Free-Energy Research of Eric Dollard

A Collection of Contributions to
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FUNCTIONAL THINKING: An Interview With Eric Dollard
by Tom Brown

Eric P. Dollard, Wireless Engineer, is a scientist who bases his work on observation of phenomenon and practical experimentation. He is the Vice-President of BSRF and the author of five published papers on electrical phenomena: CONDENSED INTRO TO TESLA TRANSFORMERS, DIELECTRIC AND MAGNETIC DISCHARGES IN ELECTRICAL WINDINGS, SYMBOLIC REPRESENTATION OF ALTERNATING WAVES, SYMBOLIC REPRESENTATION OF THE GENERALIZED ELECTRIC WAVE (IN TIME), and THE THEORY OF WIRELESS POWER. In the course of Eric's research he has investigated the works of Nikola Tesla, Charles Proteus Steinmetz, Philo Taylor Farnsworth II, Johann Sebastian Bach, Wilhelm Reich and other true Scientists of our era. I have personally witnessed the propagation of electricity without wires, the phenomenon of drawing several inch sparks off insulators and mysterious living forms in plasma gas bulbs connected to Eric's Tesla apparatus. Eric speaks a knowledge gained by hands on experience. This interview will certainly change your point of view about the Borderlands of Science and will certainly shatter any preconceived notions you once had about Tesla, Free Energy, ELF, The American Dream, etc.....

Tom: What first interested you in the works of Nikola Tesla and electrical engineering in general.

Eric: I've always been interested in the subject. Years ago someone gave me a copy of Co-Evolution Quarterly that had an article on Tesla, Philo Farnsworth and Edwin Armstrong. That got me thinking about what was going on as I had basically reinvented the Tesla coil as a teenager using equipment given to me by RCA. Things started to connect at that point. Then I read PRODIGAL GENIUS (by John O'Neill) and it was like I was hit with a bolt of lightning. That book shocked me into action.

T: What do you think that Tesla was trying to attempt in his work?

E: Its hard to sum that all up in one phrase.

T: Would the culmination be the transmission of electrical energy without wires?

E: That was part of his projects, using what could be called true single phase electricity, or mono-polar electricity. That's the key to his transmission of electrical and mechanical energy - to convert it to a single phase form.

T: Would you say that monopolar electricity is electromagnetic?

E: No, its anti-electromagnetic.

T: You mentioned Philo Farnsworth, what type of work was he doing?

E: Farnsworth built the multipactor tube, a secondary emission, negative resistance tube. It tends to take off when connected to apparatus such as a Tesla coil and exhibit electrical oscillations.

T: So, to use a catch-word of the day, it was a free energy device?

E: Yes, probably the only real free energy device that anyone ever demonstrated which can be reproduced.

T: Was there any relationship between the work of Tesla and that of Farnsworth?

E: They are really in totally opposite directions. Farnsworth was the high master of electronics...he was electronics. No one knew more about the electron than Farnsworth. Tesla was dealing with ether type forces that don't involve material or atomic particles, they involve something a little finer than that.

T: You have worked extensively with Tesla coils and we have published your books on the subject. What do you feel is the actual use of these apparatus?

E: As a transmitter-receiver device, for transmitting energy without transmission towers or large arrays of dipoles, or equivalent.

T: What is the medium for the transmission of energy if wires are not used?

E: Whatever the general media is around us, call it the ether, or air or you can transmit it through the ground. Basically it just flows. The Tesla system is designed to transmit through the ground. There's a lot of talk about propagating through the earth-ionosphere wave guide, which Tesla, in no way, shape or form envisioned. Most of his apparatus are for transmission through a common conducting medium and the earth is the best conducting medium available. The devices are one conductor electrical generators - just connect one terminal to the common conducting medium and all the other or terminal devices will receive the energy. There's no pairs of wires or wave guides to bound the energy. These are what are called unbounded waves. The Tesla Magnifying Transmitter is a converter which converts electromagnetic energy into what is called magneto-dielectric energy.

T: What exactly is the dielectric side of electricity?

E: The side of electricity that represents the faster than light phenomenon.

T: How does the dielectric relate to Reich's orgone energy?

E: Reich found that the orgone and the dielectric field are basically one and the same. If a dielectric field has the proper pulsations then you could almost call it the orgone energy. An example of this is the orgone accumulator, which is alternating layers of dielectric and reflecting material, like a capacitor. The reflecting is usually called the conducting in electrical engineering work but this is based on misconceptions from the 18th and 19th century with regards to how electricity flows. Its well known that electricity doesn't flow through wires, but that's the conception that most people carry around in their heads. Of course people used to think the earth was flat, too. Reich's dogma assumed that the insulating or dielectric material had to be organic, but of course he was using glass wool and its stretching the term organic by applying it to glass wool. You could say the glass wool is organic because the silicone dioxide has two atoms of oxygen, but that's not really true.

T: Have you found any evidence in your research relating the dielectric field to orgone energy?

E: Yes, the cosmic superimposition effect. If you take a low pressure gas (in a bulb) and place it in two superimposed dielectric fields then you get spiral formations such as Reich wrote about in his book COSMIC SUPERIMPOSITION. These formations appear as spheres, galaxies and other cosmic forms.

T: So the high voltage terminal of a properly built Tesla transmitter puts out a dielectric field?

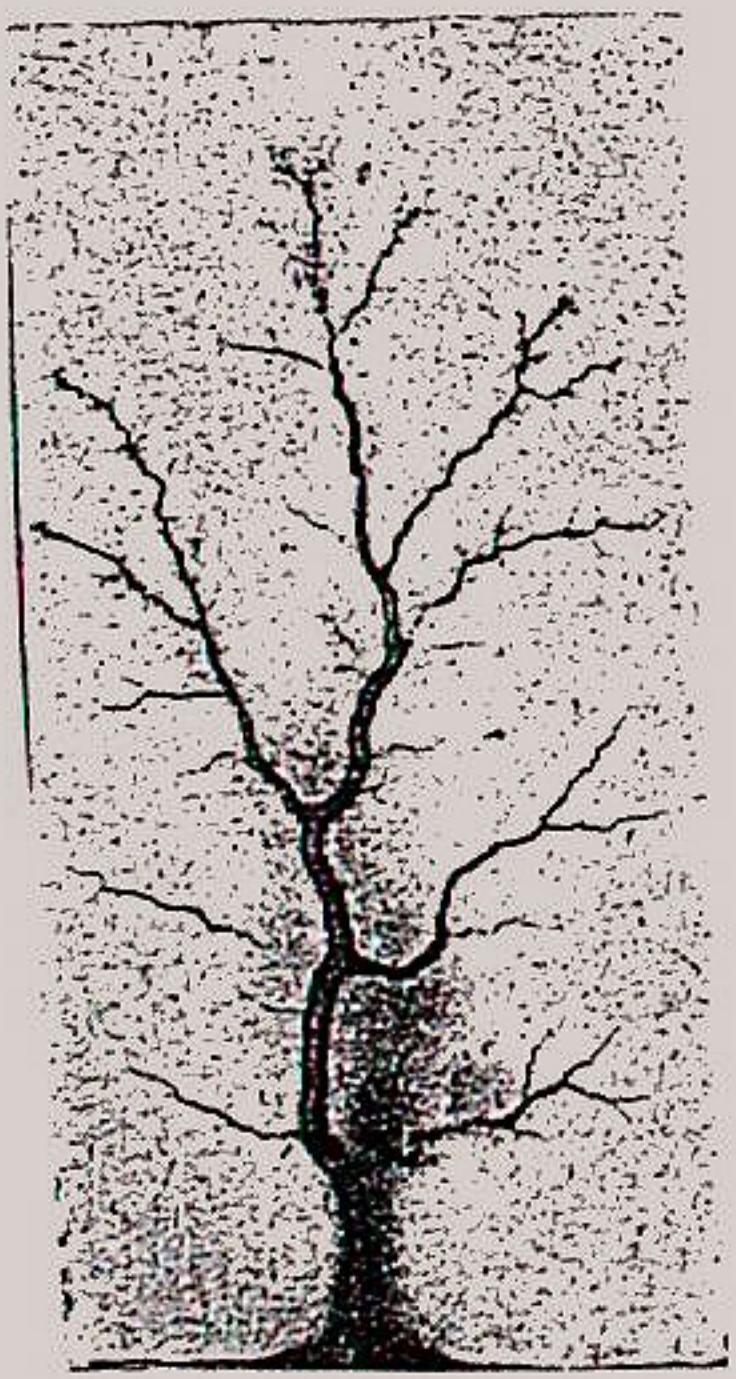
E: Right - a dielectric current - a current of many amperes flowing through free space without any electrons. This is a true electrical current.

T: Is this as you've demonstrated to me where you can draw a several inch spark off the insulator, which of course isn't supposed to happen?

E: Right, an insulator isn't supposed to conduct electricity so how can you draw a spark off of it? (laughter)

T: One thing I've noticed in these discharges is that they look like plants, like something organic, unlike regular discharges which look erratic and sparky. What explanation do you have for this?

E: Their shape is basically the Golden Ratio spiral. The log periodic spiral projecting out into space with all angles determined by the Golden Ratio. Now this is also the same shape that living objects form and you find that all discharges, in general, of potential energy will try to form this shape. You can see it in water patterns in sand and patterns in clouds in the sky. The patterns appear over and over and over again, just like the organic patterns burned into wood by the discharge of my Tesla coil. This is connected with the orgone right there. This type of monopolar electricity is in such a form that it will grow into organic patterns, a pre-life pattern from the ether itself. Any type of energy like this such as a stream flowing down the side of a mountain, a crack in a piece of window glass, or fresh water percolating up through the sand on a beach all make these organic patterns based on the Golden Ratio. Any time you have energy discharging you find this type of pattern. Of course this ties in directly with what Viktor Schauberger was saying. His work is actual proof of it. You can say there is a shape in space which is the log periodic spiral. It doesn't exist in a tangible form because it is something that grows and decays. Its size fits the wavelength and frequency of the amount of energy to be discharged. Its not like you can map space to see this particular spiral, but if you release energy into space then the spiral will appear.



Golden Ratio Discharge

T: I've heard that Tesla made references in his work to using a TMT for bringing in storms. Do you feel that there is any relationship between what Tesla was doing and what Reich was doing with his cloudbuster?

E: I haven't read too much information which indicates that Tesla was trying

to control the weather. He makes scant references here and there about how weather-like phenomena appear, such as fog appearing in his laboratory, but that wasn't Tesla's particular aim, where Reich's particular aim was in dealing directly with the actual forces. We have to remember that Tesla was a mechanistic, Victorian personality and he was trying to build machines that related to horsepower hours and BTUs and things everybody was concerned with at the time, and turn the globe into a giant amusement park.

