Chapter 7: Aerial Systems and Electrostatic Generators

Note: If you are not at all familiar with basic electronics, you might find it easier to understand this chapter if you read chapter 12 first.

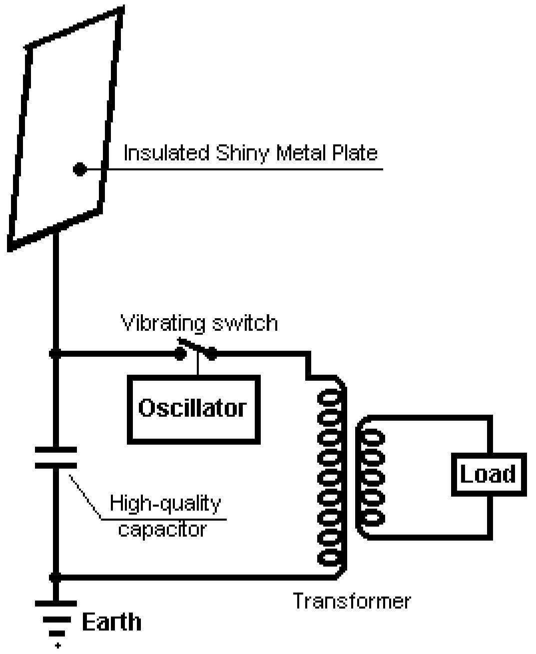
It is generally thought that aerials are not capable of gathering much power. The popular conception is that the only power available is low level radio waves from distant radio transmitters, and while it is certainly true that radio waves can be picked up with an aerial, the real sources of power are not radio transmitters.

For example, we will be looking at information from Hermann Plauson and he considered any aerial system of his which did not produce more than an excess power of 100 kilowatts, as a "small" system (admittedly, with many aerials). Thomas Henry Moray demonstrated his system to audiences repeatedly, pulling in power levels of up to 50 kilowatts from a single sort aerial. These power levels are not produced by radio station signals.

Nikola Tesla's Aerial System.

Nikola Tesla produced an aerial device which is worth mentioning. It was patented on May 21st 1901 as an "Apparatus for the Utilisation of Radiant Energy", US Patent number 685,957.

The device appears simple but Tesla states that the capacitor needs to be "of considerable electrostatic capacity" and he recommends using the best quality mica to construct it as described in his 1897 patent No. 577,671. The circuit draws power via an insulated, shiny metal plate. The insulation could be spray-on plastic. The larger the plate, the greater the energy pick-up. The higher the plate is elevated, the greater the pick-up.



This system of Tesla's picks up energy day and night. The capacitor gets charged up and a vibrating switch repeatedly discharges the capacitor into the step-down transformer. The transformer lowers the voltage and raises the current available and the output is then used to power the electrical load.

It seems probable that this device operates primarily from static electricity, which some people believe is a manifestation of the zero-point energy field. Tesla's equipment might well operate when fed by a motor-driven Wimshurst machine instead of a large aerial plate. Details of home-built Wimshurst equipment are available in the book 'Homemade Lightning' by R.A. Ford, ISBN 0-07-021528-6.

However, it should be understood that Tesla described two different forms of energy pick-up. The first is static electricity, picked up from very slight interaction of the pick-up plate with the zero-point energy field flowing through it, and the other being pick-up of dynamic radiant energy events, typically from lightning strikes. At a casual glance, the average person would not consider lightning as being a viable source of energy, but this is not the case as there are about two hundred lightning strikes per second - mainly in the tropics - and what is generally not understood is that they are radiant energy events and their effects are felt instantly everywhere on earth as transmissions through the zero-point energy field are instantaneous at any distance. To clarify the situation a little more, here are two of Tesla's patents, one on pick-up of the static field which Tesla remarks appears to be unlimited in voltage, and one patent on pick-up of dynamic energy.

This is a slightly re-worded copy of this patent, as some words have changed their meaning since this patent was issued. If you wish to see the original, then http://www.freepatentsonline.com will allow you to download a copy without any charge.

Patent US 685,957 5th November 1901 Inventor: Nikola Tesla

APPARATUS FOR THE UTILISATION OF RADIANT ENERGY

To all whom it may concern:
Be it known that I, Nikola Tesla, a citizen of the Unites States, residing at the borough of Manhattan, in the city, county and State of New York, have invented certain new and useful improvements in Apparatus for the Utilisation of Radiant Energy, of which the following is a specification, reference being had to the drawings accompanying and forming a part of the same.

It is well known that certain radiations - such as those of ultra-violet light, cathodic, Roentgen rays, or the like - possess the property of charging and discharging conductors of electricity, the discharge being particularly noticeable when the conductor upon which the rays impinge is negatively electrified. These radiations are generally considered to be ether vibrations of extremely small wave lengths, and in explanation of the phenomena noted, it has been assumed by some authorities that they ionise, or render conducting, the atmosphere through which they are propagated. However, my own experiments and observations lead me to conclusions more in accord with the theory heretofore advanced by me that sources of such radiant energy throw off with great velocity, minute particles of matter which are strongly electrified, and therefore capable of charging an electrical conductor, or, even if not so, may at any rate discharge an electrified conductor, either by bodily carrying off its charge or otherwise.

My present application is based upon a discovery which I have made that when rays or radiations of the above kind are permitted to fall upon an insulated conducting-body connected to one of the terminals of a capacitor, while the other terminal of the capacitor is made to receive or carry away electricity, a current flows into the capacitor so long as the insulated body is exposed to the rays, and under the conditions specified below, an indefinite accumulation of electrical energy in the capacitor takes place. After a suitable time interval during which the rays are allowed to act, this energy may manifest itself in a powerful discharge, which may be used for the operation or control of mechanical or electrical devices, or rendered useful in many other ways.

