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Wireless Power Transmission on Tesla Principle

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Abstract: A Tesla coil is a device used for obtaining high voltage at high frequency. The initial purpose its creator, Nikola Tesla, envisioned for it was to transmit wireless energy; advances in electronics have helped people build Tesla coils that can produce music, the lightning bolts acting like a speaker. Nowadays, this device is used for research and special effects. However, we argue that such a device is also very useful in transmitting power wirelessly. The scope of the project is to be able to present concepts in physics, Transmit the power wirelessly! Consequently, in this project we will present the concept of wireless electricity and eliminate limitation of wireless electricity transmission

I. INTRODUCTION

A Tesla coil is a radio frequency oscillator that drives the air-core double-tuned resonant transformer to produce high voltages with low currents.

A Tesla coil is a two-stage transformer which high voltage, high frequency, power generator, primarily built for conducting experiments and to observe phenomenon associated withalternating electricity. With this coil, Tesla was able to generate voltages of such magnitude, they would shoot out of the apparatus as bolts of lightning.

The Tesla Coil is an air-core transformer with primary and secondary coils tuned to resonate. The primary and secondary function as a step-up transformer which converts relatively low- voltage high current to high-voltage low current at high frequencies.

The Tesla Coil demonstrates the fundamental principles of high frequency electrical phenomena. It illustrates the principles of ionization of gases and behavior of insulators and conductors when in contact with high frequency electrical fields.

Nikola Tesla (1856-1943) was one of the most inventors in human history. He had 112 US patents and a similar number of patents outside the United States, including 30 in Germany, 14in Australia, 13 in France, and 11 in Italy. He held patents in 23 countries, including Cuba, India, Japan, Mexico, Rhodesia, and Transvaal. He invented the induction Motor and our present system of 3-phase power in 1888. He invented the Tesla coil, a resonant air-core transformer, in 1891. Then in 1893, he invented a system of wireless Transmission of intelligence. Although Marconi is commonly credited with the invention of Radio, the US Supreme court decided in 1943 that the Tesla Oscillator patented in 1900 had priority over Marconi's patent which had been issued in 1904. Therefore, Tesla did the fundamental work inpower and communications, the major areas of electrical Engineering. Their inventions have truly changed the course of human history. After Tesla had invented-phase power systems andwireless radio, he turned his attention to further development of the Tesla coil. He built a largelaboratory in Colorado Springs in 1899 for this purpose. The Tesla secondary was about 51 feet in diameter. It was in a wooden building in which no ferrous metals were used in construction. There was a massive 80-foot wooden tower, topped by a 200-foot mast on whichperched a large copper ball which he used as a transmitting antenna. The coil worked well. There are claims of bolts of artificial lightning over a hundred feet long,although Richard Hull asserts that from Tesla's notes, he never claimed a distance greater thanfeet. A Lightning Generator Capable of generating small miniature lightning bolts up to 24-in. longthe device is unusually potent considering its overall simplicity and minimal power requirements. In operation, the Lightning Generator spouts a continuous, crackling discharge of pulsating lightning bolts into the air. These waving fingers of electricity will strike any conduction object that comes within it's rang. A piece of paper placed on top the discharging terminal will burst into flames after a few seconds of operation, and a balloon tossed near the terminal will pop as though shot down by lightning.

Coiling is the popular term used to describe the building of resonant transformer of high frequency and high potential otherwise known as Tesla Coils, Nikola Tesla was the foremost scientist, inventor, and electrical genius of his day and has been unequaled since. Although never publicly credited, Nikola Tesla invented radio and the coil bearing his name, which involves most of the concepts in radio theory. The spark gap transmitters used in the early daysof radio development were essentially Tesla coils. The fundamental difference is that the energy is converted to a spark instead of being propagated through a medium (transmitted). The old spark gap transmitters relied on very long antenna segments (approximately 4wavelengths) to propagate the energy in a radio wave; the quarter-wave secondary coil is in itself a poor radiator of energy.

Tesla coils or resonant transformers of high frequency and highpotential have been used in many commercial applications; the only variation being the high voltage is used to produce an effect other than a spark. Although not all commercial applications for Tesla coils are still in use some historical and modern-day applications including:

1) Spark gap radio transmitters
2) Induction and dielectric heating (vacuum tube & spark gap types)
3) Induction coils (differ only in the transformer core material being used)
4) Medical X-ray devices (typically driven by an induction coil)
5) Quack medical devices (violet-ray)
6) Ozone generators
7) Particle accelerator

II. PROBLEM STATEMENT

In the present-day situation, the main mode of transmission of this electrical energy available to all of us is through wires but efficiency is significantly reduced in power transmission through wires. Only 71% of the electrical energy can be transferred efficiently. Moreover, it is always difficult to lay cables in remote area.