T: Such as his plan to light up the atmosphere at night?

E: Right, you would never be able to see the stars, you'd just have the sound of electrical apparatus roaring everywhere. People weren't ready for Nikola Tesla.

T: I get the feeling that you don't approve of Tesla's final vision for the earth.

E: Not the way he represented the ideas, but what's interesting about the technology he made available, when used in perspective, is actually quite healthy for the planet. Then you're dealing with energies that take on organic shapes and you're one step closer to the type of energy that Reich theorized and made some actual physical discoveries of.

T: There's some popular literature on the market today claiming that the strange weather patterns the earth has been experiencing over the last ten years or so are being caused by Soviet use of Tesla apparatus. Have you done any research which would confirm or deny such claims?

E: The claims are basically groundless. I did a four year research project at Sonoma State University (California) involving the relationship between the planets in general, the sun and the weather on this planet, and the effects of solar flares on the weather, the effects of planetary alignments on solar flares, the effects of these things on radio propagation, earthquake activity, and tried to tie the geometries of all these energy patterns together. I found the weather patterns were very tightly coupled to the solar flare cycles, the Russians really don't have anything to do with this. Any effect the Russian Woodpecker signal would seem to have on it would be purely incidental because during these periods of intense solar flares signals like the woodpecker would be sounding louder and propagating better. Maybe its an advantageous point for the Russians to utilize the signal. This seems to be the case. But to think that the woodpecker is making solar flares on the sun and controling the times at which the planets align is absolutely absurd! As far as all these geometric patterns being seen in the sky, the Indians and other ancients knew about these patterns and they look like the patterns generated by mundane forces such as water and dielectricity.

T: What do you feel the woodpecker is and what is its use?

E: Its a non-Hertzian, shortwave signal which could be used for one of two things. Either its used for sounding and exploring the electrical system of the planet or more likely its a cryptographic signal utilizing the spread spectrum technology of frequency hopping and direct sequencing modulation. It is not an ELF signal!

T: Then the cloud patterns are the indicators of cosmic flux?

E: Exactly. A well trained observer can look at the sky and it serves as a metering of the intensity of the cosmic energy which exists at a particular point in space and time. I've utilized this during periods

of heavy solar flares to get an idea of the flare's more subtle characteristics by watching the geometries they produce in space, particularly at the intervals when the solar flares have stopped and all the earth is receiving the discharge from the flares. These discharges produce very profound cloud patterns and of course heavy rain. So the heavy rain cycles were produced by the enormous flares of solar cycle 21, which were cranked out between 1978 and 1982. The flares were most intense around 1978 and as the flares died down we got an upward cycle of precipitation. Now we're at the point where the energy has mostly fizzled out and the weather is fairly indeterminate from the solar-terrestrial physics standpoint.

T: In January we've received reports that the coldest temperatures on record have hit England and on the same day we got a report of an abnormally high 46° temperature in Antartica. Dog sleds have to be run at night because of the heat. My research shows that some of the major contributing factors to the erratic weather patterns have been the mass deforestation of rainforests to produce toilet paper and newsprint, and also nuclear testing which is also directly related to earthquake and volcanic activity.

E: You have to keep in mind that mass deforestation and large amounts of thermodynamic and nuclear energy are going to have a much stronger effect than the subtle energies coming from the planets and the sun. Deforestation and nuclear energy are definitely going to be dominant influences. Being that the size of the earth and the scope of the phenomena are so large, and the frequency of events is slow, its going to take a while to see exactly what effect all these destructive actions are going have. It seems as though everyone intuitively knows that life is going to thoroughly disrupt and things are going to get pretty bad. You just can't keep whacking on the earth and expect things not to start changing.

T: There has been a lot of varying literature on the polar shift appearing over the last 30-40 years. One aspect which I've pursued is the magnetic reversal of the poles. In some of the Native American prophecies they say that the earth will get very hot and then very cold, and then things will balance out again. Does this relate to any electrical phenomena as you understand it?

E: At the point at which the earth's magnetic field equals zero, which happens between maximum positive and maximum negative the planet will cease to be a magnetic energy type of situation and become a dielectric energy type of situation. In most spatial geometry systems which contain electric energy the point of zero magnetic energy is the point of maximum dielectric energy. Interestingly enough, for navigational purposes you wouldn't be able to use iron, or magnetic, permeability type materials anymore. You'd have to start using dielectric permeability materials like ceramic for compasses.

T: Would this be a short lived situation?

E: It would be in balanced proportion to the magnetic and it is probably going on right now, but it is not generally acknowledged due to the lack of measuring instruments. Physicists have focused their attention strictly on magnetism. In a newspaper article I was looking through the other day I saw that the physicists now have an even bigger magnet so they can smash atoms ever harder and find more little tiny fragments to catalog and confuse themselves. What could be quirkier than a quark? (laughter)

T: If this is happening right now and there is a dielectric propagation during the changeover of the magnetic poles could this in some way account for the shifting of orgone streams and be a part of the phenomena of the strange weather we've been having?

E: Yes, it could definitely tie in. You're talking about a whole different spatial geometry emerging as far as how electrical energy is distributed so you're going to have all kinds of effects. The weather is filling in patterns that already exist in space determined by all these fields of force, most of which we don't even know about yet. Tesla was able to open up a door into all these things, but he really didn't explain how to do it. There are other flux fields that can be measured with his apparatus that get more into this dielectric type of situation. Tesla was successful in measuring the amount of charge on the planet, but no one really knows how he did that. That would be an experiment to try. The velocity of light continually changes which changes the capacity of all capacitors and changes the effect of orgone. A fundamental property of an orgone accumulator is that the dielectric material, which Reich called the organic material, serves the purpose of slowing down the velocity of light trying to draw in the orgone energy. Then themetallic layers reflect the electromagnetic part but the dielectric part penetrates through it without even seeing what's going on. The accumulator serves as a magneto-dielectric separator. I don't know if Reich would go along with this. He had his own way of looking at it.

T: In science one has to look at different ways of viewing things if progress is to take place.

E: The important thing about Wilhelm Reich is not so much his apparatus or his theories but his concept of functional thinking. If you know the basic patterns of nature then you have no problem seeing all these phenomena. You have no problem looking up in the sky, knowing what all the cloud patterns mean. You have no problem developing apparatus to work with these energies because you just basically know. The great minds such as Johann Sebastian Bach and Nikola Tesla worked with these types of situations. You could say that all their work is based on archetypal forms. That's what makes their inventions or music so powerful. They were discoverers and not just inventors or composers or whatever kinds of names are put on these types of people. They go beyond that, they have tapped in and can see these fundamental shapes and geometries that everyone else is numb to. Viktor Schauberger is most important for bringing these things down to a practical level. If you make the right shapes then organic energy or water flow becomes easily manageable, that is, engineerable. He only intuitively knew a lot of this so it still wasn't worked in engineering science. If you bring in Tesla, Reich and, interestingly enough, Johann Sebastian Bach (who plays an important part in this) then you begin to find the nature of this basic form. If we take Tesla's three phase electricity, or rotating magnetic field, we find that it is based on the archetypal form known as the solar cross or by various other names.

T: Mandalas, medicine wheels?

E: Right, these are four quadrant types of forms, a balanced cross as opposed to an unbalanced cross.

T: This is where you get the Four Quadrant Theory of Electricity?

E: Right, electricity has to be viewed from a four quadrant type of situation. The right angle plays an extremely fundamental role in electricity. It is generally a right angle phenomenon.

T: This goes back to what we were discussing earlier about the positions of the planets in relation to solar flares and the weather. How do the quadrature relationships tie in with that?

E: When you take the planets like Mercury and Jupiter, which are the real activity generators, in right angle relationships involving the earth and the sun then you find that radio reception and electrical conditions on the earth tend to be disrupted. RCA used this for a number of years, its called radio astrology. Astronomers refuse to even talk about it, but you have a big company like Radio Corporation of America basing all their circuit predictions on it. They were big time, too. They had the big time circuits. They had the patents on radio and they're using astrology. Many old time RCA employees would talk about how the planets affect people's behavior, its just common knowledge to them because they have meters right there where they see these cosmic disturbances, and of course when they go out on the street or drive home they find that people are also modified by these various waves that were affecting shortwave transmission.

T: Since we're talking about behavioral modification, there is a lot of talk currently claiming that the Soviets are modifying behavior using extremely low frequencies (ELF). This is being attributed to Tesla apparatus. What exactly did Tesla do with ELF?

E: Tesla never did any work in ELF. His work was with the high frequencies, the opposing end of the spectrum. Tesla was the first to break away from the low frequency phenomena and that is what makes his work so important.

T: What about literature claiming that the Russians are using Tesla's ELF transmitters?

E: As far as I can tell, its basically a paranoid fantasy.

T: No direct relationship to any scientific work you've done or any mention by Tesla?

E: No, I've never seen evidence of such things, but I don't want to discredit people's work in that area.

T: Right, I feel that Dr. Robert Beck has done some tremendous and groundbreaking research into how ELF fields affect people's behavior. My question was to find out if any of this research is related to Tesla's work in any way.

E: There's no connection at all to Nikola Tesla. Its my personal opinion that the communists are not attempting anything of the sort.

T: So Tesla's name is being used as a technique to enhance various people's theories?

E: Basically. What's interesting is that these behavioral modification techniques are found on television commercials here in this country. American TV commercials that involve a lot of money use certain images, frequencies, wavelengths and such. This is along the lines of what has been proposed that the Russians are doing, but it all comes through the TV screen. It is not being transmitted through the ground or the ether or the earth-ionosphere wave guide.

T: So you're saying that high tech TV commercials are a form of psychotronic programming?

E: Yes, they're totally psychotronic. People in a sensitized state will react to that stuff pretty heavily, wheras the average person sees it as just something else on the TV.

T: Do you see these psychotronic images, not just on TV, but actually In the products being sold to consummers?

E: Its everywhere. Architecture represents the thought patterns of each era, so now we have an architecture which is sort of the logical conclusion of modernism, or what I refer to at this point as techno-fascism. The covers of Omni Magazine serve as a perfect example of techno-fascistic art. There is sterility and everything is in rectangular x, y, z, coordinates. The images are usually faceless and abstract. Of course architecture and art have a direct influence on people. It gets right down to the inside without having to go through any thinking process or educational process. If we take for example any piece of great music which has been around for a while, for a few hundred years, and people still want to listen to it for some reason. It doesn't matter if they're English or French or Russian, everybody likes it. The same thing with mathematics - it doesn't matter if you're German or Yugoslavian, any equation is still the same, the numbers and letters are still the same. There's no instructions needed, you just go right to work. So the art and architecture now is kind of an engineered thing designed to maximize the efficiency of consumption in the things that are desired in this particular type of techno-fascistic society.