In applying my discovery, I provide a capacitor, preferably of considerable electrostatic capacity, and connect one of its terminals to an insulated metal plate or other conducting-body exposed to the rays or streams of radiant matter. It is very important, particularly in view of the fact that electrical energy is generally supplied to the capacitor at a very slow rate, to construct the capacitor with the greatest care. I prefer to use the best quality of mica as the dielectric, taking every possible precaution in insulating the armatures, so that the instrument may withstand great electrical pressures without leaking and may leave no perceptible electrification when discharging instantaneously. In practice, I have found that the best results are obtained with capacitors treated in the manner described in Patent 577,671 granted to me on 23rd February 1897. Obviously, the above precautions should be the more rigorously observed the slower the rate of charging and the smaller the time interval during which the energy is allowed to accumulate in the capacitor. The insulated plate or conducting-body should present to the rays or streams of matter, as large a surface as is practical, I having ascertained that the amount of energy conveyed to it per unit of time is, under otherwise identical conditions, proportional to the area exposed, or nearly so. Furthermore, the surface should be clean and preferably highly polished or amalgamated. The second terminal or armature of the capacitor may be connected to one of the poles of a battery or other source of electricity, or to any conducting body or object whatever of such properties or so conditioned that by its means, electricity of the required sign will be supplied to the terminal. A simple way of supplying positive or negative electricity to the terminal is to connect it to an insulated conductor supported at some height in the atmosphere, or to a grounded conductor, the former, as is well known, furnishing positive, and the latter negative electricity. As the rays or supposed streams of matter generally convey a positive charge to the first terminal of the capacitor mentioned above. I usually connect the second terminal of the capacitor to the ground, this being the most convenient way of obtaining negative electricity, dispensing with the necessity of providing an artificial source. In order to use the energy collected in the capacitor for any useful purpose, I also connect to the capacitor terminals, a circuit containing an instrument or apparatus which it is desired to operate, and another instrument or device for alternately closing and opening the circuit. This latter device can be any form of circuit-controller with fixed or moveable parts or electrodes, which may be actuated either by the stored energy or by independent means.

My discovery will be more fully understood from the following description and drawings, where **Fig.1** is a diagram showing the general arrangement of the apparatus as usually employed.

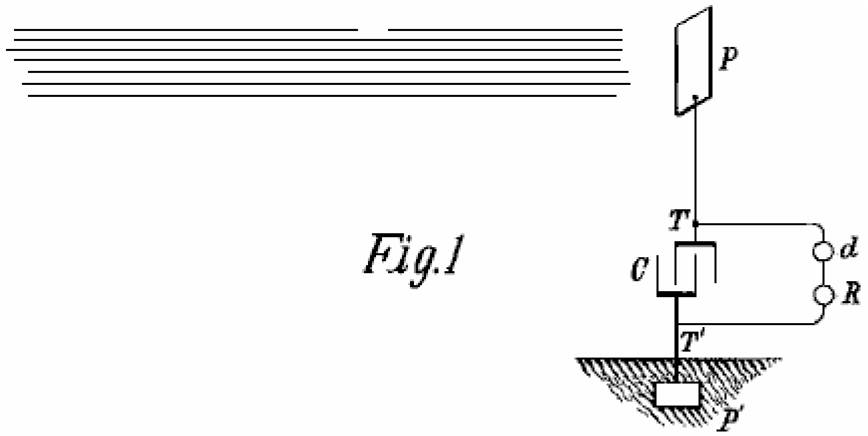


Fig.1

Fig.2 is a similar diagram, illustrating in more detail, typical forms of the devices or elements used in practice.

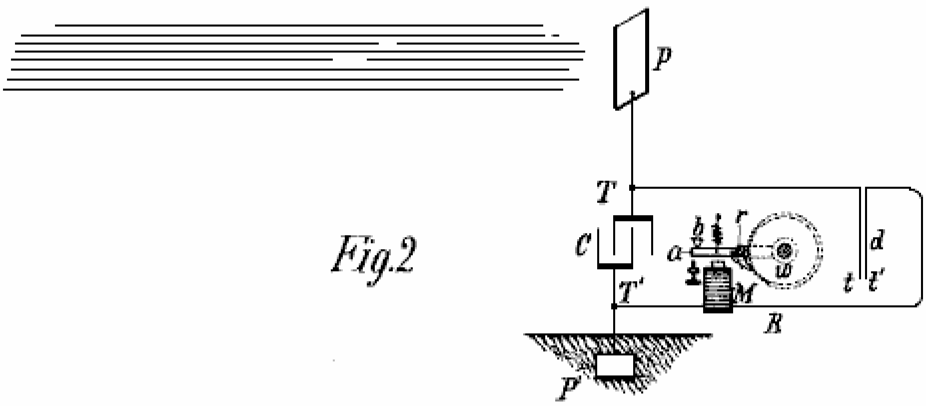


Fig.2

Fig.3 and **Fig.4** are diagrams of modified arrangements suitable for special purposes.

