

# "True" Electromagnetism of Nikola Tesla

Eric P. Dollard

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# Chapter 1

## Tesla Round 2, The Story of Eric Dollard

### 1.1 THE JOURNEY OF ERIC DOLLARD

Nikola Tesla single handedly gave us the technology that has created our entire power grid and communications systems. As the pinnacle of the evolution of the Victorian scientists Tesla aspired to create a system that would light up the entire world without wires. In the end a combination of his own wreck less decisions and the agenda of the moneyed elite brought upon his downfall and banishment. Undaunted by this, Eric's set out to recreate all of Tesla's technology and to design a system of communication and energy synthesis for the world, naturally at no cost.

Eric was successful in rediscovering Tesla's core work, yet he is now living out in the desert. His laboratory and all of his possessions taken were from him. Eric's story is the story of all those who fight for truth in defiance of power. How his story ends is up to us.

As a fifteen year old Eric was granted free access to RCA's great Bolinas Radio Facility. RCA, America's biggest Radio station at the time was happy to grand the young prodigy complete accessto all of their facilities for his research into high frequency alternating current. Eric wasn't on the payroll for legal reasons but the competition for Eric was high and Bell Telephone quickly snatched him up right out of High School. Eric left high school with three certifications as a full fledged engineer at the age of sixteen. Bell Labs called him their "Golden boy" and "Angel of Electricity".

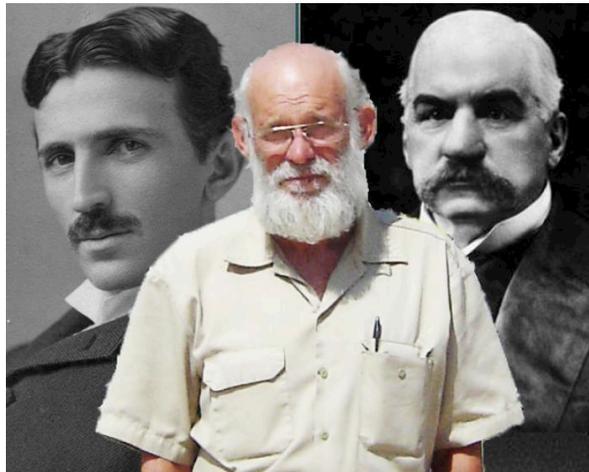


Figure 1.1: Meet Eric P. Dollard, the only scientist alive to have recreated the work of Nikola Tesla.

To pursue true science is to pursue truth and all truth seekers are to be tested. Eric learned this a hard way at an early age when his parents wrecked his garage laboratory and kicked him out of the house. This was to be the first time his laboratory and work would be deliberately destroyed. In desperation he enlisted in the US Navy. They gladly accepted the young recruit and after aptitude testing referred to him as "God's gift to the Navy". He solved their "impossible problems" with ease and later returned to RCA to save their network from the rapidly advancing threat of satellite communications.

Eric was happy to be back at the massive Bolinas station as he was beginning to see just how special it was among radio facilities. The great Bolinas Radio station, also called KPH was one of the oldest in the world and it held a secret that had been covered up for decades.

He began to see that much was being hidden about how radio really worked. With his free time he began peering into the forbidden history of radio. Then one day he read a copy of John O'Neill's book *Prodigal Genius*. The suppressed history of Nikola Tesla was laid before him. Eric began to see how the radio system as it was now was merely a shadow of what it was intended to be and once was.

Eric began reading all of Tesla's patents and lectures. What he discovered was that after reinventing alternating current in the 1890's Tesla then discovered an entirely new kind of electricity that was not electro magnetic in origin, hence completely different from the system we use today. This was confirmed by reading the court transcripts from the patent trial between Tesla and Marconi, where Tesla stated many times that his technology was not electro magnetic, a statement that at the time fell on deaf ears. Eric, heard him loud and clear.

If Tesla's discovery did not use electro magnetic waves then what kind of waves were they and how was it different? Eric did not turn to the false path of theorizing with nebulous mathematics as our modern day physics would but to experimentation, as Tesla himself always did. From his lab in California and working the salvage business Eric managed to recreate all of Tesla's key experiments. What he discovered would come as a surprise to even the most learned Tesla fan.

## 1.2 THE TRUTH ABOUT TESLA

Most scientists associate Tesla's work with Frankenstein movies the same way childrendo. EventhemostavidTeslafansbuild Tesla Coils for Halloween entertainment

and completely miss the point of his invention.

-Tesla's system of wireless transmission of power and communications was not through the sky, but through the earth, as in the actual ground. While it did naturally reach out into the atmosphere, the earth itself was the main conductor.

-Tesla discovered a completely new kind of electrical energy, one that was faster than the speed of light and did not lose strength as it was transmitted. hence it was NOT electro magnetic.

-This new energy could send power through the earth and the earth amplified this energy as it traveled, meaning that one transmitting station could send one million volts through the ground and 5 receiving stations whether around the neighborhood or around the world could each receive one million volts, for a total of five million volts of power!

-This energy could be used to send communications as well as power, and this was the case from 1900 to the 1919's until RCA refitted the landmark Bolinas plant and suppressed the Tesla longitudinal technology.

Tesla's secret project was about far more than simply transmitting electricity without wires. It was about all communications at faster than light speeds and giving energy away to all humanity for nothing. Tesla figured it all out in theory but did not complete his system. Eric Dollard has figured out how to implement the core of these ideas into a viable system. The first major radio installation in the USA was at Bolinas California. The same station where Eric got his start as a fifteen year old engineer working for RCA. Bolinas was first built by Italian inventor Marconi in California in 1913. Marconi used 17 of Tesla's patents to build this system and it worked. This station used massive plates in the ground, one buried in the ocean near the fault lines, to transmit radio waves that ALSO carried power, not enough to power homes but certainly enough to power radios. This is why the old crystal radio sets of the 20's and 30's had bright clear sound **WITH NO BATTERY OR WIRE TO THE WALL OUTLET!**

Thus we can now see that the first radio stations in the USA were leading back to Tesla's free power transmission system that sent radio waves using Tesla's method. Marconi did not go all the way and build it as Tesla envisioned which was to broadcast power to a network of such stations worldwide. The Tesla Marconi station sent out radio waves using Tesla's longitudinal wave technology. These

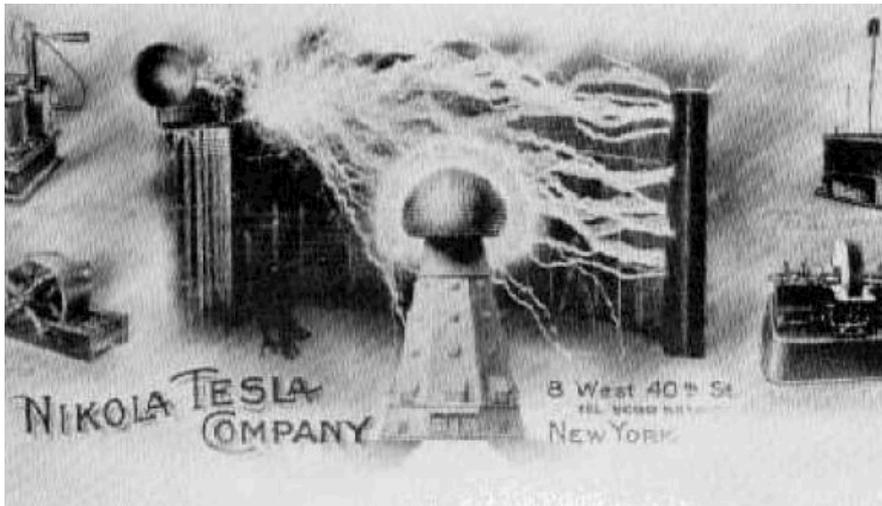


Figure 1.2: The work of Nikola Tesla.

waves provided enough power to amplify the signals it sent without any external electricity, even worse the existence of such technology left the door wide open for others to naturally pursue the transmission of energy via radio. This was far too threatening for the energy industry and they had Marconi's station shut down and replaced with an inferior system of electro magnetic waves, which is what we use today.

This plant was further augmented with the technology of another brilliant radio engineer by the name of Alexandersson. It became such a prized jewel into crown of the military industrial complex that it's secret had to be hidden away. The true value of the Bolinas Radio station can now be seen. Not only did RCA bury it's significance but other shadowy NGO's such as Commonwael of Bolinas, California made it there prime directive to literally bury the facility under a pile of dirt and garbage. Commonwael poses as a harmless NGO but this belies it's true purpose as a front of the central banking cartel to suppress forbidden technologies.

Commonwael presents itself as an non profit organization dedicated to the environment and health, with a focus on cancer. Ironically they were the prime agents in the vandalization of the Bolinas Facility. By aiding in the suppression of Tesla's radio technology which is perfectly safe, unlike the current electro magnetic technology which has been proven to cause cancer, they have shown themselves to be an organization against the environment and against fighting cancer. Commonwael is another Rockerfeller front.

### **1.3 THE TESLA MYSTIQUE DE-CLOAKED**

Tesla is now wrapped within the cloak of a deep mystique as a flawless genius who invented AC current, radio, electricity and pretty much everything else. Tesla was indeed a magnificent genius but he was far from perfect. People blame J.P. Morgan for crushing his dream at Wardencllyffe but they fail do their research, read the book *Empire of Lights*, and see that Tesla had received monies from Morgan to develop telegraphic radio and from Astor for the florescent light bulk yet Tesla in his own idealistic way spent the money instead to further his own theoretical research, which lead not to the promised deliverables but to a lack of confidence amongst him and his investors instead. The mystique buries Tesla under a mountain of sugar and keeps his admirers from seeing the true and revolutionary nature of his work.

Why hasn't all this critical information about Tesla been revealed, at least among the Tesla community? You would think that the many Tesla societies



Figure 1.3: The family of Eric P. Dollard.

around the country would have revealed these shocking and revolutionary truths long ago. Eric Dollard claims that the vast majority of Tesla societies are disinformation fronts funded and controlled by the very same interests that suppressed Tesla's work.

Eric gave several long and deep presentations on the truth of Tesla's work at the San Francisco Tesla Society. To this day these video presentations and even a book that Eric had written are being withheld from the Public by the San Francisco Tesla Society, a now revealed to be a front for the Lawrence Livermore National Labs. Those who wish to know the truth about radio and Tesla's real work should connect Eric Dollard with an attorney willing to sue the San Francisco Tesla Society in court to retrieve the videos and book.

Lawrence Livermore Labs feigns alternative energy research but is simply a front for high finance to make certain no real energy solutions ever enter the market. They sponsor Tesla Societies throughout the country in an effort to obscure the truth about Tesla and keep us looking at ineffective solutions like solar.

Eric made an excellent video about the truth of the Tesla Marconi radio station and why it was shut down. When this video was made Eric still did not know the full extent of the suppression. The books of Gerry Vassilatos, *Secrets of Cold war Technology* and the *Vril Compendium*, showed him just how far RCA and the shadowy organizations funded by the central banking cartel went to suppress Tesla's longitudinal wave technology.

## **1.4 POLITICS OF THE AETHER**

After Eric confirmed and double checked all these findings he was left to accept a very painful political truth. All of Tesla's work with this new type of electricity and wave form had been actively suppressed. Despite this new type of energy wave being far more cost efficient and effective it was banned from all commercial use and banished from textbooks as well. The scientific community has disavowed any knowledge of it, why?

This original form of transmission, called dielectric wave forms, if allowed to proliferate through the industry would have naturally lead to the transmission and synthesis of energy at no cost. The very intellectual admission of the existence of this type of energy was the admission that there was energy all around us. Victorian scientists up until the twentieth century called this energy field that permeated the entire universe, the aether. Tesla believed that his system of longitudinal electricity worked because of the aether.

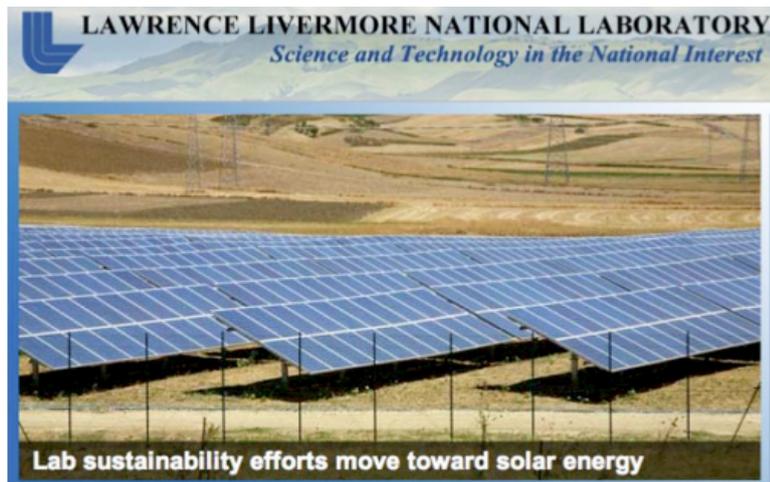


Figure 1.4: The Lawrence Livermore National Laboratory.

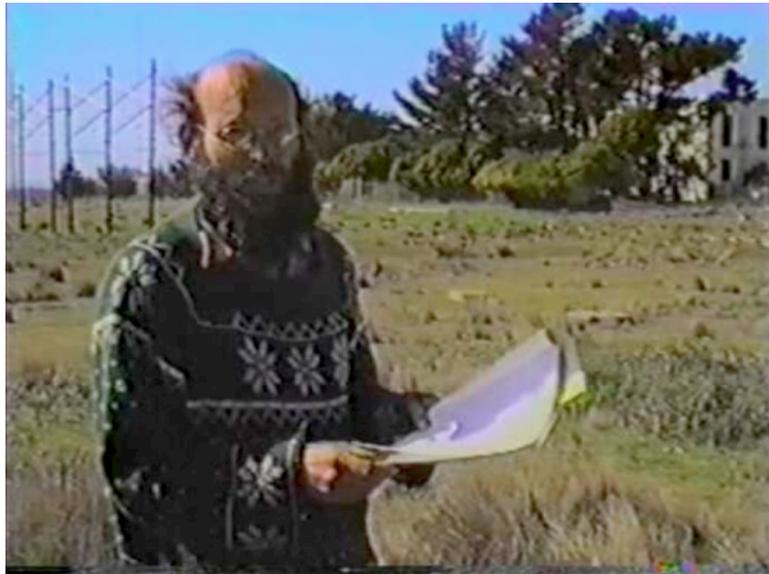


Figure 1.5: The Tesla Marconi radio station.

The aether was a dangerous concept to the energy barons such as Rockefeller, Morgan and the central bankers that funded them such as the Rothschilds. It was not enough to destroy Nikola Tesla, and to tear down any trace of such technology such as the Marconi radio plants built with Tesla and Alexandersson dielectric technology. The powers that be had to completely destroy the very idea of the aether and ensure that free energy would never again threaten their monopoly.

Physics was hijacked and turned into a religious cult of personality. Nebulous theories and quirky characters were constructed to misinform all generations afterwards. Eric Dollard has not been shy in his writings and named The Theory of Relativity and Einstein as the main constructs to this end. Many other scientists support him and there is a growing movement to liberate physics from pseudo psychics from the high priests of nebulous pseudoscientific banker funded dogma. Time magazine, The NY Times and many other publications have recently published articles citing the evidence that Einstein was wrong. Einstein was proven wrong the moment he introduced his theory and has been proven wrong countless times since, yet we still hail him as a saint of science.

The suppression is inter generational and Einstein was only the first pillar of the deception. Carl Sagan, Stephen Hawking and most recently Michio Kaku have taken up the flag of obfuscated mysticism in a desperate effort to suppress aether theory. All this at the bidding of the same central banking giants which sprang from the Rothchilds and Rockefellers.

Knowing this and knowing the fate of Tesla and all those that tried after him to recreate his work was not enough to stop Mr. Dollard. Eric went about his work and peered even more deeply into the past.

Einstein, Tesla and Steinmetz. One is a fraud, plagerist and pillar of disinformation, one is a brilliant scientist whose true work has been ruthlessly suppressed and the other a brilliant mathematician whose work has been buried. From left to right, Einstein, Tesla, Steinmetz.

Stephen Hawking is one of the main pillars of the establishments corruption of physics. Theorizers such as himself are praised and lauded while those who actively work to implement true physics for the betterment of humanity are left destitute in the wild

Eric Dollard is not the only one fighting against the hijack of science by the stooges of international finance and social control. There is a growing movement to liberate psychics from the lies and to resurrect the work of natural scientists such as Tesla.

Tesla scared the central bankers senseless. They knew what his plan meant. Energy independence meant an almost complete loss of control of the people.



Figure 1.6: Albert Einstein, Nikola Tesla and Proteus Steinmetz at RCA. (c.f. But the "Nikola Tesla" in the picture should not be real Nikola Tesla. Because since he was a 190 cm tall guy, he should be much bigger than Albert Einstein as well as Charles P. Steinmetz. This guy in the picture is suspected to be Reff Carson whose face was very similar to that of Nikola Tesla.)



Figure 1.7: Stephen Hawking.

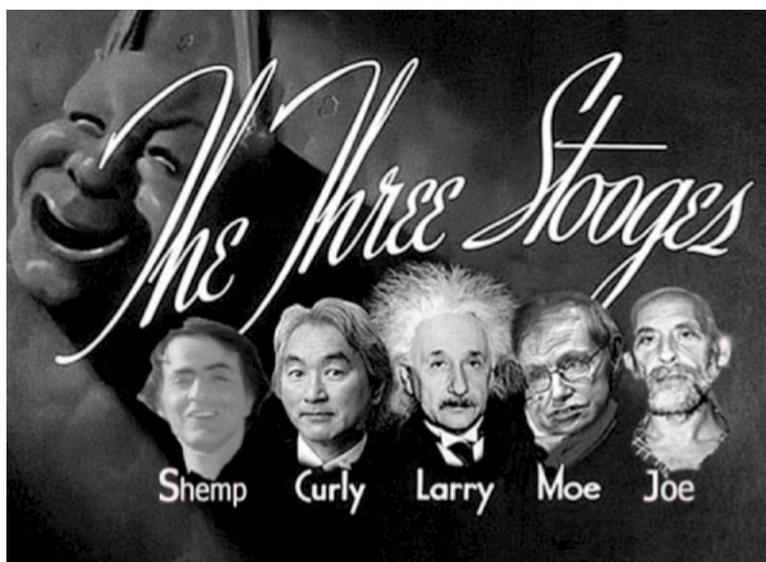


Figure 1.8: The main pillars of the establishments corruption of physics.



Figure 1.9: Morgan, Rothschild and Rockefeller, the three stooges of international finance and social control.

They used Morgan as the front man to shut Tesla Down. They are doing the same thing today through nebulously named ngo's such a Commonwael.

## 1.5 BACH & ORGANIC ELECTRICITY

Science and logic alone were not enough to comprehend the aether and how energy flowed through it and from within it. Eric looked to the legendary mathematician Charles P Steinmetz and to Oliver Heaviside for answers. Their censored writings revealed that they too had taken this battle for truth upon themselves and were met with the same resistance. In their mathematics and Tesla's experiments lie the key to unlocking the aether but there was one element missing to decipher the riddle.

Johannes Sebastian Bach and his music held the answer. The multi-dimensional organ music of Bach began to reveal an organic matrix to Eric. He began to see the work of Bach as a culmination of the same thread of natural science exposed by Pythagoras of Samos. The aether and the energy it produced was not some mechanical construct and thus pure mechanics and mathematics alone could not represent it. The aether was an organic energy matrix and it was as responsible for the static electricity in the air as it was for the plants that grow from the ground and the animals that walk the earth. Eric had begun to step out of the world of pure science and into the metaphysical.

Eric noticed in his experiments that when he ran this special electricity of Tesla's through wood or other organic matter that it would burn tree like etchings into it. They looked like the branches of trees and their dimensions reflected the golden ratio. Going a step further Eric noticed that when this energy was transmitted within vacuum bulbs that galactic formations and cosmic arrangements would form within the bulbs. It was as if he was looking through the Hubble telescope through a light bulb on his lab bench. Further experiments revealed the fractal organic nature of all matter. The aether theory became all the stronger the more one compared the cosmic and organic.

The aether was ever present and could project it's formative powers to any proportions. The deeper he went into true science the more that he saw that science and spirituality were one and the same. He began to see quantum physics as a misinformation campaign for true aetheric science. The mystics of the past knew more of true science than the quantum physics of today.

Eric would progress even further into the study of the ether. The more he experimented with channeling dielectricity through various enclosed spaces the

more he uncovered the truth behind the "Theory of Creation" The Big Bang was a big Hoax and Einstein, Darwin and the whole lot of them were crushed by his experiments. Eric Dollard now became a very dangerous man to the establishment as his scientifically proven and tested research could destroy the web of lies which they had carefully built for over the past three hundred years.

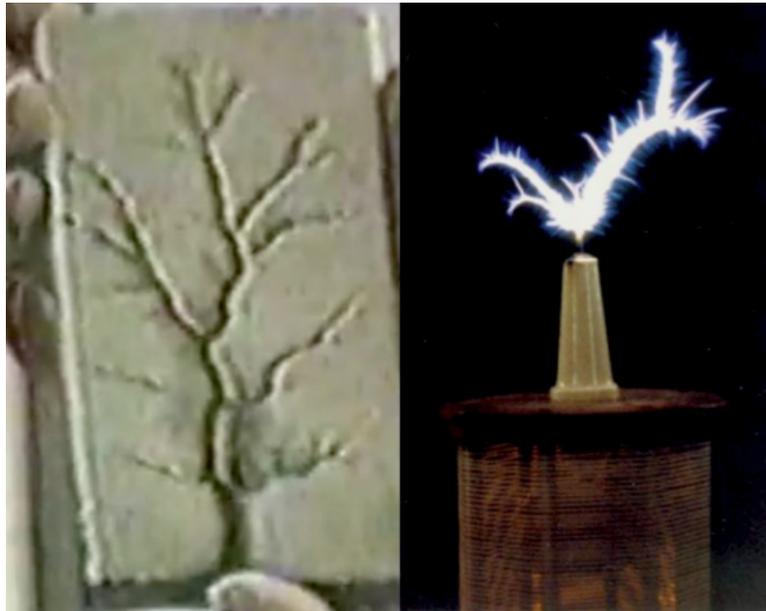


Figure 1.10: Tesla Coil.

The shape on the left has been burned into wood by a Tesla coil. The right is the special kind of electricity Tesla discovered in its pure raw form. Notice the

organic shape.

## **1.6 THE MIRACLE OF GROUND RADIO**

A retired aerospace technician named Walter J De-Roche, who would die under suspicious circumstances, left Eric a facility which was once used for Ionospheric and Telluric research. This was the last research laboratory Eric had and was located at Landers California.

A wealthy investor in the alternative science scene once commented that "Eric Dollard has done more with food stamps than you all have with millions" This kind of praise was not an understatement as Eric single handedly transformed the long abandoned Landers facility into a radio base to serve the country of San Bernadino and the 29 Palms Marine Corp Base as a civil defense station and earthquake warning system. On a shoestring budget Eric had taken Telluric ,relating to the study of electricity within the earth, research to new heights and his facility could even detect underground nuclear blasts from North Korea.

The Landers plant could be scaled to serve the entire country with free, loss less, faster than light radio, save lives via earth quake detection and potentially far more. Upon the completion of this modern day wonder, the powers that be swooped, shut it down and destroyed it. A certain Roy McGee and Olin Bates worked together to cheat Eric out of the property and even confiscated all his notes, gear and work.

After losing this, his last laboratory and being so close to implementing a system that would revolutionize communication for the community, Navy and possibly the entire country Eric has realized that his work shall always be marked for destruction. Eric wants those that truly desire the advancement of science to step forward and support a campaign to sue the guilty parties in court and get back his life's work. The potential for the advancement of humanity is tremendous.

Eric inherited a radio station in Landers, CA from a friend. He spent years building it up and turned it into the an advanced ground radio station that could detect earthquakes before they occur, transmit faster than light radio with no losses and potentially far more. The "far more" part sent the powers that be scrambling to destroy it and they did.



Figure 1.11: Eric Dollard in his Lab.

## **1.7 A HARD FOUGHT BATTLE**

Eric, now in his sixties has had to endure more hardship than most humans and even rebel scientists can imagine. He has been assaulted many times and suffered serious injuries. He has had his home and lab's raided repeatedly and been driven to homelessness. All of his friends have betrayed him, all of his possessions taken from him and worse still all of his notes and work burned. In this last scenario they even took his pet dog away from him.

While Eric has had to face off with the men in Black many times, it was the women in white that the powers that be choose to send after him this time. An NGO posing as a charitable foundation but in actuality being a front of the energy brokers was what did him in this time. They knew he was close to releasing something monumental and they swooped in and took everything but his life.

You would be harder pressed to find a scientist who has gone through more destroyed laboratories than Eric P. Dollard.

1. High school era lab destroyed...by his own parents
2. Project One Fan Francisco Lab, destroyed by financial interests
3. Sonoma State University Lab, junked by New State Administration
4. Santa Barbara Lab, embezzled by Mr. George Flores
5. Richmond Shipyard Lab, destroyed by Mr. George Flores as well
6. Camp David Installation, destroyed by County of Marin
7. R.C.A./Marconi Lab, destroyed by General Electric, Common-wael,  
Green Peace and Park Service
8. Landers destroyed by Olin Bales with the blessing of the San Bernardino Sheriffs Department and Court System.

Eric has not given up. While he has rebuilt his lab many times and rallied to the finish line alone, this time it is different. Now in his sixties, black listed and without a penny to his name we cannot ask this man to try and bless the human race with the gift of free natural energy yet again, not without our help.

Eric Dollard has fought for the truth his entire life. His reward has been tyranny and poverty. Eric is now homeless and on welfare. It is miracle he is even alive.

Barbara Boxer is a senator in California. She has steadily and forcefully pushed a thinly veiled communist agenda upon the state and according to her FBI file has been linked to the suppression of the work of Eric Dollard. Powerful forces are always against those who fight for truth. They do not always send the

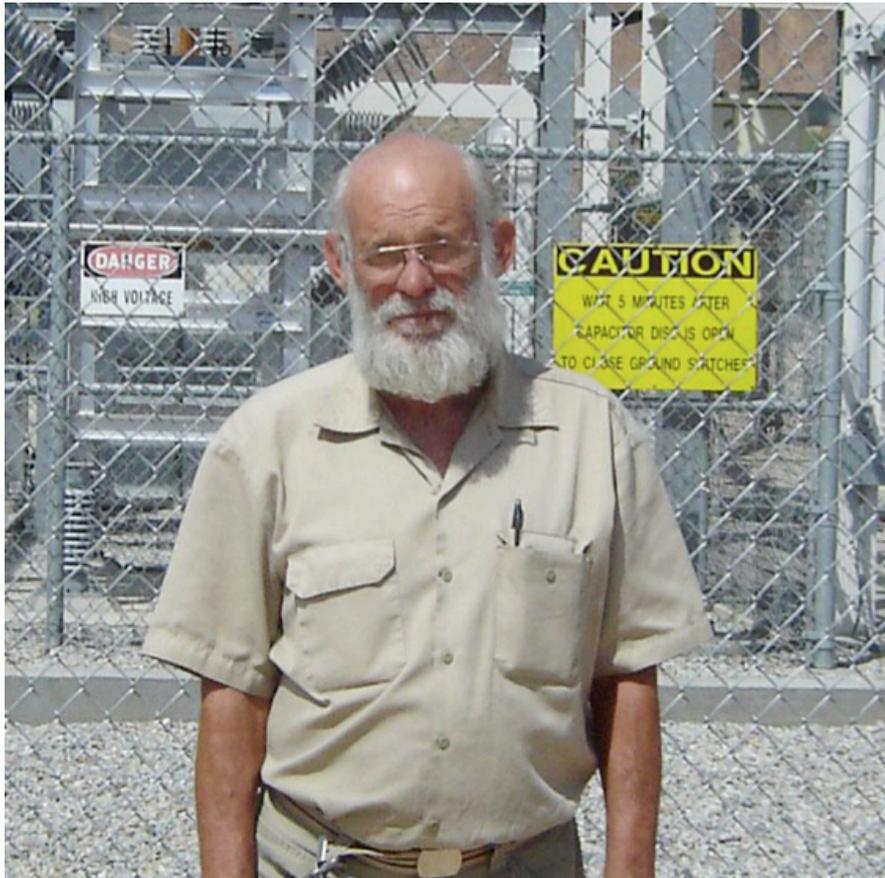


Figure 1.12: Eric Dollard has fought for the truth his entire life.



Figure 1.13: Barbara Boxer, a senator in California.

men in black but instead opt for the women in white when they think you are a truly serious threat.

The facility that held the secrets of Tesla technology has been vandalized, gutted, and now destroyed. The suppression of energy technologies is very real.

George Gadboury is the President of the Tesla Society of San Francisco. He has been holding onto Eric's presentations and even his book. First he demanded a ransom then when people offered to pay he refused to even answer. A confirmed agent of suppression.

## 1.8 ROUND TWO

Being a huge Tesla fan I would always dream about living back in Tesla's time, being his friend and student. I would be the one to stand by him and support him when everyone left. I would be the friend that inspired him and brought other allies to his cause. I would be the one to help pick him up when they knocked him down and I would also be there at the party to celebrate the energy independence of all humanity. Energy barons, central bankers? To hell with them. If you have the will then anything is possible.

This is why I am writing this article. It took 5 months of research before I finally discovered Eric Dollard, what he had accomplished and what had been done to him. His entire story has been hidden even within the niche of the alternative science community, such is how desperate the powers that be are to bury his work. I believe in him 100% and I believe that energy for all humanity is not only natural but our God given right.

There are three things you can do right now to help Eric P Dollard and his mission.

1. Believe in abundance, believe that energy for all humanity at no cost is as natural as a seed in the ground producing fruit. This is the hardest thing but it only takes a second.
2. Send this article to your friends and spread the word about The Mission of Eric P Dollard.
3. Write Eric a letter! Not an email, a real paper letter, in the mail! Eric is old fashioned. analog only and homeless but he does have a PO Box. It would help his spirits immensely to know he had believers.



Figure 1.14: The destroyed facility for the secrets of Tesla technology.



Figure 1.15: George Gadbury, the President of the Tesla Society of San Francisco.

Eric Dollard  
General Delivery Lone Pine, CA 93545

Eric has not given up, he is still trying to pass on his knowledge so that others might recreate his work and Tesla's work.

Eric Dollard has given many lectures around the USA. Many of them have not been released but the ones that we have offer immense insight into the truth of electrical engineering. He hopes that someone can continue the work in his place but imagine if we could give Eric the chance to finish his mission.

- Imagine if we all came together and shone a spotlight on this selfless and brilliant scientist.

- Imagine if Eric could once again have his own lab, which no one could take away from him and the support of millions.

- Imagine if the powers that be, a hundred and twenty years after they shut down Nikola Tesla, were defeated by his student and his army of believers.

Imagine a world where dreams and the will of the people ruled.

Please support The IndieGogo Campaign for Eric Dollard.



Figure 1.16: Eric Dollard has given many lectures around the USA.



## Chapter 2

# Radio Archaeology

Eric gives us a true lesson in the history of Radio. Much more than a history lesson the truth behind this story threatens to shatter the entire scientific world.

Radio was suppressed and the radio we now have is but a primitive shadow of what it was at the turn of the century. Tesla technology was ripped from the power grid and the radio system for fear that people would learn the truth about electricity.

IN June of 1997 Bolinas radio station KPH went silent after ninety-four years of service to the maritime industry. KPH was started in 1903 as PH (Palace Hotel) in San Francisco by famous radio experimenter and pioneer Lee DeForest. PH became a successful wireless station and was later absorbed by the American Marconi Co., as were many other stations and wireless patents. By 1913 Marconi had personally selected a new station site thirteen miles north of San Francisco, near the fishing and lumber town of Bolinas. Bolinas was and still is a geo-physical radio anomaly of exceptional power, a fact recognized by the native Miwok Indians centuries before Marconi's arrival. It was at this new site near Bolinas that Marconi engaged in a major engineering effort – the construction of his new wireless facility, at that time one of the world's largest.

American Marconi employed the J.C. White Engineering Co. to construct the powerhouse and related facilities. General Electric, through the efforts of Charles Steinmetz and Ernst Alexanderson, designed and constructed the wireless appliances. A pair of systems were employed by American Marconi, one was the disruptive discharge/oscillation transformer system of Nikola Tesla, the other was the alternator/multiple tuned antenna system of Ernst Alexanderson. Both systems involved transmission into the earth, which necessitated the planting of large bronze plates in the ocean, as well as many miles of wire in the soil sur-

rounding the powerhouse. These are still present to this day, rendering powerful radionic influence to this site. The Tesla system operated at a power level of 300 kilowatts and the Alexanderson system 200 kilowatts, the alternators running at 18 kilocycles per second. This facility represented the leading edge of science and philosophy at that time, and Marconi had brought the wireless principles of Tesla and Steinmetz together in what was now called KPH. Marconi also brought electricity to the town of Bolinas.

At the height of this endeavor, Ernst Alexanderson proclaimed at an engineering convention that wireless will "forever free mankind from political slavery." Little did he realize that decades later Bolinas would serve as an institute for the perpetuation of political slavery.

In 1919, upon completion of this grand facility, KPH Bolinas, it was seized from American Marconi by the U.S. Navy. In 1920 KPH, along with related facilities on the East Coast, as well as scientist Alexanderson, were turned over to the newly formed Radio Corporation of America (RCA), under the rule of David Sarnoff. Shortly thereafter the wireless equipment, with the exception of the 18 kc alternators, was smashed up and dumped over the ocean cliffs. By 1920 General Electric began the development of the water-cooled pliotron oscillator as the source of high frequency electric currents. The pliotron was a refined version of the DeForest thermionic triode vacuum tube. The pliotron oscillator was much more manageable than previous oscillators, the noise of which could be heard in the town of Bolinas two miles distant. Pliotrons were silent. Along with the usual bent L aerials, Alexanderson developed new structures known today as colinear-broadside arrays. These arrays remained the principal KPH antennas for the rest of its history.

By 1924, new facilities were completed to accommodate the growing capabilities of KPH. Building "2" was constructed for new transmission equipment and Building "9" was constructed as the power substation control. A parking garage was also erected. General Electric developed new transmitters utilizing the now standard master oscillator-power amplifier configuration. Water-cooled pliotrons called "207's" served as the power amplifiers. The oscillations were derived from a plate cut from a quartz crystal, and then amplified to high power levels through successive intermediate stages using the just developed 860 and 861 tetrode vacuum tubes. These systems were called the "B" sets, operating in the megacycle range with a power output of 20 kilowatts. The Alexanderson infinite propagation velocity principle, used in his 18 kilocycle array, was again applied in a new design for megacycle operation.

These were called the Type "A" projectors and had the appearance of fish

bones. The "A" was a vertical electro-magnetic broadside array that transferred no electric induction into the ground. Here was the birth of electro-magnetic radio, the radio of today.

At the end of the 1920's and into the 1930's, General Electric developed larger versions of the "B" sets and the "C" sets that followed them. These operated at power levels of 40 kilowatts and began the utilization of crude amplitude modulation. They were called the Type "D" and "E" sets. RCA scientists, Beverage, Carter, and Hansell, developed the electro-magnetic wave antenna. These antennas worked on the traveling wave principle. Large self supporting towers were erected to hold the long wires hundreds of feet in the air. These antennas were called the Type "B" and "C" projectors. Out of these came the Type "D", now known as the rhombic array. The rhombic has remained a principal HF antenna to this day.

A new station now stood with KPH, it was called KET. KPH served as the original ship-to-shore service of DeForest and Marconi, remaining in the Marconi Building, now called Building "1". KET, in the new Building "Z", served as the point-to-point overseas link to the Orient, replacing the Marconi-Alexanderson 18 kilocycle system. While KET served as the principal call letters for the point-to-point operation, many had to be assigned to cover the vast number of channels the station now offered. The Morse code still used by KPH gave way to the Armstrong Frequency Shift System and Teleprinter Operation for KET.

At this point in history, the sun shone upon this system of communication with disfavor, through the dramatic reduction in solar flux. Lowered solar flux weakens the earth's ionosphere, thereby diminishing its ability to propagate the launched electro-magnetic waves. While a major setback for HF radio, RCA forced its way through with higher power and larger antennas. The desire to override the competition, in light of the increased crowding of the HF band, forced the use of even higher power. The water could be heard to sing with the Morse code in the pliotron water jackets. Electro-magnetic radio was forever married to the cycles of the sun, undergoing disruption every eleven years. Later, in 1950, RCA scientist Nelson determined that the cycles of the planets also played a major role in radio propagation, requiring the development of radio astrology.

By 1939 RCA had contracted Westinghouse Electric Corporation to design and build the "F" set. This transmitter differed little from the "D" or "E" set of General Electric (GE), but serves as a point of departure from GE's domination of RCA equipment supply. RCA had already made their own vacuum tubes and condensers for the GE sets, but about this time, began producing complete transmitters. The first RCA designed transmitter for Bolinas was the "S" set. It utilized

the new forced air cooled triodes, the 891, and was plate amplitude modulated.

The "S" set was an AM short wave broadcast unit for voice and music, with an output of 20 kilowatts. About the same time, RCA had purchased the "U" sets from the Bunnell Telegraph Company. The "U" sets were more powerful than the "S" sets, but they had a tendency toward instability in the power amplifier. These were high fidelity, amplitude modulated transmitters with an air cooled plate modulator and a large single water-cooled triode, which required an independent distilled water-cooling system.

At this point in history, World War II was under way and the "U" and "S" sets served in propaganda broadcasting to Japan. The station was surrounded by army soldiers to protect against enemy attack. Bolinas had become a primary U.S. radio communications terminal, making it a likely target. The Japanese had already destroyed the RCA station on the Philippine Islands. The U.S. Navy reentered the scene, reenergizing the old 18 kilocycle wireless alternators and erecting a new Alexanderson multiple loaded antenna network. The Navy still needed Marconi's wireless technology to communicate with its submarines, as RCA's electro-magnetic radio was incapable of this task. The Navy also utilized RCA transmitters for surface communication, constructing its own Hertzian Dipole antennas for the task. Several signal corps water cooled triode (129B) transmitters were installed in the Marconi Building. With a power out of 10 kilowatts, these became the new KPH transmitters after the war.

When the war ended, so did wireless – for good. Tesla and Steinmetz were long gone, and Marconi was history. DeForest was still alive, but only Farnsworth was still inventing. Then there was Sarnoff, whose RCA had grown to be one of the most powerful corporations on earth, leaving a trail of dead inventors. The Navy left Bolinas, junking the alternators. Another layer of breakage went over the cliffs to be consumed by clay and salt. The 10 kilowatt signal corps units, called the "V" sets, remained, and there they served KPH until its final years.

In the 1950's the RCA Global Communication Facility in Bolinas underwent a massive expansion. Building Two had become overcrowded with HF transmitting equipment and obsolete antennas. The rhombic antenna exhibited outstanding performance and became the principal antenna for point-to-point radio communication. The collinear-broadside array remained the KPH ship-to-shore antenna.

The obsolete "A", "B", and "C" antennas came down, and fifty rhombics went up over the postwar years, occupying three thousand acres of land. A 50 kilowatt, 500 kilocycle transmitter, called BL-10, was installed in the Marconi Building. It used a single, massive, forced air-cooled triode (the 5671), weighing over 100 pounds. A 315 foot broadcasting tower with an aviation beacon lamp was erected

as its antenna. A shack was constructed at its base to house the large tuning coils. A new building was constructed to house a new 750 kilowatt, 4 kilovolt power generating set. Driven by a port engine from a Navy L.S.T. landing ship, this set could power the entire town of Bolinas. A large addition was made to Building Two, called 2A. A 2500 kilowatt electrical system was connected to Pacific Gas and Electric (PG& E.) to meet the growing station load – the electric bill was \$25,000 a month.

By the mid 1950's, Marconi and KPH had grown into a massive radio facility. The lights in the town of Bolinas dimmed when the telegraph operator pressed his key. RCA Global Communications handled virtually all radio traffic to the Pacific. RCA installed its new 20 and 40 kilowatt transmitters, called the "K" and "L" sets. The "L" sets were amplitude modulated and the "K" sets were frequency shift keying. These were refined units representing RCA's finest designs. Some of the control equipment, such as the BA-6A limiting amplifier are still in demand to this day. Broadcasting and teleprinter operations were covered by the "K" and "L" sets.

The 1960's saw the development of a revolutionary new form of modulation called sideband, a process of amplitude modulation that allowed for greater utilization of power and larger channel capacity. Through the use of voice frequency tone group (VFTG) multiplexing the channel capacity per transmitter expanded from two to sixty-four teleprinters. The Telesignal Corp. 101 and 102 VFTG units were purchased by RCA and installed, RCA changing the name tags to the RCA 901 and 902 to make them look like their own. (This was typical of RCA.) RCA scientist Kahn developed his brilliant envelope elimination and reinsertion (EER) exciters for the AM "L" sets, rendering them powerful sideband units with no need for wasteful linear power amplification.

RCA Global continued to grow in Bolinas with numerous radiophoto, broadcast, teleprinter, and telegraph transmissions. The station load had grown to 1000 kilowatts, and the PG&E Alto Line (Mill Valley) following the Dipsea Trail was no longer able to run Bolinas and RCA at the same time. For some reason PG&E had removed the transformers that it had installed for the young RCA of the 1920's on the 60 kilovolt Lakeville Line (Petaluma), and routed it to Woodacre for the water department. PG&E had to run a new 12 kilovolt line back to Bolinas to serve the station. Two lines, the Alto and the Woodacre, along with its 750 kilowatt alternator, rendered the station a major power center. More transmitters were installed, new linear sideband units called the "H" sets. Like the "K" and "L" sets they utilized forced air-cooled tetrodes. The power out was 10 kilowatts average and 20 kilowatts peak. All modulation was performed at low power levels, thus there was

no plate modulator, making for a very compact unit. Some 40 transmitters were now in operation, and over 60 antennas had risen to full glory. Its communications capacity pushed to the limit the old lead and paper telephone cable, which was put up by Chinese laborers in the 1920's along what was to become the Pacific Coast Highway.

As the 1960's came to a close, communication technology began its shift toward satellite systems, where 200,000 teleprinter channels were possible. Rumbblings of the closure of KET were in the air. Again the ocean cliffs – two "B" sets, 91313 and 11 BB, went over in large chunks, soon followed by the "S" sets. This time however the clay and salt did not claim another era of Bolinas. A group of young high school science students from the Air Force town of Novato were dragging a piece at a time to their garage laboratories. RCA allowed them to freely enter the station and gather what had not gone over the side. One of these students had reassembled 111313 in his parents two car garage. The next generation of radio development was on its way.

By the early 1970's, things did not farewell for RCA Global in Bolinas – KET started to disintegrate, David Sarnoff was dead, Marconi became small letters in a history book, and Tesla who? RCA had no head and flailed like a chicken. The old employees that worked the wireless were in their graves. A single channel remained to the island of Papetee. The crew was down to two in the day shift, Jim Bourne and Ivan Neilson, both old men now. The buildings were empty at night, so a cyclone fence was put around to keep out vandals. The Marconi Hotel stood open to vandalism and its records blew away in the wind.

RCA had decided to junk everything in Buildings 2 and 2A, except the "H", "K", and "L" sets of postwar design. However, the local RCA administration transferred it to the new adult science students. They leased a 3000 square foot warehouse space in San Francisco, known as Project One. These individuals, as well as local Vice President Jim Hepburn, himself an avid and brilliant radio experimenter, felt that new developments were possible in high frequency radio.

The U.S. Navy again reentered, and, through the Coast Guard, constructed station NMC at the Palo Marin edge of the RCA property. This took over the vital functions abandoned by the dying RCA Global. KPH still remained functional and intact, however, being a different branch of RCA called Radiomarine Corporation of America. By 1975 RCA turned the property over to the National Park Service, a branch of the U.S. Department of the interior, for preservation. RCA leased back what it needed to run the marine operation KPH, the ships did not want satellite communications. At this transition point a group calling itself Commonweal gained access to the site through the trust for public land. Commonweal,

a political organization, showed no regard for the history of the station, nor for the efforts of those operating and preserving it. In a period of five weeks, Commonweal had destroyed the entire contents of Building Two and sent all historic notes and records into the dumpster – KET vanished to the winds.

At the onset of the 1980's, only little of KPH remained. The "V" sets in the Marconi Building sat dead. BL-10 remained the only active transmitter in that building. KPH operation was transferred to the "H", "K", and "L" sets in Building 2A. These sets were adapted to telegraph operation, something that they were not designed for. Building 2, gutted of its shop and radio equipment, was sealed off by Commonweal and converted into office space and a party hall. Only one of the science students, who now was a professional radio engineer, remained. He operated a small research laboratory in the Alexanderson room of the Marconi Building, repairing and installing cables for RCA and Commonweal to earn his stay. Eventually he was forced out.

KPH, under the management of Ed Brennen, was allowed to decay rapidly. The aircraft beacon was dark, and rhombics crumbled to the ground. Rigging by unqualified persons caused a major electrical fire that destroyed the 750 kilowatt generator. Radio receivers were thrown from second story windows to assure destruction, despite the mandate to preserve them through science education and study at Sonoma State College.

In the mid 1980's GE returned, this time not to create, but to destroy what RCA and Commonweal had not. The "V" sets were smashed up by locals and dumped in a creek bed, except for a few scraps saved by a local fisherman. The remaining laboratory equipment vanished. A guardian of the old Marconi Building, the BL-10 remained active, electrocuting the last RCA employee, George Gieser, as if in an act of retribution. This was the only person to be electrocuted since BL-10 killed one of the RCA's first employees in 1920.

KPH limped along under GE. With rigged antennas that often caught fire and transmitters that performed poorly, the station could not be heard by its own customers. A glimmer of hope appeared, however, as the up-and-coming Globe Wireless Co., which had grown out of KPH's competitor, KFS of Half Moon Bay, applied to the Federal Communication Commission to takeover the Bolinas site as it had done with so many other sites around the world. The FCC denied Globe Wireless and instead it was turned over to MCI. MCI threw together a low cost system utilizing cheap 4 kilowatt transmitters made by a ham radio outfit called Henry Radio Co. The crumbling mass of rhombics were heaped into a great pile and four of the original Type "B" towers, which stood since 1938 without a spot of rust, were sold to a foreign country. MCI shabbily erected anew set of col-

inear broadside arrays. These required debugging by the still present, lone radio engineer and experimenter who, after having his new wireless antennas in town destroyed by Marin County sheriffs, now lived in his car in the antenna field. Perhaps his newly found radio theories could now find commercial application under MCI.

Under MCI, KPH traffic dwindled to nothing. KPH could never get business from American ships due to the lingering hatred of David Samoff, the murderer of wireless. MCI announced impending closure, and the remaining customers bailed to Globe Wireless. Station manager Jack Martini courageously rode his ship to the bottom in the maritime tradition. Finally as Hong Kong fell to China, KPH died, its frequencies sold to Globe Wireless. BL- 10 was wrecked by vandals and the Marconi Building stripped of its power source. The building deteriorated rapidly under Commonweal stewardship. Marconi's once great radio facility by in ruins, and one of the earths most significant radio hot spots sits Went with the exception of NMC. I, however, am the lone radio experimenter and am far from silent. The underground wires of Alexanderson are still present, waiting to sprout into a new form of wireless.

At present, in 1997-98, wireless transmission is considered a prehistoric technology, replaced by a vastly superior one of electromagnetic radio. But is radio really superior, or is it a mere shadow of a wider reaching science? When one looks back in history, as recently done by Mr. Vassilatos in his compendia, it is found that early wireless systems not only exhibited significantly less propagation loss and deviation, but also required no batteries or power supply. In fact, it can be seen that some exhibited the properties of energy producing rather than energy consuming systems. Such were those of Nikola Tesla. Is this why KPH and similar stations are forced to close and new laws rendering radio illegal are in the making?

It must be remembered that the first wireless detectors involved mechanical force between coils, the welding together of metal chips, or the heating of fine wires, all of which require the reception of substantial quantities of electric energy. There were no batteries. Modernistic radio requires amplification of millions to render the feeble electro-magnetic waves powerful enough to produce the same result. The amplifier of course requires batteries or some other source of energy. It was found in the early years that direction finding systems utilizing wireless impulses exhibited little or no deviation, whereas those systems utilizing electro-magnetic waves suffered from scatter and propagation disturbances. Wireless impulses obviously travel a more direct path than do the dispersive electromagnetic waves utilized today. It is further found that the emanations from

wireless coils and condensers were utilized by medical doctors to abate a variety of diseases, whereas electro-magnetic waves are an acknowledged hazard to health.

It is instructive to examine certain technical distinctions existing between wireless technology and the radio technology of today. It is also instructive to examine the efforts to block the scientific research and experimentation (at locations like KPH Bolinas) required to revive an important technology.

In electric wireless systems there exists a reciprocal relation between the energy of the antenna network in contact with the space and the utility that supplies power to the wireless transformers. Thus the reactance of the antenna network appears as a reactance to the power company, if the wireless system is so adjusted. Therefore, it is theoretically possible for the wireless system to become a supply of electrical energy to the power company without burning fuel. In contrast, the load offered by contemporary radio systems is a pure resistance to direct current, the very archetype of the destruction of electric force – nothing is returned to the power company.

Another distinction is that wireless networks such as the Tesla oscillation transformer, Alexanderson multiple loaded antenna, or the Marconi coaxial antenna, all exhibit frequencies and wavelength of higher order than those of electro-magnetic radio. These factors exist as complex quantities or conjugate pairs. Their propagation involve factors beyond distance and velocity, thus transmission without travel through intervening space. Electro-magnetic radio waves are inexorably tied to the effective velocity of light and the impedance of distance.

Ultimately it must be stated that the distinction between electric wireless and electronic radio is that wireless engineering is a science of the aether and radio engineering is a science of physical matter. Wireless theory considers space to be filled with an all permeating aether, this aether possessing the capacity to store and transfer energy in the form of a pair of conjugate fields of induction. These are called the magnetic field and the dielectric field. An alteration of the field intensity at one location results in an alteration of the field at another location, irrespective of distance. From cosmic forces and not human artifice, wireless networks ultimately are self powering.

In contrast, modernistic electro-magnetic radio theory considers space to be empty and distorted. Propagation is effected by a forced spray of photonic particles, traveling at the aforementioned effective velocity of light. Magnetic and dielectric actions are ignored, and instead the actions of physical particles like electrons serve to store and transfer energy. Distance and velocity are the principal factors, and the continuous consumption of energy is required, supplied by an

artifice such as a battery or engine driven generator.

The loss of the aetheric science of wireless and the supplanting of radio can be attributed to a pair of causes, conflict between the various pioneers of wireless and the subjugation of science and philosophy by corporate force. DeForest vs. Fessenden vs. Armstrong vs. Marconi vs. Tesla vs. etc. was the way that wireless developed. Not only did these individuals not completely understand their own discoveries, but a comprehensive science did not exist to unify them. The situation was further compounded by corporate moguls entering the science with capitalistic forces that fueled the conflict, and by institutions that favored dysfunctional theories. Names like Sarnoff, Morgan, and Rockefeller were the principals of this factor, a historic example will serve to illustrate the condition. Long distance cable telephony was set back many years by the British Royal Society's firm denial of the dielectric factors involved in the transmission of impulses through the long undersea cables and telegraph impulses were smeared, thus limiting the speed of transmission to slow rates. The brilliant Scottish theoretician Oliver Heaviside demonstrated in his archetypal telegraph equation that the dielectric term  $RC$  had to be brought into accord with the magnetic term  $LG$  to facilitate the undistorted transmission of electric impulses.