T: How does this relate to automobile styling?

E: Well of course that's architecture again. There's generally three or four architectural patterns produced by all automobile manufacturers and interestingly enough, once you start looking for these things, you notice each automobile manufacturer actually uses the same letters and numbers for the same form of car that all the other companies do. It seems almost as if there is some sort of program, but it seems that now, rather than being a characteristic style of the era, there is a plan behind all of it. Of course its easy to cook up all these conspiracy theories about this, it could be accidental. It is interesting to study to see what representations exist in the modern era.

T: Its not accidental that the psychotronic programming has filtered into television programming, is it?

E: No. There's strong evidence indicating that its not accidental. The best case of that which I've seen is that of a picket fence I saw in the surf on a TV commercial to give a flash of vertical lines, which is a fundamental geometry used in all high tech TV commercials. Its either an x, y, coordinate grid, or horizontal lines, which are very popular, but very often vertical lines. Its hard to distinguish exactly what determines which one is used. Now I saw a commercial where people were playing on the beach and out in the surf was a small picket fence. Now how many times does a person see a small section of picket fence in the surf? It won't stay there too long anyway. So apparently it was necessary to use it to place the vertical lines. Whether this is an architectural style or whether it has an archetypal meaning still has to be determined.

T: That would be a whole area of research in itself, the deciphering of TV commercials to see what is being put into people's heads.

E: Its the same thing with the food. You go to the store and grab two loaves of bread. You look at one loaf and its ingredients read like a chemical rubber company's handbook on organic chemistry. It tastes like garbage and it doesn't do anything good for you. Its just worthless stuff. If you get a loaf of bread that has none of that stuff in it then it tastes good and makes you feel good. These chemicals don't really prolong the life of the bread, they don't make the food taste any better, yet they're in there. Why are they in there? They don't do anything...why are they in there?

T: It can't be an accident.

E: No, they certainly didn't slip in. They're all precisely measured and metered.

T: There's also a lot of stuff that's not required to be on the label. Take for example the new soft cookies in the stores. They contain plastic, but since plastic is not a food it doesn't appear on the list of ingredients.

E: That reminds me that in the 1930s PCBs were going to be used to extend the life of chewing gum. Shortly afterwords came the phrase - "Better Living Through Chemistry." From an ecological standpoint the chemical destruction of the planet has to be feared more than the nuclear or anything else. We have all these PCBs and everything just floating on the surface of the oceans. What's going to happen when it all soaks in?

T: Well we have the phenomenon of whales beaching themselves, and of course the scientists can't figure it out because they see everything as being disconnected.

E: That one's not too hard to figure out. Take a large naval aircraft carrier. This thing is going to have some heavy duty sonar on it with a peak output power of about 750,000 watts. This is 750,000 watts of sound, which is precisely in the wavelength that the whales communicate on. They can hear their own sounds halfway across the ocean and now the ocean is filled with these incredible shrieking noises that sound like spark gaps, ringing sounds and rapid explosions. It probably sounds like being in a battle zone. Its no wonder why they would want to hop out of the water. Their environment has been turned into a raucous.

T: I've heard that the sound that whales make is a direct transmission of a three dimensional picture. Before the advent of propeller driven boats and sonar and whatever the whales could communicate around the world in 3-D.

E: Sure, we've screwed ourselves. Nikola Tesla worked in a clean electrical environment to make his various measurements. Now the space is just alive with 60 cycles and its harmonics. You can walk out into the deep desert, and after meditating and calming down for a while, you can feel the air itself hum like a giant induction motor. This pulsating 60 cycles is just roaring in the air. You have to keep in mind that the entire electrical system of the country is operating in phase conjunction. Everything has to move together. Every motor, every transformer, every piece of machinery that produces electromagnetic vibrations is all locked in phase. Everything is moving in unison and whacking on the planet simultaneously and the planet actually hums at 60 cycles.

T: What do you feel are the prospects for a beneficial technology and who do you think are the sources for actually producing it?

E: It seems to me that the best place to start is with Viktor Schauberger and Wilhelm Reich. There's not really too many people doing anything real these days. There's a lot of people making claims.

T: The only other person I'm in touch with besides yourself who is actually producing something that works is Trevor James Constable. He's really figured something out about how these subtle etheric flows operate on the planet and he can demonstrate it over and over again.

E: Yeah, there aren't too many around like Trevor. The same thing is with the "free energy" thing. Now that I've completely gone through all the various works I've really run across only one person who is really doing anything, and I know he doesn't want his name mentioned in public. This person is not known by anybody. All the people out there making all these claims and hoop-de-doo are frauds. Every single one of them is a fraud! And that leaves out none.

T: So basically the free energy thing is like the ELF stuff, its just a technique for getting people promoted in the public eye?

E: Right, also everyone is trying to accomplish it with bigger and bigger magnets, the favorite toys of the physicists. Free energy will never come out of magnetism unless the magnetism is tricked with hysteresis, and of course very little is understood about that. Free energy will come from the dielectric field where energy grows rather than decays, perhaps orgone energy will be the way.

T: I've been checking into the concepts of the four ethers as presented by Rudolph Steiner and the Anthroposophical schools, and Trevor Constable has shown that the Chemical or Tone ether is related to the water system of the planet and is functionally equivalent to orgone. I've found through looking into your work that this ether is also related to the dielectric field. Electromagnetism doesn't fit in and was considered a corrupted ether along with the nuclear force. These weren't natural forces.

E: In alternating current engineering the magnetic wave is the one that is consumptive and retarded, whereas the dielectric wave is productive and advanced. You could say that electromagnetism is the fundamental geometry of consumptive retardation.

T: That makes a good anology of our present society.

E: Exactly, because everything always fits together. All of our machines and apparatus and theories are extensions of our own thought patterns. Its all basically an architectural type of situation.

T: It seems as though the true promise for beneficial technology lies in the etheric, organic side, the side of life. It seems as though when one presents this information on living energy to scientists, rather than looking at it objectively, they react in a rage. Reich called this the emotional plague and his work has suffered from it. What do you think is with these scientists who refuse to face scientific verification of energies such as orgone.

E: The problem is that they are not scientists, they're not following the precepts of science. They're mystics worshipping a nuclear type of destructive energy. My contention about nuclear power plants is

that they're not there to generate energy, they serve as temples to worship this energy of decay and destruction and disease. The high laws are the laws of thermodynamics where everything must diffuse, decay and dissipate. Its quite obvious that they're pretty much worthless for generating electricity because, for one reason, they cost too much. They have to pump billions and billions of dollars into them and they hardly produce enough electricity to justify their existence, let alone break even. So they serve no practical purpose even though they were purported in the late 1950s to be so-called free energy devices. You look at the way things were in the 50s and you find its basically a death worship. That's one thing that surprises me now is that people want to get back to the 50s and relive those images.

T: So you're saying that the American Dream has turned out to be a nightmare?

E: The American Dream is to destroy the earth. We've succeeded in training everbody else how to do it too, so in case we fail they can take over where we left off.

T: I know what you mean. New Zealand's native forests are being stripped to make disposable chopsticks for the Japanese. Eric, in closing do you have any final message?

E: Tell everyone to quit their jobs and smash their televisions.

TRANSMISSION OF ELECTRICITY

Eric P. Dollard

Part I - Electro-Magnetic Energy

A) When electro-magnetic energy is conveyed from one point in space to another point in space a closed loop is required to connect the point of generation with the point of utilization. This closed loop is called the electric circuit and consists of a boundary formed by what have become known as electric conductors. This boundary encloses a definite quantity of space.

When electro-magnetic energy flows through the space enclosed by the electric circuit phenomena take place inside the circuit material as well as the space outside this material.

Within the circuit conductor material, during the passage of electro-magnetic energy, this energy is continuously being consumed within the molecular space and converted into thermo-dynamic energy (heat). This may be represented by the passing electro-magnetic wave dragging into the electric circuit material. This drag is analogous to frictional losses and is called the resistance of the electric circuit, R.

In the space outside the circuit conductor material, during the passage of electro-magnetic energy, a condition of aetheric stress exists, which is called the electric field of the electric circuit. The energy contained by the electric field is continuously being transferred through this space from the point of generation which supplies energy to the electric field to the point of utilization which abstracts energy from the electric filed.

The electric field of the circuit exerts physical magnetic and dielectric actions. The magnetic action is orientated parallel to the surface of the conductor material (in its immediate vicinity). That is, a needle shaped magnetic body tends to set itself in a direction parallel to the surface of the conductor material.

The dielectric action is orientated perpendicular to the surface of the conductor material (in its immediate vicinity). That is, a needle shaped dielectric body tends to set itself in a direction perpendicular to the surface of the conductor material

Thus, the electric field of the circuit, over which passes the flow of electro-magnetic energy, has three fundamental axes which are at right angles with each other:

The dielectric axis, perpendicular to the conductor surface,

The magnetic axis, parallel to the conductor surface,

The electro-magnetic axis, co-axial with the direction of the electric circuit.

The space outside of the conductor material, bounded by the electric circuit, has the property of propagating a wavefront of light at a definite velocity, C. This velocity is a characteristic property of the aether in which the electric circuit exists. The inverse square of this velocity is called the capacitance of the electric circuit.

$$C = \frac{1}{c^2} \qquad (4\pi 10^{-9} p)^{-1} \text{ farads}$$

The capacitance is a measure of the ability to store energy in the dielectric field of induction, of the electric circuit.

The quantity of space enclosed by the bounding electric circuit is proportional to the total length of the electric circuit, l_1, multiplied by the distance between the bounding conductors, l_2.

$$l_1 \, l_2 = l_0^2 \qquad \text{(centimetre)}^2$$

and has the dimensions of an area. This area in square centimetres defines what is called the inductance of the electric circuit.

$$l_0^2 = L \qquad 4\pi 10^{-9} p \text{ Henrys}$$

The inductance is a measure of the ability to store energy in the magnetic field of induction of the electric circuit.

Together, the capacitance and the inductance representing the dielectric and magnetic fields of induction of the electric circuit, serve as a measure of the propagation characteristics of the electric circuit for the transmission of electro-magnetic energy.

$$-LC = t_0^2 \quad \text{, natural period}$$

$$-\frac{L}{C} = Z_0^2 \quad \text{, natural impedance}$$

B) The popular conception of electro-magnetic energy transmission as it exists today is; energy is transmitted through the interior of the conductor material, that is, electricity flows through wires like water flows through pipes. This transmission is said to involve the flow of charged sub-atomic particles called electrons.

According to this theory the materials possessing the most "free electrons" serve as the best conductors of electro-magnetic energy. Conversely, the materials possessing the least "free electrons" serve as the poorest conductors of electro-magnetic energy. These materials are called insulators. Insulators are said to block the passage of electricity.