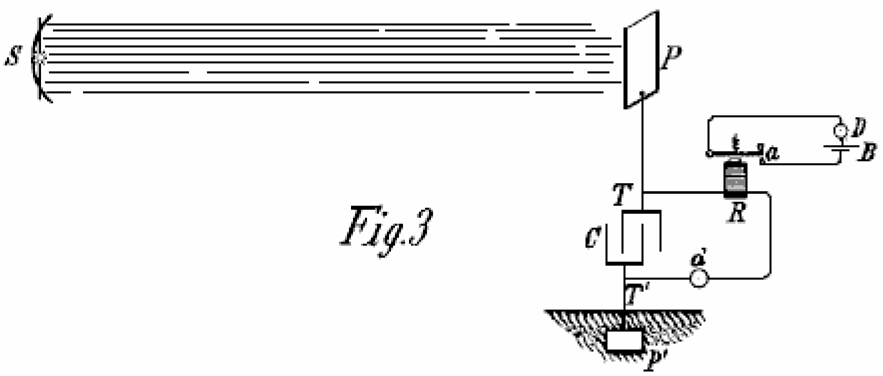


Fig.3

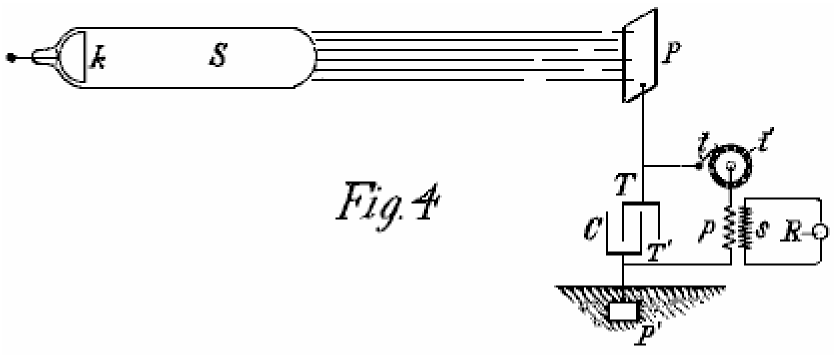


Fig.4

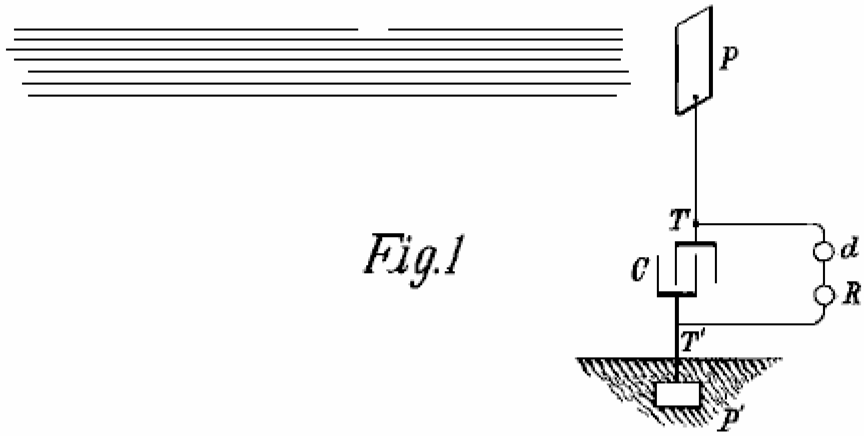


Fig.1

Fig.1 shows the simplest form, in which **C** is the capacitor, **P** the insulated plate or conducting-body which is exposed to the rays, and **P'** another plate or conductor which is grounded, all being connected in series as shown. The terminals **T** and **T'** of the capacitor **C** are also connected to a circuit which contains a device **R** which is to be operated, and a circuit-controlling device **d** as described above.

The apparatus being arranged as shown, it will be found that when the radiation of the sun, or any other source capable of producing the effects described above, fall on plate **P**, there will be an accumulation of energy in capacitor **C**. I believe that this phenomenon is best explained as follows: The sun, as well as other sources of radiant energy , throws off minute particles of positively electrified matter, which striking plate **P**, create an electrical charge on it. The opposite terminal of the capacitor being connected to the ground, which can be considered to be a vast reservoir of negative electricity, a feeble current flows continuously into the capacitor, and since these supposed particles are of an inconceivably small radius or curvature, and consequently, charged to a very high voltage, this charging of the capacitor may continue as I have actually observed, almost indefinitely, even to the point of rupturing the dielectric. If the device **d** be of such character that it will operate to close the circuit in which it is included when the capacitor voltage has reached a certain level, then the accumulated charge will pass through the circuit, operating the receiver **R**.

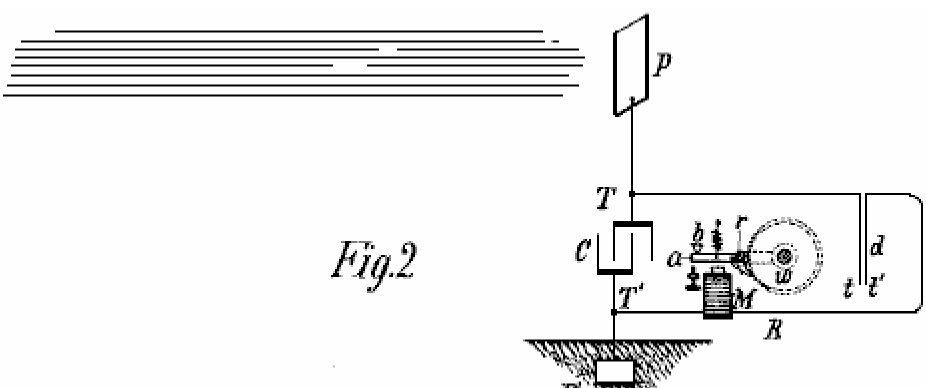


Fig.2

In illustration of this effect, **Fig.2** shows the same general arrangement as in **Fig.1**, and the device **d** is shown composed of two very thin conducting plates **t** and **t'** which are free to move and placed very close to each other. The freedom of movement can be either through the flexibility of the plates or through the character of their support. To improve their action they should be enclosed in a housing which can have the air removed from it.