The Physics Institute declared Heaviside a fool and forced the cable business to labor under an unbalanced understanding of the electric forces involved. Later electrical scientist Michael Pupin, a contemporary of Tesla and Marconi, developed a physical realization of the Heaviside Theorem known as the "Pupin Coil." This development was quickly bought up by the young American Telephone and Telegraph Company (AT&T). AT&T holding patent rights to the Pupin, or loading coil as it became known, gained absolute control over the long distance telephone business. Oliver Heaviside, who can be given credit for establishing the entire ground work for electrical engineering mathematics, died in poverty and was promptly forgotten. AT&T grew into a company of great wealth and power. If not for the effort of Charles "Proteus" Steinmetz, much of Heaviside's work may have been forever lost.

The exact same condition exists today with regard to radio and the more generalized wireless, except with a less favorable outcome. As shown by the Heaviside in his electrical equations and further developed by myself in the tradition of Steinmetz, wireless transmission can be shown to involve a conjugate pair of propagations, the electromagnetic and the magneto-dielectric. Electro-magnetism and the adulteration of its theories by Einstein and the like has become the accepted element of the propagation of electric forces. The conjugate magneto dielectricity, and the brilliant presentation of its dimensionality by Rudolf Steiner and

his followers is denied by the corporate cable institutes. But, as with the cable long distance case, electricity plays no favorites, and radio transmission suffers from analogous distortions. The archetype of conjugate pairs exists everywhere, however, and some examples will illustrate.

A very simple analog is the male and female of a given species. The species can only propagate as a conjugate pair, the male being the dielectric and the female the magnetic. Likewise, the branch and root of a plant work together as a conjugate pair, the sunlit branch as the magnetic and the root in darkness as the dielectric. An excellent example in symbolic representation is the final choral movement of G.F. Handel's *Alexander's Feast*- "The Power of Music."

The learned doctors' physical science will hear none of this heresy, and continues to labor under the delusive mathematics of chaotic uncertainty. Modernistic music serves analogously with its painful screeches and howling, empty of spiritual content. Popular music is reduced to a computer generated sado-masochistic march. This pathological social condition is brilliantly analyzed in the writings of Wilhelm Reich under titles such as *The Mass Psychology of Fascism* and *The Murder of Christ*. Needless to say Dr. Reich died in a federal prison. Modernism accepts no criticism.

A final illustration exists right here at Marconi's KPH in Bolinas. In a simple laboratory made from so called obsolete radio equipment salvaged from the hammer and axe of the "lehmed" doctor, a remarkable discovery has been made. Through the application of wireless: principles, cosmic superimposition was effected on the work bench Suns and stars in stunning Galactic form burst forth, creating matter and energy on the spot, yet across the bay at Livermore Lab, with billions of kilowatt-hours and dollars no such thing seems possible, but the kilowatt dollars continue to flow. After all, you pay for it.



Figure 2.1: Galactic Life in a light bulb? Cosmic forms appear in plasma discharges inside glass bulb. Created by Eric Dollard at the old BSRF Laboratories, Santa Barbara, California, 1988.

# Chapter 3

## Law of Electro-Magnetic Induction

### 3.1 One

(1) Electro-Motive Force, or E.M.F., is a consequence of the law of electromagnetic induction, Faraday's Law. This is his Electro-Tonic State. It is dimensionally the time rate at which magnetic induction is produced or consumed, or in other words "moved about". The dimensional relation is given as Weber per Second, This defines E.M.F. in Volts.

(2) The notion exists that the electro-motive force, E.M.F. in volts, is established by "cutting" lines of magnetic induction via a so called electric conductor. This "cutting" is then said to impel the motions of so called electrons within the conducting material. It is however that a perfect conductor cannot "cut" through lines of induction, or flux lines,  $\Phi$ . Heaviside points out that the perfect conductor is a perfect obstructor and magnetic induction cannot gain entry into the so called conducting material. So where is the current, how then does an E.M.F. come about? Now enters the complication; it can be inferred that an electrical generator that is wound with perfect conducting material cannot produce an E.M.F. No lines of flux can be cut and the aether gets wound up in a knot. Heaviside remarks that the practitioners of His Day "do a good deal of churning up the aether in their dynamos".

(3) A good analogy exists between the induction generator, and its hydraulic counterpart, the centrifugal pump. The pump casing is filled with water in order to operate. Once filled with water, in the condition that the suction and discharge valves are shut thereby confining water to the pump casing, the pump consumes no energy from its shaft. The pump impeller rotates with no damaging pressure,

and the water and impeller rotate in step within the pump casing. Upon opening the valves the shaft is loaded by the energy required to move the water through the pump casing. The law of energy continuity is established in that the energy consumed by the pump shaft is continued as the energy delivered to the motion of the water. Also by the law of reciprocity the energy can be extracted from the flow of water and continued as the delivery of energy to the shaft. Now the centrifugal pump is a centrifugal turbine.

In this configuration the centrifugal apparatus is connected with an electro-dynamic machine, this an induction motor. This induction motor delivers motive energy to the centrifugal pump. It is however that the centrifugal apparatus is also capable of serving as a centrifugal turbine delivering energy to the motor shaft and hence now this induction machine is and induction generator. Again the law of energy continuity is established in that the motive energy taken from the flow of water is delivered to the shaft of the induction machine. The law of reciprocity is established in that the energy continuity is equivalent in both directions of power flow. (This is not possible with an engine).

(4) The induction machine is in some ways analogous to the centrifugal machine. In order for the centrifugal machine to function the casing must be filled with water. Likewise, the induction machine must be filled with magnetism, this in order to function as a generator or motor, otherwise the shaft & rotor spin free transferring no energy. This describes the torque converter in an automatic transmission, a fluidic clutch. As with the centrifugal machine, once it is filled with magnetism, it is that no load appears on the shaft of the induction machine when its circuit breaker is open. Only upon closing the breaker can energy be supplied to the shaft as an induction generator, or taken from the shaft as an induction motor. This analogy between the centrifugal machine and the induction machine fails in one aspect, where the body of water in the casing is moved along with the flow, the magnetism in the induction machine remains stationary and static. No magnetic energy is required beyond that necessary to fill the induction machine. Hence this magnetizing force can be maintained by an electro- static condenser.

It is however that a large electro-magnetic energy is developed by the induction generator, taking this from the rotor shaft and its prime mover. Here the magnetic induction & E.M.F. developed greatly exceeds that involved in the excitation of the induction machine. This opens the question as to where exactly does this generated electricity come from, and likewise with an induction motor where does the consumed electricity go. A sea of partial differential equations is of no assistance in finding the answer. It is occult to human kind, and the actual dimensions of electricity remain unknown. Here is where we begin.

## 3.2 Two

(1) In this series of writings the principle objective is the theoretical treatment of the magnetic amplifier as applied to synchronous parameter variation. The magnetic amplifier is a development of Ernst Alexanderson, a Swedish born engineer. Alexanderson worked directly with Steinmetz at General Electric. Here developed was the Alexanderson system of wireless transmission. This system was the only wireless development to show novelty over all of the encompassing patents of Nikola Tesla. The magnetic amplifier is an important element in the Alexanderson system of transmission.

(2) After the fall of Nikola Tesla and Wardencllyffe in 1904, a dark age fell upon the wireless. Promotional efforts, fraud, monopolistic practices, all ensued. Names like Lee DeForest, G. Marconi were the rulers of this age. See "Empire of the Air". A morass of interference developed from the stations of inventors and experimenters. With the onset of World War One, it became a matter of national security. The Alexanderson system was developed by 1917 and would effect greatly the course of radio history.

(3) During the dark ages the U.S. Navy became increasing disillusioned with the wireless developments provided to them. Poor and unreliable performance along with the dependence upon civilian technicians frustrated the efforts of establishing a reliable and effective naval radio communication system. The Alexanderson system along with later developments by Edwin Howard Armstrong would mark the end of the radio dark ages. The U.S.Navy was quick to co-opt the Alexanderson system into its communication network. KET and WII were its first Alexanderson stations for V.L.F. transmission. The Navy froze all radio patents from the dark ages, ending the relentless patent wars. The assistant secretary of the Navy Franklin D. Roosevelt used this opportunity to outlaw radio for civilian use, ending the radio experimenter. Under the direction of Admiral Bullard, U.S.N. A "Radio Corporation" was organized to serve as a holding company for radio patents and developments. Hence the birth of R.C.A. in 1919, and also the birth of radio as it has become known. The year 1919 begins the age of electromagnetic radio and its domination of transmission theory. But today we are interested in the unknown radio of yesterday, that before 1919, that of Tesla and Alexanderson.

(4) The development of the thermionic vacuum tube by General Electric and Bell Telephone put this device in the forefront of radio advancements. This could never happen in the hands of the inventor, Lee DeForest, so he was bought out by A.T.T. And his patents placed into the patent pool of the Radio Corporation,

developing into a monopolistic trust. The efforts of Edwin H. Armstrong for R.C.A. and Langmir for G.E. Led to the Pliotron Power Oscillator utilizing the UV-207 thermionic, water cooled, vacuum triode. This instantly obsoleted use of the Alexanderson alternator for the production of large quantities of radio frequency power. His system became obsolete almost as soon as it was installed (1921), R.C.A. Radio Central, Rocky Point, NY. Thus the Alexanderson system became a dinosaur, to be buried and then forgotten. In the American tradition it was all smashed into rubble and then thrown over the cliffs into the sea. (Bolinias). Another historic "elimination".

(5) Becoming obsolete, the Alexanderson system was regarded as of no significance to the "modern understanding" of electricity. As electronic ideas began to overtake electrical ideas a misunderstanding developed with regard to the electric wireless of Tesla and Alexanderson. Radio became married to electro-magnetism, and electricity became married to the electron. It is however that the Alexanderson system is electrical, not electronic. It was in fact developed specifically to avoid the electronic patents, and also work in a way not already specified in the patents of Nikola Tesla. The magnetic amplifier served as a kind of magnetic transistor, eliminating the need for the electronic vacuum triode of DeForest. The Alexanderson aerial is unlike the structures of Tesla and Marconi and also is not an electro-magnetic radiator. The developments of Ernst Alexanderson operate in a unique fasion, unlike more commonly known electrical developments. Hence the importance of the study of the elements of the Alexanderson system.

(6) The Alexanderson system consists of three principle elements;

I) The Variable Reluctance Alternator, for the generation of V.L.F. Power.

II) The Magnetic Amplifier, for the modulation of this V.L.F. Power.

III) The Multiple Loaded Aerial, for the transmission of the modulated V.L.F. Power.

All three of these elements are based upon radical departures from more conventional electrical designs. The Law of Electromagnetic Induction finds a new meaning in these particular developments of Alexanderson. These represent a "third way" in the development of electromotive force. It can be expected that certain anomalies as well as certain oppositions by "the group" in the Law of Energy Continuity are to be found in the elements that comprise the Alexanderson

system. Such is demonstrated with the Variable Reluctance Generator seen in the Borderland video, this machine similar to the Alexanderson alternator in principle.

(7) Electro-Motive Force is brought about by magnetism in motion. The motional relationship between magnetism and its bounding metallic-dielectric geometry give rise to E.M.F., this E.M.F. as a reaction to magnetic motion is an inertial force, at least as it is commonly understood. The production or consumption of electro-motive force is developed by three distinct relations;

I) The E.M.F. of Variable Magnetic Induction, such as with the static transformer,

II) The E.M.F. of Motional Magnetic Induction, such as with the rotating motor-generator,

III) The E.M.F. of Variable Magnetic Inductivity, such as the static magnetic amplifier, or rotating variable reluctance alternator.

In basic terminology, with the static transformer it is the intensity of the magnetism is variable, in the motor-generator the position of the magnetism is variable, and in the magamp or Alexanderson alternator it is the containment of the magnetism is variable.

In the static transformer the magnetizing force is made to vary, as with alternating current. This gives rise to a continuously variable quantity of magnetic induction developing a continuously variable E.M.F. Induction is the variable.

In the motor-generator the position of the magnetic induction is made to vary via rotation. This rotation is constant developing an E.M.F. which is also constant and constantly rotating as is the magnetism. Here the E.M.F. is not alternating as with the static transformer, but has a vector of constant length in constant rotation. Hence this E.M.F. is in a polyphase or direct current relation. Orientation in Space is the variable.

In the magnetic amplifier, or Alexanderson alternator, the inductivity of the medium supporting the magnetic induction is made to vary, this by saturation or relative motion. Hereby magnetism is made to enter or leave the magnetic medium through the variation of the storage capability of that medium. The E.M.F. developed is in order to facilitate the flow of magnetic energy into, or out of, the medium of variable magnetic inductivity. Storage Capability is the variable. This is the "third way".

### 3.3 Three

(1) The analysis of the Faraday Law, the Law of Electro-Magnetic Induction, continues here with the "Theory and Calculation of Alternating Current Phenomena", by Charles Proteus Steinmetz, PhD, 1916<sup>1</sup>. This is the fifth edition, which is partitioned into several other allied books. Two chapters are used in the analysis here, chapter three, "The Law of Electro-Magnetic Induction", and chapter twenty-five, "Distortion of Wave-shape and Its Cause". The chapter on reaction machines is missing from the fifth edition as it is partitioned into an allied volume. The 1900 edition is more suited for the study of Synchronous Parameter Variation in terms of a wider conception, however the 1916 edition is sufficient for the analysis here, this is all glom provides.

(2) Many of the expressions given by Steinmetz are unclear, particularly the harmonic expression of the reactance variation. The signs and symbols in the subscript have misprints, and the dimensions often do not line up. It must also be remembered that Steinmetz was forced to alter his mathematical expressions by the P.E.E.E. He literally came under attack by the pendants particularly for his development of the "Law of Hysteresis". Hence Steinmetz changed his expressions because of PEEE adopted international standards, to quote;

"Thus for the engineer familiar with one representation only, but less familiar with the other, the most convenient way when meeting with a treatise is in, to him, unfamiliar representation is to consider all the diagrams clockwise and all the signs of  $j$  reversed."

"In conformity with the recommendation of the Turin Congress – however ill conceived this may appear to many engineers – in the following the Crank Diagram will be used, and where ever conditions require the Time Diagram, the latter be translated into the Time Diagram."

In basic terms if it seems daylight savings time is a bad idea, now it is a standard that all clocks must turn backwards in their rotation.

(3) Steinmetz does not use rational units in the development of his expressions. Heaviside warns that this is fatal to a solid theoretical understanding. The result is a quagmire of  $4\pi$ , one over  $c$  square, one over ten and all multiplied by ten to the

<sup>1</sup>Charles P. Steinmetz, *Theory and calculation of alternating current phenomena*, (McGraw-Hill Book Co., Inc., New York, 1916).

eighth power. Steinmetz compounds the confusion by using cyclic frequencies in cycles per second rather than angular frequencies in radians per second. This results in the continual appearance of  $2\pi$  in all his expressions. The numeric  $\pi$  is seen to appear and vanish so many times in Steinmetz equations and formulae that its meaning has become lost.

Steinmetz works backward from the practitioner's law for the output of a D.C. dynamo,

$$E = 4F \cdot n\Phi \times 10^{-8} \text{ volts,}$$

where  $E$  is the developed E.M.F.,  $F$  is the frequency in cycles per second,  $n$  is the number of turns, and  $\Phi$  is the quantity of magnetism. The numeric 4 is the number of inductions per cycle, one for each angular quadrant. Steinmetz considers this as an average E.M.F. where in actuality the average value of a sine wave is zero. His average value is the rectified value, that of a half wave. This in order to express the E.M.F. in maximum or peak values, the factor  $\pi$  over two must be affixed to the average E.M.F. This creates another  $\pi$  in all the expressions, fading in and out like a ghost throughout.

In the development of his expressions, by working backwards, it appears to be a "force-fit" in order to arrive at an already predetermined result, a form of contrivance to quickly reach a practical result. This obviates any understanding of the theoretical conditions involved. Steinmetz created his system of mathematics for the practicing engineer, not the theoretician. This riles the pendant, nemesis ensues.

(4) As is well known Steinmetz introduced many mathematical concepts to greatly simplify the understanding and utilization of alternating current electricity. But General Electric did not want him to put too much know how in his books. Other than Steinmetz, it was only Nikola Tesla of Westinghouse Electric that could make working A.C. equipment. But Tesla did not write books, his failing, out loss.

Throughout his writings Steinmetz utilizes a dimensionless time operator which greatly simplifies the expression of alternating current phenomena. An angular rate is substituted for a time rate. It is an instantaneous position variable along the A.C. cycle, the dimension of time is canceled by the angular frequency in radians per time, given is,

- $t$  = Time Variable, second
- $T$  = Time Period, second
- $F$  = Frequency, cycle per second
- $\omega$  = Time Rate, per second

Hence the following expressions,

$$T = \frac{1}{F} \text{ second,}$$

$$\omega = 2\pi F \text{ per second,}$$

$$\frac{t}{T} \text{ ratio or percent,}$$

$$\omega t = 2\pi \frac{t}{T} \text{ numeric,}$$

$$\omega t = 2\theta \text{ angular position variable, numeric,}$$

where the factor  $2\pi$  can be called an "angular tensor".

The differential expressions for alternating current phenomena become a dimensionless operator, not a time rate

$$\frac{d}{dt}, \text{ per second,}$$

is now,

$$\frac{d}{d\theta}, \text{ numeric,}$$

Now it is a variation in angular position, radians are dimensionless.

(5) Through this methodology the A.C. wave is simplified in expression, its frequency is of unit value. This is a consequence of the fact that all parts of an alternating current networks are all operating at the exact same frequency, differing only in their angular position along the unit A.C. wave. For example, at a frequency of 60 cycles per second

$$T = \frac{1}{60} = 0.0166666 \dots, \text{ second,}$$

$$F = 60 \text{ per second,}$$

$$\omega = 2\pi F = 377 \text{ radian per second,}$$

Hence for 60 cycles the angular position is given by

$$\theta = 377t \text{ radians,}$$

For one radian it is that

$$t = 2.653 \times 10^{-3} \text{ seconds,}$$

This the time taken for the 60 cycle A.C. wave to advance one radian in its angular progress through a cycle. This is a dimensionless operation. This angular position variable is like an instantaneous versor operator of infinitesimal unit positions. This operator is then compounded with the quadrantal A.C. operator,

$$k\omega t = k\theta \text{ numeric,}$$

where  $k^n$  is given by

$$n = 0, \quad k = +1, \quad \sqrt{+1},$$

$$n = 1, \quad k = +j, \quad \sqrt{-1},$$

$$n = 2, \quad k = -1, \quad \sqrt{+1},$$

$$n = 3, \quad k = -j, \quad \sqrt{-1}.$$

The result is the segregation of the resistive from reactive terms, or more properly the kilowatts from the kilovolt-amperes reactive. Great simplification is derived here through inductance expressed in ohms as is resistance, and by capacitance expressed in siemens as in conductance. The differential expressions vanish and Ohm's Law as well as Kirchoff's Law can be utilized in alternating current circuits. This is known as the "Steinmetz Method" a mathematical breakthrough for the expression of the phenomena of alternating electric waves. This was the birth of electrical engineering in alternating current systems. While the engineer loves it, (This is why E.F.W. Alexanderson came to America, in order to work with the great engineering mathematician, Dr. Steinmetz.) the pendant has a deep contempt for the Steinmetz methodology (Pupin). At a common level, upon my unusually high test scores in naval electronics entry school, this through my use of the Steinmetz method, naval instructors accused me of cheating, and caused me trouble!

### 3.4 Four

(1) The following analysis begins with chapter three, "Law of Electro-Magnetic Induction" by C.P. Steinmetz, 1916<sup>2</sup>. This chapter opens with the definition of one volt of electro-motive force. One volt of E.M.F. is developed by the movement of 100 million lines of magnetic induction. This movement develops its E.M.F. via

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<sup>2</sup>Charles P. Steinmetz, *Theory and calculation of alternating current phenomena*, (McGraw-Hill Book Co., Inc., New York, 1916).

the metallic-dielectric geometry bounding the magnetic induction. Hereby the relation is given as

$$E = \frac{\Phi \cdot 10^8}{T}, \text{ volt.}$$

And,

$$ET = \Phi \cdot 10^8, \text{ volt-second.}$$

The volt-second defines the unit of "magnetic charge", just as the ampere-second defines the unit of "electric charge". Hence, an E.M.F. of one volt, over a duration of one second, produces or consumes one unit of magnetic induction, this induction consisting of 100 million lines of magnetic flux. One flux line, or tube of induction, can be taken as a discrete entity, and of a distinct dimensional size, this a numerical constant. In other words a quantum size of magnetic induction defines all lines of induction as being the same size. It is then that this line of induction is a constituent of the Planck, a quantum dimensional relation consisting in part of a quantum of magnetic induction. The factor of ten to the eighth power partially defines the size of the Planck, in defining a distinct line of magnetic induction. Here is a partial answer to the old question of "how big is a Planck?"

(2) The volt-second, or magnetic "charge" is the conjugate of the ampere-second, or dielectric charge. Magnetic charge is in weber, dielectric charge is in coulomb, this dimensionally given as

$$ET = \Phi,$$

$$IT = \Psi,$$

In common practice the unit of dielectric charge is the ampere-hour, and defines the quantity of electricity into, or out of, an electric accumulator (storage battery).

Considering the ampere-second it is when the displacement current,  $I$ , in amperes, passes through an impedance,  $Z$ , in ohm, that energy is exchanged with the dielectric field of induction. In this passage the displacement current,  $I$ , in amperes is transformed into a magneto-motive force,  $i$ , also in amperes. This  $i$  relates to the metallic, and the displacement  $I$  relates to the dielectric. When this impedance,  $Z$ , consists of a resistance,  $R$ , in ohm, the displacement current gives rise to an electronic current,  $i$ , this also in amperes, the energy in the dielectric is dissipated at the rate,

$$P = i^2 R, \text{ watt, or joule per second}$$

(3) The concept of the accumulation of "charge" is normally not considered when dealing with a magnetic field and the energy it contains. This magnetic

"charge" is analogous to the dielectric charge. Magnetic charge is given as the volt-second, this a volt of E.M.F. When this volt of E.M.F. is impressed upon an admittance,  $Y$ , in siemens, that energy is exchanged with the magnetic field of induction. Hereby the E.M.F.,  $E$ , in volt, is transformed into an electro-static potential,  $e$ , also in volt. When this electro-static potential is impressed upon a conductance,  $G$ , in siemens, this conductance dissipates the energy stored in the magnetic field of induction at the rate,

$$P = e^2G, \text{ watt, or joule per second}$$

It was shown in the "Four Quadrant Theory", E.P. Dollard, that dielectric discharges give rise to strong currents, whereas magnetic discharges give rise to high E.M.F.s. This was shown in recent experiments with the 60KV, 3000KVA, power line transformer. The magnetic charge drawn from only a 12 volt car battery can have destructive consequences if discharged rapidly by an open circuit, hence the flashover on the bushing safety gap.

(4) Electro-motive force is the medium by which energy is supplied to, or demanded of, the magnetic field developing this E.M.F. When this E.M.F. is made to be an electro-static potential, then energy can be exchanged. Part of this energy is stored, through a displacement current,

$$P_1 = eI, \text{ volt-ampere}$$

or it is dissipated,

$$P_2 = ei, \text{ watt}$$

or combined, for an A.C. wave,

$$P_o = e(i - jI), \text{ joule per second}$$

Gives the total electrical activity of the magnetic field of induction in the exchange of its energy to an external form. In this relation the E.M.F.,  $E$ , is made equivalent to electro-static potential,  $e$ , this via a parallel connection of the magnetic inductance to the external system. Conversely, for the dielectric field, the displacement current,  $I$ , is made equivalent to M.M.F., or electronic current,  $i$ , this via a series connection of the dielectric capacity to the external system. Hence the Law of Electro-Magnetic Induction is entirely analogous to the Law of Dielectric Induction, and the understanding of one can be derived from the other.

### 3.5 Five

(1) This part in the series, Law of Electro-Magnetic Induction here continues with chapter three from the Steinmetz A.C.. book, 1916 edition<sup>3</sup>. Here he has just given his definition of the Volt as,

$$E = \frac{\Phi}{t}, \quad 10^8 \text{ volt}$$

And by algebraic operation, the magnetic "charge" is,

$$\frac{E}{n} = E_n = \frac{\Phi}{t}, \quad 10^8 \text{ volt}$$

where  $E_n$  is the volt per turn and  $n$  is the number of turns. No explanation is provided as to the reason for the reversal of the power of ten, from plus eight, to minus eight. We are off to a good start here!

The number of turns in the winding act co-jointly to multiply the E.M.F. These turns also act co-jointly to multiply the current. This current,  $i$ , in amperes, is continuous throughout the coiled winding. As each turn comes about it carries current,  $i$ , with it, round and round again, throughout the total number of turns. The net result is a sheet current, this consisting of  $n$  individual currents. This is given by the relation,

$$i_s = ni, \quad \text{ampere-turn.}$$

This sheet current is the magneto-motive force that maintains the magnetic induction. This is in distinction to the current,  $i$ , which is related to the "electronic" current. Hence the M.M.F. is expressed in ampere-turns, the "electronic" current,  $i$ , and the number of turns,  $n$ . For example, a reactance coil has 1000 turns, and it is drawing a current,  $i$ , of one ampere, the sheet current of the coil,  $i_s$ , is now 1000 amperes. Hence this coil is operating with a M.M.F. of 1000 ampere-turns. Large M.M.F.'s can be produced with small currents through the compounding of these currents via multiple turn windings of many turns. The limiting factor is the accumulation of series resistance as the winding gets longer in length.

This was an important discovery in electro-magnetism. It's first engineering application was the Morse Telegraph Coil as developed by Joseph Henry, the American Faraday.

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<sup>3</sup>Charles P. Steinmetz, *Theory and calculation of alternating current phenomena*, (McGraw-Hill Book Co., Inc., New York, 1916).

(2) These multiple turns not only multiply the current,  $i$ , they also multiply the E.M.F.,  $E$ . The currents compound, side by side, in a parallel fashion, this creating a sheet current. The E.M.F. per turn compounds, end to end, in a series fashion. Each and every turn develops an identical E.M.F. All turns are linked together through the mutual magnetic induction which surrounds the entire winding. Each individual E.M.F. adds to the next, in a series manner, developing a total E.M.F., that of the entire winding.

This is expressed in the relation,

$$E_o = nE, \text{ volt-turn,}$$

where,

$E_o$ , the total end to end E.M.F.

$E$ , the individual turn E.M.F.

For example, the same reactance coil, 1000 turns. This coil is discharged at a constant rate over a period of one second. During this discharge each turn develops an E.M.F. of one volt. The coil has 1000 turns, hence the total E.M.F. at the ends of the windings is 1000 volts. This is the principle of automobile ignition coil, a magnetic discharge device.

Here established is two relations, one for the total M.M.F.,

$$i_s = ni, \text{ ampere-turn,}$$

The other for the total E.M.F.,

$$E_o = nE, \text{ volt-turn,}$$

The individual currents are identical throughout the coiled winding, no gradient exists in this current. The individual E.M.F.'s are also identical, but not as with the current. A gradient exists in between the turns as the E.M.F. compounds along the winding. Hence a voltage gradient exists along the winding length expressed as volts per turn. Here in this metallic-dielectric geometry the magnetic force and the dielectric force are oriented in the same direction, (MK).

(3) In chapter three, page 16, Steinmetz gives the dynamo formula for the average value of E.M.F. as,

$$E_a = 4F \cdot n\Phi, 10^{-8} \text{ volt,}$$

where,  $F$ , frequency in cycles/second.

Steinmetz states here the numeric four results from the lines of force being "cut" four times in one complete rotation or cycle of alternation. This gives rise to four quarter wave surges of induced E.M.F. Each is in succession, one follows the other. These surges alternate in half wave sets, first plus-minus, then minus plus. For example, consider the 1000 turn reactance coil. At the onset of the cycle the magnetic induction expands outward, this with a "north" polarity. As it expands it must force its way through the windings, giving rise to an E.M.F. in a reverse direction. As the cycle progresses the magnetism expands to its maximum extent and then is withdrawn, back inside the coil. This back surge of magnetism must again force its way through the windings, giving rise to an induced E.M.F. in a forward direction. The first half cycle is now complete, giving a reverse and then a forward induced electro-motive force. At the onset of the next half cycle the magnetic induction expands outward again, this time it is of a "south" polarity. As it expands it again forces its way through the windings giving rise to an induced E.M.F. in the forward direction, forward because the magnetism is now "south" rather than "north". As this next half cycle progresses the magnetism expands to its maximum extent and is withdrawn. This back surge of magnetism must again force its way through the windings to get back inside. This gives rise to an induced E.M.F. in the reverse direction and then the cycle is complete. Hence the existence of four distinct E.M.F. each existing in one quadrant of the A.C. cycle.

- 1) Expansion, north (+).
- 2) Contraction, north (-).
- 3) Expansion, south (-).
- 4) Contraction, south (+).

Euro-standards require reverse to be positive, its the law, the law of the crank. Reverse means here a back E.M.F. in opposition.

It should be noted that if the windings are shorted with no resistance, it is that no E.M.F. can exist and thus no motion of the magnetic induction is possible. This will halt the rotation of the dynamo.

(4) Steinmetz continues with the development of the dynamo formula. The maximum, or peak, value of E.M.F. is given by the relation,

$$E_m = \frac{\pi}{2} E_a, \text{ volt,}$$

This alters the dynamo formula into,

$$E_m = 2\pi F \cdot n\Phi, \text{ } 10^{-8} \text{ volt.}$$

Here it is given that,

$$2\pi F = \omega, \text{ angular frequency in radians per second.}$$

Steinmetz fails to incorporate this angular velocity or frequency, into his equations. This would simplify the dynamo equation to,

$$E_m = n\omega\Phi, \text{ } 10^{-8} \text{ volt.}$$

or on a Per Turn Basis,

$$E = \omega\Phi, \text{ } 10^{-8} \text{ volt.}$$

Substituting the relation

$$t = \frac{1}{\omega}, \text{ second per radian.}$$

The dynamo formula now becomes the basic expression of the law of E.M. Induction, this given as,

$$E = \frac{\Phi}{t}, \text{ } 10^{-8} \text{ volt.}$$

This on a per turn, or unit, E.M.F. basis. Hence a volt is given as weber per second. The radian is dimensionless.

Throughout his writings it is that Steinmetz refuses to use the angular frequency,  $\omega$ , and insists upon the use of the cyclic frequency,  $F$ , cycles rather than radians. This unnatural form of expression results in the continued appearance of the factor  $2\pi$  throughout his equations. This makes each equation that much more complex and gives rise to the situation of interferences with other  $\pi$  factors causing cancellations and squares.

Steinmetz continues here to give the relation for the effective value of E.M.F.,

$$E_c = \frac{E_m}{\sqrt{2}}, \text{ volt.}$$

This is also known as the root mean square value, (RMS).

The dynamo formula now take the form,

$$E_c = \sqrt{2} \cdot \pi F \cdot n\Phi, \text{ } 10^{-8} \text{ volt.}$$

This is the "Steinmetz Formula" for the law of E.M. Induction, a convoluted mess! This is a "practitioner's" formula for winding dynamo coils, not a starting point for a theoretical study of A.C. phenomena.<sup>4</sup>

<sup>4</sup>Oliver Heaviside, "Introduction to ElectroMagnetic Theory", Vol. I, note "Practitioner".

### 3.6 Six

(1) Steinmetz closes chapter three in his A.C. book, 1916 edition<sup>5</sup>, with his development of the concept of Inductance. Here given, for the first time in chapter three, is the current,  $i$ , in ampere. It is the "electronic" current, for the lack of a better term. Steinmetz gives the relation,

$$L = n \cdot \frac{\Phi}{i}, \quad 10^{-8} \text{ henry.}$$

This is the Magnetic Inductance, also known as the coefficient of magnetic energy storage.

Steinmetz complicates this relation by giving the current,  $i$ , in effective values, an unnatural form. The relation is given by,

$$i_m = \sqrt{2}i, \quad \text{ampere.}$$

Hence the resulting expression is given by,

$$n\Phi = \sqrt{2}iL, \quad 10^{-8} \text{ henry-ampere.}$$

This derives from Steinmetz's expression the coefficient of self induction.

Using maximum rather than effective values for current simplifies the relation to,

$$L = n \cdot \frac{\Phi}{i}, \quad 10^{-8} \text{ henry.}$$

This the basic expression for the coefficient of self induction.

(2) This self induction is a non motional, or static, induction. This represents the reactance coil. It is important to notice that the self induction is distinct from the motional induction produced by the dynamo. The motional relation, that of rotary motion, is given by the relation,

$$E = n \cdot \omega\Phi, \quad 10^{-8} \text{ volt.}$$

The induction for the static, or stationary, condition is given by the relation,

$$X = \omega \cdot L, \quad \text{henry/second.}$$

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<sup>5</sup>Charles P. Steinmetz, *Theory and calculation of alternating current phenomena*, (McGraw-Hill Book Co., Inc., New York, 1916).

Establishes the basic Ohm's Law expression for alternating currents,

$$E = iX, \text{ volt.}$$

$X$  is called the reactance of the coiled winding. Transposing gives the expression for the reactance as,

$$X = \frac{E}{i}, \text{ volt/ampere.}$$

And it is that volt per ampere defines the dimensions of the ohm. This volt per ampere can also be expressed as a henry per second, giving the relations,

$$X = \frac{E}{i} = \frac{L}{t}, \text{ henry/second.}$$

And it is,

$$t = \frac{1}{\omega}, \text{ second.}$$

This expression of reactance can be considered a synchronous inductance, this in an A.C. circuit.

(4) The total magnetic induction can be sub-divided into a pair of independent factors.

One, the intensity of the magneto-motive force, this maintaining the quantity of magnetism, Force,  $i$ , in ampere.

Two, the concentration, or inductance, containing the quantity of magnetism, Concentration,  $L$ , in henry.

These two factors are related through the Law of Magnetic Proportion, given by,

$$L = \frac{\Phi}{i}, \text{ weber/ampere.}$$

where,  $i$ , is the ampere of current. Transposing gives the relation for magnetic induction as,

$$\Phi = i \cdot L, \text{ ampere-henry.}$$

Hence the total magnetic induction is the product of two Independent Parameters, each of which contributes to the induction. Each of these two parameters can be varied separately. The E.M.F. is developed through the resulting variation of the total magnetic induction.

The total energy contained in the magnetic induction is given by the relation,

$$W = i\Phi, \text{ weber-ampere.}$$

It was given that,

$$\Phi = iL, \text{ henry-ampere.}$$

Substituting this into weber-ampere gives,

$$W = i \cdot iL, \text{ ampere square-henry.}$$

And this leads to the expression of magnetic energy as,

$$W = \frac{1}{2}i^2L, \text{ joule.}$$

(5) The quantity of magnetic induction is made to vary by variation of the current or the variation of inductance, or by the variation of both. This variation of magnetism that results from the parameter variation gives rise to a variation of the quantity of stored energy contained in the magnetic induction. The E.M.F. developed by the variation of magnetism is the means by which the stored energy can either leave or enter its magnetic form. It is then the current, or M.M.F., represents the potential energy stored in the magnetic field, and the E.M.F. represents the kinetic energy given or taken by the magnetic field.

This is analogous to the dielectric field. Here it is the electro-static potential,  $e$ , in volt that represents the potential energy of the field. The displacement current,  $I$ , in ampere then represents the kinetic energy taken or given to the dielectric field. Hence,

$$\Phi \left[ \begin{array}{l} i, \text{ ampere, potential.} \\ E, \text{ volt, kinetic.} \end{array} \right]$$

$$\Psi \left[ \begin{array}{l} e, \text{ volt, potential.} \\ I, \text{ ampere, kinetic.} \end{array} \right]$$

Therefore where it is that the voltage,  $e$ , is the electro-static potential, it is the M.M.F. (and its current,  $i$ ,) is the magneto- static potential.

Both potentials in themselves do not represent energy, only the force required to maintain this energy in a static, or potential, state.

(6) The M.M.F. is the force holding the magnetism in place. A stationary magnetic field needs a continuous current to remain stationary.

The inductance is the holder of the magnetism. An invariant inductance can hold a stationary magnetic field of induction in place.

Variation of either the M.M.F. or the inductance requires the magnetism move. This gives rise to an E.M.F. of energy transfer, this as a result of a time rate of

change in the quantity of magnetism. The E.M.F. is directly proportional to this change, the quicker the change, the larger the E.M.F.

Neither the M.M.F., nor the inductance, represent energy. They are only factors of the induction, parts of a whole. While each parameter effects the magnetism as a whole, the effects of each are not interchangeable, and this needs to be taken into account regarding the Law of Energy Continuity.

(7) In the static reactance coil it is the intensity of force, as a current, that is made to vary. This variation is expressed in ampere per second,

$$i\omega = \eta, \text{ ampere/second.}$$

where,

$$\omega = 2\pi F, \text{ radian/second.}$$

The inductance of the reactance coil is constant, or invariant in this situation. Hence the E.M.F. developed by the reactance coil is derived from the time rate of current variation only. This is expressed by the relation,

$$E = i\omega L = \eta L, \text{ volt.}$$

Where,  $\eta$ , ampere-second. It is customary however to express this relation using

$$X = \omega L = \eta L, \text{ henry/second.}$$

and

$$E = iX, \text{ volt.}$$

But here in the reactance coil the inductance is in-variant, no such henry per second exists. It is the ampere per second which acts here. Hence in its common expression the term reactance can be misleading.

(8) In the employment of parameter variation for the development of an E.M.F., this through variation of the current, the objective is to develop a back E.M.F. of self induction. The E.M.F. facilitates the flow of energy but this flow is wattless. Here the reactance coil serves as a "dissipationless resistor" for A.C. circuits. All energy is conserved, what goes into the magnetism all comes back out of the magnetism. The Law of Energy Continuity is not a consideration here. The alternative condition is the development of an electro-motive force by the variation of the inductance. This E.M.F. represents the transfer of energy into, or out of, the magnetism. However the energy is not conserved, thus the Law of Energy Continuity must be applied to identify the location of the transferred energy, (motion, heat, aether, etc).

(9) Parameter Variation of the inductance is expressed by the relation,

$$E = i \cdot \omega L, \text{ ampere-henry/second.}$$

And here it is

$$\omega L = X_L, \text{ henry/second.}$$

In comparison, for the condition of parameter variation of the current the relation is,

$$\eta = i\omega, \text{ ampere/second.}$$

Hence,

Current variation in ampere per second,  $\eta$ , and inductance variation in henry per second,  $XL$ , two distinct variations.

In these two distinctly different conditions, each have the same component dimensions,

$i$ , current, ampere  
 $\omega$ , time, per second  
 $L$ , induction, henry

These three dimensional relations engender but one magnetic field. However the order in which these three dimensions are situated gives rise to two distinctly different conditions, that is,

Ampere–Henry per Second

Henry–Ampere per Second

The Law of E.M. Induction exists in two forms with the same basic dimensions. Hence the term reactance can take on two new meanings, the reactance of self inductance, and the reactance of inductance variation,

$$X = \omega \cdot L, \text{ static inductance.}$$

$$X_L = \omega L, \text{ variant inductance.}$$

Only in the variant inductance are the dimensions correctly in the henry per second.

(10) For the condition of current variation with respect to time the inductance is a constant, or invariant. The alternating E.M.F. is produced by a current alternating between maximum values of opposite polarity, positive and negative. A zero crossing results, between maximum values.

For the condition of inductance variation with respect to time the current can be constant, a direct current, that is, invariant. The alternating E.M.F. is produced by the pulsation of inductance between maximum and minimum values. There is no zero inductance. Both the maximum and minimum values are positive.

Where it is possible to reverse the current, or make it pulsating, the inductance cannot be reversed. Negative inductance is undefined. The inductance variation is intrinsically asymmetrical in nature. The variation exists as a percentage of modulation, 100 percent being variation of inductance between zero inductance, and the maximum inductance, values, as limits.

(11) This parameter variation can be extended to both the current and the inductance, both in variation together. Each can be in variation at their own time rates, each at its own frequency and phase angle. This gives rise to a complex E.M.F. containing modulation products of sum and difference frequencies, with the originating frequencies suppressed. This is known as a double sideband modulation. The E.M.F. is of the form,

$$E = (\omega_1 \pm \omega_2)iL, \text{ volt.}$$

Here enters chapter 25, of Steinmetz's A.C. book, 1916 edition<sup>6</sup>. The chapter is titled "Distortion of Wave-shape and Its Cause". Here Steinmetz develops expressions for what is called Synchronous Parameter Variation, for both rotating and static apparatus. This serves as an extension on the Theory and Laws of Hysteresis.

## 3.7 Seven

(1) Magnetism is a product of two factors;

One, the Magneto-Motive Force,  $i_s$ , in Ampere-Turn,  
Two, The Magnetic Inductance,  $L$ , in Henry.

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<sup>6</sup>Charles P. Steinmetz, *Theory and calculation of alternating current phenomena*, (McGraw-Hill Book Co., Inc., New York, 1916).

Variation of one or both of these factors results in the variation of the quantity of magnetism. In turn this variation in magnetism develops and E.M.F. in direct proportion to the time rate of this variation. This E.M.F. is developed through Parameter Variation. Variation of the parameter magneto-motive force is brought about by the variation of the current,  $i$ , in ampere which produces this M.M.F. The M.M.F. and its current are related by,

$$i = \frac{i_s}{n}, \text{ ampere.}$$

Or,

$$n = \frac{i_s}{i}, \text{ numeric,}$$

where  $n$  =Number of Turns. This number,  $n$ , is the ratio of M.M.F. to its current, and it serves as a magnification factor for current flow. Variation of the parameter Inductance is brought about by the variation of the factor

$$\sigma = \frac{\mu}{l}, \text{ numeric,}$$

where  $\mu$  is the magnetic permeability, in centimeter,  $l$  is the magnetic path length, in centimeter.

This factor,  $\sigma$ , is the effective permeability of the magnetic circuit. The magnetic permeability is a characteristic of the medium which supports the magnetic induction. This is not to be confused with the relative permeability. The magnetic permeability

$$\mu \text{ centimeter,}$$

is an Aether constant derived from One Over  $c$  Square. The relation is given by,

$$\mu\epsilon = \frac{1}{c^2} \text{ second square per centimeter square,}$$

where  $\epsilon$  is the dielectric permeability.  $c$  is the Velocity of Light. Hence the relation is given as

$$\mu = \frac{1}{\epsilon c^2} \text{ centimeter.}$$

This is the magnetic permeability. In order to simplify mathematical expression the relative permeability is often used. It is given by the relation

$$\mu_o = \frac{\mu}{\mu_c},$$

where  $\mu_c$  is the magnetic permeability of free space or the Aether. Here then exists three expressions for permeability;

One, Magnetic Permeability,

$$\mu, \text{ centimeter,}$$

Two, Effective Permeability,

$$\sigma, \text{ Numeric,}$$

Three, Relative Permeability,

$$\mu_o, \text{ Numeric,}$$

(2) The general expression for magnetic inductance is given by the relation,

$$L = n^2 \sigma A, \text{ centimeter square,}$$

where  $A$  is the sectional area of the magnetic induction, in centimeter square,  $n^2$  is the total flux inter-linkages between the current,  $i$ , and the magnetic induction,  $\Phi$ .  $\sigma$  is the effective permeability, a numeric.

For a unit turn the relation becomes,

$$\sigma A, \text{ centimeter square.}$$

The relation hereby derived is given as,

$$\rho = \frac{1}{\sigma A}, \text{ per square centimeter.}$$

This parameter,  $\rho$ , is called the Reluctance of the magnetic circuit. This reluctance is a mathematical fiction given to give an analogy between the magnetic circuit, and the electric circuit. Where it is resistance in an electric circuit, it is a reluctance in a magnetic circuit. Reluctance is hereby a magnetic resistance. This analogy does not recommend itself. It has become commonplace to express parameter variation in terms of Variable Reluctance. Such is the "Variable Reluctance Generator". The factor,  $\sigma$ , the effective permeability is more suited for the expression of parameter variation.

The two basic expressions for Magnetic Parameter Variation are thus, The expression of parameter variation of current,

$$\frac{di}{dt}, \text{ ampere per second.}$$

And the expression of parameter variation of Inductance,

$$\frac{d\sigma}{dt}, \text{ numeric per second.}$$

(3) The Magnetic Inductance is formed from several factors, or sub-parameters,

- $n$ , Number of Turns,
- $A$ , Sectional Area,
- $l$ , Path Length,
- $\mu$ , Magnetic Permeability.

The number of turns, and the sectional area are in general invariant. The number of turns is fixed by the impedance, and the sectional area is fixed by the volt-ampere capacity. The path length can be variable by mechanical means. The magnetic permeability can be made variable by magnetic means.

The path length and the magnetic permeability are directly related as they have the same dimension, centimeter. They are both lengths, and their ratio is the effective permeability. This is the parameter to undergo variation.

(4) Permeability works through the dimension of length, here in centimeter. The length of a magnetic flux line determines the amount of M.M.F. required to maintain that length. A force is required to hold this line in place. The more the flux line is stretched out, the greater the M.M.F. required. This determines the magnetic gradient along the flux line as,

$$H = \frac{i_s}{l}, \text{ ampere per centimeter.}$$

The flux lines are elastic, if stretched out, they hold the energy required in this stretching and it returns when the stretching force is withdrawn. During the interval in which the flux line expands or contracts an E.M.F. is developed to facilitate the movement of energy into, or out of, the elasticity of the magnetic flux line.

If now the magnetic permeability is made to increase, the M.M.F., and thus the current, required to maintain a flux line at a certain length is decreased in proportion to the increase in permeability

$$l \rightarrow \mu i, \text{ ampere - centimeter.}$$

Hence the magnetic permeability acts to shorten the lines of magnetic induction. This is to say that the magnetic permeability allows the magnetism to contract into it. In a magnetic path of centimeter length, a path of high permeability has a much

longer effective path length than that of a low permeability. The relation is given as

$$l_{\sigma} = \mu_{\sigma}l, \text{ centimeter,}$$

where  $\mu_{\sigma}$  is the relative permeability, a numeric proportion. For example, iron has a relative permeability of,

$$\mu_{\sigma} = 1000, \text{ numeric.}$$

A portion of this iron is in the magnetic path and the length of this portion of iron is,

$$l = 1, \text{ centimeter.}$$

The effective path length along this iron is then given as

$$\mu_{\sigma}l = 1000, \text{ centimeter.}$$

If this magnetic permeability undergoes parameter variation, it results in an effective variation in path length, this for the Magnetic Induction.

(5) The effective permeability can be made variable through mechanical and magnetic means. Variation is produced mechanically by the insertion and removal of permeable material into & out of the path of magnetic induction. This results in the variation of the effective path length, and thus a variation of the effective permeability,  $\sigma$ .

In many magnetic materials their magnetic permeability is a function of the flux densities within these materials. The greater the flux density, the less the permeability. When the flux density is increased beyond a certain point the magnetic permeability of the material becomes that of free space. This is known as Saturation. Hereby the magnetic permeable material can be made to vary its permeability by the application of a magnetic field of induction. This in turn gives variation to the effective permeability,  $\sigma$ , and thus a variation in effective path length.

(6) The general expression for magnetic induction is given by the relation,

$$\Phi = iL, \text{ ampere-henry.}$$

In this relation two parameters can be varied. One is the current can be made variable, in turn giving a variation of M.M.F. The other is the effective permeability can be made variable, this in turn giving a variation of inductance. The current,  $i$ , and the effective permeability,  $\sigma$ , undergo variation and give rise to a variation

of Magnetism,  $\Phi$ . This variation of magnetism develops and E.M.F. Three basic relations exist,

One,

$$\Phi = iL, \text{ ampere-henry.}$$

Two,

$$i = \frac{\Phi}{L}, \text{ weber per henry.}$$

Three,

$$L = \frac{\Phi}{i}, \text{ weber per ampere.}$$

These fundamental relations bear resemblance to those of Ohm's Law, as basic expressions of proportionality.

Relation one expresses a conservation of magnetism,  $\Phi$ . This gives the Motor-Generator relation. Here an increase in current relates to a decrease in inductance, or an increase in inductance relates to a decrease in current. This proportionality maintains a constant quantity of magnetism.

Relation two expresses a conservation of Current,  $i$ . This gives the variable parameter relation. Here an increase in magnetism relates to an increase in inductance, or a decrease in inductance relates to a decrease in magnetism. This proportionality maintains a constant current.

Relation three expresses a conservation of inductance. This gives the reactance coil relation. Here an increase in magnetism relates to an increase in current, or a decrease in current relates to a decrease in magnetism.

In any one of these three various conditions that give rise to a variation in magnetism the E.M.F. which results from this variation transfers energy into, or out of, the Magnetic Field of Induction,  $\Phi$ . Here derived is a more general expression for the Law of E.M. Induction for the study of parameter variation in electro-magnetic systems.

### 3.8 Eight

Magnetic Parameter Variation can be divided into two categories. One is the variation of the M.M.F., through variation of the Current,  $i$ . The other is the variation of the Inductance through variation of the Effective Path Permeability,  $\sigma$ . Current,  $i$ , and permeability factor,  $\sigma$ , are the two parameters which can undergo variation in order to give a variation in the quantity of Magnetism,  $\Phi$ .

The condition in which only the current undergoes variation exists with the Reactance Coil. Here the inductance is a constant, it is a factor of proportionality. This is expressed in the relation,

$$L = \frac{\Phi}{i}, \text{ weber per ampere.}$$

Here a sine wave of current develops a sine wave of magnetism. Both waves exist in a direct proportion,  $L$ , and are thus "in phase".

For the Reactance Coil the Law of Energy Conservation is satisfied. All the energy given to the magnetism is given back by the magnetism, no gain or loss. This movement of energy is facilitated by the induced E.M.F.

The condition in which only the Inductance undergoes the Parameter Variation exists with the Magnetic Amplifier, or the General Parametric Apparatus. Here the current is constant, it is a factor of proportionality. This is expressed by the relation,

$$i = \frac{\Phi}{L}, \text{ weber per henry.}$$

Here a sine wave of Inductance Variation develops a sine wave of Magnetism. Both wave exist in direct proportion,  $i$ , and thus are in phase. Energy is exchanged through the developed Induced E.M.F.

Here the Law of Energy Conservation is not satisfied. The Energy given to the Magnetism is not the Energy given back by the Magnetism, there is a gain or loss of Energy. In this situation the Law of Energy Continuity must be considered.

The condition in which the Magnetism is a constant is the Motor-Generator. This is expressed by the relation

$$\Phi = iL, \text{ ampere-henry.}$$

Here it is both the Current,  $i$ , undergoing variation and the Inductance,  $L$ , undergoing variation, these in an Inverse Proportion in order to maintain a constant Magnetism. As sine wave of Inductance gives a sine wave of Current, but here the two waves are in Phase Opposition, that is, "out of phase".