The conclusion drawn is that electricity is the flow of electrons and that the space outside of the conductor material is empty and dead. It follows that a superconductor is that material which offers no opposition to the flow of electrons and hence no opposition to the flow of electricity. Conversely, free space devoid of matter offers total opposition to the flow of electricity. Nothing could be further from the truth, yet this is the concept of electricity propounded by the scientist of today.

The real actions of the conducting material presents itself when it is in the so-called superconducting state. If a section of a superconducting material is suspended in space, free to move, and a magnetic field of induction is made to approach this material, it is found that the material is repelled by the approach of the field. If the material is indeed superconducting it will maintain a definite distance, l, for an indefinite period of time $t \longrightarrow \infty$, from the source of magnetic induction. Any tendency for the material to sink into the magnetic field, $l \longrightarrow 0$, indicates the material is not perfectly superconducting but has a finite resistance R.

It may be concluded that the so-called conducting material does not so much conduct as it does <u>repel</u> or reflect magnetism, or electro-magnetic energy in general.

If an electric circuit is conveying electro-magnetic energy as previously discussed it is found that a force or pressure is exerted upon the circuit material. This pressure tends to repel opposing parts of the circuit material and cause the circuit to expand. The quantity of this pressure in the space bounded by the circuit is called the magneto-motive force of the circuit.

It can therefore be seen that the conducting materials serve as the walls of a container holding magnetic pressure. If the conducting material is in the so-called superconducting state and the ends of the circuit are shorted the electric circuit will hold this magneto-motive pressure indefinitely, in analogy with compressed air stored in a tank. In order for this to be the result of electron flow requires that this flow be in perpetual motion, an unlikely proposition.

It may be concluded that materials called electric conductors might best be called electric obstructors and serve not to conduct electro-magnetism but serve to reflect it back on itself. The flow of electro-magnetism is conducted by the aethereous space bound by the obstructing material.

The character of this aethereous space is represented by its inductance L and its capacitance C. Since pure space is considered a perfect insulator by atomic theory is it not ironic that it offers the least resistance to the flow of electro-magnetism? It is then the insulators that are the true conductors of electricity.

THE TRANSMISSION OF ELECTRICITY, Part II

By Eric P. Dollard

Part I of "The Transmission Of Electricity" (Sept-Oct 1987 JBR) dealt with the nature of electric transmission along space bounded by a set of guiding wires. These wires were found not to be the conductors of electricity, but space itself is the electric conductor. In reality the so-called conductor material of which the wires are made are reflectors of electricity, analogous to the reflective metal coating on the back of glass (dielectric) mirrors.

Because the dimensions of the co-efficient of dielectric induction, or farads, is given by the inverse of the square of the velocity of light,

$$1/c^2 = t^2/l^2 \qquad \text{sec}^2 \text{ per } \text{cm}^2 \qquad (4\pi 10^{-9})^{-1} \text{ farads}$$

the notion has occurred that these dimensions establish the propagation velocity of electric transmission, and thereby electricity and light are the same thing. This concept may have become the most significant obstacle to the understanding of electric transmission.

In this part of the study of the transmission of electricity the conduction of electricity of space will be further examined through observation of the characteristics of radio transmission and reception in the medium frequency range, 300-3000 kilocycles per second.

When the distance between the guiding wires of an electric system is significantly increased the electric field that is associated with these wires occupies a large volume of space which extends far beyond the vicinity of the guiding wires. The expanded electric field of induction associated with the spaced apart guiding wires now can combine with the electric fields of induction associated with more distant sets of guiding wires. This sharing of electric fields by two or more remote systems of wires is known as the mutual inductance of the systems. Through the process of mutual inductance electricity may be transmitted through space without the employment of a set of guiding wires to connect the transmitter to the distant receiver. Hence, the "wireless" system of electric transmission through space.

One example of such a system is the A.M. broadcasting service in commercial use today (535-1650 Kc/sec). In this form of transmission the guiding wires spread out into a very tall tower (75-300 ft) far into space on one side and a large copper screen buried in the ground on the other side of the system.

The spacing that exists between the uppermost part of the tower and the outermost part of the screen is very large, therefore the electric field of this system extends to great distances as a result of this spacing. As with any system involving an electric field of

induction energy is taken up by the field during one portion of the A.C. cycle and returned during the next portion of the A.C. cycle. If measurements are taken on the flow of energy at the terminals of the tower-screen arrangement it is observed that only a small fraction of the energy taken by the electric field is returned during the discharge portion of the A.C. cycle.

This loss of energy is unlike that which occurs in the oscillating energy exchange that takes place with closely spaced guiding wires. For close spacing the loss of energy is very small and that energy which is lost is fully accountable by the equivalent quantity of heat gain in and around the wires. However, for wide spacing the loss of energy is very large but the gain of heat energy is disproportionately small.

This direct observation of the disappearance of electric energy without its reappearance in an equivalent quantity of a differing form such as heat or mechanical activity raises a most important question, that is, where does all this energy go?

Many believe that this lost energy is radiated away from the tower in the same manner as light & heat radiation from a light bulb. While this theory seems plausible, there exists evidence that it may not be the correct interpretation of how the energy is lost. Nikola Tesla, the discoverer of radio, claimed repeatedly that the electromagnetic radiation theory (then known as the Hertzian wave theory) was inimical to the proper understanding of the wireless process as he conceived it.

The electromagnetic theory, or what was known as the Hertzian wave theory in Tesla's era, fails to explain certain observations made in practical radio engineering. According to E.M. theory the propagating velocity of electric induction must be the velocity of light. In the practical world of engineering however, the factor $\pi/2$, or 1.57 times the velocity of light will appear in wave calculations. Is it not coincidental that Tesla claimed that the effective propagation velocity of his wireless system was $\pi/2$ faster than the so-called speed of light?

Also, according to E.M. theory, the propagation of electric induction must be the cross combination of the dielectric induction and the magnetic induction, these two inductions never propagating independently. The work of J.J. Thomson & M. Faraday indicate that these two distinct forms of induction do propagate independently. Wheatstone claimed that the dielectric induction propagated at $\pi/2$ times faster than light.

In the practical world of radio engineering in the A.M. broadcast band it is not feasible to employ electromagnetic antennae at the point of reception. This is because an electromagnetic antenna must support a large fraction of the electromagnetic wavelength, this wavelength being several hundreds of feet. That is, such an antenna must be a tall tower. Since the employment of a tower for every radio receiver is an absurdity other forms of antennae are used. One such antenna is the magnetic permeability antenna found in transistor radios. This

antenna responds only to the magnetic field of induction and works on the principle that a ferrite core multiplies the effective value of space a thousand fold and thereby simulates a large structure. This type of antenna is found to be very directional and must be oriented perpendicular to the direction of the transmitting station. Another form of antenna is the electro-static capacity antenna found on automobile radios. This antenna responds only to the dielectric field of induction and works on the principle that a resonant transformer connected to an elevated capacitance counteracts the effects of distance and thereby appears close to the transmitter. This type of antenna is found to be completely non-directional and can be oriented in any fashion.

Neither of the aforementioned antennae operate on the principle of electro-magnetic induction as propounded by Hertzian wave theory, but on distinctly magnetic inductive propagation or dielectric inductive propagation. This is contrary to the notion that the magnetic & dielectric fields of induction are inseparable, that is, they must propagate co-jointly. This distinct separate propagation of these two fields of induction is how electric propagation was conceived by nearly all of the important electrical pioneers.

The question has remained unanswered as to where does all the energy go that the broadcast transmitter must supply to the tower if it is not radiated in a fashion similar to light or heat energy. The answer may be found in the statement of C.P. Steinmetz that it is consumed by the hysteresis of the aether in which the tower is immersed. To quote, "Mr. Kennelly says that air has apparently no hysteresis, and this is the general assumption, too. But nevertheless, in the light of modern science we must say that even air has a certain hysteresis, a time-hysteresis. For we know now, that the magnetic stress in air does not appear instantaneously with its source; but we know that magnetic disturbances are propagated though air with a finite velocity, the velocity of light. Now, if you examine the phenomenon more particularly, you will see, that then, and only then, no energy would be dissipated in space, if the magnetic disturbance set up at any place, were propagated through the whole space instantaneously. But as soon as the propagation of energy through space consumes a finite time, no matter how small this time be, a certain loss of energy must necessarily be connected therewith, and, calling the retardation of the magnetic disturbance behind the magneto-motive force, hysteresis, we must say: even air has hysteresis." (1)

The notion of aethereous hysteresis will be explored in part III of "The Transmission Of Electricity".

1. Transactions of the AIEE, Kennelly On Magnetic Reluctance, Oct. 27, 1891.

UNDERSTANDING THE ROTATING MAGNETIC FIELD

by ERIC P. DOLLARD

TESLA, PHYSICS AND ELECTRICITY

Research into the works of Nikola Tesla reveals electric phenomena that behave contrary to the theory of electricity in present use. Explanation of Tesla's inventions has been given from the standpoint of physics, yeilding many misconceptions. The science of physics is based on the phenomena surrounding particles and mass, which finds little application in the study of electric phenomena.

The explanation of Tesla's discoveries are to be found in the science of electricity rather than the science of physics. The science of electricity has been dormant since the days (1900) of Steinmetz, Tesla and Heaviside. This is primarily due to vested interests which we may call the "Edison Effect."

Charles Proteus Steinmetz

To assist in the understanding of Nikola Tesla's discoveries, thereby putting his inventions to work, a theory of electric phenomena applicable to these discoveries must be developed.

A starting point of such a theory has been developed by C.P. Steinmetz. Steinmetz was employed by the Edison/Morgan Company, General Electric, to decipher the Tesla patents, thereby evading these patents. With unlimited funds for research and a keen insight into electric phenomena, Steinmetz is a most significant contributor to the knowledge of electricity. His work is presented in three volumes:

I) "Theory and Calculation of Alternating Current Phenomena", third edition, 1900, McGraw Hill, New York.

II) "Theory and Calculation of Transient Electric Phenomena and Oscillations", third edition, 1920, McGraw Hill, N.Y.

III) "Electric Waves, Discharges and Impulses", second edition, 1914, McGraw Hill, N.Y.

These serve as an introduction to the theoretical understanding required.

INTENT OF PAPER

This paper serves as a preface to a theoretical investigation of N. Tesla's discoveries by the examination of the rotating magnetic field and high frequency transformer. It is assumed that the reader is acquainted with the commonly available material on Tesla, and possesses a basic knowledge of mechanics and electricity.