The plates **t** and **t'** are connected in series in a working circuit which includes a suitable receiver, which in this example is shown as an electromagnet **M**, a moveable armature **a**, a spring **b**, and a ratchet wheel **w**, provided with a spring-pawl **r**, which is pivoted to armature **a** as illustrated. When the radiation falls on plate **P**, a current flows into the capacitor until its voltage causes the plates **t** and **t'** to be attracted together, closing the circuit and energising the magnet **M**, causing it to draw down the armature **a** and cause a partial rotation of the ratchet wheel **w**. When the current flow stops, the armature is retracted by the spring **b**, without, however, moving the wheel **w**. With the stoppage of the current, the plates **t** and **t'** cease to be attracted and separate, thus restoring the circuit to its original condition.

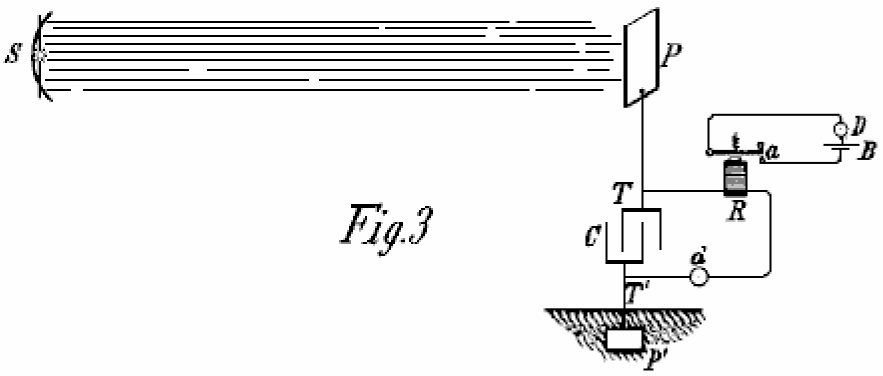


Fig.3

Fig.3 shows a modified form of apparatus used in connection with an artificial source of radiant energy, which in this case may be an arc emitting copious ultra-violet rays. A suitable reflector may be provided for concentrating and directing the radiation. A magnet **R** and circuit-controller **d** are arranged as in the previous figures, but in this case, instead of performing the whole of the work, the magnet performs the task of alternately opening and closing a local circuit, containing a source of current **B** and a receiving or translating device **D**. The controller **d** may, if desired, consist of two fixed electrodes separated by a minute air gap or weak dielectric film which breaks down more or less suddenly when a definite voltage difference is reached at the terminals of the capacitor, and returns to its original state when the discharge occurs.

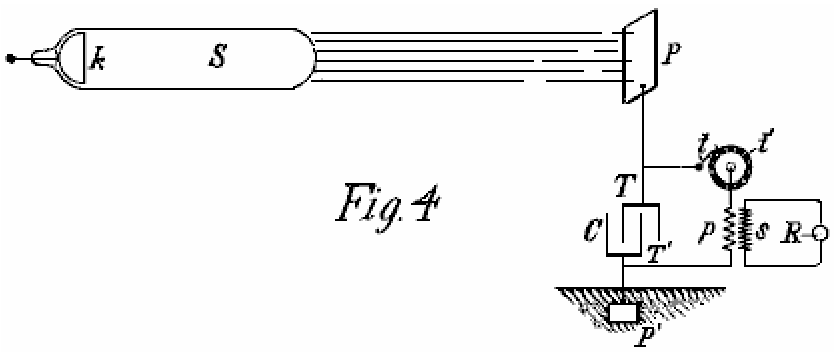


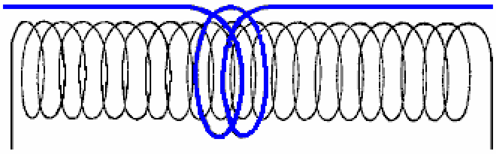
Fig.4

Still another modification is shown in **Fig.4**, in which **S**, the source of radiant energy is a special form of Roentgen tube devised by me, having only one terminal **k**, generally of aluminium, in the form of half a sphere, with a plain polished surface on the front side, from which the streams are thrown off. It may be excited by attaching it to one of the terminals of any generator with sufficiently high electromotive force; but whatever apparatus is used, it is important that the tube has the air inside it removed to a high degree, otherwise it might prove to be entirely ineffective. The working, or discharge circuit connected to the terminals T and T' of the capacitor, includes, in this case, the primary winding **p** of a transformer, and a circuit-controller comprised of a fixed terminal or brush **t** and a moveable terminal **t'** in the shape of a wheel, with conducting and insulating segments, which may be rotated at an arbitrary speed by any suitable means. In inductive relation to the primary winding **p**, is a secondary winding **s**, usually of a much greater number of turns, to the ends of which is connected a receiver **R**. The terminals of the capacitor being connected as shown, one to an insulated plate **P** and the other to a grounded plate **P'**. When the tube **S** is excited, rays or streams of matter are emitted from it and these convey a positive charge to the plate **P** and capacitor terminal **T**, while the capacitor terminal **T'** is continuously receiving negative electricity from plate **P'**. As already explained, this results in an accumulation of electrical energy in the capacitor, and this continues as long as the circuit including the primary winding **p** is interrupted. Whenever the circuit is closed by the rotation of the terminal **t'**, the stored energy is discharged through the primary winding **p**, giving rise to induced currents in the secondary winding **s**, which operates the receiver **R**.

