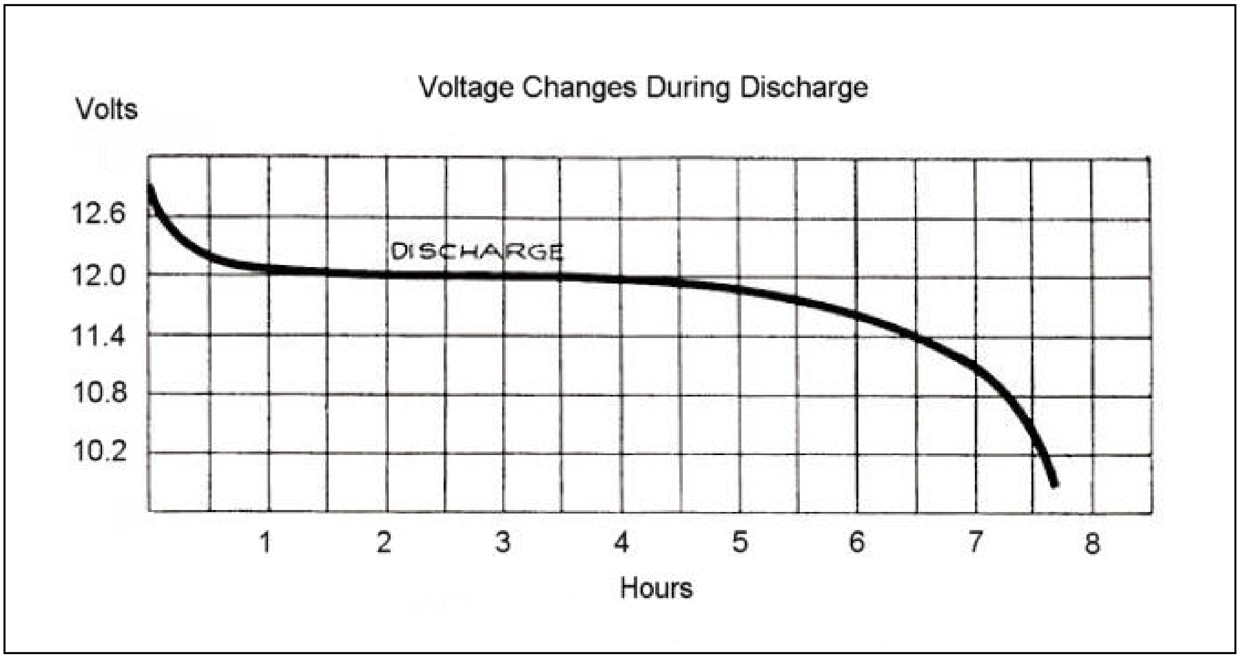
$$\text{(c).}\quad PbO_2 + Pb + 2H_2SO_4 = 2PbSO_4 + 2H_2O$$

So, what happens when electricity is taken out of a battery? The answer is expressed above in equation (c). Two molecules of the acid in the electrolyte combine with the lead materials of the positive and negative plates to form two molecules of water and two molecules of lead sulfate.

[Editors Note: The image above is taken from a book printed in 1922 where the older spelling form of the words "sulfate" and "sulfuric acid" are shown as "sulphate" and "sulphuric acid". Please don't let these spelling differences confuse you. We are talking about the same thing. Thanks.]

So, electricity becomes available to use outside of the battery when a water molecule is produced inside the battery. This is the "little secret" of the battery industry. Lead-acid batteries are essentially, a reversible "water fuel cell". The question is, how many times can this process be cycled? The answer will amaze you.

So, this is what happens to the voltage when the battery is discharged.

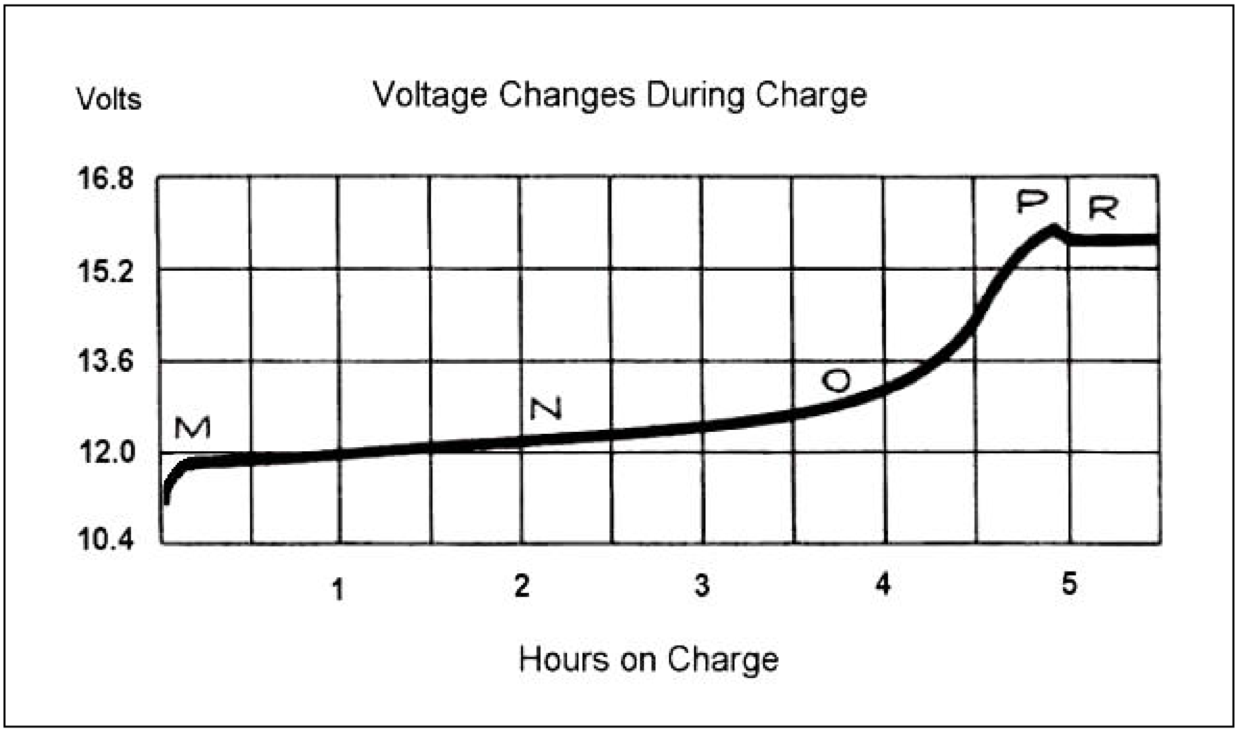


As you can see from the graph, as soon as a load is connected to the battery, it's voltage drops a little. Then the voltage stabilizes and remains constant for a long time before dropping off more at the end.

The first voltage drop indicates that the chemical changes we discussed earlier have started to happen. The long, stable voltage period indicates that these chemical reactions are taking place fast enough to supply the necessary amounts of electricity to power the loads, and that there are plenty of materials available for the chemical processes to happen. When the voltage starts to drop near the end of the discharge time, this indicates that the battery is running out of acid in the electrolyte to react with the plates, and it is time to charge the battery.

Actually, there are two things happening in the battery that cause the voltage to drop. First, we have to remember what makes the voltage in the first place. The voltage is just the electrical "potential difference" that indicates the physical "chemical difference" between the positive and negative plates. When we started, the positive plate was 100% Lead Peroxide and the negative plate was 100% pure Lead. As the electrical discharge proceeds, Lead Sulfate deposits on both plates as water molecules "water down" the electrolyte. So, the battery plates are losing their "chemical difference" because the same material, Lead Sulfate, is building up on both of them. As the "chemical difference" slowly disappears, so the "electrical difference" disappears as well. And that "electrical difference" disappearing IS the voltage drop.

That is what happens when the battery discharges. OK. So, what happens when the battery is charged up again. The following graph shows what happens to the voltage when the battery is charged.



So, the voltage starts at "M" and will rise a little bit as the charge starts. How much it rises depends on the battery's condition and the strength of the charge being applied. Then, it rises very slowly through "N" until it reaches "O". This is the primary charge plateau, and most of the time during the charge will be spent here. At "O" the voltage starts rising faster until it reaches "P", which is the highest value the voltage can reach. After "P" the voltage may drop slightly to "R", indicating the charge process has finished.

As the electricity is applied to the battery to initiate the charging process, the water molecules start being broken down to produce hydrogen and oxygen again. But this is only the first step. If these gasses simply bubble out, the battery is NOT being charged.

The Oxygen must recombine with the Lead at the positive plate to produce Lead Peroxide, and these newly re-formed Lead Peroxide molecules must mechanically connect to the other Lead Peroxide material that is there. The Hydrogen must stay in the electrolyte, as a charged ion, and strip the sulfate ions out of both plates to re-form the sulfuric acid. Only when these two processes happen after the water molecule is broken down is the battery really being "charged".

From the graph you can see that the voltage of a lead-acid battery will approach 16 volts as the charging process finishes. Point "P" on the graph is the indicator that there are NO MORE sulfate ions in the plates and that 100% of the chemistry has been reversed from the last discharge.

If the charge process is stopped before point "P" is reached, it means that some sulfate ions are still left in the plates. If, for any reason, the voltage is prevented from rising to the finishing level, the charge will NOT complete.

This is another "little secret" of the battery industry. By limiting the voltage that most battery chargers provide to 14.8 volts, they know that the batteries will only last for a certain number of cycles, because a small amount of the sulfate ions are (purposely) being left in the plates at the end of each charge.

So, repeated, incomplete charging is what causes most batteries to fail. A Lead-acid battery that is charged to a finishing voltage at the end of each charge cycle can easily operate for 5,000 charge and discharge cycles, which is over 15 years of service. This is how to make your batteries last a very long time.

Finally, let's talk a little bit about battery charging "efficiency", which is really at the heart of the Bedini SG project.

In other words, "What do I have to do to charge the battery in the least amount of time, using the least amount of electricity?"

The first thing you must know is that the "state of charge" in the battery is a CHEMICAL condition, not an ENERGY condition. A completely dead battery has the same number of electrons in it as a fully charged battery!

Anything that restores the chemical condition in the battery where all of the sulfate ions are in the electrolyte and all of the free oxygen atoms are combined with the Lead on the Positive Plate **is contributing to the charging process** of the battery.

Likewise, anything that applies electricity to the battery that creates "off-gassing" or produces "heat" that warms the battery up, is wasting electricity and NOT contributing to the charging process of the battery.

John discovered that if he applied "voltage spikes" to the battery, it strongly contributed to moving the heavy, lead ions in the "charge direction" while minimizing electrical input, heat production, and off-gassing. This process was eventually referred to as "over-potentializing the electrolyte".

Editor's Note: The charts and graphs in this chapter are modified versions of materials from the book:

The Automotive Storage Battery
It's Care and Repair
(Third Edition) 1922
by O. A. Witte

For more information on efficient battery charging and the discoveries of John Bedini regarding battery rejuvenation, go here: **Battery Secrets**

Chapter Eight

Energizer Kits

With this Bedini SG manual, you have already been empowered with all the information necessary to successfully build your own energizer correctly. And the best way to learn of course is to build it all from scratch yourself. But understandably, not everyone has the time to do this and some would rather just purchase a pre-built kit that they can put together to have a fully working model in the shortest period of time.

If you happen to be one of these people who are not in a position of having the time to do it yourself, then you now have the opportunity to purchase a Bedini SG Bicycle Wheel Energizer kit, personally designed by John Bedini. It's not just built right, with all the circuitry built to his specifications, it is a beautiful, collectible work of art!

Pictures of this Kit Model are at the website listed below.

What's included…

- High quality, laser cut, adjustable plastic frame that comes partially assembled. Each one has its own unique serial number with the Bedini logo engraved.
- 20″ diameter steel bicycle wheel with axle extensions and bearings. This allows the entire shaft to rotate for the purpose of connecting a fan, switches, etc…
- Aluminum fan blade that you can attach to the shaft. This gives the shaft a real load demonstrating that real mechanical work is performed while moving air.
- A coil that is pre-wound with the appropriate windings around a plastic spool, with the bundled welding rod core already inserted.

- Complete circuit board with all transistors, resistors, diodes, neon bulb protection, etc… All you have to do is connect the wires from the coil to the correct places on the circuit, hook an input and output battery up and you're done.
- Batteries not included.

At the time of this writing, we have already assembled and tested the prototype. It performs even better than our highest expectations. The entire kit can be assembled and running within an hour, depending, of course, on your ability to follow simple instructions.

To learn more about these kits and to check the current availability, please visit http://www.teslachargers.com/bedinisg.html.

If you want to be one of the first to be notified when the kits are available at Tesla Chargers, sign up for the Tesla Chargers free newsletter, which is available at the top right of the Tesla Chargers website.

These Kit Energizers have a clear plastic frame, a fully assembled circuit board, a fully wound coil, a wheel with magnets, shaft extensions, bearings, and a fan. Also available, as an additional option, is a fully operational Capacitor Discharge circuit that markedly increases the battery charging process.

Assembly time is less than one hour.

Visit the website above for more details.

Appendices

United States Patents issued to John C. Bedini:

USP #6,392,370	(Re-gauging Motor)	Page 84
USP #6,545,444	(Mono-Pole Motor)	Page 97
USP #6,677,730	(Battery Charging Methods)	Page 107
USP #7,990,110	(Advanced Battery Methods)	Page 120

Article:

Attractions of Magnetism by Jeane Manning Page 131

(Reprinted by Permission)

Visit Jeane Manning's Blog at: http://changingpower.net

Photos:

Shop Models from Museum Collection Page 134

Other Resources:

Electronic Parts

Mouser Electronics http://www.mouser.com

Radio Shack http://www.radioshack.com

Permanent Magnets

http://www.magnet4less.com/product_info.php?cPath=2_6&products_id=255

Pick up a Magnetic Pole Indicator while you are shopping for magnets.

Magnet Wire

http://www.surplustraders.net/category/MAGNET%20WIRE-0745

A&P Electronic Media - Home of the Best collection of Information Products on the Planet! http://www.emediapress.com

Tesla Chargers - Home of "ready to use" battery chargers designed by John Bedini http://teslachargers.com

US006392370B1

(12) **United States Patent**
Bedini

(10) **Patent No.:** **US 6,392,370 B1**
(45) **Date of Patent:** **May 21, 2002**

(54) **DEVICE AND METHOD OF A BACK EMF PERMANENT ELECTROMAGNETIC MOTOR GENERATOR**

(75) Inventor: **John C. Bedini**, Coeur d'Alene, ID (US)

(73) Assignee: **Bedini Technology, Inc.**, Coeur d'Alene, ID (US)

(21) Appl. No.: **09/483,715**

(22) Filed: **Jan. 13, 2000**

(51) **Int. Cl.**^{7} **H02K 47/14**

(52) **U.S. Cl.** **318/140**; 318/492; 318/538; 310/113

(58) **Field of Search** 318/140, 148, 318/151, 153, 459, 491, 492, 538; 310/152, 156, 112, 113

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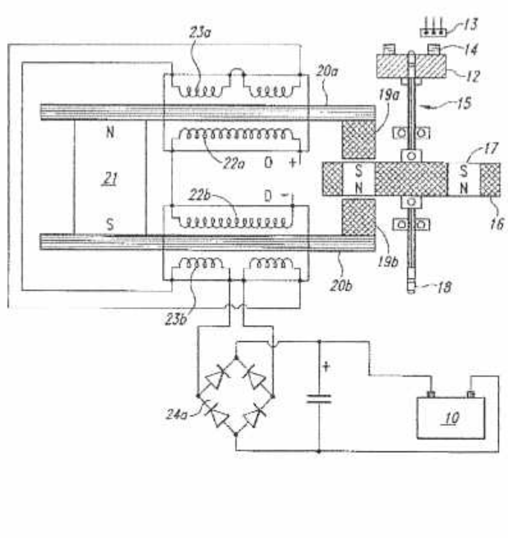
WO	WO 99/38247	7/1999

Primary Examiner—Bentsu Ro
(74) *Attorney, Agent, or Firm*—Thomas G. Walsh; Graybeal Jackson Haley LLP

(57) **ABSTRACT**

This invention is a back EMF permanent electromagnetic motor generator and method using a regauging process for capturing available electromagnetic energy in the system. The device is comprised of a rotor with magnets of the same polarity; a timing wheel in apposition to a magnetic Hall Effect pickup switch semiconductor; and a stator comprised of two bars connected by a permanent magnet with magnetized pole pieces at one end of each bar. There are input and output coils created by wrapping each bar with a conducting material such as copper wire. Energy from the output coils is transferred to a recovery rectifier or diode. The magnets of the rotor, which is located on a shaft along with the timing wheel, are in apposition to the magnetized pole pieces of the two bars. The invention works through a process of regauging, that is, the flux fields created by the coils is collapsed because of a reversal of the magnetic field in the magnetized pole pieces thus allowing the capture of available back EMP energy. Additional available energy may be captured and used to re-energize the battery, and/or sent in another direction to be used as work. As an alternative, the available back EMF energy may be dissipated into the system.

10 Claims, 3 Drawing Sheets



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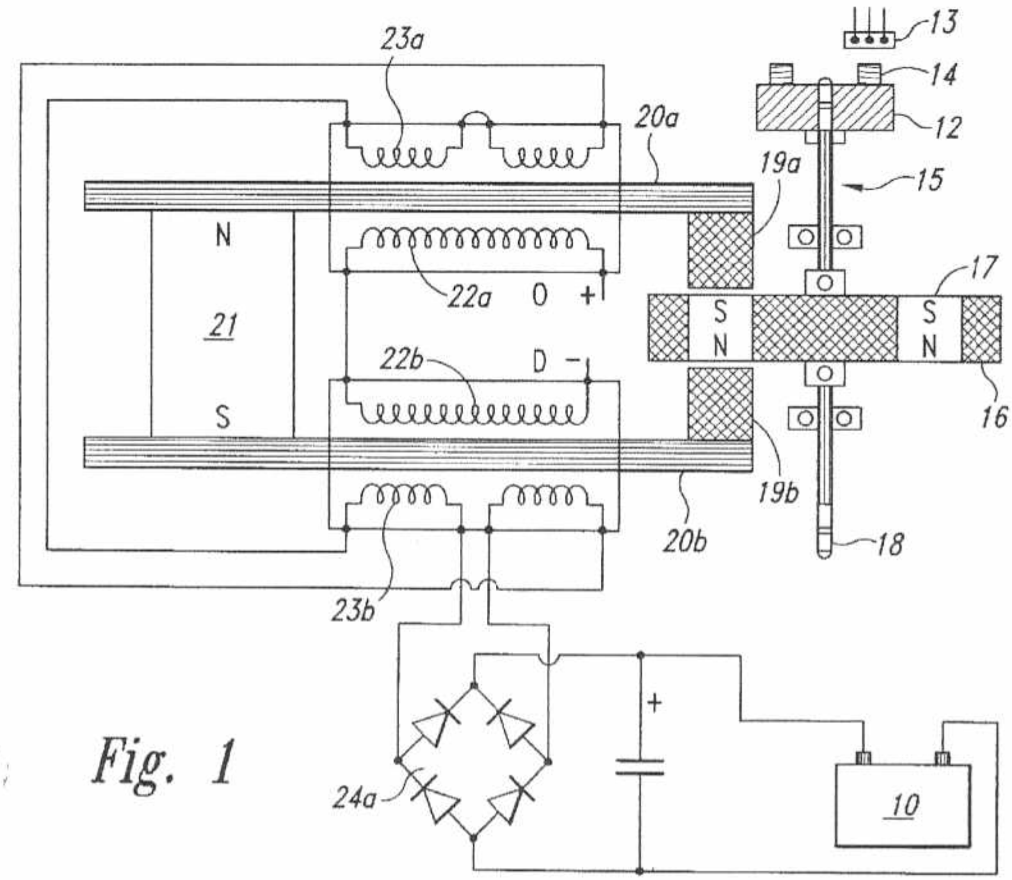

Fig. 1

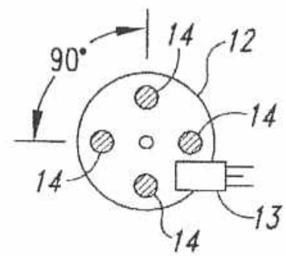

Fig. 1A

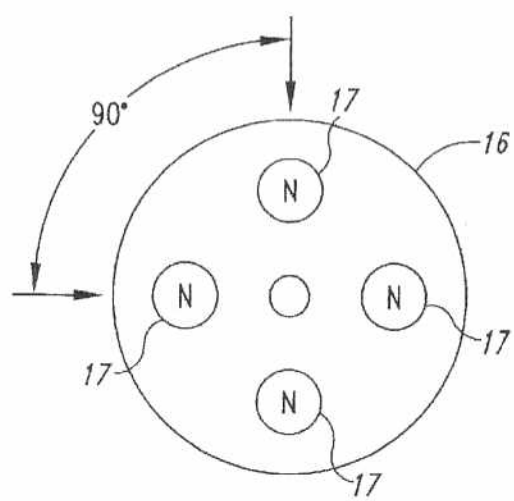

Fig. 1B

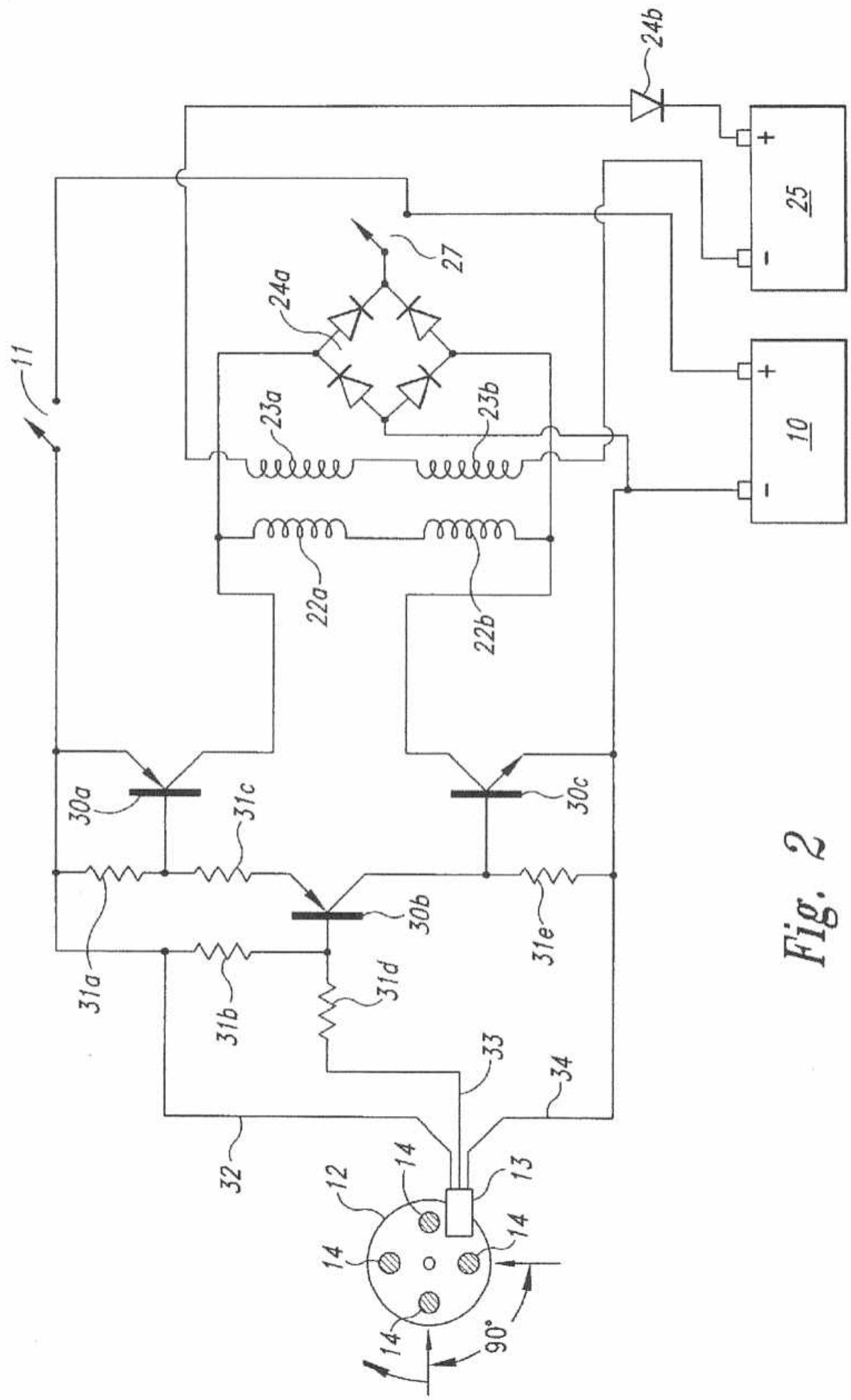
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Fig. 2

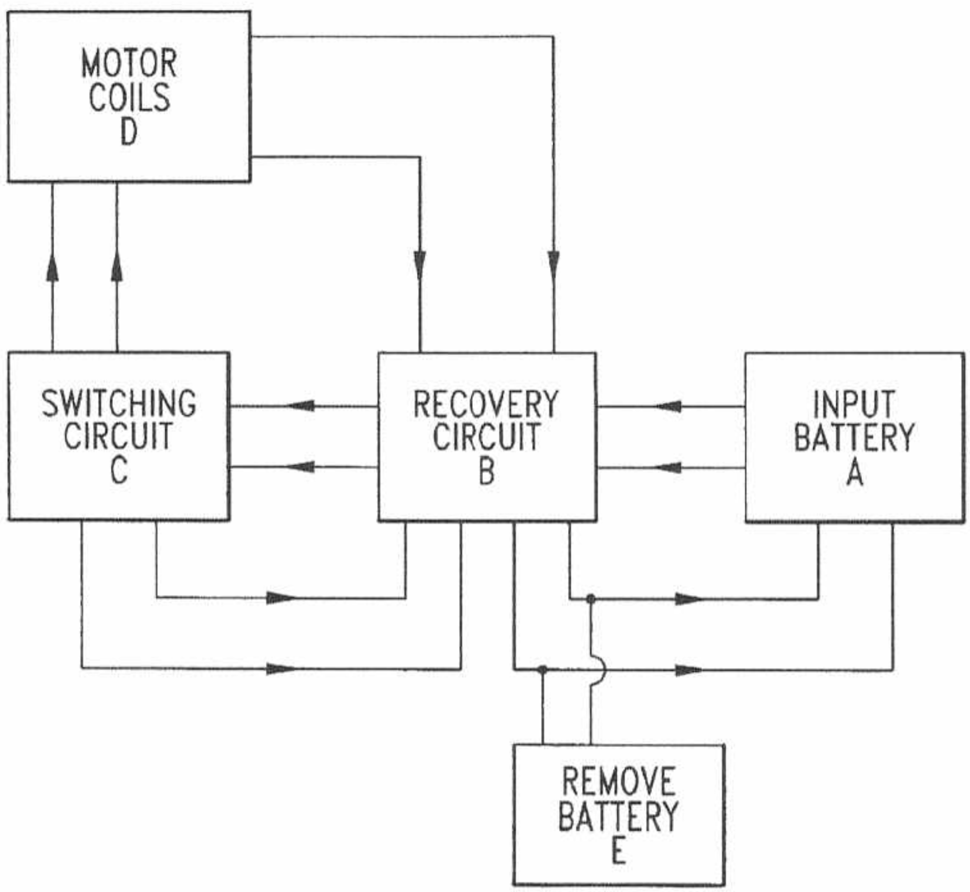
MOTOR
COILS
D
SWITCHING
CIRCUIT
C
RECOVERY
CIRCUIT
B
INPUT
BATTERY
A
REMOVE
BATTERY
E

Fig. 3

DEVICE AND METHOD OF A BACK EMF PERMANENT ELECTROMAGNETIC MOTOR GENERATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to the capturing of electromagnetic energy using a method and device to create back EMF (electromagnetic force) and re-phasing of the back EMF to recycle and capture the available back EMF energy. Back EMF is also referred to as regauging and may be defined as energy created by the magnetic field from coils, and only by coils, and not by magnets.