III. LITERATURE SURVEY

1) *A Simple Design of a Mini Tesla Coil with DC Voltage Input*

Publisher: IEEE
M.B. Farriz; A. Din; A.A. Rahman; M.S. Yahaya; J.M. Herman
Abstract:
This paper explicates the simple design of the miniature Tesla coil that have advantages compared to the typical Tesla Coil, which normally has mobility issues due to their bulky size. The proposed design has a similar functionality with the typical Tesla coil where it is able to produce medium voltage with high frequency current at the secondary circuit side. The significant part of the proposed design is that it is without alternating current voltage at the input voltage. The design only needs a low direct current voltage as an input for the primary circuit. According to the Pspice simulation, it proved that the proposed design has the capability to step up the energy and voltage at the secondary winding at least fifty times greater compared to the input voltage. The miniature Tesla coil that has been proposed in this paper is recommended to be use for advance studies particularly on wireless energy evolution.
Published in: 2010 International Conference on Electrical and Control Engineering
https://ieeexplore.ieee.org/document/5631706

2) *The USB Powered Miniature Tesla coil, with Filament bulb, fluorescent lamp and Discharge to Body*

Publisher: IEEE
Simoom Rahman; Shahriar Khan
Abstract:
First invented in 1891, the Tesla coil supplied high voltage at low current, demonstrating spectacular feet-long arcing discharge. The Tesla coil has been used more for demonstration and entertainment, and less for teaching and research, partly because of its inherent dangers. Today's diodes, transistors and microprocessors allow low voltage Tesla coils with new capabilities and improved safety. Still, there are few commercial applications, and the Tesla coil remains mostly for demonstration and exhibition.
The improvised miniature 5 V USB port supplied Tesla coil built by the author is worthy of investigation and documentation because of its exotic phenomena like lighting up a nearby fluorescent lamp, making a common filament bulb act like a plasma ball, and producing an imperceptible continuous discharge on the finger. The fluorescent lamp lights up not from the RF from the coil, but from the induced currents in the mercury vapor. The filament bulb produces moving plasma, proving that conditions exist for such interesting phenomena. The visible continuous arc at the finger, far from giving a shock, was imperceptible because of its RF frequencies. The constructed miniature Tesla coil illustrates boosting of voltage, the air-core transformer, resonance at tuned frequency, and other electrical principles. With some simple precautions, this easily constructed low-voltage, Tesla coil with $20 of components, shows much promise for promoting teaching and research at schools, colleges and universities.
Published in: 2022 IEEE International IOT, Electronics and Mechatronics Conference (IEMTRONICS)
https://ieeexplore.ieee.org/document/9795827

3) Design and construction solution of laboratory Tesla coil
Publisher: IEEE Michal Krbal; Petr Siuda
Abstract:
Tesla coil is high-voltage high-frequency testing source used in laboratories and testing departments of MV and HV. This paper deals with the design, implementation and measured output operational parameters of the Tesla coil, which is located in the High voltage laboratory in Brno University of Technology.
Published in: 2015 16th International Scientific Conference on Electric Power Engineering (EPE)
https://ieeexplore.ieee.org/document/7161078

4) A 4-channel RF coil based on a novel dipole-element with eigen-resonant shielding plate for 7-Tesla magnetic resonance imaging
Publisher: IEEE
Zhichao Chen; Oliver Kraff; Klaus Solbach; Daniel Erni; Andreas Rennings
Abstract:
First imaging tests of a 4-channel RF coil using novel 41 cm-long dipole elements with an eigen-resonant shielding plate in a 7-Tesla magnetic resonance imaging (MRI) system are presented. The proposed 4-channel coil is loaded by a homogeneous phantom to model the human body. Gradient echo images on the transverse, sagittal and coronal planes are acquired in CP + mode and compared to the more established 25 cm-long elements. Relative B 1 + maps for each channel show good separation of transmit sensitivities.
Published in: 2014 44th European Microwave Conference

5) Wireless Power Transfer to Low Power Devices
Publisher: IEEE
Lala Bhaskar; Pradeep Kumar; Kishore Naik Mude
Abstract:
A WPT system usually consist of a transmitter connected to main power source which produces a varying magnetic field, generating flux, due to which current is induced in the receiver coil. Here the receiver coil used has parameters depending on the application. Since Tesla's work on wireless power technology, not a significant lot has been done. Wireless power transfer is used in different applications ranging from mobile chargers to charging stations. The major challenge faced by wireless power is efficiency, and it decreases drastically if the range is increased even by a fraction. In this paper a WPT charger is modeled and simulation has been conducted over Maxwell 3d of Ansys electromagnetic suite. On basis of simulation results obtained a hardware model is designed and is tested by increasing the distance between the coils and seen the better improvements in terms of efficiency. This model can be a turning point for our society. The device is easily established like in railway stations and metro cities and is affordable. This proposed design is helpful for contact less mobile charging for public places in India. This is a low budget system with an essential social application.
Published in: 2019 1st International Conference on Advances in Information Technology (ICAIT)
https://ieeexplore.ieee.org/document/8987291

IV. HISTORY

About 100 years ago Nikola Tesla invented his "Tesla Coil". Tesla invented his coil with the intention of transmitting electricity through the air. Transmission of electrical energy from power source to an electrical load without using wires.
Tesla employed the Tesla coil in his efforts to achieve wireless power transmission, his lifelong dream. In the period 1891 to 1900 he used it to perform some of the first experiments in wireless power, transmitting radio frequency power across short distances by inductive coupling between coils of wire. In his early 1890s demonstrations such as those before the American Institute of Electrical Engineers and at the 1893 Columbian Exposition in Chicago he lit light bulbs from across a room. He found he could increase the distance by using a receiving LC circuit tuned to resonance with the Tesla coil's LC circuit, transferring energy by resonant inductive coupling. At his Colorado Springs laboratory during 1899–1900, by using voltages of the order of 10 million volts generated by his enormous magnifying transmitter coil (described below), he was able to light three incandescent lamps at a distance of about 100 feet (30 m). Today the resonant inductive coupling discovered by Tesla is a familiar concept in electronics, widely used in IF transformers and short-range wireless power transmission systems such as cell phone charging pads.