It is clear from what has been stated above, that if the terminal **T'** is connected to a plate supplying positive instead of negative electricity, then the rays should convey negative electricity to plate **P**. The source **S** may be any form of Roentgen or Leonard tube, but it is obvious from the theory of action that in order to be very effective, the impulses exciting it should be wholly, or mainly of one sign. If ordinary symmetrical alternating currents are employed, then provision should be made for allowing the rays to fall on plate **P** only during those periods when they can produce the desired result. Obviously, if the source radiation is stopped or intercepted, or the intensity varied in any manner such as periodically interrupting or rhythmically varying the current exciting the source, there will be corresponding changes in the action upon the receiver **R** and thus signals may be transmitted and many other useful effects produced. Further, it will be understood that any form of circuit-closer which will respond, or be set in operation when a predetermined amount of energy is stored in the capacitor, may be used instead of the device already described in connection with **Fig.2**.

The second patent requires the equipment to be tuned to one quarter of the wavelength of the energy pulses being collected. This patent shows a transmission method as well as a receiving method, but our main concern here is the receiving section shown on the right of the diagram as that can receive naturally occurring energy pulses in the environment and so provides free usable energy.

As it may be a little difficult to visualise the coil arrangement in this patent as many people are familiar with the "Tesla Coil" arrangement where a few turns of thick wire or copper tubing are used as a winding placed around an ordinary cylindrical coil, much like, this illustration from Tesla's patent US 568,178:

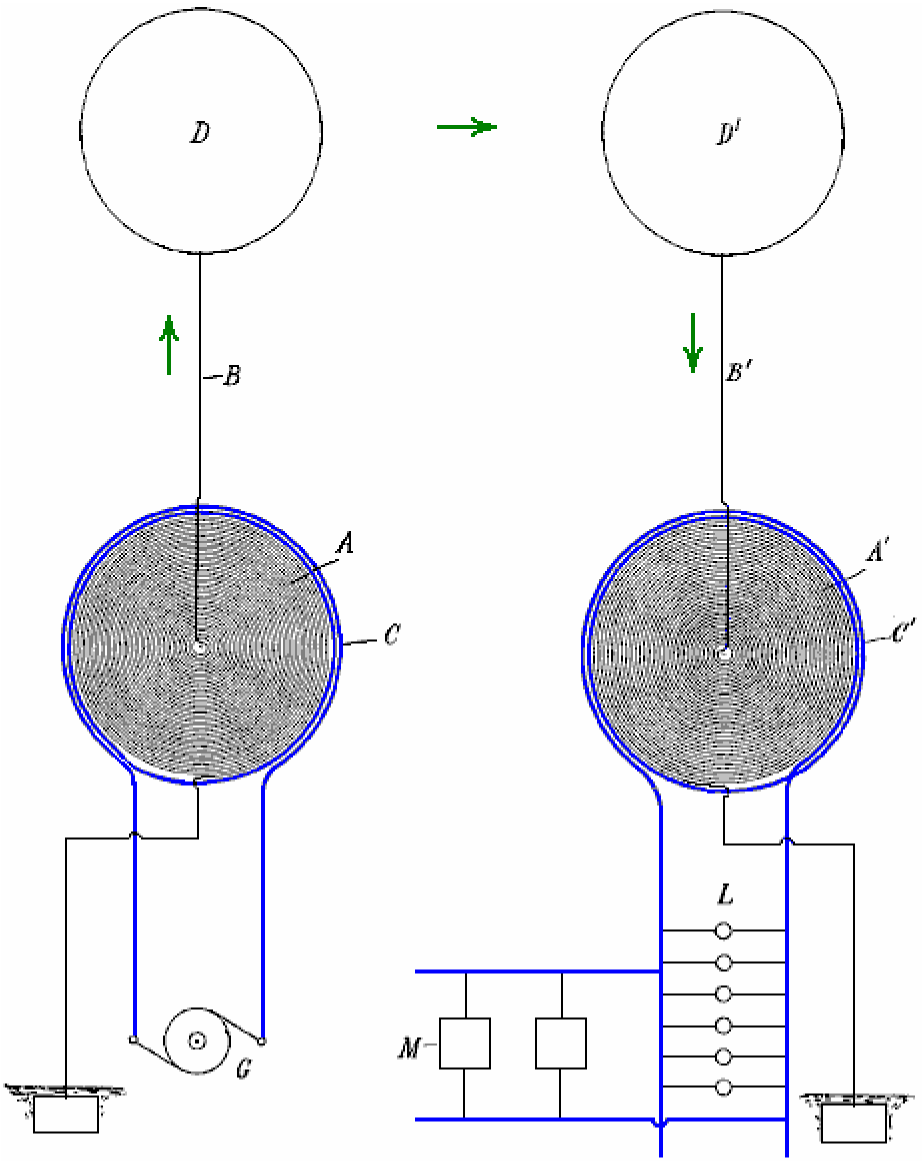


In this case it should be understood that Tesla is speaking about his flat "pancake" coil design and not the well-known Tesla Coil configuration.

Patent US 649,621 **15th May 1900** **Inventor: Nikola Tesla**

APPARATUS FOR THE TRANSMISSION OF ELECTRICAL ENERGY

To all whom it may concern:
Be it known that I, Nikola Tesla, a citizen of the Unites States, residing at the borough of Manhattan, in the city, county and State of New York, have invented certain new and useful improvements in Apparatus for the Transmission of Electrical Energy, of which the following is a specification, reference being had to the drawing accompanying and forming a part of the same.



