

TESLA'S NEW ELECTRICITY: MISUNDERSTOOD AND FORGOTTEN

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Abstract

Tesla's concept, methodology and inventions for the transmission of electricity are legitimate but very different from the electricity of today as we know it. For example, we consider air to be an insulator but Tesla showed us huge, man-made electric spark flying through air. We consider an electrical device to be in operation when a closed-circuit condition is formed according to the circuit theory; however, Tesla showed us that under the condition of electrical resonance, electricity can flow more freely in a single-wire without return. Tesla stated that EM-Hertz waves are radiations and suffer terrible losses, whereas his wireless electricity is like longitudinal sound waves or incompressible fluid, and can travel great distance without significant loss.

In this article and presentation, it will be demonstrated that our understanding of electricity is incomplete just like, without fractions, real numbers are incomplete with integers alone; without reactance, our understanding of impedance is incomplete with resistance alone. It is imperative that scientists and engineers of today understand electricity as Tesla did in order to gain a more complete understanding of electricity and magnetism for the sustainable benefit of humanity.

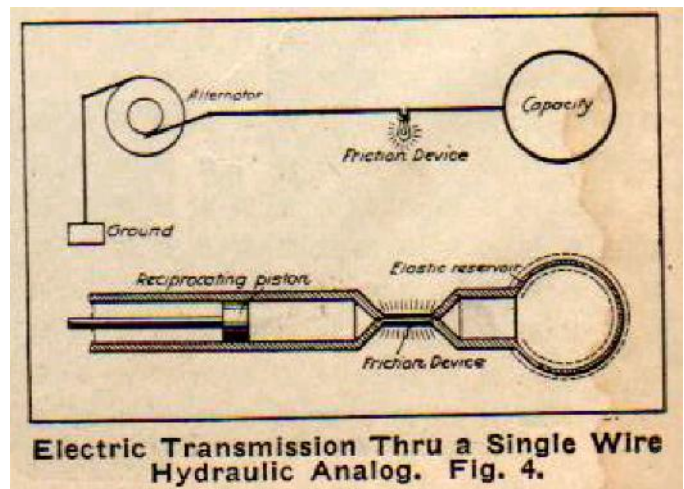
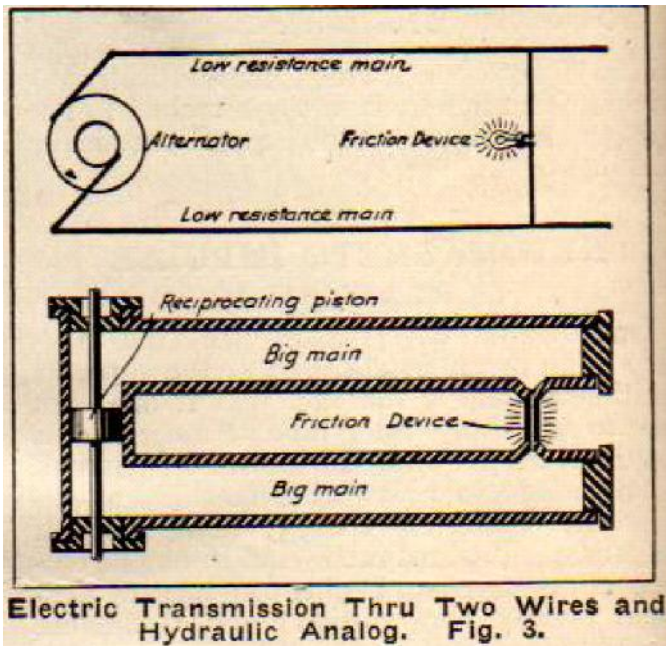
Introduction

Tesla was a very careful and attentive investigator, thinking both deeply and clearly. While his contemporaries may overlook a seemingly unimportant anomaly, Tesla apparently can not satisfy himself when theory and observation or experiment doesn't exactly match. For example, it was a common believe that the moon rotates around the earth the same way the earth rotates around the sun. However, expounded on the fact that we never see the back side of the moon anywhere from planet earth, Tesla gave detailed mathematical arguments that axial rotation of the moon is really an illusion. He also pointed out the fallacy that the Franklin's lightning-rod, contrary to common believe, actually causes lightning to strike more often. His independent and critical thinking style naturally caused hostility upon himself from all sides. More importantly, he argued that Hertzian transverse electro-magnetic wave is but energy loss, whereas his wireless electricity is longitudinal, is non-radio in nature, is recoverable in its entirety and proceeds at a varying speed that can be faster than the speed of light. Despite his efforts to proof and develop his wireless electric power transmission, his work has fallen into deaf ears, and his wireless electricity is seriously misunderstood and forever lost. (Ref: February, April and June 1919 issues of 'Electrical Experimenters').