THE ROTATING MAGNETIC FIELD

THE GENERALIZED ELECTROMECHANICAL TRANSFORMER

In the general electromechanical transformer energy is exchanged between mechanical and electric form. Such an apparatus typically employs a system of moving inductance coils and field magnets. It is

FIG 1

SINGLE POLE

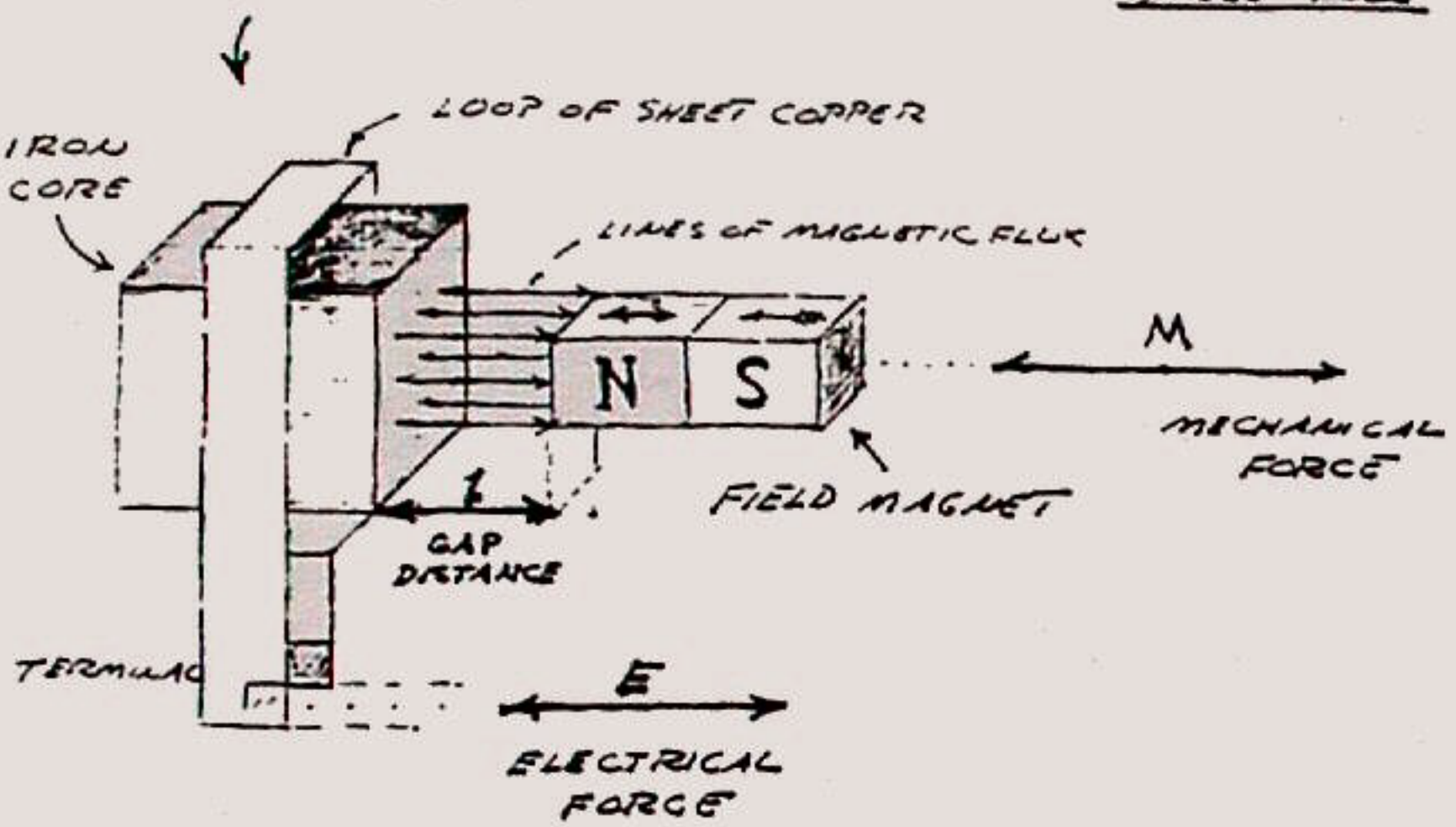
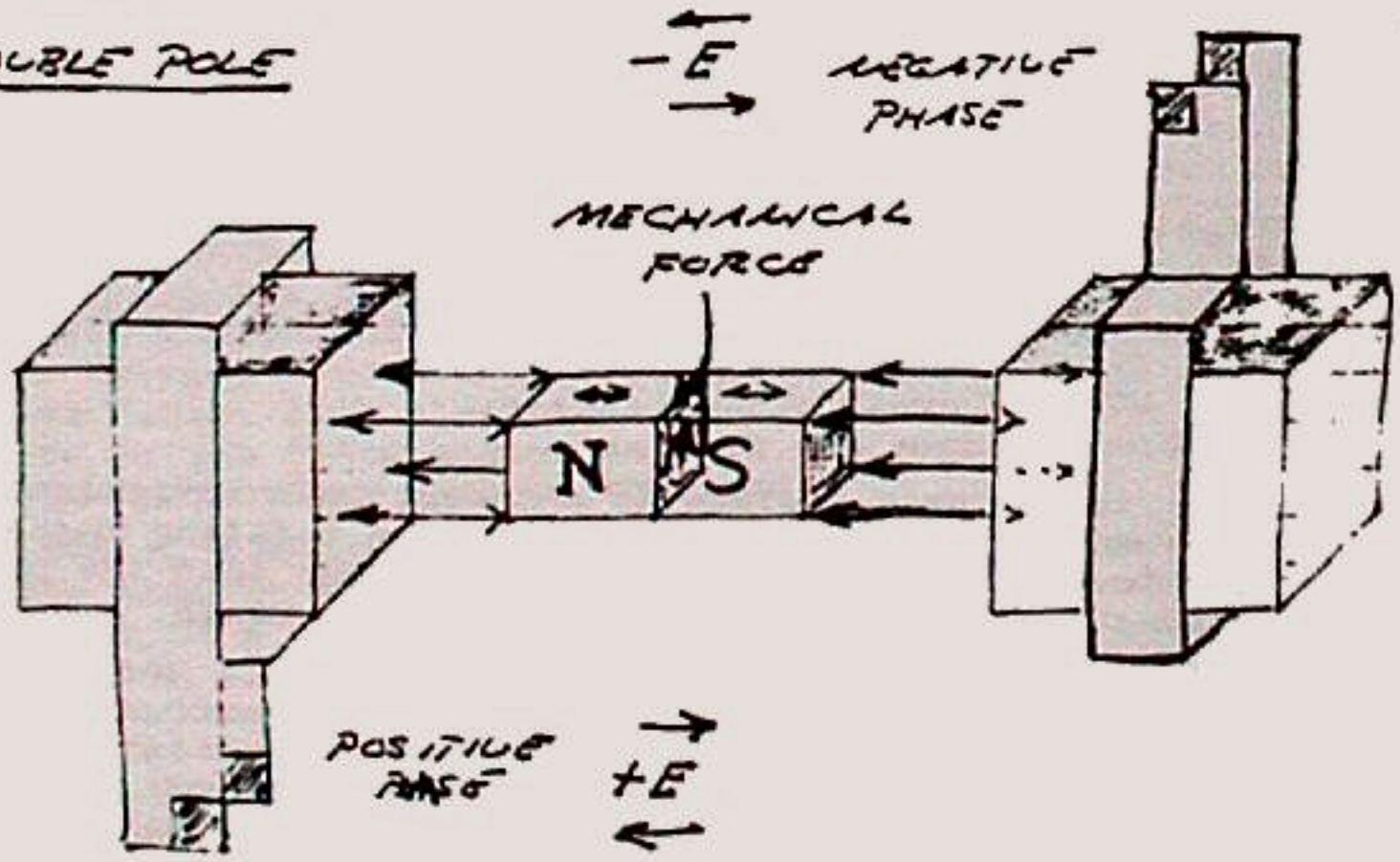


FIG 2

DOUBLE POLE



desirable that the machanical energy produced or consumed by of rotational form in order to operate with pumps, engines, turbines, etc. The method of producing rotary force, without the use of mechanical rectifiers known as commutators, was discovered by Nikola Tesla in the late 1800s and is known as the rotating magnetic field.

ELEMENTAL PRINCIPLES

An examination of the rudimentary interaction between inductance coils and field magnets will provide some insight into the principles behind the rotary magnetic field.

Consider a simple electromechanical device consisting of a piece of iron with a copper loop winding around it along with a small bar magnet (Fig. 1). Any variation in the distance (1) between the pole faces of the inductance coil and magnet produces an electromotive force (voltage) at the terminals of the copper loop resulting from the field magnet's lines of force passing through the iron core of the inductance coil. The magnitude of this E.M.F. is directly proportional to the speed at which the distance (1) is varied and the quantity of magnetism issuing from the field magnet pole face.

Conversely, if an electromotive force is applied to the inductance coil terminals, the distance (1) varies at a speed directly proportional to the strength of the E.M.F. and the quantity of magnetism issuing from the field magnet pole face. Thus electrical force and mechanical force are combined in this device.

If a flow of electrical energy (watts) is taken from the coil terminals and delivered to a load mechanical resistancy (friction) appears at the field magnet as a result of magnetic attraction and repulsion between the magnet and iron core. Mechanical force applied to the field magnet in order to move it results in power flow out of the coil. This flow of power generates an oppositional or counter electromotive force which repels the field magnet against the mechanical force. This results in work having to be expended in order to move the magnet. However this work is not lost but is delivered to the electric load.

Conversely, if the field magnet is to deliver mechanical energy to a load, with an externally E.M.F. applied to the coil terminals, the field magnet tends to be held stationary by the resistancy of the connected mechanical load. Since the field magnet is not in motion it cannot develop a counter E.M.F. in the coil to meet the externally applied E.M.F. Thus electrical energy flows into the coil and is delivered to the field magnet as work via magnetic actions, causing it to move and perform work on the load.

Hence, mechanical energy and electrical energy are rendered on and the same by this electromechanical apparatus. Connecting this apparatus to a source of reciprocating mechanical energy produces an alternating electromotive force at the coil terminals, thus a linear or longitudinal A.C. generator. Connecting this apparatus to a source of alternating electric energy produces a reciprocating mechanical force at the field magnet, thus a linear A.C. motor. In either mode of operation the field magnet reciprocates in a manner not unlike the piston of the internal combustion engine. Rotary motion is not possible without the use of a crankshaft and flywheel.