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V. BLOCK DIAGRAM

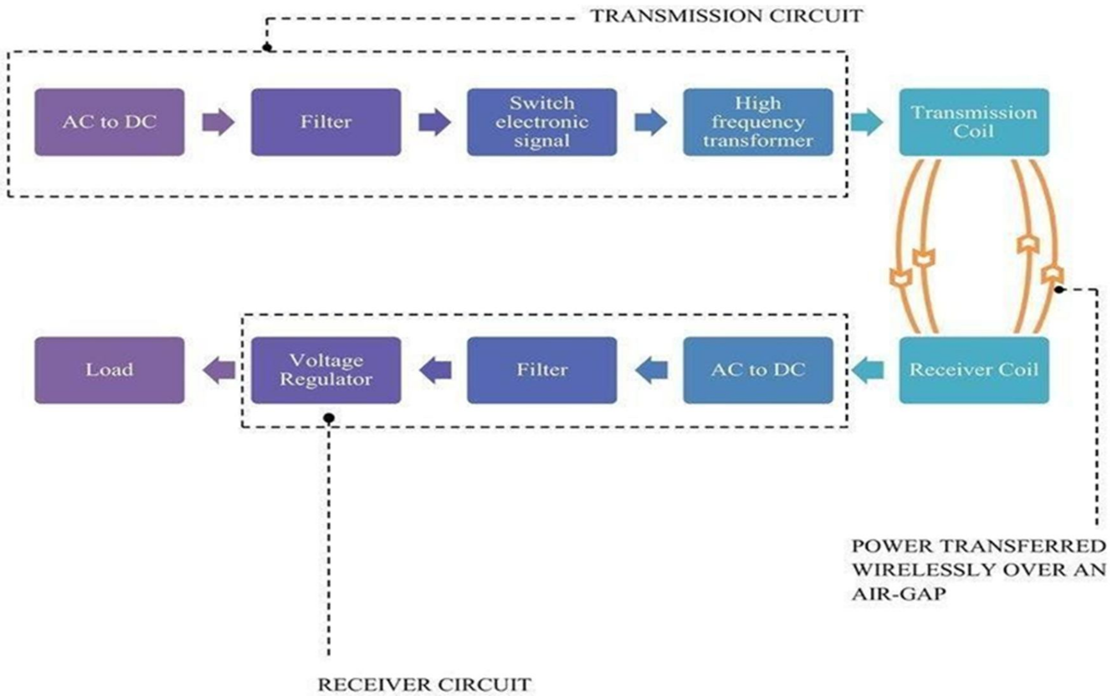

Fig:1.1 block diagram

VI. CIRCUIT DIAGRAM

This coil has two main parts – a primary coil and a secondary coil, with each coil having its own capacitor. A spark gap connects the coils and capacitors. The functionality of the spark gap is to generate the spark to excite the system.

The Power supply is a high voltage transformer used to charge the primary capacitor. Neon Sign Transformers (NSTs) are the most common power supply used in small to medium sized Tesla coils.

These calculations will be used to determine the optimum sized primary capacitor (in the next section).

NST VA = NST Vout × NST Iout

NST Impedance = NST Vout/NST Iout

A Power Factor Correction (PFC) capacitor can be wired across the NST input terminals to correct the AC power phase and increase efficiency. The optimum PFC capacitance is found with the following equation:

PFC Capacitance (F)=NST VA/(2×π×NST Fin× (NST V2 in))