2. Background Information and Related Art

Operation of a normal magnetic motor has the rotor pole attracting the stator pole, resulting in the generation of power from the magnets to the rotor and flywheel. During this phase, energy flows from the magnetics to the rotor/flywheel and is stored in the increased rotation. A rotor pole leaving a stator pole and creating a condition of drag-back results in power having to be put back into the magnetic section by the rotor and flywheel to forcibly overcome the drag-back. In a perfect, friction-free motor, the net force field is therefore referred to as most conservative. In other words, a most conservative EMF motor has maximum efficiency. Without extra energy continually fed to the motor, no net work can be done by the magnetic field, since half the time the magnetic field adds energy to the load (the rotor and flywheel) and the other half of the time it subtracts energy back from the load (the rotor and flywheel). Therefore the total net energy output is zero in any such rotary process without additional energy input. To use a present day magnetic motor, continuous energy must be input into the motor to overcome drag-back and to power the motor and its load.

Present EMF motors and generators all use such conservative fields and therefore, have internal losses. Hence, it is necessary to continually input all of the energy that the motor outputs to the load, plus more energy to cover losses inside the motor itself. EMF motors are rated for efficiency and performance by how much energy input into the motor actually results in output energy to the load. Normally, the Coefficient of Performance (COP) rating is used as a measure of efficiency. The COP is the actual output energy going into the load and powering it, divided by the energy that must be input into the device with its load. COP is the power out into the load, divided by the power input into the motor/load combination. If there were zero internal losses in a motor, that "perfect" motor would have a coefficient of performance (COP) equal to 1.0. That is, all energy input into the motor would be output by the motor directly into the load, and none of the input energy would be lost or dissipated in the motor itself.

In magnetic motor generators presently in use, however, due to friction and design flaws, there are always internal losses and inefficiencies. Some of the energy input into the motor is dissipated in these internal losses. As a consequence, the energy that gets to the load is always less than the input energy. So a standard motor operates with a COP of less than 1.0 which is expressed as COP<1.0. An inefficient motor may have a COP=0.4 or 0.45, while a specially designed, highly efficient motor may have a COP=0.85.

The conservative field inside of a motor itself can be divided into two phases. Producing a conservative field involves net symmetry between the "power out" phase from the magnetics to the rotor/flywheel and the "power back in" phase from the rotor/flywheel back to the magnetics. That is, the two flows of energy (one from the magnetics into the rotor and flywheel, and one from the rotor and flywheel back to the magnetics) are identical in magnitude but opposite in direction. Each phase alone is said to be "asymmetrical"; that is, it either has: 1) a net energy flow out to the rotor/flywheel; or 2) a net energy flow back into the magnetics from the rotor/flywheel. In simplified terms, it is referred to as "power out" and "power back in" phases with respect to the motor magnetics. Hence, the two asymmetrical phases are: 1) the power-out phase; and 2) the "power back in" phase, with reference to the magnetics.

For the power-out phase, energy is derived from the EMF existing between the stator pole and incoming rotor pole in an attraction mode. In this phase, the rotary motion (angular momentum and kinetic energy) of the rotor and flywheel is increased. In short, power is added to the rotor/flywheel (and thus to the load) from the fields between stator pole and rotor pole (the electromagnetic aspects of the system).

For the "power back in" phase, energy must be fed back into the magnetics from the rotor and flywheel (and the load) to overcome the drag-back forces existing between stator pole and outgoing rotor pole. In this phase, energy is returned back to the internal magnetic system from the rotary motion of the rotor and flywheel (the angular momentum, which is the rotational energy×time). As is well known in physics, a rotor/flywheel's angular momentum provides a convenient way to store energy with the spinning rotor/flywheel mass acting as an energy reservoir.

All present day conventional magnetic motors use various methods for overcoming and partially reversing back EMF. Back EMF is the return pulse from the coil out of phase and is also referred to as regauging. The back EMF is shorted out and the rotor is attracted back in, therefore eliminating back drag. This can be accomplished by pouring in more energy, which overpowers the back EMF, thereby producing a forward EMP in that region. The energy required for this method must be furnished by the operator.

The motor of the present invention uses only a small amount of energy to "trigger" a much larger input of available energy by supplying back EMF, thus increasing the potential energy of the system. It then utilizes this excess potential energy to reduce or reverse back EMF, thereby increasing the efficiency of the motor and, therefore, the COP.

If the energy in phase 1 (the power-out phase) is increased by additional available energy in the electromagnetics themselves, then the energy in phase 1 can be made greater than the energy in phase 2 (the power-back-in phase) without the operator furnishing the energy utilized. This produces a non-conservative net field. Net power can then be taken from the rotating stator and flywheel, because the available energy added into the stator and flywheel by the additional effects, is transformed by the rotor/flywheel into excess angular momentum and stored as such. Angular momentum is conserved at all times; but now some of the angular momentum added to the flywheel is evoked by additional effects in the electromagnetics rather than being furnished by the operator.

Electrodynamicists assume that the potential available energy of any system can be changed at will and without cost. This is back EMF and is well-known in physics. It is also routinely employed by electrodynamicists in the theoretical aspects. But to simplify the mathematics, electrodynamicists will create a back EMF twice simultaneously, each back EMF carefully selected just so that the two available forces that are produced are equal and opposite and cancel each other "symmetrically". This is referred to as "symmetrical back EMF". A symmetrical back EMF system cannot produce a COP>1.0.

On the other hand, the motor of the present invention deliberately creates a back EMF itself and its potential energy only once at a time, thereby retaining each extra force for a period of time and applying it to increase the angular momentum and kinetic energy of the rotor and flywheel. Specifically, this back EMF energy with its net force is deliberately applied in the motor of the present invention to overcome and even reverse the conventional drag-back (the back EMF). Hence less energy must be taken from the rotor and flywheel to overcome the reduced back EMF, and in the ideal case none is required since the back EMF has been overpowered and converted to forward EMF by the back EMF energy and force. In the motor of the present invention, the conventional back-drag section of the magnetics becomes a forward-EMF section and now adds energy to the rotor/flywheel instead of subtracting it. The important feature is that the operator only pays for the small amount of energy necessary to trigger the back EMF, and does not have to furnish the much larger back EMF energy itself.

When the desired energy in phase 1 (the power out phase) is thus made greater than the undesired "drag-back" energy in phase 2, then part of the output power normally dragged back from the rotor and flywheel by the fields in phase 2 is not required. Hence, additional power compared to the system (without the special back EMF mechanisms) is available from the rotor/flywheel. The rotor maintains additional angular momentum and kinetic energy, compared to a system which does not produce back EMF itself. Consequently, the excess angular momentum retained by the rotor and flywheel can be utilized as additional shaft power to power an external load connected to the shaft.

A standard magnetic motor operates as the result of the motor being furnished with external energy input into the system by the operator to reduce phase 2 (power back into the magnetics from the rotor/flywheel) by any of several methods and mechanisms. The primary purpose of this external energy input into the system is to overcome the back EMF and also provide for the inevitable energy losses in the system. There is no input of energy separate from the operator input. Therefore, the COP of any standard magnetic motor is COP less than 1.0. The efficiency of a standard magnetic motor varies from less than 50% to a maximum of about 85%, and so has a COP<1.0. When nothing is done in the motor that will produce a reduction of the back EMF without the operator inputing all the energy for it, then for even a frictionless, ideal permanent magnet motor, the COP can never exceed 1.0.

Until the introduction of the motor of the present invention, it has been standard universal practice that the operator must furnish all energy used to reduce the back EMF, provide for the internal losses, and power the load. It is therefore a common belief by the scientific community that an ideal (loss-less) permanent magnet motor cannot exceed COP=1.0. And that is true, so long as the operator himself must furnish all the energy. Further, since real permanent magnetic motors have real internal losses, some of the input energy is always lost in the motor itself, and that lost energy is not available for powering the rotor/flywheel and load. Hence a real permanent magnetic motor of the conventional kind will always have a COP<1.0.

The common assumption that the COP of a motor is limited to less than 1.0 is not necessarily true, and that

COP>1.0 is permitted without violating the laws of nature, laws of physics, or laws of thermodynamics. However, it can immediately be seen that any permanent magnet motor exhibiting a COP>1.0 must have some available energy input returning in the form of back EMF.

A problem relates to how back EMF energy can be obtained from a circuit's external environment for the specific task of reducing the back-drag EMF without the operator having to supply any input of that excess energy. In short, the ultimate challenge is to find a way to cause the system to: 1) become an open dissipative system, that is, a system receiving available excess energy from its environment, in other words, from an external source; and 2) use that available excess energy to reduce the drag-back EMF between stator and rotor poles as the rotor pole is leaving the stator pole. If this objective can be accomplished, the system will be removed from thermodynamic equilibrium. Instead, it will be converted to a system out-of-thermodynamic equilibrium. Such a system is not required to obey classical equilibrium thermodynamics.

Instead, an out-of-equilibrium thermodynamic system must obey the thermodynamics of open systems far from the established and well-known parameters of thermodynamic equilibrium. As is well known in the physics of thermodynamics, such open systems can permissibly: 1) self-order; 2) self-oscillate; 3) output more back EMF energy than energy input by the operator (the available excess back EMF energy is received from an external source and some energy is input by the operator as well); 4) power itself as well as its loads and losses simultaneously (in that case, all the energy is received from the available external source and there is no input energy from the operator); and 5) exhibit negentropy, that is, produce an increase of energy that is available in the system, and that is independent of the energy put into the system by the operator. As a definition, entropy roughly corresponds to the energy of a system that has become unavailable for use. Negentropy corresponds to additional energy of a system that has become available for use.

In the back EMF permanent magnet electromagnetic motor generator of the present invention, several known processes and methods are utilized which allow the invention to operate periodically as an open dissipative system (receiving available excess energy from back EMF) far from thermodynamic equilibrium, whereby it produces and receives its excess energy from a known external source.

A method is utilized to temporarily produce a much larger source of available external energy around an energized coil. Then the unique design features of this new motor provides a method and mechanism that can immediately produce a second increase in that energy, concurrently as the energy flow is reversed. Therefore, the motor is capable of producing two asymmetrical back EMFs, one after the other, of the energy within a single coil, which dramatically increases the energy available and causes that available excess energy to then enter the circuit impulsively, being collected and utilized.

The present motor utilizes this available excess back EMF energy to overcome and even reverse the back-drag EMF between stator pole and rotor pole, while furnishing only a small trigger pulse of energy necessary to control and activate the direction of the back EMF energy flow.

By using a number of such dual asymmetrical self back EMFs for every revolution of the rotor, the rotor and flywheel collectively focus all the excess impulsive inputs into increased angular momentum (expressed as energy× time), shaft torque, and shaft power.

Further, some of the excess energy deliberately generated in the coil by the utilization of the dual process manifests in the form of excess electrical energy in the circuit and is utilized to power electrical loads, e.g., a lamp, fan, motor, or other electrical devices. The remainder of the excess energy generated in the coil can be used to power the rotor and flywheel, with the rotor/flywheel also furnishing shaft horsepower for powering mechanical loads.

This new and unique motor utilizes a means to furnish the relatively small amount of energy to initiate the impulsive asymmetrical self back EMF actions. Then part of the available excess electrical power drawn off from the back EMFs is utilized to recharge the battery with dramatically increased over voltage pulses.

The unique design features of this motor utilize both north and south magnetic poles of each rotor and stator magnet. Therefore, the number of impulsive self back EMFs in a single rotation of the rotor is doubled. Advanced designs increase the number of self back EMFs in a single rotor rotation with the result that there is an increase in the number of impulses per rotation which increase the power output of this new motor.

The sharp voltage pulse produced in the coil of this new motor by the rapidly collapsing field in the back EMF coil is connected to a battery in charge mode and to an external electrical load. The net result is that the coil asymmetrically creates back EMF itself in a manner adding available energy and impulse to the circuit. The excess available energy collected in the coil is used to reverse the back-EMF phase of the stator-rotor fields to a forward EMF condition, impulsively adding acceleration and angular momentum to the rotor and flywheel. At the same time, a part of the excess energy collected in the coil is used to power electrical loads such as charging a battery and operating a lamp or such other device.

It is well known in the art that changing the voltage alone creates a back EMF and requires no work. This is because to change the potential energy does not require changing the form of that potential energy, but only its magnitude. Work is rigorously the changing of the form of energy. Therefore, as long as the form of the potential energy is not changed, the magnitude can be changed without having to perform work in the process. The motor of the present invention takes advantage of this permissible operation to create back EMF asymmetrically, and thereby change its own usable available potential energy.

In an electric power system, the potential (voltage) is changed by inputing energy to do work on the internal charges of the generator or battery. This potential energy is expended within the generator (or battery) to force the internal charges apart, forming a source dipole. Then the external closed circuit system connected to that source dipole ineptly pumps the spent electrons in the ground line back through the back EMP of the source dipole, thereby scattering the charges and killing the dipole. This shuts off the energy flow from the source dipole to the external circuit. As a consequence of that conventional method, it is a requirement to input and replace additional energy to again restore the dipole. The circuits currently utilized in most electrical generators have been designed to keep on destroying the energy flow by continually scattering all of the dipole charges and terminating the dipole. Therefore, it is necessary to keep on inputing energy to the generator to keep restoring its source dipole.

An investigation of particle physics is required to see what furnishes the energy to the external circuit. Since neither a battery nor a generator furnishes energy to the external circuit, but only furnishes energy to form the source dipole, a better understanding of the electric power principle is required to fully understand how this new motor functions. A typical battery uses its stored chemical energy to form the source dipole. A generator utilizes its input shaft energy to rotate, forming an internal magnetic field in which the positive charges are forced to move in one direction and the negative charges in the reverse direction, thereby forming the source dipole. In other words, the energy input into the generator does nothing except form the source dipole. None of the input energy goes to the external circuit. If increased current is drawn into the external load, there also is increased spent electron flow being rammed back through the source dipole, destroying it faster. Therefore, dipole-restoring-energy has to be inputed faster. The chemical energy of the battery also is expended only to separate its internal charges and form its source dipole. Again, if increased current and power is drawn into the external load, there is increased spent electron flow being rammed back through the source dipole, destroying it faster. This results in a depletion of the battery's stored energy faster, by forcing it to have to keep restoring the dipole faster.

Once the generator or battery source dipole is formed (the dipole is attached also to the external circuit), it is well known in particle physics that the dipole (as is any charge) is a broken symmetry in the vacuum energy flux. By definition, this means that the source dipole extracts and orders part of that energy received from its vacuum interaction, and pours that energy out as the energy flowing through all space surrounding the external conductors in the attached circuit. Most of this enormous energy flow surging through space surrounding the external circuit does not strike the circuit at all, and does not get intercepted or utilized. Neither is it diverged into the circuit to power the electrons, but passes on out into space and is just "wasted". Only a small "sheath" of the energy flow along the surface of the conductors strikes the surface charges in those conductors and is thereby diverged into the circuit to power the electrons. Standard texts show the huge available but wasted energy flow component, but only calculate the small portion of the energy flow that strikes the circuit, is caught by it, and is utilized to power it.

In a typical circuit, the huge available but "wasted" component of the energy flow is about 10^{13} times as large as is the small component intercepted by the surface charges and diverged into the circuit to power it. Hence, around every circuit and circuit element such as a coil, there exists a huge non-intercepted, non-diverged energy flow that is far greater than the small energy flow being diverted and used by the circuit or element.

Thus there exists an enormous untapped energy flow immediately surrounding every EMF power circuit, from which available excess energy can be intercepted and collected by the circuit, if respective non-linear actions are initiated that sharply affect and increase the reaction cross section of the circuit (i.e., its ability to intercept this available but usually wasted energy flow).

The method in which the motor of the present invention alters the reaction cross section of the coils in the circuit, is by a novel use, which momentarily changes the reaction cross section of the coil in which it is invoked. Thus, by this new motor using only a small amount of current in the form of a triggering pulse, it is able to evoke and control the immediate change of the coil's reaction cross section to this normally wasted energy flow component. As a result, the motor captures and directs some of this usually wasted environmental energy, collecting the available excess energy in the coil and then releasing it for use in the motor. By timing and switching, the innovative gate design in this new motor directs the available excess energy so that it overcomes and reverses the return EMF of the rotor-stator pole combination during what would normally be the back EMF and demonstrates the creation of the second back EMF of the system. Now instead of an "equal retardation" force being produced in the back EMF region, a forward EMF is produced that is additive to the rotor/flywheel energy and not subtractive. In short, it further accelerates the rotor/flywheel.

This results in a non-conservative magnetic field along the rotor's path. The line integral of the field around that path (i.e., the net work on the rotor/flywheel to increase its energy and angular momentum) is not zero but a significant amount. Hence, the creation of an asymmetrical back EMF impulse magnetic motor: 1) takes its available excess energy from a known external source, the huge usually non-intercepted portion of the energy flow around the coil; 2) further increases the source dipolarity by this back EMF energy; and 3) produces available excess energy flow directly from the source dipole's increased broken symmetry in its fierce energy exchange with the local vacuum.

No laws of physics or thermodynamics are violated in the method and device of the present invention, and conservation of energy rigorously applies at all times. Nonetheless, by operating as an open dissipative system not in thermodynamic equilibrium with the active vacuum, the system can permissibly receive available excess energy from a known environmental source and output more energy to a load than must be input by the operator alone. As an open system not in thermodynamic equilibrium, this new and unique motor can tap in on back EMF to energize itself, loads and losses simultaneously, fully complying with known laws of physics and thermodynamics.

A search of prior art failed to reveal any devices that recycle available energy from back EMF of a permanent electromagnetic motor generator as described in the present invention. However, the following prior art patents were reviewed:

1. U.S. Pat. No. 5,532,532 to DeVault, et al., Hermetically Sealed Super-conducting Magnet Motor.
2. U.S. Pat. No. 5,508,575 to Elrod, Jr., Direct Drive Servovalve Having Magnetically Loaded Bearing.
3. U.S. Pat. No. 5,451,825 to Strohm, Voltage Homopolar Machine.
4. U.S. Pat. No. 5,371,426 to Nagate et al., Rotor For Brushless Motor.
5. U.S. Pat. No. 5,369,325 to Nagate et al., Rotor For Brushless Electromotor And Method For Making Same.
6. U.S. Pat. No. 5,356,534 to Zimmermann, deceased et al., Magnetic-Field Amplifier.
7. U.S. Pat. No. 5,350,958 to Ohnishi, Super-conducting Rotating Machine, A Super-conducting Coil, And A Super-conducting Generator For Use In A Lighting Equipment Using Solar Energy.
8. U.S. Pat. No. 5,334,894 to Nakagawa, Rotary Pulse Motor.
9. U.S. Pat. No. 5,177,054 to Lloyd, et al., Flux Trapped Superconductor Motor and Method.
10. U.S. Pat. No. 5,130,595 to Arora, Multiple Magnetic Paths Pulse Machine.
11. U.S. Pat. No. 4,980,595 to Arora, Multiple Magnetics Paths Machine.

12. U.S. Pat. No. 4,972,112 to Kim, Brushless D.C. Motor.
13. U.S. Pat. No. 4,916,346 to Kliman, Composite Rotor Lamination For Use In Reluctance Homopolar, And Permanent Magnet Machines.
14. U.S. Pat. No. 4,761,590 to Kaszman, Electric Motor.
15. U.S. Pat. No. 4,536,230 to Landa, et al., Anisotropic Permanent Magnets.
16. U.S. Pat. No. Re. 31,950 to Binns, Alternating Current Generators And Motors.
17. U.S. Pat. No. 4,488,075 to DeCesare, Alternator With Rotor Axial Flux Excitation.
18. U.S. Pat. No. 4,433,260 to Weisbord et al., Hysteresis Synchronous Motor Utilizing Polarized Rotor.
19. U.S. Pat. No. 4,429,263 to Muller, Low Magnetic Leakage Flux Brushless Pulse Controlled D-C Motor.
20. U.S. Pat. No. 4,423,343 to Field, II, Synchronous Motor System.
21. U.S. Pat. No. 4,417,167 to Ishii et al., DC Brushless Motor.
22. U.S. Pat. No. 4,265,754 to Menold, Water Treating Apparatus and Methods.
23. U.S. Pat. No. 4,265,746 to Zimmermann, Sr. et al. Water Treating Apparatus and Methods.
24. U.S. Pat. No. 4,222,021 to Bunker, Jr., Magnetic Apparatus Appearing To Possess a Single Pole.
25. U.S. Pat. No. 2,974,981 to Vervest et al., Arrester For Iron Particles.
26. U.S. Pat. No. 2,613,246 to Spodig, Magnetic System.
27. U.S. Pat. No. 2,560,260 to Sturtevant et al., Temperature Compensated Magnetic Suspension.

SUMMARY OF THE INVENTION

The device and method of the present invention is a new permanent electromagnetic motor generator that recycles back EMF energy (regauging) thus allowing the motor to produce an energy level of COP=0.98, more or less, depending upon configuration, circuitry, switching elements and the number and size of stators, rotors and coils that comprise the motor. The rotor is fixed between two pole pieces of the stator. The motor generator is initially energized from a small starter battery means, analogous to a spark plug, that sends a small amount of energy to the motor, thus stimulating a rotating motion from the rotor. As the rotor rotates, energy is captured from the surrounding electromagnetic field containing an asymmetrical pulse wave of back EMF. The energy produced and captured can be directed in one of several directions, including returning energy to the initial starter battery, rotating a shaft for work and/or sending a current to energize a fan, light bulb or other such device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top perspective view of a back EMF permanent electromagnetic motor generator with a single stator and a single rotor.

FIG. **1a** is a side perspective view of a timing wheel and magnetic Hall Effect uptake switch of the back EMF motor generator.

FIG. **1b** is a side perspective view of the rotor of the back EMF motor generator.

FIG. **2** is a schematic drawing incorporating circuitry for the back EMF motor generator.

FIG. **3** is a box diagram showing the relationships of the back EMF motor generator circuitry.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is a device and method for creating a back EMF permanent electromagnetic motor generator. As described in the Background Information, this new motor generator conforms to all applicable electrodynamic laws of physics and is in harmony with the law of the conservation of energy, the laws of electromagnetism and other related natural laws.

The back EMF permanent electromagnetic motor generator is comprised of combination of electrical, material and magnetic elements to capture available electromagnetic energy (back EMF) in a recovery rectifier or single diode from output coils. The capturing of back EMF energy is also known as regauging in the art. As an arbitrary starting point in describing this invention, an input battery, as a means of energy, sends power through a power on-off switch and then to a means for timing such as a magnetic timing switch (Hall Effect magnetic pickup switch, a semiconductor) which interfaces with or is in apposition to a magnet on a timing wheel. The timing wheel may contain any number of magnets of one or more, with the South polarity facing outward and in apposition with the Hall Effect pickup switch. The timing wheel is mounted at the end of a shaft that also runs through the center midline of a rotor containing any number of magnets of two or more. The rotor magnets are arranged in a manner wherein they have the same polarity and are equidistant from each other. The shaft has the timing wheel mounted at one end, the rotor, and then a means for work, such as a power take off at the opposite end. However, there are other embodiments in which the position of the rotor, timing wheel and power take-off have other arrangements. The rotor is stabilized to a platform or housing means and is fixed in a stationary position within a stator.

The stator is comprised of a permanent magnet connected to a means for conducting electromagnetic energy such as two parallel bars, each bar having a magnetized pole piece at one end of each bar. The conduction material of the bar may be ferrous, powdered iron, silicon steel, stainless magnetic steel, laminations of conductive material or any other magnetic conductive material. Each bar is wrapped in a conducting means to form an input coil. The means for conducting may be copper, aluminum or any other conductive material suitable for making a coil. The primary or input coil is connected to the switching circuit. A second conductive wrapping on top of the input coil becomes a secondary or output coil. The secondary or output coil is connected to the recovery circuit. The rotor is symmetrically located between the pole pieces of the bars of the stator and contains a series of magnets all having the same polarity, North or South, with each magnet in the rotor being in apposition to the pole piece as the rotor is in rotation around the shaft.

When the rotor is energized from the battery of the switching circuit, there is an initial magnetic field that is instantly overcome as the magnetized pole pieces are in apposition with the rotor magnets. As the rotor begins to move, increasing electromagnetic energy is produced as a result of flux gaiting from the apposed magnets of the rotor and pole pieces. The coils surrounding the bars "buck" the permanent magnet connecting the bars. This is known in the art as the "buck boosting" principle. When the permanent magnet is bucked by the coils, it reverses the polarity of the pole pieces which are apposed to the rotor magnets causing the rotor to increase its rotation or spin. The energy available from the fields that are collapsing in the primary and secondary coils, which creates the back EMF within the system, is now in non-equilibrium. Through circuitry and a switching means, energy can be put back into the system. Available energy captured from the back EMF, may be applied in different directions, including re-energizing the input battery, storage in a capacitor, conversion by a recovery rectifier to be stored in the input battery, a capacitor or a secondary or recovery battery. Recovery rectifiers convert AC to DC. Available energy may be used to energize an electric bulb, fan or any other uses.

The shaft in the midline of the rotor can transfer energy in the form of work through a power take-off. The power take-off may be connected to any number of secondary shafts, wheels, gears and belts to increase or reduce torque.

This is a description of the basic invention, however, there are an innumerable number of combinations and embodiments of stators, rotors, Hall Effect magnetic pickup switches, coils, recovery rectifiers and electronic connecting modes that may be combined on a single shaft or several shafts connected in various combinations and sequences, and of various sizes. There may be any number of stators to one rotor, however, there can be only one rotor if there is a single stator. The number of Hall Effect pickup switches may vary, for example, in the case of multiple stators of high resistant coils, the coils may be parallel to form a low resistant coil so that one Hall Effect pickup with one circuit may fire all of the stators at the same time. The number of magnets in both the timing wheel and the rotor may also vary in number as well as the size and strength of the magnets in gauss units. All types of magnets may be used. The number of winds on both the input and output coils on each conducting bar may also vary in number and in conductive material.