Because the Magnetism is "Static" no Energy is exchanged. Thus no "Energy Law" is involved in this condition of constant Magnetism. Hereby no E.M.F. is developed, the E.M.F. of the Motor-Generator is derived solely from the Rotation of the machine. The Law of Energy Continuity is involved here in that the Mechanical Energy consumed by the shaft re-appears as Electrical Energy produced by the armature windings, this representing a Generator. The reverse is true for a

Motor. In each case the form of Energy is not conserved, it is consumed, or it is produced. Thus the Law of Energy Continuity expresses the Energy relationship.

For the condition of Inductance Parameter Variation and a constant Current the Magnetic Energy is not conserved. While for the Motor-Generator the Law of Energy Continuity is obvious, it is not so for the Parameter Variation apparatus. Here the Law of Energy Continuity is not identifiable, it is somewhat Indeterminate. This now brings into question the Law of Energy Perpetuity, this is to say Energy goes on forever just as it has existed forever As written in the Bible; "As it was in the Beginning, so it shall be, for now and Ever-more:. The Law of Energy Perpetuity is similar to a Religious Law, to be defended and upheld by the "Church". Amen.

### 3.9 Nine

The basic characteristics of the Three Principle Conditions has been considered.

One, The Reactance Coil

Two, The Variable Parameter Apparatus

Three, The Motor-Generator.

For the Reactance Coil it is a sine wave of Current variation, for the Parameter Apparatus it is a sine wave of Inductance variation, and for the Motor-Generator it is a sine wave of shaft rotation, these sine waves give rise to a sine wave of Electro-Motive Force.

While it is that conditions one and three are generally understood, not so with condition two. The development of an E.M.F. by variation of the Permeability Factor,  $\sigma$ , is a non- conventional methodology. The most notable apparatus for this purpose is the Alexanderson Alternator. Also the Alexanderson Magnetic Amplifier can serve as a Generator of and Alternating E.M.F. but this has not found practical application. Little exists to facilitate study.

(1) An example of Magnetic Parameter Variation can be found in the phenomena of Hysteresis. It is a natural phenomena characteristic of certain Magnetic materials, such as Iron. Hysteresis gives rise to an Energy loss in the cycle of Magnetic Induction. For example, if the Reactance Coil has a Magnetic path consisting mostly of Steel, the Energy taken by the Magnetism is not all given back by the Magnetism, part is lost. In conformance to the Law of Energy Continuity it is presumed that the Energy is continued in the form of Heat. Hysteresis results

in the heating up of the Steel which makes up the Magnetic path. It was the pioneering work of Steinmetz that led to an understanding of Hysteresis, a major advancement in the engineering of A.C. machinery.

In general the phenomena of Hysteresis is lumped together with the phenomena of Magnetic saturation. This is an un-fortunate circumstance. While in general the Hysteresis Cycle gives rise to a gain or loss, the Saturation only distorts the wave. The gain or loss of energy is produced by the Hysteresis component of a Magnetic Cycle, not the Saturation component.

(2) Hysteresis is defined as a Time Displacement, it is derived from the Greek work defining "To Lag". Here with Hysteresis it is that Cause is displaced in time from Effect. This is to say that Action and Reaction no longer exist in the same Time Frame, one can lag or lead the other.

For the condition of Hysteresis loss in Magnetic material, the current,  $i$ , and the M.M.F. produced is displaced in time from the co-responding Magnetic Induction. The M.M.F. causing the effect of Magnetism exists at a different time than that of the M.M.F. Here the sine wave of current has fallen out of step with the sine wave of Magnetism. The Induced E.M.F. is the cosine wave, that is the rate of change of the sine wave of Magnetism. When the M.M.F. is in step with the Magnetism, that is "in phase", the cosine wave of E.M.F. is "in quadrature phase" with the Current. Here the Energy of the Magnetism is conserved. When the Magnetism has fallen out of step with the Current a quadrature relation no longer exists with the Current and the Induced E.M.F. This introduces an Energy Component into the E.M.F. and the Energy of the Magnetism is not conserved. The degree by which the Current is out of step with the Magnetism, and accordingly the E.M.F. is known as the Angle of Hysteresis,  $\alpha$ .

In general if this angle,  $\alpha$ , Lags, Energy is lost and if it Leads, Energy is gained, by the Magnetic Field of Induction. The Law of Energy Continuity requires the Energy lost or gained to continue as heat or mechanical activity.

(3) Let the quantity of Magnetism at any instant in time, or arbitrary phase angle, be represented by the relation,

$$\Phi = iL, \text{ ampere-henry.}$$

If the wave of Current is displaced in phase from its co-responding wave of Magnetism, the Current existing at the time of Magnetism is foreign, it is from another time. The Cause is not present for its Effect. This foreign relation exists through the Inductance, and the Hysteresis Cycle gives rise to the Variation of this Inductance maintaining the Magnetism at that instant in Time. Thus in the sine wave

of Magnetism there exists a co-responding sine wave of Inductance variation, the sine wave of Current will shift in phase to accommodate the sine wave of Inductance variation. This exists in the Reactance Coil with a Hysteresis Loss. Here the sine wave of Current gives rise to a sine wave of Magnetism. This is in phase if the Inductance remains constant. It is however that the Hysteresis gives rise to a sine wave of Inductance variation and this gives rise to a co-responding phase displacement between the Current and the Magnetism. The factor by which Energy is lost via Hysteresis is given by the relation

$$a = \sin \alpha,$$

where  $\alpha$  is the angle of Hysteresis, and,  $a$ , is the Power Factor of the Reactance Coil.

In the general situation, if a Reactance Coil exists in which a sine wave of Induction variation is applied, the Reactance Coil can be made to consume Energy for a lagging Hysteresis angle, and to produce Energy for a leading Hysteresis angle.

### 3.10 Ten

(1) Hysteresis is described as the separation in time between cause and effect. Cause and Effect relations can be expressed as points on a curve, normally this curve is a straight line. In the graphical representation of electronic devices this curve is called a Load Line. A straight line gives the condition of a direct relation between Cause and Effect. As an example is the condition where the E.M.F.,  $E$ , is the cause, and the Current,  $i$ , is the effect,

$$R = \frac{E}{i}, \text{ volt per ampere.}$$

The Proportionality,  $R$ , exists between Cause,  $E$ , and Effect,  $i$ , and here it is a Resistance. If the Cause,  $E$ , is given graphically as a vertical coordinate, the resulting Load Line is the graphical plot of the Proportionality between the Cause,  $E$ , and the Effect,  $i$ . For the condition of a constant fixed resistance,  $R$ , in Ohm the Load Line is a straight line. The slope of this line is the instantaneous ratio of the E.M.F. to the Current, and it is constant anywhere along the line. No differential relation exists in that the ratio of any E.M.F. to its co-responding current is always the same value. It is a constant resistance,  $R$ .

$$\frac{dE}{di} = \text{constant, volt per ampere.}$$

This is known as a Linear relationship.

(2) Electrical devices such as Incandescent Lamps or Thyrites do not exhibit a direct relation between cause and effect. For example, the Lamp shows an Increasing Resistance for an Increasing Current, and a Thyrite shows a decreasing Resistance for an increasing applied E.M.F. Here the Load Line is no longer straight, but it is now curved in a parabolic form. The slope is no longer constant but varies with position along the curve. An E.M.F. and its co-responding Current have a different ratio than another E.M.F. and Current taken at another point on the curve. The variation of the slope represents the variation of Resistance,

$$\frac{dE}{di} = r \text{ volt per ampere.}$$

Cause and Effect are now in Dis-Proportion to each other. Here Effect can become exaggerated by the cause and a sine wave of E.M.F. no longer gives rise to a sine wave of Current, distortion results. This is known as a Non-Linear relationship. Magnetic Saturation in Magnetic material is one such disproportional relationship, here between the M.M.F. and the Magnetic Induction, the Load Lines are known as the Saturation Curves of the Magnetic Material.

In both the Linear and the Non-Linear relation every E.M.F. has one and only one co-responding current. These exist at one unique point on the Proportionality Curve. The Relationship here is Uni-Valent, or single valued.

(3) Another more complex relation can exist between Cause,  $E$ , and Effect,  $i$ . In this relationship Cause and Effect become Dis-Joint. Here the curve for rising values is not the same curve as for falling values. In this situation the graphical expressions of the relation is no longer Linear, nor is it non-Linear, it is now an Elliptical relationship. In the Non-Linear relationship the limit in curvature is the straight line, here the curvature is Infinitesimal. Likewise for the Elliptical relationship, the limit in ellipticity is the full circle, a limiting case for Elliptical curvature. When the "Load Line" is a circle the Proportionality Factor of Resistance becomes the Dis-Proportionality Factor of Reactance.

$$\frac{dE}{di} = j\omega L \text{ henry per second.}$$

Reactance is Resistance in constant variation at an angular rate of  $\omega$ . Here the Resistance is the Reaction of the Inductance to the constantly variable current,

$$\omega i \text{ ampere per second.}$$

(4) For the condition of the Elliptical Load Line, the point by point relationship is no longer uni-valent, for each Cause, or E.M.F.,  $E$ , there exist two co-responding Effects, or Currents,  $i$ . These two Effects exist displaced in Time. Likewise, for each Effect, Current,  $i$ , there exists two co-responding Causes, E.M.F.s. These two Causes exist displaced in Time. Where it is the Linear or Non-Linear relationship is a Uni-Valent function, it is for the Circular and Elliptical relationships a Quadra-Valent function.

For the condition of the Linear and the Non-Linear relationships, As the Cause, or E.M.F. becomes smaller and smaller, likewise the Effect or Current becomes smaller and smaller. For both Proportionate and Dis-Proportionate relationships a zero Cause has a co-responding zero Effect. Both become zero together, Uni-Valent.

For the condition of the Circular and Elliptical relationships, these Quadra-Valent functions arrive at zero points in four locations on the curve, two for the Cause, E.M.F. and two for the Effect, Current. The two zero points for E.M.F. are displaced in Time as are the two zero points for Current, and all four zeros are displaced in Time from each other. Moreover here exists a unique situation where a Cause, E.M.F. can have zero Effect, Current, or and Effect, Current, can have no Cause, E.M.F. Cause and Effect are here Dis-Joint from each other. This condition can be called the Hysteretic Cycle of Proportionality.

(5) In its most general form, ruling out Non-Linearity, the Load Line can be considered a Circle rotating on an axis, this axis in the plane of the Circle and normal to its curvature, bisecting it. As this circle is turned on its axis it begins to contract into an ellipse. Continuing the rotation further, upon reaching one quadrant, 90 degrees, of rotation, the circle has completely contracted into a line with a slope of one, a 45 degree line. This quadrantal rotation represents the transformation from Reactance to Resistance. The angle by which the circle is displaced towards the line is called the Angle of Hysteresis,  $\alpha$ .

In order to carry the angle,  $\alpha$ , beyond one quadrant one more transformation is required. Here the circle has a pair of rotational axes, these also in a quadrature relation, dividing the circle into four quadrants. As the angle,  $\alpha$ , passes beyond 90 degree the rotational axis is shifted to the quadrantal axis and it is inverted. As the line opens into an ellipse the position of this curve now travels in the opposite direction, the A.C. wave now rotates around the Load-Line in the opposite direction. Continuing to advance angle,  $\alpha$ , another 90 degrees, upon reaching two quadrants the line has opened up again into a full circle with a cyclic direction opposite to the circle at the start when the angle,  $\alpha$ , was zero. This now is a Negative Reactance. Where the first quadrant of rotation transformed Reactance into Resistance, the

second of rotation transforms Resistance into Negative Reactance. Continuing to carry the rotational, or Hysteretic Angle,  $\alpha$ , beyond two quadrants, or 180 degrees, again contracts this counter-circle back into an ellipse. However the slope of this ellipse is now backwards, or negative, this as well as counter-cyclic. Upon reaching the next quadrant of rotation the ellipse has contracted into a line but now the line has a negative slope. Here is the unique situation where an increasing Cause, E.M.F. has a co-responding decreasing Effect, Current. Inversely, it is the greater the Effect, the less the Cause required to produce this Effect. This is a condition of Negative Resistance.

Upon passing through this inverse Linear relationship the rotational axis of the Load Line Circle is shifted back to the original. As angle,  $\alpha$ , is carried past three quadrants, or 270 degrees, the Load Line again opens into an Ellipse of positive slope and normal rotation. Continued rotation returns the Load Line back to the original circle of Reactance at four quadrants or 360 degrees.

(6) In symbolic form, for the four quadrants through which the Angle of Hysteresis is rotated it is

$$\begin{aligned} j^0, & X, \text{ reactance(positive)} \\ j^1, & R, \text{ resistance(positive)} \\ j^2, & -X, \text{ reactance(negative)} \\ j^3, & -R, \text{ resistance(negative)} \end{aligned}$$

Here the Versor Operator,  $j$ , expressed the Angle of Hysteresis,  $\alpha$ , in quadrantal form.

In any intermediate angle between quadrantal angles of 0, 90, 180, 270, the values of Reactance and Resistance combine in a quadrantal vector relationship, this for intermediate angles in the first quadrant the relation is given as,

$$Z = X + jR \text{ ohm.}$$

This is the Hysteretic Impedance for the first quadrant, and

$$\frac{R}{X} = \arctan \alpha \text{ ohm.}$$

Here,  $Z$ , is a Positive Impedance but now the Resistance has become an imaginary quantity. Likewise for the opposing quadrant the relation is given as,

$$-Z = j^2 X + j^3 R \text{ ohm.}$$

Or by resolving powers of  $j$ , it is

$$-Z = -X - jR \text{ ohm.}$$

Here it is a negative Hysteretic Impedance. Hence Reactance and Resistance can be synthesized in Positive or Negative forms by positioning the Angle of Hysteresis,  $\alpha$ .

### 3.11 Eleven

(1) Magnetic materials such as Iron exhibit internal parameter variations during a Magnetic cycle of Induction. These can be divided into two distinct phenomena, Saturation and Hysteresis. It has become commonplace to consider the two as a single phenomena, but this leads to misleading concepts. Saturation and Hysteresis must be analyzed separately.

Saturation gives rise to a Non-Linear loadline. The path taken by a point on this curve through the A.C. cycle follows the same path up the curve as down the curve. This curve defines a single path. Also, here in the Iron, the Saturation curve is Symmetrical, both positive and negative values give the same curvature. The Non-Linearity of the Saturation curve gives rise to Dis-Proportion between cause and effect. This in turn distorts the wave into a non-sinusoidal form. A series of odd ordered harmonics is produced by this non-linear distortion. This is an Amplitude Distortion of the A.C. wave. Hysteresis gives rise to an Elliptical loadline. A point on this curve does not follow the same path up the curve, as that path down the curve. Each path is on one or the other side of the elliptical curve. This path is now a loop. The elliptical load line is ultimately derived from a linear curve as a side view of a rotating circle. Hence the distortion produced is not an amplitude throughdistortion as normally considered. In the elliptical curve the distortion is not the result of a dis- proportionate relation between cause and effect as with the Saturation, rather it is that cause and effect have become separated in a time loop. Thereby Hysteresis gives rise to a Phase Distortion in the A.C. wave.

Parameter variation of Inductance by external means, through rotation or controlled saturation, can be utilized to develop synthesized Saturation and Hysteresis curves unique from those of the Iron itself. The practical knowledge in this realm is very limited. Experimentation is required here.

The principle apparatus utilizing parameter variation are the developments of Ernst Alexanderson, the Variable Induction Alternator and the Magnetic Amplifier.

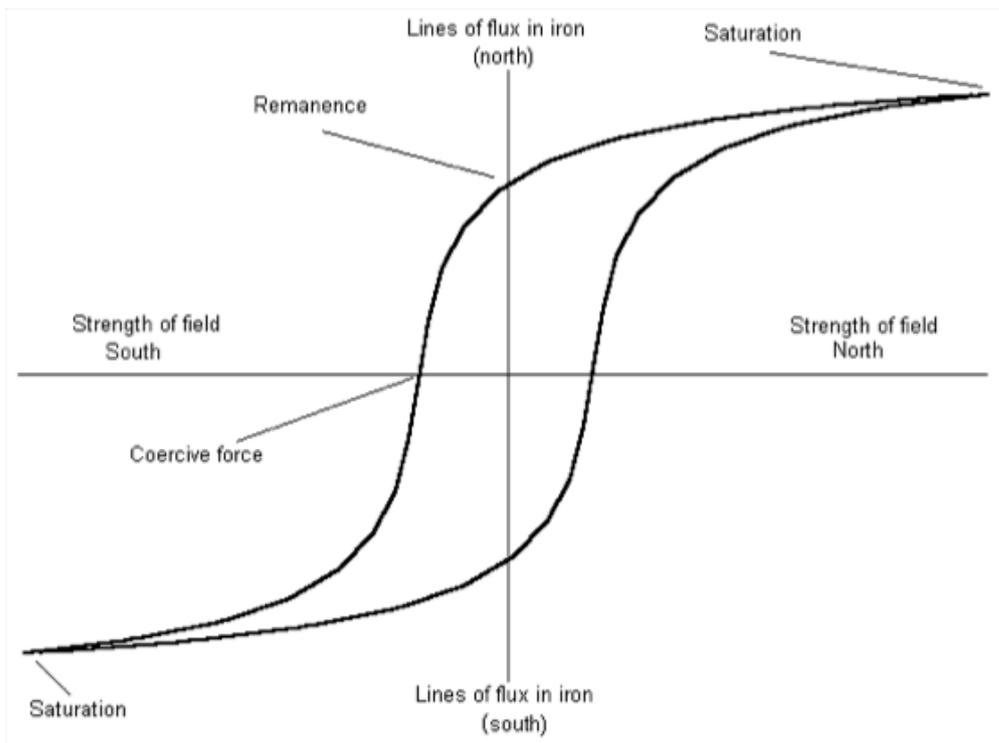


Figure 3.1: Hysteresis curve.

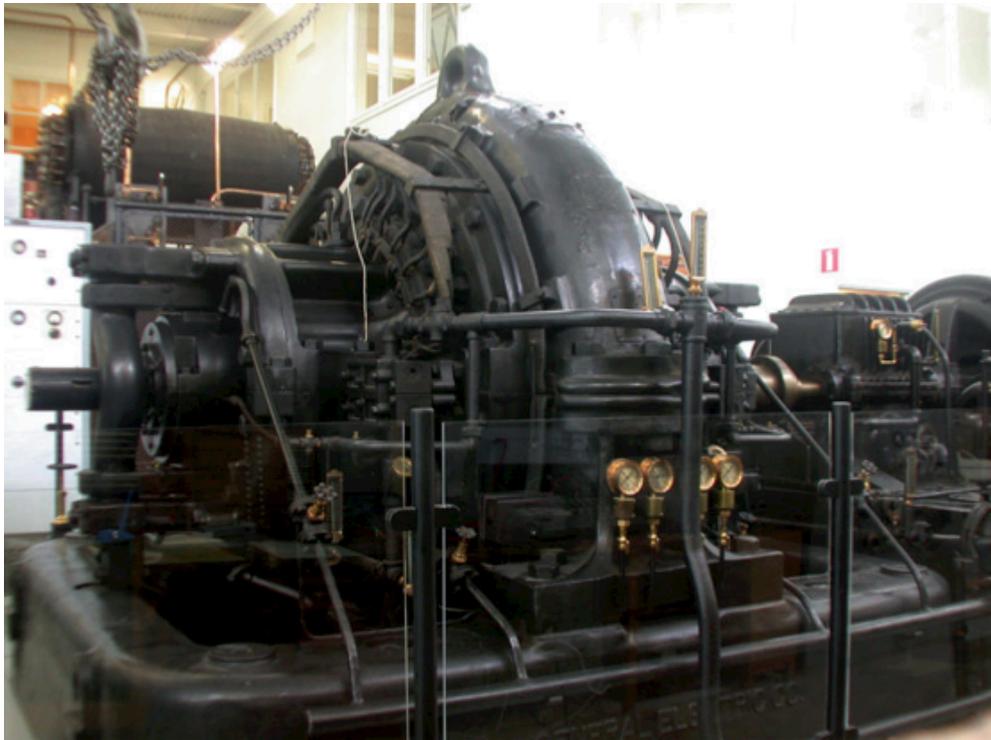


Figure 3.2: The Variable Induction Alternator.

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Fig. 1.

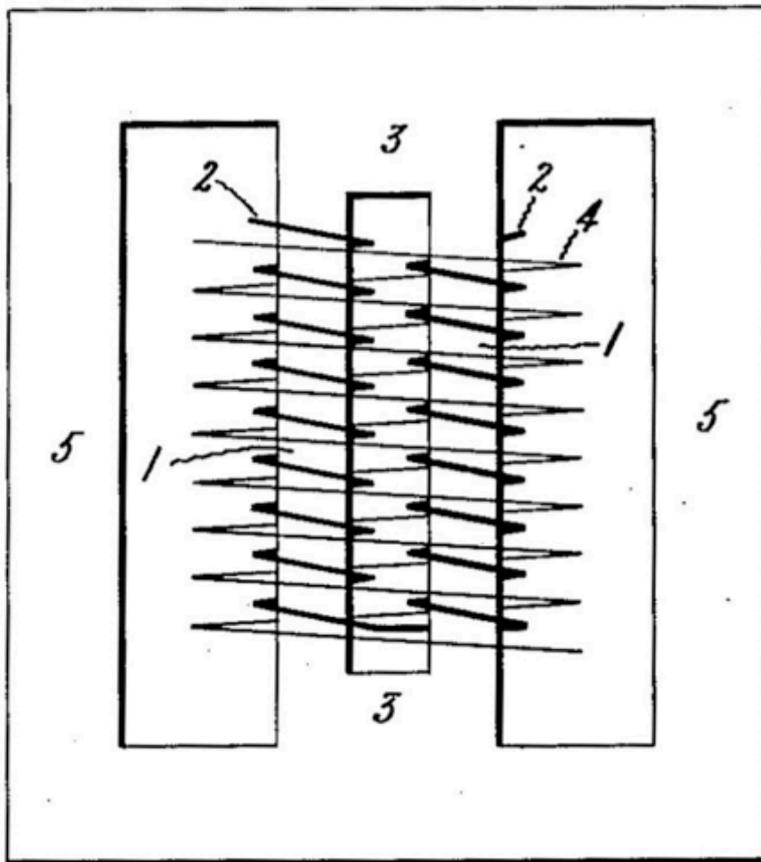


Figure 3.3: The Magnetic Amplifier.

The alternator is a complex machine but the Mag-Amp is a quite simple device. The Mag-Amp is where to begin the study of parameter variation. The utilization of the Mag-Amp as a parameter variation device is somewhat different than its use as an amplifier. As an amplifier it serves as a variable Impedance, consuming E.M.F. as a Reactance Coil. In the situation of parameter variation this device is called upon to produce an E.M.F. and thereby function as an A.C. generator. One important feature of the Mag-Amp is that the control windings are Electro-Magnetically isolated from the power windings. The Magnetic circuit of the Mag-Amp acts as a balanced bridge, giving a cancellation of power flux in the control winding. Hereby no energy can be exchanged between control circuits and power circuits. This is a consideration in the Law of Energy Continuity.

(3) C.P. Steinmetz, in his editions of "Theory and Calculation of A.C. Phenomena"<sup>7</sup>, does not development Saturation and Hysteresis as separate and distinct phenomena. Saturation and Hysteresis are combined in the Magnetic material giving rise to a Distortion Complex of phase shifted harmonics. This is a composite of the separate amplitude and phase distortions. Little is given in the A.C. book that relates to the utilization of parameter variation for the generation of Electro-Motive Force and the transfer of Electric Energy thereby. Steinmetz only considers situations where Saturation and Hysteresis are considered as parasitic phenomena, these to be minimized. In later chapters, "Reaction Machines" and "Distortion of Waveshape and Its Causes", Steinmetz develops an analysis of parameter variation and the E.M.F.s developed thereby.

A considerable portion of the Steinmetz A.C. book is devoted to the Synchronous Machine, such as the common polyphase Alternator and the Synchronous Motor. The Synchronous Machine, a development of Nikola Tesla, is the principle apparatus of Electric Power Engineering. Nearly all Electric Energy is generated by Synchronous Alternators, their first major application at the Niagara Power Plant.

(4) The Synchronous Machine has applications other than converting mechanical to electrical Energy as a generator, or converting electrical energy to mechanical Energy as a motor. The Synchronous Machine can synthesized Electric Power. Here the machine operates with no mechanical connection to the shaft whatsoever, it is spinning freely in synchronism with the applied A.C. wave. When the Synchronous Machine is operating in perfect synchronism with an A.C. power line, no power flows into, or out of, the A.C. power line. Here the rotor is in exact

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<sup>7</sup>Charles P. Steinmetz, *Theory and calculation of alternating current phenomena*, (McGraw-Hill Book Co., Inc., New York, 1916).



Figure 3.4: The Synchronous Machine.



Figure 3.5: The Synchronous Motor of Niagara Fall Power Plant.

step with the rotation of the A.C. wave developed by the machine stator. Both rotations are in phase unison, top dead center on the rotor is top dead center on the stator, the two rotations in synchronism. In order to maintain this condition the machine must be excited by a specific quantity of Magnetism, this produced by the Field Current. This specific value is determined by the condition of no power flow between the machine and the power line. Here the E.M.F. of the machine just matches the E.M.F. of the line, no cross current exists. This is a neutral condition.

If the Field Current (and excitation) is increased beyond the value required for a neutral condition, the rotor pushes ahead of the rotating A.C. wave to a position advanced in phase, but still rotating in synchronism with the wave. With increasing excitation the machine begins to draw a leading Current from the power line, the greater the excitation, the greater the current taken by the machine from the line. Since these Currents are reactive no Energy is expended in maintaining them. Here the Synchronous Machine is exhibiting the characteristics of an Electro-Static Condenser and in this manner of operation it is called a Synchronous Condenser.

Inversely, reducing the Field Current below that required to maintain a neutral condition, the rotor falls behind the A.C. wave of the stator, this to a position retarded in phase while rotating with the A.C. wave. The less the excitation, the more the rotor lags behind the stator. With decreasing excitation the Machine draws a lagging Current from the power line, the less the excitation, the more Current is drawn. Here the machine is exhibiting the characteristics of a Reactance Coil. This can be called a Synchronous Reactor.

In this manner the Synchronous Machine is operating as a two terminal Reactance Arm. There is no connection to the rotating shaft. The Machine can synthesize an actual Inductor or Condenser. Operating in this manner the machine can create a substantial reactive power flow, this flow controlled by the D.C. excitation of the machine. This Controlled Reactance is used at the end of long distant power lines in order to regulate the voltage and phase at lines end.

As a reactance arm the two terminals (per phase) serve as input and serve as output. There is only one power line. The Energy flows into the machine during one part of the Cycle, and Energy flows out of the machine during another part of the Cycle. Here input and output are separated in Time rather than space. The Energy is caught in a Hysteresis Loop.

It is important to note here that this machine is operating as a Synthesizer. The power flow of Condensers and Reactors are developed by synthesis, without the intense Dielectric and Magnetic Fields that normally are required to create this flow, or surging, of Electric Energy. Here a "Synthetic Power" is derived from a

dynamic of parameter variational form.

### 3.12 Twelve

(1) In the last section it was shown that a Synchronous Machine can synthetically produce reactive power. The practical embodiment of this feature is the regulation of long distance power lines. No stored Energy of Magnetic Induction, nor that of Dielectric Induction, is present to account for this reactive power flow.

In the chapter "Reaction Machines" Steinmetz continues with a more in depth analysis of parametric E.M.F. production. Here Steinmetz presents a situation where a Synchronous Machine can synthesize its own D.C. excitation. This is with no outside source of current to develop the M.M.F., nor any remnant Magnetism.

(2) The chapter "Reaction Machines" gives a more theoretical analysis of Hysteresis. Here the Hysteresis is no longer connected with Saturation, it is independently synthesized by the machine. A pair of Hysteresis Cycles can be formed, one is a forward cycle representing Energy consumption, the other is a reverse cycle representing Energy production; see hysteresis motor.

It is assumed through the Law of Energy Continuity that the rotating shaft transfers the Energy that is produced or consumed in an Electrical form. The E.M.F. developed in the parametric machine however is unlike that developed by the Motor-Generator. The Motor-Generator is a Constant Magnetism machine and the energy transferred is strictly a function of shaft rotation. The regulation here between mechanical and electrical forms is definitely established by the Law of Energy Continuity.

The parametric E.M.F. is developed by a variation of Magnetism, it is not constant, but pulsates with respect to time. In this situation the machine operates in the constant Current condition and the Energy transferred is a function of Inductance variation via shaft rotation, but not shaft rotation directly. This complicates the Law of Energy Continuity.

(3) In the Synchronous Machine irregularities in pole facings and winding distributions give rise to a pulsation upon the normally constant Magnetism. This constancy is a characteristic of operation as a Motor-Generator. The E.M.F. of rotation and the E.M.F. of variation combines with it to give an effective total E.M.F. at the machine terminals.

Steinmetz suggests no apparatus for developing an E.M.F. by parametric means in his A.C. books, however the Alexanderson Alternator was under development at the time of writing of the Fifth Edition, 1916. In general these parametric vari-

ations in rotating machinery are hereby considered parasitic phenomena, just as with Saturation and Hysteresis in magnetic material. These effects are to be minimized not optimized. It is however in this series of writings that the optimization of parametric E.M.F. generation is sought, and its application to the Law of Energy Continuity studied.

(4) In the next chapter, "Distortion of Waveshape and Its Causes", Steinmetz further develops the analysis of Synchronous Parameter Variation. The material presented in this chapter is minimal. Dimensional in-congruities, irrational units, ambiguous equations, and typo errors render the understanding of this chapter difficult. Also, again Saturation and Hysteresis become merged into a common phenomena, this blurring the true relations between Amplitude and Phase distortions.

In "Distortion of Waveshape and Its Causes" Steinmetz also gives an analysis of the synchronous parameter variation of Resistance, such as in Arc Lighting Systems. Here the remarkable condition exists that a form of reactive power is produced, however with no phase displacement. It is noted by Steinmetz that, where it is Inductance variation gives rise to an effective Resistance of Energy transfer, here the Resistance variation gives rise to an effective Reactance of Energy storage. This reactance is synthetic, no Field of Induction, nor relative mechanical activity, is present to facilitate any reactive power. This synthetic reactance is a result of the particular cause and effect relations in the variant resistance. Again the Law of Energy Continuity is in question. Here the Law of Energy Perpetuity may even be invalidated. This is an important study.

(5) The chapter 25 from "Theory and Calculation of Alternating Current Phenomena" Fifth Edition, 1916<sup>8</sup>, is here re-developed in the following, concentrating of a general equation for the synchronous parameter variation of Inductance and the E.M.F. developed thereby. Symbol standardization, and rationalizing by removal of pi and root two, will be applied to the expressions of Steinmetz.

The parameter variation in this chapter is of the synchronous type. Here the Inductance of a reactance coil with an applied A.C. current is brought into synchronous variation at a harmonic rate in proportion to that of the applied A.C. current. Two E.M.F.'s are developed, that of the reactance opposing the variation of Current, and that of Inductance variation. The E.M.F. of constant Inductance and Current variation is compounded with the E.M.F. of constant Current and Inductance variation. Steinmetz fails to separated these two E.M.F.'s. Here exists

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<sup>8</sup>Charles P. Steinmetz, *Theory and calculation of alternating current phenomena*, (McGraw-Hill Book Co., Inc., New York, 1916).

a modulation process, the Inductance variation modulating the reactance current variation. Complex E.M.F.'s result consisting of multiple frequencies and with distorted waveforms.

In chapter 25, expressions are given for the E.M.F. of rotating parameter variation, as in the Synchronous Machine, and the E.M.F. of stationary parameter variation, as in the magnetic material of the static reactance coil. The two are of basically the same mathematical form thus distinction is not a necessity in the development of a General Equation of synchronous parameter variation.

Chapter 25, article 234 begins the analysis, "Lack of Uniformity and Pulsations of the Magnetic Field." This serves as the basis for the derived General Equation. The sine wave of Magnetism is given by,

$$\Phi(\cos \theta) \text{ weber,}$$

where,

$$\Phi \text{ average magnetic induction,}$$

and

$$\theta \text{ time angle in radians,}$$

Here the Time Angle is the independent variable, this is defined by,

$$\theta = \omega t \text{ radian.}$$

And

$$\omega = 2\pi F \text{ radian per second,}$$

where,

$$F, \text{ frequency in cycles/sec,}$$

and

$$t, \text{ Time variable, seconds,}$$

This time angle is a dimensionless position variable on the A.C. cycle of revolution. Substituting the cyclic period,

$$T = \frac{1}{F}, \text{ seconds/cycle}$$

gives the Time Angle as the ratio of the time along the cycle to the time of a complete cycle, that is,

$$\theta = 2\pi \cdot \frac{t}{T}, \text{ percent(cycle)}$$

or in rational form, in radian,

$$\theta = \frac{t}{\tau}, \text{ percent(radian),}$$

where

$$\tau = \frac{1}{\omega}, \text{ percent per radian.}$$

(6) Let the instantaneous value of Magnetism be given by the relation,

$$\phi = \Phi \cos \theta [1 + \delta \cos(n\theta - \alpha)],$$

where

- $\phi$ , instantaneous magnetism,
- $\theta$ , time angle,
- $n$ , harmonic number,
- $\alpha$ , angle of hysteresis,
- $\delta$ , depth of modulation,
- $\Phi$ , average magnetism.

Substituting the following relation for Magnetic Induction,

$$\Phi = iL, \text{ ampere-henry.}$$

into the general expression segregates the two subjects of parameter variation, that of the Current,  $i$ , and that of the Inductance,  $L$ . The sine wave of current is given by

$$i \cos \theta, \text{ ampere.}$$

And the pulsating wave of Inductance is given by

$$L[1 + \delta \cos(n\theta - \alpha)], \text{ henry.}$$

Here in the Inductance the sine wave of variation is offset, and for a modulation depth of one (100%) the sine wave is a pulsating wave in variation with peaks at zero and twice the value of static Inductance. This is expressed as

$$L + L\delta \cos(n\theta - \alpha), \text{ henry,}$$

where

$$\cos(n\theta - \alpha), \text{ numeric,}$$

is the sine wave of Inductance variation. For a modulation depth of zero the cosine term vanishes and the constant term of static Inductance,  $L$ , remains

$$L + L \cdot 0, \text{ henry.}$$

Segregating variations the General Equations for Magnetic synchronous parameter variation becomes

$$\phi = i \cos \cdot L[1 + \delta \cos(n\theta - \alpha)], \text{ ampere-henry.}$$

(7) For the condition of Saturation and Hysteresis as exists in magnetic materials the process of saturation is the same for positive and negative half cycles, it is symmetrical. The reduction of Inductance due to saturation in the positive half is the same reduction of Inductance due to the saturation in the negative half. Hence the reduction, or modulation, of Inductance is at Twice the frequency of the A.C. cycle of Magnetism, that is, the Inductance pulsates at Double Frequency. In this situation it is,

$$n = 2, \text{ numeric.}$$

where,  $n$ , is the harmonic number.

Two factors exist in the characteristics of magnetic material, Hysteresis gives rise to a phase angle,  $\alpha$ , the angle of hysteresis, and Saturation gives rise to a modulation factor,  $\delta_s$ , the depth of modulation. Hence the sine wave of Inductance variation is expressed by the term,

$$\delta_s \cos(2\theta - \alpha), \text{ numeric,}$$

this for Magnetic material.

(8) The E.M.F. developed by the instantaneous Magnetic Induction,  $\phi$ , is the time rate of its variation,

$$E = \frac{d\phi}{dt}, \text{ weber per second.}$$

The time rate of variation is expressed as

$$p = \frac{d}{dt}, \text{ per second.}$$

Steinmetz substitutes the expression for angular rate of variation,

$$\omega \frac{d}{d\theta}, \text{ numeric,}$$

where

$$\omega = \frac{2\pi}{T}, \quad \text{radian/second,}$$

and

$$\theta = \omega t, \quad \text{radian,}$$

This angular differential is here given symbolically,

$$\gamma = \frac{d}{d\theta}, \quad \text{per radian,}$$

and it is dimensionless. Here gamma represents an infinitesimal Versor Operator, this of an infinite number of divisions, symbolically,

$$1^{\frac{1}{\infty}}, \quad \text{unit versor.}$$

Here the angular frequency,  $\omega$ , has become a tensor magnitude, or a Tensor Frequency. The angular rate of variation is thus symbolically expressed by

$$\omega\gamma, \quad \text{numeric.}$$

Substituting into the relation for E.M.F. gives

$$E = (\omega\gamma)i \cos \theta L[1 + \delta \cos(n\theta - \alpha)], \quad \text{ampere-henry.}$$

And differentiating, gives the developed E.M.F. of synchronous parameter variation of Inductance as,

$$E = (\omega\Phi)[\sin \theta + A_1 \sin(\beta_1 - \alpha) + A_2 \sin(\beta_2 - \alpha)], \quad \text{volt.}$$

where it is,

$$A_1 = \frac{\delta}{2}(n - 1), \quad \text{numeric,}$$

$A_1$  being the Sideband Amplitude, and

$$A_2 = \frac{\delta}{2}(n + 1), \quad \text{numeric,}$$

$A_2$  being the Upper Sideband Amplitude. Also,

$$\beta_1 = (n - 1)\theta, \quad \text{radian,}$$

the Lower Sideband Time Angle,

$$\beta_2 = (n + 1)\theta, \quad \text{radian,}$$

the Upper Sideband Time Angle.

Note here that

$$\omega\Phi = \frac{\Phi}{\tau}, \quad \text{radian,}$$

dimensionally establishes the volt.

Hence a pair of new Frequencies are generated by the synchronous parameter variation of Inductance, these given by the relations,

Lower Sideband Frequency,

$$\omega_1 = (n - 1)\omega, \quad \text{radian/second,}$$

Upper Sideband Frequency,

$$\omega_2 = (n + 1)\omega, \quad \text{radian/second,}$$

where,  $\omega$ , is the "Carrier Frequency", of current variation via the A.C. cycle of the external current source.

Hence three alternating electric waves exist in the process of synchronous parameter variation, the values are given in Table 1, Two particular harmonic modulating frequencies are of interest, the second harmonic and the fourth harmonic. For the condition of second harmonic modulation the frequency of the Lower Sideband is equal to the carrier frequency, these two combine in a resultant wave at the carrier frequency. The Upper Sideband is the third harmonic of the carrier frequency and super-imposed upon it creates a regular harmonic waveform. For the condition of fourth harmonic modulation the Lower Sideband gives the Third Harmonic of the carrier wave and the Upper Sideband gives the Fifth Harmonic of the carrier frequency. The odd order series, one, three, five exists here and again super-impose upon each other producing a regular harmonic waveform. All other harmonic modulating frequencies, three, five, etc, give rise to an irregular sequence and thus produce irregular harmonic waveforms. The depth of modulation as well as the Angle of Hysteresis both have a considerable effect on the resulting wave shape. This can give rise to very complex waveforms. It is to be noted that for large depth of modulation, and high orders of modulating harmonics, that the resulting E.M.F. can greatly exceed the E.M.F. of the reactance coil in reaction to the carrier frequency of the external A.C. current source. These processes are worthy of Experimental Research.

TABLE 1 27

| $n$ | $A_1$ | $A_2$ | $\omega_1$ | $\omega_2$ |
|-----|-------|-------|------------|------------|
| 1   | 0     | 1     | 0          | 2          |
| 2   | 0.5   | 1.5   | 1          | 3          |
| 3   | 1     | 2     | 2          | 4          |
| 4   | 1.5   | 2.5   | 3          | 5          |
| 5   | 2     | 3     | 4          | 6          |
| 6   | 2.5   | 3.5   | 5          | 7          |
| 7   | 3     | 4     | 6          | 8          |
| $n$ | $A_1$ | $A_2$ | $\omega_1$ | $\omega_2$ |

VALUES FOR  $\delta = 1$ , 100% MODULATION  
AND  $\omega = 1$ , FOR FUNDAMENTAL FREQUENCY

Figure 3.6: The synchronous parameter variation.

(9) Steinmetz does not develop this subject much further. The equations for parameter variation in stationary reactance coils, article 236, are dimensionally invalid,

$$\phi \neq \frac{X}{\omega}, \quad \text{henry,}$$

A weber is not an ohm-second per radian, it is rightly given as

$$\phi = i \frac{X}{\omega}, \quad \text{ampere-henry,}$$

The equations for harmonic summation are not clear and something seems not right. No in depth analysis exists of Resistance parameter variation on a theoretical level, everything is reduced to effective values. E.M.F. is not equated to a co-responding current in many cases making the study of Power Flow difficult in the case of Inductance parameter variation. It is noteworthy in this chapter that Steinmetz gives experimental verification of his parameter variation expressions. It is this feature of Steinmetz's work that makes it of value.

(10) Herewith closes this series of writings, "The Law of Electro-Magnetic Induction". Three principle conditions for the development of electro-motive force have been presented,

Constant Magnetism,  
Constant Current,  
Constant Inductance.

While the condition of Constant Magnetism, the Motor-Generator, and the condition of Constant Inductance, the Reactance Coil, are well known engineering realities, it is the special condition of Constant Current that awaits further analysis and experimentation. In this particular condition of E.M.F. development the Law of Energy Continuity may be in need of re-definition. Here the Law of Energy Perpetuity, the holy dictum of modernistic physics, may possibly be invalidated.

## Chapter 4

# Metrical Dimensional Relations of the Aether

### 4.1 Metrical Dimensional Relations of the Aether

In order to establish the dimensional relations regarding the calculations of the Inductance of the magnetic field, and the Capacitance of the dielectric field, metrical dimensional relations must be applied to the Aether. It is however we really know very little of anything quantitative about this Aether. Names like J.J. Thomson, N. Tesla, G. Le-Bon, W. Crookes, and Mendeleev, all have an important role in the Electrical Engineer's understanding of the aether concept. The physical representation of the Aether as an ultra-fine gas has been qualitatively established, this gas relating to the "Pre Hydrogen Series" of the un-abridged Periodic Table of the Elements. In an analogous compliment is the Trans-Uranium Series of the currently known Periodic Table of the Elements.

This gaseous Aether is the seat of electrical phenomena through the process of its polarization. This polarization gives rise to induction, which then gives rise to stored energy. Tesla gives a good presentation of his Aether ideas in his "Experiments with Alternate Currents of High Potential and High Frequency." Given in previous chapters has been the Planck,  $h$ , as the primary dimensional relation defining the "Polarized Aether", this is as an "Atom of Electricity". It is however, from the views of J.J. Thomson, the Coulomb,  $\psi$ , the total dielectric induction is the primary dimension defining the "Polarized Aether". Thomson developed the "Aether Atom" ideas of M. Faraday into his "Electronic Corpuscle", this is the indivisible unit. One corpuscle terminates one Faradic tube of force,

and this is quantified as one Coulomb. This corpuscle is NOT an electron, it is a constituent of what today is known as an electron. (Thomson relates 1000 corpuscles per electron) In this view, that taken by W. Crookes, J.J. Thomson, and N. Tesla, the cathode ray is not electrons, but in actuality corpuscles of the Aether. The lawyer like skill of today's theoretical physicist (Pharisee) has erased this understanding from human memory, it is henceforth sealed by the Mystic Idol of Albert Einstein. If Einstein says no, then it is impossible. What a nice little package.

However, as Electrical Engineers we can give a "Flying Foxtrot" about Einstein, or about bar room fights over the constitution of the Aether. The City of Los Angeles wants its electricity and our job is to get it there intact. How to accomplish this begins with the understanding of Inductance and Capacitance. These represent the energy storage coefficients of the electric field of induction, this induction in turn a property of the Aether. Magnetic Inductance is thus a dimensional relation for the magnetic properties of the Aether, and Dielectric Capacitance is thus a dimensional relation for the dielectric properties of the Aether. Inductance and Capacitance are thus the application of metrical dimensional relations to certain characteristics of the Aether.

For the magnetic induction the Aetheric relation is known as the magnetic "Permeability", for the dielectric induction the Aetheric relation is known as the dielectric "Permittivity". These two terms were so named by Oliver Heaviside. Here the Permeability is denoted as  $\mu$ , the Permittivity as  $\epsilon$ . These two relations represent the "Magnetic Inductivity" and the "Dielectric Inductivity", respectively. This pair of dimensional relations,  $\mu$  and  $\epsilon$ , in conjunction with the metrical dimensional relations defined by the metallic-dielectric geometry bounding the electrified Aether, constitute the dimensional relations of Inductance and Capacitance. It is therefore the Inductance and the Capacitance,  $L$  and  $C$  are in, and of, themselves metrical dimensional relations. They consist of not substancive dimensions, they are not substantial, they are metrical.

The substancive dimensional relation of Dielectric Induction,  $\psi$ , in Coulomb, is combined with the metrical relation of Capacitance,  $C$ , in Farad, giving rise to the compound dimensional relation of electro-static potential,  $e$ , in Volt.

- (1)  $C$ , Coulomb,  $\Psi$ , substantial
- $F$ , Farad,  $C$ , metrical
- $V$ , Volt,  $e$ , compound, substantial and metrical.

The Farad "operates upon the Coulomb, giving rise to the Volt. Likewise, the substancive dimensional relation of Magnetic Induction,  $\Phi$ , in Weber is combined

with the metrical dimensional relation of Inductance,  $L$ , in Henry, giving rise to the compound dimensional relation of magneto-motive force,  $I$ , in Ampere

- (2)  $W$ , Weber,  $\Phi$ , substantial
- $H$ , Henry,  $L$ , metrical
- $A$ , Ampere,  $I$ , compound, substantial and metrical

The Henry "operates" upon the Weber, giving rise to the Ampere.

The permittivity, as a factor of Capacitance, and the Permeability as a factor of Inductance represent aspects of the medium bounded by the metallic-dielectric geometry.  $\mu$  represents the magnetic aspect,  $\epsilon$  the dielectric aspect of this medium, be it Aether or 10 –  $C$  oil. Here it should be noted that the electrical activity is contained solely within the Dielectric Medium, not within the metallic portion of the geometry which bounds it. Again, the basic theory of J.C. Maxwell.

The concept of gradients is here again evoked. These gradients,

- (3)  $V/cm$ , Volt per Centimeter,  $d$
- (4)  $A/cm$ , Ampere per Centimeter,  $m$

can be represented each in a pair of forms, these giving four gradients total. One form represents the gradient co-linear with the tubes of force themselves, these considered as circuits. The gradients here are in "series". This condition exists within the "lumped" capacitors and inductors. These gradients constitute "Forces" within the Lines of Induction and can be considered longitudinal in nature.

The alternate form of gradient exists broadside to the tubes of force. Here the inductive forces appear as "fronts" and the gradients can be seen as in "parallel". This condition exists along the span of the long distance A.C. transmission line. This is,

- (5)  $V/l$ , Volt per Span,  $d'$
- (6)  $A/l$ , Ampere per Span,  $m'$

Here the gradients exist perpendicular or transverse to the Lines of Induction.

Hence, as given, the dielectric gradients,  $d$ , and  $d'$ , as well as the magnetic gradients,  $m$ , and  $m'$ , can in general exist each as space quadrature pairs, and as such can represent versor magnitudes in space. See Space Versor part in "Theory of Wireless Power", by E.P. Dollard<sup>1</sup>. Here again basic electrical relations exist in the archetypal four polar form. The dielectric and the magnetic relations each

<sup>1</sup>Eric P. Dollard, *Theory of Wireless Power*, Wireless Engineer, (Boderland Sciences, Bayside, 1986).

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can be expressed as a pair of versor sub-relations, or four relations total. It may be inferred that both the Inductance and the Capacitance each can be expressed in a pair of distinct forms. This is for (3) and (4) THE "Mutual" Capacitance in per Farad, and the "Mutual" Inductance in per Henry, respectively. For (5) and (6) it is the "Self" Capacitance, in Farad, and the "Self" Inductance, in Henry, respectively. Hereby the four coefficients of induction,

(I) The Electromagnetic coefficients;

- (a) Self Inductance in Henry,  $L$
- (b) Self Capacitance in Farad,  $C$

(II) The Magneto-Dielectric coefficients;

- (a) Mutual Inductance, in Per Henry,  $M$
- (b) Mutual Capacitance, in Per Farad,  $K$

The coefficient,  $M$ , may be called the "Enductance" and the coefficient,  $K$ , may be called the "Elastance". This four polar condition will be considered later on. In what follows will be in terms of the transverse electro-magnetic form, self Inductance and self Capacitance.

The Law of Magnetic Proportion is expressed by the dimensional relation,

- (7)  $W$ , Weber, or  $A \cdot H$ , Ampere - Henry

and for the Law of Dielectric Proportion,

- (8)  $C$ , Coulomb, or  $V$ , Volt -  $F$ , Farad

The gradients of the Inductance and the Capacitance, are given as, for the magnetic,

- (9)  $H/cm$ , Henry per Centimeter, or  $\mu$ ,

and for the dielectric,

- (10)  $F/cm$ , Farad per Centimeter, or  $\varepsilon$ .

Hereby taking the Inductance gradient,  $\mu$ , and the Capacitance gradient,  $\varepsilon$ , and substituting these into the Law of Magnetic Proportion and the Law of Dielectric Proportion, respectively, the product of the resulting magnetic and dielectric relations gives

- (11)  $\frac{W \cdot C}{cm^2}$ , Weber - Coulomb per Centimeter Square

equals

$$V \cdot A \cdot \mu \cdot \varepsilon, \text{ Volt - Ampere} - \mu - \varepsilon$$

Substituting the following relations

$$(12) \mu - \varepsilon, \text{ or } \Gamma^2, \text{ (Metric)}$$

$$(13) W \cdot C, \text{ Weber - Coulomb, or } h, \text{ Planck, (Substancive)}$$

and substituting (12)and (13)into (11)gives

$$(14) \frac{h}{cm^2}, \text{ Planck per Centimeter Square, or Volt - Ampere} - \Gamma^2$$

Since it is that

$$(15) V \cdot A \text{ equals } \frac{h}{s^2}, \text{ Planck per Second Square}$$

substituting (15)into (14)and canceling the Plancks, produces the dimensional relation

$$(16) \frac{1}{cm^2}$$

equals

$$\frac{1}{s^2} \cdot \gamma^2.$$

Rearranging this relation, the product (11)gives the definitive metrical dimensional relation

$$(17) \gamma^2$$

equals

$$\frac{s^2}{cm^2}$$

or thus

$$(17a) \gamma^2, \text{ or } \frac{1}{v^2}, \text{ one over Velocity Square}$$

And it has been determined that this velocity  $V$  is the velocity of light  $c$ . This is to say, the product of the Magnetic Permeability,  $\mu$ , and the Dielectric Permittivity,  $\varepsilon$ , is one over the velocity of light square. This relation is the very foundation of the theory of Electro-Magnetic Wave Propagation through the Aether, this in a transverse induction form. It is a T.E.M. bounded wave. Hence the product  $\mu \cdot \varepsilon$  is a fundamental metrical relation of the "Luminiferous Aether", the carrier of light.