Where: Fin is input frequency

Π = 3.14

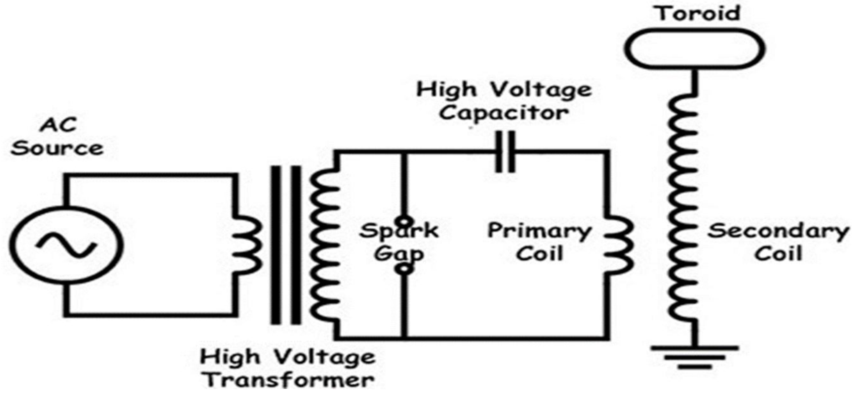

Fig:1.2 circuit diagram

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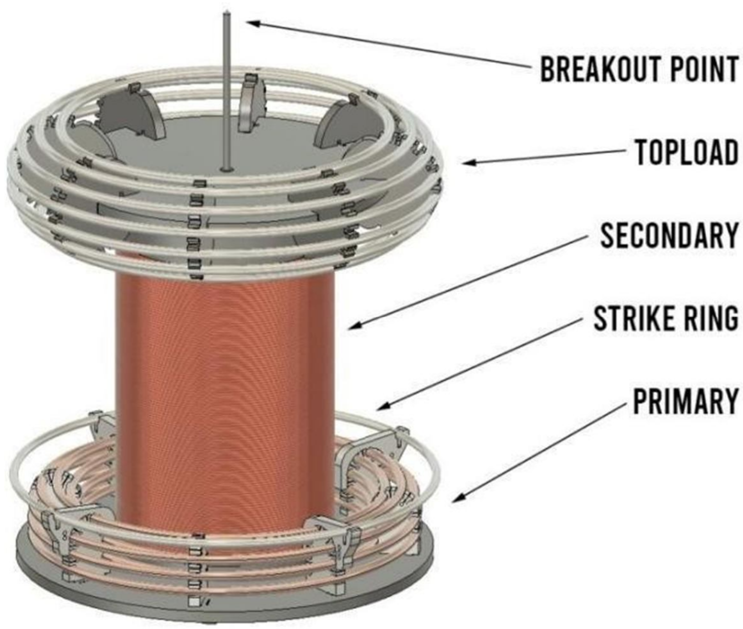
VII. PARTS OF TESLA COIL

1) Primary Coil
2) Secondary coil
3) Top load
4) Capacitor
5) Auto Transformer
6) Other components



A. *Primary Coil*

1) The primary coil is used with the primary capacitor to create the primary LC circuit.
2) The primary coils also responsible for transferring power to the secondary coil.

B. *Secondary Coil*

1) The secondary coil is used with the top load to create the secondary LC circuit.
2) Magnet wire is used to wind the coil.
3) There's always a little space between turns, so the equation assumes the coil turns are 97% perfect.

C. *Top Load*

1) The top load is used with the secondary coil to create the secondary LC circuit.
2) Generally, a toroid or sphere shape is used.
3) The ring diameter refers to the widest length from edge to edge of a toroid shape.

D. *Capacitor*

The primary capacitor is used with the primary coil to create the primary LC circuit.

E. *Auto Transformer*

1) It use to regulate the primary coil voltage.
2) Its use to increase the voltage in tesla coil.

VIII. AIR DISCHARGES

A small, later-type Tesla coil in operation: The output is giving 43-cmsparks. The diameter of the secondary is 8 cm. The power source is a 10 000 V, 60 Hz current-limited supply. While generating discharges, electrical energy from the secondary and toroid is transferred to the surrounding air as electrical charge, heat, light, and sound. The process is similar to charging or discharging a capacitor.

The current that arises from shifting charges within a capacitor is called a displacement current. Tesla coil discharges are formed as a result of displacement currents as pulses of electrical charge are rapidly transferred between the high-voltage toroid and nearby regions within the air (called space charge regions). Although the space charge regions around the toroid are invisible, they play a profound role in the appearance and location of Tesla coil discharges.

When the spark gap fires, the charged capacitor discharges into the primary winding, causing the primary circuit to oscillate. The oscillating primary current creates a magnetic field that couples to the secondary winding, transferring energy into the secondary side of the transformer and causing it to oscillate with the toroid capacitance. The energy transfer occurs over a number of cycles, and most of the energy that was originally in the primary side is transferred into the secondary side. The greater the magnetic coupling between windings, the shorter the time required to complete the energy transfer. As energy builds within the oscillating secondary circuit, the amplitude of the toroid's RF voltage rapidly increases, and the air surrounding the toroid begins to undergo dielectric breakdown, forming a corona discharge.

As the secondary coil's energy (and output voltage) continues to increase, larger pulses of displacement current further ionize and heat the air at the point of initial breakdown. This forms a very conductive "root" of hotter plasma, called a leader that projects outward from the toroid.

The plasma within the leader is considerably hotter than a corona discharge, and is considerably more conductive. In fact, its properties are similar to an electric are. The leader tapers and branches into thousands of thinner, cooler, hair-like discharges (called streamers). The streamers look like a bluish "haze' at the ends of the more luminous leaders, and transfer charge between the leaders and toroid to nearby space charge regions.

The primary break rate of sparking Tesla coils is slow compared to the resonant frequency of the resonator-top load assembly. When the switch closes, energy is transferred from the primary LC circuit to the resonator where the voltage rings up over a short period of time up culminating in the electrical discharge.

In a spark gap Tesla coil, the primary-to-secondary energy transfer process happens repetitively at typical pulsing rates of 50-500 times per second, and previously formed leader channels do not get a chance to fully cool down between pulses. So, on successive pulses, newer discharges can build upon the hot pathways left by their predecessors.