The motor generator, as shown in FIG. **1**, a top perspective view of a single stator, single rotor back EMF motor and is comprised of a means of providing energy, such as input battery **10** connected to power switch **11** (shown in FIG. **2**) and Hall Effect magnetic pickup switch **13**. Magnetic pickup **13** interfaces with timing wheel **12** to form a timing switch. Timing wheel **12** is comprised of four magnets **14** with the South pole of each said magnet facing outward to magnetic pickup **13**. Timing wheel **12** is fixed at one end of shaft **15**. Located on shaft **15** is rotor **16**. Rotor **16** can be of any size, said rotor containing four rotor magnets **17**. Said rotor magnets **17** are arranged in a manner so all have the same polarity. Opposite timing wheel **12** on shaft **15** is a means for work, such as a power take-off **18**. Rotor **16** is mounted in a fixed position with rotor magnets **17** in apposition with magnetized pole pieces **19***a* and **19***b*. Each pole piece **19***a* and **19***b* is connected to iron bars **20***a* and **20***b*. Iron bars **20***a* and **20***b* are connected by a permanent magnet **21**. A means for conduction is wrapped around iron bars **20***a* and **20***b* to form input coils **22***a* and **22***b*. Superimposed upon input coils **22***a* and **22***b* are output coils **23***a* and **23***b*. Output coils **23***a* and **23***b* are connected to full wave bridge first recovery rectifier **24***a*. First rectifier **24***a* is connected to battery **10**.

FIG. **1***a* is a perspective side view of the back EMF Motor Generator timing wheel **12** with Hall Effect magnetic pickup switch **13** in apposition individually to each of four magnets **14** as said timing wheel **12** rotates. Said magnets **14** have the South polarity facing outward with an equidistant separation of 90°.

FIG. **1***b* is a perspective side view of rotor **16** with four rotor magnets **17** with 900 equidistant separation and having the same polarity.

FIG. **2** is a schematic diagram of the motor generator circuitry showing input coil connections from input battery

10 through power switch **11**, transistors **30***a,b*, resistors **31***a–d*, through power supply lead **32** (VCC+) and to magnetic pickup **13**. Magnetic pickup **13** is in apposition with timing wheel magnets **14** located on timing wheel **12**. Off of magnetic pickup **13** is collector lead **33** and ground lead **34**. When current is reversed, it flows through resistor **31***e* and transistor **30***c* to input battery **10**. Input coils **22***a,b* send power to full wave bridge first recovery rectifier **24***a* which then sends power through switch recovery **27** back into the system, and/or to input battery **10**. Output coils **23***a* and **23***b* send power through single diode second recovery rectifier **24***b* to recovery battery **25**. In this particular embodiment, the value and type number of the components are as follows: Hall Effect magnetic pickup switch **13** is a No. 3020; transistor **30***a* is a No. 2N-2955; transistor **30***b* is a No. MPS-8599; and transistor **30***c* is a No. 2N-3055; resistors **31***a* and b are 470 ohms resistors; resistor **31***b* is a 2.2 K ohms resistor; resistor **31***c* is a 220 ohms resistor; resistor **31***d* is a 1 K ohms resistor; and recovery rectifier **24***a* is a 10 Amp, 400 volts bridge rectifier.

FIG. **3** is a box diagram showing the flow of voltage from input battery A, through recovery circuit B, switching circuit C and motor coils D. Motor coils D send available back EMF energy through recovery circuit B, and from B to recovery battery E and input battery A. Available back EMF energy can also flow from switching circuit C to recovery circuit B.

In multiple stator/rotor systems, each individual stator may be energized one at a time or all of the stators may be energized simultaneously. Any number of stators and rotors may be incorporated into the design of such multiple stator/rotor motor generator combinations. However, while there may be several stators per rotor, there can only be one rotor for a single stator. The number of stators and rotors that would comprise a particular motor generator is dependent upon the amount of power required in the form of watts. The desired size and horse power of the motor determines whether the stators will be in parallel or fired sequentially by the magnetic Hall Effect pickup switch or switches. The number of magnets incorporated into a particular rotor is dependent upon the size of the rotor and power required of the motor generator. In a multiple stator/rotor motor generator, the timing wheel may have one or more magnets, but must have one magnet Hall Effect pickup switch for each stator if the stators are not arranged in parallel. The back EMF energy is made available through the reversing of the polarity of the magnetized pole pieces thus collapsing the field around the coils and reversing the flow of energy to the recovery diodes, which is capturing the back EMF.

Individual motors may be connected in sequence with each motor having various combinations of stators and rotors or in parallel. Each rotor may have any number of rotor magnets ranging from a minimum of 2 to maximum of 60. The number of stators for an individual motor may range from 1 to 60 with the number of conducting bars ranging from 2 to 120.

What distinguishes this motor generator from all others in the art is the presence of a permanent magnet connecting the two conducting bars which transfer magnetic energy through the pole pieces to the rotor, thereby attracting the rotor between the pole pieces. With the rotor attracted in between the two pole pieces, the coils switch the polarity of the magnetic field of the pole pieces so that the rotor is repelled out. Therefore there is no current and voltage being used to attract the rotor. The only current being used is the repulsion of the rotor between the two conductive bar pole pieces thereby requiring only a small amount of current to repel the rotor. This is known as a regauging system and allows the capturing of available back EMF energy for use.

Finally, although the invention has been described with reference of particular means, materials and embodiments, it is to be understood that the invention is not limited to the particulars disclosed and extends to all equivalents within the scope of the claims.

What is claimed is:

1. A back EMF permanent electromagnetic motor generator using a regauging process for capturing available electromagnetic energy in the system comprising.

a. a means for producing a source of input energy to said motor generator, said energy conducted through a power switch and a magnetic timing switch;

b. a means for timing said motor generator, having a timing wheel connected to a shaft, said timing wheel comprised of one or more magnets, said magnets arranged so that the South polarity faces outward and is in apposition with said timing switch;

c. a rotor and a means for transferring a force on said shaft, said rotor containing magnets having the same polarity;

d. a stator comprised of two bars made of a magnetic conductive means, said bars connected by a permanent magnet and having a pole piece at one end of each said bar, said pole pieces thereby magnetized and in apposition with magnets of said rotor, said rotor positioned between said pole pieces;

e. an input coil comprised of a conductive material wrapped around each of said bars of said stator, said input coil connected to a circuit;

f. an output coil comprised of a conductive material wrapped around each of said input coil of said bars, said output coils connected to a recovery rectifier or diode;

g. said circuit for transferring electrical power, said circuit connecting said means for producing input energy to said power switch, said circuit comprising a pickup timing switch thereby providing an electronic voltage pulse to said circuit and then to said coils resulting in rotation of said rotor, said rotor turning said timing wheel to provide additional electronic voltage pulses to said circuit and then to said coils again, thereby providing a means for collecting available back EMF energy for storage, use or dissipation into the system.

2. The motor generator of claim **1**, wherein said input producing means is a battery.

3. The motor generator of claim **1**, wherein said magnetic timing switch is a Hall Effect magnetic pickup semiconductor.

4. The motor generator of claim **1**, wherein the number of rotors may range from 1 to 60.

5. The motor generator of claim **1**, wherein the number of magnets in said rotor has a range of 2 to 60.

6. The motor generator of claim **1**, wherein said magnetic conductive means may be ferrous, powdered iron, silicon steel, stainless magnetic steel, laminations of a conductive material or any other magnetic conductive material.

7. The motor generator of claim **1**, wherein the number of magnetic conductive bars has a range of 2 to 120.

8. The motor generator of claim **1**, wherein said means for transferring a force on said shaft may be a power take-off mechanism, gears, flywheels, belts or other methods of transferring force for the purpose of doing work.

9. A back EMF permanent electromagnetic motor generator using a regauging process for capturing available electromagnetic energy in the system comprising:

a. a battery connected to a power switch and a Hall Effect magnetic pickup switch, said magnetic pickup switch in apposition with a timing wheel, said timing wheel on a shaft;

b. a rotor and a power take-off means on said shaft, said rotor having four magnets of the same polarity, said magnets equidistant from each other;

c. a stator, said stator comprised of two iron bars connected by a permanent magnet and wrapped in a first copper conducting material to form an input coil that is connected to a circuit, on top of said input coil, there is wrapped a second copper conducting material to form an output coil with said output coil connected to a recovery rectifier or single diode, said iron bars further having a pole piece at one of each end of said bars, said pole pieces in apposition to said magnets on said rotor;

d. a circuit for transferring electrical power, said circuit connecting said battery to said power switch, said circuit comprising-said Hall Effect pickup switch thereby providing an electronic voltage pulse through said circuit and then to said coils resulting in rotation of said rotor, said rotor turning said timing wheel to provide additional electronic voltage pulses to said coils again, thereby providing a means for collecting available back EMF energy for storage, use or dissipation into the system.

10. A method of producing a back EMF permanent electromagnetic motor generator using a regauging process comprising the steps of:

a. placing a rotor containing magnets of the same polarity on a shaft with a timing wheel on said shaft;

b. placing in apposition to said timing wheel a Hall Effect magnetic pickup switch;

c. placing in apposition to said magnets of said rotor magnetized pole pieces of a stator, said stator comprised of two conducting bars connected by a permanent magnet; input coil connected a circuit;

e. on top of said input coil, wrapping a second conducting material to form an output coil, said output coil connected to a recovery rectifier or a single diode;

f. connecting a circuit for transferring electrical power, said circuit connected to a battery and a power switch, said circuit comprising said Hall Effect magnetic pickup switch thereby providing an electronic voltage pulse to said circuit and then to said coils resulting in increase rotation of said rotor, said rotor turning said timing wheel to provide additional electronic pulses to said circuit and then to said coils again, thereby providing a means for collecting available back EMF energy for storage, use or dissipation into the system.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,392,370 B1
DATED : May 21, 2002
INVENTOR(S) : John C. Bedini

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

<u>Column 13,</u>
Line 19, please delete the hyphen in between "comprising" and "said" and insert a space.

<u>Column 14,</u>
Line 11, after the semicolon, please delete "input coil connected a circuit;".
Line 12, please insert the following new paragraph:
-- d. wrapping said bars with a first conducting material to form an input coil, said input coil connected to a circuit --.

Signed and Sealed this

Tenth Day of December, 2002

JAMES E. ROGAN
Director of the United States Patent and Trademark Office

US006545444B2

(12) **United States Patent**
Bedini

(10) **Patent No.:** **US 6,545,444 B2**
(45) **Date of Patent:** **Apr. 8, 2003**

(54) **DEVICE AND METHOD FOR UTILIZING A MONOPOLE MOTOR TO CREATE BACK EMF TO CHARGE BATTERIES**

(75) Inventor: **John C. Bedini**, Coeur d'Alene, ID (US)

(73) Assignee: **Bedini Technology, Inc.**, Coeur D'Alene, ID (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/805,762**

(22) Filed: **Mar. 13, 2001**

(65) **Prior Publication Data**

US 2002/0130633 A1 Sep. 19, 2002

(51) **Int. Cl.**[7] **H02P 5/28**

(52) **U.S. Cl.** **318/798**; 318/434; 318/138; 318/801; 318/802; 318/364; 318/139; 318/146; 318/806; 318/459

(58) **Field of Search** 318/798, 434, 318/138, 801, 802, 364, 134, 146, 806, 459; 388/928.1

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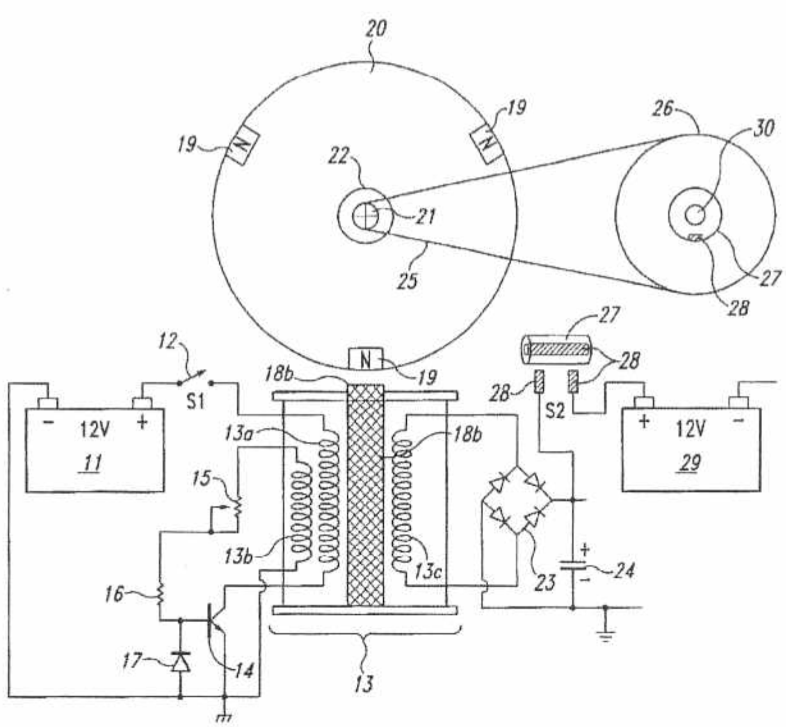
Primary Examiner—Karen Masih
(74) *Attorney, Agent, or Firm*—Graybeal Jackson Haley LLP

(57) **ABSTRACT**

A back EMF monopole motor and method using a rotor containing magnets all of the same polarity and in a monopole condition when in momentary apposition with a magnetized pole piece of a stator having the same polarity, said stator comprised of a coil with three windings: a power-coil winding, a trigger-coil winding, and a recovery-coil winding. The back EMF energy is rectified using a high voltage bridge, which transfers the back EMF energy to a high voltage capacitor for storage in a recovery battery. The stored energy can then be discharged across the recovery battery through the means of a contact rotor switch for further storage.

10 Claims, 3 Drawing Sheets



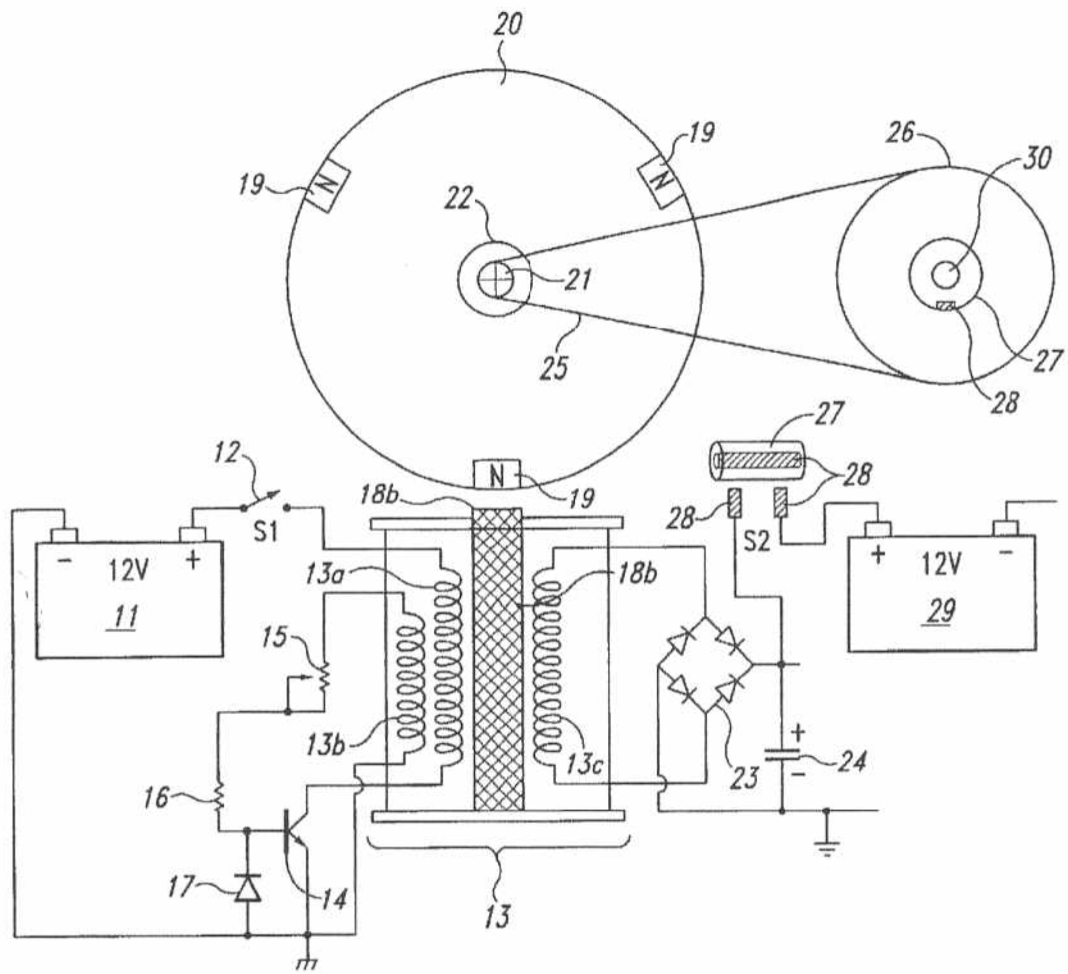

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Fig. 1

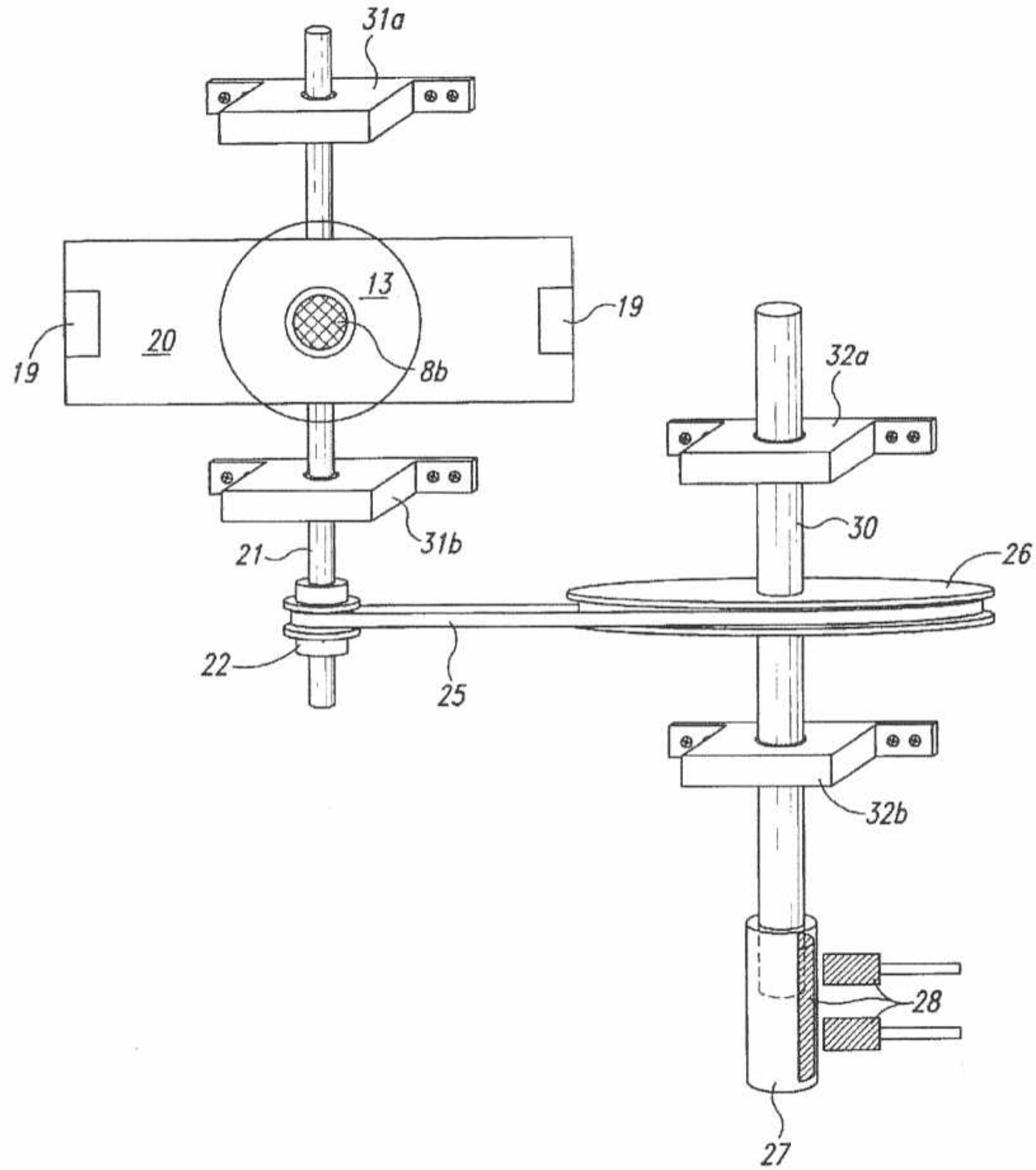

Fig. 2

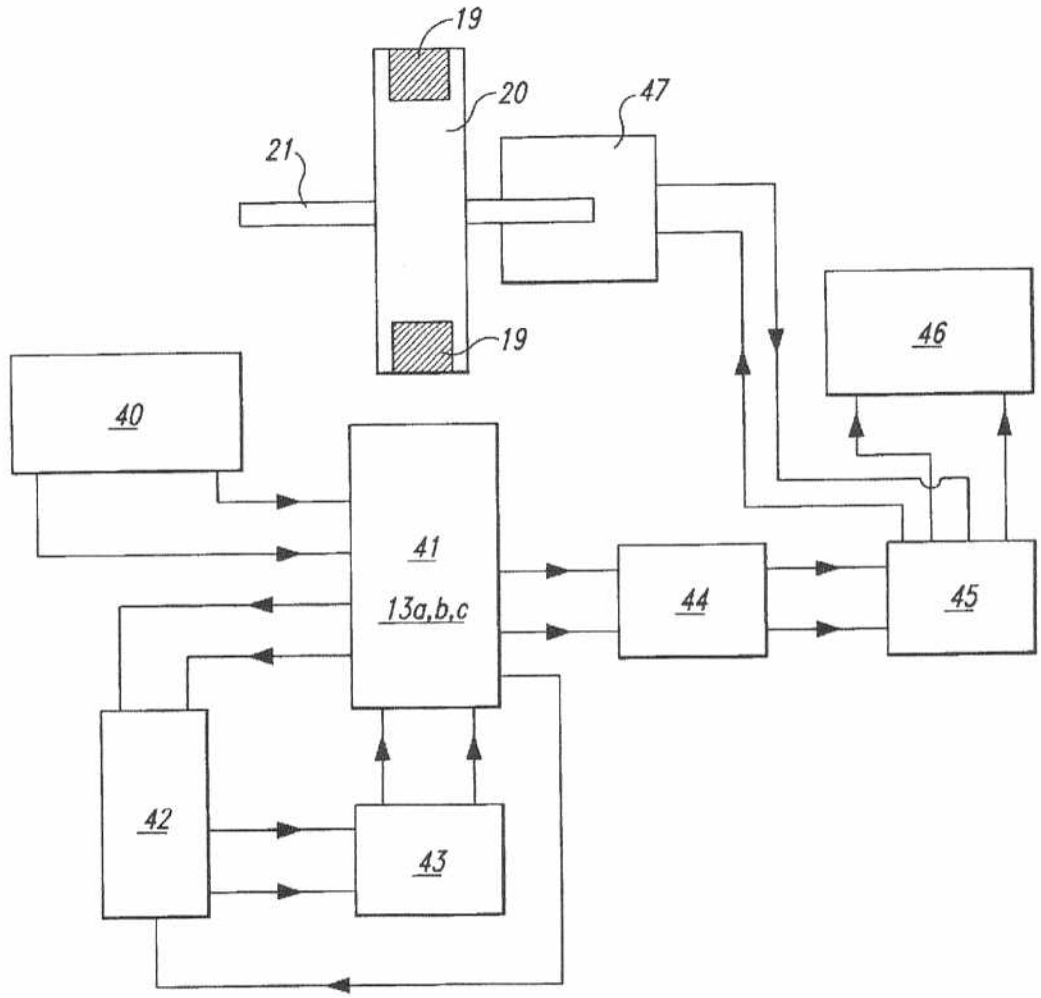

Fig. 3

DEVICE AND METHOD FOR UTILIZING A MONOPOLE MOTOR TO CREATE BACK EMF TO CHARGE BATTERIES

TECHNICAL FIELD

The invention relates generally to the capturing of available electromagnetic energy using a device and method for creating an electromagnetic force (hereinafter, EMF) and then using the available stored energy for recycling into the system as stored energy. The method of creating back EMF is the result of coupling/uncoupling a voltage source to and from a coil.

BACKGROUND

Operation of present day normal magnetic motors has the rotor pole attracting the stator pole, resulting in the generation of mechanical power from the magnets to the rotor and flywheel. During this phase, energy flows from the magnetics to the rotor/flywheel and is stored as kinetic energy in the increased rotation. A rotor pole leaving a stator pole and creating a condition of "drag" results in power having to be put back into the magnetic section by the rotor and flywheel to forcibly overcome the drag. In a perfect, friction-free motor, the net force field is therefore referred to as "most conservative". A most conservative EMF motor has maximum efficiency. Without extra energy continually fed to the motor, no net work can be done by the magnetic field, since half the time the magnetic field adds energy to the load (the rotor and flywheel) and the other half of the time it subtracts energy back from the load (the rotor and flywheel). Therefore, the total net energy output is zero in any such rotary process without additional energy input. To use a present day magnetic motor, continuous energy must be input into the motor to overcome drag and to power the motor and its load.

Motors and generators presently in use, all use such conservative fields and therefore, have internal losses. Hence, it is necessary to continually input all of the energy that the motor outputs to the load, plus more energy to cover losses inside the motor itself. EMF motors are rated for efficiency and performance by how much energy "input" into the motor actually results in "output" energy to the load. Normally, the Coefficient of Performance (hereinafter, COP) rating is used as a measure of efficiency. The COP is the actual output energy going into the load and powering it, divided by the energy that must be input into the device with its motor/load combination. If there were zero internal losses in a motor, that "perfect" motor would have a COP equal to 1.0. That is, all energy input into the motor would be output by the motor directly into the load, and none of the input energy would be lost or dissipated in the motor itself.

In magnetic motor generators presently in use, however, due to friction and design flaws, there are always internal losses and inefficiencies. Some of the energy input into the motor is dissipated in these internal losses. As a consequence, the energy that gets to the load is always less than the input energy. So a standard motor operates with a COP of less than 1.0, which is expressed as COP<1.0. An inefficient motor may have a COP=0.4 or 0.45, while a specially designed, highly efficient motor may have a COP=0.85.

The conservative field inside of a motor itself is divided into two phases. Producing a conservative field involves net symmetry between the "power out" phase from the magnetics to the rotor/flywheel and the "power back in" phase from

the rotor/flywheel back to the magnetics. That is, the two flows of energy (one from the magnetics into the rotor and flywheel, and one from the rotor and flywheel back to the magnetics) are identical in magnitude but opposite in direction. Each phase alone is said to be "asymmetrical", that is, it either has: 1) a net energy flow out to the rotor/flywheel; or 2) a net energy flow back into the magnetics from the rotor/flywheel. In simplified terms, it is referred to as "power out" and "power back in" phases with respect to the motor magnetics.