This application is a division of an application filed by me on 2nd September 1897, US 650,343 entitled "Systems of Transmission of Electrical Energy" and is based on new and useful features and combinations of apparatus shown and described in that patent application.

This invention comprises a transmitting coil or conductor in which electrical currents or oscillations are produced and which is arranged to cause these currents or oscillations to be propagated by conduction through the natural medium from one location to a remote location, and a receiving coil or conductor adapted to be excited by the oscillations or currents propagated by the transmitter.

This apparatus is shown in the accompanying diagram where **A** is a coil, generally of many turns and of a very large diameter, wound in spiral form, either around a magnetic core or not as may be desired. **C** is a second coil formed by a conductor of much larger size and smaller length, wound around and in proximity to coil **A**.

The apparatus at one point is used as a transmitter, the coil **A** in this case forming a high-voltage secondary of a transformer, and the coil **C** the primary which operates at a much lower voltage. The source of current for the primary winding is marked **G**. One terminal of the secondary winding **A** is at the centre of the spiral coil, and from this terminal the current is led by a conductor **B** to a terminal **D**, preferably of large surface, formed or maintained by such means as a balloon at an elevation suitable for the purpose of transmission. The other terminal of the secondary winding **A** is connected to earth, and if desired, to the primary winding also in order that the primary winding may also be at substantially the same voltage as the adjacent portions of the secondary winding, thus ensuring safety.

At the receiving station, a transformer of similar construction is used, but in this case the coil **A'** constitutes the primary winding and the shorter coil **C'** is the secondary winding. In this receiving circuit, lamps **L**, motors **M**, or other devices for using this current, are connected. The elevated terminal **D'** connects with the centre of the coil **A'** and the other terminal is connected to earth and preferably, also, to the coil **C'** again for safety reasons as mentioned above.

The length of the thin wire coil in each transformer should be approximately one quarter of the wave length of the electric disturbance in the circuit, this estimate being based on the velocity of propagation of the disturbance through the coil itself and the circuit with which it is designed to be used. By way of illustration, if the rate at which the current flows through the circuit containing the coil is 185,000 miles per second, then a frequency of 925 Hz would maintain 925 stationary nodes in a circuit 185,000 miles long and each wave would be 200 miles in length.

For such a low frequency, which would only be resorted to when it is indispensable for the operation of ordinary motors, I would use a secondary winding wound from a wire 50 miles in length. By adjusting the length of wire in the secondary winding, the points of highest voltage are made to coincide with the elevated terminals **D** and **D'**, and it should be understood that whatever wire length is chosen, this length requirement should be complied with in order to get the best possible results.

It will be readily understood that when these relationships exist, the best conditions for resonance between the transmitting and receiving circuits are attained and owing to the fact that the points of highest voltage in the coils **A** and **A'** are coincident with the elevated terminals, the maximum current flow will take place in the two coils and this implies that the capacitance and inductance in each of the circuits have the values which produce the most perfect synchronism with the oscillations.

When the source of current G is in operation and produces rapidly pulsating or oscillating currents in the circuit of coil **C**, corresponding induced currents of very much higher voltage are generated in the secondary coil **A**, and since the voltage in that coil gradually increases with the number of turns towards the centre, and the voltage difference between adjacent turns is comparatively small, a very high voltage is generated, which would not be possible with ordinary coils.

As the main objective is to produce a current with excessively high voltage, this objective is facilitated by using a current in the primary winding which has a very considerable frequency, but that frequency is in a large measure, arbitrary, because if the voltage is sufficiently high and the terminals of the coils be kept at the proper height where the atmosphere is rarefied, the stratum of air will serve as a conducting medium with even less resistance then through an ordinary conductor.

As to the elevation of terminals **D** and **D'**, it is obvious that this is a matter which will be determined by a number of things, such as the amount and the quality of the work to be performed, the condition of the atmosphere and the character of the surrounding countryside. Thus, if there are high mountains in the vicinity, then the terminals should be at a greater height, and generally, they should be at an altitude much greater than that of the highest objects near them. Since, by the means described, practically any voltage which is desired may be produced, the currents through the air strata may be very small, thus reducing the loss in the air.

The apparatus at the receiving station responds to the currents propagated by the transmitter in a manner which will be well understood from the description above. The primary circuit of the receiver - that is, the thin wire coil **A'** - is excited by the currents propagated by conduction through the intervening natural medium between it and the transmitter, and these currents induce in the secondary coil **C'**, other currents which are used to operate the devices connected to that circuit.

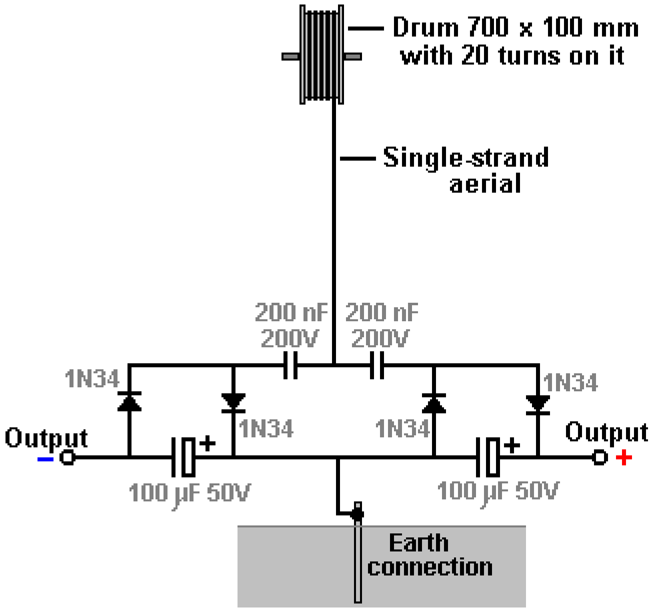
Obviously, the receiving coils, transformers, or other apparatus may be moveable - as for instance, when they are carried by a vessel floating in the air or by a ship at sea. In the former case, the connection of one terminal of the receiving apparatus to the ground might not be permanent, but might be intermittently or inductively established.