This causes incremental growth of the leader from one pulse to the next, lengthening the entire discharge on each successive pulse. Repetitive pulsing causes the discharges to grow until the average energy available from the Tesla coil during each pulse balances the average energy being lost in the discharges (mostly as heat). At this point, dynamic equilibrium is reached, and the discharges have reached their maximum length for the Tesla coil's output power level.

The unique combination of a rising h.igh-voltage radio frequency envelope and repetitive pulsing seem to be ideally suited to creating long, branching discharges that are considerably longer than would be otherwise expected by output voltage considerations alone.

High-voltage discharges create filamentary multibranched discharges which are purplish-blue in color. High-energy discharges create thicker discharges with fewer branches, are pale and luminous, almost white, and are much longer than low-energy discharges, because of increased ionization. A strong smell of ozone and nitrogen oxides will occur in the area. The important factors for maximum discharge length appear to be voltage, energy, and still air of low to moderate humidity.

IX. TUNING PRECAUTIONS

The primary coil's resonant frequency is tuned to that of the secondary, using low-power oscillations, then increasing the power until the apparatus has been brought under control. While tuning, a small projection (called a "breakout bump") is often added to the top terminal in order to stimulate corona and spark discharges (sometimes called streamers) into the surrounding air. Tuning can then be adjusted so as to achieve the longest streamers at a given power level, corresponding to a frequency match between the primary and secondary coil. Capacitive "loading" by the streamers tends to lower the resonant frequency of a Tesla coil operating under full power. For a variety of technical reasons, toroid provide one of the most effective shapes for the top terminals of Tesla coils.

X. COMPONENT DESCRIPTION

A. Resistor

A resistor is a component that opposes a flowing current. Every conductor has a certain resistanceif one applies a potential difference V at the terminals of a resistor, the current I passing throughit is given by

I=V/R

This formula is known as Ohm's Law. The SI unit of resistance is Ohm (12). One can show thatthe power p(in J/s) dissipated due to a resistance is equal to

$P=VI=R^2$

B. Capacitors

A Capacitor is a component that can store energy in the form of an electric field. Less abstractly, it is composed in its most basic form of two electrodes separated by a dielectric medium. If there is a potential difference V between those two electrodes, charges will accumulate on those electrodes: a charge Q on the positive them. If both of the electrode and an opposite charge Q on the negative one. An electrical field therefore arises between them. If both of the electrodes carry the same amount of charge, one can write

Q=CV

Where C is the capacity of the capacitor. Its unit is the Farad (F). The energy E stored a capacitor (in Joules) is given by

E= (1/2) QV = (1/2) CV2

Where one can note that the dependence in the charge Q shows that the energy is indeed the energy of the electric field. This corresponds to the amount of work that has to be done to place the charges on the electrodes.

C. Inductors

An inductor stores the energy in the form a magnetic field. Every electrical circuit is characterized by a certain inductance. The auto-inductance of a circuit measures its tendency to oppose a change in current: when the current changes, the flux of magnetic field that crosses the circuit changes. That leads to the apparition of an "electromotive force" & that opposes this change.

D. Impedances

The impedance of a component expresses its resistance to an alternating current (i.e., sinusoidal). This Quantity generalizes the notion of resistance. Indeed, when dealing with alternating current a component can act both on the amplitude and the phase of the signal.

E. LC Circuit

An LC circuit is formed with a capacitor C and an inductor L connected in parallel or in series to a sinusoidal signal generator. The understanding of this circuit is at the very basis of the Tesla coil functioning, hence the following analysis. The primary and secondary circuits of a Tesla coil are both series LC circuits that are magnetically coupled to a certain degree. We will therefore only look at the case of the series LC circuit.

F. Resonant Frequencies

In our analysis of the LC circuit, we found that the oscillations of current and voltage naturally occurred at a precise angular speed, uniquely determined by the capacitance and inductance of the circuit. Without other effects, oscillations of current and voltage will always take place at this angular speed

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G. Magnetic Wires

Magnet wire or enameled wire is a copper or aluminum wire coated with a very thin layer of insulation. It is used in the construction of transformers, inductors, motors, speakers, hard disk head actuators, electromagnets, and other applications which require tight coils of wire.

The wire itself is most often fully annealed, electrolytic ally refined copper. Aluminum magnet wire is sometimes used for large transformers and motors. An aluminum wire must have 1.6 times the cross-sectional area as a copper wire to achieve comparable DC resistance.