For the power-out phase, energy is derived from the EMF existing between the stator pole and incoming rotor pole in an attraction mode. In this phase, the rotary motion (angular momentum and kinetic energy) of the rotor and flywheel is increased. In short, power is added to the rotor/flywheel (and thus to the load) from the fields between stator pole and rotor pole (the electromagnetic aspects of the system).

For the "power back in" phase, energy must be fed back into the magnetics from the rotor and flywheel (and the load) to overcome the drag forces existing between stator pole and outgoing rotor pole. In this phase, energy is returned back to the internal magnetic system from the rotary motion of the rotor and flywheel (the angular momentum, which is the rotational energy×time). As is well known in physics, a rotor/flywheel's angular momentum provides a convenient way to store energy with the spinning rotor/flywheel mass acting as an energy reservoir.

Most present day conventional magnetic motors use various methods for overcoming and partially reversing back EMF. Back EMF may be defined as the return pulse from the coil out of phase and is the result of regauging, which is the process of reversing the magnetics polarity, that is, form North to South, etc. The back EMF is shorted out and the rotor is attracted back in, therefore eliminating drag. This can be accomplished by pouring in more energy, which overpowers the back EMF, thereby producing a forward EMF in that region. The energy required for this method is furnished by the operator.

It is well known in the art that changing the voltage alone creates a back EMF and requires no work. This is because to change the potential energy does not require changing the form of that potential energy, but only its magnitude. Work is the changing of the form of energy. Therefore, as long as the form of the potential energy is not changed, the magnitude can be changed without having to perform work in the process. The motor of the present invention takes advantage of this permissible operation to create back EMF asymmetrically, and thereby change its own usable available potential energy.

In an electric power system, the potential (voltage) is changed by inputting energy to do work on the internal charges of the generator or battery. This potential energy is expended within the generator (or battery) to force the internal charges apart, forming a source dipole. Then the external closed circuit system connected to that source dipole ineptly pumps the spent electrons in the ground line back through the back EMF of the source dipole, thereby scattering the charges and killing the dipole. This shuts off the energy flow from the source dipole to the external circuit. As a consequence of this conventional method, it is a requirement to input and replace additional energy to again restore the dipole. The circuits currently utilized in most electrical generators have been designed to keep on destroying the energy flow by continually scattering all of the dipole charges and terminating the dipole. Therefore, it is necessary to keep on inputting energy to the generator to keep restoring its source dipole.

A search of prior art failed to reveal any monopole motor devices and methods that recycle available energy from back EMF to charge a battery or provide electrical energy for other uses as described in the present invention. However, the following prior art patents were reviewed:

U.S. Pat. No. 4,055,789 to Lasater, Battery Operated Motor with Back EMF Charging.

U.S. Pat. No. 2,279,690 to Z. T. Lindsey, Combination Motor Generator.

SUMMARY OF THE INVENTION

An aspect of the device and method of the present invention is a new monopole electromagnetic motor that captures back EMF energy. The captured back EMF energy maybe used to charge or store electrical energy in a recovery battery. The amount of energy recoverable, as expressed in watts, is dependent upon the configuration, circuitry, switching elements and the number and size of stators, rotors, magnets and coils that comprise the motor.

The motor uses a small amount of energy from a primary battery to "trigger" a larger input of available energy by supplying back EMF, thus increasing the potential energy of the system. The system then utilizes this available potential energy to reduce or reverse the back EMF, thereby increasing the efficiency of the motor and, therefore, the COP.

If the energy in phase 1 (the power-out phase) is increased by additional available energy in the electromagnetics themselves, then the energy in phase 1 can be made greater than the energy in phase 2 (the power-back-in phase) without the operator furnishing the energy utilized. This produces a non-conservative net field. Net power can then be taken from the rotating stator and flywheel, because the available energy added into the stator and flywheel by the additional effects is transformed by the rotor/flywheel into excess angular momentum and stored as such. Angular momentum is conserved at all times; but now some of the angular momentum added to the flywheel is evoked by additional effects in the electromagnetics rather than being furnished by the operator.

That is, the motor deliberately creates a back EMF itself and its potential energy once at a time, thereby retaining each extra force for a period of time and applying it to increase the angular momentum and kinetic energy of the rotor and flywheel. Specifically, this back EMF energy with its net force is deliberately applied in the motor of the present invention to overcome and even reverse the conventional drag-back (the back EMF). Hence less energy must be taken from the rotor and flywheel to overcome the reduced back EMF, and in the ideal case none is required since the back EMF has been overpowered and converted to forward EMF by the back EMF energy and force. In the motor, the conventional drag section of the magnetics becomes a forward-EMF section and now adds energy to the rotor/flywheel instead of subtracting it. The important feature is that the operator only pays for the small amount of energy necessary to trigger the back EMF from the primary battery, and does not have to furnish the much larger back EMF energy itself.

When the desired energy in phase 1 (the power out phase) is thus made greater than the undesired drag energy in phase 2, then part of the output power normally dragged from the rotor and flywheel by the fields in phase 2 is not required. Hence, additional power compared to the system (without the special back EMF mechanisms) is available from the rotor/flywheel. The rotor maintains additional angular momentum and kinetic energy, compared to a system, which does not produce back EMF itself. Consequently, the excess angular momentum retained by the rotor and flywheel can be utilized as additional shaft power to power an external load connected to the shaft.

In the motor, several known processes and methods are utilized which allow the motor to operate periodically as an open dissipative system (receiving available excess energy from back EMF) far from thermodynamic equilibrium, whereby. it produces and receives its excess energy from a known external source.

A method is utilized to temporarily produce a much larger source of available external energy around an energized coil. Design features of this new motor provide a device and method that can immediately produce a second increase in that energy concurrently as the energy flow is reversed. Therefore, the motor is capable of producing two asymmetrical back EMFs, one after the other, of the energy within a single coil, which dramatically increases the energy available and causes that available excess energy to then enter the circuit impulsively, being collected and utilized.

The motor utilizes this available excess back EMF energy to overcome and even reverse the drag EMF between stator pole and rotor pole, while furnishing only a small trigger pulse of energy from a primary battery necessary to control and activate the direction of the back EMF energy flow.

By using a number of such dual asymmetrical self back EMFs for every revolution of the rotor, the rotor and flywheel collectively focus all the excess impulsive inputs into increased angular momentum (expressed as energy× time), shaft torque, and shaft power.

Further, some of the excess energy deliberately generated in the coil by the utilization of the dual process manifests in the form of excess electrical energy in the circuit and can be utilized to charge a recovery battery(s). The excess energy can also be used to power electrical loads or to power the rotor and flywheel, with the rotor/flywheel also furnishing shaft horsepower for powering mechanical loads.

The motor utilizes a means to furnish the relatively small amount of energy from a primary battery to initiate the impulsive asymmetrical self back EMF actions. Then part of the available excess electrical power drawn off from back EMF created energy is utilized to charge a recovery battery with dramatically increased over-voltage pulses.

Design features of this monopole motor utilize one magnetic pole of each rotor and stator magnet. The number of impulsive self-back EMF in a single rotation of the rotor is doubled. Advanced designs can increase the number of self-back EMFs in a single rotor rotation with the result that there is an increase in the number of impulses per rotation, which increase the power output of this new motor.

The sharp voltage spike produced in the coil of this monopole motor by the rapidly collapsing field in the back EMF coil is connected to a recovery battery(s) in charge mode and to an external electrical load. The net result is that the coil asymmetrically creates back EMF itself in a manner adding available energy and impulse to the circuit. The available energy collected in the coil is used to reverse the back-EMF phase of the stator-rotor fields to a forward EMF condition, impulsively adding acceleration and angular momentum to the rotor and flywheel. The available back EMF energy collected in the coil is used to charge a battery. Loads can then be drawn off the battery.

A device and method in which the monopole motor alters the reaction cross section of the coils in the circuit, which momentarily changes the reaction cross section of the coil in which it is invoked. Thus, by this new motor using only a small amount of current in the form of a triggering pulse, it is able to evoke and control the immediate change of the coil's reaction cross section to this normally wasted energy-flow component. As a result, the motor captures and directs some of this usually wasted available environmental energy, collecting the available excess energy in the coil and then releasing it for use in the motor. By timing and switching, the innovative gate design in this new motor directs the available excess energy so that it overcomes and reverses the return EMF of the rotor-stator pole combination during what would normally be the back EMF and demonstrates the creation of the second back EMF of the system. Now instead of an "equal retardation" force being produced in the back EMF region, a forward EMF is produced that is additive to the rotor/flywheel energy and not subtractive. In short, it further accelerates the rotor/flywheel.

This results in a non-conservative magnetic field along the rotor's path. The line integral of the field around that path (i.e., the net work on the rotor/flywheel to increase its energy and angular momentum) is not zero but a significant amount. Hence, the creation of an asymmetrical back EMF impulse magnetic motor: 1) takes its available excess energy from a known external source, the huge usually non-intercepted portion of the energy flow around the coil; 2) further increases the source dipolarity by this back EMF energy; and 3) produces available excess energy flow directly from the source dipole's increased broken symmetry in its fierce energy exchange with the local vacuum.

By operating as an open dissipative system not in thermodynamic equilibrium with the active vacuum, the system can permissibly receive available energy from a known environmental source and then output this energy to a load. As an open dissipative system not in thermodynamic equilibrium, this new and unique monopole motor can tap in on back EMF to energize itself, loads and losses simultaneously, fully complying with known laws of physics and thermodynamics.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective side view of a monopole back EMF motor with a single stator and a single rotor.

FIG. 2 is a perspective top view of a monopole back EMF motor with a single stator and a single rotor.

FIG. 3 is a block diagram demonstrating the circuitry for a monopole back EMF motor.

DETAILED DESCRIPTION OF THE INVENTION

An embodiment of the present invention is a device and method for a monopole back EMF electromagnetic motor. As described in the Summary of the Invention, this monopole motor conforms to all applicable electrodynamic laws of physics and is in harmony with the law of the conservation of energy, the laws of electromagnetism and other related natural laws of physics.

The monopole back EMF electromagnetic motor comprises a combination of elements and circuitry to capture available energy (back EMF) in a recovery element, such as a capacitor, from output coils. The available stored energy in the recovery element is used to charge a recovery battery.

As a starting point and an arbitrary method in describing this device, the flow of electrical energy and mechanical forces will be tracked from the energy's inception at the primary battery to its final storage in the recovery battery.

FIG. 1 is a perspective side view of the monopole motor according to an embodiment of the invention. As shown in FIG. 1, electrical energy from primary battery **11** periodically flows through power switch **12** and on to and through power-coil wiring **13***a*. In one embodiment, power switch **12** is merely an On-Off mechanical switch and is not electronic. However, the switch **12** may be a solid-state switching circuit, a magnetic Reed switch, a commutator, an optical switch, a Hall switch, or any other conventional transistorized or mechanical switch. Coil **13** is comprised of three windings: power-coil winding **13***a*, trigger-coil winding **13***b*, and recovery-coil winding **13***c*. However, the number of windings can be more or fewer than three, depending upon the size of the coil **13**, size of the motor and the amount of available energy to be captured, stored and used, as measured in watts. Electrical energy then periodically flows from power-coil winding **13***a* and through transistor **14**. Trigger energy also periodically flows through variable potentiometer **15** and resistor **16**. Clamping diode **17** clamps the reverse base-emitter voltage of transistor switch **14** at a safe reverse-bias level that does not damage the transistor **14**. Energy flows to stator **18***a* and pole piece **18***b*, an extension of stator **18***a*. Pole piece **18***b* is electrically magnetized only when transistor switch **14** is on and maintains the same polarity as the rotor poles **19**—here North pole—when electrically magnetized. The North rotor poles **19***a*, **19***b* and **19***c*, which are attached to rotor **20**, come in momentary apposition with pole piece **18***b* creating a momentary monopole interface. The poles **19***a*,*b*,*c*, which are actually permanent magnets with their North poles facing outward from the rotor **20**, maintain the same polarity when in momentary apposition with pole piece **18***b*. Rotor **20** is attached to rotor shaft **21**, which has drive pulley **22**. Attached to rotor shaft **21** are rotor-shaft bearing blocks **31***a* and **31***b*, as seen in FIG. **2**. As rotor **20** begins to rotate, the poles **19***a*,*b*,*c* respectively comes in apposition with magnetized pole piece **18***b* in a momentary monopole interface with energy flowing through diode bridge rectifier **23** and capacitor **24**. The number of capacitors may be of a wide range, depending upon the amount of energy to be temporarily stored before being expelled or flash charged into recovery battery **29**. Timing belt **25** connects drive pulley **22** on timing shaft **21** to timing wheel **26**. Attached to timing wheel **26** is contact rotor **27**, a copper insulated switch that upon rotation, comes in contact with brushes on mechanical switch **28**. The means for counting the number of rotor revolutions may be a timing gear or a timing belt. Finally, the available energy derived from the back EMF that is stored in capacitor **24** is then discharged and stored in recovery battery **29**.

FIG. **2** is a mechanical perspective top view of the monopole motor of the instant invention without electrical circuitry. Stator **18***a* consists of coil **13**, which is comprised of three separate coil windings: power-coil winding **13***a*, trigger-coil winding **13***b* and recovery-coil winding **13***c*. Pole piece **18***b* is at the end of stator **18***a*. As rotor **20**, which is attached to rotor shaft **21**, rotates, each pole **19** respectively comes in a momentary monopole interface with pole piece **18***b*. The polarity of pole piece **18***b* is constant when electrically magnetized. Rotor shaft **21** has rotor shaft bearing blocks **31***a*,*b* attached to it for stabilization of rotor shaft **21**. Attached to rotor shaft **21** is drive pulley **22** with timing belt **25** engaged onto it. Another means for timing may be a timing gear. Timing belt **25** engages timing wheel **26** at its other end. Timing wheel **26** is attached to timing shaft **30**. Shaft **30** is stabilized with timing shaft bearing blocks **32***a*,*b*. At one end of timing shaft **30** is contact rotor **27** with brush **28***a*, which, upon rotation of timing shaft **26**, comes into momentary contact with brushes **28***b*,*c*.

FIG. 3 is a block diagram detailing the circuitry of the monopole motor. Block 40 represents primary battery 11 with energy flowing to coil block 41, which represents coil windings 13*a,b,c*. From coil block 41 energy flows into three directions: to trigger-circuit block 42, transistor-circuit block 43, and rectifier-circuit block 44. Energy flows from rectifier-block 44 to storage-capacitor block 45 with energy flowing from block 45 to both recovery-battery block 46 and rotor-switch block 47.

Referring to FIG. 1, the operation of the motor is described according to an embodiment of the invention. For purpose of explanation, assume that the rotor 20 is initially not moving, and one of the poles 19 is in the three o'clock position.

First, one closes the switch 12. But because the transistor 14 is off, no current flows through the winding 13*a*.

Next, one starts the motor by rotating the rotor 20, for example in a clockwise rotation. One may rotate the rotor by hand, or with a conventional motor-starting device or circuit (not shown).

As the rotor 20 rotates, the pole 19 rotates from the three o'clock position toward the pole piece 18*b* and generates a magnetic flux in the windings 13*a*–13*c*. More specifically, the stator 18*a* and the pole piece 18*b* include a ferromagnetic material such as iron. Therefore, as the pole 19 rotates nearer to the pole piece 18*b*, it magnetizes the pole piece 18*b* to a polarity—here South—that is opposite to the polarity of the pole 19—here North. This magnetization of the pole piece 18*b* generates a magnetic flux in the windings 13*a*–13*c*. Furthermore, this magnetization also causes a magnetic attraction between the pole 19 and the pole piece 18*b*. This attraction pulls the pole 19 toward the pole piece 18*b*, and thus reinforces the rotation of the rotor 20.

The magnetic flux in the windings 13*a*–13*c* generates respective voltages across the windings. More specifically, as the pole 19 rotates toward the pole piece 18*b*, the magnetization of the stator 18*a* and the pole piece 18*b*, and thus the flux in the windings 13*a*–13*c*, increase. This increasing flux generates respective voltages across the windings 13*a*–13*c* such that the dotted (top) end of each winding is more positive than the opposite end. These voltages are proportional to the rate at which the flux is increasing, and thus are proportional to the velocity of the pole 19.

At some point, the voltage across the winding 13*b* becomes high enough to turn on the transistor 14*c*. This turn-on, i.e., trigger, voltage depends on the combined serial resistance of the potentiometer 15 and the resistor 16. The higher this combined resistance, the higher the trigger voltage, and vice-versa. Therefore, one can set the level of the trigger voltage by adjusting the potentiometer 15.

In addition, depending on the level of voltage across the capacitor 24, the voltage across the winding 13*c* may be high enough to cause an energy recovery current to flow through the winding 13*c*, the rectifier 23, and the capacitor 24. Thus, when the recovery current flows, the winding 13*c* is converting magnetic energy from the rotating pole 19 into electrical energy, which is stored in the capacitor 24.

Once turned on, the transistor 14 generates an opposing magnetic flux in the windings 13*a*–13*c*. More specifically, the transistor 14 draws a current from the battery 11, through the switch 12 and the winding 13*b*. This current increases and generates an increasing magnetic flux that opposes the flux generated by the rotating pole 19.

When the opposing magnetic flux exceeds the flux generated by the rotating pole 19, the opposing flux reinforces the rotation of the rotor 20. Specifically, when the opposing flux—which is generated by the increasing current through the winding 13*a*—exceeds the flux generated by the pole 19, the magnetization of the pole piece 18 inverts to North pole. Therefore, the reverse-magnetic pole piece 18 repels the pole 19, and thus imparts a rotating force to the rotor 20. The pole piece 18 rotates the rotor 20 with maximum efficiency if the pole-piece magnetization inverts to North when the center of the pole 19 is aligned with the center of the pole piece. One typically adjusts the potentiometer 15 to set the trigger voltage of the transistor 14 at a level that attains or approximates this maximum efficiency.

The transistor 14 then turns off before the opposing flux can work against the rotation of the rotor 20. Specifically, if the pole piece 18 remains magnetized to North pole, it will repel the next pole 19 in a direction—counterclockwise in this example—opposite to the rotational direction of the rotor 20. Therefore, the motor turns the transistor 14, and thus demagnetizes the pole piece 18, before this undesirable repulsion occurs. More specifically, when the opposing flux exceeds the flux generated by the pole 19, the voltage across the winding 13*b* reverses polarity such that the dotted end is less positive than the opposite end. The voltage across the winding 13*b* decreases as the opposing flux increases. At some point, the voltage at the base of the transistor decreases to a level that turns off the transistor 14. This turn-off point depends on the combined resistance of the potentiometer 15 and resistor 16 and the capacitance (not shown) at the transistor base. Therefore, one can adjust the potentiometer 15 or use other conventional techniques to adjust the timing of this turn-off point.

The rectifier 23 and capacitor 24 recapture the energy that is released by the magnetic field—and that would otherwise be lost—when the transistor 14 turns off. Specifically, turning off the transistor 14 abruptly cuts off the current that flows through the winding 13*a*. This generates voltage spikes across the windings 13*a*–13*c* where the dotted ends are less positive than the respective opposite ends. These voltage spikes represent the energy released as the current-induced magnetization of the stator 18*a* and the pole piece 18*b* collapses, and may have a magnitude of several hundred volts. But as the voltage spike across the winding 13*c* increases above the sum of the two diode drops of the rectifier 23, it causes an energy-recovery current to flow through the rectifier 23 and the voltage across the capacitor 24 charge the capacitor 24. Thus, a significant portion of the energy released upon collapse of the current-induced magnetic field is recaptured and stored as a voltage in the capacitor 24. In addition, the diode 17 prevents damage to the transistor 14 by clamping the reverse base-emitter voltage caused by the voltage spike across the winding 13*b*.

The recaptured energy can be used in a number of ways. For example, the energy can be used to charge a battery 29. In one embodiment, the timing wheel 26 makes two revolutions for each revolution of the rotor 20. The contact rotor 27 closes a switch 28, and thus dumps the charge on the capacitor 24 into the battery 29, once each revolution of the wheel 26. Other energy-recapture devices and techniques can be used as well.

One can stop the rotor 20 by braking it or by opening the switch 12.

Other embodiments of the monopole motor are contemplated. For example, instead of remaining closed for the entire operation of the motor, the switch 12 may be a conventional optical switch or a Hall switch that opens and closes automatically at the appropriate times. To increase the power of the motor, one can increase the number of stators **18***a* and pole pieces **18***b*, the number of poles **19**, or both. Furthermore, one can magnetize the stator **18***a* and pole piece **18***b* during the attraction of the pole **19** instead of or in addition to magnetizing the stator and pole piece during the repulsion of the pole **19**. Moreover, the stator **18***a* may be omitted such that the coil **13** has an air coil, or the stator **18***a* and the pole piece **18***b* may compose a permanent magnet. In addition, although the transistor **14** is described as being a bipolar transistor, it may be a MOS transistor. Furthermore, the recaptured energy may be used to recharge the battery **11**. In addition, although described as rotating in a clockwise direction, the rotor **20** can rotate in a counter-clockwise direction. Moreover, although described as attracting a rotor pole **19** when no current flows through winding **13***a* and repelling the pole **19** when a current flows through winding **13***a*, the pole piece **18***b* may be constructed so that it attracts the pole **19** when a current flows through winding **13***a* and repels the pole **19** when no current flows through winding **13***a*.

In multiple stator/rotor systems, each individual stator may be energized one at a time or all of the stators may be energized simultaneously. Any number of stators and rotors may be incorporated into the design of such multiple stator/rotor monopole motor combinations. However, while there may be several stators per rotor, there can only be one rotor for a single stator. The number of stators and rotors that would comprise a particular motor is dependent upon the amount of power required in the form of watts. Any number of magnets, used in a monopole fashion, may comprise a single rotor. The number of magnets incorporated into a particular rotor is dependent upon the size of the rotor and power required of the motor. The desired size and horse power of the motor determines whether the stators will be in parallel or fired sequentially. Energy is made accessible through the capturing of available energy from the back EMF as a result of the unique circuitry and timing of the monopole motor. Individual motors may be connected in sequence with each motor having various combinations of stators and rotors or in parallel. Each rotor may have any number of rotor magnets, all arranged without change of polarity. The number of stators for an individual motor may also be of a wide range.

One feature that distinguishes this motor from all others in the art is the use of monopole magnets in momentary apposition with the pole piece of the stator maintaining the same polarity when magnetized. In this particular embodiment, there are three magnets and one pole piece, said pole piece an extension of a permanent-magnet stator. Finally, although the invention has been described with reference of particular means, materials and embodiments, it is to be understood that the invention is not limited to the particulars disclosed and extends to all equivalents within the scope of the claims.

What is claimed is:

1. A back EMF monopole motor utilizing a rotor wherein the magnets of said rotor maintain a polarity when in apposition with a stator pole piece having the polarity, said motor to capture available back EMF energy for charging and storage in a recovery device, the motor comprising:

a. a means for producing initial energy;

b. a means for capturing energy in the form of back EMF, said back EMF energy available as the result of a collapsing field in a coil, said coil comprised of multiple windings with said pole piece at one end of said stator of said coil, said pole piece having said polarity when magnetized and in apposition to said magnets of said rotor;

c. a means for rectifying said back EMF energy, said means comprising a voltage bridge for transferring said energy to a capacitor for storage;

d. a means for discharging said stored voltage across a recovery battery; and

e. a means for counting the revolutions on said rotor.

2. The back EMF monopole motor of claim **1**, wherein the means for producing the initial energy comprises a battery.

3. The back EMF monopole motor of claim **1**, wherein said means for counting the revolutions on said rotor comprises a timing gear.

4. The back EMF monopole motor of claim **1**, wherein said means for counting the revolutions on said rotor comprises a timing belt.

5. The back EMF monopole motor of claim **1**, wherein said means for discharging collected energy comprises a rotating switching commutator, said commutator switch discharging said energy into a recovery battery, said commutator switch having the same polarity as said recovery battery.

6. A back EMF monopole motor utilizing a rotor wherein the magnets of said rotor maintain a polarity when in apposition with a magnetized stator pole piece having the polarity, said motor to capture available back EMF energy for charging and storage in a recovery device, the motor comprising:

a. a means for producing initial energy, said means a primary input battery and a means for switching the battery, said means for switching either a solid-state switching circuitry, a magnetic Reed switch, a commutator, an optical switch, or a Hall switch;

b. a means for capturing energy in the form of back EMF, said back EMF energy available as the result of a collapsing field in a coil, said coil comprised of multiple windings, and said pole piece at one end of said stator of said coil, said pole piece maintaining said polarity when magnetized and in apposition to said magnets of said rotor;

c. a means for rectifying said back EMF energy, said means comprising a voltage bridge for transferring said energy to a capacitor for storage;

d. a means for discharging said stored voltage across a recovery battery, said means a rotating contact rotor switch;

e. a means for counting the revolutions on said rotor, said means a timing gear or timing belt;

f. a means for switching said rotating contact rotor switch, said means comprising a rotating switching commutator.

7. A back EMF monopole motor utilizing a rotor wherein the magnets of said rotor maintain a polarity when in apposition with a stator pole piece magnetized to have the polarity, said motor to capture available back EMF energy for charging and storage in a recovery device such as a battery, the motor comprising:

a. an initial energy input produced by a device such as a battery;

b. said back EMF energy captured and available as the result of a collapsing field in a coil, said coil comprised of multiple windings with said pole piece having the polarity when magnetized and in apposition to said magnets of said rotor;

c. said back EMF energy transferred by said rotor containing said magnets, which maintain the polarity and in momentary apposition with said magnetized stator pole piece having said polarity;

d. said back EMF energy rectified using a voltage bridge transferring said energy to a capacitor for storage;

e. said voltage discharged across a recovery device such as a battery for storage by means of a rotating contact rotor switch;

f. a timing belt or timing gear used to count the revolutions on said rotor; and

g. a rotating switching commutator to control said rotating contact rotor switch.

8. A method of producing a back EMF monopole motor utilizing a rotor wherein magnets of said rotor retain a polarity when in apposition with a pole piece of a stator, said motor to capture available back EMF energy for charging and storage in a recovery battery, comprising the steps of:

a. producing initial energy;

b. switching a voltage to drive a motor;

c. capturing said energy in the form of back EMF, said back EMF energy available as the result of a collapsing field in a coil, said coil comprised of multiple windings and said pole piece at one end of said stator of said coil, said pole piece maintaining the polarity when magnetized and in apposition to said magnets of said rotor;

d. recovering said back EMF energy in a storage device.

9. The method of claim 8, wherein the back EMF energy is rectified by using a bridge transferring said energy to a capacitor for storage.

10. The method of claim 8, wherein voltage is discharged across a recovery battery using a rotating contact rotor switch, said switch having the same polarity as said recovery battery.