It should be noted that Tesla's suggestion of using the conductive envelope of a specially constructed balloon as a good method of increasing the active area of the elevated receiving plate, is one that was taken up by Hermann Plauson when he was building power stations operating on naturally occurring energy.

Jes Ascanius' Version of Nikola Tesla's Aerial System.

This sort of information may seem confusing and maybe a little too technical for you, so let me tell you about the practical and useful applications used by Jes Ascanius, a Danish developer, to whom thanks is due for sharing his design. Initially, he set up a system to charge his mobile phone battery overnight from an aerial. Then he went on to produce a full-size Tesla Aerial System as described at the start of this chapter. Let's start with the very simple system and progress from that to the more powerful arrangements.

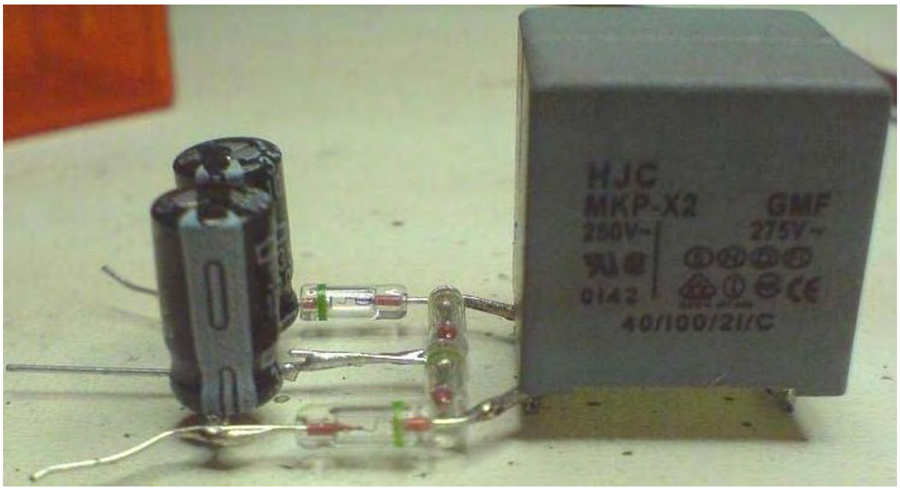
The initial circuit uses one strand of solid wire which rises vertically to a 700 mm diameter drum where there are some twenty turns. The arrangement is like this:

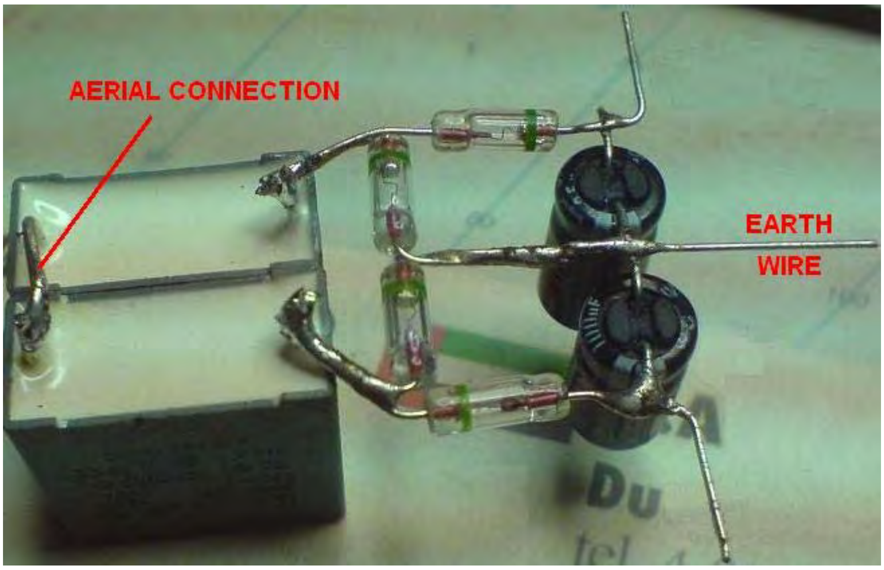


The aerial wire is several metres long, and in the prototype, was supported by (and insulated from) the eaves of a house. The aerial should be vertical or near vertical and a proper earth connection provided by driving a metal rod into the ground or connecting a wire to a metal plate and burying the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

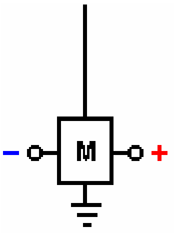
The wire used to connect with the earthing rod is very important and should not be less than 8 swg copper wire, that is, 4 mm diameter and 13 sq. mm. cross-sectional area. As with all free-energy devices, the exact constructional details are vital.