While Tesla worked endless hours to put his inventions into perfection, the philosophical concept of his works is often very simple. For example, central to his world or cosmic view is that we are living in an electric universe and that electric power is everywhere present in unlimited quantities. He envisioned the Niagara Fall as nature's working endlessly in completing the ecological cycle. So instead of the destruction energy process of combustion via the use of coal, oil, gas, or other fuels, he worked endlessly to master and perfect the art of transforming energy from one form to another and from one quality to another, synchronizing with nature. He was way ahead of his time. When others were working on DC, he was already working with AC; when others were working on AC, he was already working with pulsed electricity and resonances. At a very young age, he developed incandescent lamp and envisioned it feasible of a DC generator and motor without any brush. Then he envisioned the creation of rotating magnetic field similar to the rotation of celestial bodies. One discovery led to the next, he later perfected the art of controlling electric impulses, refining electric transformers via multiple resonances, developing his unique magnifying transformer, creating high frequency, high pressure electric current, followed by single-wire electricity, wireless power, X-ray, ozone generator, remote controlled boat, radar, etc.

Single Wire Electricity with no Return

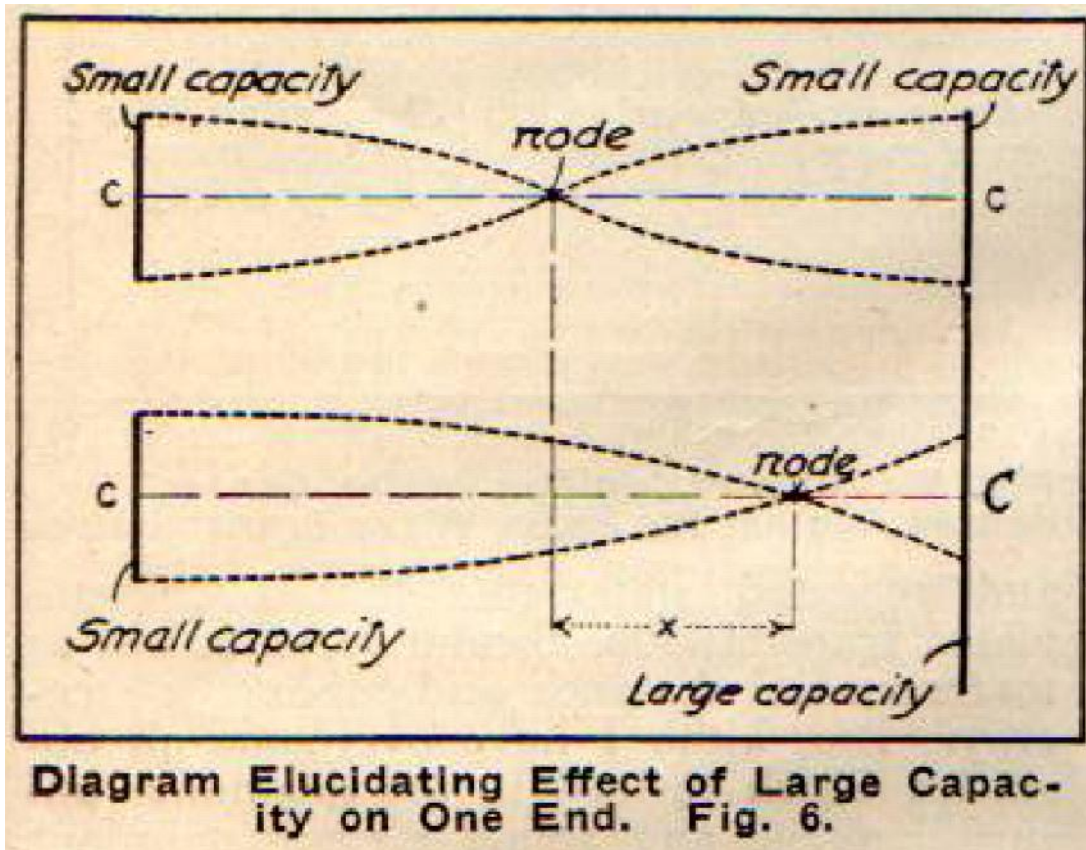
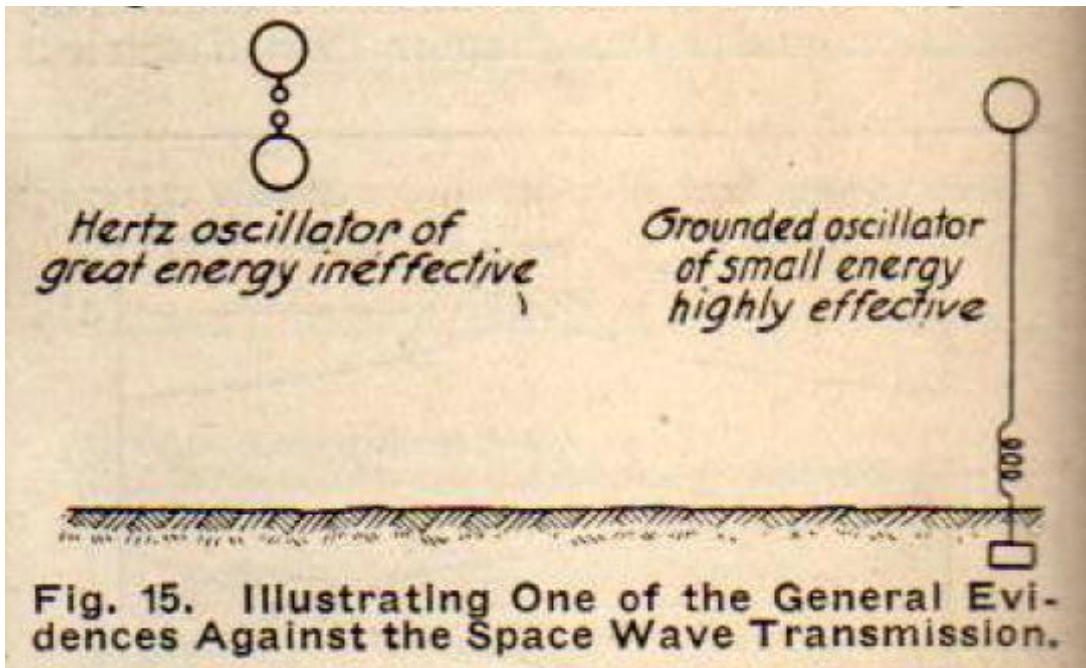
In "The True Wireless" published in May 1919 of Electrical Experimenter, Tesla described clearly the principle of his single wire electricity, and how it differs distinctly from the accepted principle and dogma of the closed-loop electricity. In Figure 3 of the article, the hydraulic analogy for a closed-loop circuit is given where the light bulb is represented by the narrowing of the fluid passage, while the alternator corresponds to the driving piston. The circuitry can be seen as a rigid container, inside which the fluid or electricity would flow. Hence, a closed-passage is needed to transfer the energy back and forth. In Figure 4 of the article, the hydraulic analogy for the single-wire electricity is given where the light bulb is again represented by the narrowing of the fluid passage, while the capacity ball corresponds to the elastic container or reservoir. Evidently with an elastic container, a closed-passage or closed-loop circuit is no longer needed to transfer the energy back and forth. Though appears simple, it takes a genius mind to come up with the idea of an elastic container when everybody else is stuck with the concept of a rigid container in this case.