* * * * *

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Bedini

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(45) Date of Patent: **Jan. 13, 2004**

(54) **DEVICE AND METHOD FOR PULSE CHARGING A BATTERY AND FOR DRIVING OTHER DEVICES WITH A PULSE**

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(52) **U.S. Cl.** **320/139**
(58) **Field of Search** 320/103, 124, 320/125, 129, 130, 139, 166

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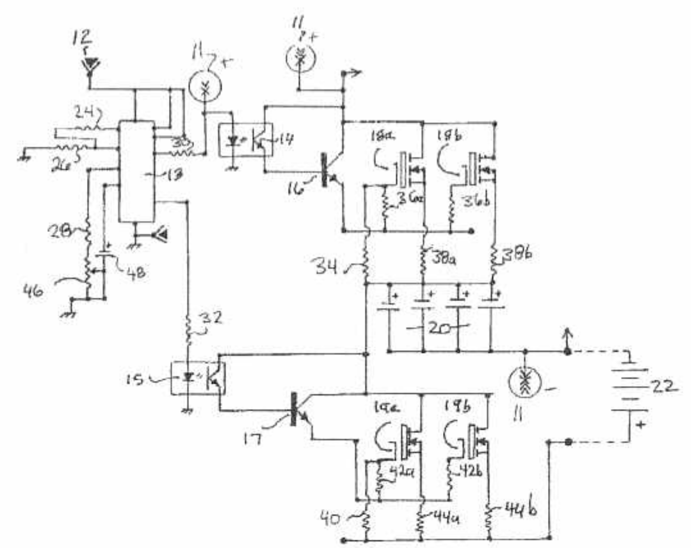
(57) **ABSTRACT**

A two-phase solid-state battery charger can receive input energy from a variety of sources including AC current, a battery, a DC generator, a DC-to-DC inverter, solar cells or any other compatible source of input energy. Phase I is the charge phase and phase II the discharge phase wherein a signal or current passes through a dual timing switch that controls independently two channels dividing the two phases. The dual timing switch is controlled by a logic chip or pulse width modulator. A potential charge is allowed to build up in a capacitor bank, the capacitor bank is then disconnected from the energy input source and then pulse charged at high voltage into the battery to receive the charge. The momentary disconnection of the capacitor from the input energy source allows for a free-floating potential charge in the capacitor. Once the capacitor has completed discharging the potential charge into the battery, the capacitor disconnects from the battery and re-connects to the energy source thus completing the two-phase cycle.

25 Claims, 6 Drawing Sheets



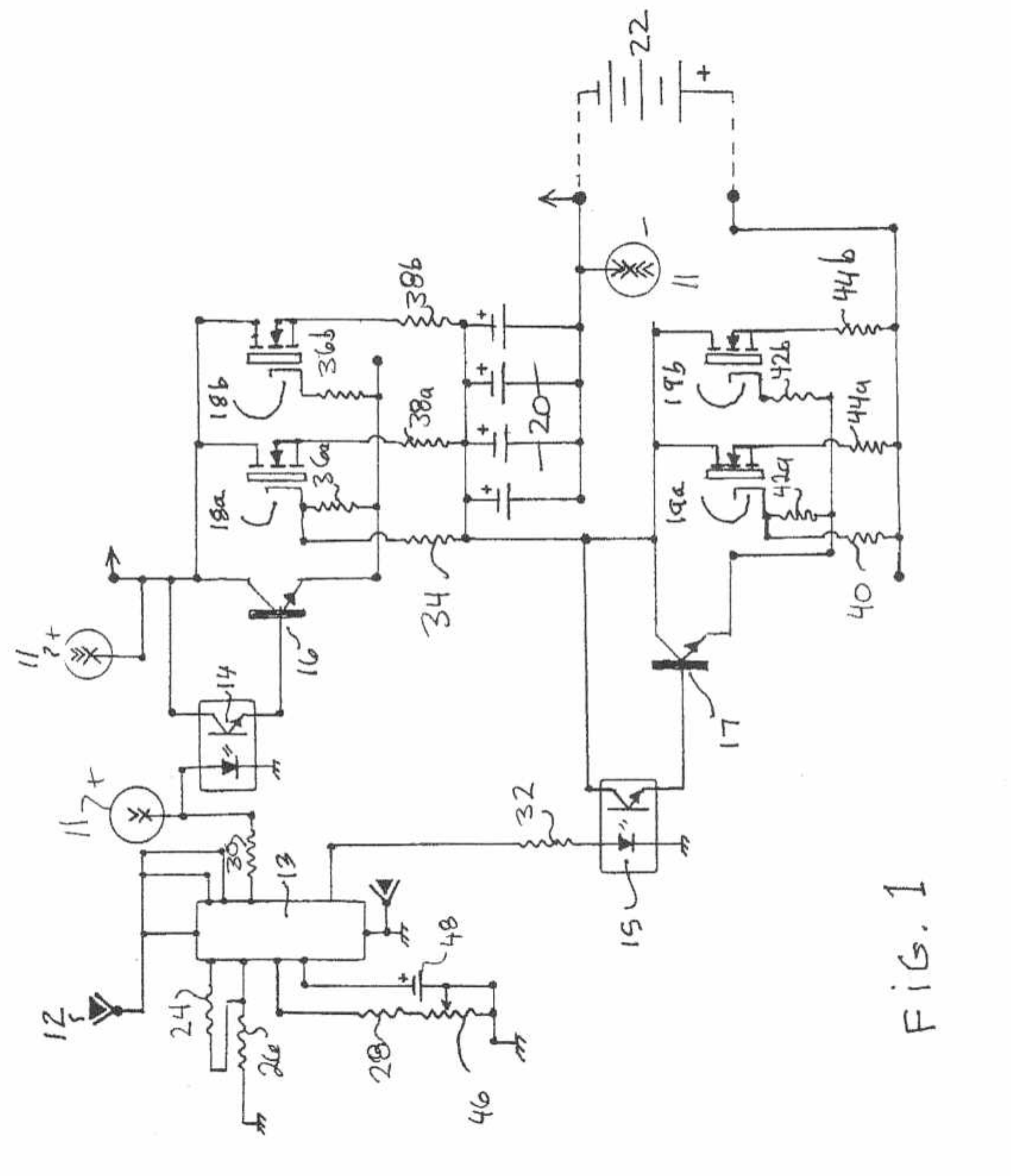


FIG. 1

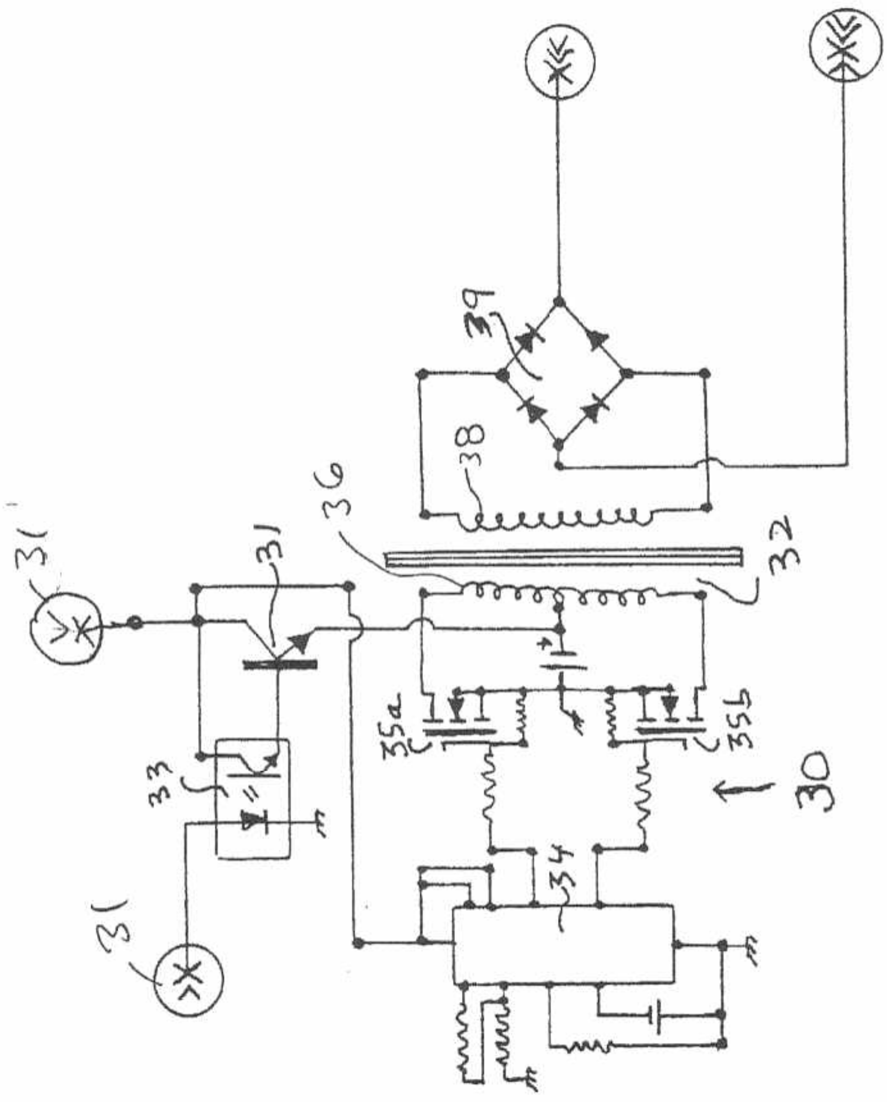


FIG. 2

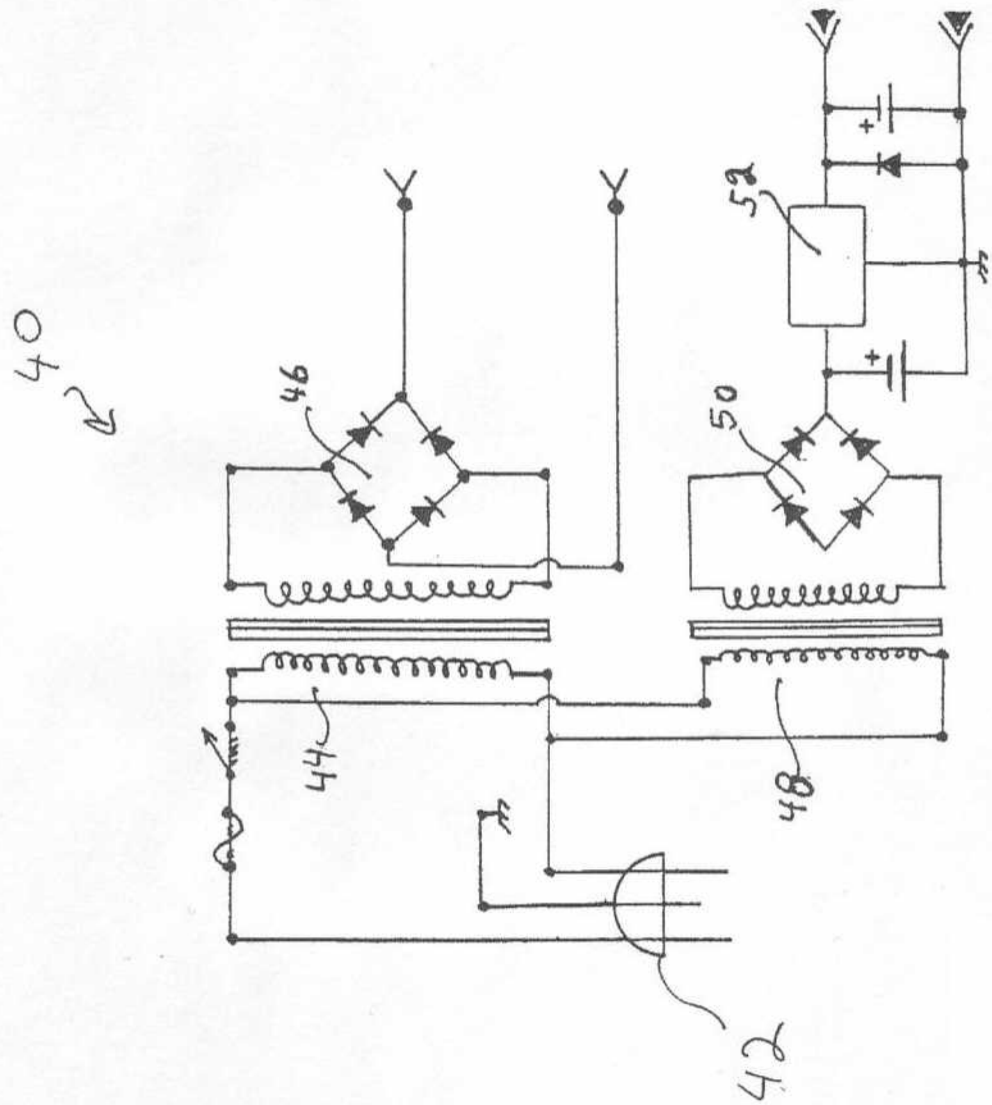


FIG. 3

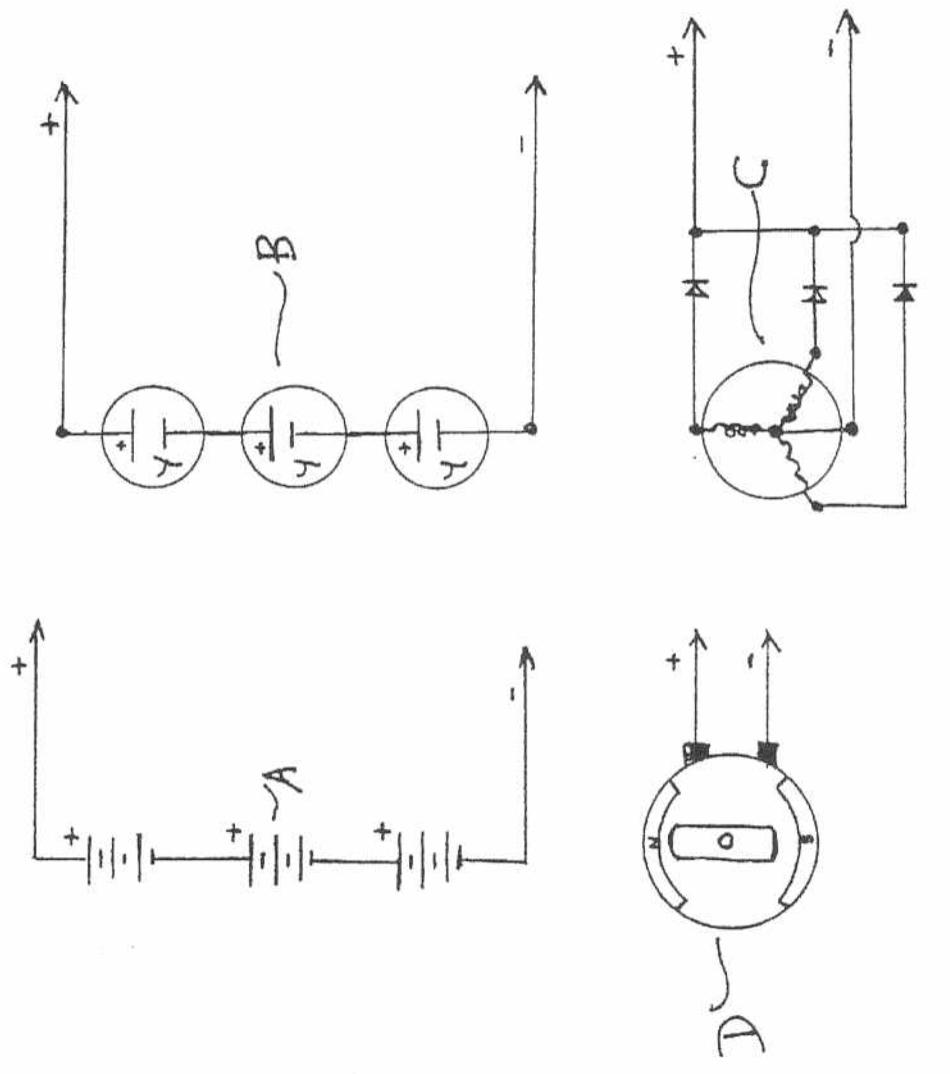


FIG. 4A-D

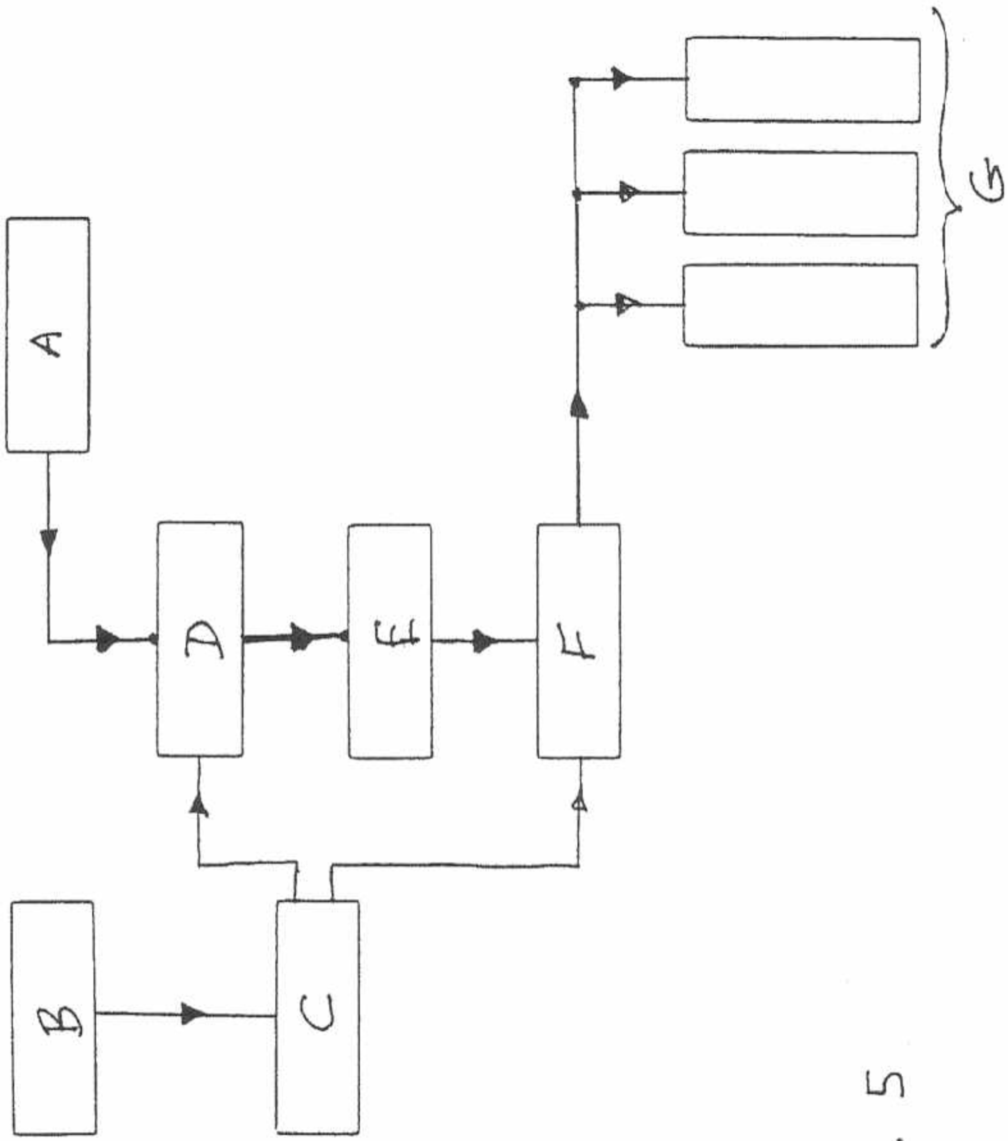


FIG. 5

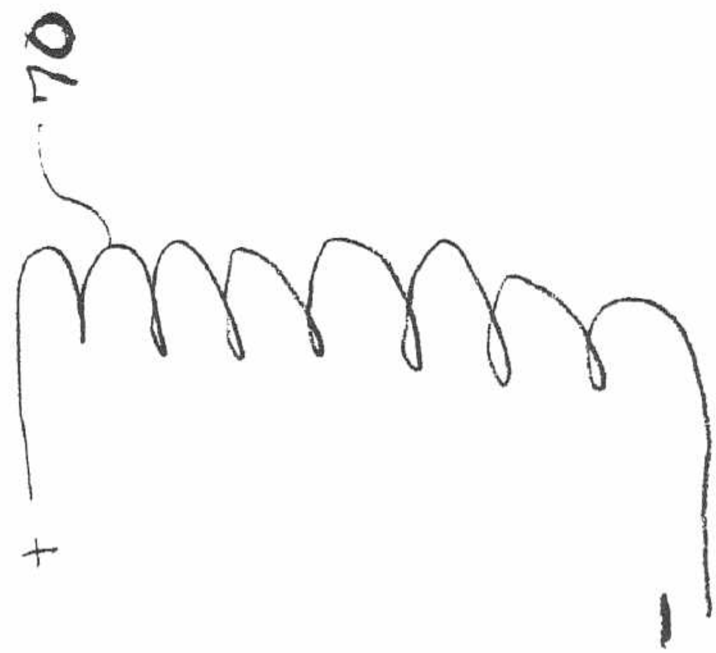


FIG. 7

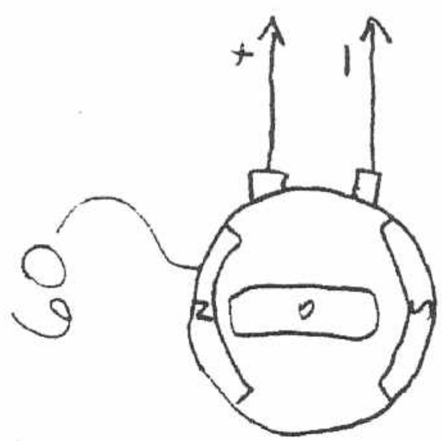


FIG. 6

DEVICE AND METHOD FOR PULSE CHARGING A BATTERY AND FOR DRIVING OTHER DEVICES WITH A PULSE

TECHNICAL FIELD

The invention relates generally to a battery pulse charger using a solid-state device and method wherein the current going to the battery is not constant. The signal or current is momentarily switch-interrupted as it flows through either the first channel, the charge phase, or the second channel, the discharge phase. This two-phase cycle alternates the signal in the two channels thereby allowing a potential charge in a capacitor to disconnect from its power source an instant before the capacitor discharges its stored potential energy into a battery for receiving the capacitor's stored energy. The capacitor then disconnects from the battery and re-connects to the power source upon completion of the discharge phase, thereby completing charge-discharge cycle. The battery pulse charger can also drive devices, such as a motor and a heating element, with pulses.

BACKGROUND AND PRIOR ART

Present day battery chargers use a constant charge current in their operation with no momentary disconnection of the signal or current as it flows either: 1) from a primary energy source to the charger; or 2) from the charger itself into a battery for receiving the charge. Some chargers are regulated to a constant current by any of several methods, while others are constant and are not regulated. There are no battery chargers currently in the art or available wherein there is a momentary signal or current disconnection between the primary energy source and the charger capacitors an instant before the capacitors discharge the stored potential energy into a battery receiving the pulse charge. Nor are there any chargers in the art that disconnect the charger from the battery receiving the charge when the charger capacitors receive energy from the primary source. The momentary current interruption allows the battery a short "rest period" and requires less energy from the primary energy source while putting more energy into the battery receiving the charge while requiring a shorter period of time.

SUMMARY OF THE INVENTION

One aspect of the invention relates to a solid-state device and method for creating a pulse current to pulse charge a battery or a bank of batteries in which a new and unique method is used to increase and preserve for a longer period of time the energy stored in the battery as compared to constant-current battery chargers. The device uses a timed pulse to create a waveform in a DC pulse to be discharged into the battery receiving the charge.

One embodiment of the Invention uses a means for dual switching such as a pulse width modulator (PWM), for example, a logic chip SG3524N PWM, and a means for optical coupling to a bank of high-energy capacitors to store a timed initial pulse charge. This is the charge phase, or phase I. The charged capacitor bank then discharges the stored high energy into the battery receiving the charge in timed pulses. Just prior to discharging the stored energy into the battery, the capacitor bank is momentarily disconnected from the power source, thus completing the charge phase, and thereby leaving the capacitor bank as a free-floating potential charge disconnected from the primary energy source to then be discharged into the battery. The transfer of energy from the capacitor bank to the battery completes the discharge phase, or phase II. The two-phase cycle now repeats itself.

This embodiment of the battery pulse charger works by transferring energy from a source, such as an AC source, to an unfiltered DC source of high voltage to be stored in a capacitor or a capacitor bank. A switching regulator is set to a timed pulse, for example, a one second pulse that is 180 degrees out of phase for each set of switching functions. The first function is to build the charge in the capacitor bank from the primary energy source; the second function is to disconnect the power source from the capacitor bank; the third function is to discharge the stored high voltage to the battery with a high voltage spike in a timed pulse, for example, a one second pulse; and the fourth function is to re-connect the capacitor bank to the primary energy source. The device operates through a two-channel on/off switching mechanism or a gauging/re-gauging function wherein the charger is disconnected from its primary energy source an instant before the pulse charger discharges the high-energy pulse into the battery to be charged. As the primary charging switch closes, the secondary discharging switch opens, and visa-versa in timed pulses to complete the two phase cycle.

The means for a power supply is varied with several options available as the primary energy source. For example, primary input energy may come from an AC source connected into the proper voltage (transformer); from an AC generator; from a primary input battery; from solar cells; from a DC-to-DC inverter; or from any other adaptable source of energy. If a transformer means is the source of primary input energy, it can be a standard rectifying transformer used in power supply applications or any other transformer means applicable to the desired function. For example, it can be a 120-volt to 45-volt AC step-down transformer, and the rectifier can be a full-wave bridge of 200 volts at 20 amps, which is unfiltered when connected to the output of the transformer. The positive output terminal of the bridge rectifier is connected to the drains of the parallel field-effect transistors, and the negative terminal is connected to the capacitor bank negative.

The Field Effect Transistor (FET) switches can be IRF260 FETs, or any other FET means to accomplish this function. All are in parallel to achieve the proper current of the pulses. Each FET may be connected through a 7-watt, 0.05-ohm resistor with a common bus connection at the source. All the FET gates may be connected through a 240-ohm resistor to a common bus. There also may be a 2 K-ohm resistor between the gates and the drain bus.

A transistor means, for example an MJE15024 transistor, as a driver for the gates, drives the bus and in turn, an optical coupler drives the driver transistor through the first channel. A first charging switch is used to charge the capacitor bank, which acts as a DC potential source to the battery. The capacitor bank is then disconnected from the power rectifier circuit. The pulse battery charger is then transferred to a second field effect switch through the second channel for the discharge phase. The discharge phase is driven by a transistor, the transistor driven by an optical coupler. With a second or discharge switch on, the capacitor bank potential charge is discharged into the battery to receive the charge. The battery receiving the charge is then disconnected from the pulse charger capacitor bank to repeat the cycle. The pulse charger may have any suitable source of input power including: 1) solar panels to raise the voltage to the capacitor bank; 2) a wind generator; 3) a DC-to-DC inverter; 4) an alternator; 5) an AC motor generator; 6) a static source such as a high voltage spark; and 7) other devices that can raise the potential of the capacitor bank.