The diodes used are germanium 1N34 or 1N34a which are particularly suited to this application. Ceramic disc types are recommended for the 200 nF capacitors. The prototype build looked like this:

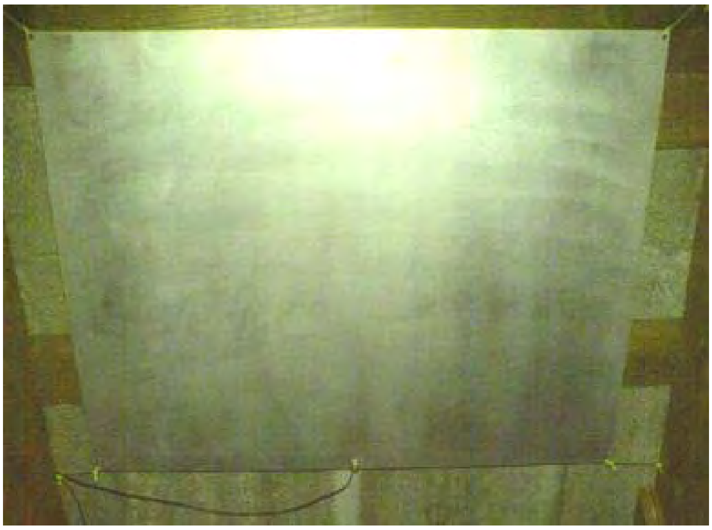




Now, consider this circuit as described, to be one modular building block which can lead to unlimited power from an aerial. I will represent the circuit shown above as a rectangle, showing the above circuit as:

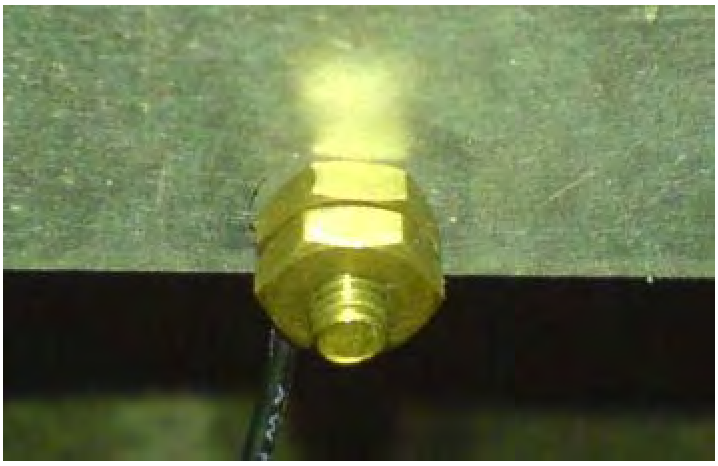


While it is possible to use more than one module with the aerial to get more power, the Danish developer then switched to the full-blown Tesla arrangement by attaching a 600 x 800 x 2 mm aluminium plate inside the sloping roof of his house:



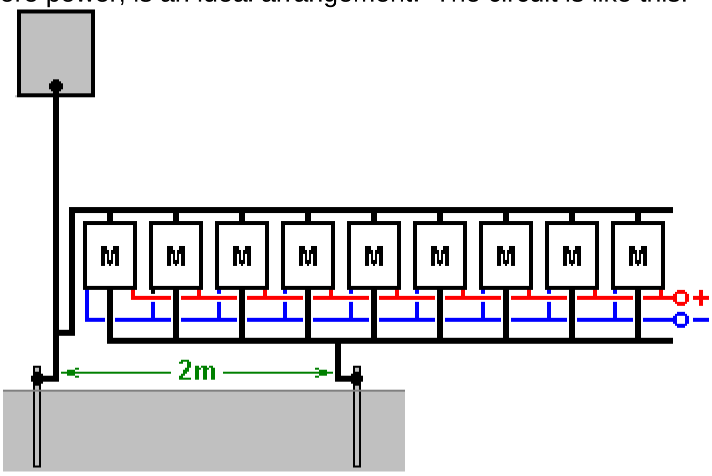
The plate being suspended using nylon cord to prevent it touching the roof or anything else:

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



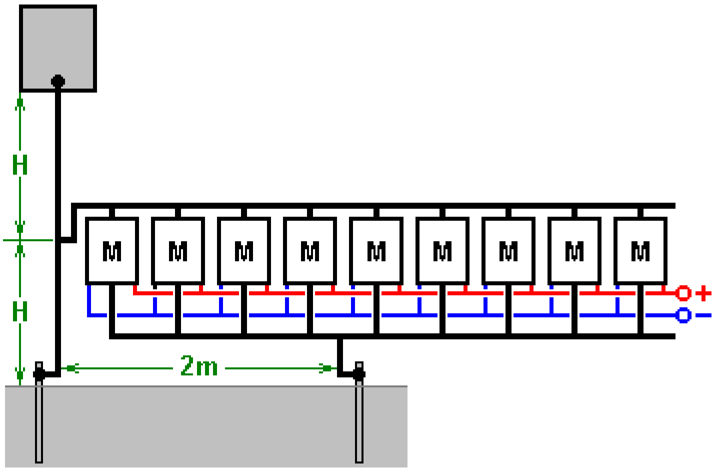
The cable is connected to the aluminium plate using a brass bolt and nuts which the builder thinks may be significant, quite apart from avoiding any galvanitic connection to the circuit. The cable is then run vertically downwards to the circuit. For this arrangement a second earthing point is also used.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

This arrangement provides serious power, enough to cause injury to, or kill a careless human. With two modules, it will light an LED very brightly, driving it to 2.6 volts. If the LED is removed, then the voltage climbs to about twenty volts and is easily sufficient to charge a 12V battery or battery bank although that takes time. With twenty modules a 12V battery can be charged over night. It is estimated that with two hundred modules, the power would be sufficient to power a household although that has not yet been done. It should be borne in mind that each module is easy and cheap to make, so arranging for a stack of them where additional modules can be added at a later date for more power, is an ideal arrangement. The circuit is like this:



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

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



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

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