Wireless Electric Energy Transmission through the Earth

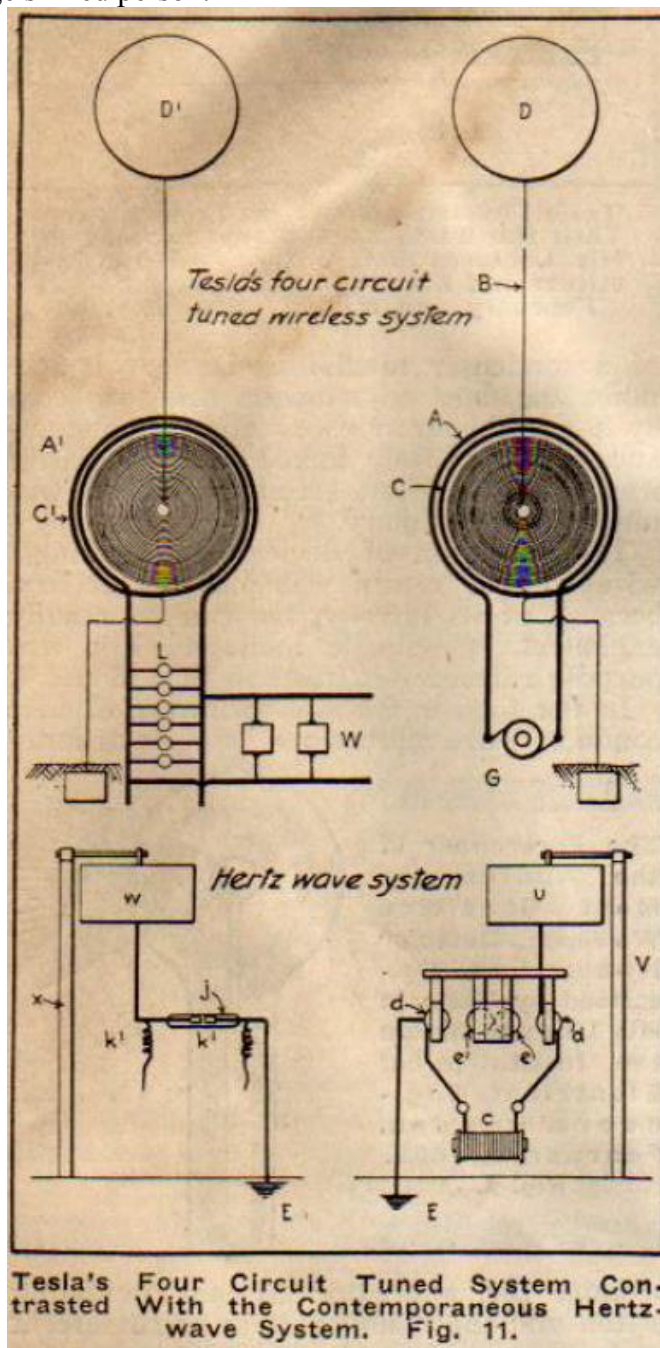
Today it is generally accepted that wireless radio propagates through space via transverse electromagnetic Hertzian waves. However, in Figure 15 of the article "The True Wireless", Tesla pointed out that the pure Hertzian oscillator of the left is ineffective in transmission, while the grounded oscillator of his in the right is highly effective. This was the topic of debate and legal issue between Marconi and Tesla, and why all transmission towers are grounded today. Perhaps, the only pure Hertzian oscillator today is the walkie-talkie and no doubt cannot operate over significant distances.

Consider Figure 6 of the same article where Tesla depicted the series induction-capacitance oscillation as two end-capacity "cc" connected in the middle by the inductor "2L". At resonance, the node is found in the middle and the peaks are found at the two ends. However, if one of the end-capacity is larger, then the node will shift towards the larger capacity. Tesla used this illustration to show that the planet earth is the very large capacity in this case and the node, therefore, shifts all the way to the right on the earth surface with his transmitter (shown horizontal in Fig. 6).