FIG 3

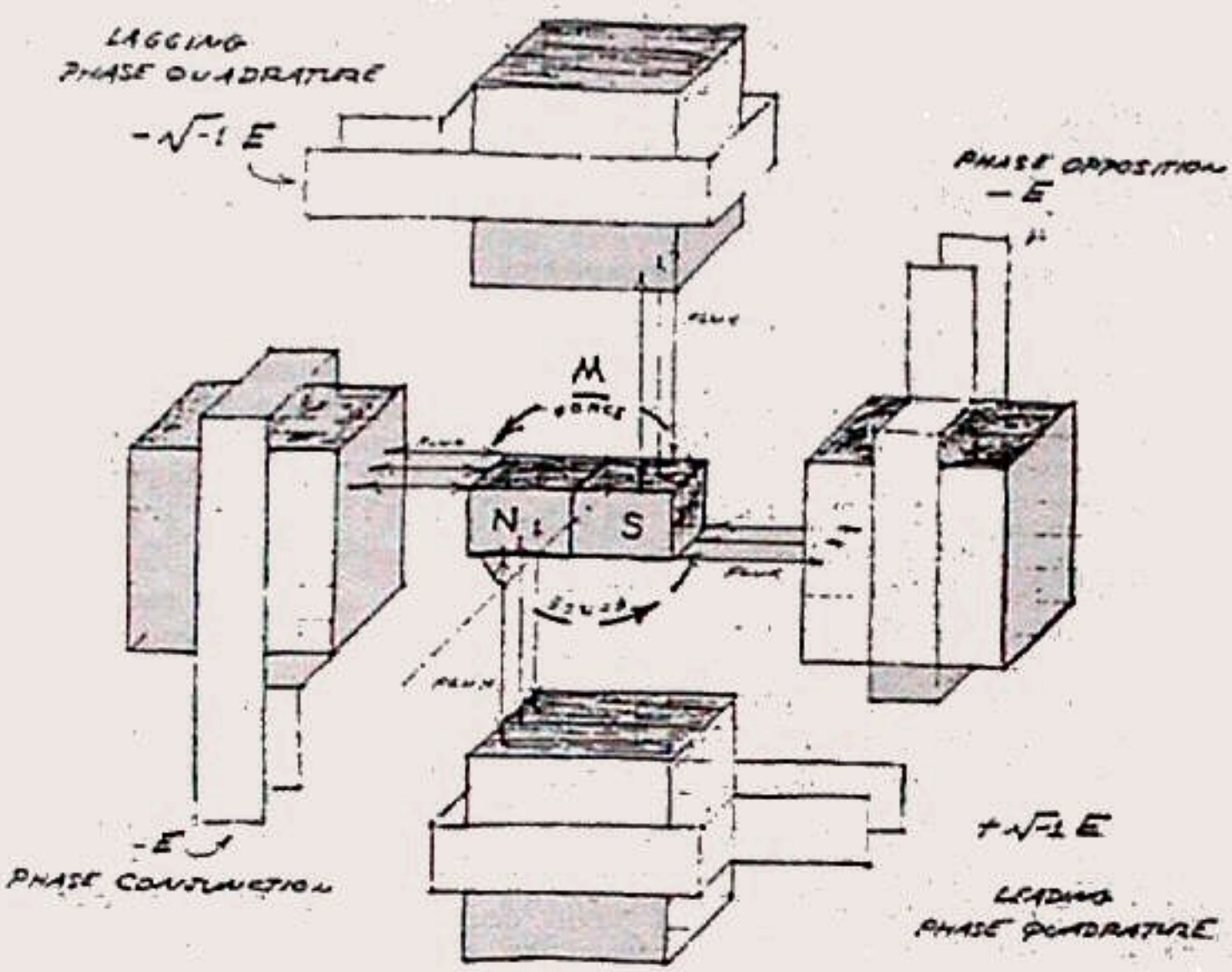
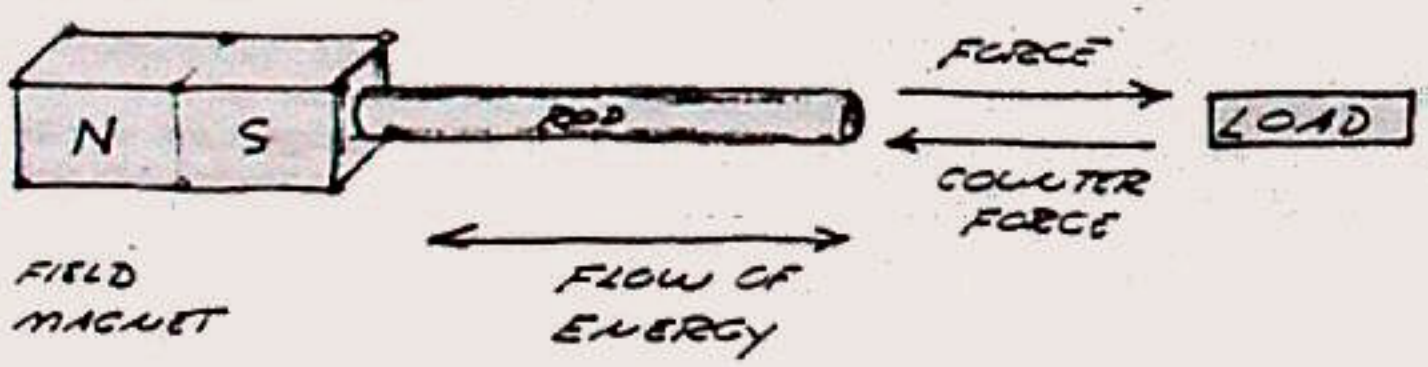

LAGGING
PHASE QUADRATURE
$-\sqrt{-1}\,E$
PHASE OPPOSITION
$-E$
M
FORCE
N
S
$-E$
PHASE CONJUNCTION
$+\sqrt{-1}\,E$
LEADING
PHASE QUADRATURE

FIG 4


N
S
ROD
FORCE
LOAD
COUNTER
FORCE
FIELD
MAGNET
FLOW OF
ENERGY

Arranging two inductance coils in a line as shown in Fig. 2 and connecting these coils to a pair of alternating E.M.F.s that are out of step by 1/2 of an alternating cycle with respect to each other results in the mechanical force being directed inwardly into the molecular spaces (inner space) within the field magnet. The field magnet is alternately stretched and compressed by magnetic action and no external force is evident except as vibration and heat. However, arranging two of the pairs shown in Fig. 2 at right angles to each other, connecting each to a pair of alternating E.M.F.s that are out of phase or step by one quarter cycle (quadrature) with respect to each other produces a rotating travelling wave of magnetism, that is, a whirling wirtual magnetic pole. This virtual pole travels from one pole face to the next during the time interval of one quarter cycle, thus making one 'complete revolution around all the pole faces for each cycle of alternation of the E.M.F.s. The field magnet aligns with the virtual pole, locking in with the rotary magnetic wave, thereby producing rotational force.

An analogy may assist in understanding this phenomena. Consider that the sun appears to revolve around the earth. Imagine the sun as a large magnetic pole and your mind's view of it as the field magnet. As the sun sets off in the distant horizon, it seemingly dissappears. However, the sun is not gone but it is high noon 90 degrees, or one quarter, the way around the planet. Now imagine moving with the sun around the planet, always keeping up with it so as to maintain the constant appearance of high noon. Thusly, one would be carried round and round the planet, just as the field magnet is carried round and round by the virtual pole. In this condition the sun would appear stationary in the sky, with the earth flying backwards underfoot. Inspired to thinking of this relation by the poet Goethe, Tesla percieved the entire theory and application of alternating electric energy, principally the rotating magnetic wave.

"The glow retreats, done is the day of toil;
it yonder hastes, new fields of life exploring;
Ah, that no wing can lift me from the soil,
upon its track to follow, follow soaring..."

ROTATIONAL WAVES

The fundamental principle behind the production of the rotary magnetic field serves as the principle behind all periodic electric waves. It is therefore of interest to investigate the discovery a little further.

The apparatus shown in Fig. 1 develops mechanical force along the axis of the field magnet as shown in Fig. 4. Likewise, mechanical counterforce is applied along the axis of the field magnet. Hence, if work is to be drawn or supplied respectively to the field magnet from an axternal apparatus, a connecting rod is required between the two machines. The flow of energy is along the axis of the rod and thus is in line (space conjunction) with the forces involved. A simple analogy is a hammer and nail. The hammer supplies mechanical force to the nail, the nail transmitting the force into the wood. The counterforce tends to make the hammer bounce off the nail. However, the wood is soft and cannot reflect a strong counterforce back up the nail and

into the hammer. Thus the nail slides into the wood absorbing mechanical energy from the hammer which is dissipated into the wood.

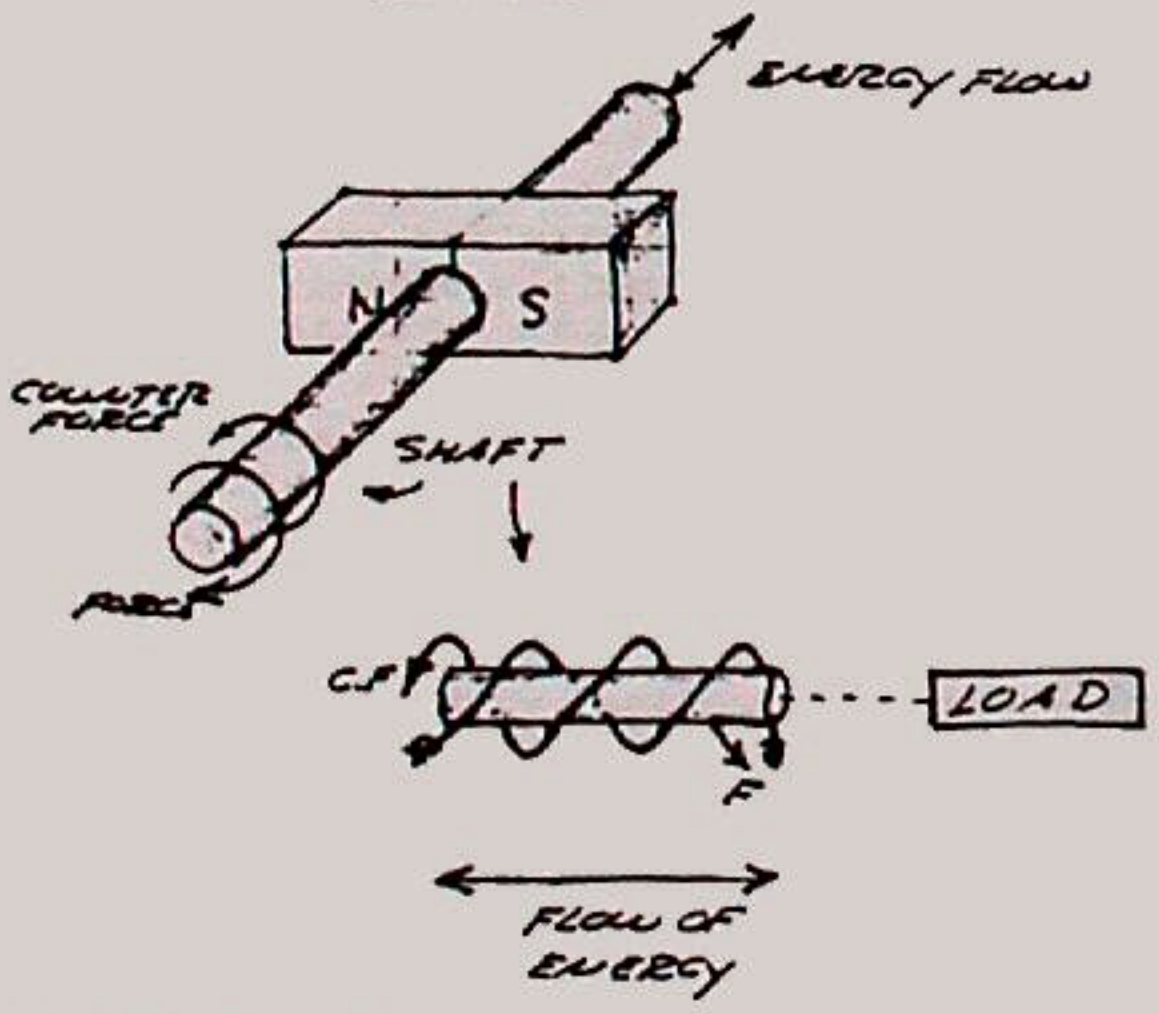
The apparatus of Fig. 2 develops mechanical force axially also, but it is entirely concentrated within the molecular space. Any counterforce must push back along the same axis. Thus the work is also along axis like Fig. 4 and is delivered to the molecular structure. The analogy is two hammers striking a steel block from opposite sides, pounding the block and producing heat and vibration within it.