In another embodiment of the invention, one can use the pulse charger to drive a device such as a motor or heating element with pulses of energy.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic drawing of a solid-state pulse charger according to an embodiment of the invention.

FIG. 2 is a schematic drawing of a conventional DC-to-DC converter that can be used to provide power to the pulse charger of FIG. 1 according to an embodiment of the invention.

FIG. 3 is a schematic drawing of a conventional AC power supply that can be used to provide power to the pulse charger of FIG. 1 according to an embodiment of the invention.

FIGS. 4A–D are schematic drawings of other conventional power supplies that can be used to provide power to the pulse charger of FIG. 1 according to an embodiment of the invention.

FIG. 5 is a block diagram of the solid-state pulse charger of FIG. 1 according to an embodiment of the invention.

FIG. 6 is a diagram of a DC motor that the pulse charger of FIG. 1 can drive according to an embodiment of the invention.

FIG. 7 is a diagram of a heating element that the pulse charger of FIG. 1 can drive according to an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

An embodiment of the present invention is a device and method for a solid-state pulse charger that uses a stored potential charge in a capacitor bank. The solid-state pulse charger comprises a combination of elements and circuitry to capture and store available energy into a capacitor bank. The stored energy in the capacitors is then pulse charged into the battery to be charged. In one version of this embodiment, there is a first momentary disconnection between the charger and the battery receiving the charge during the charge phase of the cycle, and a second momentary disconnection between the charger and the input energy source during the discharge phase of the cycle.

As a starting point and an arbitrary method in describing this device and method, the flow of an electrical signal or current will be tracked from the primary input energy to final storage in the battery receiving the pulse charge.

FIG. 1 is a schematic drawing of the solid-state pulse charger according to an embodiment of the invention. As shown in FIG. 1, the primary input energy source to the pulse charger is a power supply **11**, examples of which are shown in FIGS. **2**, **3**, **4A–4D**. A 12-volt battery, as a low voltage energy source **12**, drives a dual switching means of control such as a logic chip or a pulse width modulator (PWM) **13**. Alternatively, the voltage from the power supply **11** may be converted to a voltage suitable to power the PWM **13**. The PWM **13** may be an SG3524N logic chip, and functions as an oscillator or timer to drive a 2-channel output with "on/off" switches that are connected when on to either a first optical isolator **14**, or in the alternative, to a second optical isolator **15**. The first and second optical isolators **14** and **15** may be H11D3 optical isolators. When the logic chip **13** is connected to a first channel, it is disconnected from a second channel, thus resulting in two phases of signal direction; phase I, a charge phase, and phase II, a discharge phase. When the logic chip **13** is switched to the charge phase, the signal flows to the first optical isolator **14**. From the optical isolator **14**, the signal continues its flow through a first NPN power transistor **16** that activates an N-channel MOSFET **18***a* and an N-channel MOSFET **18***b*. Current flowing through the MOSFETs **18***a* and **18***b* builds up a voltage across a capacitor bank **20**, thereby completing the charge phase of the switching activity. The discharge phase begins when the logic chip **13** is switched to the second channel, with current flowing to the second optical isolator **15** and then through a second NPN power transistor **17**, which activates an N-channel MOSFET **19***a* and an N-channel MOSFET **19***b*. After the logic chip **13** closes the first channel and opens the second channel, the potential charge in the capacitor bank **20** is free floating between the power supply **11**, from which the capacitor bank **20** is now disconnected, and then connected to a battery **22** to receive the charge. It is at this point in time that the potential charge in the capacitor bank **20** is discharged through a high-energy pulse into the battery **22** or, a bank (not shown) of batteries. The discharge phase is completed once the battery **22** receives the charge. The logic chip **13** then switches the second channel closed and opens the first channel thus completing the charge-discharge cycle. The cycle is repetitive with the logic chip **13** controlling the signal direction into either channel one to the capacitor bank, or to channel two to the battery **22** from the capacitor bank. The battery **22** is given a momentary rest period without a continuous current during the charge phase.

The component values for the described embodiment are as follows. The resistors **24**, **26**, . . . **44***b* have the following respective values: 4.7KΩ, 4.7KΩ, 47KΩ, 330Ω, 330Ω, 2KΩ, 47Ω, 47Ω, 0.05Ω(7 W), 0.05Ω(7W), 2KΩ, 47Ω, 47Ω, 0.05Ω(7 W), and 0.05Ω(7W). The potentiometer **46** is 10KΩ, the capacitor **48** is 22 μF, and the total capacitance of the capacitor bank **20** is 0.132F. The voltage of the battery **22** is between 12–24 V, and the voltage of the power supply **11** is 24–50 V such that the supply voltage is approximately 12–15 V higher than the battery voltage.

Other embodiments of the pulse charger are contemplated. For example, the bipolar transistors **16** and **17** may be replaced with field-effect transistors, and the transistors **18***a*, **18***b*, **19***a*, and **19***b* may be replaced with bipolar or insulated-gate bipolar (IGBT) transistors. Furthermore, one can change the component values to change the cycle time, the peak pulse voltage, the amount of charge that the capacitor bank **20** delivers to the battery **22**, etc. In addition, the pulse charger can have one or more than two transistors **18***a* and **18***b*, and one or more than two transistors **19***a* and **19***b*.

Still referring to FIG. **1**, the operation of the above-discussed embodiment of the pulse charger is discussed.

To begin the first phase of the cycle during which the capacitor bank **20** is charged, the logic circuit **13** deactivates the isolator **15** and activates the isolator **14**. Typically, the circuit **13** is configured to deactivate the isolator **15** before or at the same time that it activates the isolator **14**, although the circuit **13** may be configured to deactivate the isolator **15** after it activates the isolator **14**.

Next, the activated isolator **14** generates a base current that activates the transistor **16**, which in turn generates a current that activates the transistors **18***a* and **18***b*.

The activated transistors **18***a* and **18***b* charge the capacitors in the bank **20** to a charge voltage equal or approximately equal to the voltage of the power supply **11** less the lowest threshold voltage of the transistors **18***a* and **18***b*. To begin the second phase of the cycle during which the capacitor bank **20** pulse charges the battery **22**, the logic circuit **13** deactivates the isolator **14** and activates the isolator **15**. Typically, the circuit **13** is configured to deactivate the isolator **14** before or at the same time that it activates the isolator **15**, although the circuit **13** may be configured to deactivate the isolator **14** after it activates the isolator **15**.

Next, the activated isolator **15** generates a base current that activates the transistor **17**, which in turn generates a current that activates the transistors **19***a* and **19***b*.

The activated transistors **19***a* and **19***b* discharge the capacitors in the bank **20** into the battery **22** until the voltage across the bank **20** is or is approximately equal to the voltage across the battery **22** plus the lowest threshold voltage of the transistors **19***a* and **19***b*. Alternatively, the circuit **13** can deactivate the isolator **15** at a time before the bank **20** reaches this level of discharge. Because the resistances of the transistors **19***a* and **19***b*, the resistors **44***a* and **44***b*, and the battery **22** are relatively low, the capacitors in the bank **20** discharge rather rapidly, thus delivering a pulse of current to charge the battery **22**. For example, where the pulse charger includes components having the values listed above, the bank **20** delivers a pulse of current having a duration of or approximately of 100 ms and a peak of or approximately of 250 A.

FIG. **2** is a schematic drawing of a conventional DC-to-DC converter **30** that can be used as the power supply **11** of FIG. **1** according to an embodiment of the invention. A DC-to-DC converter converts a low DC voltage to a higher DC voltage or vice-versa. Therefore, such a converter can convert a low voltage into a higher voltage that the pulse charger of FIG. **1** can use to charge the capacitor bank **20** (FIG. **1**). More specifically, the converter **30** receives energy from a source **31** such as a 12-volt battery. An optical isolator sensor **33** controls an NPN power transistor **31**, which provides a current to a primary coil **36** of a power transformer **32**. A logic chip or pulse width modulator (PWM) **34** alternately switches on and off an IRF260 first N-channel MOSFET **35***a* and an IRF260 second N-channel MOFSET **35***b* such that when the MOSFET **35***a* is on the MOSFET **35***b* is off and vice-versa. Consequently, the switching MOSFETS **35***a* and **35***b* drive respective sections of the primary coil **36** to generate an output voltage across a secondary coil **38**. A full-wave bridge rectifier **39** rectifies the voltage across the secondary coil **38**, and this rectified voltage is provided to the pulse charger of FIG. **1**. Furthermore, the secondary coil **38** can be tapped to provide a lower voltage for the PWM **13** of FIG. **1** such that the DC-to-DC converter **30** can be used as both the power supply **11** and the low-voltage supply **12** of FIG. **1**.

FIG. **3** is a schematic drawing of an AC power supply **40** that can be used as both the power supply **11** and the power supply **12** of FIG. **1** according to an embodiment of the invention. The power input **42** to the supply **40** is 120 VAC. A first transformer **44** and full-wave rectifier **46** compose the supply **11**, and a second transformer **48**, full-wave rectifier **50**, and voltage regulator **52** compose the supply **12**.

FIGS. **4A–D** are schematic drawings of various conventional primary energy input sources that can be used as the supply **11** and/or the supply **12** of FIG. **1** according to an embodiment of the invention. FIG. **4A** is a schematic drawing of serially coupled batteries; FIG. **4B** is a schematic drawing of serially coupled solar cells; FIG. **4C** is a schematic drawing of an AC generator; and FIG. **4D** is a schematic drawing of a DC generator.

FIG. **5** is a block diagram of the solid-state pulse charger of FIG. **1** according to an embodiment of the invention. Block A is the power supply **11**, which can be any suitable power supply such as those shown in FIGS. **2**, **3**, **4A–4D**. Block B is the power supply **12**, which can be any suitable power supply such as a 12 VDC supply or the supply shown in FIG. **3**. Block C is the PWM **13** and its peripheral components. Block D is the charge switch that includes the first optical isolator chip **14**, the first NPN power transistor **16**, the first set of two N-channel MOSFETs **18***a* and **18***b*, and their peripheral resistors. Block E is the capacitor bank **20**. Block F is the discharge switch that includes the second optical isolator chip **15**, the second NPN power transistor **17**, the second set of two N-channel MOSFETs **19***a* and **19***b*, and their peripheral resistors. Block G is the battery **22** that is being pulse charged.

A unique feature that distinguishes one embodiment of the above-described pulse charger from conventional chargers is the method charging the battery with pulses of current instead of with a continuous current. Consequently, the battery is given a reset period between pulses.

FIG. **6** is a diagram of a DC motor **60** that the pulse charger of FIG. **1** can drive according to an embodiment of the invention. Specifically, one can connect the motor **60** in place of the battery **22** (FIG. **1**) such that the pulse charger drives the motor with pulses of current. Although one need not modify the pulse charger to drive the motor **60**, one can modify the pulse charger to make it more efficient for driving the motor. For example, one can modify the values of the resistors peripheral to the PWM **13** (FIG. **1**) to vary the width and peak of the drive pulses from the capacitor bank **20** (FIG. **1**).

FIG. **7** is a diagram of a heating element **70**, such as a dryer- or water-heating element, that the pulse charger of FIG. **1** can drive according to an embodiment of the invention. Specifically, one can connect the heating element **70** in place of the battery **22** (FIG. **1**) such that the pulse charger drives the element with pulses of current. Although one need not modify the pulse charger to drive the element **70**, one can modify the pulse charger to make it more efficient for driving the element. For example, one can modify the values of the resistors peripheral to the PWM **13** (FIG. **1**) to vary the width and peak of the drive pulses from the capacitor bank **20** (FIG. **1**).

In the embodiments discussed above, specific electronic elements and components are used. However, it is known that a variety of available transistors, resistors, capacitors, transformers, timing components, optical isolators, pulse width modulators, MOSFETs, and other electronic components may be used in a variety of combinations to achieve an equivalent result. Finally, although the invention has been described with reference of particular means, materials and embodiments, it is to be understood that the invention is not limited to the particulars disclosed and extends to all equivalents within the scope of the claims.

What is claimed is:

1. A solid-state pulse battery charger wherein input power from a primary source is stored as a potential charge in a capacitor bank, said capacitor bank then disconnected from said input power source through a dual timing means, said capacitor then connected to a battery to receive the potential charge, the charge then discharged into said battery from said capacitor, said battery then disconnected from said capacitor through said dual timing means, said capacitor then re-connected to said input power source completing a two phase switching cycle comprising:

a. a means for providing input power;

b. a means for timing a signal and a current flow in two phases, a charge phase and a discharge phase, through either a first channel output for charging said capacitor bank, or a second channel output for discharging stored energy from said capacitor into said battery, the current flowing from said first channel output through a first optical isolator and through a first NPN power transistor, said first transistor activating a first pair of N-channel MOSFETs with voltage stored as the potential charge in said capacitor bank, said capacitor disconnecting from said input power means by said timing means;

c. said means for timing current flow connecting to said second channel output, current flowing from said second channel through a second optical isolator and through a second NPN power transistor, said second transistor activating a second pair of N-channel MOSFETs, said capacitor connecting to said battery, the potential charge discharging into said battery, said timing means disconnecting said capacitor from said battery, and connecting said capacitor to said power means.

2. The pulse charger of claim 1 wherein the means for providing input power is an AC voltage current.

3. The pulse charger of claim 1 wherein the means for providing input power is a battery.

4. The pulse charger of claim 1 wherein the means for providing input power is a DC generator.

5. The pulse charger of claim 1 wherein the means for providing input power is an AC generator.

6. The pulse charger of claim 1 wherein the means for providing input power is a solar cell.

7. The pulse charger of claim 1 wherein the means for providing input power is a DC-to-DC inverter.

8. A method of making a solid-state pulse battery charger wherein input power from a primary source is stored as a potential charge in a capacitor bank, said capacitor disconnected from said input power source through a dual timing means, said capacitor connected to a battery to receive the potential charge, said charge discharged into said battery from said capacitor, said battery disconnected from said capacitor through said dual timing means, said capacitor reconnected to said input power source completing a two phase cycle comprising the steps of:

a. providing a source of input power;

b. connecting a means for dual-timing said charger to control a signal or current flow through a first channel output comprising a first optical isolator, a first NPN power transistor and a first pair of N-channel MOSFETs;

c. capturing energy from said current and storing said energy in said capacitor bank thereby charging said capacitor;

d. switching the flow of said current using said timing device to a second channel comprising a second optical isolator, a second NPN power transistor and a second pair of N-channel MOSFETs, thus disconnecting said capacitor from said power source and connecting said capacitor to said battery;

e. discharging the potential charge into said battery;

f. switching the flow of the current using said timing device to said power source and said first channel to complete said cycle.

9. The pulse charger of claim 8 wherein the means for providing input power is an AC voltage current.

10. The pulse charger of claim 8 wherein the means for providing input power is a battery.

11. The pulse charger of claim 8 wherein the means for providing input power is a DC generator.

12. The pulse charger of claim 8 wherein the means for providing input power is an AC generator.

13. The pulse charger of claim 8 wherein the means for providing input power is a solar cell.

14. The pulse charger of claim 8 wherein the means for providing input power is a DC-to-DC inverter.

15. A battery charger, comprising:

a supply node;

a charge node;

a charge-storage device; and

a switch circuit coupled to the supply and the charge nodes and the charge-storage device, the switch circuit operable to,

charge the charge-storage device and prohibit a battery-charge current from flowing into the charge node during a battery-rest period; and

allow the battery-charge current to flow from the charge-storage device into the charge node during a battery-charge period, and

prohibit the battery-charge current from flowing into the charge node during a battery-rest period.

16. The battery charger of claim 15, further comprising:

a capacitor coupled to the switch circuit; and

wherein the switch circuit is operable to,

allow the battery-charge current to from the capacitor into the charge node during the battery-charge period, and

charge the capacitor during the battery-rest period.

17. A method, comprising:

charging a battery during a first period of a charge cycle; and

accumulating charge in a charge-storage device and prohibiting the charging of the battery during a second period of the charge cycle.

18. The method of claim 17 wherein:

charging the battery comprises charging the battery with a charge current during the first period of the charge cycle; and

prohibiting the charging of the battery comprises prohibiting the charge current from flowing into the battery during the second period of the charge cycle.

19. The method of claim 17, wherein:

charging the battery comprises discharging the charge-storage device into the battery during the first period of the charge cycle; and

prohibiting the charging of the battery comprises uncoupling the charge-storage device from the battery during the second period of the charge cycle.

20. The method of claim 17 wherein the charge-storage device comprises a capacitor.

21. The method of claim 17 wherein the length of the second period is related to a level of charge accumulated in the charge-storage device.

22. A method, comprising:

discharging a charge-storage device into a battery during a first period of a battery-charge cycle; and

uncoupling the charge-storage device from the battery and charging the charge-storage device during a second period of the battery-charge cycle.

23. The method of claim 22 wherein uncoupling the charge-storage device comprises uncoupling the charge-storage device from the battery before commencing charging of the charge-storage device.

24. The method of claim 22 wherein uncoupling the charge-storage uncoupling the charge-storage device from the battery after commencing charging of the charge-storage device.

25. The method of claim 22 wherein uncoupling the charge-storage device comprises simultaneously uncoupling the charge-storage device from the battery and commencing charging of the charge-storage device.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,677,730 B2
DATED : January 13, 2004
INVENTOR(S) : John C. Bedini

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 10,
Line 2, before "uncoupling", please insert -- device comprises --.

Signed and Sealed this

Sixth Day of July, 2004

JON W. DUDAS
Acting Director of the United States Patent and Trademark Office

US007990110B2

(12) United States Patent
Bedini

(10) **Patent No.:** **US 7,990,110 B2**
(45) **Date of Patent:** **Aug. 2, 2011**

(54) **CIRCUITS AND RELATED METHODS FOR CHARGING A BATTERY**

(76) Inventor: **John C. Bedini**, Coeur d'Alene, ID (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 400 days.

(21) Appl. No.: **11/592,633**

(22) Filed: **Nov. 3, 2006**

(65) **Prior Publication Data**

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(51) **Int. Cl.**

H02J 7/00	(2006.01)
H02J 7/04	(2006.01)
H02J 7/06	(2006.01)

(52) **U.S. Cl.** **320/139**; 320/137; 320/163; 320/128

(58) **Field of Classification Search** 320/139, 320/140, 141, 145, 165, 128; 363/15, 21.06, 363/18

See application file for complete search history.

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Assistant Examiner — Ahmed Omar
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(57) **ABSTRACT**

An aspect of the present invention provides a circuit for generating a voltage that can be used to recharge a battery. The circuit includes an inductive voltage generator operable to generate a magnetic field when the voltage generator is energized by power, and operable to generate a voltage from the magnetic field's collapse when the voltage generator is de-energized, and a switch operable to allow the voltage generator to receive power to energize the voltage generator, and operable to disconnect the power from the voltage generator to de-energize the generator. With this circuit, a power source that generates less voltage than the fully charged capacity of a rechargeable battery can be used to recharge the battery. Also, the circuit can convert power in different forms, such as constant direct current, varying direct current, or alternating current, into a second voltage for charging a battery. Furthermore, the circuit can supply whatever charging voltage is most suitable for the specific battery that is being charged. Current is delivered to the battery in the form of high energy impulses which can improve the proper removal or deposit of material from/on an electrode of the battery. Consequently the life of the battery being charged by the circuitry employed by the present invention is significantly extended, and, in many cases, a battery that is unable to be charged by traditional means, can be restored to a useable condition.