It must be remembered that here it is both  $\mu$  and  $\varepsilon$  represent transverse relations only, and thus useful only in a Transverse Electro-Magnetic metallic- dielectric geometrical form.

## 4.2 Explosion at the Shipyard, N.F.G.

Lieutenant Junior Grade, U.S.N. Albert Einstein is seated before five senior officers at a Judge Advocate General Board of Inquiry. It has been convened at Pearl Harbor Naval Shipyard. Lt. J.G. Einstein is the defendant and the Board is about to issue it's verdict. The charges are very serious.

It seems that Mr. Einstein utilized a college physics textbook, in lieu of Bureau of Ships directives, in performing operations on a shore power connection. Mr. Einstein employed "his understanding", as derived from Physics, "Maxwell's Equations", in determining the connections for a shore power transformer bank (480V at 1500 KVA). Seaman Lopez was directed by Lt. J.G. Einstein to make the "backward" connections, but Lopez knew the outcome would spell disaster. He learned in his Naval Electricians Mate training that the connection would cross phase, however Mr. Einstein berated Lopez, as Einstein's Princeton University education overshadowed "Electricity Schools". Lopez was reminded that to refuse orders would result in a Captains Mast and possible Court Martial under the U.C.M.J. A terrified Lopez closed the switch and was killed in the blast. Four more were injured and the Shipyard was without power for several hours.

Lieutenant Junior Grade Albert Einstein was pronounced –guilty– by the Board. He received a life sentence at Leavenworth Federal Prison. The next day the Chief of Naval Operations issues the following directive to all Fleet Commanders. It reads in part; At 0000 hours U.T.C. Dec 21, 2012 the following order is in effect: The use of Physics Texts in any and all Naval Operations is henceforth PROHIBITED. The next day a Presidential Order is signed abolishing the practice of teaching Electrical Principles by Physicists. (But the Mayan Calendar says we will not make it that far)

We have reached the Final Proclamation. It can no longer be avoided. It is that the "Laws of Physics" find no application in the understanding of Electricity for the Electrical Scientist. The Physicist is best regarded as a subversive from an enemy country, and his efforts best suited for the development of "Weapons of Mass Destruction."

The entire system of "Units and Dimensions" for electrical work as they exist today are an incongruous quagmire force fit to Einstein's  $E = mc^2$ . Electricity is a "mass free" phenomena. This is given by Dr. Wilhelm Reich in his "Cosmic Superimposition". Mass has no place in Electrical Units and a directive is issued to remove it from said units and dimensions. The question of mass is

touched upon by Oliver Heaviside<sup>2</sup> in his "Electro-Magnetic Theory" Vol I, pages 337 to 339.

Art. 189, Internal Obstruction and Superficial Conduction On page 339, "In the limit, with no resistance (perfect conduction)it never gets in at all. Where then is the current?" There is none.

It is further found that the existing system of units are infected with useless constants such as  $4\pi$  and one over  $c$  square, as well as a multitude of arbitrary powers of ten. The systems of units as they exist today are pure N.F.G. This is given by Heaviside, same Volume I, pages 116 to 123.

Art. 90, "The eruption of the  $4\pi$ "

Art. 91, "The origin and the spread of the Eruption."

Art. 92, "The cure of the Disease by Proper Measure of the Strength of the Sources."

Art. 93, "The Obnoxious Effect of the Eruption."

Art. 94, "A Plea For the Removal of The Eruption by the Radical Cure."

Here now the Primary Directive is issued: Rationalize the system of units and dimensions. Remove all "pathogenic" dimensional relations, MASS IN PARTICULAR. This will follow shortly. (Also, on this matter see "Impulses, Waves, Discharges", Steinmetz<sup>3</sup>, pages 14 & 15.)

Lamare has pushed forward these writings in order to accommodate the "Moon-bounce Initiative". Hence certain introductory material for the "Youngsters" must be passed over for now. This "act of genius" on the part of Lamare must in itself be pushed forward; An International Ham Contest to disprove Einstein, (but do not ask the A.R.R.L.). Wow Mr. Wizard, that sounds like loads of fun. Lets get started today.

It should be noted however that Lamare is taking a most difficult path. His route lacks any definite engineering formulation but let me draw his attention to C. P. Steinmetz and the treatment of a related situation. It is found in "Theory and Calculation of Transient Electric Phenomena", "Transients in Space" and section on "Velocity of Propagation of the Electric Field, Capacity of a Sphere". When the one over  $c^2$  and the  $4\pi \cdot 10^{-9}$  are eliminated, the velocity of propagation of the dielectric field is an independent variable. These relations were given by myself at the International Tesla Society in my lecture "Hysteresis of the Aether". The P.E.E.E., QRM and Dis-infos were conspicuously absent from this presentation!

<sup>2</sup>Oliver Heaviside, *Electro-Magnetic Theory*, Vol. I, (Benn Brothers Limited, London, 1922).

<sup>3</sup>Charles Proteus Steinmetz, *Elementary lectures on electric discharges, waves and impulses and other transients*, (McGraw-Hill Book Co., New York, 1911).

I wonder why?

It is however, that the Telluric Transmission Networks of N. Tesla are completely engineer-able. This is also true for the U.S.N. Alexanderson systems of transmission. The Rogers U.S.N. system also should be noted. The Tesla "through the Earth" radio has been rendered mere technical details by the writings of L.V. Bewley, Blume, Steinmetz, and Dollard. In particular note Bewley, "Traveling Waves on Transmission Systems"<sup>4</sup>, chapter on single winding waves, and Dollard, "Condensed Introduction to the Tesla Transformer"<sup>5</sup>, and "Theory of Wireless Power"<sup>6</sup> section on coil Coil Calculations. The Tesla Magnifying Transmitter is now an engineer-able reality, this for any competent radio engineer. The 160 meter Ham Band, (1.8 - 2.0 Megacycle per sec.) is the perfect spot for our "International Contest." My longitudinal videos show the construction of a "160 meter" flat spiral transformer. These medium wave frequencies along with large paths of transmission on a quadrant of the Earth make velocity determination possible. Note that Tesla's drawing indicates that velocity depends on the cosecant of the latitudinal angle, it is infinity at the poles and luminal at the equator, if anyone ever bothered to look at the fine print. The  $\pi$  over two is the effective velocity between the limits of  $c$  and infinity. There is no longer any excuse for not implementing Tesla Transmission on the Ham Bands, none!

Now the Coyote has to puke. Up comes the goo & mucus of undigestible matter, what a mess. Forget the Bearden fecal matter, Forget the Corm carrion. IT IS ABSOLUTELY USELESS. This material is Pathogenic, also from another standpoint. There are Journalistic Interest, such as the B.B.C. & etc. that sometimes turn a favorable ear to Tesla concepts. For these interested to get mired in a concatenated sequence of falsehoods & misconceptions is the "Kiss of Death" to any public awareness. It also illegitimizes "The Work" in the eyes of Scientists & Engineers. Puke it up once and for all!

The Bearden zealot stands at the bottom of the utility pole, exclaiming to the lineman on top, replacing a missing cross-arm brace, "You lose half your power in that 33KV line (50% efficient) because you don't pump the Scalar Waves." The irritated Lineman drops the brace and now must climb down to retrieve it. Angered, the Lineman slams his fist into the mouth of the yack-yack, knocking him

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<sup>4</sup>Loyal Vivian Bewley, *Traveling Waves on Transmission Systems*, (John Wiley & Sons, New York, 1951).

<sup>5</sup>Eric P. Dollard, *Condensed Introduction to the Tesla Transformer*, (Boderland Sciences, Bayside, 1986).

<sup>6</sup>Eric P. Dollard, *Theory of Wireless Power*, Wireless Engineer, (Boderland Sciences, Bayside, 1986).

to the ground and shouts, "This Line is 98% efficient you moron." What more can I say, Heaviside<sup>7</sup> E.M. Theory, Vol III, page 1, art. 450.

Adagio. Andante, Allegro Moderato.

"There is a time for all things: for shouting, for gentle speaking, for silence; for washing of pots and the writing of books. Let the pots go black, and set to work. It is hard to make a beginning, but it must be done." Oliver Heaviside

### 4.3 Prelude, Quadra-Polar Electricity

It has been repeatedly observed in the previous writings that any given dimensional relation, say Volt, Ampere, and etc always exist in a dual relation. This is known since it is  $e$ , in volts and  $E$ , in volts. The geometric archetype of the electric phenomena is four polar. This polar quadrantal form is well expressed in Native American art forms. These serve as their "Versor Diagrams" for the four polar seasons and lunar positions. These are important for those that "live outside". See "When Stars Look Down" for a good popular, not technical, description of this topic. The quadra-polar concept in the mind of Nikola Tesla resulted in the polyphase motors and generators of today's AC technology.

It is likewise, Inductance and Capacitance are a pair of coefficients representing a pair of fields, and in turn each representative coefficient in itself exists as a pair, hence giving the four coefficients total.

Steinmetz first noticed this quadrature pair of inductances in his study of the AC power transformer. This inductance now exists as a pair of inductances: the Leakage Inductance,  $L$ , and the Mutual Inductance,  $M$ . The lines of induction for  $L$  are at right angles (Space Quadrature) to the lines of induction for  $M$ . So it is  $L$  and  $M$  do not "see each other". Alexanderson utilized this in his magnetic amplifier. Here the saturation flux must be in space quadrature with the power flux. It is then that the two are separated but in the same core. In a metallic-dielectric form it is given as a toroidal magnetic circuit, wound with a pair of metallic circuits, one in winding around the core cross sectional area, the other winding at right angles to the toroidal windings, this being circumferal around the core. (See Alexanderson Patents). Here derived is a "quadra-polar Inductance Coil". This quadra-polar inductance,  $LM$ , serves as a first step towards understanding

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<sup>7</sup>Oliver Heaviside, *Electro-Magnetic Theory*, Vol. III, (Benn Brothers Limited, London, 1922).

#### 100CHAPTER 4. METRICAL DIMENSIONAL RELATIONS OF THE AETHER

tesla type transformers. Needless to say P.E.E.E. Pupin rudely declared Steinmetz as un-Maxwell. So Here we go again.

With regard to parameter variation only the first step has been taken. For example:

Henry per 1, or Henry  
Henry per 1 second

That is to say

Henry per second, or Ohm

But what about Henry per second square, or what?

Heuristic (see Guillimen)dimensional relations will be utilized as before.  
To quote Maxwell "Electricity and Magnetism"<sup>8</sup> volume 1, page 2;

"A knowledge of the dimensions of the units furnishes a test which ought to be applied to the equations resulting from any lengthened investigation. The dimensions of every term of such an equation, with respect to the three fundamental units must be the same. If not, the equation is absurd, and contains some error, as its interpretation would be different according to the arbitrary system of units which we adopt."

Here utilized are the "Three Fundamental Units":

1. Planck
2. Second
3. Centimeter

See "Theorie de Chaleur" by Fourier.

Parametric oscillator<sup>9</sup>

Application of power multiplication to electric power distribution<sup>10</sup>

We have landed, and it is now possible to understand electricity with complete freedom from the shackles of Physics. We are now entering a New World and it is yet to be discovered what wonders may lay ahead.

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<sup>8</sup>J. C. Maxwell, *A treatise on electricity and magnetism*, (Clarendon Press, Oxford, 1873).

<sup>9</sup>[http://en.wikipedia.org/wiki/Parametric\\_oscillator](http://en.wikipedia.org/wiki/Parametric_oscillator)

<sup>10</sup><http://www.freepatentsonline.com/7969042.pdf>

U.S. Patent Jun. 23, 1987

Sheet 1 of 3

4,675,615

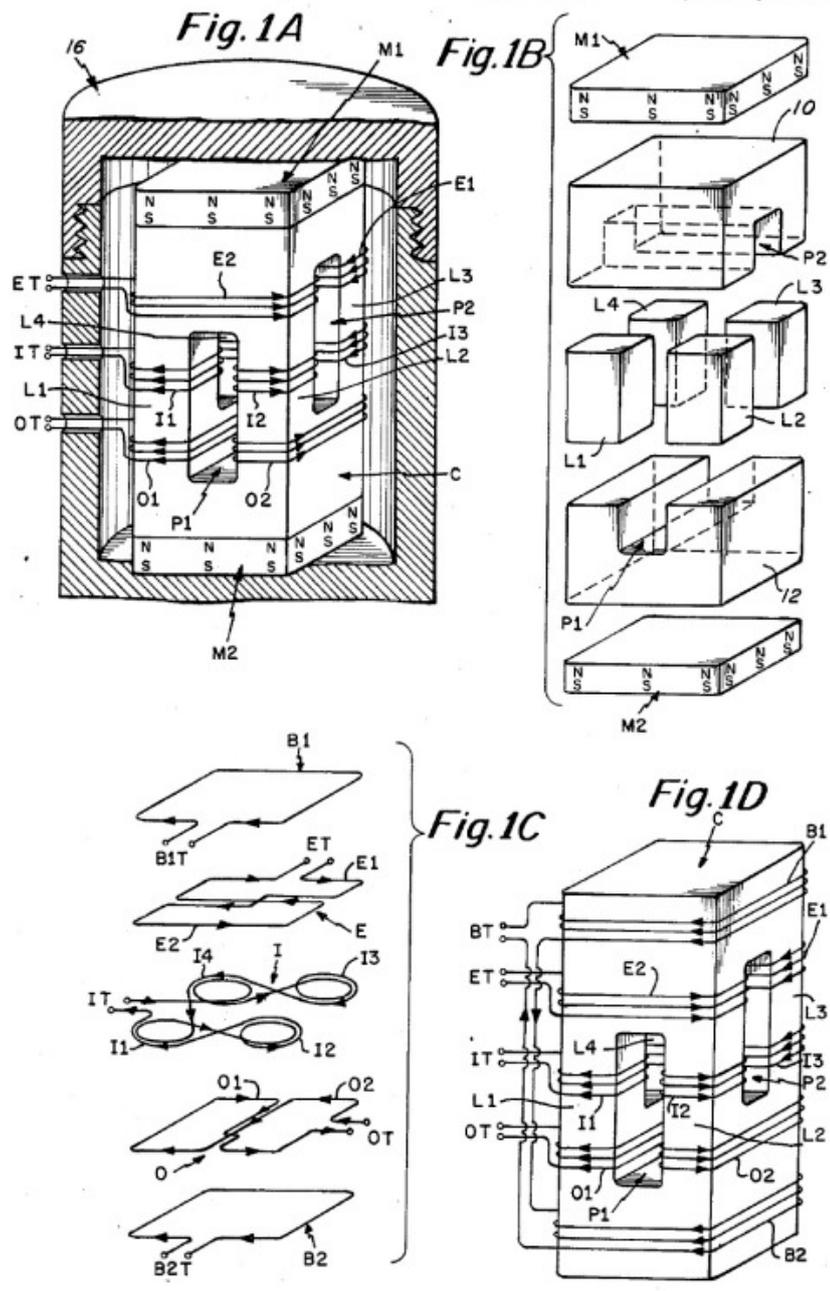
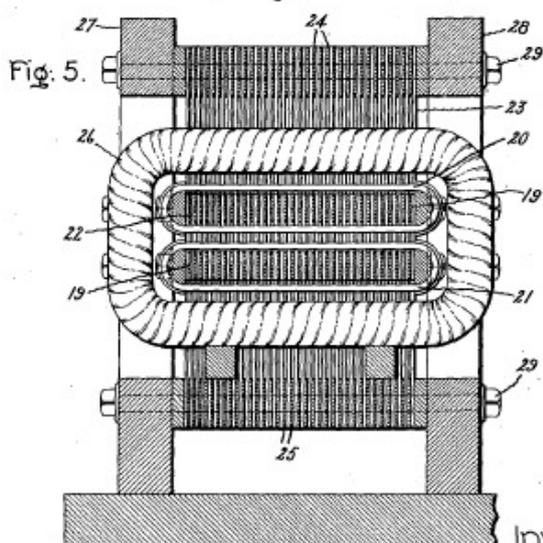
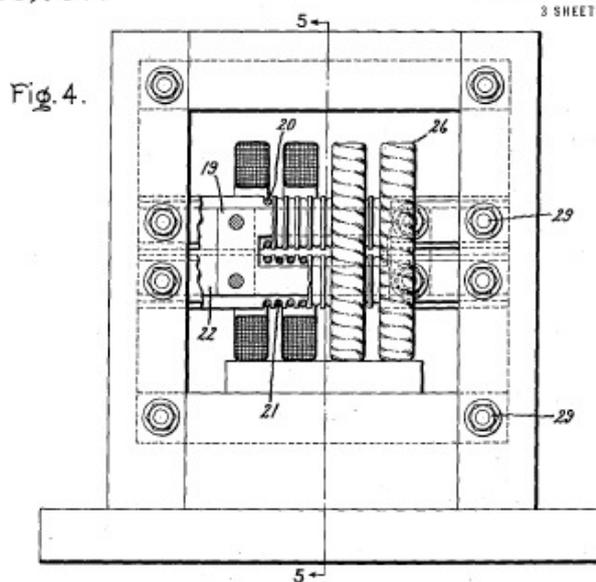


Figure 4.1: US-Patent-46756151.

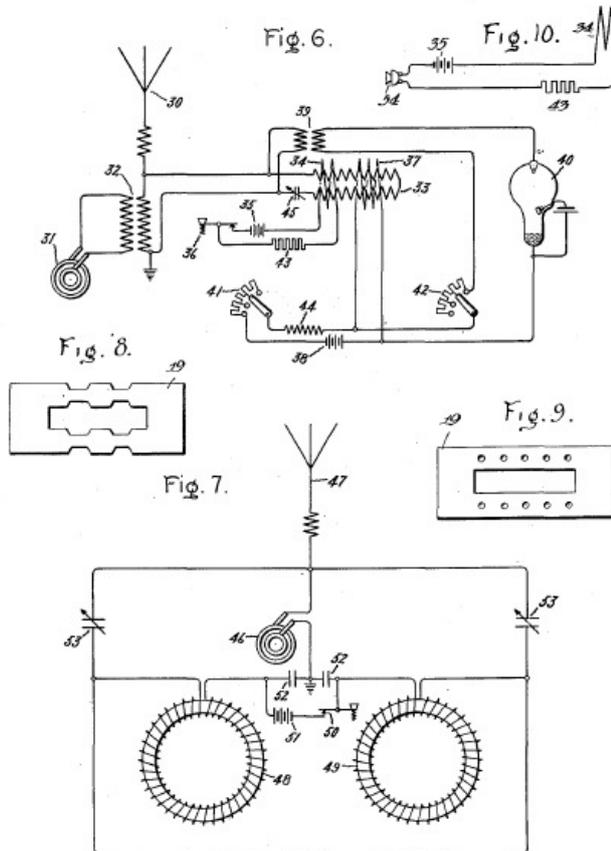
E. F. W. ALEXANDERSON.  
MEANS FOR CONTROLLING ALTERNATING CURRENTS.  
APPLICATION FILED NOV. 26, 1915. Patented Jan. 20, 1920.  
1,328,797. 3 SHEETS—SHEET 2.



Inventor:  
Ernst F. W. Alexanderson,  
by *Alfred Davis*  
His Attorney.

Figure 4.2: Alexanderson-US-Patent-1328797-sheet-21.

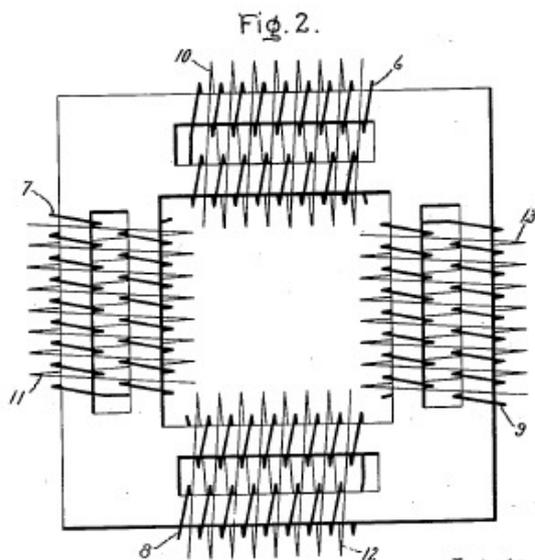
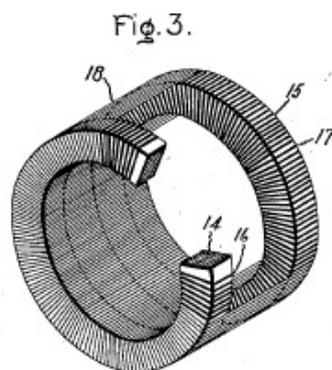
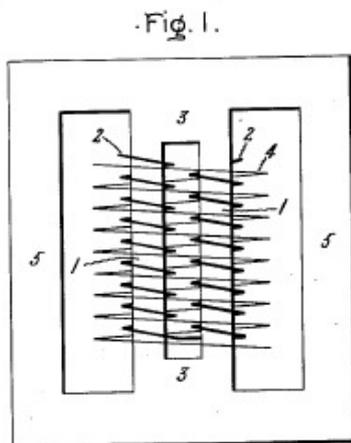
E. F. W. ALEXANDERSON.  
 MEANS FOR CONTROLLING ALTERNATING CURRENTS.  
 APPLICATION FILED NOV. 26, 1915. Patented Jan. 20, 1920.  
 1,328,797. 3 SHEETS—SHEET 3.



Inventor :  
 Ernst F.W.Alexanderson,  
 by *Allen S. Davis*  
 His Attorney.

Figure 4.3: Alexanderson-US-Patent-1328797-sheet-31.

E. F. W. ALEXANDERSON.  
MEANS FOR CONTROLLING ALTERNATING CURRENTS.  
APPLICATION FILED NOV. 26, 1915. Patented Jan. 20, 1920.  
1,328,797. 3 SHEETS—SHEET 1.



Inventor:  
Ernst F. W. Alexanderson,  
by *Wm. S. Davis*  
His Attorney.

Figure 4.4: Alexanderson-US-Patent-1328797-controlling-alternating currents1.

We have broken the "Einstein Barrier". He has been left behind on the Prison Planet, but Oliver has been taken with us. We are not done with him yet. No one will live long enough to exhaust the works of Heaviside, and in all probability, Human Society will not either.

The electrical "System of Units and Dimensions" that have been established and taught in the "Schools" of today is encapsulated in a thick coating of  $E$  equals  $mc^2$ , intermingled with the likes of  $4\pi$  and one over  $c^2$ , and peppered with a multitude of arbitrary powers of ten. This system is really a complete, absolute, mess.

In order that we may continue to utilize the established size of the Ohm, Volt, Henry, and etc, and remain in accord with the new system of dimensions that has been presented in my series of writings, a mathematical "adapter" must be derived. This adapter will also make lucid the sheer extent of the mess. (See table at end)

Previously established in my writings has been a concrete dimensional system for the description of the "Electrical Phenomena". These relations will serve as the screws, nuts, and bolts with which to construct a revised concept of electricity, this in accord with the efforts of J.J. Thomson, Oliver Heaviside, Nikola Tesla, and Carl Steinmetz. We no longer need to be involved in the convolutions of the Pendant, the Mystic, and the Dis-informer. They are back on the prison planet with Albert Einstein.

Three dimensions form the primary basis for subsequent relations:

(1)  $Q$ , Total Electrification, Planck,

This is our substantial dimension, the spaghetti, or the milk; and,

(2)  $t$ , Time, Second,

(3)  $l$ , Space, Centimeter.

These serve as our metrical dimensions, the forgotten past, or the throw-away package. Subsequently established has been a series of dimensions and dimensional relationships, save yet Inductance, Capacitance, and the Electric Force. Two primary substantial dimensions were established by divorce from  $Q$ .

(1)  $\Psi$ , Total Dielectric Induction, Coulomb,

(2)  $\Phi$ , Total Magnetic Induction, Weber.

Derived then are four secondary, or compound, dimensional relations:

- (1)  $I$ , Displacement Current, Ampere,
- (2)  $E$ , Electro-Motive Force, Volt,

The laws of induction; and,

- (3)  $e$ , Electro-static Potential, Volt,
- (4)  $i$ , Magneto-Motive Force, Ampere, The laws of proportion.

Hereby it is we have two Volts and two Amperes:

Volt; Weber per second,  $E$ ,  
 Volt; Coulomb per Farad,  $e$ ,

and

Ampere; Coulomb per second,  $I$ ,  
 Ampere; Weber per Henry,  $i$ .

These four dimensional relations serve the principle needs of Electrical Theory.

A pair of auxiliary dimensional relations are also important. These are given as,

- (1) Energy; Joules, or Planck per Second
- (2) Activity, or Power; Watt, or Planck per Second Square.

Here we have arrived at eight principle dimensional relations for the understanding of Electrical Theory and Practice. All other dimensional relations are developed from consideration of the Metallic-Dielectric Geometry and the Aether with which it is engaged.

In our effort to cleanse the system of units and dimensions, a foremost extraneous element is the "Bogo", and its arbitrary powers of ten. The Bogo,  $bs$ , is entwined with most electrical units. Its function is to involve all electrical relations with "charge carriers" and  $E$  equals  $mc^2$ , the pathogens injected by Physics. With lawyer like skill the Bogo has been contrived in such a manner as to simply cancel itself out within most dimensional combinations, remaining itself occult. The Bogo however continues to lurk as a mischievous spirit.

Three primary dimensions make up the Bogo,

- (1) Mass,  $m$ , Gram
- (2) Charge,  $q$ , "Coulomb"
- (3) Numeric,  $b$ ,  $4\pi \cdots 10^{-9}$

A principle dimensional relation in the makeup of the Bogo is given as,

Gram per "Coulomb square",  $s$ .

The "Coulomb" here has an adulterated meaning, it is "charge" rather than Total Dielectric Induction. Hence the quotation marks on Coulomb. This is what Steinmetz refers to as a "Prehistoric Concept". This relation,  $s$ , is the significant pathogen so its removal is of primary importance. This factor  $s$  is the "Seed of Confusion".

On the Magnetic side of electrical relations it is for example;

Henry,  $L$ ,  $cm^2$

This in the pure form, and its "adapter" is given by,

$s$ , Gram per "Coulomb" square,

Multiplied by

$b$ ,  $4\pi$  times ten to the negative ninth power

Hence the application is given by

$L'$  equals  $b \cdot s \cdot L$ , C.G.S. Henry.

On the dielectric side of the dimensional relations it is for example,

Farad,  $C$ , Numeric.

This is in pure form, this dimensionless numeric Farad is based upon the numerical value of one over the speed of light square as has been previously discussed. The "adapter" is given as the product of

per (gram per "Coulomb" square),  
per ( $4\pi$  times ten to the negative ninth power),

and properly,

per Velocity of Light Square.

Substituting the relation,

$c$ , Second Square per Centimeter Square

gives the complete dimensional expression as,

"Coulomb" Square - Second Square

per

Gram - Centimeter Square

Hence the application of the "adapter" is given as

$$C' = C/(b \cdot s \cdot c^2), \text{ C.G.S. Farad}$$

In order to combine magnetic relations with dielectric relations in an Electro-Magnetic configuration all dielectric relations must be multiplied by one over  $c^2$ . Magneto-Dielectric relations have not been considered.

Another most stunning pathogenic relation is what can be called the "Sheisen-burg non-functionalability Principle", Weber equals;

Coulomb - Gram - Centimeter Square

per

"Coulomb" Square - Second

Yikes Mr. Wizard, don't let the coyote eat it! This one is surely meant for Davy Jones' Locker.

Weber equals .... Weber!

How simple, don't you think? It is a wonder that today's electrical units are of any use at all.

Next down the line is the removal of mass from the dimensional relations for Magnetic Force, and Dielectric Force.\* (\*Note: These are tentative relations) In addition the Magnetic force and the Dielectric force must be expressed by the same dimensional relation. Also, the Magnetic force and the Dielectric force are considered to be equal and opposite in magnitude when a certain condition exists. This is the condition when the actual, or forced ratio of magnetic induction,  $\Phi$ , to dielectric induction,  $\Psi$ , is equal to the natural, or characteristic, ratio of magnetic induction,  $\Phi$ , to dielectric induction,  $\Psi$ . Here relates to what is known as the Natural, or characteristic impedance of the Electro-Magnetic system,

Weber per Coulomb, or Ohm

This has yet to be proven, however by intuition it must be correct.

Magnetic force is the product of the following,

- (1) Magnetic Permeability,  $\mu$ ,
- (2) Magneto-Motive Force,  $i$ ,
- (3) Displacement Current,  $I$ .

These are defined by the dimensional relations,

- (1)  $\mu$ , Centimeter
- (2) Ampere,  $i$ , Weber per Henry
- (3) Ampere,  $I$ , Coulomb per Second

and also

- (4) Henry,  $L$ , Centimeter Square.

The magnetic force is thus expressed by

Dyne, or  $\mu$ -Ampere Square  
 $f = \mu \cdot i \cdot I$ , Dynes.

In dimensional expression this magnetic force is given as

$\mu$  - Weber - Coulomb

per

Henry - Second.

Substituting the relation

$\mu$  per Henry, or Per Centimeter

and also

Coulomb - Weber, or Planck

gives the dimensional relation for Magnetic Force as,

Planck per Second - Centimeter.

Substituting the relation

Planck per Second, or Joule

gives the final form in dimensional representation for magnetic force as

Joule per Centimeter, or Dyne.

Likewise for the Dielectric Force,

$$f = \epsilon e E.$$

Substituting

$e$ , Coulomb per Farad  $E$ , Weber per Second

and

$\epsilon$ , Second Square per Centimeter Cube,

gives the complete dimensional expression as

Coulomb - Weber - Second Square

per

Farad - Second.

Substituting the relation

$\epsilon$  per Farad, or per Centimeter

and the relation,

Coulomb - Weber, or Planck

gives the Relation,

Planck per Second - Centimeter,

and substituting,

Planck per Second, or Joule.

Arrived at is the final dimensional expression for dielectric force,

Joules per Centimeter, or Dyne.

It is hereby shown that the magnetic force and the dielectric force are dimensionally equivalent since it is,

$\mu$  per Henry,

equals

$\varepsilon$  per Farad,

or

per Centimeter.

This is for the Electro-Magnetic configuration. The Magneto-Dielectric configuration is yet to be investigated. It can be seen that both the magnetic and the dielectric forces, in energy per distance, Joule per Centimeter, represent and "Energy Gradient", much like " $m$ " and " $d$ ", as previously given.

Turning now to the dimensional relations for mechanical force,

$$f = ma,$$

where it is,

$f$ , Force in Dynes

$m$ , Mass in Grams

$a$ , Acceleration in Centimeter per Second Square.

Expanding gives

$$f_m = m \frac{l}{t^2}.$$

The Electro-Magnetic Force is given by the relation

$$f_e = \frac{Q}{lt}.$$

Taking the ratio of mechanical electrical force, it is,

$$\frac{f_m}{f_e} = n$$

or

$$\frac{m l^2}{Q t}.$$

Dimensionally it is given as,

Gram - Centimeter Square

per

Planck - Second,

and the relation for mass equivalency is given as

Gram,  $m = \text{Planck - Second per Centimeter Square}$

$$m = Q \cdot \frac{t}{l^2}.$$

Likewise the quantity equivalence relation

Planck,  $Q, = \text{Gram - Centimeter Square per Second}$

$$Q = m \cdot \frac{l^2}{t}.$$

The dimensions of Physics and the dimensions of Electricity are hence shown in comparison.

## 4.4 Mechanical and Electrical Forces

Since we have established a concrete system of dimensional relations this now can be applied to the case of equal and opposite mechanical forces on a two wire T.E.M. transmission line. This will be derived by dimensional synthesis, a particular line of reasoning that has been developed by this series of writings. It must be remembered that both Oliver Heaviside and Ernst Guillimen considered mathematics an experimental science from which to forge engineering tools.

The dimensional relations for force can be arrived at two different ways. The one given in the past writing is the A.C. way, hence the planck. The other is the D.C. way, this follows

I, Magnetic Force:

(1) Weber - Ampere - ( $\mu$  per Henry)

or

Table of Units, Symbols, and Dimensions

|    | Quantity                          | Symbol       | mks Unit Rationalized  | Defining Equation                        | Dimensional Formula Exponents of |    |    |    | cgs emu                   | No. of emu No. of mks | cgs esu                     | No. of esu No. of mks |
|----|-----------------------------------|--------------|------------------------|--|----------------------------------|----|----|----|---------------------------|-----------------------|-----------------------------|-----------------------|
|    |                                   |              |                        |  | L                                | M  | T  | Q  |                           |                       |                             |                       |
| 1  | Length                            | $L$          | m                      | $A = L^2$                                | 1                                | 0  | 0  | 0  | cm                        | $10^2$                | cm                          | 1                     |
| 2  | Area                              | $A$          | m <sup>2</sup>         | $v = L^3$                                | 2                                | 0  | 0  | 0  | cm <sup>2</sup>           | $10^4$                | cm <sup>2</sup>             | 1                     |
| 3  | Volume                            | $v$          | m <sup>3</sup>         |  | 3                                | 0  | 0  | 0  | cm <sup>3</sup>           | $10^6$                | cm <sup>3</sup>             | 1                     |
| 4  | Mass                              | $M, m$       | kilogram               |  | 0                                | 1  | 0  | 0  | gram                      | $10^3$                | gram                        | 1                     |
| 5  | Time                              | $T, t$       | second                 | $v = L/T$                                | 0                                | 0  | 1  | 0  | second                    | 1                     | second                      | 1                     |
| 6  | Velocity                          | $v$          | m/sec                  | $a = L/T^2$                              | 1                                | 0  | -1 | 0  | cm/sec                    | $10^4$                | cm/sec                      | 1                     |
| 7  | Acceleration                      | $a$          | m/sec <sup>2</sup>     | $F = Ma$                                 | 1                                | 0  | -2 | 0  | cm/sec <sup>2</sup>       | $10^2$                | cm/sec <sup>2</sup>         | 1                     |
| 8  | Force                             | $F$          | newton                 | $W = FL$                                 | 1                                | 1  | -2 | 0  | dyne                      | $10^5$                | dyne                        | 1                     |
| 9  | Energy                            | $W$          | joule                  | $P = W/T$                                | 2                                | 1  | -2 | 0  | erg                       | $10^7$                | erg                         | 1                     |
| 10 | Power                             | $P$          | watt                   | $F = Q^2 / (4\pi\epsilon_0 L^2)$         | 2                                | 1  | -3 | 0  | erg/sec                   | $10^7$                | erg/sec                     | 1                     |
| 11 | Charge                            | $Q, q$       | coulomb                | $\epsilon_0 = 1 / (\mu_0 c^2)$           | 0                                | 0  | 0  | 1  | abcoulemb                 | $10^1$                | statcoulemb                 | 100c                  |
| 12 | Dielectric constant of free space | $\epsilon_0$ | farad/m                | $\epsilon_r = \epsilon / \epsilon_0$     | -3                               | -1 | 2  | 2  | 1                         | $4\pi c^2 / 10^7$     | 1                           | $4\pi c^2 / 10^7$     |
| 13 | Dielectric constant relative      | $\epsilon_r$ | numeric                |  | -3                               | -1 | 2  | 2  | 1                         | 1                     | 1                           | 1                     |
| 14 | Charge density                    |              |                        |  | 0                                | 0  | 0  | 0  |                           |                       |                             |                       |
| 15 | volume                            | $\rho$       | coulomb/m <sup>3</sup> | $\rho = Q/v$                             | -3                               | 0  | 0  | 1  | abcoulemb/cm <sup>3</sup> | $10^7$                | statcoulemb/cm <sup>3</sup> | 100c                  |
| 16 | surface                           | $\rho_s$     | coulomb/m <sup>2</sup> | $\rho_s = Q/A$                           | -2                               | 0  | 0  | 1  | abcoulemb/cm <sup>2</sup> | $10^5$                | statcoulemb/cm <sup>2</sup> | 100c                  |
| 17 | wire                              | $\rho_l$     | coulomb/m              | $\rho_l = Q/L$                           | -1                               | 0  | 0  | 1  | abcoulemb/cm              | $10^3$                | statcoulemb/cm              | 100c                  |
| 18 | Electric intensity                | $E$          | volt/m                 | $E = F/Q = -V/L$                         | 1                                | 1  | -2 | -1 | abvolt/cm                 | $10^6$                | statvolt/cm                 | 1/(100c)              |
| 19 | Electric flux density             | $D$          | coulomb/m <sup>2</sup> | $D = \epsilon E = \psi/A$                | -2                               | 0  | 0  | 1  | abvolt/cm                 | $4\pi / 10^7$         | statvolt/cm                 | 100c                  |
| 20 | Electric flux                     | $\psi$       | coulomb                | $\psi = DA$                              | 0                                | 0  | 0  | 1  | abvolt/cm                 | $4\pi / 10^7$         | statvolt/cm                 | 100c                  |
| 21 | Electric potential                | $V$          | volt                   | $V_s = -d\phi/dt$                        | 2                                | 1  | -2 | -1 | abvolt                    | $10^6$                | statvolt                    | 1/(100c)              |
| 22 | EMF                               | $V_s$        | volt                   | $C = Q/V$                                | 2                                | 1  | -2 | -1 | abvolt                    | $10^6/c$              | statvolt                    | 1/(100c)              |
| 23 | Capacitance                       | $C$          | farad                  | $I = Q/T$                                | -2                               | -1 | 2  | 2  | abfarad                   | $10^9$                | statfarad                   | 1/(100c) <sup>2</sup> |
| 24 | Current                           | $I, i$       | ampere                 | $J = I/A$                                | 0                                | 0  | -1 | 1  | abampere                  | $10^1$                | statampere                  | 100c                  |
| 25 | Current density                   | $J$          | ampere/m <sup>2</sup>  | $R = V/I$                                | 2                                | 0  | -1 | 1  | abampere/cm <sup>2</sup>  | $10^1$                | statampere/cm <sup>2</sup>  | 100c                  |
| 26 | Resistance                        | $R$          | ohm                    | $\rho = RA/L$                            | -2                               | 0  | -1 | 1  | abohm                     | $10^9$                | statohm                     | 1/(100c) <sup>2</sup> |
| 27 | Resistivity                       | $\rho$       | ohm-m                  | $G = 1/R$                                | 2                                | 1  | -1 | -2 | abohm                     | $10^9$                | statohm                     | 1/(100c) <sup>2</sup> |
| 28 | Conductance                       | $G$          | mho                    | $\sigma = 1/\rho = J/E$                  | 3                                | 1  | -1 | -2 | abohm-cm                  | $10^{11}$             | statohm-cm                  | 1/(100c) <sup>2</sup> |
| 29 | Conductivity                      | $\sigma$     | mho/m                  | $P = D - \epsilon_0 E = \rho L$          | -2                               | -1 | 1  | 2  | abmho                     | $10^9$                | statmho                     | (100c) <sup>2</sup>   |
| 30 | Electric polarization             | $x_e$        | coulomb/m <sup>2</sup> | $x_e = P/E = \epsilon_0(\epsilon_r - 1)$ | -3                               | -1 | 1  | 2  | abmho/cm                  | $10^{11}$             | statmho/cm                  | (100c) <sup>2</sup>   |
| 31 | Electric susceptibility           | $\chi_e$     | farad/m                | $m_e = QL$                               | -2                               | 0  | 0  | 1  | abcoulemb/cm <sup>2</sup> | $10^5$                | statcoulemb/cm <sup>2</sup> | 100c                  |
| 32 | Electric dipole moment            | $m_e$        | coulomb-m              | $\omega_e = DE/2$                        | -3                               | -1 | 2  | 2  | 1                         | $4\pi c^2 / 10^7$     | 1                           | $4\pi c^2 / 10^7$     |
| 33 | Electric energy density           | $\omega_e$   | joule/m <sup>3</sup>   |  | 1                                | 0  | 0  | 1  | erg/cm <sup>3</sup>       | 1                     | erg/cm <sup>3</sup>         | 1                     |

Figure 4.5: Table of Units, Symbols, and Dimensions – The dimensions of Physics and the dimensions of Electricity.

| Quantity                      | Symbol        | mks Unit Rationalized        | Defining Equation                               | Dimensional Formula Exponents of |    |    | cgs emu | No. of emu No. of mks                                     | cgs esu | No. of esu No. of mks |
|-------------------------------|---------------|------------------------------|---|----------------------------------|----|----|---------|---|---------|-----------------------|
|                               |               |                              |   | L                                | M  | T  |         |   |         |                       |
| 34 Permeability of free space | $\mu_0$       | henry / m                    | $\mu_0 = 4\pi / 10^7$                           | 1                                | 1  | 0  | -2      |   |         |                       |
| 35 Permeability               | $\mu$         | henry / m                    | $\mu = B / H$                                   | 1                                | 1  | 0  | -2      |   |         |                       |
| 36 relative                   | $\mu_r$       | numeric                      | $\mu_r = \mu / \mu_0$                           | 0                                | 0  | 0  | 0       |   |         |                       |
| 37 Magnetic pole              | $p$           | weber                        | $p = A(\mathbf{B} \cdot \mathbf{B}_0)$          | 2                                | 1  | -1 | -1      | pole<br>$10^3 / 4\pi$                                     |         |                       |
| 38 Magnetic moment            | $m$           | weber-m                      | $m = pL$  | 3                                | 1  | -1 | -1      | pole-cm<br>$10^{10} / 4\pi$                               |         |                       |
| 39 Magnetic intensity         | $H$           | ampere / m or newton / weber | $H = U / L \text{ or } F / p$                   | -1                               | 0  | -1 | 1       | oersted or gilbert / cm<br>$4\pi / 10^3$                  |         |                       |
| 40 Magnetic flux density      | $B$           | weber / m <sup>2</sup>       | $B = \mu H = \phi / A$                          | 0                                | 1  | -1 | -1      | gauss or maxwell / cm <sup>2</sup><br>$10^4$              |         |                       |
| 41 Magnetic flux              | $\phi$        | weber                        | $\phi = BA = \int \mathbf{B} \cdot d\mathbf{l}$ | 2                                | 1  | -1 | -1      | maxwell<br>$10^8$   |         |                       |
| 42 Magnetic potential         | $U$           | ampere                       | $U = \int \mathbf{H} \cdot d\mathbf{l}$         | 0                                | 0  | -1 | 1       | gilbert<br>$4\pi / 10$                                    |         |                       |
| 43 MMF                        | $\mathcal{F}$ | ampere                       | $\mathcal{F} = I$                               | 0                                | 0  | -1 | 1       | gilbert<br>$4\pi / 10$                                    |         |                       |
| 44 Intensity of magnetization | $M$           | weber / m <sup>2</sup>       | $M = \mathbf{B} - \mathbf{B}_0 = m / L^3$       | 0                                | 1  | -1 | -1      | pole / cm <sup>2</sup> or gauss / 4 $\pi$<br>$104 / 4\pi$ |         |                       |
| 45 Inductance self            | $L$           | henry                        | $L = \phi / I$                                  | 2                                | 1  | 0  | -2      | abhenry<br>$10^9$   |         | $1 / (100c)^2$        |
| 46 mutual                     | $M$           | henry                        | $M = \phi / I = W / F$                          | 2                                | 1  | 0  | -2      | abhenry<br>$10^9$   |         | $1 / (100c)^2$        |
| 47 Reluctance                 | $\mathcal{R}$ | ampere / weber               | $\mathcal{R} = \mathcal{F} / \phi$              | -2                               | -1 | 0  | 2       |   |         | $10^9 / c^2$          |
| 48 Reluctivity                | $\nu$         | meter / henry                | $\nu = 1 / \mu$                                 | -1                               | -1 | 0  | 2       |   |         | $10^9 / c^2$          |
| 49 Permeance                  | $\mathcal{P}$ | weber / amp                  | $\mathcal{P} = 1 / \mathcal{R}$                 | 2                                | 1  | 0  | -2      |   |         |                       |
| 50 Permittivity               | $\mu$         | henry / meter                | $\mu = 1 / \nu$                                 | 1                                | 1  | 0  | -2      |   |         |                       |
| 51 EMF                        | $V_s$         | volt                         | $V_s = -d\phi / dt$                             | 2                                | 1  | -2 | -1      | abvolt<br>$10^8$  |         | $1 / (100c)$          |
| 52 Poynting's vector          | $\mathcal{P}$ | watts / m <sup>2</sup>       | $\mathcal{P} = \mathbf{E} \cdot \mathbf{H}$     | 0                                | 1  | -3 | 0       | abwatt / cm <sup>2</sup><br>$10^3$                        |         | $10^8 / c$            |
| 53 Magnetic energy density    | $\omega_m$    | joule / m <sup>3</sup>       | $\omega_m = \mathbf{H} \cdot \mathbf{B} / 2$    | -1                               | 1  | -2 | 0       | erg / cm <sup>3</sup><br>$10$                             |         | $10^3$                |
| 54 Magnetic susceptibility    | $\chi_m$      | henry / m                    | $\chi_m = M / H = \mu_0(\mu_r - 1)$             | 1                                | 1  | 0  | -2      | henry / m<br>$10^7 / 4\pi$                                |         | $10^7 / 4\pi$         |

$\mu_0 = 4\pi / 10^7$  henrys / m. For  $c = 2.998 \times 10^8$  meters / sec,  $\epsilon_0 = 1 / \mu_0 c^2 = 10^7 / (4\pi c^2) = 8.854 \times 10^{-12}$  farad / meter  
 For  $c \sim 3 \times 10^8$  meters / sec,  $\epsilon_0 \sim 1 / (36\pi 10^9)$  farad / meter  
 $c^2 = 8.988 \times 10^{16} \sim 9 \times 10^{16}$

Figure 4.6: Table of Units, Symbols, and Dimensions – The dimensions of Physics and the dimensions of Electricity.

(2) Weber - Ampere per Centimeter

$$f_m = \mu i i$$

$$f_m = \mu i \frac{\phi}{L} \quad (1)$$

$$f_m = \frac{\mu}{L} i \phi, \quad (2)$$

where it is given  $\mu$  per Henry, or per Centimeter.

II, Dielectric Force:

(3) Coulomb - Volt - ( $\epsilon$  per Farad),

or

(4) Coulomb - Volt per Centimeter

$$f_d = \epsilon e e$$

$$f_d = \epsilon e \frac{\psi}{C} \quad (3)$$

$$f_d = \frac{\epsilon}{C} e \psi. \quad (4)$$

This pair of dimensional relations relates to the magnetic force and the dielectric force as dimensionally distinct from each other. This is to say that no interaction between the magnetic field and the dielectric field of induction, no Plancks. It is static, hence D.C. In alternate expression is the A.C. force relationships.

Let  $I$  be the displacement current in Coulomb per Second, and  $E$  be the E.M.F. in Webers per Second. The relation for magnetic force is now given

(5) ( $\mu$  per Henry) Weber - Coulomb per Second.

or

(6) ( $\mu$  per Henry) Planck per Second.

$$f_m = \mu i I$$

$$f_m = \mu i \frac{\psi}{t}$$

$$f_m = \frac{\mu \phi \psi}{L t} \quad (5)$$

$$f_m = \frac{\mu Q}{L t}. \quad (6)$$

Equation 6 reduces to

(7) Joules per Centimeter,

where the versor is in the direction of E.M. propagation, that is, centimeters down the line. The dielectric force is given by,

(8) ( $\epsilon$  per Farad)- Coulomb - Weber per second,

or

(9) ( $\epsilon$  per Farad)- Planck per second,

and

(10) (Joules per Centimeter)

and the same versor direction as the magnetic.

$$f_d = \epsilon e E$$

$$f_d = \epsilon e \frac{\phi}{t}, \quad (7)$$

$$f_d = \frac{\epsilon \psi \phi}{C t}. \quad (8)$$

Hence

$$f_d = \frac{Q}{lt} \quad (9)$$

or

$$f_d = \frac{W}{l} = f_m. \quad (10)$$

Equations (7) and (10) give the same dimensional relation for magnetic and dielectric force.

Consider the D.C condition for equal and opposite forces. It is dimensionally given by

(11) ( $\mu$  per Henry)- Ampere - Weber.

equals

(12) ( $\varepsilon$  per Farad)- Volt - Coulomb.

$$\frac{\mu}{L} i \phi = \quad (11)$$

$$\frac{\varepsilon}{C} e \psi, \quad (12)$$

and

$$\frac{e}{i} = \frac{\mu C \phi}{L \varepsilon \psi}. \quad (13)$$

The dimensional relation we are seeking is

(13) Volt per Ampere,

That is how many Volts compared to how many Amperes results in force cancellation. It is however,

(14) Volt per Ampere, or Ohm.

Hence our problem is based upon a relation of Impedance. In the D.C. case, it is

(15)  $Z = \text{Ohm}$

and the A.C. case, it is

(16)  $Z = \text{Henry per Second.}$

These factors considered it is that,

Volt per Ampere,

is the product of three distinct dimensional ratios,

(17)  $\mu$  per  $\varepsilon$

(18) Farad per Henry

(19) Weber per Coulomb

$$\sqrt{\frac{\mu}{\varepsilon}}, \text{ Ohms.} \quad (20)$$

This is the natural impedance of the Aether in its unbounded form.

The ratio (18) is given as

$$\sqrt{\frac{C}{L}} = \text{Siemens.} \quad (21)$$

This is the characteristic admittance of the metallic - dielectric geometry bounding the Aether,  $\mu \cdot \varepsilon$ . And the ratio (19) is given as

$$\frac{\phi}{\psi} = \text{Ohms.} \quad (22)$$

This is the natural impedance of the proportion between the magnetic induction and the dielectric induction as determined by the metallic - dielectric geometry. In this case then given is

$$\sqrt{\frac{C}{L}} \cdot \frac{\phi}{\psi} = 1, \text{ Unit Numeric,} \quad (23)$$

or

$$Y \cdot Z = 1, \text{ Siemens-Ohm.} \quad (24)$$

Hereby the product of factors (18) and (19) gives

$$\frac{C}{L} \cdot \frac{\phi}{\psi} = Y, \text{ Siemens.} \quad (25)$$

The characteristic admittance of the metallic - dielectric geometry. The factor (17) is

$$Z_c \cdot Z_c = \frac{\mu}{\varepsilon}, \text{ Ohm square.} \quad (26)$$

Combining (25) and (26) gives the expression

$$Z_c \cdot (Z_c Y), \text{ Ohm.} \quad (27)$$

Hence for equal and opposite forces as by equations (17), (18) and (19) the product is hence

$$\frac{e}{i} = a Z_c, \text{ Ohm,} \quad (28)$$

where it is

$$a = (Z_c Y), \text{ Numeric,} \quad (29)$$

$a$  is the impedance operator.

For the E.M. condition it is known that the ratio of  $\mu$  to  $\varepsilon$  is a constant

$$\sqrt{\frac{\mu}{\varepsilon}} = 377, \text{ Ohm.} \quad (30)$$

As is the product a constant

$$\frac{1}{\sqrt{\mu \cdot \varepsilon}} = 3 \cdot 10^{10}, \text{ cm/sec.} \quad (31)$$

Calling this constant,

$$R = 377, \text{ Ohm.} \quad (32)$$

The force cancellation is given by

$$\frac{e}{i} = R^2 Y, \text{ Ohm.} \quad (33)$$

for equal and opposite forces.