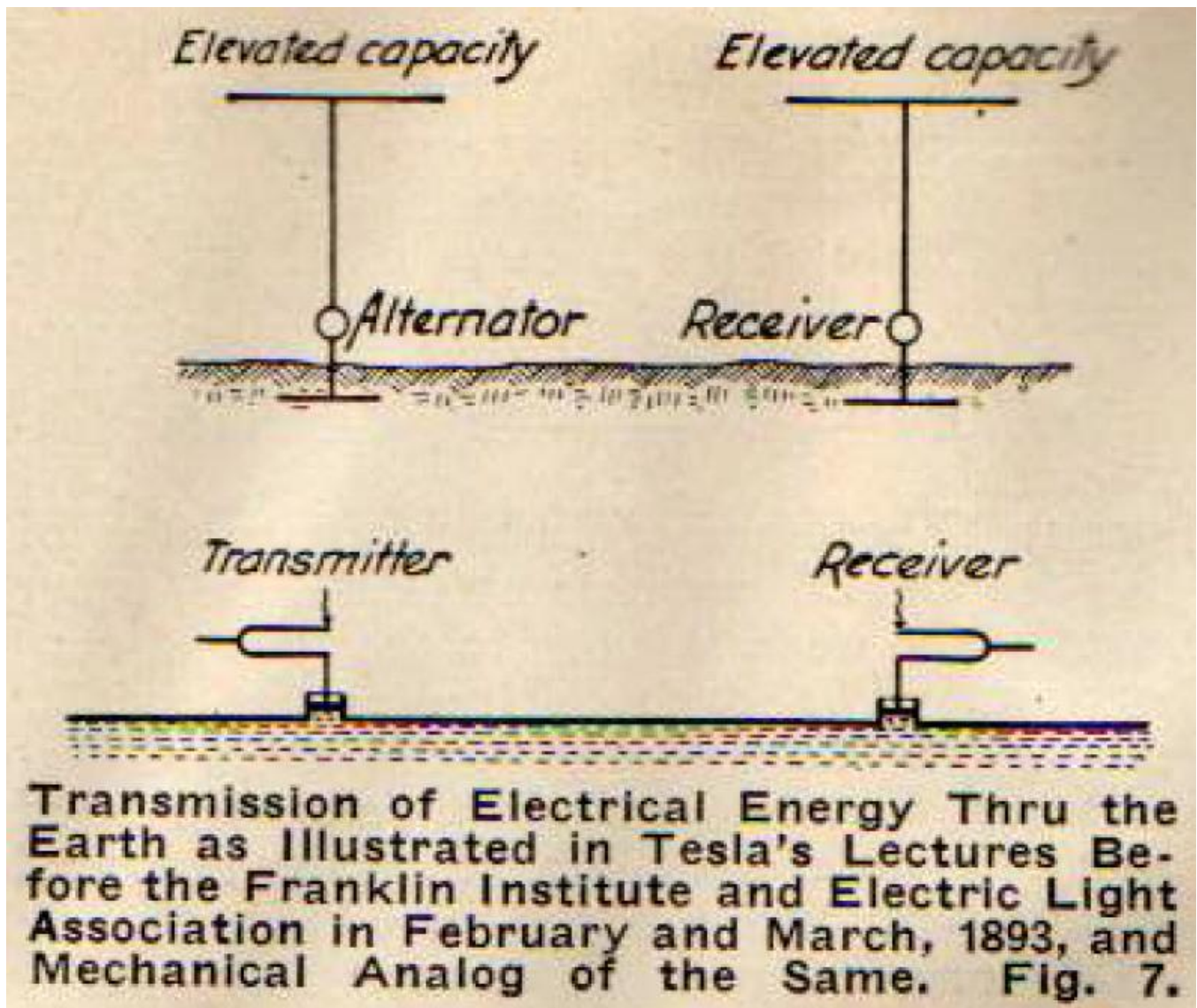


To obtain tremendous oscillation at resonance, Tesla made use of many different ways to magnify the standing wave effect over and over again. Firstly, he made use of the quarter-wavelength secondary coil. In Figure 11 of the same article, the length of the secondary transmit pancake coil C is of quarter wavelength (primary coil C' in the receiver). With an inductive quarter-wavelength coil, the outside end of the coil will be at the node (i.e., at zero degree of the sine wave magnitude) while the inner end will be free to oscillate at some maximum (i.e., at 90 degree of the sine wave magnitude). Secondly, after the

inductance of the quarter-wavelength coil is measured or calculated, the elevated capacity D (and D') is chosen to resonant with the inductance according to the well-known inductance-capacitance resonance condition. These are just 2 of the many ways used in his magnifying transformer and they are the easiest to understand by an average skilled person.



In Figure 7 of the article, Tesla gave an acoustical analogy to his wireless electrical transmission system. With an active acoustical tuning fork or transmitter placed on the table, a passive but identically tuned receiver will vibrate when placed on the table, as the table (and air) becomes the propagation medium. In like manner, the earth (and the ionosphere) is the propagation medium in the wireless electrical transmission case.