48 Claims, 3 Drawing Sheets

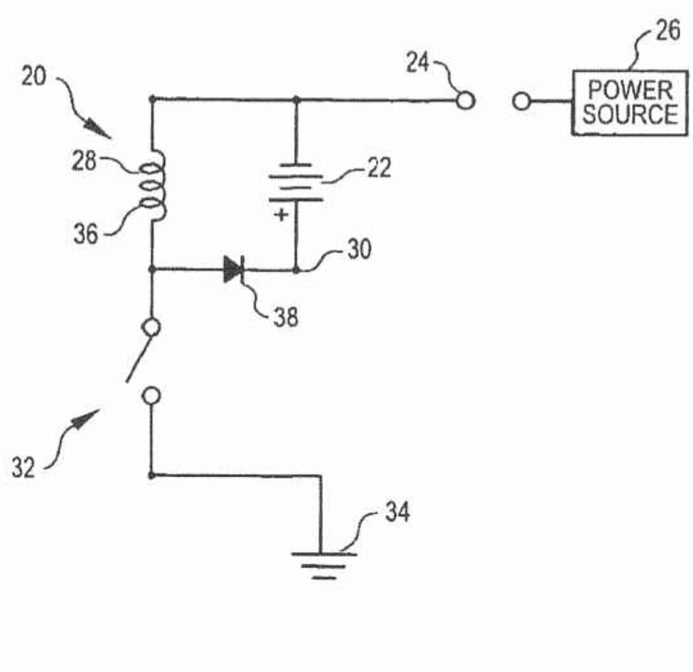


FIG. 1

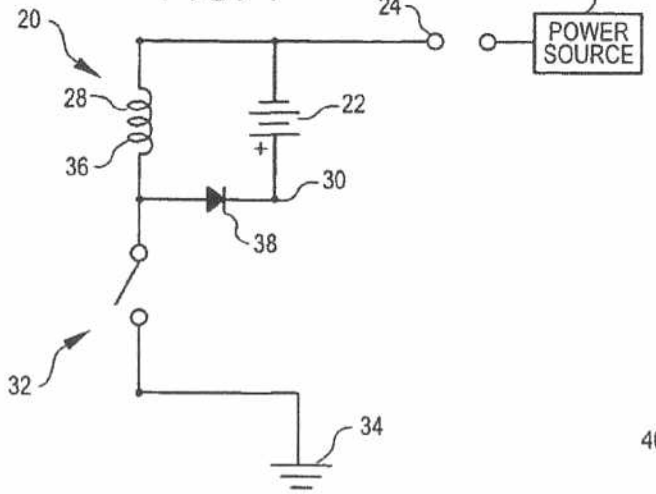


FIG. 2

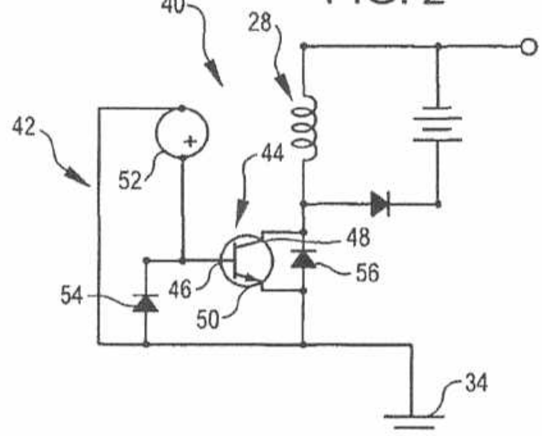


FIG. 3

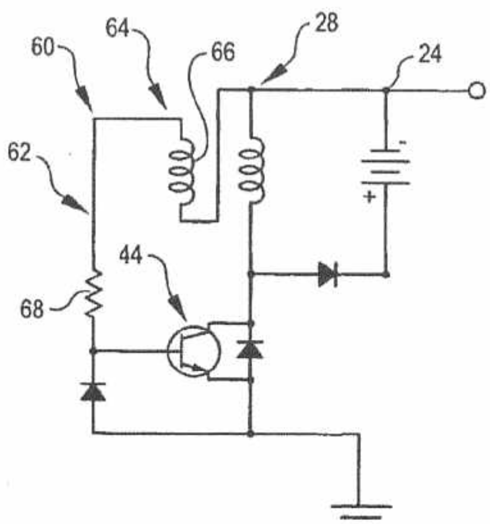


FIG. 4

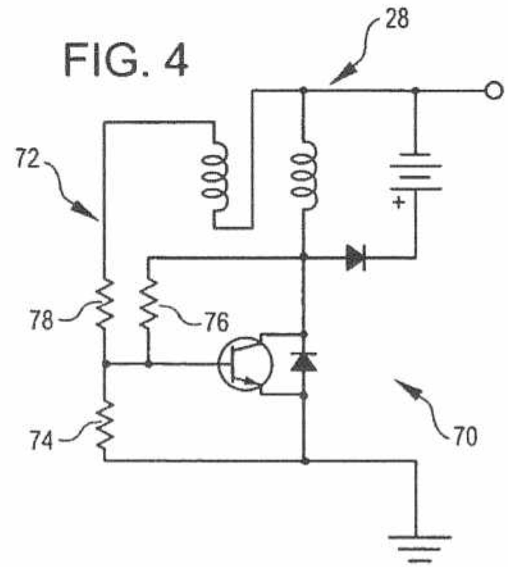


FIG. 5

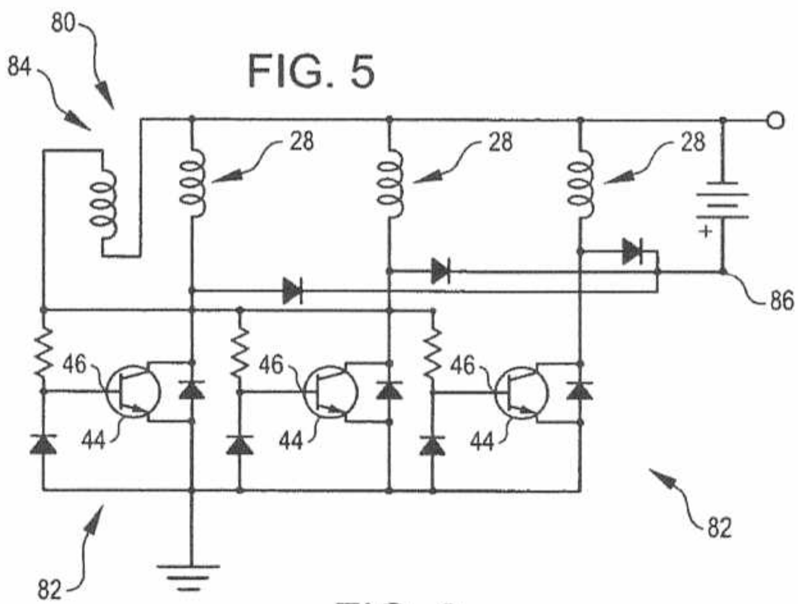


FIG. 6

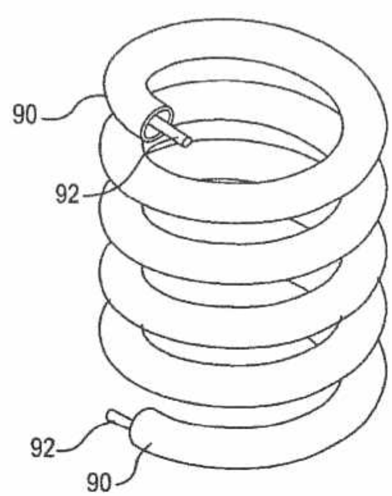


FIG. 7

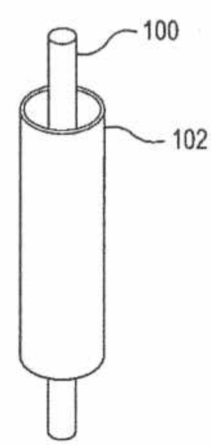


FIG. 8

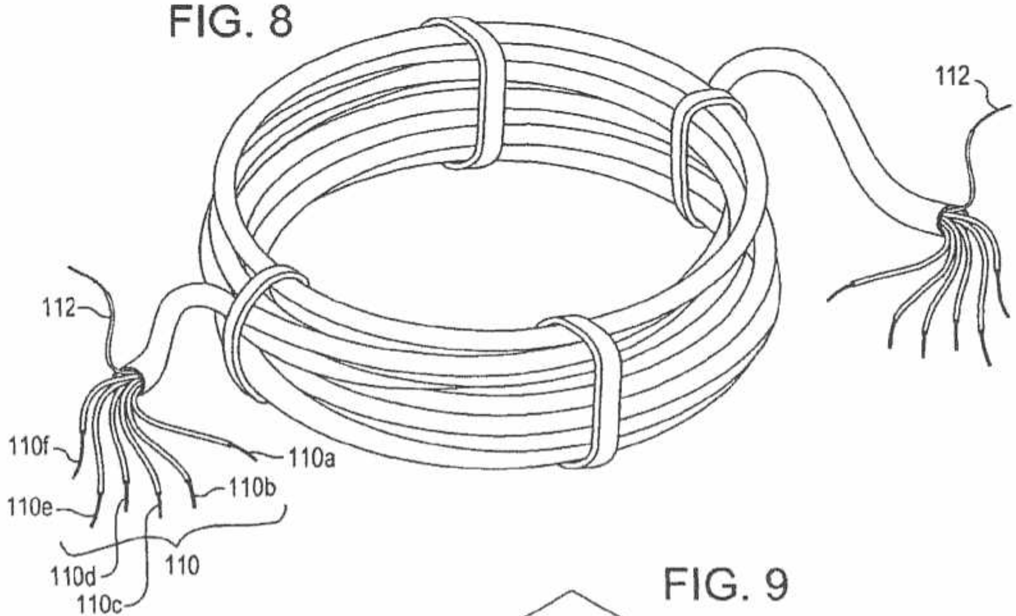


FIG. 9

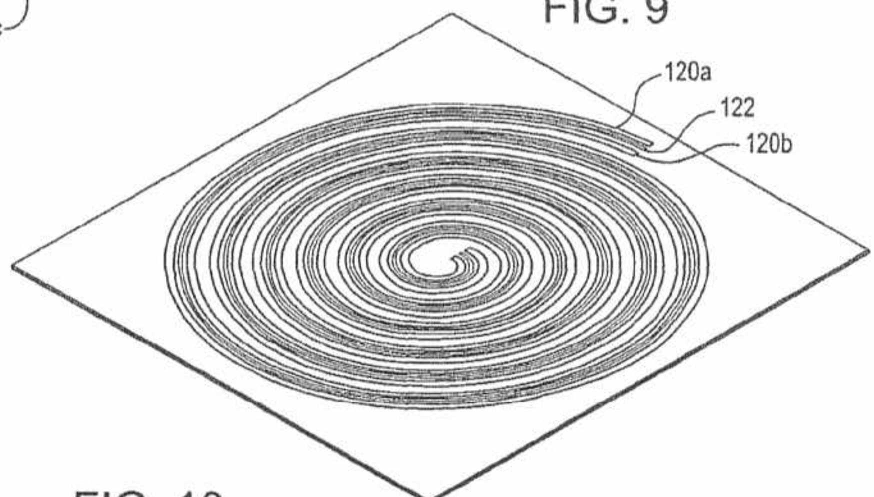


FIG. 10

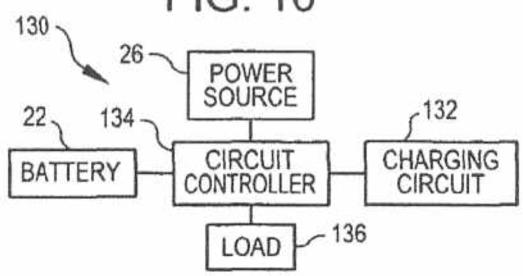
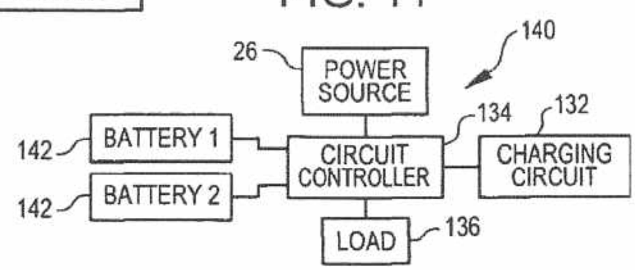


FIG. 11



CIRCUITS AND RELATED METHODS FOR CHARGING A BATTERY

BACKGROUND

Many types of batteries, such as lead-acid, nickel-cadmium, and lithium-ion, can be recharged to replenish their charge and thus be used again to power a device such as an MP3 player, an electric motor for a golf cart, or a starter motor for an internal combustion engine. An advantage to using a rechargeable battery to power a device is that one does not have to purchase many single-use batteries to power the device.

The process for recharging a battery involves applying a current to the battery that is opposite in polarity to the discharge current generated by the battery. The applied current reverses the battery's chemical process that occurs in the discharge cycle, and causes material to be deposited on and/or removed from one or more of the battery's electrodes. Some recharge processes provide the depleted battery a constant current at a voltage that is slightly higher than the standing voltage of the battery when it is fully charged. A problem with this process is that the current does not decrease as the battery nears its full charge capacity. Thus, the battery receives more current than the chemical process can consume when the battery nears it charge capacity. The excess current can damage the battery by:

1) Converting a portion of its electrolyte into gas which is vented from the battery,
2) Improperly removing material from or depositing material to an electrode of the battery, or
3) Excessively heating the battery.

Another recharge process provides the depleted battery a current at a constant voltage that is slightly higher than the fully recharged capacity of the battery. Thus, as the depleted battery is recharged, the voltage difference between the charging source and the battery decreases, causing the current delivered to the battery to decrease. One problem with this process is that it takes significantly longer for the depleted battery to reach its full charge capacity at the end of the recharge cycle. Another problem is that the battery can suffer the same damaging effects of the constant current recharge process during the beginning of a constant voltage recharge cycle because there is an excessive current caused by an initially high difference in voltage between the charging source and the battery at the beginning of the recharge cycle.

A problem common to both the constant current and constant voltage charging methods is the inability of the battery to completely reverse all of the battery chemistry to the original condition it had before it was discharged. In other words, with each discharge/recharge cycle there exists a portion of the battery's chemistry that is not converted back to the charged condition. This results in successive degradation of the battery with each discharge/recharge cycle until the battery's capacity is lowered beyond a state of practical use and must be replaced.

SUMMARY

An aspect of the present invention provides a circuit for generating a voltage that can be used to recharge a battery. The circuit includes a supply node operable to receive electrical power having a first voltage, a voltage generator operable to generate a magnetic field when the voltage generator is energized by electrical power, and operable to generate a second voltage from the magnetic field's collapse when the voltage generator is de-energized, an output node operable to

provide access to the second voltage, and a switch operable to allow the voltage generator to receive power to energize the voltage generator and operable to disconnect the power from the voltage generator to de-energize the voltage generator.

With this circuit, a power source that generates less voltage than the fully charged capacity of a rechargeable battery can be used to recharge the battery. As is well known in the art, charging systems employing a solar or wind powered voltage source can only use the power delivered by these sources when the source voltage level is above the voltage level of the battery to be charged. When powered by sources such as solar or wind powered voltage sources under less than optimum conditions, the circuit is able to use power not normally available to charge a battery, i.e. power whose voltage is below that of the battery to be charged. For example, the circuit can operate from a power source providing 0.7 volts to fully recharge a 12 volt battery. Also, the circuit can convert power in different forms, such as constant direct current, direct current that varies over time, or alternating current, into a second voltage for charging a battery. Furthermore, current is delivered to the battery in the form of high energy impulses which can improve the proper removal or deposit of material from/on an electrode of the battery. Consequently the life of the battery being charged by the circuit can be significantly extended, and, in many cases, a battery that is unable to be charged by traditional means can be restored to a useable condition.

BRIEF DESCRIPTION OF THE FIGURES

FIG. **1** is a schematic view of a circuit according to an embodiment of the invention.

FIG. **2** is a schematic view of a circuit according to another embodiment of the invention.

FIG. **3** is a schematic view of a circuit according to yet another embodiment of the invention.

FIG. **4** is a schematic view of a circuit according to yet another embodiment of the invention.

FIG. **5** is a schematic view of a circuit that includes a plurality of circuits similar to the one shown in FIG. **3**, according to another embodiment of the invention.

FIG. **6** is a perspective view of one embodiment of the voltage generator of the circuit shown in FIG. **3** and the circuit shown in FIG. **4**, according to an embodiment of the invention.

FIG. **7** is a perspective view of one embodiment of the voltage generator of the circuit shown in FIG. **3** and the circuit shown in FIG. **4**, according to another embodiment of the invention.

FIG. **8** is a perspective view of one embodiment of the voltage generator of the circuit shown in FIG. **3** and the circuit shown in FIG. **4**, according to yet another embodiment of the invention.

FIG. **9** is a perspective view of one embodiment of the voltage generator of the circuit shown in FIG. **3** and the circuit shown in FIG. **4**, according to yet another embodiment of the invention.

FIG. **10** is a schematic view of a system that includes a charging circuit according to an embodiment of the invention.

FIG. **11** is a schematic view of a system that includes a charging circuit according to another embodiment of the invention.

DETAILED DESCRIPTION

FIG. **1** is a schematic view of a circuit **20** according to an embodiment of the invention. The circuit **20** can be used to recharge a battery 22, and can also be used to repair and/or rejuvenate a battery by improving the proper removal or deposit of material from/on an electrode of the battery. The circuit 20 includes a supply node 24 that can be coupled to a source 26 of power having a voltage. The circuit 20 also includes a voltage generator 28 that generates a magnetic field when the power from the source 26 energizes the generator 28, and that generates a voltage from the magnetic field's collapse when the generator 28 is de-energized. The circuit 20 also includes an output node 30 that provides access to the voltage generated by the voltage generator 28, and a switch 32 to allow one to control the flow of power from the source 26 to the generator 28 to energize or de-energize the generator 28.

In operation, the circuit 20 generates a voltage spike—a high voltage condition lasting for a short period of time—from the collapse of a magnetic field that is generated by the voltage generator 28. Because the magnetic field collapses quickly, the voltage spike forms quickly, and the voltage in the spike is high. When the magnetic field is generated and then collapses, repeatedly, the circuit 20 generates a series of voltage spikes. Each voltage spike is directed to the output node 30 where it is available for use by the battery 22 or some other device. When the circuit 20 generates a series of voltage spikes, the voltage available at the output node 30 pulsates. Thus, the circuit 20 can apply sharp, high-voltage spikes to recharge the battery 22.

The voltage generator 28 generates the magnetic field from current flowing through the generator 28. When the voltage generator 28 is coupled to the power source 26 and the switch 32 is closed, the voltage of the source's power causes current to flow through the generator 28 and toward ground 34, thus energizing the generator 28. To collapse the magnetic field generated by the generator 28, one opens the switch 32 to stop the flow of current through the generator 28, thus de-energizing the generator 28.

Because the voltage spikes are brief moments of high voltage, the spikes can be used to provide a battery 22 pulses of substantial current to recharge the battery 22 without generating excessive heat in the batteries anode and cathode plates. Current delivered to the battery in the form of these high energy impulses can improve the proper removal or deposit of material from/on an electrode of the battery. In addition, because the voltage of the voltage spikes is typically greater than the voltage of the power source 26, the circuit 20 can be used to recharge a battery 22 having a remaining voltage or a fully charged voltage that is greater than the voltage of the power provided by the source 26.

Still referring to FIG. 1 the power source 26 can be any desired power source capable of providing enough power to energize the voltage generator 28. For example, in this and certain other embodiments the power source 26 provides a substantially constant 10 volts. Thus, when switch 32 is closed, direct current flows through the voltage generator 28. In other embodiments, the power source 26 can provide a voltage and current that varies over time. An example of such a power source includes a solar cell array that generates a voltage and current during the night or cloudy days that is less than the voltage and current it generates on a sunny day. Another example of a varying voltage source includes a windmill whose available power varies with wind speed. The advantage of the present invention when using such solar or wind powered voltage sources is that the circuit is able to charge a battery whose voltage is significantly higher than the voltage delivered by the power source. In still other embodiments, the power source 26 can provide a voltage that follows a saw tooth or sinusoidal pattern over time. If the power source 26 provides AC power, the power should be rectified and filtered before powering the voltage generator 28. Because the pulse of voltage spikes at the output node 30 depends on the opening and closing sequence of the switch 32, the circuit 20 can also modify the form of the power from the power source 26.

Still referring to FIG. 1, the voltage generator 28 includes a component that generates a magnetic field when energized. For example, in some embodiments of the voltage generator, the component is a conductor 36 coiled around an axis (not shown) similar to a conventional inductor, and has an inductance of 200 μH. The strength of the magnetic field generated by the conductor 36 when energized, and thus the voltage generated as the field collapses, depends on the amount of current flowing through the generator 28, the size of each coil in the conductor, and the number of coils in the conductor. The specific size of each coil in the conductor and the specific number of coils in the conductor can be any desired size and number that provides a desired field strength.

Other embodiments of the component of the voltage generator 28 are possible. For example, as discussed in greater detail in conjunction with FIG. 7, the component may be a conductor that is substantially straight; not coiled around an axis. As another example, the component may include a conductor in the vicinity of an iron, ferrite, or other magnetically affected material to alter the inductance of the voltage generator.

Still referring to FIG. 1, the switch 32 can be any switch capable of opening and closing the circuit to allow one to control the flow of current through the generator 28. For example, in this and certain other embodiments, the switch is a conventional mechanically operated switch. When switch 32 is closed, current flows through the voltage generator 28 to energize the generator 28. When switch 32 is opened, power stops flowing through the voltage regulator 28 to de-energize the generator 28.

Other embodiments of the switch 32 are possible. For example, the switch may be electrically operated as discussed in greater detail in conjunction with FIGS. 2-5.

Still referring to FIG. 1, the circuit 20 also includes a component for isolating the voltage generated by the voltage generator 28. For example, in this and certain other embodiments the component includes a diode or other rectifying device 38 that allows current to flow from the generator 28 to the output node 30 but not in the opposite direction. Thus, the voltage generated by the battery 22 can remain isolated from the voltage generator 28 while the generator 28 is energized.

FIG. 2 is a schematic view of a circuit 40 according to another embodiment of the invention. The circuit 40 is similar to the circuit 20 but includes a switch 42 that is electrically operated; not mechanically operated. The switch 42 includes a transistor 44 to control the flow of current through the voltage generator 28, and a trigger 46 to control the operation of the transistor 44.

The transistor 44 includes a base 46, a collector 48, and an emitter 50. When the base 46 receives a voltage that is greater than a threshold voltage, current can flow into the collector 48 through the transistor 44 to the emitter 50, and thus the transistor is closed. When the voltage at the base 46 is less than the threshold voltage, current does not flow into the collector 48 through the transistor 44 and out the emitter 50, and thus the transistor is open.

The transistor 44 can be any desired transistor that allows one to control the flow of current through the voltage generator 28. For example, in this and certain other embodiments, the transistor 44 is an NPN bipolar transistor having a threshold voltage of about 0.7 volts. In other embodiments, the transistor 44 may be a PNP bipolar transistor. In still other embodiments, the transistor 44 may be any desired field-effect transistor such as a MOSFET, JFET, or IGBT that has a source that is functionally equivalent to the emitter 50, a drain that is functionally equivalent to the collector 48, and a gate that is functionally equivalent to the base 46. In still other embodiments, the transistor 44 may be any other desired semiconductor switching device.

The trigger 46 includes a DC pulse generating circuit 52 that provides a voltage to the base 46 of the transistor 44 that is greater than the threshold voltage. Thus, when the DC pulse generator 52 provides a voltage to the base 46, the transistor 44 allows current from the power source 26 to flow through the generator 28, thus energizing the generator 28. When the DC pulse generator 52 does not provide a voltage to the base 46, the transistor 44 prevents current from the power source 26 from flowing through the generator 28, thus de-energizing the generator 28.

Still referring to FIG. 2, the switch 42 also includes diodes 54 and 56 to protect the base 46 and isolate the voltage generated by the generator 28 when the magnetic filed collapses. Diodes 54 and 56 are not necessary to the switch 42, but protect the transistor 44 by routing any negative high voltage transients to ground 34.

FIG. 3 is a schematic view of a circuit 60 according to yet another embodiment of the invention. The circuit 60 is similar to the circuit 40 (FIG. 2) but includes a switch 62 that automatically closes to energize the voltage generator 28 and automatically opens to de-energize the generator 28—i.e. the circuit 60 oscillates by itself when coupled to the power source 26. With a switch 62 that automatically opens and closes, the circuit 60 can self oscillate when powered from a source whose voltage and current vary. An example of such a power source includes a solar cell array that generates a voltage and current during the night or cloudy days that is less than the voltage and current it generates on a sunny day. Another example of a varying voltage source includes a windmill whose available power varies with wind speed. When using solar or wind powered voltage sources, the circuit 60 is able to recharge a battery whose voltage is significantly higher than the voltage delivered by the power source.

The switch 62 includes a transistor 44 (bipolar transistor, MOSFET, JFET, IGBT, or any other desired semiconductor switching device) to control the flow of current through the voltage generator 28, and a trigger 64 to control the operation of the transistor 44. The trigger 64 generates a voltage opposite to the voltage applied to the transistor's base 46 from the power source 26 (FIG. 1), and opens the transistor 44 when the generated voltage reduces the voltage applied to the base 46 below the transistor's threshold voltage. The power source 26 powers the voltage generator 28, the trigger 64, and the transistor 44, and thus the circuit 60 self-oscillates to energize and de-energize the voltage regulator 28.

Still referring to FIG. 3, in this and certain other embodiments of the trigger 64, the trigger 64 includes a component that generates a voltage from the magnetic field generated by the voltage generator 28. For example, in this and certain other embodiments of the trigger 64, the trigger 64 includes a conductor 66 coiled around an axis (not shown) similar to a conventional inductor, and has an inductance of 200 μh. The coiled conductor 66 can have any desired coil size and any desired number of coils to provide any desired inductance and thus any desired voltage induced by the magnetic field generated by the voltage generator 28.

The coiled conductor 66 is oriented relative to the voltage generator 28 such that current flowing from the power source 26 flows through the coiled conductor in a direction opposite than the direction that current flowing from the power source 28 flows through the generator 28. When power from the source is initially applied to the supply node 24, power flows through the coiled conductor 66 and a voltage is applied at the base of the transistor 44. The switch 62 closes, and power begins to flow through the voltage generator 28. The magnetic field generated by the generator 28 induces a voltage in the coiled conductor 66 that opposes the voltage from the power source 26. When the induced voltage is sufficient to reduce the voltage at the base 46 below the threshold voltage, the transistor 44 opens causing the generator 28 to de-energize. This then causes the magnetic field around the generator 28 to collapse, and thus generate a voltage spike. Because the magnetic field collapses quickly, the voltage spike forms quickly, and the voltage in the spike is high. As the generator's magnetic field collapses, it induces a positive voltage in the coiled conductor 66 that increases and combines with the voltage from the power source 26. When the combined voltage is above the transistor's threshold voltage the transistor 44 closes causing the generator 28 to re-energize. In this manner the circuit 60 can use the power from the power source 26 to generate a series of voltage spikes by self-oscillating the voltage applied to the base 46 of transistor 44, and thus the current that flows through the generator 28.

The oscillation of voltage applied to the base 46 can have any desired period. For example, in this and certain other embodiments the period is 15,000 cycles per second. In other embodiments, the period can be 60 cycles per second. Because the collapse of the generator's magnetic field generates the voltage spike, the amount of voltage in the spike depends on the strength of the magnetic field. Before the magnetic field is fully developed, the strength of the magnetic field depends on the length of time that the current flows through the generator 28. An oscillation period that is long, i.e. the number of cycles per second is few, increases the length of time that current flows through the generator 28 when the switch 62 is closed. Thus the generated magnetic field is strong, and the spike's voltage is high. An oscillation period that is short, i.e. the number of cycles per second is many, decreases the length of time that current flows through the generator 28 when the switch 62 is closed. Thus the generated magnetic field is weaker, and the spike's voltage is less.

Still referring to FIG. 3, the switch 60 can include a resistor 68 having any desired resistance. For example, in this and certain other embodiments, the resistor's resistance is 470 Ohms. The resistance of resistor 68 affects the oscillation period of the voltage applied to the base 46 of the transistor 44. A resistor 68 having a high resistance causes current to flow through the generator 28 for a shorter period than a resistor 68 having a lower resistance.

FIG. 4 is a schematic view of a circuit 70 according to yet another embodiment of the invention. The circuit 70 is similar to the circuit 60 (FIG. 3) but includes a switch 72 that has a resistor 74 that replaces the diode 54 (FIG. 2), and resistor 76 to bias the voltage applied to the base 46 of the transistor.

The combination of the resistors 74, 76 and 78, affects the oscillation period of the voltage applied to the base 46 of the transistor 44. Raising the value of resistor 74 causes current to flow through the generator 28 for a shorter period. Raising the value of resistors 76 and/or 78 causes current to flow through the generator 28 for a longer period.

FIG. 5 is a schematic view of a circuit 80 that includes a plurality of circuits 82, each similar to the circuit 60 (FIG. 3), according to another embodiment of the invention. Each circuit 82 includes a voltage generator 28, and a transistor 44. The circuit 80 includes a trigger 84 that is used to oscillate the flow of power through each circuit **82**. The circuits **82** are arranged so that the power that each voltage generator **28** generates from the collapse of their respective magnetic fields is combined with the power from the others to make a significant amount of power available at the output node **86**. The circuit **80** can have any desired number of circuits **82** to provide a desired amount of power at the output node **86**.

FIG. **6** is a perspective view of a voltage generator's coiled conductor **90** and a trigger's coiled conductor **92** of the circuit **60** shown in FIG. **3** and the circuit **70** shown in FIG. **4**, according to an embodiment of the invention. In this embodiment, both coiled conductors **90** and **92** are components of a coaxial cable that has been coiled. In other embodiments, the coiled conductor **90** can be the trigger's coiled conductor, and the coiled conductor **92** can be the voltage generator's coiled conductor.

FIG. **7** is a perspective view of a voltage generator's conductor **100** and a trigger's conductor **102** of the circuit **60** shown in FIG. **3** and the circuit **70** shown in FIG. **4**, according to another embodiment of the invention. In this embodiment, the voltage generator's conductor **100** and trigger's conductor **102** are shown to be coaxial and straight, not coiled. In other embodiments, the conductor **100** can be the trigger's conductor, and the conductor **102** can be the voltage generator's conductor.

Other embodiments are possible. For example either or both conductors **100** and **102** can have any shape desired to fit any desired application requirements. For example the conductors **100** and **102** can spiral in a single plane as shown in FIG. **9** as would be the case if etched on a common circuit board, or they can serpentine.

FIG. **8** is a perspective view of a voltage generator's conductor **110** and a trigger's conductor **112** of the circuit **60** shown in FIG. **3** and the circuit **70** shown in FIG. **4**, according to another embodiment of the invention. The conductor **110** includes six separate wires **110***a*, **110***b*, **110***c*, **110***d*, **110***e*, **110***f* that each generate a portion of the magnetic field generated by the generator **28** (FIG. **5**) when current flows through the conductor **110**, and generate a portion of the voltage generated by the generator from the collapse of their respective portions of the magnetic field. The conductor **112** generates a voltage opposite to the voltage applied to the transistor's base **46** (shown in FIG. **5**, but omitted from FIG. **8** for clarity), and opens the transistor **44** (shown in FIG. **5**, but omitted from FIG. **8** for clarity) when the generated voltage reduces the voltage applied to the base **46** below the transistor's threshold voltage.

FIG. **9** is a perspective view of a voltage generator's conductor **120** and a trigger's conductor **122** of the circuit **60** shown in FIG. **3** and the circuit **70** shown in FIG. **4**, according to another embodiment of the invention. The conductor **120** includes two separate traces **120***a* and **120***b* disposed in/on a circuit board that each generate a portion of the magnetic field generated by the generator **28** (FIG. **5**) when current flows through the conductor **120**, and generate a portion of the voltage generated by the generator from the collapse of their respective portions of the magnetic field. The conductor **122** generates a voltage opposite the voltage applied to the transistor's base **46** (shown in FIG. **5**, but omitted from FIG. **9** for clarity), and opens the transistor **44** (shown in FIG. **5**, but omitted from FIG. **9** for clarity) when the generated voltage reduces the voltage applied to the base **46** below the transistor's threshold voltage.

FIG. **10** is a schematic view of a system **130** that includes a charging circuit **132**, according to an embodiment of the invention. The charging circuit **132** can be the circuit **20** (FIG. **1**), the circuit **40** (FIG. **2**), the circuit **60** (FIG. **3**) and/or the circuit **70** (FIG. **4**). The system **130** also includes a circuit controller **134** that controls the connection of the power source **26** to the supply node **24** (FIG. **1**). The circuit controller **134** can also, if desired, control the connection of the battery **22** to a load **136**, such as an electric motor, (if present).

In this and certain other embodiments, the circuit controller **134** includes a processor or microcontroller (not shown) that executes instructions expressed in software, and one or more circuits (also not shown) to monitor operating conditions of the load **136**, the battery **22**, and/or the charging circuit **132**. In this and certain other embodiments, the controller **134** includes a circuit to confirm the presence of the battery **22** before connecting the charging circuit **132** to charge the battery **22**. The controller **134** may also include other circuits to detect the voltage and/or temperature of the battery **22** to monitor the voltage and/or temperature and stop the charging process when the battery **22** is fully charged.

FIG. **11** is a schematic view of a system **140** that includes a charging circuit **132**, according to another embodiment of the invention. The system **140** is similar to the system **130** except the system **140** includes two batteries **142** and **144**. In this and certain other embodiments, each battery **142** and **144** can deliver the amount of power that the load **136** requires, and thus alternately power the load **136**. A benefit of this arrangement is that while one of the batteries **142** and **144** powers the load **136**, the other battery **144** or **142** can be recharged by the charging circuit **132**. Thus, in this and certain other embodiments, the circuit controller **134** can also include a switch (not shown) that connects one of the batteries **142** or **144** to the charging circuit **132** to recharge the battery while the other battery powers the load **136**. And, when the powering battery is depleted or the charging battery is fully charged, the switch can connect the recharged battery to the load **136** to power the load, and connect the depleted battery to the charging circuit **132** to recharge the battery.

The preceding discussion is presented to enable a person skilled in the art to make and use the invention. The general principles described herein may be applied to embodiments and applications other than those detailed above without departing from the spirit and scope of the present invention. The present invention is not intended to be limited to the embodiments shown, but is to be accorded the widest scope consistent with the principles and features disclosed or suggested herein.