Next consider the A.C. relations for equal and opposite forces,

$$f_m = f_d,$$

or

$$\frac{\phi Q}{L t} = \frac{\varepsilon Q}{C t}, \quad (34)$$

or

$$\mu \frac{\phi}{L} i = \varepsilon \frac{\psi}{C} E, \quad (35)$$

or

$$\mu i \frac{\psi}{t} = \varepsilon e \frac{\phi}{t}. \quad (36)$$

It is then

$$\frac{e}{i} = \frac{\mu \psi}{\varepsilon \phi}, \text{ Ohm.} \quad (37)$$

$$\frac{e}{i} = \frac{\mu I}{\varepsilon E}, \text{ Ohm.} \quad (37a)$$

Hence, as with the D.C. relations, it is given

$$\frac{e}{i} = Z_c(Z_c Y), \text{ Ohm,} \quad (38)$$

$$\frac{e}{i} = a Z_c, \text{ Ohm,} \quad (39)$$

where it is defined

$$Y = \frac{\psi}{\phi}, \text{ Siemens,} \quad (40)$$

and

$$Z_c Y = a, \text{ Ohm-Siemens,} \quad (41)$$

and as with D.C. it is hereby

$$\frac{e}{i} = R^2 Y, \text{ Ohm,} \quad (42)$$

The condition for equal and opposite forces.

Finally since it is given that

$$Z = \frac{1}{Y}, \text{ per Siemens, or Ohm.} \quad (43)$$

The ratio  $a$  follows

$$a = \frac{Z_c}{Z}. \quad (44)$$

Thus  $a$  is a distortion factor existing between the natural impedance of the Aether and the characteristic impedance of the magnetic geometry. Through this line of reasoning it is not the natural Aether impedance, nor the characteristic geometry, that directly gives equal forces. It is however given by the natural impedance of the Aether as modified by the distortion factor  $a$ , that is

$$\frac{e}{i} = a(377) \text{ Ohm.} \quad (45)$$

This is not the result expected which would be thought to be

$$\frac{e}{i} = \sqrt{\frac{L}{C}} \text{ Ohm.} \quad (46)$$

What of this discrepancy? Is the previous line of reasoning invalid? Only concrete Physical Experiment can give the facts. Math can lead you down many paths, images of its own expression.

Returning to equation (34), and substituting the relation

Planck per Second, or Joule,

It is

$$\begin{aligned} f_m &= f_d, \\ \frac{\mu}{L} W_m &= \frac{\varepsilon}{C} W_d, \end{aligned} \quad (47)$$

And for  $W_m = W_d$

$$\frac{\mu}{L} = \frac{\varepsilon}{C}, \quad \frac{\mu}{\varepsilon} = \frac{L}{C}. \quad (48)$$

That is, the natural impedance of the Aether is equal to the characteristic impedance of the metallic - dielectric geometry. In this case the factor  $a$  is unity and thus

$$a = \frac{Z_c}{Z} = 1 \quad \text{or} \quad Z_c = Z. \quad (49)$$

Considering that the following relation exist

Henry, or  $\mu$  - Centimeter

and

Farad, or  $\varepsilon$  - Centimeter.

It is then, if

$$Z_c Z_c Y,$$

It is  $L$  &  $C$  themselves contain  $\mu$  and  $\varepsilon$  which makes the factor  $a$  a versor operator, giving the final relation for equal and opposite forces to be simply given as

$$\frac{e}{i} = \sqrt{\frac{L}{C}} = Z, \quad \text{Ohm}, \quad (50)$$

where  $Z$  is the characteristic impedance of the metallic – dielectric geometry, or here the two wire line, and then it is

$$Z = aZ_c, \quad \text{Ohm}. \quad (51)$$

Thus far we have experimentally engaged in the determination of forces without invoking volumetric space differential, or integral equations. Here utilized was no more than school boy algebra and physics. This is the direct Heuristic approach to reasoning about electric forces. It can be seen that concrete solutions can be obtained by this reasoning. But none can replace experimental verifications. As a postscript the following would be very helpful. What is needed is the magnetic and dielectric field diagrams for the "D.C. lines example" for the following

Dielectric field for equal and opposite voltage plus or minus 500KV,

and for

equal and opposite current in both lines plus or minus 1000 amp.

Likewise, for the magnetic field

equal and opposite current in both lines plus or minus 1000 amp.

and for

equal current in both lines of plus 1000 amp.

If someone can do this, many important facts can be gained.

## **4.5 Make Your Own Tesla Telluric Transmission System**

This post is in response to Kokomojo post # 646

A good coil to use is the flat spiral shown on the "Tesla Longitudinal Electricity" video. It's on the 160 meter HAM band. Remember that you must have a government license to transmit R.F. energy. The "primary" coil is the magnetizing coil. It connects with a constant potential, thus the few turns the better, one is best. Surface area is equal on all windings and also equal to the surface area on the condenser. Basically all component coils and the condenser should be the same weight. Max magneto motive force (m.m.f.) is what we want here in the primary.

#### 4.5. MAKE YOUR OWN TESLA TELLURIC TRANSMISSION SYSTEM<sup>123</sup>

The "extra" coil is the constant current, maximum potential is what we want here, on the sphere, sphere capacity small. It is important to note these coils are no longer to be thought of as just reactance coils, now they are transmission lines, and operate by the laws of transmission lines.

Hence given is the constant potential primary, a lumped LC circuit of very large  $b$  to a ratio ( $a$  is the power factor and  $b$  is the induction factor- see Heaviside equation), also there is the constant current extra coil, a distributed transmission structure in the form of a coil. Copper weight is the same. Also note  $b/a$  is the magnification factor of the circuit. Hereby, the "secondary coil" is a transmission structure connecting the constant current extra coil to the constant potential primary coil. Hence the "Secondary coil" has an impedance and is a quarter wave resonant so as to match the constant current coil to the constant potential coil. That is the radio engineers description of a Tesla Magnifying Transmitter. No new theories or mystical unknowns, a basic transmission line calculation only. Simple. But, you better have an A.M. broadcast station ground for this system to operate.

So let's use an A.M. station as an example. 1600 on your A.M. dial. It has a quarter wave tower, a star ground plane consisting of 120 radial wires each a quarter wave long. A matching unit connects this to a 5kw transmitter, the "alternator" of 1.6 megacycles AC.

Now let's shorten the tower, a "loading coil" must now go in series and resonate with the shortened tower. The ground current has increased. We keep doing this, shorter tower, bigger coil. Finally no tower, giant coil, high ground current. The coil is now resonant to its own internal electro-static capacity. The price to pay for the high ground current is an extreme potential,  $e$ , at the open end of the coil. This is why the "mushroom" hood, or just a sphere. This extreme potential energizes the Tesla "Ray" Tube for atomic work, not radio work. The ground end of our "Loading Coil" is the output NOT the mushroom cap. No one gets this. So we have converted 1600 on your AM dial to a Tesla Telluric Broadcast. No hidden secrets, no profound mysteries, just simple A.C. Ohms Law and a HAM radio license. "Theory of Wireless Power" gives all the coil calculations for impedance and propagation time. but the "tables" have errors. The basic formula is ok. "Condensed Intro to Tesla Tesla Transformer" gives a more specific theoretical description of the Tesla Transmission structures, including impulse modes. This paper is more for the radio engineer. Tesla gives a complete description, with photos and calculations, of his system in "Colorado SpringsNotes." Also the unit at my RCA laboratory is on the cover of "Condensed Intro to Tesla Transformers." No shortage of experimentally confirmed information on this topic, even by Tesla himself.

## 4.6 The Oscillating Current Transformer

Originally published in JBR, May-June 1986. The original I got my hands on via the internet can be found [here](#).

The oscillating current transformer functions quite differently than a conventional transformer in that the law of dielectric induction is utilized as well as the familiar law of magnetic induction. The propagation of waves along the coil axis does not resemble the propagation of waves along a conventional transmission line, but is complicated by inter-turn capacitance & mutual magnetic inductance. In this respect the O.C. transformer does not behave like a resonant transmission line, nor a R.C.L. circuit, but more like a special type of wave guide. Perhaps the most important feature of the O.C. transformer is that in the course of propagation along the coil axis the electric energy is dematerialized, that is, rendered mass free energy resembling Dr. Wilhelm Reich's Orgone Energy in its behavior. It is this feature that renders the O.C. transformer useful for wireless power transmission and reception, and gives the O.C. transformer singular importance in the study of Dr. Tesla's research.

### 4.6.1 FUNDAMENTALS OF COIL INDUCTION

Consider the elemental slice of a coil shown in fig. 1. Between the turns 1,2 & 3 of the coiled conductor exists a complex electric wave consisting of two basic components. In one component (fig. 2), the lines of magnetic and dielectric flux cross at right angles, producing a photon flux perpendicular to these crossings, hereby propagating energy along the gap, parallel to the conductors and around the coil. This is the transverse electro-magnetic wave. In the other component, shown in fig. 3, the lines of magnetic flux do not cross but unite along the same axis, perpendicular to the coil conductors, hereby energy is conveyed along the coil axis. This is the Longitudinal Magneto-Dielectric Wave. Hence, two distinct forms of energy flow are present in the coiled conductor, propagating at right angles with respect to each other, as shown in fig. 4. Hereby a resultant wave is produced which propagates around the coil in a helical fashion, leading the transverse wave between the conductors. Thus the oscillating coil poses a complex wavelength which is shorter than the wavelength of the coiled conductor.

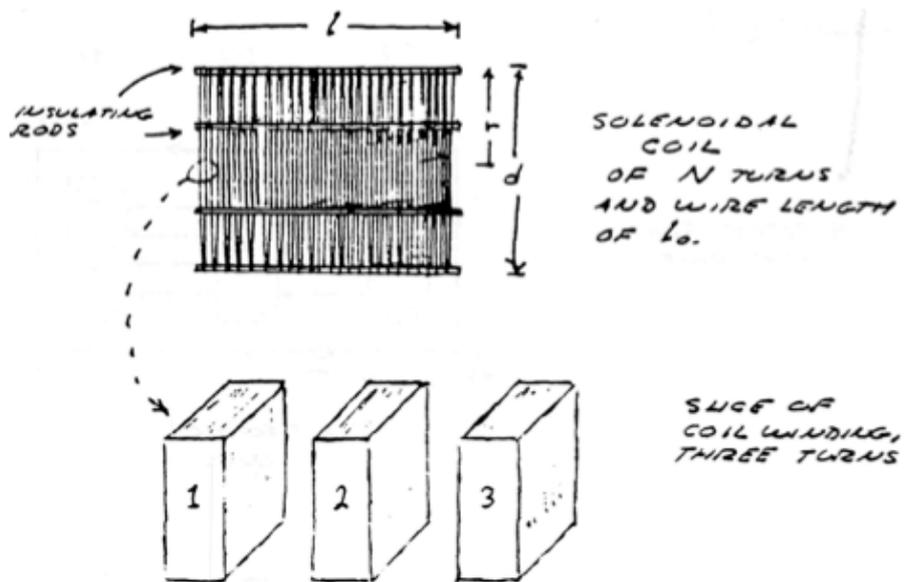


Figure 4.7: Figure(1).

FIGURE (2)

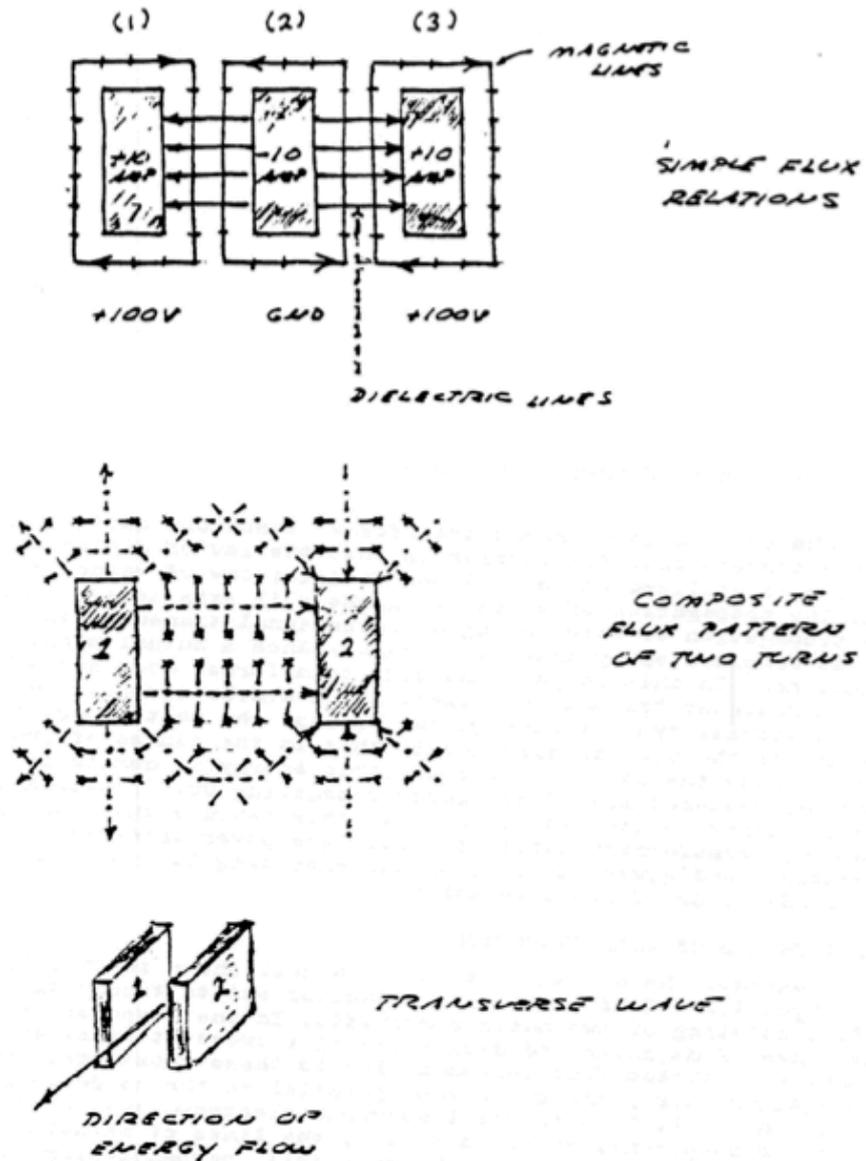


Figure 4.8: Figure(2).

### 4.6.2 COIL CALCULATION

Note: Dollard models a coil here in great detail. It is interesting to compare this model with Corum's model<sup>11</sup>, described here<sup>12</sup>.

"By modeling a wire-wound coil as an anisotropically conducting cylindrical boundary, one may start from Maxwell's equations and deduce the structure's resonant behavior. Not only can the propagation factor and characteristic impedance be determined for such a helically disposed surface waveguide, but also its resonances, "self-capacitance"(so-called), and its voltage magnification by standing waves. Further, the Tesla coil passes to a conventional lumped element inductor as the helix is electrically shortened."

If the assumptions are made that an alternating current is applied to one end of the coil, the other end of the coil is open circuited, Additionally external inductance and capacitance must be taken into account, then simple formulae may be derived for a single layer solenoid.

The well known formula for the total inductance of a single layer solenoid is

$$L = r^2 N^2 (9r + 10l), \quad 10^{-6} \text{ Henry(inches)}, \quad (1)$$

where  $r$  is coil radius,  $l$  is coil length, and  $N$  is number of turns. The capacitance of a single layer solenoid is given by the formula

$$C = pr, \quad 2.54 \times 10^{-12} \text{ Farads(inches)}, \quad (2)$$

where the factor  $p$  is a function of the length to diameter ratio, tabulated in table (1). The dimensions of the coil are shown in figure (1). The capacitance is minimum when length to diameter ratio is equal to one.

Because the coil is **assumed to be in oscillation with a standing wave, the current distribution along the coil is not uniform**, but varies sinusoidally with respect to distance along the coil. This alters the results obtained by equation (1), thus for resonance

$$L_0 = \frac{1}{2}L, \quad \text{Henrys}, \quad (3)$$

likewise, for capacitance

$$C_0 = 8\pi C, \quad \text{Farads}. \quad (4)$$

<sup>11</sup>K. L. Corum and J. F. Corum, "RF Coils, Helical Resonators and Voltage Magnification by Coherent Spatial Modes", (TELSIK 2001, University of Nis Yugoslavia(Sept. 19-21, 2001) and MICROWAVE REVIEW), pp.1-10.;[http://www.tuks.nl/pdf/Reference\\_Material/Corum/Corum-Voltage\\_Magnification\\_by\\_Standing\\_Waves.pdf](http://www.tuks.nl/pdf/Reference_Material/Corum/Corum-Voltage_Magnification_by_Standing_Waves.pdf)

<sup>12</sup><http://www.energeticforum.com/141833-post2353.html>

FIGURE (3)

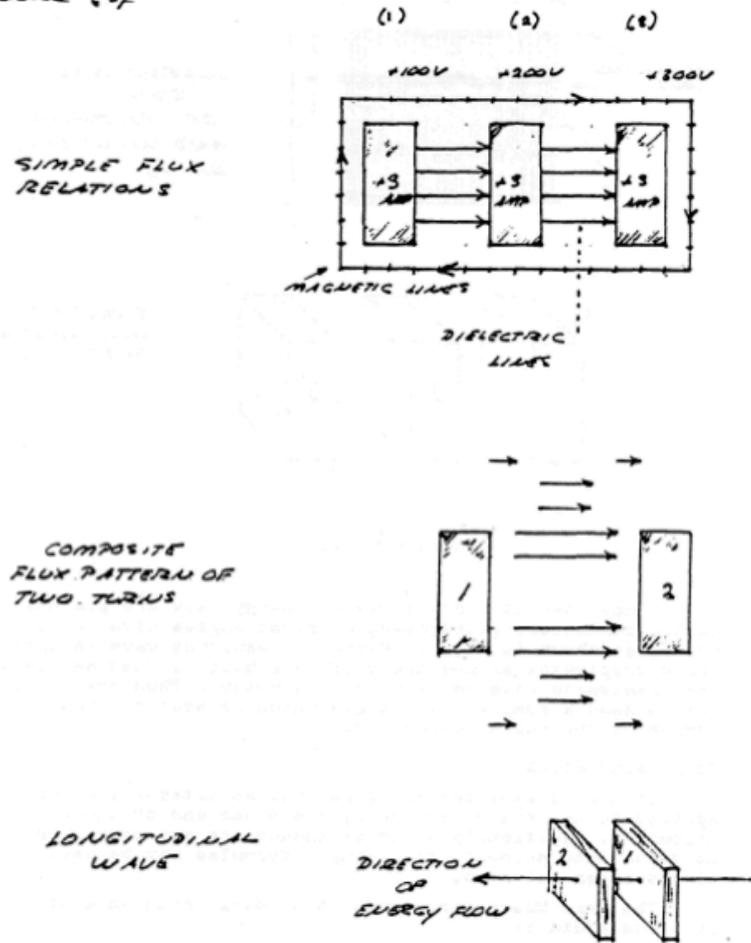


Figure 4.9: Figure(3).

Hereby the velocity of propagation is given by

$$V_0 = 1/L_0 C_0 = \eta V_c, \text{ Units/sec,} \quad (5)$$

where

$$V_c = 1/\mu\epsilon, \text{ Inch/sec.} \quad (6)$$

That is, the velocity of light, and

$$V_0 = \eta V_c = [1.77p + 3.94pn]^{1/2}, \quad 2\pi 10^9 \text{Inch/sec,} \quad (7)$$

where  $n$  = the ratio of coil length to coil diameter. The values of propagation factor  $\eta$  are tabulated in table (2).

Note: Paul Nicholson wrote an interesting piece on how the velocity factor<sup>13</sup>, which appears to be the same as Dollard's propagation factor  $\eta$ , depends mostly on the  $h/d$  ratio of a coil:

"Ed Phillips noticed that wire length divided by the free space wavelength of the quarter wave resonance of an unloaded coil was a smooth function of the  $h/d$  ratio and largely independent of the turn count. [...] Ed's observation recognizes that the velocity factor for a coil is a function largely of the overall geometry of the coil and does not depend very much on how many turns are put in. This means that it is worth while defining a geometry factor with which to relate the velocity factor directly to the  $h/d$  ratio of the coil."

This is the relation they came up with using curve fitting:

$$F_{res} = (0.39 \ln(h/d) + 1.19) \cdot 75e^6/l, \quad 2\pi 10^9 \text{Inch/sec, Hertz.}$$

What is interesting from their observation that the velocity factor for a coil is a function largely of the overall geometry of the coil is that this connects very nicely to the Corums' model, noted above, whereby they consider a coil as a geometric construction conducting in one direction only.

Thus, the frequency of oscillation or resonance of the coil is given by the relation

$$F_0 = V_0 (l_0^4), \text{ Cycles/sec,} \quad (8)$$

where  $l_0$  = total length of the coiled conductor in inches. The characteristic

<sup>13</sup>[http://www.tuks.nl/pdf/Reference\\_Material/Wire\\_length\\_Geometry\\_Velocity\\_Factor.pdf](http://www.tuks.nl/pdf/Reference_Material/Wire_length_Geometry_Velocity_Factor.pdf)

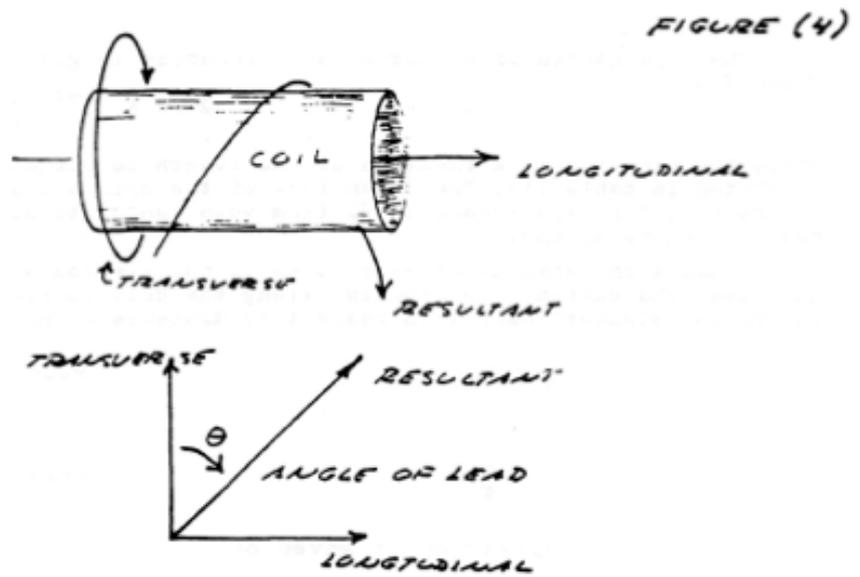


Figure 4.10: Figure(4).

impedance of the resonant coil is given by

$$Z_c = L_0 C_0, \text{ Ohms.} \quad (9)$$

Hence,

$$Z_c = N Z_s, \text{ Ohms,} \quad (10)$$

where

$$Z_s = [(182.9 + 406.4n)p]^{1/2}, \pi^2 \cdot 10^3 \text{ Ohms,} \quad (11)$$

and  $N$  = number of turns. The values of sheet impedance,  $Z_s$ , are tabulated in table (3).

The time constant of the coil, that is, the rate of energy dissipation due to coil resistance is given by the approximate formula

$$u = R_0^2 L_0 = (2.72r + 2.13l)\pi F_0, \text{ Nepers/sec (inches),} \quad (12)$$

where

$r$  = coil, radius,

$l$  = coil length.

In general, the dissipation of the coil's oscillating energy by conductor resistance:

1. Decreases with increase of coil diameter,  $d$ ;
2. Decreases with increase of coil length,  $l$ , rapidly when the ratio,  $n$ , of length to diameter is small with little decrease beyond  $n$  equal to unity;
3. Is minimum when the ratio of wire diameter to coil pitch is 60%.

By examination of the attached tables, (1), (2) & (3), it is seen that the long coils of popular designs do not result in optimum performance. In general, coils should be short and wide, and not longer than  $n = 1$ . The frequency is usually given as  $F_0 = V_c/\lambda_0$  which by equation (7) is incorrect. Winding on solid or continuous formers rather than spaced slender rods, as shown in figure (1), greatly retards wave propagation as indicated in equation (6), thereby seriously distorting the wave. The dielectric constant of the coil,  $\epsilon$ , should be as close to unity as is physically possible to insure high efficiency of transformation.

The equations for the voltampere relations of the oscillating coil are

$$E_1 = j(Z_c Y_0 + \delta)E_0, \text{ Complex Input Voltage,} \quad (13)$$

$$I_1 = j(Y_c Z_0 + \delta)I_0, \quad \text{Complex Input Current,} \quad (14)$$

$$Z_1 = Z_c Y_0 + \delta Y_c Z_0 + \delta Z_0, \quad \text{Input Impedance, Ohms,} \quad (15)$$

where

$$\begin{aligned} E_0 &= \text{Voltage on elevated terminal,} \\ I_0 &= \text{Current into elevated terminal,} \\ Y_c &= Z_c - 1, Z_0 = \text{Terminal impedance,} \\ Y_0 &= \text{Terminal admittance,} \\ \delta &= u^2 F_0 = \text{Decrement,} \\ j &= \text{root of } -1. \end{aligned}$$

For negligible losses and absolute values

$$E_1 = (Z_c 2\pi F_0 C_0) E_0, \quad \text{Volts,} \quad (16)$$

$$I_1 = \left( \frac{Y_c}{2\pi} F_0 C_0 \right) I_0, \quad \text{Amperes,} \quad (17)$$

where

$$C_0 = \text{Terminal capacitance.}$$

By the law of conservation of energy

$$E_1 I_1 = E_0 I_0, \quad \text{Volt-Amperes.} \quad (18)$$

If the terminal capacitance is small then the approximate input/ output relations of the Tesla coil are given by Complex Input Voltage (13) Complex Input Current (14) Input Impedance, Ohms (15)

$$E_0 = Z_c I_1, \quad \text{Output Volts.} \quad (19)$$

$$I_1 = E_0 Y_c, \quad \text{Input Amperes.} \quad (20)$$

$$I_0 = Y_c E_1, \quad \text{Output Amperes.} \quad (21)$$

$$E_1 = I_0 Z_c, \quad \text{Input Volts.} \quad (22)$$

Table 4.1: Coil Capacitance Factor

| Length/Width = $n$ | Factor $P$ | Length/Width = $n$ | Factor $P$ |
|--------------------|------------|--------------------|------------|
| 0.10               | 0.96       | 0.80               | 0.46       |
| 0.15               | 0.79       | 0.90               | 0.46       |
| 0.20               | 0.70       | 1.00               | 0.46       |
| 0.25               | 0.64       | 1.5                | 0.47       |
| 0.30               | 0.60       | 2.0                | 0.50       |
| 0.35               | 0.57       | 2.5                | 0.56       |
| 0.40               | 0.54       | 3.0                | 0.61       |
| 0.45               | 0.52       | 3.5                | 0.67       |
| 0.50               | 0.50       | 4.0                | 0.72       |
| 0.60               | 0.48       | 4.5                | 0.77       |
| 0.70               | 0.47       | 5.0                | 0.81       |

## 4.7 Electrical Oscillations in Induction Coils

The following quote is from John M. Miller in Further Discussion on Electrical Oscillations in Antennas and Induction Coils.

"When applying the theory of uniform lines to coils I think a very large error is made at once, which vitiates, very largely any conclusions reached. The  $L$  and  $C$  of the coil, per centimeter length, are by no means uniform, a necessary condition in the theory of uniform lines; in a long solenoid the  $L$  per centimeter near the center of the coil is nearly twice as great as the  $L$  per centimeter at the ends, a fact which follows from elementary theory, and one which has been verified in our laboratory by measuring the wave length of a high frequency wave traveling along such a solenoid. The wave length is much shorter in the center in the center of the coil than it is near the ends. What the capacity per centimeter of a solenoid is has never been measured, I think, but it is undoubtedly greater in the center of the coil than near the ends."

Request to find by Eric: Abnormal Voltages In Transformers. J.M. Weed. American Institute of Electrical Engineers. September 1915, p 2157. The following is

Table 4.2: Coil Capacitance Factor

| Length/Width = $n$ | $V_0$ Inches/Sec   | Percent Luminal Velocity = $\eta$ |
|--------------------|--------------------|-----------------------------------|
| 0.10               | $9.42 \times 10^9$ | 79.8%                             |
| 0.15               | 10.9               | 92.2                              |
| 0.20               | 12.0               | 102                               |
| 0.25               | 13.0               | 110                               |
| 0.30               | 13.9               | 118                               |
| 0.35               | 14.8               | 125                               |
| 0.40               | 15.6               | 132                               |
| 0.45               | 16.4               | 139                               |
| 0.50               | 17.2               | 146                               |
| 0.60               | 18.4               | 156                               |
| 0.70               | 19.5               | 165                               |
| 0.80               | 20.5               | 176                               |
| 0.90               | 21.4               | 181                               |
| 1.00               | 22.1               | 187                               |
| 1.5                | 25.4               | 215                               |
| 2.0                | 27.6               | 234                               |
| 2.5                | 28.7               | 243                               |
| 3.0                | 29.7               | 251                               |
| 3.5                | 30.3               | 257                               |
| 4.0                | 30.9               | 262                               |
| 4.5                | 31.6               | 268                               |
| 5.0                | 32.4               | 274                               |
| 6.0                | 33.0               | 279                               |
| 7.0                | 33.9               | 287                               |

Table 4.3: Coil Capacitance Factor

| $L/W = n$ | $Z_s$             |
|-----------|-------------------|
| 0.10      | $0.107 \times 10$ |
| 0.15      | 0.070             |
| 0.20      | 0.116             |
| 0.25      | 0.116             |
| 0.30      | 0.116             |
| 0.35      | 0.115             |
| 0.40      | 0.115             |
| 0.45      | 0.114             |
| 0.50      | 0.113             |
| 0.60      | 0.110             |
| 0.70      | 0.106             |
| 0.80      | 0.103             |
| 0.90      | 0.099             |
| 1.00      | 0.095             |
| 1.5       | 0.081             |
| 2.0       | 0.070             |
| 2.5       | 0.061             |
| 3.0       | 0.054             |
| 3.5       | 0.048             |
| 4.0       | 0.044             |
| 4.5       | 0.040             |
| 5.0       | 0.037             |
| 6.0       | 0.032             |
| 7.0       | 0.028             |

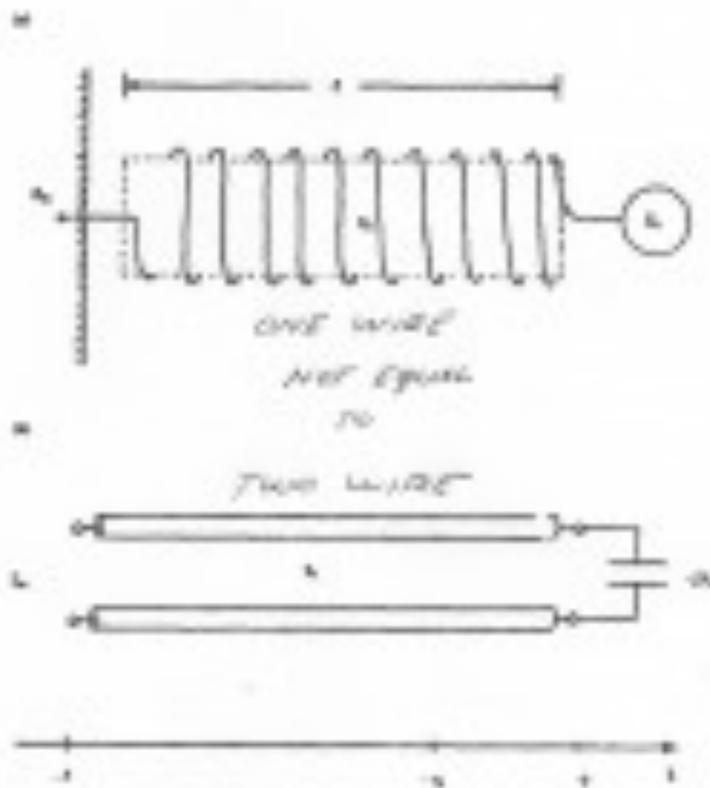


Figure 4.11: Figure(4).

#### 4.8. ELECTRICAL RESONANCE OF INDUCTANCE AND CAPACITANCE<sup>137</sup>

from the Steinmetz book *Theory and Calculation of Transient Electrical Phenomena*. In response to: source

The fence is a single turn primary and a 22 turn secondary. Primary and secondary windings have the same weight. The size of wire used in both is 8 gauge. Obviously paralleled in the primary into one large conductor. The extra coil is wound with #10 wire. More specifically equal width to height ratio and the extra spacing on the outer turns is due to the accelerated voltage gradient. All of your odd harmonics add up at this point, and produce an enormous rise in electrostatic potential.

### 4.8 Electrical Resonance of Inductance and Capacitance

It has been given by previous writing that there exists the following laws: The Laws of Proportion: (1) Weber, or Ampere - Henry, (2) Coulomb, or Volt - Farad. The Laws of Induction: (3) Volt, or Weber per Second, (4) Ampere, or Coulomb per Second.

Substituting relation (4) into relation (1), and re-arranging gives

(5) Henry, or Weber - Second per Coulomb,

and substituting relation (3) into relation (2), and re-arranging gives

(6) Farad, or Coulomb - Second per Weber.

It has also been given in previous writings that a proportionality factor, or ratio exists between the Magnetic Field and the Dielectric Field of Inductions,

(7) Ohm, or Weber per Coulomb,

(8) Siemens, or Coulomb per Weber.

These relationships represent the Characteristic Impedance, and the Characteristic Admittance, respectively, of the Electric Field.

Substituting relation (7) into relation (5), and substituting relation (8) into relation (6) gives

(9) Henry, or Ohm - Second,

(10) Farad, or Siemens - Second.

## CHAPTER IV.

## DISTRIBUTED CAPACITY OF HIGH-POTENTIAL TRANSFORMERS.

40. In the high-potential coils of transformers designed for very high voltages phenomena resulting from distributed capacity occur.

In transformers for very high voltages — 100,000 volts and more, or even considerably less in small transformers — the high-potential coil contains a large number of turns, a great length of conductor, and therefore its electrostatic capacity is appreciable, and such a coil thus represents a circuit of distributed resistance, inductance, and capacity somewhat similar to a transmission line.

The same applies to reactive coils, etc., wound for very high voltages, and even in smaller reactive coils at very high frequency.

This capacity effect is more marked in smaller transformers, where the size of the iron core and therewith the voltage per turn is less, and therefore the number of turns greater than in very large transformers, and at the same time the exciting current and the full-load current are less; that is, the charging current of the conductor more comparable with the load current of the transformer or reactive coil.

However, even in large transformers and at moderately high voltages, capacity effects occur in transformers, if the frequency is sufficiently high, as is the case with the currents produced in overhead lines by lightning discharges, or by arcing grounds resulting from spark discharges between conductor and ground, or in starting or disconnecting the transformer. With such frequencies, of many thousand cycles, the internal capacity of the transformer becomes very marked in its effect on the distribution of voltage and current, and may produce dangerous high-voltage points in the transformer.

The distributed capacity of the transformer, however, is different from that of a transmission line.

Figure 4.12: Steinmetz book.

In a transmission line the distributed capacity is shunted capacity, that is, can be represented diagrammatically by condensers shunted across the circuit from line to line, or, what amounts to the same thing, from line to ground and from ground to return line, as shown diagrammatically in Fig. 88.



Fig. 88. Distributed capacity of a transmission line.

The high-potential coil of the transformer also contains shunted capacity, or capacity from the conductor to ground, and so each coil element consumes a charging current proportional to its potential difference against ground. Assuming the circuit as insulated, and the middle of the transformer coil at ground potential, the charge consumed by unit length of the coil increases from zero at the center to a maximum at the ends. If one terminal of the circuit is grounded, the charge consumed by the coil increases from zero at the grounded terminal to a maximum at the ungrounded terminal.

In addition thereto, however, the transformer coil also contains a capacity between successive turns and between successive layers. Starting from one point of the conductor, after a certain

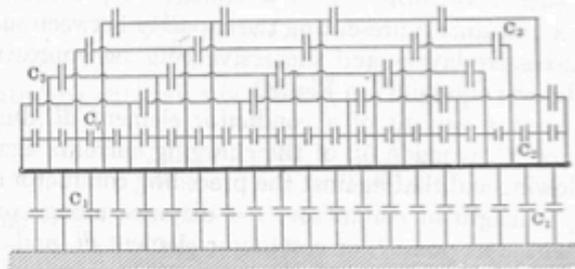


Fig. 89. Distributed capacity of a high-potential transformer coil.

length, the length of one turn, the conductor reapproaches the first point in the next adjacent turn. It again approaches the

Figure 4.13: Steinmetz book.

first point at a different and greater distance in the next adjacent layer.

A transformer high-potential coil can be represented diagrammatically as a conductor, Fig. 89.  $C_1$  represents the capacity against ground,  $C_2$  represents the capacity between adjacent turns, and  $C_3$  the capacity between adjacent layers of the coil.

The capacities  $C_2$  and  $C_3$  are not uniformly distributed but more or less irregularly, depending upon the number and arrangement of the transformer coils and the number and arrangement of turns in the coil. As approximation, however, the capacities  $C_2$  and  $C_3$  can be assumed as uniformly distributed capacity between successive conductor elements. If  $l$  = length of conductor, they may be assumed as a capacity between  $l$  and  $l + dl$ , or as a capacity across the conductor element  $dl$ .

This approximation is permissible in investigating the general effect of the distributed capacity, but omits the effect of the irregular distribution of  $C_2$  and  $C_3$ , which leads to local oscillations of higher frequencies, extending over sections of the circuit, and of lesser power.

41. Let then, in the high-potential coil of a high-voltage transformer,  $e$  = the e.m.f. generated per unit length of conductor, as, for instance, per turn;  $Z = r - jx$  = the impedance per unit length;  $Y = g - jb$  = the capacity admittance against ground per unit length of conductor, and  $Y' = pY$  = the capacity admittance, per unit length of conductor, between conductor elements distant from each other by unit length, as admittance between successive turns.  $Y'$  is assumed to represent the total effective admittance representing the capacity between successive turns, successive layers, and successive coils, as represented by the condensers  $C_2$  and  $C_3$  in Fig. 89.

The charging current of a conductor element  $dl$ , due to the admittance  $Y'$ , is made up of the charging currents against the next following and that against the preceding conductor element.

Let  $l_0$  = length of conductor;  $l$  = distance along conductor;  $E$  = potential at point  $l$ , or conductor element  $dl$ , and  $I$  = current in conductor element  $dl$ ; then

$$dE = \frac{dE}{dl} dl = \text{the potential difference between successive}$$

conductor elements or turns.

Figure 4.14: Steinmetz book.

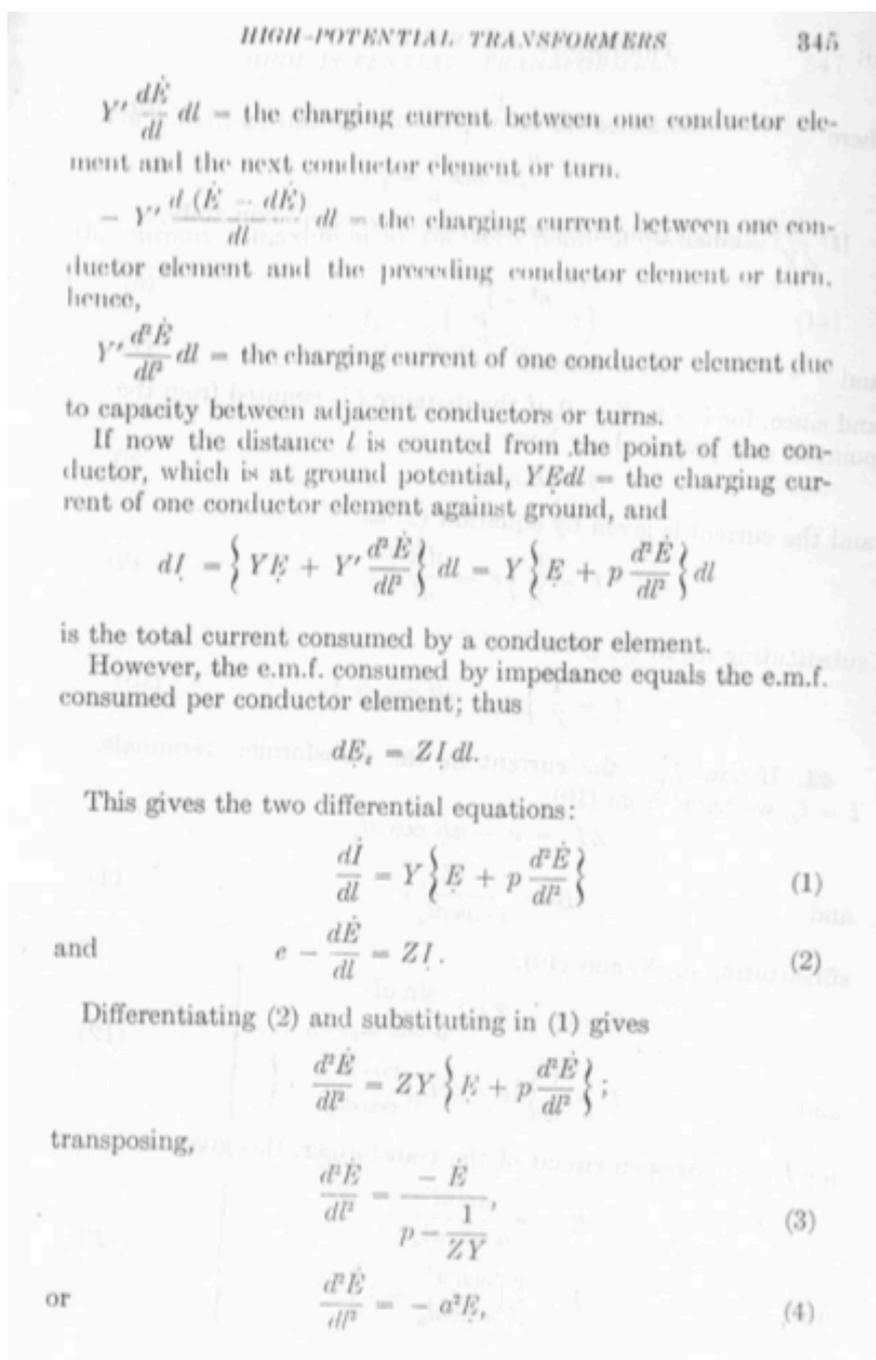


Figure 4.15: Steinmetz book.

FIG 1a TESLA MAGNIFICATION TRANSFORMER

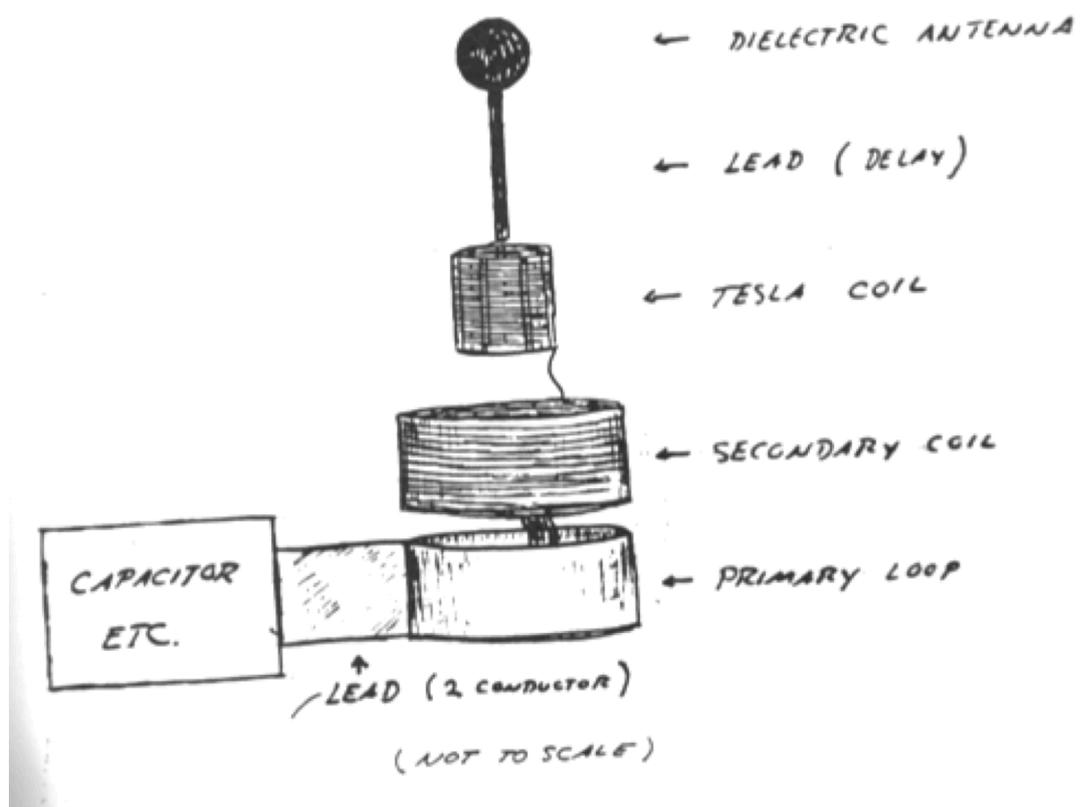


Figure 4.16: Steinmetz book.

#### 4.8. ELECTRICAL RESONANCE OF INDUCTANCE AND CAPACITANCE 143

Since the Electric Induction is the product of the magnetic induction and the dielectric induction, the product of the magnetic coefficient (9) and the dielectric coefficient (10) gives the electric relation as

(11) Henry - Farad, or

Ohm - Siemens - Second square.

The relation

(12) Ohm - Siemens, Numeric,  $h$

is the dimensionless versor operator, and it cancels from (11). Hence

(13) Henry - Farad

equals

Second square.

$$LC = hT^2, \quad (13a)$$

$$h = \sqrt{\pm 1}, \quad (13b)$$

$$LC = \pm T^2. \quad (13c)$$

Denoting time square by the relation (14)  $\omega$  square, or (radians per second) square. Where  $\omega$  is the angular frequency of oscillation of the  $LC$  relationship. It is then, (14a) Per (Henry - Farad) equals

(Radians per Second) square.

Hence the frequency of oscillation is given by the relation, (14b)  $\omega$  equals one over the square root of the product of the inductance  $L$  and the capacitance  $C$ .  $\omega$  is the angular frequency in radians per second.

It is noteworthy that two metrical "space" relations,  $L$  and  $C$  when combined collapse dimensionally into the primary dimension of Time. Hereby it can be shown that the dimension of TIME exists between the Magnetic Field of Induction, and the Dielectric Field of Induction, despite these fields being a relation of space.

If then, the inductance is a geometric expression in centimeters and the capacitance is a geometric expression in per centimeters, the dimension of time results as a consequence of one over  $c^2$  (second square over centimeter square). This

would suggest that possibly time rather than velocity is the "dimensional transform" between the magnetic and dielectric fields of induction. It only appears as a velocity in an Electro-Magnetic configuration. The dimension of time is the "crossing point" so to speak. Time is the exchange of Magnetism and Dielectricity and their transformation into Electric Power and Energy. Frequency gives rise to energy, this in plancks per second.

Taking the relation  $LC$  equals  $T$  square, and factoring gives,

$$(15) \text{ Henry per Second, Ohm,}$$

equals

$$(16) \text{ Second per Farad, per Siemens.}$$

Taking the ratio of (15) to (16) and substituting,

$$(17) \text{ Ohm per - per Siemens, or Ohm square,}$$

It is hereby that the square root of relation (17) is the Characteristic Impedance of the  $LC$  configuration.

$$(17a) \text{ Ohm square, or Henry per Farad}$$

$Z$  square is the ratio of  $L$  to  $C$ , this from the magnetic standpoint. Likewise from the dielectric standpoint.

$$(18) \text{ Farad per Second, or Siemens}$$

equals

$$(19) \text{ Second per Henry, or per Ohm.}$$

And, taking the ratio of (18) to (19),

$$(20) \text{ Siemens per - per Ohm, or Siemens Square.}$$

It is hereby that the square root of relation (20) is the Characteristic Admittance of the  $LC$  configuration.

$$(20a) \text{ Siemens Square, or Farad per Henry.}$$

#### 4.8. ELECTRICAL RESONANCE OF INDUCTANCE AND CAPACITANCE 145

$Y$  square is the ratio of  $C$  to  $L$ , this from the dielectric standpoint. Hence it is given,

$$Z = \sqrt{\frac{L}{C}} \text{ Ohm, ,} \quad (21)$$

$$Y = \sqrt{\frac{C}{L}} \text{ Siemens,} \quad (22)$$

and

$$\omega = \frac{1}{\sqrt{LC}} \text{ Radians per second.} \quad (13)$$

Relating the Impedance,  $Z$ , and the Admittance,  $Y$ , to primary dimensional relations gives

$$(23) Z, \text{ or Weber per Coulomb,}$$

$$(24) Y, \text{ or Coulomb per Weber,}$$

and

$$(23a) Z, \text{ or Volt per Ampere,}$$

$$(24a) Y, \text{ or Ampere per Volt,}$$

It is hereby seen that the ratio of magnetic induction bound in the reactance coil to the dielectric induction bound in the static condenser is expressed by the relation (21). Likewise, the ratio of the dielectric induction bound in the static condenser to the magnetic induction bound in the reactance coil is expressed by the relation (22). Through relations (23a) & (23b) the proportionality between E.M.F.,  $E$ , of the reactance coil and the displacement current,  $I$ , of the condenser are determined also by relations (21)& (22).

$$E = ZI, \quad I = YE, \quad (25)$$

$$\Phi = Z\Psi, \quad \Psi = Y\Phi. \quad (26)$$

In a  $LC$  configuration with no gain or loss of energy, that is a configuration with no resistance or conductance, it is in this condition only that  $Z$  is one over  $Y$ . Here the  $LC$  configuration is in a "Free Oscillation," with a frequency  $\omega$ . The proportionality between  $\Phi$  and  $\Psi$  is then  $Z$  in Ohms. This is a condition of what is called "Perpetual Motion", trapped energy surging between magnetic

and dielectric forms, with no where to go. The energy itself remains constant in this  $LC$  oscillation. It is stored alternating current energy, hence the  $LC$  resonant circuit is known as a "Tank Circuit" in radio work. This phenomena of energy storage play a very important role in the work of Nikola Tesla.

In the discussion of the "Telegraph Equation" two important factors were given,

a, The Power Factor,

b, The Induction Factor,

and switchboard instruments have been developed to display these factors. Defining  $a$  and  $b$ .

The Power Factor is the ratio of the Energy produced or consumed to the total Energy of an electrical configuration, The Induction Factor is the ratio of the Energy stored, Magnetic and Dielectric, to the total energy of an electrical configuration. Relating these to the oscillating  $LC$  circuit, The Power Factor represents the "Leakage of Alternating Energy", The Induction Factor representing the "Storage of Alternating Energy".