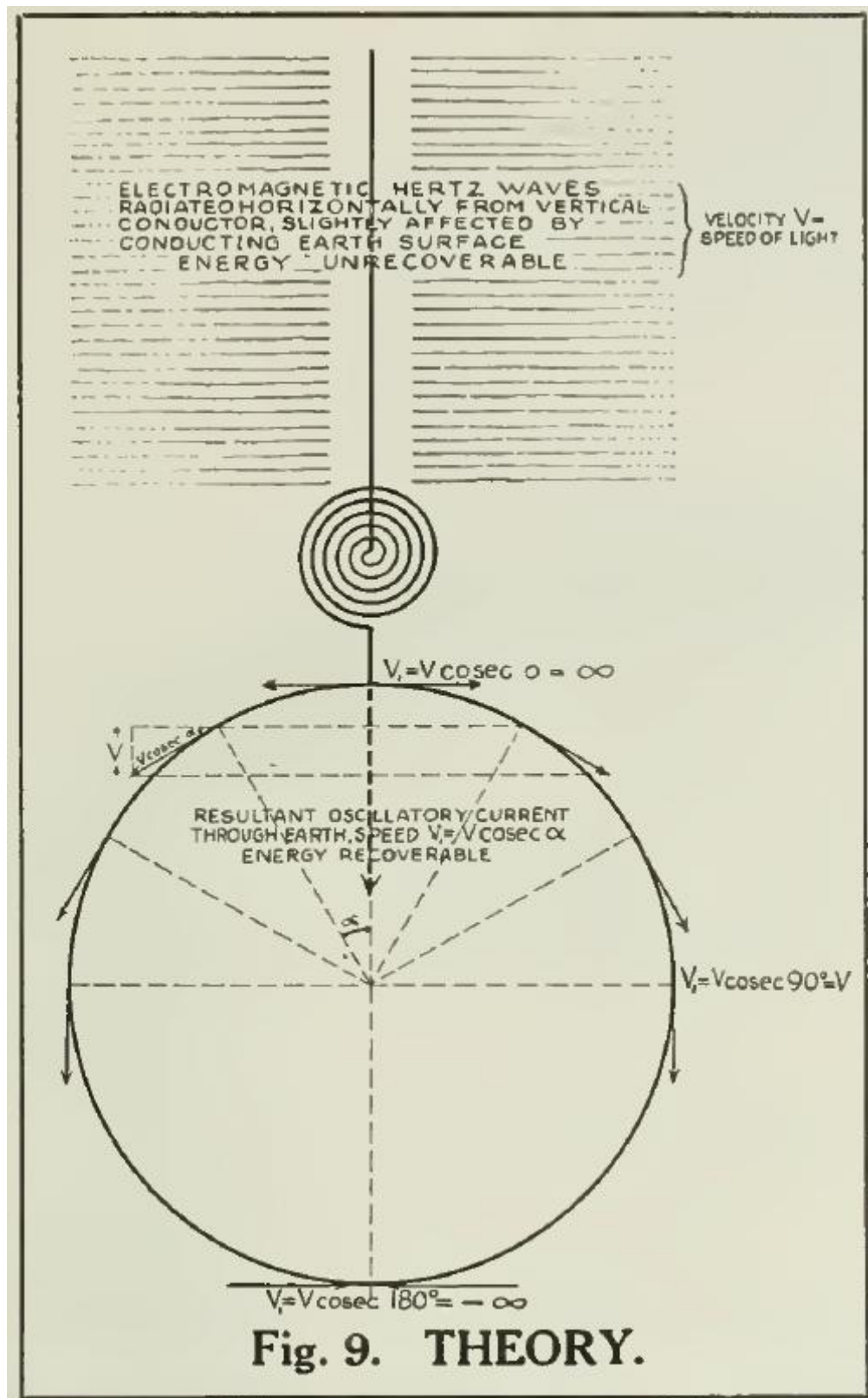


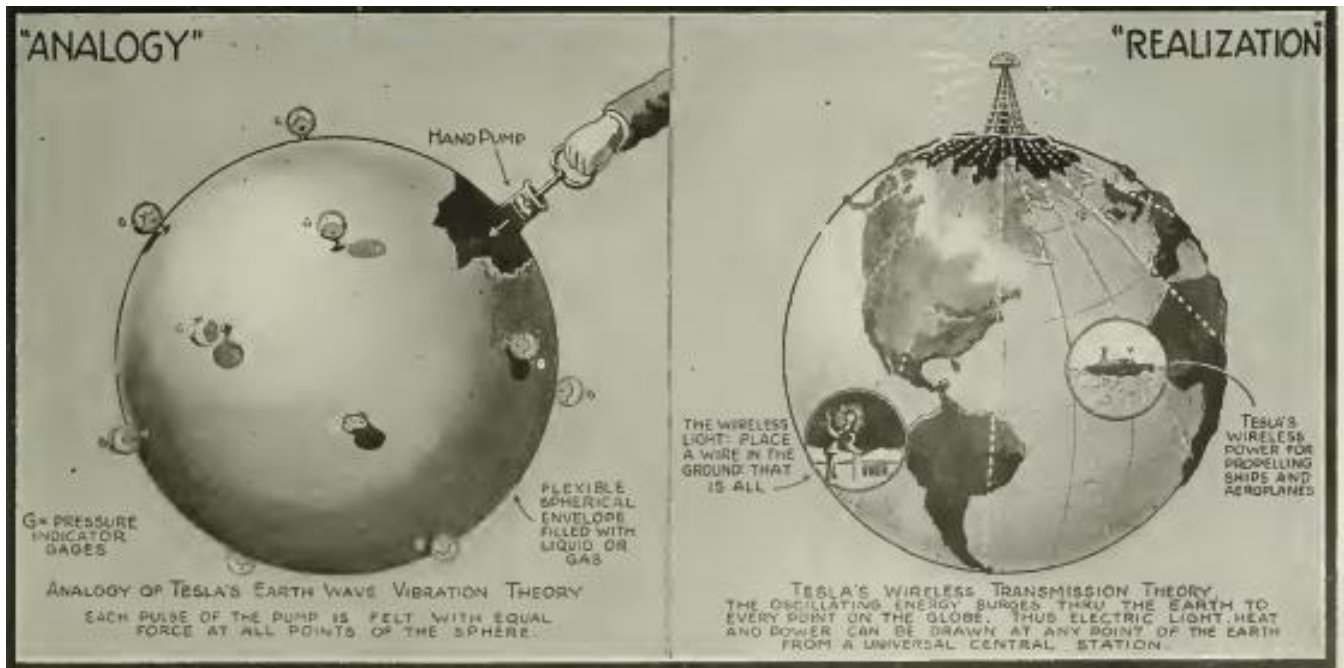
But how could the earth (non-metal) be an electrical conduction? In his March 5, 1904 article in *Electrical World and Engineer* titled "The Transmission Of Electric Energy Without Wires" Tesla described his experimental findings in Colorado Springs and stated that "*No doubt, whatever remained: I was observing stationary waves.*" While observing lightning and thunders with his sensitive earthed-receiver, Tesla apparently found that the earth is alive with electrical standing waves. In like manner, Tesla intended to create standing waves that travel around and through the earth, as seen from Figure 9 of his February 1919 *Electrical Experimenter* article titled "Famous Scientific illusions". In the figure, the waves that travel around the earth contain a cosec term that gives an almost infinite propagation speed at 0 and 180 degree away from the transmitter, which can be described as a hand pump in the subsequent figure.

Longitudinal vs. Transverse Electro-Magnetic Wave Propagation

Transverse electro-magnetic wave propagation is but one component of the electric wave phenomenon. The term transverse comes from the understanding that electric field, magnetic field and the direction of energy propagation are all 90 degree from each other. In basic algebra, this can be described whereby the vector product of the electric field and the magnetic field yield the energy propagation. However, if transverse electric wave is all that we have then, in algebra, one must ask "what happen to the dot product of the two vectors?" The dot product disappears or vanishes when the two vectors are orthogonal, but obtains the maximum value when the two vectors are parallel to one another. Now it is clear that scientists

had made a big assumption that electric field and magnetic field are always orthogonal to one another, but Tesla had been working on something completely different. This is particularly the case when electric and magnetic fields are parallel inside the elements of the inductive coil or transformer, as can be seen from the work of Eric Dollard, Charles Steinmetz, and Konstantin Meyl.





Tesla's World-Wide Wireless Transmission of Electrical Signals, As Well As Light and Power, is Here Illustrated in Theory, Analogy and Realization. Tesla's Experiments With 100 Foot Discharges At Potentials of Millions of Volts Have Demonstrated That the Hertz Waves Are Infinitesimal In Effect and Unrecoverable; the Recoverable Ground Waves of Tesla Fly "Thru the Earth". Radio Engineers Are Gradually Beginning to See the Light and That the Laws of Propagation Laid Down by Tesla Over a Quarter of a Century Ago Form the Real and True Basis of All Wireless Transmission To-Day.