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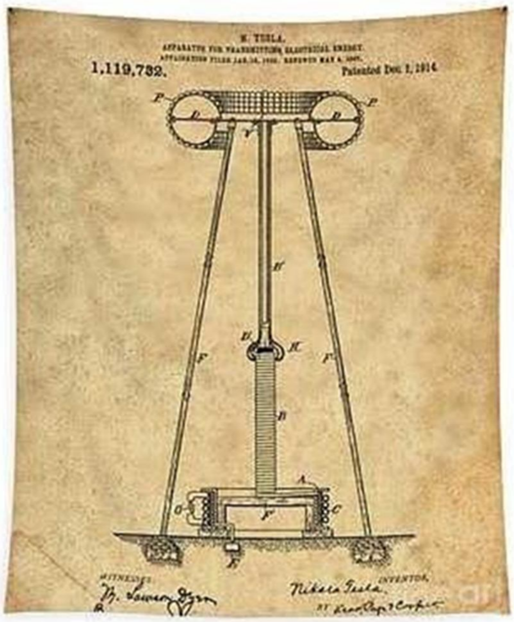
XI. TESLA COIL WORKING PRINCIPLE

This coil has the ability to produce output voltages up to several million volts based upon the size of the coil. The Tesla coil works on a principle to achieve a condition called resonance. Here, the primary coil emits huge amounts of current into the secondary coil to drive the secondary circuit with maximum energy. The fine-tuned circuit helps to shoot the current from primary to secondary circuit at a tuned resonant frequency. This coil uses a specialized transformer called a resonant transformer, a radio-frequency transformer, or an oscillation transformer. The primary coil is connected to the power source and the secondary coil of a transformer is coupled loosely to ensure that it resonates. The capacitor connected in parallel with the transformer circuit acts as a tuning circuit or an LC circuit to generate signals at a specific frequency. The primary of the transformer, otherwise referred to as a resonant transformer stepsup to generate very high levels of voltage ranging between 2kv to 30 kV, which in turn chargesthe capacitor. With the accumulation of massive amounts of charge in the capacitor, eventually,breaks down the air of the spark gap. The capacitor emits a huge amount of current through theTesla Coil (L1, L2), which in turn generates a high voltage at the output.



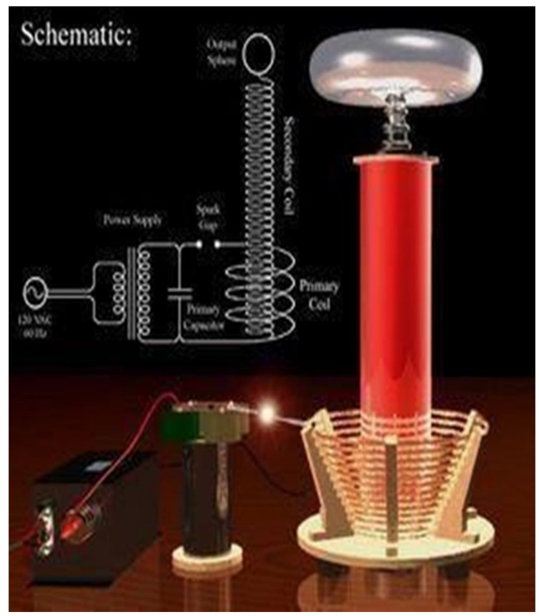


Fig: 6.1 working of tesla coil

XII. APPLICATION

At present, these coils do not require large complex circuits to produce high voltage. Nevertheless,small Tesla coils find their applications in a range of sectors.

1) Aluminum welding
2) Cars use these coils for the spark plug ignition
3) Created Tesla coil fans, used to generate artificial lighting, sounds like music Tesla coils inEntertainment and Education industry are used as attractions at electronics fairs and sciencemuseums
4) High vacuum systems and arc lighters
5) Vacuum system leak detectors
6) Medical X-ray devices
7) Wireless transmission and reception
8) Electrical stage shows entertainment
9) Induction coils

Tesla coil circuits were used commercially in spark gap radio transmitters for wireless telegraphy until the 1920s, and in electrotherapy and pseudo medical devices such as violet. Today, their main use is entertainment and educational displays. Tesla coils are built by many high-voltage enthusiasts, research institutions, science museums, and independent experimenters. Although electronic circuit controllers have been developed. Tesla's original spark gap design is less expensive and has proven extremely reliable.

XIII. 1902 DESIGN

Tesla's 1902 design for his advanced magnifying transmitter used a top terminal consisting of a metal frame in the shape of a toroid, covered with hemispherical plates (constituting a very large conducting surface). The top terminal has relatively small capacitance, charged to as high a voltage as practicable. The outer surface of the elevated conductor is where the electrical charge chiefly accumulates. It has a large radius of curvature, or is composed of separate elements which, irrespective of their own radii of curvature, are arranged close to each other so that the outside ideal surface enveloping them has a large radius.

XIV. WIRELESS TRANSMISSION AND RECEPTION

The Tesla coil can also be used for wireless transmission. In addition to the positioning of the elevated terminal well above the top turn of the helical resonator, another difference from the sparking Tesla coil is the primary break rate. The optimized Tesla coil transmitter is a continuous wave oscillator with a break rate equaling the operating frequency. The combination of a helical resonator with an elevated terminal is also used for wireless reception. The Tesla coil receiver is intended for receiving the no radiating electromagnetic field energy produced by the Tesla coil transmitter. The Tesla coil receiver is also adaptable for exploiting the ubiquitous vertical voltage gradient in the Earth's atmosphere. Tesla built and used various devices for detecting electromagnetic field energy. His early wireless apparatus operated on the basis of Hertzian waves or ordinary radio waves, electromagnetic waves that propagate in space without involvement of a conducting guiding surface.