What is claimed is:

1. A circuit for generating a voltage, the circuit comprising:

a supply node coupled to a conductor operable to receive power having a first voltage;

a voltage generator comprising a single conductor operable to generate a magnetic field when the voltage generator is energized by the power, and operable to generate a second voltage substantially larger than the first voltage, the second voltage generated from the magnetic field's collapse when the voltage generator is de-energized, wherein the voltage generator includes the conductor coiled around an iron bar that generates the second voltage from the magnetic field's collapse;

an output node coupled directly to the conductor operable to provide access to the second voltage; and

a switch operable to allow the voltage generator to receive power to energize the voltage generator, and operable to disconnect the power from the voltage generator to de-energize the voltage generator.

2. The circuit of claim **1** wherein the power includes direct current.

3. The circuit of claim **1** wherein the power includes rectified, filtered alternating current.

4. The circuit of claim 1 wherein the first voltage varies.

5. The circuit of claim 1 wherein the switch includes a mechanical switch.

6. The circuit of claim 1 wherein the switch includes a semiconductor switching device.

7. The circuit of claim 1 wherein the switch includes a transistor.

8. The circuit of claim 1 wherein the switch includes a trigger operable to open the switch.

9. The circuit of claim 1 wherein the switch includes:

a field effect transistor having a gate, a drain, and a source, wherein current flows from the drain to the source when a voltage greater than or equal to a threshold voltage is applied to the gate, and current does not flow from the drain to the source when a voltage less than the threshold voltage is applied to the gate; and

a trigger operable to reduce the gate's voltage below the threshold voltage.

10. The circuit of claim 1 wherein the switch includes:

a transistor having a base, a collector, and an emitter, wherein current flows from the collector to the emitter when a voltage greater than or equal to a threshold voltage is applied to the base, and current does not flow from the collector to the emitter when a voltage less than the threshold voltage is applied to the base; and

a trigger operable to reduce the base's voltage below the threshold voltage.

11. The circuit of claim 1 wherein the switch includes a trigger operable to close the switch.

12. The circuit of claim 1 wherein the switch includes:

a transistor having a base, a collector, and an emitter, wherein current flows from the collector to the emitter when a voltage greater than or equal to a threshold voltage is applied to the base, and current does not flow from the collector to the emitter when a voltage less than the threshold voltage is applied to the base; and

a trigger operable to increase the base's voltage above the threshold voltage.

13. The circuit of claim 1 wherein the switch includes:

a field effect transistor having a gate, a drain, and an source, wherein current flows from the drain to the source when a voltage greater than or equal to a threshold voltage is applied to the gate, and current does not flow from the drain to the source when a voltage less than the threshold voltage is applied to the gate; and

a trigger operable to increase the gate's voltage above the threshold voltage.

14. The circuit of claim 1:

wherein the switch closes to energize the voltage generator and opens to de-energize the voltage generator, repeatedly, to generate a pulsating current; and

further comprising a component operable to modify how long the switch remains closed each time it's closed.

15. The circuit of claim 1:

wherein the switch closes to energize the voltage generator and opens to de-energize the voltage generator, repeatedly, to generate a pulsating current; and

further comprising a resistor operable to modify how long the switch remains closed each time it's closed.

16. The circuit of claim 1 further comprising a diode to isolate the second voltage at the output node.

17. The circuit of claim 1 further comprising:

a battery coupled to the output node and operable to be charged by the second voltage;

a diode operable to prevent the battery from generating a voltage across the voltage generator while the power energizes the voltage generator.

18. The circuit of claim 1 wherein the voltage generator oscillates between the energized state and the de-energized state.

19. The circuit of claim 1 wherein the voltage generator automatically oscillates between the energized state and the de-energized state when the supply node is coupled to power.

20. A battery charger comprising:

a power source operable to provide power having a first voltage;

a circuit operable to generate a second voltage, the circuit including:

a supply node coupled to the power source and coupled to a conductor node,

an inductive voltage generator, having an air, iron, or ferrite core, coupled to the conductor node and operable to generate a magnetic field when the voltage generator is energized by the power, and operable to generate the second voltage on the conductor node from the magnetic field's collapse when the voltage generator is de-energized, wherein the second voltage is substantially greater than the first voltage,

an output node coupled directly to the conductor node to provide access to the second voltage, and

a switch operable to energize the voltage generator by allowing the voltage generator to receive the power, and operable to disconnect the power from the voltage generator to de energize the voltage generator.

21. The battery charger of claim 20 wherein the output node is coupled to a battery to be charged.

22. The battery charger of claim 20 wherein:

the output node is coupled to a battery to be charged, the battery having a third voltage, and

the first voltage is less than the third voltage.

23. The battery charger of claim 20 wherein the first voltage varies.

24. The battery charger of claim 20 wherein the power includes rectified, filtered alternating current.

25. The battery charger of claim 20 wherein the second voltage is high and the circuit is operable to provide the output node a large amount of current.

26. The battery charger of claim 20 further comprising a battery having a third voltage and connected to the output node, and wherein the circuit charges the battery while the first voltage is less than the third voltage.

27. The battery charger of claim 20 wherein the second voltage is used to charge at least one of the following types of batteries: a lead acid battery, a nickel cadmium battery, a nickel metal hydride battery, and a lithium-ion battery.

28. A method for charging a battery, the method comprising:

energizing a voltage generator comprising a single conductor of a circuit from a conductor node coupled to a power source to generate a magnetic field in the voltage generator, the magnetic field generated about an air, iron or ferrite core;

operating a switch to allow the voltage generator to receive power to energize the voltage generator, and to disconnect the power from the voltage generator to de-energize voltage generator to collapse the magnetic field in the voltage generator;

generating a voltage from the collapsing field on the conductor node of the voltage generator, wherein the generated voltage is substantially larger than the input voltage; and

isolating the voltage at an output node directly coupled to the conductor node of the circuit.

29. The method of claim 28 wherein energizing the voltage generator includes closing a switch to allow power to flow from a power source through the voltage generator.

30. The method of claim 28 wherein de-energizing the voltage generator includes opening a switch to prevent power from a power source from flowing through the voltage generator.

31. The method of claim 28 wherein energizing the voltage generator includes applying a voltage to a transistor's base to allow power to flow from a power source through the voltage generator.

32. The method of claim 28 wherein energizing the voltage generator includes applying a voltage to a field effect transistor's gate to allow power to flow from a power source through the voltage generator.

33. The method of claim 28 wherein de-energizing the voltage generator includes reducing a voltage applied to a transistor's base to prevent power from a power source from flowing through the voltage generator.

34. The method of claim 33 wherein de-energizing the voltage generator includes generating a trigger voltage to reduce a voltage applied to a transistor's base to prevent power from a power source from flowing through the voltage generator.

35. The method of claim 28 wherein de-energizing the voltage generator includes reducing a voltage applied to a field effect transistor's gate to prevent power from a power source from flowing through the voltage generator.

36. The method of claim 35 wherein de-energizing the voltage generator includes generating a trigger voltage to reduce a voltage applied to a transistor's gate to prevent power from a power source from flowing through the voltage generator.

37. The method of claim 28 further comprising:

re-energizing the voltage generator of the circuit to generate a subsequent magnetic field in the voltage generator; and

de-energizing the voltage generator to collapse the subsequent magnetic field in the voltage generator.

38. The method claim 28 further comprising capturing the voltage with a battery coupled to the output node.

39. A system comprising:

a battery charger that includes:

a power source operable to provide power having a first voltage;

a circuit operable to generate a second voltage, the circuit including:

a supply node coupled to the power source and coupled to a conductor node,

a voltage generator having a single conductor coupled to the conductor node and multiple coiled coaxial conductors operable to generate a magnetic field when the voltage generator is energized by the power, and operable to generate the second voltage on the conductor node from the magnetic field's collapse when the voltage generator is de-energized, wherein the second voltage is substantially greater than the first voltage;

an output node coupled directly to the conductor node to provide access to the second voltage, and

a switch operable to energize the voltage generator by allowing the voltage generator to receive the power, and operable to disconnect the power source from the voltage generator to de-energize the voltage generator;

a battery operable to power a load; and

a circuit controller operable to selectively connect and disconnect the battery charger to the battery.

40. The system of claim 39 wherein the circuit controller includes a processor operable to execute instructions.

41. The system of claim 39 wherein the circuit controller includes a circuit operable to confirm the presence of the battery before connecting the battery charger to the battery.

42. The system of claim 39 wherein the circuit controller monitors the voltage and/or temperature of the battery, and disconnects the battery from the battery charger when the battery is charged.

43. The system of claim 39 further comprising a second battery operable to power a load.

44. The system of claim 39 wherein the second voltage is used to charge at least one of the following batteries: a lead acid battery, a nickel cadmium battery, a nickel metal hydride battery, and a lithium-ion battery.

45. The system of claim 39 wherein the second voltage is used to rejuvenate at least one of the following batteries: a lead acid battery, a nickel cadmium battery, a nickel metal hydride battery, and a lithium-ion battery.

46. The circuit of claim 39 wherein the first voltage is less than the voltage of the battery while the battery charger charges the battery.

47. A circuit for generating a voltage, the circuit comprising:

a supply node operable to receive power having a first voltage;

a voltage generator comprising one conductor operable to generate a magnetic field when the voltage generator is energized by the power, and operable to generate a second voltage substantially larger than the first voltage, the second voltage generated from the magnetic field's collapse when the voltage generator is de-energized, wherein the voltage generator includes a substantially straight conductor that generates the second voltage from the magnetic field's collapse;

an output node directly coupled to the conductor operable to provide access to the second voltage; and

a switch operable to allow the voltage generator to receive power to energize the voltage generator, and operable to disconnect the power from the voltage generator to de-energize the voltage generator.

48. A circuit for generating a voltage, the circuit comprising:

a supply node operable to receive power having a first voltage;

a voltage generator having one conductor operable to generate a magnetic field when the voltage generator is energized by the power, and operable to generate a second voltage substantially larger than the first voltage, the second voltage generated from the magnetic field's collapse when the voltage generator is de-energized, wherein the voltage generator includes multiple, coiled conductors coupled parallel or coaxial to each other;

an output node directly coupled to the conductor operable to provide access to the second voltage; and

a switch operable to allow the voltage generator to receive power to energize the voltage generator, and operable to disconnect the power from the voltage generator to de-energize the voltage generator.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,990,110 B2
APPLICATION NO. : 11/592633
DATED : August 2, 2011
INVENTOR(S) : John C. Bedini et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

- In Claim 20, Column 10, Line 28, "generator to de energize the voltage" should read --generator to de-energize the voltage--

Signed and Sealed this
Fourth Day of October, 2011

David J. Kappos
Director of the United States Patent and Trademark Office

The Attractions of Magnetism

Could a Little Child Be Leading Us to a Free Energy Future?

The search for new energy technology takes us to northern Idaho to meet a ten-year-old girl who won a science fair with a battery-charging motor. She describes it as an advanced design that extends the life of batteries for an amazing length of time. The motor was designed by John Bedini and built by her. We meet him first.

More widely known as an audio-amplifiers expert, Bedini's name is intertwined with "free energy" history. Witnesses saw his machines running successfully, but later others were unable to build devices according to his published instructions. His circuitry was mentioned favorably at a conference in Switzerland recently.

Aware of the controversies, with mixed feelings I drove into the Idaho panhandle, past a warehouse for survivalists' supplies. My hope is that he will give clues so others can duplicate his successes.

10-year-old Shawnee Baughman with her award-winning science

Inventor John Bedini tweaks a working model of his magnet motor

Explaining his theory about such devices, new-energy theorist Thomas Bearden is writing prolifically this year. Retired from electronic warfare studies and aerospace work, Bearden is the leading advocate of scalar potential electromagnetics, and he explains how the sea of energy we live in—an energetic flux of virtual particles—could be engineered to do work in the physical world.

Bearden also has a theory about another of Bedini's "scalar" inventions—one which can increase enjoyment of music. After a six-year struggle, Bedini was granted US Patent 5,487,057 for a mechanism for reducing electronic distortion in digital and analog recording and playback. Bearden (writing in *Explore Magazine* Vol. 7, No. 4, pp 53-63) says the patent examiner couldn't understand the mechanism, because Bedini's nonlinear optics process was not found in audio-, or classical electromagnetics textbooks. Meanwhile, John and his brother Gary were already selling the stress-defect-relieving devices. The process even works for media such as color film. Bearden explains Bedini's process as self-oscillating, optical-electronics, and hopes that even structural metals can eventually be treated with it to reduce stress defects. Is this negative entropy—self-ordering in the physical world?

Bearden adds that most really *new* things are invented not by academic teams or corporate scientists but by the lone "independent, fiercely creative people."

I meet Bedini at his business, surrounded by electronics equipment. The back room looks like a museum of small prototypes of unusual motor/generators. Some are pictured on websites http://rand.nidlink.com/John1 or http:/www.icehouse.net/john1/tesla.html.

He says his knowledge is on the internet, and now it's up to others to build the devices. He says they have to experiment themselves, and it reminds me that he taught a little girl how to make a motor which drove science teachers nuts—to see a little motor made of plastic with no return paths for the magnetics.

"The funny thing was that her father bent a coat hanger and put a coil above the motor and used it as a generator. The motor ran much longer under the load than they had expected."

John Bedini was roaming the "free energy" scene in California in the 1970s and early 1980s, collecting knowledge about medical as well as energy devices. He had an electronics business in Sylmar, and at home he experimented with windmills and other systems. The utility company objected—he was hooked up to their

Continued on Page 64

■ BY JEANE MANNING

Continued from Page 32

power lines and if his system were to backfeed, it could extinguish the lights in the neighborhood. He disagreed. As he tells it, the officials' final word was "we think you're stealing power" and they took their meter off the building. However, his lights were still on at night, because of his energy inventions, he tells me. Finally they struck a deal--he would have his power meter back but would pay a high fee for the service.

The power company almost took away their hookup to his shop, but it was in an industrial area and they would have had to remove a three-phase transformer and therefore deprive the other businesses of power. "They found that when they switched off all the power in the shop nothing (electrical) was being drawn, but the machines kept running."

He published instructions for an energy device which Jim Watson of Colorado Springs then built—large-scale with a heavy flywheel. Watson demonstrated it at the 1984 Bicentennial symposium celebrating Nikola Tesla's arrival in the USA.

At the same meeting, Bedini displayed a circuit which charges batteries. Only one engineer out of the audience--Eike Mueller of the European space agency--got up and measured Bedini's apparatus. He affirmed that it was charging the batteries.

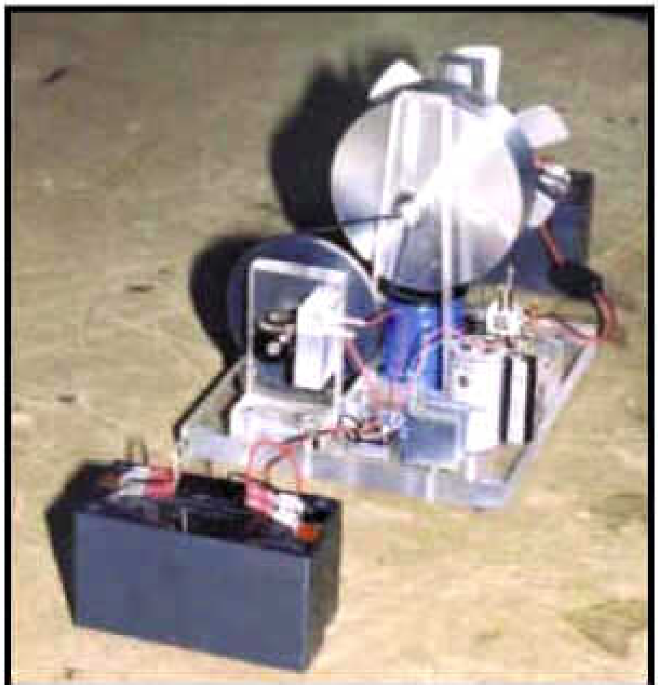
Dr. Hans Nieper's book *Revolution in Technology, Medicine and Society* states that Bedini's converter was 800% efficient in initial tests, and that 26 independent researchers successfully duplicated the device about which Bedini reported.

However, the staff of the no-longer-published magazine *Energy Unlimited* was unable to replicate the device, and consulting engineer George Hathaway criticized Mueller's measurements.

On the other hand, a presenter at the 1985 USPA conference, Ken Moore, found that his model of Bedini's G-Field Generator increased speed as its load increased. He also witnessed a Bedini prototype successfully operating.

The same year, radio KABC talk show host Bill Jenkins used his guest speaker's spot at a March 12 Town Hall forum at the Biltmore Hotel in Los Angeles to announce a free energy device, with Bedini and Steven Werth. The two demonstrated what was described as a Kromrey gravity-field generator with 180% efficiency, powered by a battery bank which required no recharging from an outside source.

A newspaper account said the audience included public utility representatives and investment brokers. Bedini, then 37, told the forum that he planned to make his generator universally available to the public at a nominal cost, instead of selling to the highest bidder. He described his working model as using stressed, pulsed scalar waves out of phase, to tap zero-point energy of the vacuum of space. The concept was not found in physics books, but is perfectly natural and it works, he said.



Toy-sized version of Bedini motor intended for commercial production.

Jenkins had publicly introduced concepts such as scalar interferometry through one of his radio guests, physicist Bearden.

How did the civic officials at the Biltmore forum react to a "free energy" demonstration--light bulbs strung across their luncheon plates? Bedini recalls the growled demands to remove the d___ bulbs so they could eat. "Free energy" was not a part of their reality.

Within a few weeks, Bedini was visited by two thugs who were definitely unfriendly toward his efforts to unhook from today's power structures. They had the appearance of body-builders who had just stepped out of a gymnasium, and pushed him against his shop wall while saying in a threatening manner that they expect he will continue to use gasoline. He laughs shortly while recalling the incident, but evidently knew they were serious.

Now that he has moved to Idaho, the reason "they" don't bother Bedini any more, he figures, is that he limits his models to toy-size. His model collection only demonstrates a principle–that he believes could power a house if scaled up in size. The principle involves storing discharged pulses of energy that are created while doing work with previously stored energy. The sequence is "do the work, discharge, do the work, discharge" and so on.

The devices operate in a manner contrary to conventional motors and generators, I am told. "You want the thing to do work. The more work it does, the more energy it gathers," Bedini says.

A recent model, incorporating a bicycle wheel with magnets glued on the inside of the perimeter, has a large-bladed fan–angled to slow the rotation–as the work load. Bedini unhooked part of his circuit to demonstrate the spark. He was showing how much energy is sent back to the battery, continually in step. Repeatedly the setup runs the motor for a certain length of time, shuts it off and then discharges.

Bedini is scornful of experts who have visited him and can't understand why a small motor could be charging a battery yet the motor does not slow down.

"We understand what the energy is. Tesla knew exactly what it was. And it's the furthest thing from what they want to measure with their electron-pushers."

Today's instruments all measure electron flow, he said, but no meters are available to measure what is involved in his models. What, then, is Bedini dealing with? It's electrostatic in nature, he replies, and must be converted into standard electricity.

The rhythmic pop, pop, pop sound of a Bedini device comes from a blue spark which he describes as an ultraviolet type of arc–similar to radio frequencies but not RF. It can be accumulated and discharged in pulses which then can be converted into electrons.

If scientists want to build a big electron-pusher, the answers are on his website, he said. However, Bedini has no patience with researchers who ask for specifics such as where to buy the magnets. "Just go get them. Don't bother me." He said the devices only need to be tuned, and exact materials are not crucial. "Use the type of magnets that fit your wheel. If you don't get enough output from the coils, add more windings. Or change the geometry."

I'll visit the little girl and see if it is that easy.

Earlier this year Shawnee Baughman wanted a science fair project. She found a book with plans for a motor, but it looked boring–corks and match boxes. Her father promised the parts for a better one. He works near John Bedini, who instructed Shawnee for a couple of hours a day for a few days. She finished building it the day before the fair.

"We only tested it for like a day, left it running overnight sometimes, but sometimes we'd leave it running for an hour or two hours or something."

The other kids liked it; that's how it was voted 'best of show'. Adult judges gave her the other top prizes.

She flicks the wheel into motion and it runs.

"This is the electromagnet coil. It has the power wire and the trigger wire...The power wire carries the voltage around the electromagnet coil and it goes through to the transistor–that little black thing–then it goes through the resistor and the diode and the trigger wire follows it and then the voltage flow comes out again and returns back to the negative side of the battery. ..The electromagnet generates the power; then it spins the wheel; the electricity goes through the generator coil which lights up the light-emitting diode. Then it starts all over again."

"We've been using this battery for a month or so now. It's supposed to have only 900 spins per nine volts, and that's a nine-volt battery, so if it were to run out then it would have run out a long time ago!"

She has only changed the battery three times since building it six months ago.

Schools' involvement in the new-energy field adds impetus. Andreas Manthey is an instructor who organized a Study Group for Free Energy at the Technical University of Berlin, Germany. He says the German version of my book impelled him back into new-energy research.

Jim Watson disappeared from the public new-energy scene a couple of years after the 1984 demonstration, but John Bedini and colleagues are sharing as much information as they believe that they can share. Bedini views children such as Shawnee as our hope for the future. ■

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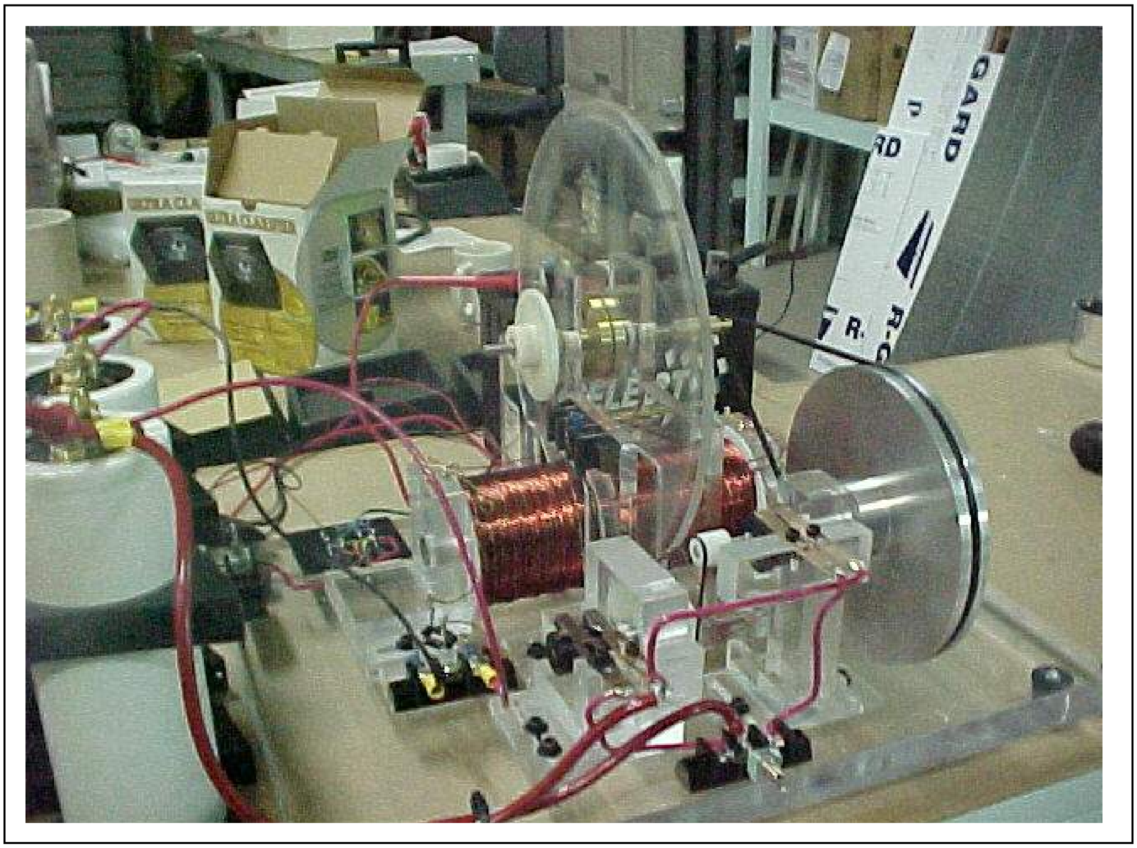

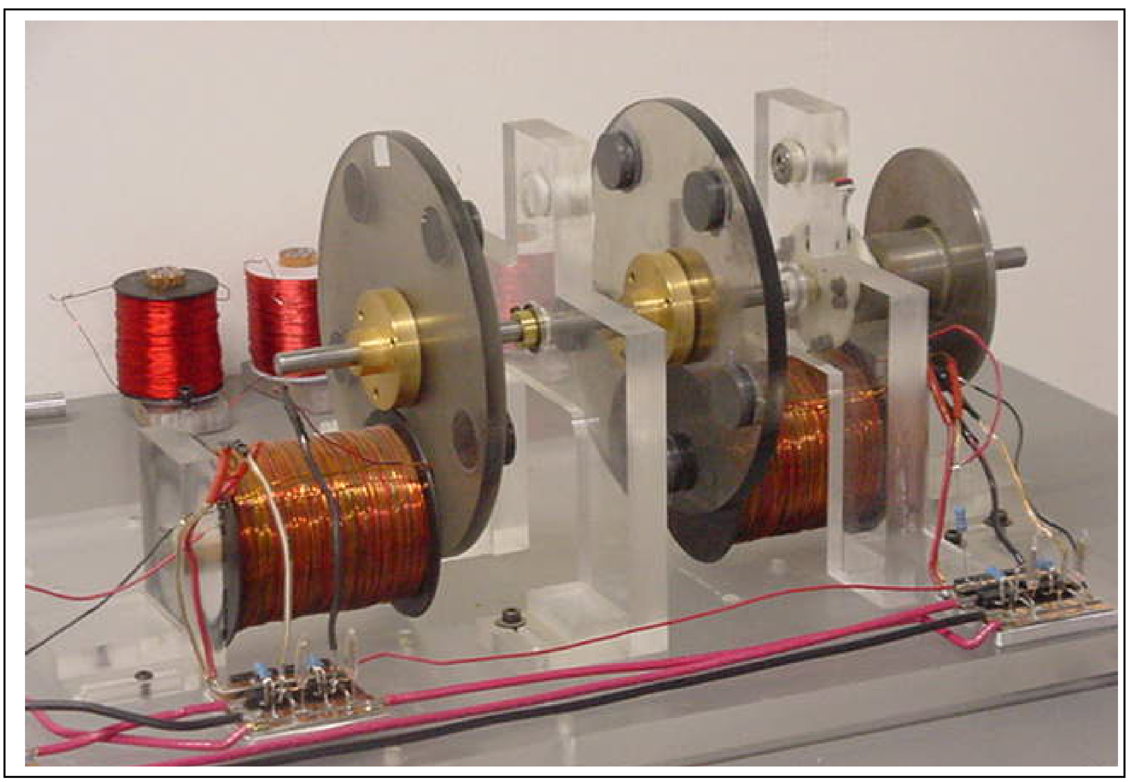

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