Common Scientific Illusions

It is important that we consider the following and many other facts about electricity:

- Electricity flows both inside and outside of a circuit
- Longitudinal Electric Wave exist
- Electricity \neq electron flow like water flow inside pipe
- Tesla's wireless via earth ground and standing waves
- Capacitance and inductance are exact counterpart to each other
- Electric and magnetic field are not necessarily 90 degree to each other

Conclusions and Discussion

Almost 20 years after Tesla's effort to demonstrate the transmission of electric power without wire via the Wardenclyffe Tower, his autobiography "My Inventions" was published in the Electrical Experimenter in 1919. The president and editor of the magazine, H. Gernsback, noted in the editorial of the February 1919 issue the following statement:

It will come as a profound shock to all wireless enthusiasts, scientific and amateur alike, that their present-day notions on wireless are totally erroneous and not based upon actual facts. For years we clung to the theory that a wireless message radiates from the aerial wires of the sending station and speeds over the surface of the earth thru the ether towards the receiving station. We thought that we were sending out pure Hertzian waves from our transmitters. We thought that we received these waves over the aerial wires of our receiving station. All of these theories are wrong and will be relegated shortly into the past along with the early notion that the earth stood still, while the sun, moon and stars revolved around it.

Remain only the physical facts that we did send and did receive messages without wires — but they are not sent by means of pure Hertz waves, nor do they go by way of the ether as radiations.

In a highly illuminating article printed elsewhere in this issue, Nikola Tesla explodes all of our present orthodox views as to wireless propagation and makes it clear that the earth is the sole medium thru which our wireless impulses travel, in the form of true conduction. Particularly does this hold true for long distance messages: Here we are sending out a compound impulse three quarters of which is a

galvanic current, traveling thru the conducting earth, the other quarter or less is in the form of Hertz waves, going by way of the ether. This explains why we can send signals to airplanes and vice versa; but even here we probably have to do not with pure Hertz waves; it is almost certain that we have capacity-inductive effects as well.

Tesla maintaining that there can be no long distance effects by radiations transmitted thru the ether, but rather only by currents thru the earth, it follows that in his opinion all our radio apparatus is designed and operated faultily. Indeed, this is not a brand new idea of the famous inventor. He has been preaching it ever since he took out his first patents and described his system in 1893—long before Marconi thought of wireless. But he was preaching to a stone deaf scientific world.

But how simple it all becomes when we stop to apply a little reason and logic to Tesla's claims. For instance, we can send radio impulses three to five times as far over salt water as over land. Why? Simply because the impulses go thru the water, which is a much better conductor than earth alone. If we were sending pure Hertzian waves, why do we connect one wire at both sending and receiving station to the ground? Hertz never dreamt of such a thing. If you are still unconvinced that the earth is the chief medium of transmission, disconnect your ground wires entirely and try to send and receive. Now you may work with Hertz waves, but the distances you can bridge will be pitifully small.

Already Tesla's logic is filtering into our radio scientists' minds. All the big stations are beginning to scrap their towers and aerial wires, at least for receiving. They now bury their "aerial" wires in the ground, and lo ! they can receive signals twice as far as before. Incredible, but it is being done every day. And — wonders upon wonders — how we will laugh at our present and past blindness — the static interference is frantically gone the minute we pull our aerial wires down and bury them! Static Electricity? There never was a reason for having the bugaboo, for there is no "static" in the ground.

But Tesla goes much farther. In time he will show the world wireless power transmission effected not by ether waves but by currents thru the earth, which is a first rate conductor. Like all big things, the problem is simple. At some point on the globe he will erect a station powerful enough to charge the whole earth with electricity — and keep it charged. To do this we need about 10,000 kilowatts. Then at any point on the globe the current can be tapped by means of suitable apparatus. Like a bell ringing transformer, connected to your supply line, no current is consumed unless you close the secondary circuit. Tesla's world wireless works just that way. No current is consumed till it is tapt at the distant receiving station.

H. GERNSBACK

Tesla was a gentleman and gave himself unreserved for the well-being of humanity. In his writings, he often cheered the works and discoveries of others, as he was so very up-to-date about the works of his contemporaries. However, very few of his contemporaries gave reference to his work and contributions. He wanted to create a sustainable future where scarcity is a thing-of-the-past, where energy and resources are unlimited and distributed equally to everyone, where there will be no more greed and wars. It would please him greatly to see humanity transformed from a competitive to a cooperative civilization, with a positive shift in consciousness. He may be considered a dreamer, but he is not the only one as his dream is alive in us.

End Quote:

The scientists of today think deeply instead of clearly. One must be sane to think clearly, but one can think deeply and be quite insane. -- Nikola Tesla

Let the future tell the truth, and evaluate each one according to his work and accomplishments. The present is theirs; the future, for which I have really worked, is mine. -- Nikola Tesla



EDITORIAL

The New Wireless

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Editorial note by H. Gernsback in February 1919 issue of Electrical Experimenter