Tesla stated one of the requirements of the World Wireless System was the construction of resonant receivers. The related concepts and methods are part of his wireless transmission system (US1119732-Apparatus for Transmitting Electrical Energy-1902 January 18). Tesla made a proposal that there needed to be many more than 30 transmission-reception stations worldwide. In one form of receiving circuit, the two input terminals are connected each to a mechanical pulse- width modulation device adapted to reverse polarity at predetermined intervals of time and charge a capacitor. This form of Tesla system receiver has means for commutating the current impulses in the charging circuit so as to render them suitable for charging the storage device, a device for closing the receiving-circuit, and means for causing the receiver to be operated by the energy accumulated. A Tesla coil used as a receiver is referred to as a "Tesla receiving transformer.

The Tesla coil receiver acts as a step-down transformer with high current output. The parameters of a Tesla coil transmitter are identically applicable to it being a receiver (e.g... an antenna circuit), due to reciprocity, Impedance, generally though, is not applied in an obvious way; for electrical impedance, the impedance at the load (e.g... where the power is consumed) is most critical and, for a Tesla coil receiver, this is at the point of utilization (such as at an induction motor) rather than at the receiving node. Complex impedance of an antenna is related to the electrical length of the antenna at the wavelength in use. Commonly. impedance is adjusted at the load with a tuner or a matching network composed of inductors and capacitors. A Tesla coil can receive electromagnetic impulses from atmospheric electricity and radiant energy, besides normal wireless transmissions. Radiant energy throws off with great velocity minute particles which are strongly electrified and other rays falling on the insulated-conductor connected to a condenser (i.e., a capacitor) can cause the condenser to indefinitely charge electrically. The helical resonator can be "shock excited" due to radiant energy disturbances not only at the fundamental wave at one-quarter wavelength but also is excited at its harmonies.

Hertzian methods can be used to excite the Tesla coil receiver with limitations that result in great disadvantages for utilization, though. The methods of ground conduction and the various induction methods can also be used to excite the Tesla coil receiver, but are again at a disadvantage for utilization. The charging-circuit can be adapted to be energized by the action of various other disturbances and effects at a distance.

While Tesla coils can be used for these purposes, much of the public and media attention is directed away from transmission-reception applications of the Tesla coil since electrical spark discharges are fascinating to many people. Regardless of this fact, Tesla did suggest this variation of the Tesla coil could use the phantom loop effect to form a circuit to induct energy from the Earth's magnetic field and other radiant energy sources (including, but not limited to, electrostatics). With regard to Tesla's statements on the harnessing of natural phenomena to obtain electric power, he stated: Ere many generations pass, our machinery will be driven by a power obtainable at any point of the universe. - "Experiments with Alternate Currents of High Potential and High Frequency" (February 1892) Tesla stated that the output power from these devices, attained from Hertzian methods of charging, was low, but alternative charging means are available. Tesla receivers, operated correctly, act as a step-down transformer with high current output. To date, no commercial power generation entities or businesses have used this technology to full effect. The power levels achieved by Tesla coil receivers have, thus far, been a fraction of the output power of the transmitters.

XV. INSTANCES AND DEVICES

Tesla's Colorado Springs laboratory possessed one of the largest Tesla coils ever built, known as the "Magnifying Transmitter". The Magnifying Transmitter is somewhat different from classic two-coil Tesla coils. A magnifier uses a two-coil 'driver' to excite the base of a third coil ('resonator') located some distance from the driver. The operating principles of both systems are similar. The world's largest currently existing two-coil Tesla coil is a 130,000-watt unit; part of a 38-foot- tall (12 m) sculpture owned by Alan Gibbs and currently resides in a private sculpture park at Kakanui Point near Auckland, New Zealand. The Tesla coil is an early predecessor (along with the induction coil) of a more modern device called a flyback transformer, which provides the voltage needed to power the cathode ray tube used in some televisions and computer monitors. The disruptive discharge coil remains in common use as the "ignition coil' or 'spark coil in the ignition system of an internal combustion engine. These two devices do not use resonance to accumulate energy, however, which is the distinguishing feature of a Tesla coil. They do use inductive "kick", the forced, abrupt decay of the magnetic field, such that the voltage provided by the coil at its primary terminals is much greater than the voltage applied to establish the magnetic field, and this higher voltage is then multiplied by the transformer turns ratio. Thus, they do store energy, and Tesla resonator stores energy. A modern, low-power variant of the Tesla coil is also used to power plasma globe sculptures and similar devices.

Scientists working with a glass vacuum line (e.g., chemists working with volatile substances in the gas phase, inside a system of glass tubes, taps and bulbs) test for the presence of tiny pin holes in the apparatus (especially a newly blown piece of glassware) using high-voltage discharges, such as a Tesla coil produces. When the system is evacuated and the discharging end of the coil moved over the glass, the discharge travels through any pin hole immediately below it and thus illuminates the hole, indicating points that need to be annealed or reblown before they can be used in an experiment.

XVI. LIMITATIONS OF WIRELESS ELECTRICITY TRANSMISSION

1) High power losses.
2) Non-directionality.
3) Not efficient for long distances.

XVII. ELIMINATION OF WIRELRSS ELECTRICITY LIMITATIONS

1) High power can be eliminated by reducing resistance.
2) By using bundled conductors.
3) Good conductor maintenance.
4) Reduction of skin effect.