The apparatus of Fig. 3 produces a quite different wave form (Fig. 5). The mechanical force delivered to the shaft is applied at a right angle to the axis in clockwise direction. The counterforce is applied in the opposite rotational sense or counter-clockwise direction at a right angle to the axis. The flow of mechanical energy is still along the shaft as in Fig. 4, however, it no longer pulsates in magnitude with the cycle but it continues, quite like the flow of electric energy in a direct current circuit.

An analogy is a screw and screwdriver. The screwdriver is forced rotationally clockwise by the hand or other motive force. The counterforce appears in opposition, that is counterclockwise, thereby arresting the rotation of the screwdriver. However, the wood is soft and cannot reflect the counterforce back into the screwdriver. Thus the screw travels longitudinally into the wood, perpendicular to the rotation of the screwdriver.

The form of this wave has been of great interest to a wide variety of fields of endeavor. It has been called the Caduceus coil, spinning wave, double helix, solar cross, and of course the rotating magnetic field. Applications are as wide ranging, from sewage treatment plants and guided missles all the way to the Van Tassel Integratron and astrology.

FIG 5



Introduction to

DIELECTRICITY AND CAPACITANCE

by Eric P. Dollard

CAPACITANCE

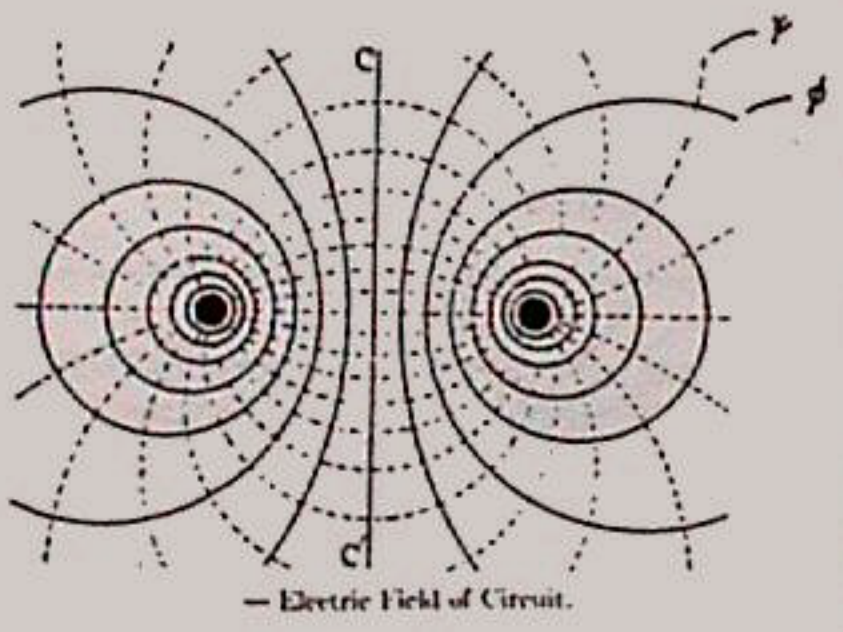
The phenomena of capacitance is a type of electrical energy storage in the form of a field in an enclosed space. This space is typically bounded by two parallel metallic plates or two metallic foils on an intervening insulator or dielectric. A nearly infinite variety of more complex structures can exhibit capacity, as long as a difference in electric potential exists between various areas of the structure. The oscillating coil represents one possibility as to a capacitor of more complex form, and will be presented here.

CAPACITANCE INADEQUATELY EXPLAINED

The perception of capacitance as used today is wholly inadequate for the proper understanding of this effect. Steinmetz mentions this in his introductory book *ELECTRIC DISCHARGES, WAVES AND IMPULSES*. To quote, "Unfortunately, to a large extent in dealing with dielectric fields the prehistoric conception of the electrostatic charge (electron) on the conductor still exists, and by its use destroys the analogy between the two components of the electric field, the magnetic and the dielectric, and makes the consideration of dielectric fields unnecessarily complicated."

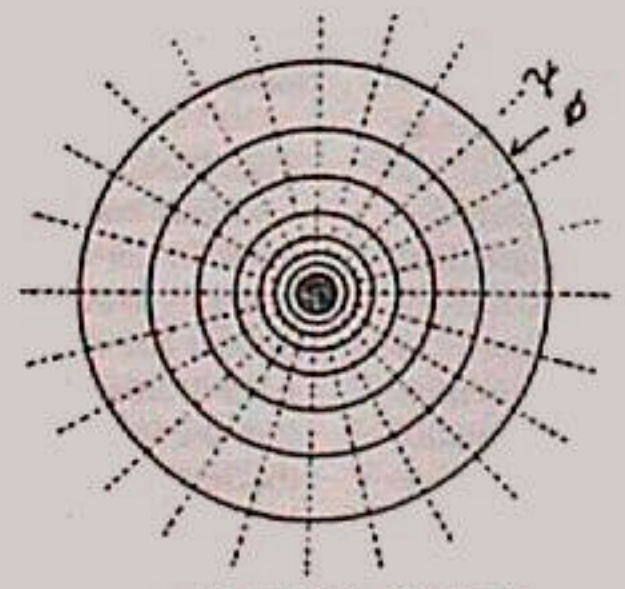
LINES OF FORCE AS REPRESENTATION OF DIELECTRICITY

Steinmetz continues, "There is obviously no more sense in thinking of the capacity current as current which charges the conductor with a quantity of electricity, than there is of speaking of the inductance voltage as charging the conductor with a quantity of magnetism. But the latter conception, together with the notion of a quantity of magnetism, etc., has vanished since Faraday's representation of the magnetic field by lines of force."



— Electric Field of Circuit.

Fig. 1a



— Electric Field of Conductor.

Fig. 1b

THE LAWS OF LINES OF FORCE

All the lines of magnetic force are closed upon themselves, all dielectric lines of force terminate on conductors, but may form closed loops in electromagnetic radiation.

These represent the basic laws of lines of force. It can be seen from these laws that any line of force cannot just end in space.

FARADAY & LINES OF FORCE THEORY

Faraday felt strongly that action at a distance is not possible thru empty space, or in other words, "matter cannot act where it is not." He considered space pervaded with lines of force. Almost everyone is familiar with the patterns formed by iron filings around a magnet. These filings act as numerous tiny compasses and orientate themselves along the lines of force existing around the poles of the magnet. Experiment has indicated that a magnetic field does possess a fibrous construct. By passing a coil of wire thru a strong magnetic field and listening to the coil output in headphones, the experimenter will notice a scraping noise. J. J. Thompson performed further experiments involving the ionization of gases that indicate the field is not continuous but fibrous (*ELECTRICITY AND MATTER*, 1906).

PHYSICAL CHARACTERISTICS OF LINES OF FORCE

Consider the space between poles of a magnet or capacitor as full of lines of electric force. See Fig.1. These lines of force act as a quantity of stretched and mutually repellent springs. Anyone who has pushed together the like poles of two magnets has felt this springy mass. Observe Fig.2. Notice the lines of force are more dense along AB in between poles, and that more lines on A are facing B than are projecting outwards to infinity. Consider the effect of the lines of force on A. These lines are in a state of tension and pull on A. Because more are pulling on A towards B than those pulling on A away from B, we have the phenomena of physical attraction. Now observe Fig. 3. Notice now that the poles are like rather than unlike, more or all lines pull A away from B; the phenomena of physical repulsion.

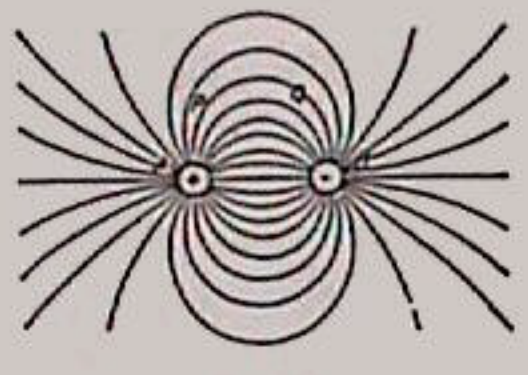


Fig. 2

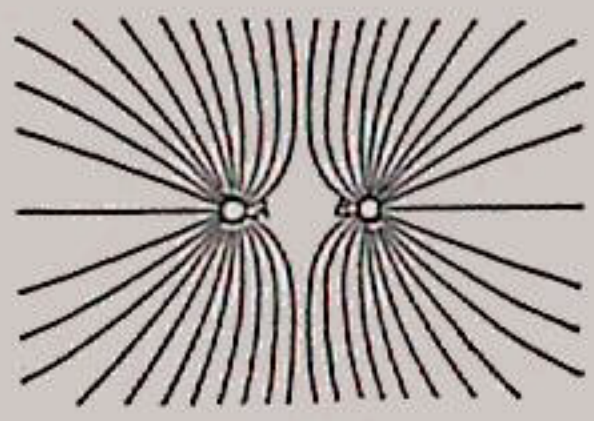


Fig. 3

MASS ASSOCIATED WITH LINES OF FORCE IN MOTION

The line of force can be more clearly understood by representing it as a tube of force or a long thin cylinder. Maxwell presented the idea that the tension of a tube of force is representative of electric force (volts/inch), and in addition to this tension, there is a medium through which these tubes pass. There exists a hydrostatic pressure against this media or ether. The value of this pressure is one half the product of dielectric and magnetic density. Then there is a pressure at right angles to an electric tube of force. If through the growth of a field the tubes of force spread sideways or in width, the broadside drag through the medium represents the magnetic reaction to growth in intensity of an electric current. However, if a tube of force is caused to move endwise, it will glide through the medium with little or no drag as little surface is offered. This possibly explains why no magnetic field is associated with certain experiments performed by Tesla involving the movement of energy with no accompanying magnetic field.