For the condition of no energy leakage, the Power Factor,  $a$ , is zero percent, the Induction Factor is 100 percent, hence perpetual motion. Of particular interest in the  $LC$  configuration is the "Magnification Factor" of Nikola Tesla's work. Here is how Tesla achieved power gain with no amplifiers. Taking the ratio of the Induction Factor,  $b$ , to the Power Factor,  $a$ , that is,

The ratio of Energy stored to Energy lost,  $b$  over  $a$ ,

here derived is what is called the Magnification Factor,  $n$ . This factor,  $n$ , is often called the " $Q$ " or quality factor of the  $LC$  configuration, this in radio work. The following relation results,

$$P_0 = nP. \text{ Watts,} \quad (26)$$

where  $P_0$  is the Power, in watts, circulating in the  $LC$  configuration,  $P$  is the Power, in watts, supplying the losses of the  $LC$  configuration,  $n$  is the Magnification Factor.

This is to say, for every watt of power delivered to the losses of the  $LC$  configuration,  $n$  times that power is exchanged in the  $LC$  configuration. Example, given is an  $LC$  configuration, its magnification factor,  $n$ , is 1000. An alternating frequency supply of energy, operating at a frequency of omega, is delivering energy to the  $LC$  configuration. The rate of energy delivered is one watt, this representing the losses of the  $LC$  circuit. It is then,  $n$  times one watt is the rate of energy exchange between  $L$  and  $C$ , or 1000 watts. Hence a Power Amplification of 1000, or

30 decibels. This is an underlying principle to a major part of the work of Nikola Tesla. (The Magnifying Transformer).

## 4.9 Extending Inductance and Capacitance

In the previous section the following dimensional relation has been established,

(1) Henry - Farad, or Second Square.

Here given is the dimensional relation uniting inductance and capacitance, time. This dimensional relation (15) can be expressed in a pair of forms

(2) Per Henry, or Farad per Second Square,

and

(3) Per Farad, or Henry per Second Square

Substituting the relations;

(4) Henry per Second, or Ohm,

into relations (2) and (3) results in the following relations;

(7) Per Henry, or Siemens per Second,

and

(8) Per Farad, or Ohm per Second.

These relations suggest that variation of resistance with respect to time results in an "Elastance"  $K$ , in per Farad. Likewise, a variation of conductance with respect to time results in an "Enductance"  $M$ , in per Henry. What is significant here is that the variation of resistance gives rise to a reactance, this without energy storage in an actual field. See C. P. Steinmetz, "Theory and Calculation of Alternate Current Phenomena", 1900 edition, "Pulsation of Resistance"<sup>14</sup>.

Henry, time to the zero power,

Henry per second, time to the first power,

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<sup>14</sup>Charles Proteus Steinmetz, *Theory and Calculation of Alternate Current Phenomena*, (University of Michigan Library, 1897).

or

Ohm, time to the first power,  
Ohm per second, time to the second power,

or

Per Farad, time to the second power,

and

Henry per Second Square, or Per Farad.

Here it is suggested that the variation of a magnetic inductance at a rate which is the square of the time function (cosine squared, etc.) converts this inductance into the equivalent of a Dielectric Elastance. Likewise, the variation of an electrostatic capacity at a rate which is the square of the time function (sine squared, etc) converts this capacitance into the equivalent of a Magnetic Enductance.  $L$ , in Henry, is transformed through time squared into  $K$ , in Per Farad.  $C$ , in Farad, is transformed into  $M$ , in Per Henry. Here the principles of Parameter Variation have been extended to include "second order" Parameter Variation, this giving rise to a quadra-polar configuration of inductance,  $L$ ,  $M$ , and capacitance,  $C$ ,  $K$ . Little knowledge exists on this topic, however the principle of the "Negative Resistance" Telephone Repeater is similar. Many experimental possibilities exist here.

While the previous material gives alternate expressions for inductance and capacitance in the dimension of time, it is very instructive to consider alternate expressions for inductance and capacitance in the dimensions of space, since they are geometric expressions of space in and of themselves. In the previous writings they have been, for the most part, directed primarily into electro-magnetic relations. Such is the giga-watt D.C. power line to Los Angeles. The so called current is in opposite directions and the potential is of opposite polarity. Hereby, the magnetic field, as given by  $L$ , in Henry, repels, and the dielectric field, as given by  $C$ , in Farad, attracts.  $L$  and  $C$  represent the transverse E. M. forces. However, consider the current is in the same direction, and the potential is the same on both wires. Now the magnetic field attracts, and the dielectric field repels. Here result in alternate expression for the Magnetic and Dielectric Forces;

Henry,  $L$ , magnetic repulsion,

Farad,  $C$ , dielectric attraction,

and alternately,

Per Henry,  $M$ , magnetic attraction,

Per Farad,  $K$ , dielectric repulsion.

$LC$  represents the Transverse Electro-Magnetic wave,  $MK$  represents the Longitudinal Magneto-Dielectric Wave.

The T.E.M., or  $LC$  wave propagates along the conductor axis, The L.M.D., or  $MK$ , propagates normal to the axis of the conductor. In general, both  $LC$  and  $MK$  waves exist on a complex structure such as a resonant transformer coil. Here derived is a quadra-polar magnetic/dielectric relationship. Resonance is now on a higher order since two energy exchanges are now FOUR energy exchanges, hence a Fourth order differential equation results. See, L.V. Bewely, "Transmission Systems" book<sup>15</sup>. This fourth order resonance was very important for Tesla's Transformers and today is ignored. (Corums). Here established is the forms of inductance, and two forms of capacitance. Expressing these in dimensional relations,

(1)  $L$ , Henry. Transverse Inductance.

Centimeter Square

(2)  $C$ , Farad. Transverse Capacitance.

Second Square per Centimeter Square

(3)  $M$ , per Henry. Longitudinal Inductance.

Per Centimeter Square

(4)  $K$ , per Farad. Longitudinal Capacitance.

Centimeter Square per Second Square.

Hence given is the quadra-polar relations

$L$ , the self inductance

$C$ , the self capacitance

$M$ , the mutual enductance

$K$ , the mutual elastance.

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<sup>15</sup>Loyal Vivian Bewley, *Traveling Waves on Transmission Systems*, (John Wiley & Sons, New York, 1951).

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Derived is two time scalar space distributions

$LM$ , Henry per Henry

$CK$ , Farad per Farad

$LM$  is called the Magnetic Space Factor,

$CK$  is called the Dielectric Space Factor.

These space factors  $LM$  and  $CK$  represent this quadra-polar space distribution as extensions of the basic  $L$  and  $C$ . Also, a pair of frequencies now exist

$LC$ , Henry - Farad, or Second Square,

and

$MK$ , per (Henry - Farad) or per Second Square.

It hereby can be seen that resonance of a complex structure, such as an oscillating coil, is much more difficult to represent than a simple  $LC$  relationship. Here is the major obstacle to the engineering of Tesla type resonant transformers.

## Chapter 5

# Four Quadrant Energy Exchange in Induction

### 5.1 Part One

The Magnetic Field of Induction,  $\Phi$ , is directly related to the magneto-motive force, or "current",  $i$ , in amperes. A constant, time invariant, M.M.F. constitutes a constant, or "direct current", magnetic field. This constant M.M.F., or direct current, gives rise to no reactionary Electro-Motive Force,  $E$ . E.M.F. is a result of the magnetic field acting to maintain a constant current in a regulatory manner. Here the current, and hence the M.M.F. are already constant, thus zero E.M.F. In this condition no energy is exchanged, thus the magnetic energy is "static", or all Potential Energy, in Weber-Ampere. Since Electric Activity, or Power, in watts, is the product of this constant current,  $i$ , and an E.M.F.,  $E$ , which is zero, the Activity, or Power is also zero. Thus in the absence of an E.M.F. no Power is required in order to maintain a static Magnetic Field of Induction, Fig 1A.

Likewise, a Dielectric Field of Induction,  $\Psi$ , is directly related to an electrostatic potential,  $e$ , in volts. A constant, time invariant potential constitutes a constant, or "D.C.", Dielectric Field. This constant potential gives rise to no reactionary Displacement Current,  $I$ , in amperes. Displacement is the result of the Dielectric Field acting to maintain a constant potential, but here the potential is already constant, thus the Displacement is zero. In this condition no energy is exchanged, thus the Dielectric Energy is "static", or Potential Energy in Coulomb-Volts.

Since Electrical Activity, or Power,  $P$ , in watts, is the product of this Constant

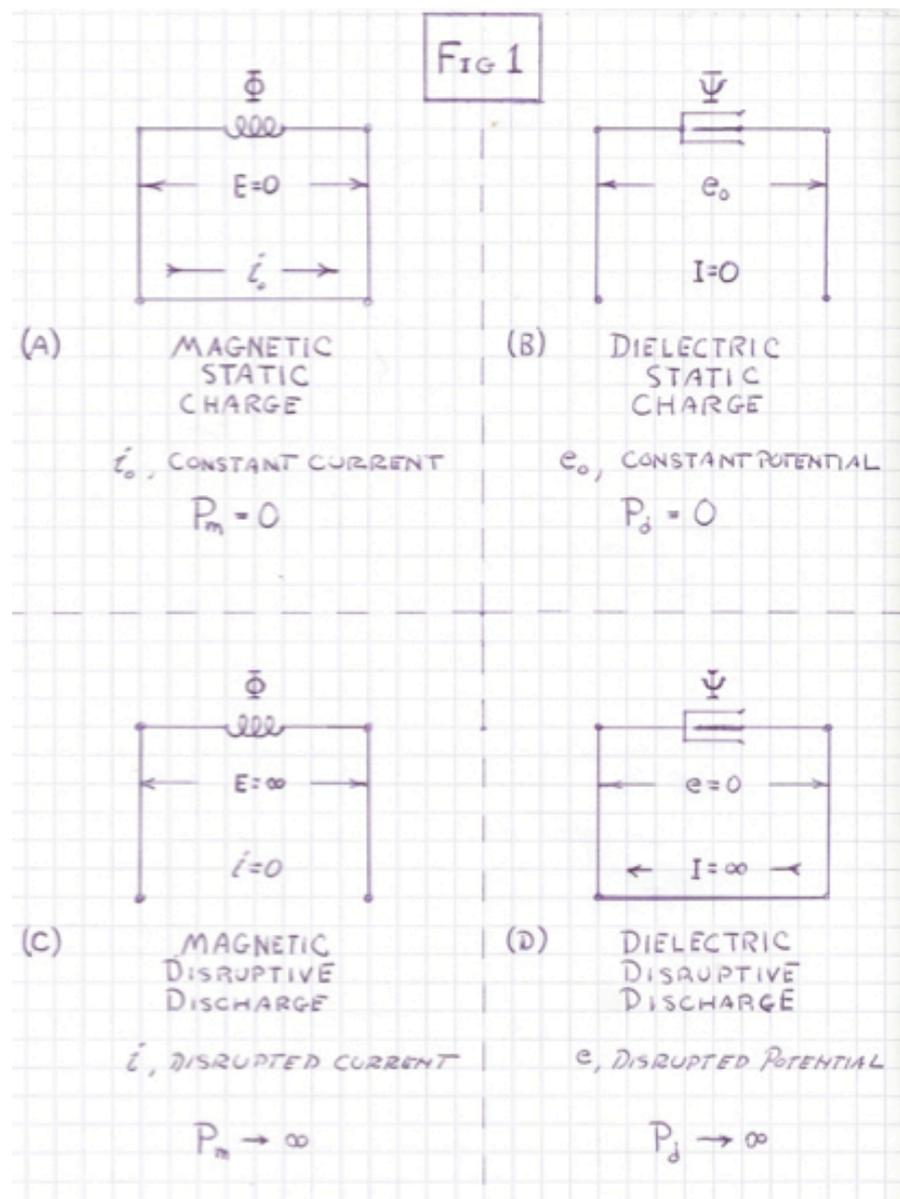


Figure 5.1: Four Quadrant Energy Exchange in Magnetic & Dielectric Fields of Induction.

Potential,  $e$ , and a Displacement Current,  $I$ , which is zero, the Activity, or Power is also zero. Thus in the absence of Displacement no power is required to maintain a static Dielectric Field of Induction, Fig 1B.

A violent magnetic discharge, in the form of an intense forward E.M.F., results from the path for current,  $i$ , being broken, or open circuited. This forward E.M.F. is the result of the stored energy within the Magnetic Field acting to maintain a continuous current, and its M.M.F., which now has been disrupted by an open circuit. An open circuit is the denial of any current flow, thus an infinite E.M.F. is developed within the Metallic-Dielectric Geometry of the Inductance. Fig 1C.

Likewise, a violent dielectric discharge, in the form of an intense Forward Displacement Current, results from the Potential,  $e$ , being Short Circuited. This Forward Displacement is the result of stored energy within the Dielectric Field acting to maintain a Continuous Potential which now has been disrupted by a short circuit. A short circuit is the denial of any Potential, thus an infinite Displacement is developed within the metallic-dielectric geometry of the Capacitance. Fig 1D.

The Flow of Power, or Activity, is indefinite in all four of the above conditions. No products can be formed since it is either the current is zero, or the potential is zero. The energy involved is only that contained in the Fields of Induction themselves, no energy exchanged, or transfer, exists with outside forces. The static charge, or Transient Discharge must remain within the metallic-dielectric geometry of the Inductance, or the Capacitance.

For the static case, the energy remains in a signal form, magnetic or dielectric. For the disrupted case, the energy escapes into its conjugate form within the Counter-Spatial Dimensions of the Inductor, or the Condenser, containing the energy involved. For the Disrupted Magnetic Discharge the extreme E.M.F.,  $E$ , becomes an extreme electro-static potential,  $e$ , thus the energy escapes into Dielectric Form within the Inductor.

Likewise, for the disrupted Dielectric Discharge, the extreme displacement,  $I$ , becomes an extreme M.M.F.,  $i$ , thus the energy escapes into Magnetic Form within the Condenser. Because no energy is dissipated, powerful electric oscillations are produced within the Inductor or Condenser. The trapped energy is continuously reflected to and fro between Magnetic & Dielectric Forms within the metallic-dielectric geometry of the device.

Little Theoretical or Experimental knowledge exists on this subject, but here enters the work of Nikola Tesla, and his disruptive discharge apparatus.

When the energy contained within the Fields of Induction is delivered to, or taken from, external forms, a set of relations exist as shown in Fig 2. This condition of energy transfer involves Electrical Activity, or Power,  $P$ , in watts. Power

is The Time Rate of Energy Transfer into, or out of The Field of Induction. The Dimension of Time now takes part. Thus energy transfer gives rise to Frequencies and Time Constants.

For this condition of External Energy Transfer, the external device is a specifically constructed dry cell, this the size and shape of the common "D" cell as used in a flashlight. This dry cell has virtually no internal losses. It also has been proportioned to have a Natural Impedance of one ohm, and thus a Natural Admittance of one siemens. Hence the following characteristics of this "XD" dry cell;

Open Circuit Potential,  $e_o$ , 1 Volt

Short Circuit Current,  $i_o$ , 1 Ampere

And thus the ratio of one volt to one ampere is

Natural Impedance,  $Z_o$ , 1 Ohm

The Polarity markings for  $e_o$  and  $i_o$  are shown on the dry cell in Fig 2.

This unit dry cell is hereby a source of Constant Potential to a Charged Condenser of Equal Potential, and a source of Constant Current to a Charged Inductor of the Same Current. The Displacement or E.M.F. is zero. In both conditions the energy is static, no Transfer of Energy takes place giving rise to Activity.

The Power is zero thus the conditions revert to those of Fig 1A & 1B.

This unit dry cell contains a certain quantity of Stored Chemical Energy. This Chemical Energy can be taken out and delivered to an external form, or it can be given back to Chemical Form within the dry cell, taking energy from an external form. Energy can be taken from or given to this unit dry cell, it is rechargeable.

This unit dry cell thus can be a Negative Resistance, or a Negative Conductance, when supplying Energy to External Forms. It also can be a Positive Resistance, or a Positive Conductance, when taking energy from external forms. For the condition of constant current this unit dry cell is a Positive Resistance,  $R$ , in ohm when taking in energy from an External Form, or it is a Negative Resistance, a "Receptance",  $H$ , in ohm when giving out Energy to an External Form.

Likewise, for the Condition of Constant Potential this unit dry cell is a positive Conductance,  $G$ , in siemens when taking in energy from External Forms, or a negative Conductance, and Acceptance,  $S$ , in siemens when giving out energy to External Forms.

This unit dry cell is here shown to be a bi-directional resistance or conductance. In ordinary Resistances  $R$  or Leakages  $G$  energy flow is always a uni-directional flow, out, in the form of Heat Energy commonly. Here then is a Versor Resistance, or a Versor Conductance. The D.C. Versor operator is derived from

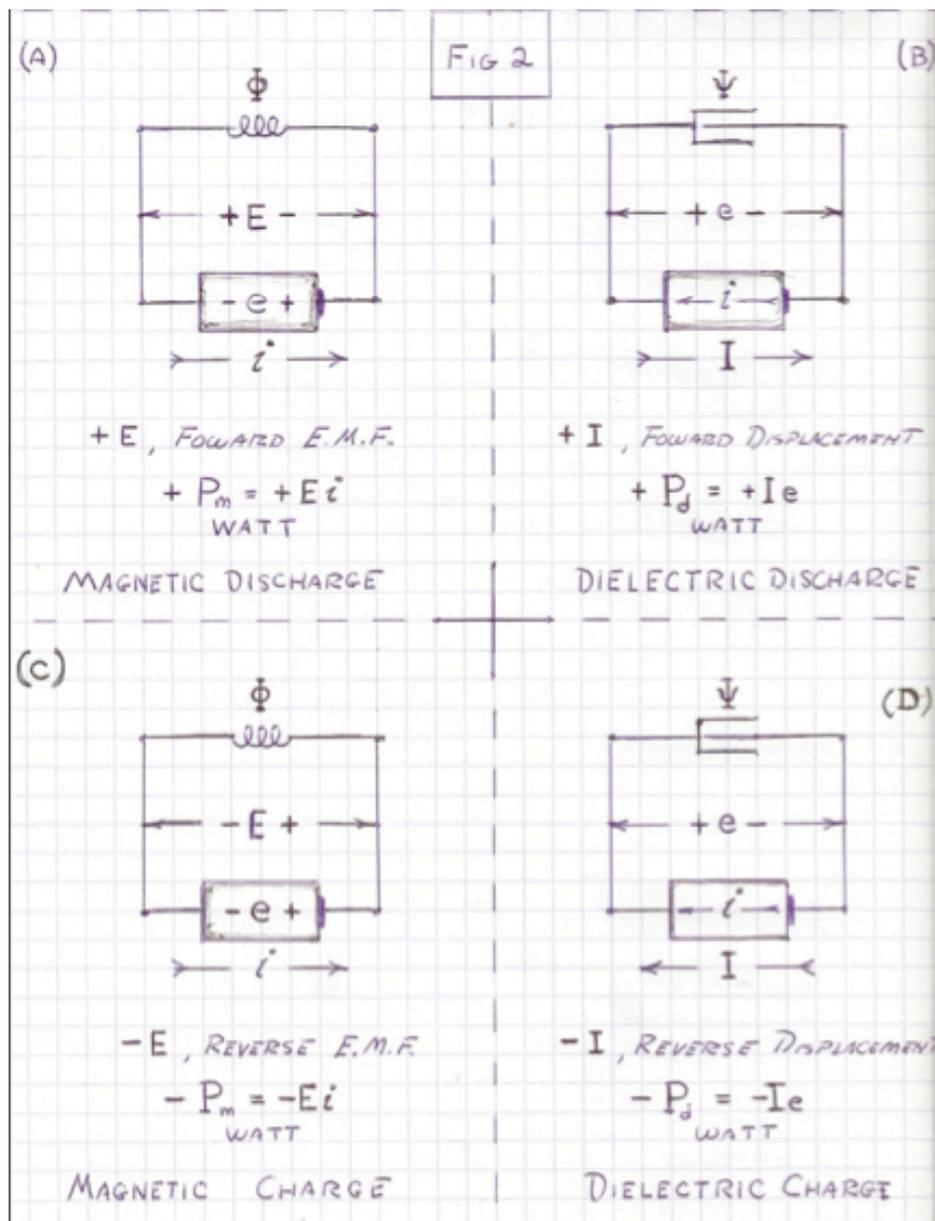


Figure 5.2: Four Quadrant Energy Exchange in Magnetic & Dielectric Fields of Induction.

the expression,

$$\sqrt{+1}. \quad (1)$$

Symbolically it is

$$+1^{\frac{1}{2}} \quad (2)$$

with roots, +1 and -1.

The versor operator becomes, for this D.C. condition of bi-directional flow

$$1^{\frac{1}{2}} = h_2^N, \quad N = 0, 1. \quad (3)$$

and

$$h^0 = +1,$$

$$h^1 = +1,$$

$$h^2 = -1,$$

$$h^3 = -1, \text{ etc.}$$

Hereby the versor relations of the bi-directional device, such as the unit dry cell are given

$$\begin{aligned} R &= h^1 H, \quad G = h^1 S, \\ H &= \frac{R}{h^1}, \quad S = \frac{G}{h^1}. \end{aligned} \quad (4)$$

and it is  $\frac{1}{h^1} = -1$ .

The energy stored within the Magnetic Field of Induction can be supplied to, or taken from the unit dry cell. Likewise the energy stored within the Dielectric Field of Induction can be supplied to or taken from the unit dry cell. Whereas the disruptive circuit condition completely open circuits the Inductance, or completely short circuits the Capacitance, here now the unit dry cell is inserted in the place of the open circuit, or the short circuit. Circuit Continuity is hereby maintained by the dry cell. Energy can now be transferred in a finite manner. The Magnetic Inductance can take the Chemical Energy out of the dry cell, storing it within its magnetic field. Conversely, The Magnetic Inductance can deliver its Stored Energy to the Chemical Energy of the dry cell. This is a two way Reciprocal Relation.

Likewise, The Dielectric Capacitance can take the Chemical Energy out of the dry cell, storing it within its Dielectric Field. Conversely, The Dielectric Capacitance can deliver its Stored Energy to the Chemical Energy of the dry cell. Again this is a two way Reciprocal Relation. The Inductance and Capacitance can give

or take energy just as can the dry cell. Hereby Four Distinct Conditions exist, a pair for each Field of Induction, one pair the Energy Transfer between the dry cell and Inductor,

(1) charge, (2) discharge,

the second pair the Energy Transfer between the dry cell and Condenser,

(3) charge, (4) discharge.

Hence,

(1) The Energy,  $W$ , in Joules, stored in the Magnetic Field,  $\Phi$ , in Weber, is delivered by Electrical Activity,  $P$ , in Watts, Fig 2A, to the dry cell.

(2) The Energy,  $W$ , in Joules, stored in the Dielectric Field,  $\Psi$ , in Coulomb, is delivered by Electrical Activity,  $P$ , in Watts, Fig 2B, to the dry cell.

(3) The Energy,  $W$ , in Joules, stored in the Magnetic Field,  $\Phi$ , in Weber is derived from the Electrical Activity,  $P$ , in Watts, Fig 2C, out of the Chemical Energy of the dry cell.

(4) The Energy,  $W$ , in Joules, stored by the Dielectric Field,  $\Psi$ , in Coulomb, is derived from the Electrical Activity,  $P$ , in Watts, Fig 2D, out of the dry cell.

Hence Magnetic Power Flow in watts can transfer energy from the Magnetic Field, or to the Magnetic Field, this energy to, or from, the Chemical Energy of the dry cell. The flow of power is two way, or bi-directional. It is a differential quantity.

Likewise hence, Dielectric Power Flow in watts can transfer energy from the Dielectric Field, or to the Dielectric Field, this Energy to, or from, the dry cell. Again the Power Flow is bi-directional, a differential quantity.

The Magnetic Inductance develops an Electro-Motive Force,  $E$ , during the Time of Energy Transfer with the dry cell. This E.M.F. acts in conjunction with, or in opposition to, the Continuity of Current (M.M.F.),  $i$ , this developing the Electrical Activity,  $E_i$ , in watts, of Energy Transfer. This Activity, or Power,  $P_m$ , is the time rate of Energy Transfer.

Likewise, the Dielectric Capacitance develops a Displacement Current,  $I$ , during the Time Interval of Energy Transfer with the dry cell. This Displacement

acts in conjunction with, or in opposition to, the Continuity of Potential,  $e$ , this developing the Electrical Activity,  $I_e$ , in watts, of Energy Transfer. This Activity, or Power,  $P_d$ , is the Time Rate of Energy Transfer.

It hereby can be seen that the dimension of Time plays an important role in this Energy Transfer. Electrical Activity is the time rate of Energy Transfer,

$$\text{Watt, or Joule per Second.} \quad (5)$$

The longer, more prolonged, time rate of transfer, the less in magnitude is the Power Flow. Likewise, the shorter, more instantaneous, time rate of transfer, the greater in magnitude is the Power Flow. The Disruptive Discharge is a Limiting Condition, and as well is the Static Charge. In both cases the Flow of Power is zero. The Energy remains within the Inductor or the Condenser.

Through adjustment of the time rate of charge, and the time rate of discharge, involved in Energy Transfer into, or out of, a Field of Induction, any magnitude of Electrical Activity,  $P$ , can be developed from a given quantity of stored Energy,  $W$ , Fig 3, Fig 4. Denoting the charge time as  $t_1$ , and the discharge time as  $t_2$ , taking the ratio as,

$$\frac{-t_1}{t_2} = -n, \text{ Numeric.} \quad (6)$$

The Power Magnification is given as

$$-P_2 = nP_1, \text{ Watts.} \quad (7)$$

and through Energy Conservation, it is,

$$t_2P_2 - t_1P_1 = 0, \text{ Joules.} \quad (8)$$

The factor  $n$  is called The Magnification Factor of Energy Exchange.

While a Magnetic Inductance is gathering energy from the Chemical Energy of the dry cell, a backward directed E.M.F.,  $E$ , is developed within this Inductance. This E.M.F. acts to maintain a constant M.M.F., or current,  $i$ , that is it acts to maintain the quantity of Energy Stored within the Magnetic Field. While an Inductance is delivering its Magnetic Energy to the Chemical Energy of The dry cell, a forward directed E.M.F.,  $E$ , is developed within the Inductance. This E.M.F. also serves to maintain a constant M.M.F. or current,  $i$ , that is it acts to maintain The Quantity of Energy Stored within the Magnetic Field. Fig 2A & 2C.

Hence the charging Inductance, gaining Magnetic Energy, develops an E.M.F.,  $E$ , in opposition to the Potential,  $e$ , of the dry cell. The resulting Voltage Difference combines with the current,  $i$ , in delivering Energy to the Magnetic Field of

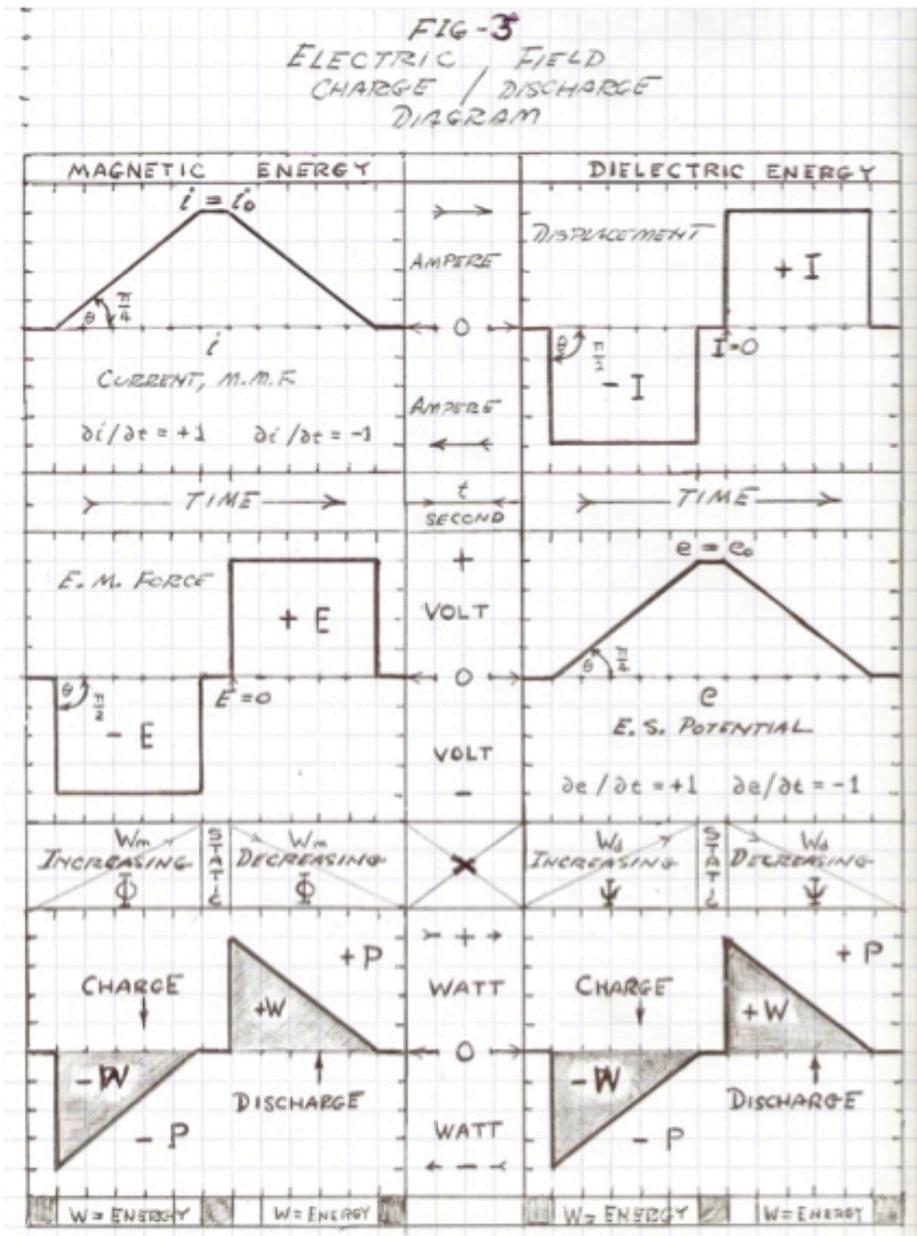


Figure 5.3: Electric Field Charge/Discharge Diagram.

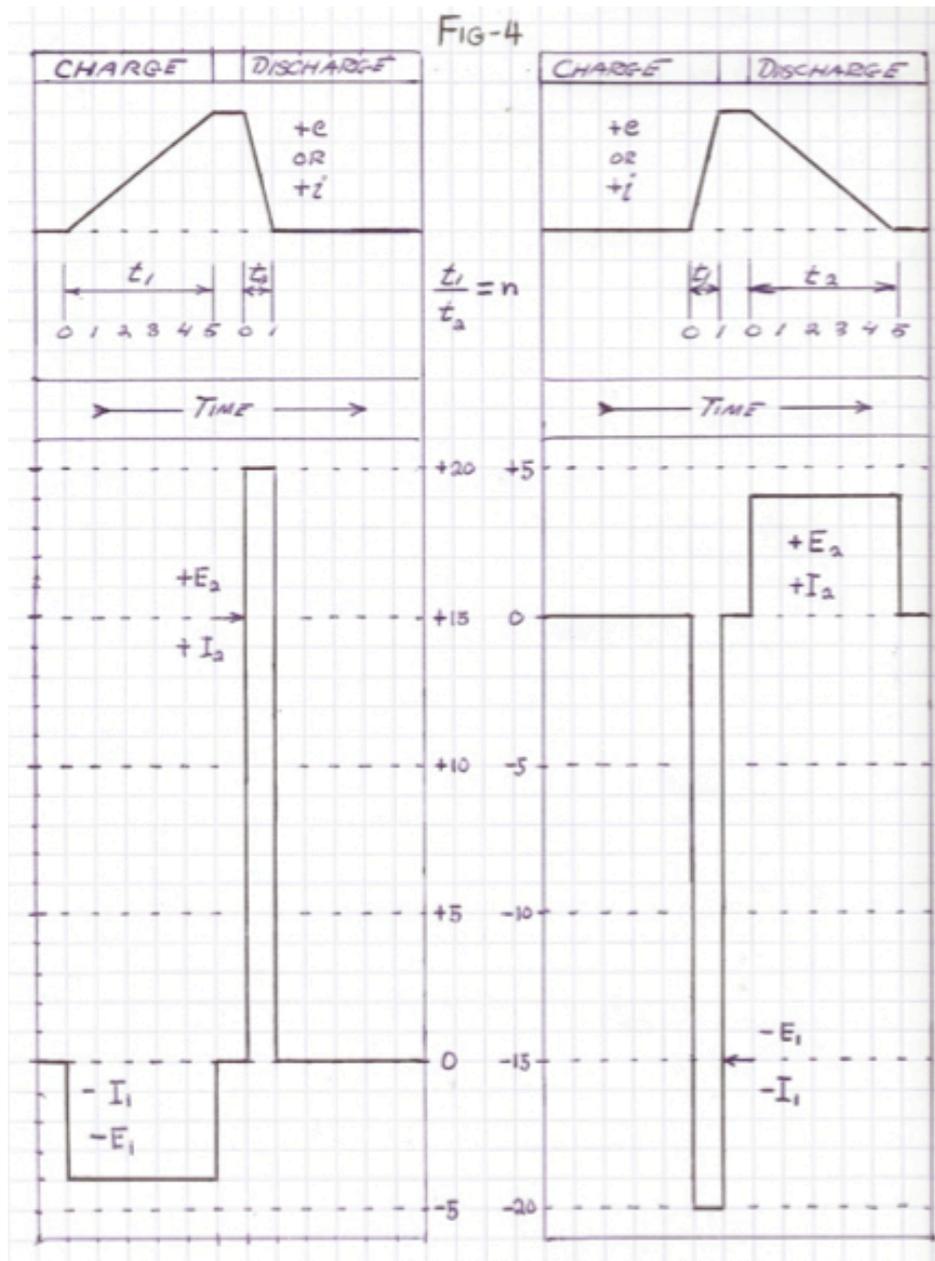


Figure 5.4: Electric Field Charge/Discharge Diagram.

Induction. This E.M.F. is called the "Back E.M.F.". Also, the Discharging Inductance, losing Magnetic Energy, develops an E.M.F.,  $E$ , in conjunction with the Potential,  $e$ , of the dry cell. The Resulting Voltage Summation combines with the current,  $i$ , in delivering Energy to the dry cell. This E.M.F. is called the "Forward E.M.F.". The E.M.F. is thus a differential magnitude, Back E.M.F. on charge,  $+E$ , Forward E.M.F. on discharge,  $-E$ . Fig 3.

Likewise, hence the Charging Capacitance and Displacement Current,  $I$ , in opposition to the current,  $i$ , of the dry cell. The resulting current flow combines with Potential,  $e$ , in Delivering Energy to the Dielectric Field, taking it from the Chemical Energy of the dry cell. The Discharging Capacitance develops a Displacement Current,  $I$ , this in conjunction with the current,  $i$ , of the dry cell, in Delivering Energy to the dry cell, taking it from the Stored Energy of the Dielectric Field, Fig 2B & 2D. The Charging Displacement is called the "Back Displacement," and The Discharging Displacement is called the "Forward Displacement". Back Displacement,  $-I$ , Forward Displacement,  $+I$ , the displacement is a differential magnitude. Fig 3.

Hereby, The Four Primary Energy Transfer Relations

- 1) Magnetic Energy Discharge, Forward E.M.F., Fig 2A.
- 2) Dielectric Energy Discharge Forward Displacement, Fig 2B.
- 3) Magnetic Energy Charge, Back E.M.F., Fig 2C.
- 4) Dielectric Energy Charge Back Displacement, Fig 2D.

Note, the unfortunate condition exists that the Production of Energy is taken as a Negative Value, the Consumption of Energy is taken as a Positive Value. However, this is the established convention, despite the confusion it creates.

The following relations for power flow are hereby derived MAGNETIC POWER FLOW;

$$1) \text{ Charge, } + Ei = +P_m, \quad (9)$$

$$2) \text{ Discharge, } - Ei = -P_m, \quad (9')$$

DIELECTRIC POWER FLOW;

$$3) \text{ Charge, } + Ie = +P_d, \quad (10)$$

$$4) \text{ Discharge, } - Ie = -P_d. \quad (10')$$

The versor expressions for charge and discharge are given as

$$+E = h^0 E, \quad +I = h^0 I,$$

$$-E = h^1 E, \quad -I = h^1 I, \quad (11)$$

where  $h^N$  is the charge/discharge versor operator. Substituting these expressions into the general relations of Power Flow, the magnetic,

$$\begin{aligned} +P_m &= +Ei, & h^0 P_m &= h^0 Ei, \\ -P_m &= -Ei, & h^1 P_m &= h^1 Ei, \end{aligned} \quad (12)$$

and, the dielectric

$$\begin{aligned} +P_d &= +Ie, & h^0 P_d &= h^0 Ie, \\ -P_d &= -Ie, & h^1 P_d &= h^1 Ie, \end{aligned} \quad (13)$$

Hence the most general expression for Versor Power is

$$\begin{aligned} \dot{P}_m &= h^N P_m, & \text{Versor Watts,} \\ \dot{P}_d &= h^N P_d, & \text{Versor Watts,} \end{aligned} \quad (14)$$

where  $N = 0, 1$ . Break, more to follow.

## 5.2 Part Two

In part one the energy transfer was one only of two forms, the transfer of Magnetic Energy, or the transfer of Dielectric Energy. Only one form of Inductive Energy exists. It is a single energy, and accordingly it is called a Single Energy Transient. Only one form of stored energy is active in a Single Energy Transient.

This stored energy can exist in one of two distinct forms,

The Magnetic Energy,

$$W_m = \frac{1}{2} i\phi, \quad \text{Ampere-Weber.} \quad (1)$$

The Dielectric Energy,

$$W_d = \frac{1}{2} e\psi, \quad \text{Volt-Coulomb.} \quad (2)$$

Because these stored energies are static quantities, they are time invariant. The dimension of time has no role in their existence. It is however that time is a

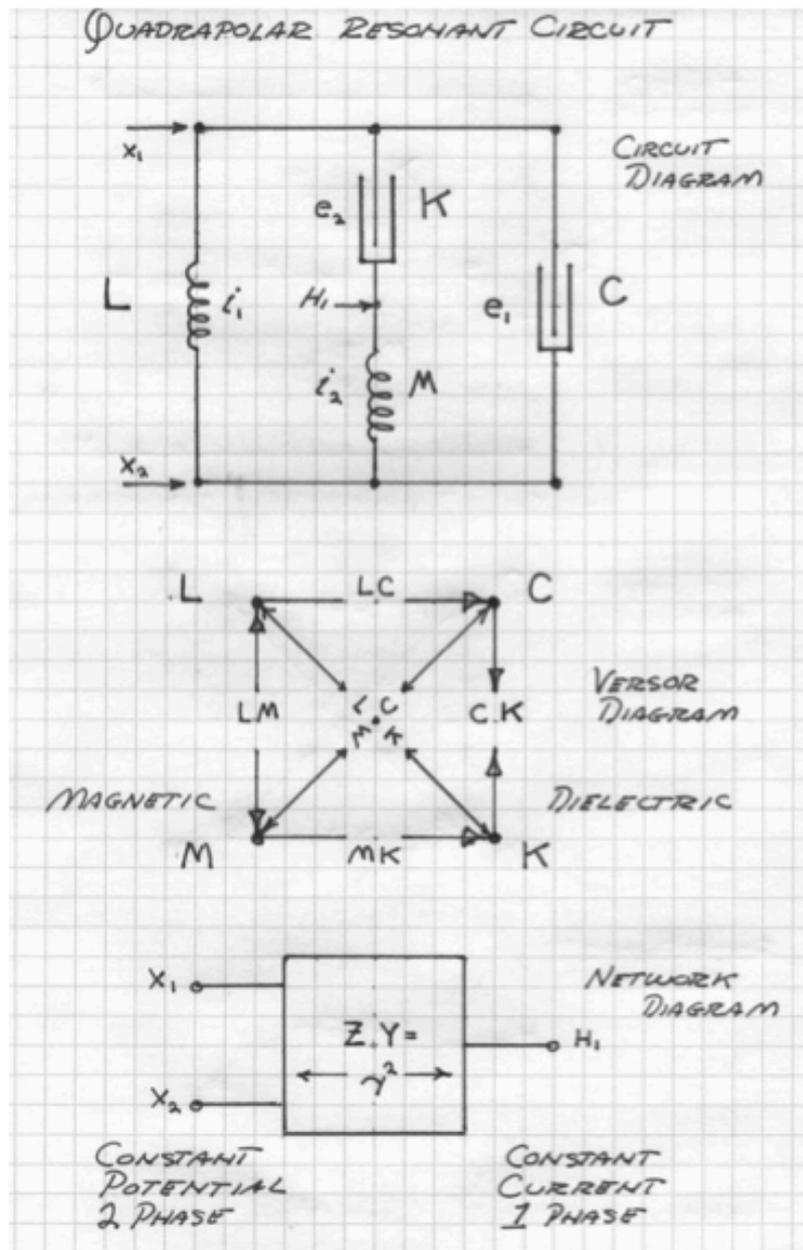


Figure 5.5: Quadrupler Resonant Circuit.

$$i_1^2 L = i_2^2 M^{-1} = e_1^2 C = e_2^2 K^{-1}$$

$$\omega_1^2 = \omega_2^2, \quad P_1 = P_2$$

THE FUNDAMENTAL RELATIONS FOR QUADRUPOLAR RESONANCE

|   |   |
|---|---|
| <p>SHUNT ADMITTANCE</p> $Y_1 = \frac{i_1}{e_1} \quad Y_1 = \sqrt{\frac{C}{L}}$ <p>SIEMENS</p> | <p>SERIES IMPEDANCE</p> $Z_1 = \frac{e_2}{i_2} \quad Z_1 = \sqrt{\frac{K}{M}}$ <p>OHM</p> |
| <p>TRANSFER ADMITTANCE</p> $Y_0 = \frac{i_2}{e_1} \quad Y_0 = \sqrt{MC}$ <p>SIEMENS</p>       | <p>TRANSFER IMPEDANCE</p> $Z_0 = \frac{e_2}{i_1} \quad Z_0 = \sqrt{LK}$ <p>OHM</p>        |
| <p>SHUNT FREQUENCY</p> $\omega_1^{-1} = \sqrt{LC}$ <p>SECOND PER RADIAN</p>                   | <p>SERIES FREQUENCY</p> $\omega_2^{+1} = \sqrt{MK}$ <p>RADIAN PER SECOND</p>              |
| <p>TRANSFER FREQUENCY</p> $N_0^{-1} = \sqrt{\frac{C}{M}}$ <p>SECOND PER RADIAN</p>            | <p>TRANSFER FREQUENCY</p> $N_0^{+1} = \sqrt{\frac{K}{L}}$ <p>RADIAN PER SECOND</p>        |

Figure 5.6: The Fundamental Relations for Quadrupole Resonance.

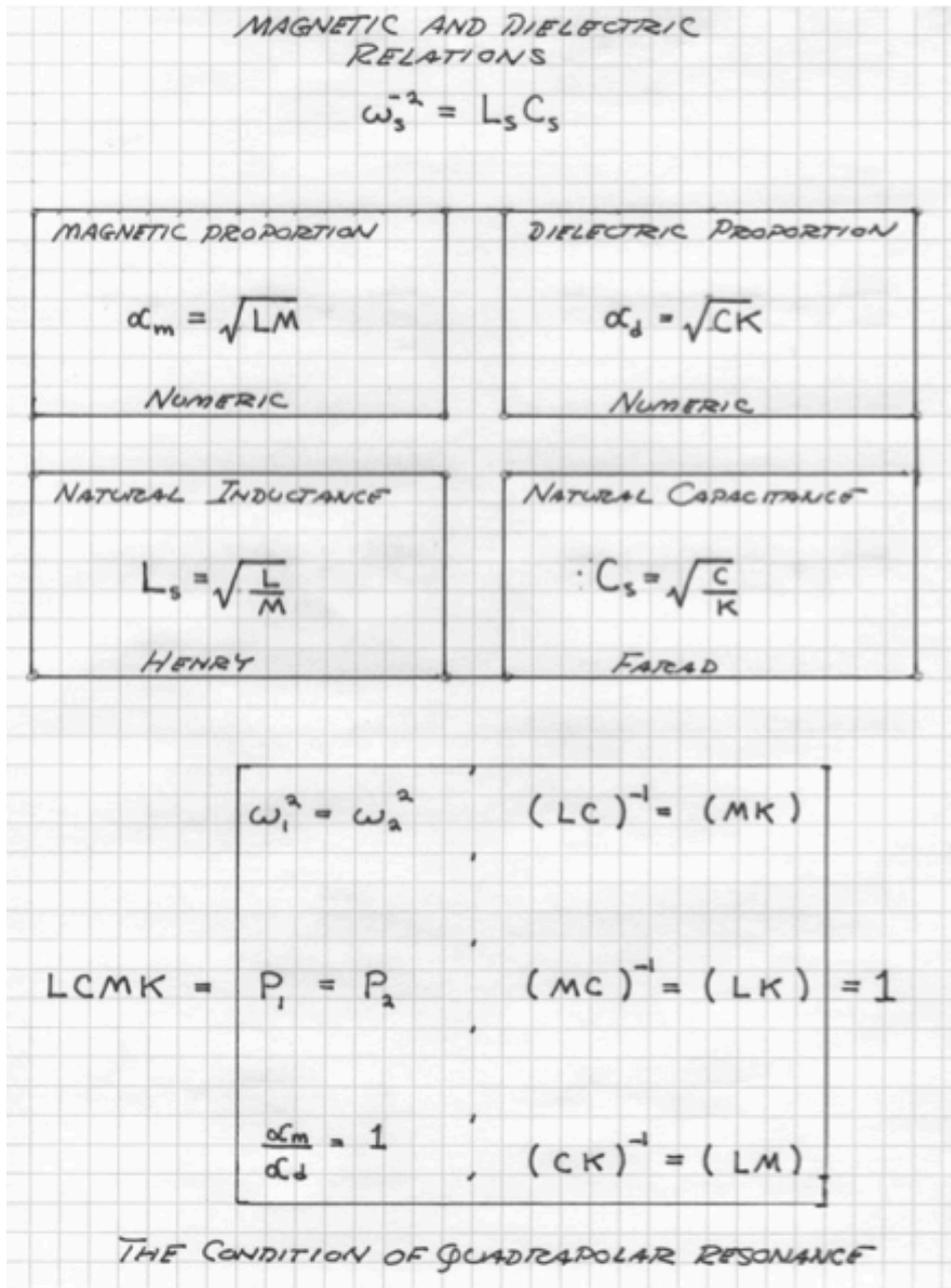


Figure 5.7: The Magnetic and Dielectric Resonance and the Condition of Quadrupole Resonance.

necessary dimensional requirement for the existence of energy. So where then is the energy?

These dimensional expressions for stored energy represent only the Potential for Energy Existence. It is that the expressions given for the energy stored by a field of induction are no more than expressions for the magnitude, and quantity, of the magnetic induction, and dielectric induction, themselves. No union of the two inductions exist to form the product, Electrification,  $Q$ , and its time rate, Energy,  $W$ .

The single energy transient is a Magnetic Energy Transient, a transient of Electro-Motive Force,  $E$ , or it is a Dielectric Energy Transient, a transient of Displacement Current,  $I$ . These two reactive transients give rise to products, these with their respective potentials, the electro-static potential,  $e$ , and the magneto-motive force,  $i$ . M.M.F. is also considered a potential in that it is static. These products of reaction and potential represent The Electrical Activity of their respective Single Energy Transients. Thus a pair of Products, one for each field

The Magnetic Activity

$$\dot{P}_m = h^N Ei = (+Ei, -Ei), \text{ Watt.} \quad (3)$$

The Dielectric Activity

$$\dot{P}_d = h^N Ie = (+Ie, -Ie), \text{ Watt.} \quad (4)$$

Each Versor Activity,  $\dot{P}_m$  or  $\dot{P}_d$ , represents one form of energy only, magnetic or dielectric, not both.

Also shown in part one was the magnification factor is a negative numeric. This magnification factor,  $n$ , is the ratio of two time spans, the time span for charge, to the time span for discharge. For the numeric ratio to be negative, one time span must also be negative. Hence the magnification factor is the ratio of a negative time span, the charge time, to a positive time span, the discharge time. The magnification factor is given as

$$-n = \frac{-t_1}{t_2}, \text{ Numeric.} \quad (5)$$

By the Law of Energy Conservation for the stored inductive energy, the amount of energy given to the field must equal the amount of energy that the field can give back. This is to say the energy sent into a field of induction is the same energy sent out of the field of induction. Hence the two energies are in opposition with

regard to the flow of power, the power in, and the power out, this resulting in a negative transfer constant, the magnification factor,  $n$ .

This results in the expressions for power flow containing a negative dimension, now exists one power flow forward in time, and another power flow, reverse in time. Power can now flow in both directions with regard to the dimension of time. Hence Power is free to move about in the dimension of Time, that is, it is a Versor Power Flow.

Here exists an analog of power flow in space along the length of a transmission line, where power is free to move along the length of the line in either direction. Thus the analog of a "Length of Time". Here then the existence of forward and reflected waves in time, just as was seen for waves on a transmission line. Hereby a composite transient, the superposition of a wave moving forward in time and a wave moving backward in time, can be developed for any instant in time. One wave travels from the past to the future, the other wave travels from the future to the past, a pair of traveling waves in time, traveling in opposite directions. The superposition of the opposing waves is the Present, or Now,  $t$  equals zero.

The versor of Electrical Activity hence resides in the metrical dimension of Time, giving the relation as

$$\dot{T} = h^N T = (+t, -t), \text{ Seconds.} \quad (6)$$

Time is now a bi-valent dimension, two values of time,

+ $t$  , real time, seconds,

- $t$ , imaginary time, seconds.

It is then given by the Law of Energy Conservation,

$$t_2 P_2 - t_1 P_1 = 0, \text{ Watt-Second.} \quad (7)$$

Imaginary Time can be called "Counter - Time", this in analog to "Counter - Space". There is however an important difference between the two. The expression for Counter-Space is given by

$$L^h, \text{ Per Centimeter,} \quad (8)$$

where  $h = -1$ . However, the expression for Counter-Time is given by

$$hT, \text{ Negative Second.} \quad (9)$$

Space is given here in terms of algebraic products, whereas Time is given here in terms of algebraic sums. This suggests a relation between Time and Space, or Time - Space where it is

$$h = 1^h, \text{ Versor,} \quad (10)$$

$$h = -1, \text{ Unit Versor.} \quad (10a)$$

A similar condition can be found for the versor condition

$$K_N^5 = 1^{\frac{1}{5}}, \text{ Versor.} \quad (11)$$

Reducing this to a base two versor,  $h^N$ , gives the pair of projections,

$$h^N \Gamma = \frac{1}{2}(1 \pm \sqrt{5}), \text{ Numeric.} \quad (12)$$

This resulting in a pair of ratios

$$\Gamma_1 = 0.618 \dots, \text{ Numeric,} \quad (13)$$

$$\Gamma_2 = -1.618 \dots, \text{ Numeric.} \quad (14)$$

Little theoretical knowledge exists on this subject. It is of interest to note here the relations

$$\Gamma_2 = \Gamma_1 + h, \text{ Numeric,} \quad (15)$$

and

$$\Gamma_2 = \Gamma_1^h, \text{ Numeric.} \quad (16)$$

Thus

$$\Gamma_1^h = \Gamma_1 + h, \text{ Numeric.} \quad (17)$$

In part one the unique condition of a disruptive discharge was given. In the disruptive discharge of a magnetic field of induction, or a dielectric field of induction, the discharged energy is confined within the metallic-dielectric geometry. No external energy transfer exists. In this condition the given field, the magnetic, or the dielectric, exchanges its energy with its Conjugate Form, the dielectric, or the magnetic. This is to say that Every Condenser has a bit of Inductance, it is the very nature of an aether filled metallic-dielectric geometry.