XVIII. FUTURE OF TESLA COIL

1) Transmission of electrical energy from power source to an electrical load withoutusing wires.
2) Different from cellular transmission of signals.
3) Made a wire free world. Electric automobile charging

XIX. CONCLUSION

The goal of this project was extend my knowledge of electrical electronics engineering and shed some light on the technical and artistic nature of Tesla coils, while attempting to create a unique and tesla coil. The coil that was created was capable of producing spark and spark was limited only by the lack of properly functioning of equipment. While there are a number of improvements that could be made the project served its initial purpose in creating a coil capable of acting as a power source and illuminating the finer points of creating such a coil.

While designing the tesla coil, we learned many things from our high voltage concepts and it also helpful in brush up of our knowledge in practical application. The main aim was to build and see the practical application of witricity i.e., wireless transmission of electricity.

Analyses of very simple improve mentation geometries provide encouraging performance characteristics and further improvement is expected with serious design optimization. Thus, the proposed mechanism is promising for many modern applications. We tried to design the unique tesla coil combining both electronics and electrical. By this project we minimized the distance between the electronics and electrical components as practical aspects.

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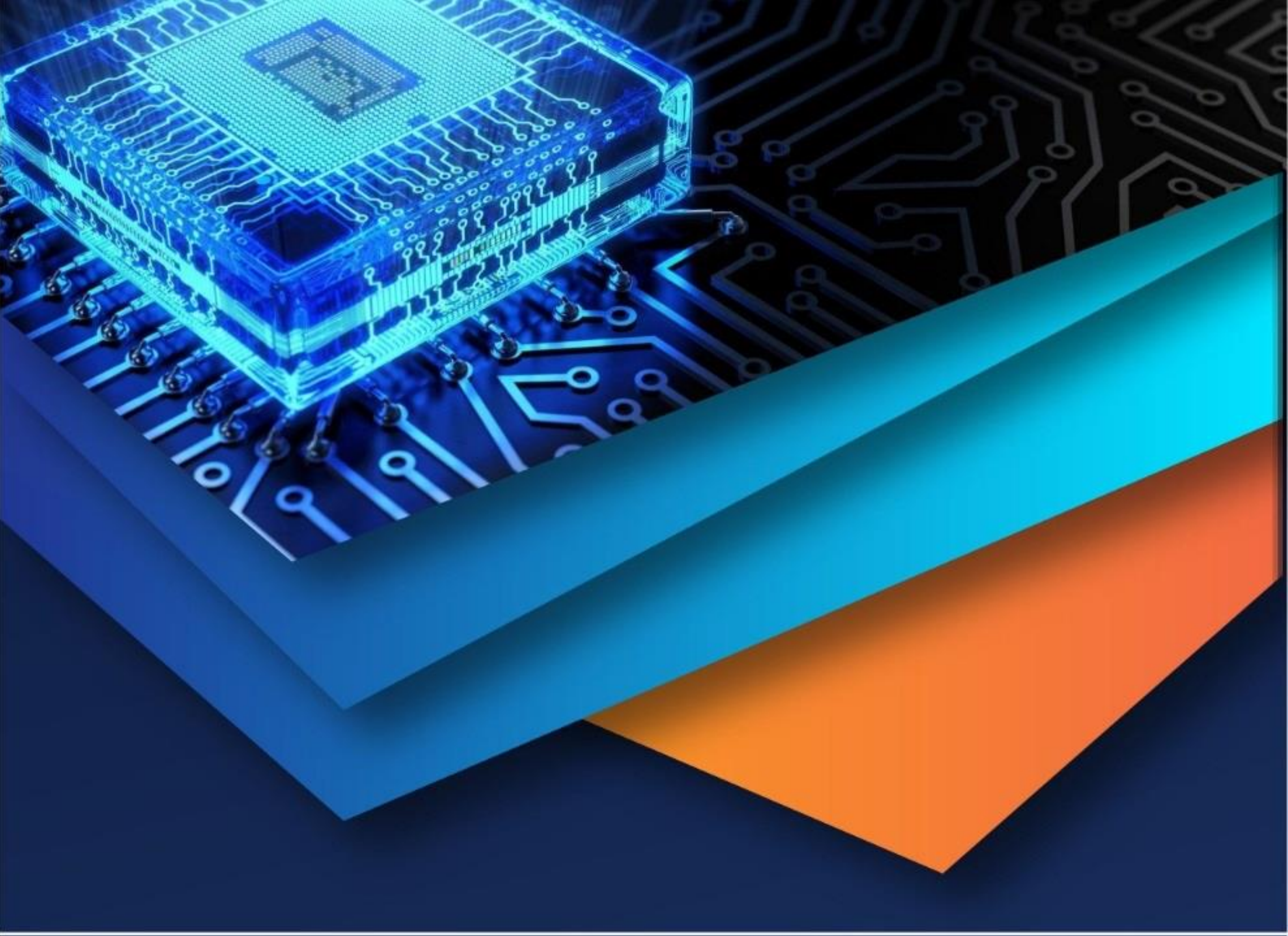

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