INDUCTANCE AS AN ANALOGY TO CAPACITY

Much of the mystery surrounding the workings of capacity can be cleared by close examination of inductance and how it can give rise to dielectric phenomena. Inductance represents energy storage in space as a magnetic field. The lines of force orientate themselves in close loops surrounding the axis of current flow that has given rise to them. The larger the space between this current and its images or reflections, the more energy that can be stored in the resulting field.

MECHANISM OF STORING ENERGY MAGNETICALLY

The process of pushing these lines or loops outward, causing them to stretch, represents storing energy as in a rubber band. A given current strength will hold a loop of force at a given distance from conductor passing current hence no energy movement. If the flow of current increases, energy is absorbed by the field as the loops are then pushed outward at a corresponding velocity. Because energy is in motion an EMF must accompany the current flow in order for it to represent power. The magnitude of this EMF exactly corresponds to the velocity of the field. Then if the current ceases changing in magnitude thereby becoming constant, no EMF accompanies it, as no power is being absorbed. However, if the current decreases it represents then a negative velocity of field as the loops contract. Because the EMF corresponds exactly to velocity it reverses polarity and thereby reverses power so it now moves out of the field and into the current. Since no power is required to maintain a field, only current, the static or stationary field, represents stored energy.

THE LIMITS OF ZERO AND INFINITY

Many interesting features of inductance manifest themselves in the two limiting cases of trapping the energy or releasing it instantly. Since the power supply driving the current has resistance, when it is switched off the inductance drains its energy into this resistance that converts it into the form of heat. We will assume a perfect inductor that has no self resistance. If we remove the current supply by shorting the terminals of the inductor we have isolated it without interrupting any current. Since the collapse of field produces EMF this EMF will tend to manifest. However, a short circuit will not allow an EMF to develop across it as it is zero resistance by definition. No EMF can combine with current to form power, therefore, the energy will remain in the field. Any attempt to collapse forces increased currents which pushes it right back out. This is one form of storage of energy.

INSTANT ENERGY RELEASE AS INFINITY

Very interesting (and dangerous) phenomena manifest themselves when the current path is interrupted, thereby causing infinite resistance to appear. In this case resistance is best represented by its inverse, conductance. The conductance is then zero. Because the current vanishes instantly the field collapses at a velocity approaching that of light. As EMF is directly related to velocity of flux, it tends towards infinity. Very powerful effects are produced because the field is attempting to maintain current by producing whatever EMF is required. If a considerable amount of energy exists, say several kilowatt hours* (250 KWH in a lightning stroke), the ensuing discharge can produce most profound effects and can completely destroy inadequately protected apparatus.

* The energy utilized by an average household in the course of one day.

ANOTHER FORM OF ENERGY APPEARS

Through the rapid discharge of inductance a new force field appears that reduces the rate of inductive EMF formation. This field is also represented by lines of force but these are of a different nature than those of magnetism. These lines of force are not a manifestation of current flow but of an electric compression or tension. This tension is termed voltage or potential difference.

DIELECTRIC ENERGY STORAGE SPATIALLY DIFFERENT THAN MAGNETIC ENERGY STORAGE

Unlike magnetism the energy is forced or compressed inwards rather than outwards. Dielectric lines of force push inward into internal space and along axis, rather than pushed outward broadside to axis as in the magnetic field. Because the lines are mutually repellent certain amounts of broadside or transverse motion can be expected but the phenomena is basically longitudinal. This gives rise to an interesting paradox that will be noticed with capacity. This is that the smaller the space bounded by the conducting structure the more energy that can be stored. This is the exact opposite of magnetism. With magnetism, the unit volume of energy can be though of as working in parallel but the unit volumes of energy in association with dielectricity can be thought of as working in series.

VOLTAGE IS TO DIELECTRICITY AS CURRENT IS TO MAGNETISM

With inductance the reaction to change of field is the production of voltage. The current is proportionate to the field strength only and not velocity of field. With capacity the field is produced not by current but voltage. This voltage must be accompanied by current in order for power to exist. The reaction of capacitance to change of applied force is the production of current. The current is directly proportional to the velocity of field strength. When voltage increases a reaction current flows into capacitance and thereby energy accumulates. If voltage does not change no current flows and the capacitance stores the energy which produced the field. If the voltage decreases then the reaction current reverses and energy flows out of the dielectric field.

"Unfortunately, to a large extent in dealing with dielectric fields the prehistoric conception of the electrostatic charge (electron) on the conductor still exists....and makes the consideration of dielectric fields unnecessarily complicated."

-- Charles Proteus Steinmetz

As the voltage is withdrawn the compression within the bounded space is relieved. When the energy is fully dissipated the lines of force vanish.

AGAIN THE LIMITS ZERO AND INFINITY

Because the power supply which provided charging voltage has internal conductance, after it is switched off the current leaking through conductance drains the dielectric energy and converts it to heat. We will assume a perfect capacitance having no leak conductance. If we completely disconnect the voltage supply by open circuiting the terminals of the capacitor, no path for current flow exists by definition of an open circuit. If the field tends to expand it will tend towards the production of current. However, an open circuit will not allow the flow of current as it has zero conductance. Then any attempt towards field expansion raises the voltage which pushes the field back inwards. Therefore, energy will remain stored in the field. This energy can be drawn for use at any time. This is another form of energy storage.

INSTANT ENERGY RELEASE AS INFINITY

Phenomena of enormous magnitude manifest themselves when the criteria for voltage or potential difference is instantly disrupted, as with a short circuit. The effect is analogous with the open circuit of inductive current. Because the forcing voltage is instantly withdrawn the field explodes against the bounding conductors with a velocity that may exceed light. Because the current is directly related to the velocity of field it jumps to infinity in its attempt to produce finite voltage across zero resistance. If considerable energy had resided in the dielectric force field, again let us say several KWH, the resulting explosion has almost inconceivable violence and can vaporize a conductor of substantial thickness instantly. Dielectric discharges of great speed and energy represent one of the most unpleasant experiences the electrical engineer encounters in practice.

ENERGY RETURNS TO MAGNETIC FORM

The powerful currents produced by the sudden expansion of a dielectric field naturally give rise to magnetic energy. The inertia of the magnetic field limits the rise of current to a realistic value. The capacitance dumps all its energy back into the magnetic field and the whole process starts over again. The inverse of the product of magnetic storage capacity and dielectric storage capacity represents the frequency or pitch at which this energy interchange occurs. This pitch may or may not contain overtones depending on the extent of conductors bounding the energies.

CHARACTERISTIC IMPEDANCE AS REPRESENTATION OF PULSATION OF ENERGY FIELD

The ratio of magnetic storage ability to that of the dielectric is called the characteristic impedance. This gives the ratio of maximum voltage to maximum current in the oscillatory structure. However, as the magnetic energy storage is outward and the dielectric storage is inward the total or double energy field pulsates in shape or size. The axis of this pulsation of force is the impedance of the system displaying oscillations and pulsation occurs at the frequency of oscillation.

ENERGY INTO MATTER

As the voltage or impedance is increased the emphasis is on the inward flux. If the impedance is high and rate of change is fast enough (perfect overtone series), it would seem possible the compression of the energy would transform it into matter and the reconversion of this matter into energy may or may not synchronize with the cycle of oscillation. This is what may be considered supercapacitance, that is, stable long term conversion into matter.

MISCONCEPTIONS OF PRESENT THEORY OF CAPACITANCE

The misconception that capacitance is the result of accumulating electrons has seriously distorted our view of dielectric phenomena. Also the theory of the velocity of light as a limit of energy flow, while adequate for magnetic force and material velocity, limits our ability to visualize or understand certain possibilities in electric phenomena. The true workings of free space capacitance can be best illustrated by the following example. It has been previously stated that dielectric lines of force must terminate on conductors. No line of force can end in space. If we take any conductor and remove it to the most remote portion of the universe, no lines of force can extend from this electrode to other conductors. It can have no free space capacity, regardless of the size of the electrode, therefore it can store no energy. This indicates that the free space capacitance of an object is the sum mutual capacity of it to all the conducting objects of the universe.

FREE SPACE INDUCTANCE IS INFINITE

Steinmetz in his book on the general or unified behavior of electricity *THE THEORY AND CALCULATION OF TRANSIENT ELECTRIC PHENOMENA AND OSCILLATION*, points out that the inductance of any unit length of an isolated filamentary conductor must be infinite. Because no image currents exist to contain the magnetic field it can grow to infinite size. This large quantity of energy cannot be quickly retrieved due to the finite velocity of propagation of the magnetic field. This gives a non reactive or energy component to the inductance which is called electromagnetic radiation.

WORK OF TESLA, STEINMETZ AND FARADAY

In the aforementioned books of Steinmetz he develops some rather unique equations for capacity. Tesla devoted an enormous portion of his efforts to dielectric phenomena and made numerous remarkable discoveries in this area. Much of this work is yet to be fully uncovered. It is my contention that the phenomena of dielectricity is wide open for profound discovery. It is ironic that we have abandoned the lines of force concept associated with a phenomena measure in the units called farads after Faraday, whose insight into forces and fields has led to the possibility of visualization of the electrical phenomena.

QUESTION AS TO THE VELOCITY OF DIELECTRIC FLUX

It has been stated that all magnetic lines of force must be closed upon themselves, and that all dielectric lines of force must terminate upon a conducting surface. It can be inferred from these two basic laws that no line of force can terminate in free space. This creates an interesting question as to the state of dielectric flux lines before the field has had time to propagate to the neutral conductor. During this time it would seem that the lines of force, not having reached the distant neutral conductor would end in space at their advancing wave front. It could be concluded that either the lines of force propagate instantly or always exists and are modified or conjugate space exists within the same boundaries as ordinary space. The properties of lines of force within this conjugate space may not obey the laws of normally conceived space.

IMPORTANT REFERENCE MATERIAL

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