Because this "parasitic" capacitance or inductance has a very small value as a coefficient of energy storage, the Disruptive Discharge Develops Transients of great intensity and of Very Short Duration in Time. For the Discharging Inductor the intensity is given by

$$E = iZ_c, \text{ Volts,} \quad (18)$$

where

$$Z_c^2 = \frac{L}{C}, \text{ Henry Per Farad,} \quad (19)$$

and  $C$  is the Parasitic Capacitance and for the Discharging Condenser,

$$I = eY_c, \text{ Ampere,} \quad (20)$$

where

$$Y_c^2 = \frac{C}{L}, \text{ Farad per Henry,} \quad (21)$$

and  $L$  is the Parasitic Inductance.

Because one form of energy storage is the denial of the other form of energy storage, in the disruptive discharge, no steady state condition is possible. The energy has nowhere to roost, it is continuously thrown back and forth, remaining within the metallic-dielectric geometry. Here the stored energy is continuously exchanged between spatial and counter-spatial forms of energy storage, this continuously moving back and forth through time and counter time. Because the Inductance in the steady state is a short circuit, it cannot maintain a potential,  $e$ , and because the Capacitance in the steady state is an open circuit, it cannot maintain a current,  $i$ . Thus a potential,  $e$ , can only exist as a time variant E.M.F.,  $E$ , and likewise a current,  $i$ , can only exist as a time variant displacement,  $I$ .

No energy is transferred into, or out of, the metallic-dielectric geometry, it is only exchanged between denials of form. It is then given

$$\begin{aligned} Ei &= -eI, \text{ Volt-Ampere,} \\ -Ei &= eI, \text{ Volt-Ampere.} \end{aligned} \quad (22)$$

Substituting the following

$$\begin{aligned} E &= e, \text{ Volt,} \\ I &= i, \text{ Ampere} \end{aligned} \quad (23)$$

gives the expression for the electrical activity of the disruptive discharge as

$$P_o = EI, \text{ Volt-Ampere.} \quad (24)$$

Instead of allowing the disrupted Field of Induction to discharge back into its conjugate form within the metallic-dielectric geometry, an external conjugate form can be utilized. That is to say, an External Condenser, or an External Inductor. Equations (19) and (21) now apply to the external energy storage element

rather than the internal parasitic values. These represent the natural impedance of the pair of energy storages. The metallic-dielectric geometry now is reduced to a magnetic inductance connected with an external condenser, or it is reduced to a dielectric capacitance connected with an external inductor. This is given in a sequence of diagrams, Fig 1.

- (1) Fig 1A, A discharging Magnetic Inductance transfers its energy into a Charging Dielectric Capacitance.
- (2) Fig 1B, A discharging Dielectric Capacitance transfers its energy into a Charging Magnetic Inductance.
- (3) Fig 1C, A charging Magnetic Inductance transfers its energy out of the Discharging Dielectric Capacitance.
- (4) Fig 1D, A charging Dielectric Capacitance transfers its energy out of the Discharging Magnetic Inductance.

Here given are the four quadrants of energy exchange between a pair of mutually conjugate forms of energy storage, the inductor and the condenser. The stored energy is being continuously transformed from one form into its conjugate form in an endless cyclic rate. The time rate of this energy exchange is the electric activity,  $P_o$ , in volt-amperes. This activity represents the flow of power between the Inductor and the Condenser. Rather than a single energy transfer, it is now a pair of energy transfers. This is now a double energy transfer, or a Double Energy Transient.

In the double energy transient the stored energy is trapped with no escape. Thus this energy remains stored energy in an alternating current form, stored A.C. energy. The activity, or the flow of power is a continuous cyclic energy exchange, an opposing pair of energy transfers each moving in opposite directions in time. One energy transfer travels forward in time, the conjugate energy travels backward in time. The superposition of this opposing pair of traveling waves in time gives rise to a stationary wave in time. This is an analog to the standing wave on the length of a transmission line.

Because the inductor is charging while the condenser is discharging, or the condenser is charging while the inductor is discharging, the relations for power flow are given by

$$t_1 P_m = t_2 P_d, \text{ Watt-Second,} \quad (25)$$

and rearranging gives the relation

$$0 = t_2 P_d - t_1 P_m, \text{ Watt-Second.} \quad (26)$$

The expression of the Law of Energy Conservation. For the condition of oscillatory energy exchange the time relations are given by

$$-t_1 + t_2 = 0, \text{ Seconds.} \quad (27)$$

The two time spans, the charge time span,  $t_1$ , and the discharge time span,  $t_2$ , are now equal and opposite. Hence a single time span can represent both  $t_1$  and  $t_2$ .

$$|-t_1| = |+t_2| = t_o, \text{ Seconds.} \quad (28)$$

This time span is the one quarter period of a complete cycle of Energy Exchange,  $T$ . In the condition of cyclic energy exchange the magnification factor is expressed by the relation

$$-n = \frac{-t_1}{t_2} = -1, \text{ Versor.} \quad (29)$$

Hence the magnification factor is always unity. The Magnetic Power,  $P_m$ , is equal to the Dielectric Power,  $P_d$ . This is to say the Charge Power Flow is equal to the Discharge Power Flow. No charge-discharge magnification exists here. This magnification factor is now just a versor operator establishing the Law of Energy Conservation.

For the condition of energy transfer, the single energy transient, the transfer of energy is into, or out of the single stored energy. It is a one way flow, backward flow, or forward flow. It is uni-directional like a direct current. However, for the condition of the double energy transient the energy is reflected back upon itself between an opposing pair of energy storages. The double energy transient is a bi-directional power flow like an alternating current.

The single energy transient can be considered a traveling wave in time, the double energy transient can be considered a standing wave in time. This is in analogy to traveling and standing waves on a transmission line. Here time is an analog of length in the movement of electric energy.

The activity of the oscillatory energy exchange is given by the product of the Electro-Motive Force,  $E$ , and the Displacement Current,  $I$ . The four quadrantal activities are thus given by

Fig, 1A,  $-EI$

Fig, 1B,  $-IE$

Fig, 1C,  $+EI$

Fig, 1D,  $+IE$ .

Each of the above activities exist in their respective quadrant in the cycle of energy exchange. It is given algebraically that

$$\begin{aligned} -EI &= -IE, \\ +EI &= +IE. \end{aligned} \quad (30)$$

No energy is gained or lost, thus the activity is identical for each quadrant in the time cycle of energy exchange. Hereby a single effective activity exists for the double energy transient in its exchange of energy between Magnetic Form and Dielectric Form. This is given as in equation (24)

$$P_o = EI, \quad \text{Volt-Amperes.} \quad (24a)$$

This is the electric activity of the oscillatory energy exchange between the Inductor and the Condenser. This is not an actual power in watts, but an electric activity in volt-amperes.

For the condition of energy transfer, the single energy transient, a pair of electrical activities exist

$$eI, \quad iE, \quad \text{Watts.}$$

Each represents the flow of power in the Dielectric, or Magnetic Energy Transfer. Here the charge time span and the discharge time span are independent time frames. An indefinite static time interval can exist between these two time frames. However, the double energy transient of oscillatory energy exchange has no possible static time interval, no possible steady state. Also the charge time span is identical to the discharge time span. One is the mirror image of the other, both of equal length in time. The two opposing energy transfers cancel out, just as do two opposing traveling waves. This leads to a stationary wave and one resultant electric activity only, that of the Cyclic Energy Exchange. No energy is gained or lost, it is confined to the oscillating system. This represents a stored alternating current and as such must possess an angular velocity of energy exchange since A.C. is a circular function. Hence it is

$$\omega = \frac{2\pi}{T}, \quad \text{Radian per Second,} \quad (31)$$

where  $T$  is the time span of one cycle of energy exchange.

This exchange is then in the form of a perpetual motion which gradually weakens due to energy leakage, that is, the losses in the metallic-dielectric geometries where the energy exchange takes place.

Power magnification in the oscillating energy transfer takes on a different form in the oscillating energy exchange. No magnification is possible between the charge and discharge portions of the cycle of energy exchange, they are equal and opposite time spans. It is however that a finite quantity of stored energy exists, and its activity is the time rate of energy exchange between magnetic and dielectric forms. A definite time cycle exists, where the transfer time,  $t_o$ , is one fourth the time span of a complete cycle of energy exchange,  $T$ . The transfer time defines the rate at which the stored energy is transferred back and forth, that is, the rate at which it is exchanged. Thus the relations for power and energy are given by

$$W_o = t_o P_o, \quad \text{Watt-Second}, \quad (32)$$

$$P_o = \frac{W_o}{t_o}, \quad \text{Watt, or Volt-Ampere}, \quad (33)$$

where  $t_o$  is one fourth period  $T$ . The Time Period,  $T$ , and thus the angular velocity of energy exchange can be derived from the Laws of Induction, these for an alternating current form.

Thus given The Law of Magnetic Induction,

$$\omega \psi = I = 2\pi \frac{\psi}{T}, \quad \text{Weber per Second}, \quad (34)$$

The Law of Dielectric Induction

$$\omega \phi = E = 2\pi \frac{\phi}{T}, \quad \text{Coulomb per Second}. \quad (35)$$

Rearranging (34) and (35) gives

$$\omega = \frac{I}{\psi}, \quad \omega = \frac{E}{\phi}, \quad \text{Radians per Second}. \quad (36)$$

And substituting the relations

$$\psi = EC, \quad \phi = IL, \quad \text{Induction}. \quad (37)$$

into the relations of (36) gives

$$\omega = \frac{I}{EC}, \quad \omega = \frac{E}{IL} \quad \text{Radians per Second}. \quad (38)$$

It is however

$$Y = \frac{I}{E}, \text{ Siemens, } Z = \frac{E}{I} \text{ Ohm.} \quad (39)$$

Thus the relations (38) become

$$\omega = \frac{Y}{C}, \quad \omega = \frac{Z}{L} \text{ Radians per Second.} \quad (40)$$

Substituting the defining ratios

$$Y = \sqrt{\frac{C}{L}}, \text{ Siemens, } Z = \sqrt{\frac{L}{C}} \text{ Ohm.} \quad (41)$$

into relations (40) gives the expressions for the angular velocity of energy exchange

$$+\omega = \frac{1}{\sqrt{LC}}, \quad -\omega = \frac{-1}{\sqrt{LC}}, \text{ Radians per Second.} \quad (42)$$

Hence

$$\omega^2 = \frac{1}{LC}, \quad (42a)$$

by definition. The expressions (42) for the angular velocity of energy exchange represent a pair of velocities, one forward in time, one reverse in time. The time period of one cycle of energy exchange is therefore given by the expression

$$T = 2\pi\sqrt{LC}, \text{ Seconds.} \quad (43)$$

And thus the time span of energy transfer is given by

$$\frac{1}{4}T = t_o = \frac{\pi}{2}\sqrt{LC}, \text{ Seconds.} \quad (44)$$

Substituting these relations into the expression for power, equation (33), where it is

$$F = \frac{1}{T}, \text{ per Second.} \quad (43a)$$

gives

$$P_o = 4W_oF, \text{ Volt-Amperes,} \quad (45)$$

where,  $F$ , is the frequency of oscillation, in cycles ( $2\pi$  radian) per second. Hence the magnification of activity for a given quantity of energy in the oscillating energy exchange is not a function of the ratio of charge to discharge times, since they are

now equal. The magnification is here given as a function of the rate of energy exchange, the Frequency of Oscillation,  $F$ , in cycles per second. The more rapid the energy exchange, the higher the frequency and thus the larger the magnitude of the resulting electric activity. Power is directly proportional to frequency.

In the above condition of energy exchange the charge time span is equal in length to the discharge time span. No charge/discharge magnification is possible. It is however that the energy storage coefficients, the Inductance  $L$ , and the Capacitance,  $C$ , can be altered between charge and discharge intervals, Fig 3. This alteration can be done in two ways. One method is to use separate inductive elements in the charge/discharge cycle. For example, an inductance can take energy from one capacitance on charge and deliver this energy to another capacitance on discharge, or alternately a capacitance can take energy from one inductance on charge and deliver this energy to another inductance on discharge. Energy exchange has now reverted to a pair of energy transfers, and an indefinite static interval. The frequency of oscillation is according different for the different charge or discharge intervals. Hence the magnification factor is given by the relation

$$-n = \frac{\omega_2}{-\omega_1}, \text{ Numeric,} \quad (46)$$

where  $\omega_1$  is the angular time rate of charge and  $\omega_2$  is the angular time rate of discharge. This magnification was utilized by Nikola Tesla for the purpose of Power Amplification with no electronic elements.

The other method of altering the charge/discharge cycles is through synchronous Parameter Variation. Rather than switching the energy storage elements, the coefficients of energy storage,  $L$ , and,  $C$ , can be made variable throughout the cycle of Alternating Energy Exchange. Hereby the capacitance can vary between charge and discharge intervals, or the inductance can vary between charge and discharge intervals, and both can be varied throughout the cycle of alternating energy exchange. The magnification factor is now a complex quantity, or versor expression. Little theoretical knowledge exists on this subject.

The relations for electric activity for differing charge and discharge frequencies are hereby the same expressions as those for single energy transfer

$$P_2 = nP_1, \text{ Volt-Ampere,} \quad (47)$$

$$P_2 - nP_1 = 0, \text{ Volt-Ampere,} \quad (48)$$

$$\frac{P_2}{\omega_2} - \frac{P_1}{\omega_1} = 0, \text{ Volt-Ampere-Second.} \quad (49)$$

Equation (49) states the Law of Energy Conservation, this for the condition of switching energy storage elements. Since the magnification factor is a complex quantity for the condition of Synchronous Parameter Variation, the Law of Energy Conservation is indeterminate. In all that has been covered thus far the Metrical Dimension of Time has been the primary consideration. Energy and Power are Products of Time. This is expressed in the relation

$$T = \frac{W}{P}, \quad \text{Joule per Watt.} \quad (50)$$

The relationship between Energy and Power is Time. The energy has been a stored energy, and the power has been the time rate of the stored energy movement.

What has not been considered thus far is the condition of an actual Direct Current, a Time Invariant Condition, nor the condition of negligible coefficients of energy storage, very insignificant values of inductance or capacitance. These are conditions of Zero Energy Storage. The dimension of time has no role in these conditions. This is the "Time Scalar" condition. Here is the fourth and final condition in the Flow of Electric Power.

In the scalar condition the transfer of energy exists with no form of energy storage, there is no charge or discharge interval. The transfer is constant. As it was in the beginning, so it shall be for now and ever more, the continuous, or Direct Current. Even with the application of an alternating current, the energy transfer is still direct, it following exactly the cycle of the applied alternating current. Hence the scalar condition is FREQUENCY INDEPENDENT, as would be expected for a time invariant condition. Thus the transfer can be instantaneous. Time does not exist in the scalar condition. The notions of constant, cyclic, or instantaneous, play no part in this condition. They can only arise from external causes.

The scalar condition is then the result of one of two distinct conditions

- 1) No time variation of the fields of induction, as with direct current,
- 2) Negligible energy storage so as not to react with time variant currents, as with transient current.

In both conditions the Electro-Motive Force,  $E$ , and the Displacement Current,  $I$ , are zero. Hence no energy exchange or transfer exists with any field of induction. Because the dimension of time in the scalar condition is indeterminate the dimensional relation of energy is also indeterminate, since energy is a product of time. It is however that power flow actually takes place as a product of the potential,  $e_o$ ,

and the current,  $i_o$ , that is,

$$P_o = e_o i_o, \text{ Watt.} \quad (51)$$

It is however

$$\frac{P_o}{W} = 0, \text{ per Second.} \quad (52)$$

This is to say that the time span is indefinite. Hence energy can only be expressed as power in the time scalar condition. Also, in the absence of an electric field of induction both  $\phi$  and  $\psi$  are non-existent, thus the product,  $Q$ , is non-existent,

$$Q = \phi\psi = 0, \text{ Planck.} \quad (53)$$

Therefore the energy is non-existent

$$\frac{Q}{T} = W = 0, \text{ Joule.} \quad (54)$$

So where then is the energy? In the scalar condition all energy is created and dissipated in the same instant, no intermediary energy exists. It is "on demand". Obviously, as with the similar situation of the disruptive discharge condition, there is always a bit of something somewhere that leads to a determinate solution, such as the connecting wires. The actual scalar condition can only exist within intermolecular dimensions.

The scalar condition can be derived by the interconnection of resistances and conductances. Resistance,  $R$ , in Ohms, and Conductance,  $G$ , in Siemens. No energy storage is possible in these elements and thus they are Time Invariant quantities. There is no energy, what ever energy is given here instantly vanishes, appearing as a source of heat. This scalar condition thus contains no electricity, it simply eliminates it. The rate at which energy is eliminated is given as a flow of power,  $P$ , in watts, this as a product of a dissipative E.M.F. and a dissipative displacement.

$-e$ , E.M.F.  $-i$ , Displacement.

Because of the scalar condition it is the E.M.F. is also the Potential, and the displacement also the current. No electric field exists. Thus the power is given by

$$P_s = ei, \text{ Watt.} \quad (55)$$

In a manner similar to the condition for oscillating energy exchange, no cross product exists between a reaction and a potential, as it is with the relation

$$P_o = EI, \text{ Volt-Ampere.} \quad (24)$$

Thus the relations exist for the scalar condition as analogs to the exchange condition. This gives

$$R_c^2 = \frac{R}{G}, \text{ Ohm per Siemens.} \quad (56a)$$

$$G_c^2 = \frac{G}{R}, \text{ Siemens per Ohm.} \quad (56b)$$

and

$$\Gamma^2 = RG, \text{ Scalar Numeric,} \quad (57)$$

where  $R_c$ , the natural resistance,  $G_c$ , the natural conductance, and  $\Gamma$ , the propagation constant.

The scalar condition can also exist for the interconnection of receptances and acceptances, receptance,  $H$ , in Ohm, and Acceptance,  $S$ , in Siemens. Here the energy is instantly produced, drawn out of the inter-molecular dimensions of the receptances and acceptances. With the resistance-conductance configuration the energy is instantly destroyed, pulled into the intermolecular dimensions of the resistances and conductances. Both are instant, no lag time is involved.

These conditions can be established with a pair of unit dry cells. This condition involves time invariant energy transfer. It is instantaneous. When a charged unit dry cell is connected with a discharged unit dry cell a constant unidirectional transfer of energy takes place. This transfer is in space, not in time. This transfer takes place from the charged dry cell to the discharge dry cell, a one way trip.

As with the prior conditions of energy movement four relations exist with regard to the flow of power. These are shown in the diagrams of Fig 4. Hence the four relations

Fig, 4A,  $-ei$ , watts

Fig, 4B,  $-ie$ , watts

Fig, 4C,  $+ei$ , watts

Fig, 4D,  $+ie$ , watts.

and algebraically it is given

$$\begin{aligned} -ei &= -ie, \text{ Watts,} \\ +ei &= +ie, \text{ Watts.} \end{aligned} \quad (58)$$

The transfer of energy and thus the flow of power is bi-directional, any dry cell can charge any other dry cell, that is,  $-ei$  &  $+ei$ , and hereby the flow of power is given as

$$h^N P_s = \pm ei, \text{ Watts.} \quad (59)$$

In the scalar condition there is no electrical activity because of the time invariant nature of this condition. Likewise, in the exchange condition there is no electrical power because of the time variant nature of this condition. One is NOT the other. Thus the relations are

$$EI = P_o, \text{ Volt-Amperes, } ei = P_s, \text{ Watts.} \quad (60)$$

Both are real quantities and thus algebraically additive. The volt-amperes represents the complete storage of energy with no leakage whereas the watts represents the complete absence of energy storage with the complete leakage of energy. Here "leakage" is defined as leakage into, or out of, the metallic-dielectric geometry. Here in final form are thus the four distinct conditions for the flow of power in an electrical configuration: 0) The Scalar, or Anti-Electric, Product;

$$ei = P_s, \text{ Watt.} \quad (61)$$

1) The Forward Cross, or Magnetic, Product;

$$Ei = P_m, \text{ Joule per Second.} \quad (62)$$

2) The Axial, or Magneto-Dielectric, Product

$$EI = P_o, \text{ Volt-Ampere.} \quad (63)$$

3) The Reverse Cross, or Dielectric, Product

$$Ie = P_d, \text{ Joule per Second.} \quad (64)$$

Hereby the Heaviside Expression for the Movement of Energy as a flow of power can be assembled, giving the general form as

$$\begin{aligned} \dot{P} &= (k^0 P_s + k^2 P_o) + (k^1 P_m + k^3 P_d), \\ \dot{P} &= h^N P_a + j^N P_b, \text{ Versor Watt.} \end{aligned} \quad (65)$$

The apparent power flow is given as the square root of the sum of the squares

$$P = \sqrt{P_a^2 + P_b^2}, \text{ Watt,} \quad (66)$$

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where  $P_a = (P_s + h^N P_o)$ ,  $P_b = (P_m + h^N P_d)$ , watt. The versor operators are tentative, however they can be derived from “ Symbolic Representation of The Generalized Electric Wave ”, E.P. Dollard. One such versor form is given as

$$k_N^s = jh = -1^{1/4}, \text{ Versor,} \quad (67)$$

$$k = jh, \text{ Versor.} \quad (67a)$$

The Three Fundamental Factors can now be derived for the electrical configuration, utilizing equations (65) and (67), hence given are

$$a = \frac{P_a}{P}, \text{ Power Factor, percent,} \quad (68a)$$

$$b = \frac{P_b}{P}, \text{ Induction Factor, percent,} \quad (68b)$$

$$n = \frac{P_b}{P_a}, \text{ Magnification Factor, Numeric,} \quad (68c)$$

where it is

$$n = \frac{b}{a}, \text{ Numeric.}$$

For the condition of equation (66) it is a circular function and

$$a^2 + b^2 = 1, \text{ Unity.} \quad (69)$$

and the general versor expression is given as

$$\gamma = a + jb, \text{ Versor.} \quad (70)$$

Taking equation (66) as

$$P = \sqrt{P_a^2 - P_b^2}, \text{ Watt,} \quad (66a)$$

as the condition of a hyperbolic function gives the relation

$$a^2 - b^2 = 1, \text{ Unity,} \quad (71)$$

and the general versor expression is given as

$$\gamma = a + hb, \text{ Versor,} \quad (72)$$

it can be seen that each quadrant is in itself another four quadrant relation. One relation is compounded with another. The versors are inordinately complex, back to the J. S. Bach. These relations given are found in “ The POWER of Music, Alexander 's Feast ”, by G.F. Handel, The Final Choral Movement. Consider this required listening.

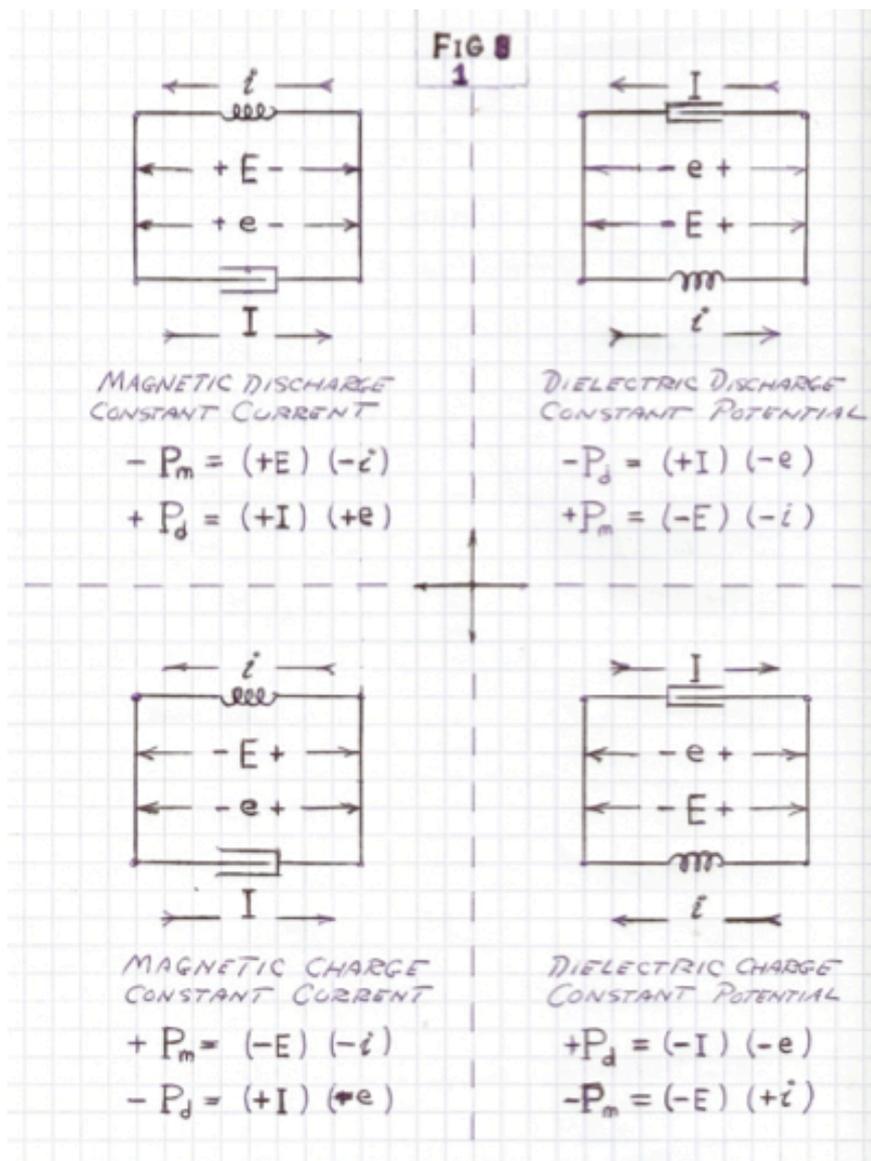


Figure 5.8: The Magnetic and Dielectric Discharge and Charge Constant Currents.

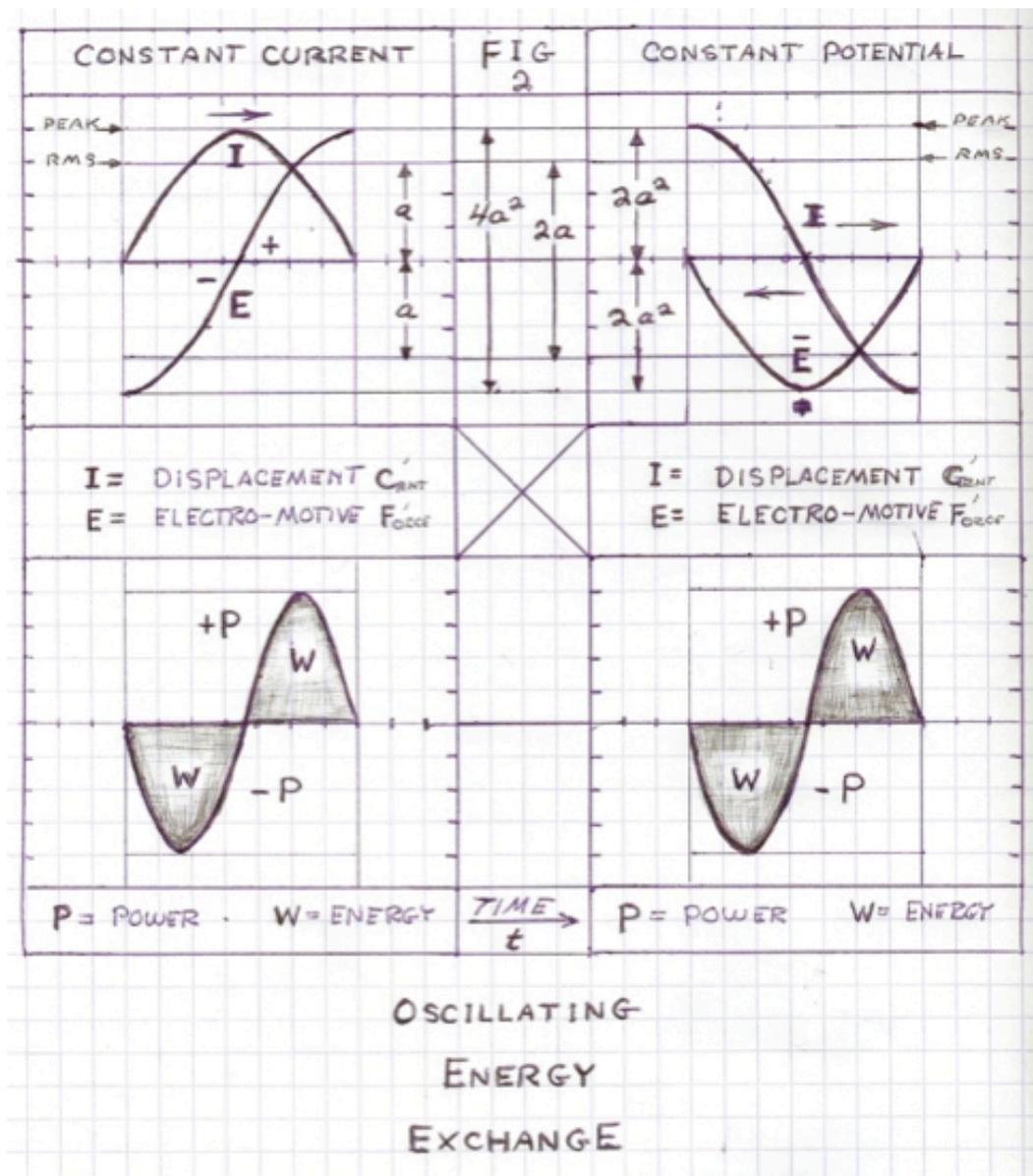


Figure 5.9: Oscillating Energy Exchange.

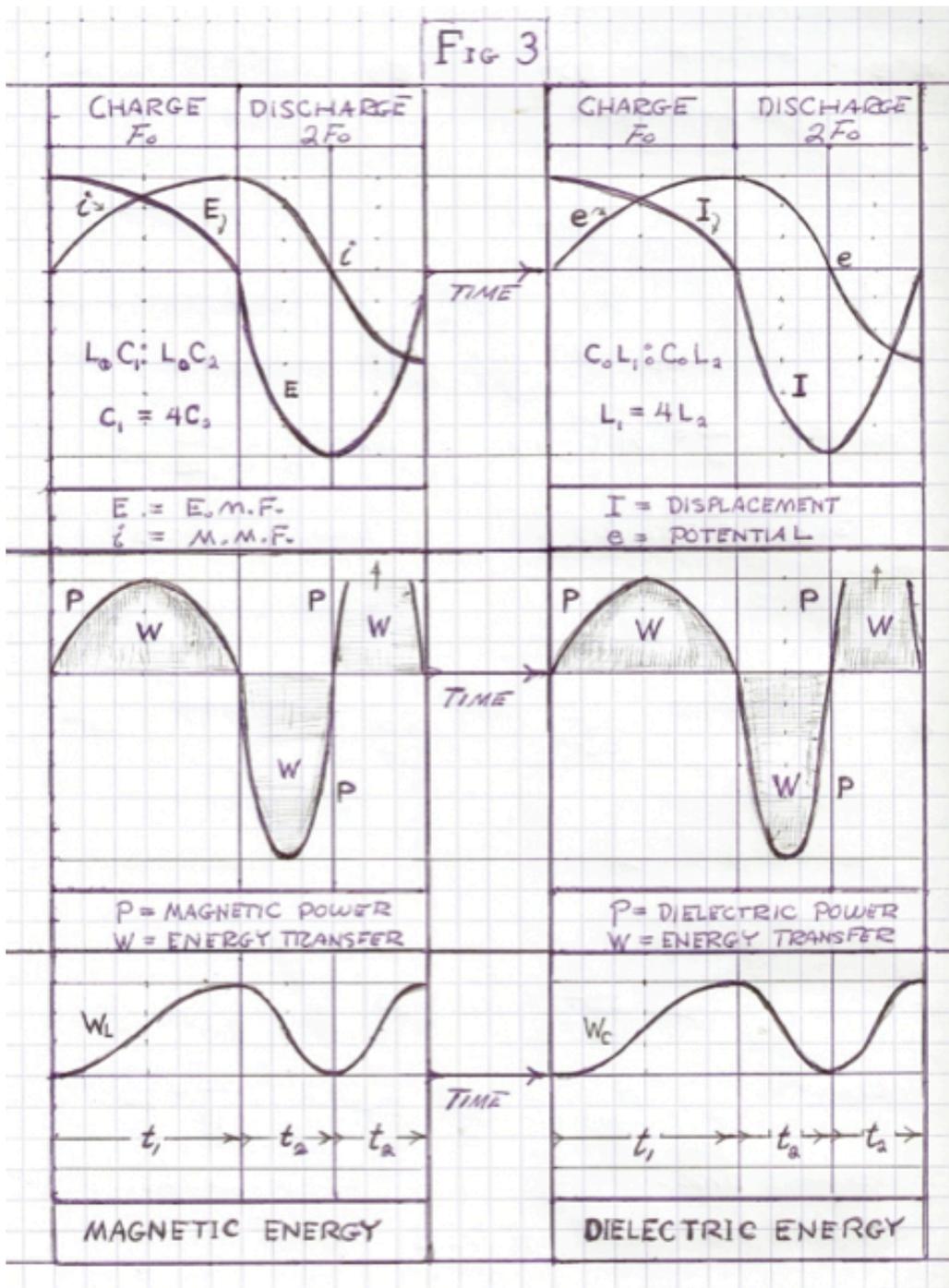


Figure 5.10: Oscillating Energy Exchange.

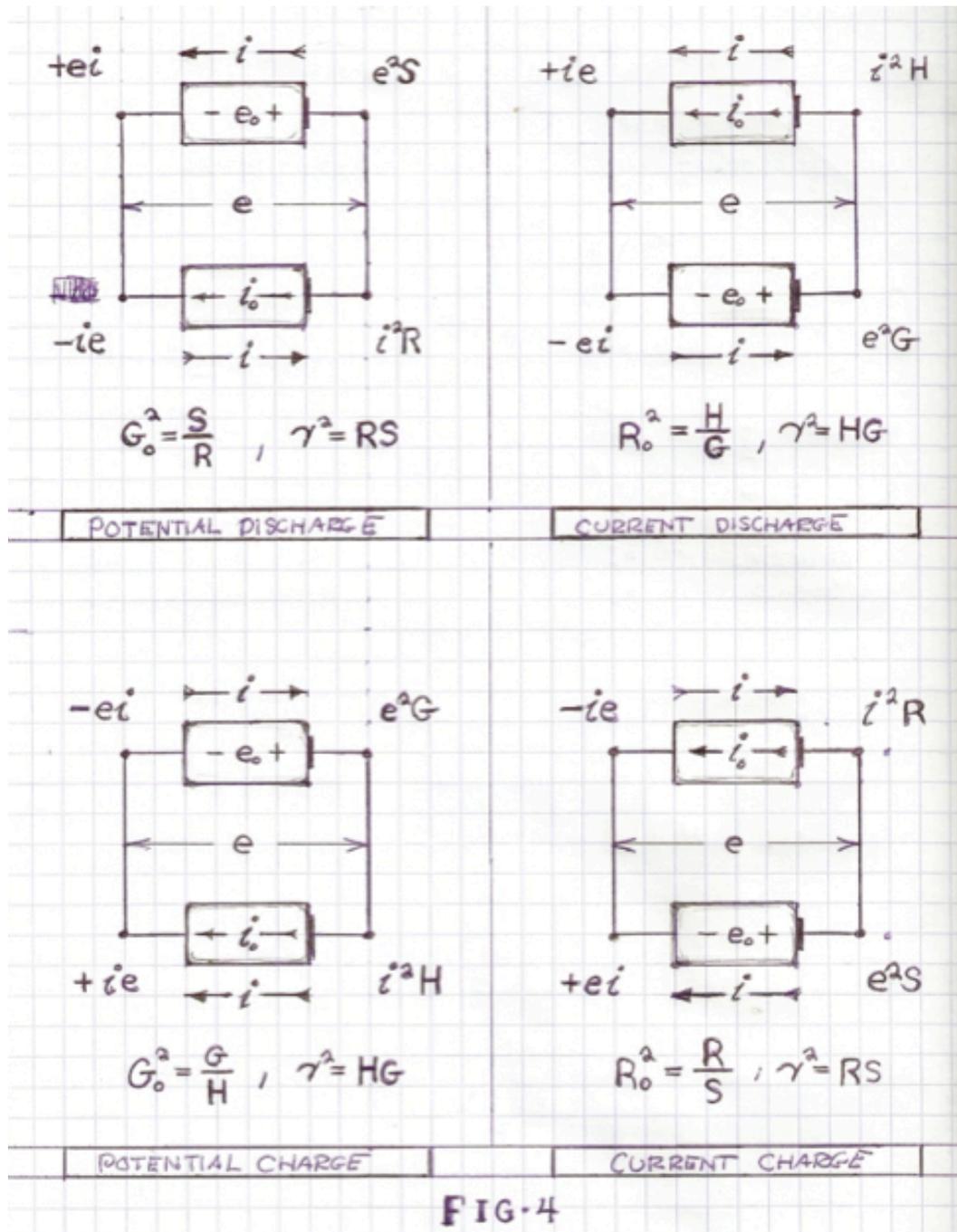


Figure 5.11: Oscillating Energy Exchange.

# Chapter 6

## The Theory of Anti-Relativity

### 6.1 Back to Space, or Why One Over $c^2$

In order to obtain a more comprehensive understanding of the dimensional relations of the magnetic inductance, and the electro-static capacitance it is necessary to turn again to the metrical dimension of space. It is, however, this dimension of space has become warped, as expressed in a N.F.G. It is in what follows found that the Faraday understanding is in direct conflict with the Einstein understanding, the latter extinguishing the former. Lines of induction have given way to relativistic concepts, fact has succumbed to phantasy. This condition has a direct influence upon the conceptual understanding of the conditions and dimensions that give rise to electrical inductivity as expressed by the coefficients of magnetic and dielectric fields known as "the inductance" and "the capacitance".

The concept of space, as given by Albert Einstein, constitutes a serious impediment to the understanding of this metrical dimension. The salient constituent of the Einstein "Theory of Relativity" is the Minkowski "Four-Space". To quote Einstein "With out it the General Theory of Relativity, etc., would of perhaps got no farther than its long cloths," "Relativity" by Albert Einstein, Institute for Advanced Study, Princeton, New Jersey. Minkowski proposed a fourth coordinate be compounded upon the three coordinate (cubic) set of Descartes, "Cartesian" third order space. Einstein here accordingly represents this fourth order space in "Gaussian" rather that "Cartesian" coordinates.

The fourth coordinate, or length, of space is derived as

(1) Velocity - Time

Since it is dimensionally

(2) Velocity, or Space per Time

Substituting (2) into (1) gives

(3) Space - Time per Time or Space - Numeric.

Here derived is a fictitious space coordinate, a length, this given as a light second. Hence

(4) Centimeter - Second per Second, or Centimeter And

(5) Second per Second, or Numeric.

Minkowski affixes a versor operator, the square root of negative one, to this numeric. It has been shown that this versor can possess two distinct values, and hence two distinct versor positions in time. Taking the light second as  $ct$ , where  $c$  is the luminal velocity, and  $t$  is the time period, the versor gives the pair

(A) Positive  $jct$ , Light - Seconds

(B) Negative  $jct$ , Light - Seconds

This quadrature form implies four distinct time frames, however, Einstein ignores the versor positions, retaining only one,  $jct$ . Einstein - Minkowski represents this as an ill-conceived space versor.

Einstein remarks here "Time is robbed of its independence". Now time is married to the velocity of light. Minkowski goes on to say, "Hence forth space by itself and time by itself are doomed". All are relative to the velocity of light. This is "The Theory of Relativity."

Here any development of a mathematics of space comes to a standstill. Space now is just a factor of the velocity of light. It is instructive to reflect here upon the history of one over the speed of light square. The dimensional relation is

(6) Constant, or Second Square per Centimeter Square

One over  $c$  square finds an origin in the work of James Clerk Maxwell, 1831 to 1879. Maxwell was a Scottish born natural philosopher. His work follows the trail of Ben Franklin and Michael Faraday, through the mathematics of Newton - Leibnitz. Here arose the "Faraday - Maxwell" theory of electricity, the foundation of electrical understanding. But does anyone understand it? I think not.

Maxwell, in his studies, had determined the existence of a distinct factor of proportionality, this factor expressing a ratio of mechanical force exerted upon physical matter through dielectric actions, to mechanical force exerted upon physical matter through magnetic actions. This of course relates directly to our principle question at hand for the quantum mechanics; the condition of equal and opposite forces between dielectricity and magnetism. No answer yet.

It may be noted that Maxwell's determination of this "proportionality factor" gave rise to a NUMERIC value of one over  $c$  square. It is a faulty inference to assume this factor is an actual velocity, or is the dimensional relation of a velocity at all. Here given it is numeric. In the comparisons of optics and electrodynamics it is found that a dielectric has the following characteristics;

(1) Refractive Index

(2) Dielectric Inductivity

(3) Luminal Velocity

All three of these relations are exactly related to the velocity of light. But here again is one over  $c$  square and actual velocity?

Maxwell's discovery of a factor of proportionality between dielectricity and magnetism led to his theory of conjugate pair of inductions, dielectric and magnetic, in union, propagating at the velocity of light through the "Luminiferous Aether". Hence, electro-magnetic waves in free space, unbounded by gross physical matter, mass free energy. This propagation is within the dielectric, or aetheric, medium itself. It is free of so-called "charge carriers" (electrons), a mass-less form of electricity. This concept had a very powerful impact upon the scientific and philosophical thoughts of Maxwell's era. So here begins the notion of "wireless", the transmission of electricity without wires or other guiding structures.

Leading up to the work of Heinrich Hertz, 1857 to 1894, the wireless transmission of electricity had found experimental verification by Joseph Henry, and Elihu Thompson. It even was patented by M. Loomis. See "Secrets of Cold War Technology" by Jerry Vasillatos. These examples however were no electro-magnetic,

they were electro-static (dielectric). Heinrich Hertz provided the first complete laboratory demonstration of the transmission of electricity through "free space", (across the room). This was instantly considered proof of the Maxwell theory of electro-magnetism, and electro-magnetic waves. When Nikola Tesla engaged in the experiments of Hertz, he found these waves not to be completely electro-magnetic. The early death of Hertz prevented any further progress. However "the world view" kept hold of its belief that "Hertzian" waves are only transverse E. M. waves, the two distinctions now synonymous.

When Nikola Tesla undertook the development of his unique transmission transformers, he soon found the velocity of light had no relation here. In his "Colorado Springs Notes" experiment and calculation demonstrate that the propagation on his "extra coil" tends toward 180 percent luminal velocity. See "Theory of Wireless Power", by E. P. Dollard. It is found that the extra coil propagation is not even in the dimension of velocity at all. See "Transmission and Reception of Telluric Electric Waves", by E. P. Dollard. The one over  $c$  square is not applicable to the efforts of Nikola Tesla. Tesla is not equal to one over  $c$  square.

In the writings of J. J. Thompson it is found he considered dielectric propagation and magnetic propagation can be independent. Also considered is that the magnetism is a secondary response to dielectric forces. This is also found in the writings of C. P. Steinmentz, "Transients in Space", page 394 to 419, from "Theory and Calculation of Transient Electric Phenomena". Here considered is a "Hysteresis of the Aether", given as an alternative to the concept of electro-magnetic radiation. In this chapter the velocity of the dielectric induction and the velocity of magnetic induction are given as independent variables. The factor one over  $c$  squared is here only a dimensional transform between inductance and capacitance. See The International Tesla Society lecture on the "Hysteresis of the Aether" by E. P. Dollard. Here again one over  $c$  squared is only a proportionality factor, not a velocity.

Finally, it has been disclosed by insiders within the space program, N.A.S.A., of a "certain complication". It was found that when far outside the Earth's field of influence the stars and sun are NOT VISIBLE! However, the Earth and the Moon are plainly visible. No direct light in outer space, only that made visible by gross physical matter. This gives rise to an important question, does the "light" from the sun propagate with a velocity at all, or is it simply a function of time. The "time delay" may be no more than a hysteresis of the luminiferous aether.

It should be noted it is only by the time delay that we can consider velocity in many situations. Otherwise also needed is the wavelength. Is it the primary luminal induction, say from the Sun, a hysteresis in order to engender visible light

on Earth? Now we are dug in deep!

So, what meaning do we attribute to one over  $c$  square? It is a velocity, an index, a ratio, a proportionality factor, and even a constituent of the Farad. It is in everything, and now we hang Einstein's Theory of Relativity on top of it all. Such is one over  $c$  square.

In order to make a determination on this matter of one over  $c$  square it is instructive to enter the One Wing Parrot itself. We will take the position of Dorthey, who must conquer the Wicked Witch of the West, (WWW). Now she must stand, with her poodle and some unlikely friends from Lone Pine, before the great Wizard of Oz. Dorthey simply wants to go back to Kansas, and so do we. Here we must meet face to face with Einstein and the Theory of Relativity. In order to become better acquainted with the development of Relativity refer to E. Whittaker, "History of the Theories of the Aether". Here follows only the salient features of Relativity as expressed by Albert Einstein. The primary purpose here is how Relativity relates to Electrical Engineering through the concepts of Inductance and Capacitance.

Einstein's theory finds its seed in a certain speed of light dilemma and the related experiments of Fitzerau involving moving liquid dielectrics ( $10 - C$  oil). Consider a pair of red lasers in a setup like the cubic experiments given earlier. Two red lasers, side by side, distant from each other, again are utilized. Each individual beam is received by its own individual target. Here the measurements are made. One laser is stationary, the other laser is moving towards its target at 50 percent luminal velocity,  $c$ . It is of course found that the beam sent by the stationary laser arrives at its target with a lag in time (hysteresis) that corresponds to the delay involved in luminal propagation through the span between the laser and its target. The moving laser beam also arrives at its target with a lag in time, but not that of 150 percent luminal velocity as given by the superposition of velocities. It arrives with the same delay as that due to luminal velocity through the span between the laser and its target. Hence the law of superposition is now not applicable to luminal velocity, no matter what the velocity of the moving laser, the velocity of the beam is always  $c$ . This situation provides the cornerstone upon which lay the Einstein concept of Relativity.

It is however that Einstein may have left out a few details. The stationary laser puts a red spot on its target. It is a red laser, just like the moving laser. They are both red, big deal. But wait Mr. Wizard, Look! Look! The spot on the moving laser's target is GREEN!

## 6.2 The Theory of Relativity, or Why One Over $c^2$

So, how are you going to explain to the cops that the light was green when it is in reality red? Will you tell them "its all relative"? They say "you were going too fast." The light looks green because of the "Doppler Effect". This is a situation where the wavelength of light shortens and the frequency increases, maintaining a constant velocity. The moving laser is traveling with a velocity 50 percent that of light, the wavelength shortens by the square root of 50 percent, the frequency increases by the square root of 50 percent. Hence red light is forced to become green light. The speed of this light is still luminal velocity,  $c$ .

The dimensional relation is given by

(1) Velocity, or Length - Frequency

This velocity is a constant or invariant. Any variation in condition is factored into, the length of the wave, and the cyclic rate of the frequency, each in a complimentary manner so as to maintain a constant velocity. Here given is

(2) Space, or Length in Centimeters,

(3) Time, or Per Frequency, in Seconds,

(4) Velocity, or Space Per Time, in Centimeter Per Second.

Thus the Doppler Effect shortens the wave length, and also shortens the time period, as given by the frequency. Because luminal velocity is the ratio of length to time, and both length and time both shorten in exact proportion to each other, the change cancels and the velocity remains a constant. In other words if the transmitting laser is in motion at a percent velocity of light, being 100 at luminal velocity, it is the length contracts by the square root of this percentage of luminal velocity, and the time period contracts by the square root of this percentage of luminal velocity. And obviously the product of a pair of square roots is the square of the square root, or the percentage of luminal velocity.

The basic dimensional relation

(5) Length times Frequency Equals the constant

$\lambda$  times  $F$  gives  $c$ . This is a most fundamental law of radio engineering, where the constant  $c$  is 300 mega-cycle - meters per second.

Relativity results from the following situation. Riding with the laser, it moving 50 percent luminal velocity, you see it as red. It has a red wavelength and a red frequency. The stationary observer sees it as green. It is a green wavelength and a green frequency. Relative to the stationary observer, you riding the moving laser see length as longer, (red vs. green), and time as slower, (red vs. green) Einstein's Relativity tells us the stationary observer sees length as shorter, (green vs. red) and time as faster relative to the motional observer, (green vs. red). Experiment shows that the light beam changes in its dimensional relations, Einstein says the motional observer changes in it's dimensional relations. What can we make of this discrepancy?

The velocity at which light propagates, the luminal velocity,  $c$ , is a property of the dielectric itself, be it aether, or 10 – C oil. This velocity has no relation to the motion of the transmitter itself, nor are its transmitted waves material projections. Nothing is "shot" out of the moving laser. The electric field can only "soak into the medium" at the rate defined by that medium. Light can only travel at luminal velocity as defined by the dielectric medium and its dimensional relation of one over  $c$  square, a numeric constant. Light is not a material projection, it is an inductive process, a process of the aether.

Is it now Einstein is in basic conflict with the radio engineer? What would the F.C.C. say? Einstein is also in conflict with Ohms Law. It has been shown by Thornberg, a critic of relativity, in his paper, "Real, or Imaginary Space - Time" that electro-magnetic relations derived through relativistic concepts are in conflict with Ohm's Law. This is, dimensionally, canceling the per centimeter.

(6) Ampere, equals Ampere plus Volt

Apples plus oranges, ampere and volt are different dimensional relations, hence they are NOT additive. But anything seems possible with Einstein's Theory of Relativity. The proper form is

(7) Volt per Ampere, or Ohm

Thus referring to (6) it is

(8) Ampere equals Ampere plus Volt per Ohm

This is Ohm's Law. What are we to make of this, have we been duped?

As seen thus far, the factor one over  $c$  squared looks as if it represents some kind of "Universal Virtue", it finding a way into a multitude of dimensional relations. One over  $c$  square becomes a "Vestige of God", transcendent from mortal scrutiny, except through the prophet Einstein. It is a seed from which to spout a religion. Through the effort of Albert Einstein luminal velocity and the "Theory of Relativity" has in a way engendered a spiritual foundation for "Today's Society". "Hey bro, its all relative, man, so..."<sup>1</sup>. To question Albert Einstein can even be considered "Anti-Semitic", hence it will be enforced.

However, Einstein is a false prophet. The Theory of Relativity as the "Holy Scripture" is like a tele-evangelistic sales pitch. Nikola Tesla regarded Relativity as the greatest historical aberration of scientific thought. Relativity is no more than a philosophical standpoint, a virus to infect a "New Age".

From the standpoint of the electrical engineer Einstein's Relativity is "Bravo-Sierra"! However, it has sunk its roots into the basic consideration of Inductance and Capacitance.  $L$  and  $C$  represent coefficients of aetheric processes, and as such represent the aether, not Relativity. Albert Einstein stands in the way of Michael Faraday, and Pharisees are now Physicists.

A basic theory of Relativity was put forth by Charles Proteus Steinmetz, the "Wizard of Schenectady". His Relativity was for use by the electrical engineer. Hereby results a great simplification when calculating transient waves on electromagnetic transmission lines. This theory finds development in his "Theory and Calculation of Transient Electric Phenomena and Oscillation," the section "Transients in Space and Time". Steinmetz refers to this as "Velocity Measure". See his "Impulses, Waves and Discharges", page 91 to 93.

In complex transmission line calculation the exponential operators, as derived from the factors of the Heaviside Telegraph Equation, are expressed in both time dimensional and space dimensional relations, it is like apples and oranges, they are not additive thus cannot be combined directly into a single unified exponential operator. Analogous is the E.M.F.,  $E$ , in Volts, a time derivative, and the dielectric gradient,  $d$ , in volts per centimeter, a space derivative. The two are not directly additive.

These complications render the general solution for the Telegraph very complex, if not impossible. In fact as of yet no general solution has been developed at all! In order to overcome this problem, Steinmetz utilized the condition that one over  $c$  square is an intrinsic property of electro-magnetic transmission lines.

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<sup>1</sup>Now the Lawyer is a Priest!

This is to say, the ratio of the space factors is a constant, the velocity of light. The metrical dimensions of space and time are unified through this constant,  $c$ , and the exponential operators are now directly additive.

Steinmetz here transforms all space dimension relations of distance along the transmission line from centimeters to LIGHT - SECONDS. The Light - Year is an equivalent metrical relation. This is given as

(9) Centimeters, or Centimeter - Second per Second,

or, in the form of

(10) Velocity - Second, or Centimeter

Hence, the space dimension of distance, in centimeters, has been replaced by the product of Luminal Velocity,  $c$ , in centimeters per second, and the Time,  $t$ , in seconds, or light - seconds,  $ct$ , in a manner like Minkowski. Space factors and time factors are rendered additive through velocity measure. This methodology allowed Steinmetz to discover previously unknown transient waves on transmission systems. Here given is the Steinmetz Theory of Relativity, a basic, easy to understand engineering tool. Late in his life C. P. Steinmetz wrote an entire book on his view of a General Theory of Relativity.

It should be noted that the Relativity of Steinmetz, and its velocity measure, is only useful in a Transverse Electro-magnetic situation. This is such in an E.M. transmission line as found in power and telephone work. Here all propagation is in terms of the factor one over  $c$  square. For situations involving transformer windings, or the networks utilized by the transmission systems of N. Tesla, E.F.W. Alexanderson, or even G. Marconi, this system of Relativity is not applicable. Propagation in these configurations cannot be represented by one over  $c$  square, nor any velocity at all. See the "Transmission and Reception of Telluric Electric Waves", by E. P. Dollard.

The mathematical work of C. P. Steinmetz follows a basic engineer's path as originated by Oliver Heaviside. It also is primarily directed into the dimension of time, little is given on the dimension of space, other than in a relation involving a propagation velocity, or for the determination of inductance and capacitance. Steinmetz methods fall short when propagation in transformer windings are involved. Here one must turn to the later efforts of L. V. Bewly, in "Traveling Waves on Transmission Systems".

It is, in the transmission systems here discussed, the inductive fields of elec-

tricity are not involved in a motional metallic - dielectric geometry. That is to say, the inductors and the capacitors are stationary in space. However these have been given in a condition of relative motion internally, as with parameter variation. Here the inductive fields of induction are CLOSED within the metallic - dielectric geometry, which in its self is stationary in space.

The theory of relativity as expressed by Einstein involves a condition where the inductors and capacitors, along with their magnetic and dielectric fields respectively, are forcibly moved about in space. Here the electric induction is made to move at a velocity other than that of its natural velocity. The writings of J. J. Thomson deal extensively with this condition but Einstein makes no reference to this important work. With Einstein's Relativity the electricity is forced into a motion beyond its own force of movement.

An example is a common bar magnet, engendering an extensive magnetic field of induction. When the magnet is at rest its magnetic lines of force exhibit only internal aetheric motions, outside this they are stationary. However, if this magnet is forced into motion, the magnetic lines of force react to this force of motion. This is a reactive force, much like the E.M.F. As with the E.M.F. or the brakes on a car, this reactive force only manifests during a change in velocity with respect to time.

(11) Velocity per Second, or Acceleration,

or

(12) Centimeter per Second Square

If the velocity remains constant the reactive force is zero. This is to say, if the magnet is moving at a uniform velocity, as well as its inductive field, no forces are developed. However, the energy consumed by this motional accelerative force upon the magnet is partly given to the momentum of the mass of the magnet and partly to a stored energy in the magnetic field. Now a condition exists where a magnetic field has an apparent mechanical momentum, just as does the physical mass of the magnet. Hence the total momentum is greater than if the body of the magnet was not magnetized. One may wrongly infer the physical body gains mass in proportion to the energy of momentum. In actuality, it is stored by the magnetic field of induction. The Einsteinian concept is that the magnet gets "heavier", as the magnet moves faster, ignoring the electrical momentum. This is faulty reasoning from the standpoint of the Faraday - Thomson understanding of electric

induction. It is considered that this inertial, or reactive force, gains a considerable magnitude, as well as the quantity of stored energy, this when the velocity of the magnet nears luminal velocity. If the motional velocity is equal to the luminal velocity, the magnitude of the line of force, and the quantity of the stored energy is infinite. Here represented is the so called "limiting velocity of the speed of light, the axiom of Einstein's Theory of Relativity. The bar magnet is considered to "gain mass" in a certain proportion to the velocity of the magnet, becoming infinite at luminal velocity. Hence, nothing can go faster than light, or even as fast for that matter. Very simple idea, but founded upon a faulty inference when considered electrically.

Oliver Heaviside wrote quite extensively on the subject of the motional electric field, but this is ignored. He may as well have not even written it. No wonder he painted his fingernails pink! One fact unmentioned here with regard to the relativistic theory is the bar magnet carries with it a magnetic field of induction, where as, in general physical mass does not. Is it then a limiting velocity condition for "un-charged" matter? Or is it all matter carries some amount of electric induction, which gives rise to a limiting velocity? To consider the gross physical mass as an increase with its physical velocity, ignoring the momentum of the electric field, seems absurd. Here lay the lack of watertight integrity in the Titanic of Einstein's Relativity. See page 22 to 24, "Electricity and Matter", J. J. Thompson, and "Occult Aether Physics", by W. Lyne.

### **6.3 Electricity, Atomic Science, and Relativity**

It has been developed thus far the general meaning of the concept One Over  $c$  Squared. Hence a broader understanding of what is meant by the "speed of light" has been obtained. The factor,  $c$ , is best not considered a velocity, it is a proportionality ratio of time and space. By virtue of  $c$  being a ratio it is dimensionally equivalent to a velocity, but  $c$  should not be considered a velocity in and of itself.

Also given has been that light should not be considered a material projection, it is not, light is not the "Cereal Shot From Guns". It has a propagation of the medium itself. For a motional transmitter, the so called "Doppler Effect" maintains the energy balance, raising the frequency in proportion to the motional velocity of the transmitter. The wavelength accordingly gets shorter. Thus the luminal velocity of the transmitted wave is always  $c$ , a constant. The concept of "hysteresis, or velocity," was touched upon.

Finally, it was given through the Faraday - Thompson concepts, that the me-

chanical momentum and the electrical momentum are two distinct forms of energy storage. This obviates any so called "Mass - Energy Equivalency," no  $E$  equals  $mc^2$ . It is in reality, not relativity, the momentum of the electric field itself that grows asymptotically in magnitude when the physical velocity nears luminal velocity. These ideas are based upon the very foundation of Electrical Theory. This is shown in "Electricity and Matter". Albert Einstein ignores these concepts in his Theory of Relativity, they just do not exist. This is given in "Occult Aether Physics". Einstein has substituted a form of mysticism to replace logical reasoning, he is a mystic.

Reviewing the writings of J. J. Thompson, Atomic Science is here seen to emerge in its infant form. Concepts now considered the realm of Albert Einstein, in actuality were those of J. J. Thompson. For example, in his book "Electricity and Matter", the idea of the Planck, a quantity of induction, is given, quote from page 63;

"The Faraday tubes stretching through the Aether cannot be regarded as entirely filling it. They are rather to be looked upon as discrete threads embedded in a continuous Aether, giving to the latter a fibrous structure; but if this is the case, then on this the view we have taken of a wave of light the wave itself must have a structure, and the front of the wave, instead of being, as it were, uniformly illuminated, will be represented by a series of bright specks corresponding to the places where the Faraday tubes cut the front."

Hence the Planck,  $Q$ . Here Thompson gives its size as that of a unit Faraday Tube, this being one Coulomb. So, how big is a Planck?

In his "Electricity and Matter" J. J. Thompson establishes the concept of Atomic Energy, predating Einstein by a decade. To quote, from page 111;

"Let us take the case of the Hydrogen atom for which  $n$  equals 1000, ( $n$  is the number of Faraday tubes, or electronic corpuscles), and take for a the value usually assumed in the kinetic theory of gases for the radius of the atom, i.e.,  $10^{-8}$  centimeter. Then the energy is 1.02 time  $10^{19}$  ergs; this amount of energy would be sufficient to lift a million tons through a height exceeding one hundred yards."

Here J. J. Thompson gives not only a dimensional relation for Atomic Energy, but establishes the size of the Planck via the tubes of induction within the Hydrogen

atom. Thompson gives 1000 corpuscles, we say one electron. Hereby given is a dielectric induction,  $\psi$ , in Coulomb, of 1000 lines per electron. The Planck can now be quantified. How is it that Einstein ignores all of this information in his Theory of Relativity?

In order to better understand the Einstein concept of "Relativity" certain concepts must be given;

- (1) Galilean Transformation
- (2) Lorentz Transformation
- (3) Minkowski Space - Time

These subjects are normally out of the realm of Electrical Engineering. In brief, the Galilean Transform affixes a point of reference in space from which to observe motions in that space. Nothing is attributed to space itself. Here derived is the concept that the Earth is not the center of the Universe, it only appears so when moving with the Earth. When the system of coordinates for observation is "Transformed" from those of the Earth to those of the Sun, the Sun now appears the center of the universe. This transformation process can be carried, stage by stage, until a coordinate system at universal rest is reached, the "Cosmic Ground". Nikola Tesla achieved this through electrical means. Einstein's Relativity says this is not possible, no Cosmic Ground can be found. Everything is relative, and must be so.

Einstein replaces the idea of a Galilean Transform with that of the Lorentz Transform. The Lorentz Transformation is in some ways like the Doppler effect, it is a numeric factor by which the impedance to motion increases asymptotically as the motional velocity nears luminal velocity. It is given by the relation,

- (1) One minus the ratio of the velocity square to  $c^2$

Denoting this relation as the factor  $\gamma^2$ , this is the difference of  $\alpha^2$  and  $\beta^2$ , it is given by

- (2)  $\gamma^2$  or  $\alpha^2 - \beta^2$

Here  $\alpha$  equals one, and  $\beta$  is defined as the ratio of motional velocity,  $v$ , and the Luminal Velocity,  $c$ . Hence relation (2) represents that of a hyperbola. Hereby  $\gamma^2$  is

(3) One squared minus  $v$  squared over  $c$  squared ( $1^2 - \frac{v^2}{c^2}$ )

The Lorentz transform is then defined as one over  $\gamma$ , and it is unity for zero motional velocity, and is infinite for a motional velocity of the speed of light. Hence the impedance to physical motion is infinite at a velocity of  $c$ , via relativistic reasoning. However is it that this is only valid for charged particles and not gross physical matter?

Because the Lorentz transform is the square root of a hyperbolic function, it can be inferred here by the existence of another "so called Universe" where a particle cannot slow down to the speed of light. Hence a pair of conditions exist here. One group of particles cannot be accelerated up to the speed of light, and a conjugate group of particles cannot be de-accelerated down to the speed of light. Wow Mr. Wizard, Einstein never told us that!

Minkowski space - time has already been discussed, but in review, Cartesian third order space is made Minkowski fourth order space by the addition of a fictitious coordinate, or length, derived as a light - second,  $ct$ . To be "cool" Minkowski affixes a versor operator, the square root of minus one, to this fictional length. Gaussian coordinates are utilized.

Combining terms from the versor hyperbolic function of the Lorentz transform to the terms of the Minkowski four - space produces a resultant 16 coordinates, (or wrongly dimensions). Consider the versor operator on the fourth coordinate, or light - second, here exists four distinct "space - time continuums" in two quadrature time frames, all this with the velocity of light as a common pole. This has now become in-ordinately overcomplicated, but through the lawyer style skill of the Einsteinian Physicists all terms are erased that do not fit the chosen idea. It may be inferred that A. Einstein was not much of a mathematician, and by ignoring J. J. Thompson he was not much of a scientist. Not a mathematician, not a scientist, not an engineer, so just what was Albert Einstein anyway? He was a Mystic.

Basic electrical knowledge is based upon the theories known as "Faraday - Maxwell". Out of this basic "arch-form" have grown the

- (1) Maxwell - Thompson Theory
- (2) Maxwell - Heaviside Theory
- (3) Maxwell - Lorentz Theory
- (4) Maxwell - Einstein Theory

It is that Maxwell has many interpreters, but where is Maxwell's words? This is

much like Christianity. Many religions, many churches, but no Jesus. Jesus is not a welcome guest in any church, nor is Maxwell. Here given is an intrinsic property of Human Society. It is written, it is invariably terminal, Jesus at age 33.

In the advancement of electrical engineering theory C. P. Steinmetz dropped Maxwell all together. Hereby Steinmetz developed his important transformer equations, the very foundation of transformer theory. The first vestige of a theory on longitudinal electric waves is seen here. Steinmetz primarily directed his efforts to the metrical dimension of time, using ideas and terms finding their origin in Oliver Heaviside. The dimension of space is primarily treated only in terms of a velocity, that is, as space - time. In his development of the Faraday concepts and inductance & capacitance the dimension of space is considered on its own, but to a limited extent. It seems that we just simply cannot separate space from the velocity of light.

## 6.4 The Lamare Longitudinal Transmission Experiment

I received Lamare's package of material, very good to see the activity it has roused. I am not sure as to how the spherical antenna is made, nor the field patterns it engenders so I can offer no comment.

Plenty of N.F.G. here in Lone Pine. Here N.F.G. for me was the Annenburg Foundation of Los Angeles. Useless Einsteiners. Same story, Oh yes I will help you, let me store your driveshaft, it will be fine. Then it all vanished. Duped again. Further, oriental mysticism blocks my writing on forum!

I fail to understand why what I have shown repeatedly through experiment and theory just seems to fly over everyone's head. I use no more than high school science and math. The impediment can only be attributed to a pathological mysticism, or mental retardation. While the latter is intrinsic, the former is induced. Is it no surprise that the only man in Lone Pine who gets what I am saying is a truck driver, Bart. My Einstein series was initiated by him and is thus dedicated to him.

The mystical experience is the force which moves one to science. It is transitory. The mysticism dissolves into Science and then bears fruit as Engineering. Mysticism, as defined in my writing, is not transitory. It is continuous and thus hates Science. Without a mystery the mystic is no longer the priest. This is a Platonic Epistemology. It is based upon Faith, not upon Reason. This is a necessity in Christianity, however in the majority of situations this Faith is based upon

nebulous reasoning. With Lawyer like skill it's factors change meaning depending upon their position in space, time, or "attitude". Platonic reasoning is ultimately Totalitarian. See "Occult Science Dictatorship" by Lyne.

This Platonic reasoning is next taken up by Einstein and formed into a Kabalistic-Existentialist view of physical reality, this in direct conflict with Nature's Laws. Einstein is the image of an ultimate and infallible creature who should be regarded as a God. The i force society of today is the flower, me, my, I, and you, you're a piece of \*\*\*\*! Here lay the foundation for the extinction of Science and Engineering in the U.S.A. Wow, Mr. Wizard, do they want to kill us? See the Commonweal - Michael - Lerner, Judaic - Buddistic Global Religion Philosophy. To say any more on Einstein would be, as Oliver said, "Slaying the slain." Let dead dogs lay.

However, to continue pandering, Bearden takes us right back to mysticism. But more so, he is a disinforming making sure no one figures out Tesla. What would Israel say about "Tesla Weapons" in Iran? Or, would we want them in the hands of Israel?

Then we have the Corum, K.L. and J.F. This is the P.E.E.E. Forget them, no Tesla knowledge exists here. And then A. Puharich (not real name). Remember at the "Last Supper" R. Josh Reynolds cut funding to A. Puharich, stating I had done more on Food Stamps than he had with millions of dollars. I am QRU on all this. In reality only I seem to be able to understand Tesla and I guess that should make me feel good, so that's that.

At this time I am engaged in the study of details for the continuation of Inductance and Capacitance series of writings. The established dimensional relations are N.F.G., even in the writings of C.P. Steinmetz. Too many canceled dimensions through unit values, and lots of missing versors in space. For example, in Inductance calculations the radius of a circle is a line, the circumference of a circle is a circle. Here we have two distinct coordinate systems, or vector expressions, a kind of space quadrature. Thus

$$c = 2\pi r \text{ Centimeters}$$

is not vectorally complete, it is

$$c = 2\pi k r \text{ Centimeters}$$

where  $k$  is a versor operator. Hence it is that  $c$  and  $2\pi r$  are not interchangeable. Here is an important complication in the dimensional relations for Inductance and

#### 6.4. THE LAMARE LONGITUDINAL TRANSMISSION EXPERIMENT 201

Capacitance. As for the factor  $\pi$  over two in the Longitudinal Velocity, it represents an integration and is not an actual velocity, per-se. This  $\pi$  over two also can result from improper derivation of the distributed constants for transmission structures. This is shown in the paper (I.R.E.) "Electrical Oscillations in Antennae and Induction Coils", J. Miller, 1919.

The propagation of a Transverse Electro-Magnetic Wave is given by the dimensional relation

Centimeter per Second, or Velocity,  $v$

This represents the ratio of space, centimeter, to time, second.

In a conjugate form the propagation constant of a Longitudinal Magneto-Dielectric Wave is given by the dimensional relation,

Per Centimeter, per Second, or per (Centimeter - Second)

Counter - Velocity,  $u$ .

This is the ratio of counterspace, per centimeter, to time, seconds. In an alternate form of expression, the T.E.M. propagation constant is the square root of the product

Henry per Second,  $\mu$

and

Farad per Second,  $\epsilon$ .

And for the L.M.D. propagation constant, it is the square root of the product

Per (Henry - Centimeter)

and

Per (Farad - Centimeter)

The composite propagation constant hence is the superposition of the velocity,  $v$ , and the counter velocity,  $u$ . The two are not dimensionally additive so a versor

and a dimensional transform of centimeter square is required.

The T.E.M. wave is always along the axis of the metallic geometry, tangent to the metallic boundary. Such is given by the "Co-axial Cable". Conversely, the L.M.D. wave is always perpendicular to the axis of the metallic geometry, normal to the metallic boundary. Such is given by the "Transformer Winding". The resulting complex propagation of  $v$  and  $u$  is a spiral with a tilt angle from the metallic axes of the coiled winding. Where T.E.M. waves drag into the metallic (electron flow) the L.M.D. wave bypasses the metallic (no electron flow) hence no Ohmic resistance. The factor  $\pi$  over two is the composite propagation for only a unique set of parameters. See "The Oscillating Coil" part of the "Theory of Wireless Power" E.P. Dollard. Note here that errors found a way into the tables, but the equations are right. Now why could not the Corum's figure this out? Why is it they make no reference to any work on this by Blume, Bewely, Dollard, and etc? The Corums, Well?

One very important fact that escapes notice (Meyl, et al) is that Tesla's transmission networks are Mono-Polar. The dipolar concepts so dear to all now swirl down the toilet bowl (burp). Forget Bearden, Forget Meyl, it is crap for the crapper! Tesla circumvents the concept of plus and minus, there is one pole only, plus. Here is a true "Single Phase" Alternating Current, one wire only. This is a philosophically disruptive concept for the God vs. Devil duality. God has no opposite pole, it is one, positive only. This is the secret to the Tesla transmission concept. Action vs. Reaction now is voided.

When considering a resonant coil in its fundamental mode of oscillation, as the Tesla "Extra Coil", the potential  $e$  at the terminal end is  $90^\circ$  ( $\pi/2$  radians) ahead in time phase compared to the E.M.F.  $E$  at the lower end. This is given by the relation

$$E = \frac{b}{a}jE,$$

where  $e$  is the Electrostatic Potential in Volts,  $E$  is the Electro-Motive Force in Volts,  $a$  is the Power Factor, and  $b$  is the Induction Factor of the Oscillating Coil.

It is hereby seen that no circulation of flux lines is possible, hence the coil becomes "Longitudinally Transmissive." Potential  $e$  and E.M.F.  $E$  exist in separate time frames. This relationship cannot be produced by a two wire (T.E.M. quarter wave line because here the laws of circuitation rule. It must be a single wire so configured as to allow propagation normal to the axis of the metallic boundary, (L.M.D.).

Hereby enclosing the electrostatic terminal of a Tesla transmission system within a metallic sphere will fail to shield the radial dielectric lines of force,

#### 6.4. THE LAMARE LONGITUDINAL TRANSMISSION EXPERIMENT 203

whereas a dipolar system within the metallic sphere cannot get out of this sphere except that leaking through the transmission line entry opening. It is that simple, but no one gets it. Every one jumps back to Bearden, Corum, Meyl, and stays mystified, WHY?

Certain considerations present themselves when applying the notion of "Antenna Gain" with regard to T.E.M. and L.M.D. propagation. The directivity of T.E.M. waves is based on the spatial dimensional relation of area. High gain is a large aperture, centimeter square, (a big dish). It is given dimensionally as

Area equals Width times  $k$ -Height

This is a cross product,  $k$  is the right angle operator, a versor of dimensionless form. Wave propagation is normal to the surface of this area of width cross height, on the axis of versor  $k$ . Heaviside calls this

$$Vwh = l.$$

The transverse product of width and height is length.  $V$  is his vector product operator.

The situation is much different for the L.M.D. wave. Directivity here is colinear, or axial. Dimensionally it is given as

Length times Length Equals Length squared

Wave propagation is colinear with this length squared. This axial "Antenna" must now be counter - spatial in form, that is, it must be subdivided. The apparent physical length here is now only an integrated resultant derived from the summation of counterspatial spans. A ruler with 16th inch spans has a physical length of one foot. Hereby it may be that a "Big Dish" is not the way to go for L.M.D. waves.

However, by another line of reasoning, since we have no established Truths as of yet, consider "Electric Sound Waves" in the Aether. After all that is what Tesla said. See Thornberg's work on "Maxwellian electric sound waves in the Aether". So it is required to make an electrical analog to sound. Helmholtz works to cover this but Heaviside points out the math is no good.

The P and S seismic wave analog looks good. What is needed is an alternative to  $\mu$  in Henry per centimeter and  $\epsilon$  in Farad per centimeter. In the L.M.D. theory it is not  $\mu$  nor  $\epsilon$  but per (Henry - cm) and per (Farad - cm). This is seen in the P & S wave papers sent to me by Lamare. Tesla praised Helmholtz but it may take another Oliver to make it work. Here a "Big Dish" may work.

Finally, I put out on the "Heretical Builder" forum an Alexanderson "Antenna" for the 160 meter ham band. It is a scalar (space) wave guide structure and has no wavelength, hence "space scalar". This network is scaled upon the 18.6 kilo-cycle version made for the Navy at station KET, Bolinas, California. A scale of 100 to 1 was selected hence 18.6kc becomes 1860kc, a ham frequency. This network produces a Longitudinal Dielectric form of propagation, with no magnetic component. Pure "Dielectric Waves" a la J.J. Thomson. Space scalar transmission may be possible between identical units in phase sync. A great ham radio project, but you will not find it in QST. But no one makes it, has Ham radio, once considered a National Technical Asset, now become a useless hobby of self denial? If so, the F.C.C. will no longer consider it valid and take steps to phase it out of existence by some "911 phantasy laws". So do we run back to Bearden's dipoles smashing electrons on the 405 freeway, back to Meyl's Edmund Scientific Toys, and back to the Corum math masturbations upon the resonant coil, back to the feet of the one wing parrot? I hope not!

## 6.5 Einstein, Tesla, and the Wizard of Oz

Einstein and his theories can be expressed by an animal story: As understood through his writing *Relativity* as a "package of ideas" is in many ways similar to the "egg of the coo-coo bird". The coo-coo bird builds no nest of its own, it looks for the right nest among those of other birds. Here found it lays its egg in the selected nest of another bird. Upon hatching its chick forces the others out of the nest, over the side. Such is the growth cycle of *Relativity*, as given by Einstein.

In order to understand the Einsteinian reasoning certain logical relationships are taken from "*Relativity*", by Albert Einstein, Random House Publisher, 1916, page 50. Here given is;

- (1) Proposition (A) is Electro-Dynamic Theory, Maxwell - Lorentz.
- (2) Proposition (B) is Relativistic Theory Einstein - Minkowski.
- (3) There are many experiments in favor of (A), or also in favor of (B).
- (4) These experiments "limit the theoretical possibilities" so that only (A) holds to the test of experience.
- (5) Certain experiments conform to (A) through an "Auxiliary Hypothesis" which is "extraneous without (B)."

Consider Einstein's statement on the same page 50;

"In the theoretical treatment of these electrons we are faced with the difficulty that electro-dynamic theory of itself is unable to give an account of their nature." "For since electrical masses constituting the electron would necessarily be scattered under the influence of their mutual repulsions, unless there are forces of another kind operating between them the nature of which has hitherto remained obscure to us."

Forces of another kind, you mean the dielectric lines of force, removed from obscurity by the Faraday - Thompson concept of induction? Every electron is a motional terminus of a quantity of dielectric lines of force, these lines contracting and stretching like rubber bands, giving motion to the terminus electron. The thermionic electron contracts, pulling the electron, the cathode ray stretching, pulled by the electron. In the former case the lines of force are dissipated, in the latter case the line of force are projected, both cases the electrons assume ray like motion, with non participating lines of force filling the voids, directing the electrons. Hence, it is the electrons travel in straight lines, that is, rays.

These facts have been known from the initial invention of the "Vacuum Tube" by Sir William Crookes, leading to the extensive experimental work into atomic science by J. J. Thompson, and Nikola Tesla. It is here seen that the so-called electron is only a shadow, its apparent physical mass is only an electrical momentum. There is no rest mass to an electron. It is given here the electron is no more than a broken loose "hold fast" under the grip of the tensions within the dielectric lines of force. They are the broken ends of the split in half package of spaghetti. Obviously this reasoning is not welcome in the realm of Einstein's Theory of Relativity. Are we to believe that Einstein had no prior knowledge of the most prominent theoretical and experimental work of his time?

Continuing from "Relativity" by Albert Einstein, page 51.

"The second class of facts to which we have alluded has a reference to the question whether or not the motion of the Earth in space can be made perceptible in terrestrial experiments."..."All attempts of this nature led to a negative result." Einstein's Relativity leads to the conclusion that no point of reference in the Galilean sense can actually exist, that is, all points of reference are relative to each other. This relativity is in a Lorentz transform rather than a Galilean Transform. No absolute reference possible, it is everything is relative. This is tantamount to the denial of the existence of God. Forgotten is that

relativity did not find favor in its day, for this very reason, it is atheistic. Like Existentialism, or Cubism, Relativism represents a most destructive philosophical construct by which to afflict modern man. The destructive philosophical forces flowered as the "Third Reich".

The monophasic dielectric forces developed through the work of Nikola Tesla nullify relativistic relations. Tesla, through a unique space-time hysteresis electrically "grounded" to a zero order Galilean coordinate system. It is also the cathode ray projector tubes utilized by Tesla in his atomic studies also nullify relativistic relations. Tesla's remarks about "radiant matter" indicate the existence of cosmic rays of immense penetrating power moving fifty (50) times faster than the velocity of light (Le Sage particles). Here Albert Einstein is in direct contradiction with the experimental researches of Nikola Tesla, and in complete ignorance of the experimental researches of J. J. Thompson. Einstein "laid his egg" in the "nest of Faraday". From here it is that "Theoretical Physics" is henceforth divorced from "Electrical Science". In turn Theoretical Physics made a "Where" of Maxwell, the "offspring" of Faraday.

Recently, in the "Los Angeles Times" newspaper, a series of page long editorials were given on Einstein, this as "Damage Control" over the European C.E.R.N. superluminal particle experiments. The L.A. Times is harsh, stating that C.E.R.N. was irresponsible, and must ask for permission to publish such findings! Later editorial writings express Einstein as the supreme authority, the spiritual master, etc. Well, after all, He pushed to make an  $E$  equals  $mc^2$  bomb to effect the genocide of the German People. A real holy man, don't you think?

In epilogue, when Albert Einstein came to America, amid the accolades, and the fanfare, he was naturally introduced to T. A. Edison, the "Axle grease and timbers" all American Scientist-Inventor. The "coyote like" Edison cunningly produced one of his company intelligence tests for Einstein to complete. Einstein did not do so good on Edison's company examination, he did not know the speed of sound! Is it possible here that Einstein is just another version of Marconi, both in defiance to Tesla. Finally, January 1, 200 A Time Magazine cover declares Albert Einstein the "Man of the Century". We verily have been duped!

So here we stand. We have penetrated the Giant One Winged Parrot. While the multitudes have been quivering at the feet of this awesome idol, the Poodle went around to the rear of it, revealing no more than a diminutive circus operator at a small control panel. This formidable idol is no more than a giant CIRCUS PROP! Now can we go back to Kansas?

# Chapter 7

## Energy Defined

### 7.1 Introduction

I will begin to formulate explanations for you all as time goes on but the violence I have suffered will make it hard; First my paper - Symbolic Representation of Alternating Electric Wave. Second - Ernst Gillimen, Vol 1 Communication - Networks. Third - Carl Steinmetz, Impulses, Waves & Discharges. Read these books, that is necessary to understand my work.

### 7.2 Energy Defined

Now, why are we all gathered here? The focus is on "Energy", but what is energy, and why is it so important to everyone anyway? It seems somewhat obsessive. The definition of it is the ability to do work, but vernacular has broadened this so now energy can mean almost anything. This must stop.

Energy in its most arch-typical form is embodied in the phenomenon of Electricity, but what is Electricity? Now our wheels even more stuck in the mud! But we have important clues, namely that of polarity, not plus or minus so much but more like male or female. This thought follows from Goethe to Tesla and Steinmetz. Thus Electricity, in order to manifest, a UNION must develop. This is the union of the "male", or projective, and "multiplied by" the "female", or receptive. Hereby, the male is the dielectric field in counterspace (of per centimeters), and the magnetic field or female in space (of centimeters squared). Space in c.m. squared is what you pay for in "real estate", counterspace in per c.m. is the space between the lines on a ruler, or between molecules in a crystal.

For the Electricity extant between a pair of wires in your lamp cord, the closer the wires, the more capacitance, and thus the more Dielectricity. Conversely, for the same cord, the farther apart the wires, the more inductance and thus the more Magnetism. Therefore it is seen that the smaller the space (the more counterspace) the more Dielectricity that can be stored, and conversely the larger the space between the wires (the more real estate) the more Magnetism that can be stored. Very simple, do not let your mind make it any more complicated than that!

Now let us reach out for a few quantitative relations: The product (line, cross, or dot - unrestricted) of the total amount of Dielectricity multiplied by the total amount of Magnetism (when both are in union) gives the total quantity of Electricity. We will call this quantity of Electricity the letter " $Q$ " and name this "The Planck" after Max Planck. For the Einsteinischen dimensions of the Planck are Energy - Time, but let us not think backwards – ass. Saying this in engineers lingo, the quantity of Electricity  $Q$  is given as Watt - Seconds ? Seconds or Watt Seconds squared.

Now, in one foot of lamp cord, bounded between the wires, I have say, one million Plancks of electric induction. The frequency is 60 cycles (377 radians) per second. Thusly the quantity of Plancks  $Q$  is being produced or consumed at a time rate of 377 radians per second, or in other words, Plancks per second,  $Q$  divided by  $t$ , the ratio of  $Q$  to  $t$ , etc. Hence the time rate of variation of the quantity of electric induction hereby gives; Watt seconds squared per second or dividing out, gives Watt seconds. But Watt seconds is the dimensions of energy. Well golly-gee Mr. Wizard, we have defined energy! And hereby energy is defined as the time rate of the production or consumption of the electric induction, or  $Q$  divided by  $t$  gives  $W$ . It is that simple. So push the "Erase Button" on your head for two notions: Energy is the product of mass times the velocity of light squared, erased? Next, Electricity is the flow of electrons in wire, erased? Good!

In the previous transmission it was shown that the electric induction, bound between the wires of a lamp cord, was the union of two distinct fields of induction, the dielectric in counterspace, and the magnetic in space. These fields consist of discrete lines of force. Thus these lines exist as individual units or quanta of inductive force. Both fields exert mechanical force upon the bounding system of so-called "conductors". These mechanical forces, those of the dielectric, and those of the magnetic, exert actions so as to increase their coefficients of induction, that is the dielectric "capacitance", and the magnetic "inductance" are increased. Hereby, the dielectric field draws the conductors nearer to each other, increasing the counterspace. Conversely the magnetic field pushes the conductors away from each other, increasing the space. Hereby we may say that the dielectric field is

contractive, and the magnetic field is expansive. Hence the resulting electric field of the union produces a resultant force upon the bounding conductors. This resultant force thus may be expansive, null, or contractive, depending upon the relative densities of the dielectric and the magnetic force fields respectively.

So now our previous discourse upon these matters brings important questions to mind that heretofore remained unanswered: First, how big is a Planck? In other words, how many Plancks per one second (unit time) equal one Watt-second (unit energy)? Second, what ratio of dielectric field density to magnetic field density results in the contractive force just balanced against the expansive force, thereby canceling any mechanical forces upon the bounding conductors? Who can solve these important questions?

References:

1. Electro-magnetic Theory Vol. 1 by Oliver Heaviside.
2. Impulses, Waves and Discharges by Carl Steinmetz.
3. Electricity and Matter by J.J. Thompson.
4. Recent Researches Into Electricity. By J.J. Thompson
5. Discharges In Windings by E.P. Dollard
6. Occult Ether Physics by Layne

## 7.3 Rates of Change

What I am attempting with these internet transmissions is to sequentially establish the correct semantics for terms that we flail with (like parrots) such as volt, watt, & etc. Oliver Heaviside did this over a century ago with his famous "Electromagnetic Induction" series of writings in England, which was eventually censured by the Royal Society (William Preece). On the other side of the coin, as far as the conspiracy against my efforts, all the necessary elements have been given and I leave it to you all to expose its fetid body to the atmosphere. This is very important work also. I will do my part in these definitive writings, but you must do your part in "cleaning the toilet bowl." OK?

So far I think the concept of space and counterspace in its basic form is established. Counterspace, as that space between the lines on a ruler is an apt descriptive analog. A ruler divided in millimeters has less counterspace than a ruler divided in nanometers. This is obvious. (think in terms of capillary action) Also, the Planck is our undivided fundamental quantity of electricity and all else will be a development of the Planck.

What needs to be focused upon at this point in writing is the concept of VARI-

ATION WITH RESPECT TO TIME, that is the dimension of per second. This also is known as the "Time Derivative",  $\delta x$  over  $\delta t$  in the Newton - Leibnitz infinitesimal calculus. Let us say the rate of change with respect to time.

Everyone's intimate mechanical relationship with their automotive apparatus (today the metal maggot or horned exoskeleton) render it useful tool for analogy. Various phenomenon make their appearance, somewhat ghostlike, during the process of variation with respect to time. Let us take the dimensional relation of velocity, that is, the ratio of the dimension of length (space) to the dimension of time. This is the velocity  $V$ , let us say specifically miles per hour. Now we know that if the dimension of mass  $m$  is moving at a given velocity  $V$ , that is, the "weight" of your body in the auto, in CONSTANT motion at the speed limit let's say, no forces or perceptible sensation is imparted to your body. In other words you feel sitting in the car seat the same as you feel in the seat in front of the television set (so the auto is like a rolling  $TV$ ). So long as the velocity remains unchanged nothing is experienced or felt. Now a deer jumps in front of your auto, you slam on the brakes and miss it, now you are moving at 1/10th of the speed limit. During the interval in time in which the velocity varied with respect to time, that is miles per hour per second, or the ratio of the velocity  $V$  to the time interval  $t$ , from somewhere your physical body experienced a powerful force pushing you forward. The more quickly the auto changed speed the more this force impacted your body. So we can say that this force  $F$  is given as the ratio of velocity to time, for any unit mass of your body. That is, the force  $F$  equals your body's mass times the ratio of the velocity to the time interval of the velocity's variation with respect to time.

So back to the Planck, that quantity of electrical induction  $Q$ . So long as there is no variation of the electrification, that is so long as it is static, no other phenomenon manifests. Just as with the mass of your body and the velocity of its motion in space, so long as there's no variation no sensation of force is experienced by your body. Completing the analogy the concept of energy is then entirely analogous to that force you felt when you hit the brakes. Hence they are both phantom like derivatives of things that you otherwise can perceive as real.

So now we are getting a further "feel" that what we call energy is not really that primary phenomenon that the Einsteinishen would like us to believe, but in reality is only a secondary derivative of some more concrete phenomenon, or ghost associated with something physically tangible or real. Now the idea that energy can be "created" or made to go away can now be brought to mind.

## 7.4 Continuing with Variation of a Dimension with Respect to Time

Continuing with the concept of the variation of a quantity (or dimension) with respect to time (another dimension). We may say then we are talking about a RATIO of a physical dimension to a metrical dimension. Previously given, the ratio of a physical dimension, the Planck  $Q$  to a metrical dimension the time  $t$  gives then the dimensional relation of energy  $W$ . Then from the Newton-Leibnitz concept we say  $\Delta Q$  over  $\Delta t$  equals  $W$ , that is, the first order time derivative of electrification  $Q$  equals the energy  $W$ . Now the Einsteiner says the inverse, and that is, the time integral of  $W$ , the energy, over time interval  $t'$  to  $t''$  is the electrification  $Q$ . This is to say  $Q$  is the PRODUCT of the energy  $W$  and the time interval  $T$ .  $W$  times  $T$  equals  $Q$ . This is backward-ass, thereby occluding the interrelationships of these three distinct relationships.

Further, hit your erase button on the gibberish of 1, 2, or 3 dimensional space, there is only ONE DIMENSION OF SPACE - SPACE! Coordinates are NOT dimensions. Example, the volume of a cylinder can be expressed in TWO terms, height and circumference. So where is the third "dimension", erased?

Continuing then it has been given that the total electrification  $Q$  is the union, or product, of the total dielectric induction  $\Psi$  and the total magnetic induction  $\Phi$ ,  $\Psi$  times  $\Phi$  equals  $Q$ . In other words, the dimensional relationship  $Q$ , the total electrification, is the product of the dimension of total dielectric induction  $\Psi$ , and the dimension of total magnetic induction  $\Phi$ . Hence we have FOUR primary dimensions in electrical engineering. These are 1) Time, 3) Dielectricity 2) Space, 4) Magnetism.

Every other relation, quantity, or expression, Volt, Amp, Ohm, etc. is derived from these FOUR dimensions. Time and Space are the metrical dimensions, Dielectricity and Magnetism are the physical dimensions. It is that basic! We are now prepared to move forward in our effort to stop being parrots.

## 7.5 Time Variance and Its Products

Continuing on the concept change with respect to time. The total electrification  $Q$  in Plancks is a resultant of the union, of PRODUCT, of a pair of inductions, the total dielectric induction,  $\Psi$  and the total magnetic induction,  $\Phi$ .

Now let us deal with these two inductions individually. Variation of the total dielectric induction  $\Psi$  with respect to time  $t$ , that is, the RATIO of the dimension of dielectric induction to the dimension of time, dielectric induction over time, or the time rate with which the dielectric induction is produced or consumed, the DISPLACEMENT CURRENT in amperes  $I^1$ .  $\Psi$  over  $t$  equals current  $I$ . This makes sense since the charge in a battery is given as Ampere?Hours, that is  $I$  times  $t$  equals  $\Psi$ . Hence we have arrived at a new dimensional relationship, the "current" in Amperes.

Analogously, we have the variation of the total magnetic induction  $\Phi$  with respect to time  $t$ , that is, the RATIO of the dimension of magnetic induction to the dimension of time, magnetic induction over time, or the time rate with which the magnetism is produced or consumed, is the electro-motive force in Volts.  $\Phi$  over  $t$  equals the voltage  $E$ . We know this as the "Faraday law". Hence we have arrived at a new complimentary dimensional relationship, the E.M.F. in Volts.

Taking the one step further, consider the ratio of the variation of the magnetic induction  $\Phi$  with respect to time  $t$ ,  $E$ , to the variation of the dielectric induction  $\Psi$  with respect to time  $t$ ,  $i$ . Since the dimension of time appears on both top & bottom of the ratio this dimension cancels leaving simply the ratio of  $\Phi$  to  $\Psi$ . Hereby the RATIO of the total magnetic induction  $\Phi$  to the total dielectric induction  $\Psi$  gives the dimensional relation of impedance,  $Z$ , in Ohms. This can be arrived at some what differently. Since the variation of magnetism with respect to time  $t$  is the electro-motive force,  $E$ , and since the variation of dielectricity with respect to time is the displacement current,  $I$ , then the RATIO of the electro-motive force,  $E$ , to the displacement current,  $I$ , give the impedance,  $Z$ , in Ohms. That is, the ratio of  $E$  to  $I$  is  $Z$  in Ohms.

Inversely, from the standpoint of dielectricity rather than magnetism the RATIO of the total dielectric induction  $\Psi$  to the total magnetic induction  $\Phi$ , that is the ratio of dielectricity to magnetism is the "Admittance",  $Y$ , in Siemens. Hence the ratio of the displacement current  $I$  to the electro-motive force  $E$  gives the Admittance,  $Y$ , in Siemens.  $I$  over  $E$  equals  $Y$ .

Here by we have arrived at four new distinctive dimensional relationships;

1. Displacement current in amperes  $I$ ,
2. Electro-motive force in volts  $E$ ,
3. The impedance in ohms  $Z$ ,
4. The admittance in Siemens  $Y$ .

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<sup>1</sup>Let us call this Maxwell law.

## 7.6 The Planck Revisited

Continuing with the conceptualization of RATES OF CHANGE with respect to time and the interactions that arise.

In summary it has been given that variation of a quantity of dielectric induction,  $\psi$ , with respect to time  $t$  is the DISPLACEMENT CURRENT, in amperes,  $i$ . We will call this Maxwell's Law of Dielectric Induction after its' discoverer James Maxwell.

Also given is that the variation of a quantity of magnetic induction,  $\phi$ , with respect to time is the ELECTRO-MOTIVE FORCE in volts,  $e$ . We will call this Faraday's Law of Electro-Magnetic Induction, after it's discoverer Michael Farady.

It should be noted that displacement currents flow through the insulation (dielectric). It is NOT the familiar conduction current of the electronic ideologies.

Likewise the electro-motive force is a result of the conductor (metallic). It is NOT the electro-static potential of the dielectric field. A conjugate relation exists here, the "insulator" and the "conductor". So now we have TWO distinct "volts" and TWO distinct "amps", hence  $e$  and  $I$  are seen to have dual definitions. The ampere,  $I$  may be a displacement current, or may be a conduction current. Likewise the volts,  $e$ , may be an electro-motive force, or it may be an electro-static potential. These distinctions are important and misunderstanding rests here.

The Maxwell-Tompson concept of electric induction, and the of the aether which engenders this induction, considers the dielectric lines of force, and the magnetic lines of force, as CONCREATE PHYSICAL REALITIES. (Read electricity and matter by J. J. Tompson, and also read Theory of Light and color by Babbit, the Un-sterilized version).

These lines can be considered "tubes of force" a hydro-dynamical vortex tube of sorts. Here we find the "hydro-dynamical model of the aether" as given by James Clerk Maxwell. Understanding of this sort has been buried by the relativists and quantum car mechanics. From the initial concept of Faraday, through the theoretical reasoning of Maxwell, into the experimentalist like Crookes and J. J. Thompson, it gave an ENGINEERABLE CONCEPT of the primordial aether. Finally Nikola Tesla, Oliver Heaviside, and Carl Steinmetz turned this into today's electrical technology. The roots of Edison sprang to life.

So what may aether be? Consider what are called the "states of matter".

1. SOLID
2. LIQUID
3. GAS

## 4. PLASMA

## 5. AETHER

Hence, the five distinct states of matter.

Electricity is embodied in the aetheric state of matter, or "proto-matter". Electricity is aether in a state of dynamic polarization; magnetism is aether in motion, dielectricity is aether under stress or strain. The motions and strains of the aether give rise to electrification.  $\Phi$  times  $\Psi$  gives  $Q$ .

In defining the hydro-dynamical tubes of force as concrete realities, a distinct phenomenon taking place with the aether, the constitution of the Planck sticks its snout out of the sand. The tubes of force are discrete, fiber-like, quanta as some would say. Experiments by J. J. Thompson indicate this. Lines of force are a quantum phenomenon, distinct concrete entities.

Further, we have the idea of "Planck's Constant", any variation in the total density of electric induction  $Q$ , in Planck's, cannot vary continuously but must exhibit its variation in discontinuous, or discrete steps. Hence a distinct quanta  $Q$ . We may infer that the union, or CROSS PRODUCT, of a single tube of DIELECTRIC induction, with a single tube of MAGNETIC induction, gives birth to a single unit of ELECTRICIFICATION  $Q$ . This idea embodies the concept of the photon, a QUANTUM UNIT of electro-magnetic induction. Also consider the J. J. Thompson concept of the "electron" (his own discovery). Thompson considered the electron the terminal end of one unit line of dielectric induction. One tube, one electron. So then, how big is a unit Planck, the quantum unit of electric induction,  $Q$ ?

Let us summarize the knowledge we have gained from what has been given to this point. The basic engineering dimensional relationships are hereby:

$Q$ , the undivided quantity of the total electrification, "Planck"

$W$ , the time rate of the production or consumption of this electrification, "Joule".  
(energy)

$\Psi$ , the total dielectric induction, or the ratio of the total electric induction  $Q$ , to the total magnetic induction which is embodied in this electric induction. This is the "Coulomb" (charge).

$\Phi$ , the total magnetic induction, or the ratio of the total electric induction,  $Q$ , to the total dielectric induction,  $\Psi$ , which is embodied within this electric induction.

This is the "Weber" (induction).

$E$ , the electro-motive force which results from the production or consumption of the total magnetic induction  $\Phi$ . The unit is the "Volt".

$I$ , the displacement current which results from the production or consumption of total dielectric induction  $\Psi$ . The unit is the "Ampere".

1.  $Q$ , Planck;  $\Psi$ , Coulombs;  $\Phi$ , Webers,
2.  $W$ , Joules;  $E$ , Volts;  $I$ , Amperes.

Group one consists of PRIMARY quantities, group two consists of REACTIONS by the primary quantities to their variation in quantity with respect to Time .

One dimension of space that is space raised to the positive exponent is simply called space (acre). Space raised to the negative exponent is called counter space (per sq. centimeter). One dimension of time that is time multiplied by positive one is called forward time and the dimension of time multiplied by negative 1 is called reverse time. Space is multiplicative (exponential) and time is additive (linear). One dimension of time(second), one dimension of space (centimeter). System of base one numbers converts the dimension into forward, backward, counter, etc.

## 7.7 The Time Tunnel

Oliver Heaviside one stated that "The law of continuity of energy" is maintained when the energy existent at one time disappears but reappears at another time. In H.G. Wells' "Time Machine" The professor argues with the doctor saying that his time device (which just vanished) is still at the same spot in the room, but the doctor can't see it because it is there, yes, but in another time. It moved through the dimension of time.

The motion of electricity in time has been the primary topic so far. Given is the three basic relations;

1. Plancks per second gives Joules.
2. Coulombs per second gives Amperes.
3. Webers per second gives Volts.

Joules, Amperes or Volts, are SECONDARY reactions in response to variation of our known PRIMARY dimensions, the total electrification in Plancks, the total

dielectrification in Coulombs, the total magnetization in Webers.

In terms established by Oliver Heaviside, the Volts of E.M.F. are a MAGNETIC REACTANCE, and the Amperes of displacement are a DIELECTRIC SUSCEPTANCE. The degree to which the reactance and the susceptance manifest is proportional to the time rate of variation, that is, per second. Here the dimension of time is not seconds, it is PER SECONDS, one over  $T$ . Somewhat like counterspace, but this is NOT COUNTER TIME. One instance of a per time arrangement is cycles per second. This is known as the FREQUENCY  $F$ , in cycles per second. Here is a dimensional relation of per second, frequency  $F$ . This frequency  $F$  represents only a rotational (alternating) cycle, and thereby is only a partial frequency. Also existent is a cycle of geometric progression or regression. This "frequency" is given in decibels per second. Hence our general frequency is given as decibel-cycle per second, or for Newton-Leibnitz methodology, it is neper-radian per second,  $\nu$ . Hereby: 1.  $\nu Q$  equals  $W$ , Joule or Planck per second. 2.  $\nu\Psi$  equals  $I$ , Ampere, or Coulomb per second. 3.  $\nu\Phi$  equals  $E$ , Volt, or Weber per second.

The dimensional factor,  $\nu$ , in per second we will call the Heaviside "Time Operator". This time operator describes the variation with respect to time as a "versor operator".

$E$  and  $I$  are NOT necessarily time coincident, but one may lag or lead another. Cause and effect become separated by what is known as HYSTERESIS. It can be said that  $E$  and  $I$  exist in different "time frames." This subject rapidly accelerates into a Bach type reality and is much too complex for now.

## 7.8 Ratios and Products Continued

Up to here has been covered the concepts of dimensional relationships known as ratios, dimension "one" per dimension "two." If dimension two is that of time, the ratio becomes a time rate or time derivative, from the Newton - Leibniz concept. This ratio is known as a first order time derivative, or differential equation. The dimension of time is in PER SECOND and this may be called a FREQUENCY  $\nu$ , in NEPER - RADIANS per SECOND. But let us not plunge these depths quite yet.

So what about products, the union of dimensional relation "one" by the dimensional relation "two", the product of one and two? Given thus far is the product of the magnetic induction,  $\Phi$ , and of the dielectric induction,  $\Psi$ , giving forth the total electric induction,  $Q$ . The product of magnetism united with dielectricity gives

rise to the total electrification of the aether.  $\Psi$  times  $\Phi$ .

But consider the union of the law of magnetic and dielectric induction. Faradays' times Maxwell's. Thus the union, or product, of the electro-motive force,  $E$ , in volts with the displacement current,  $I$ , in amperes.  $E$  times  $I$ . Here specifically is the product of the dimensional relation WEBERS per SECOND, and the dimensional relation COULOMB per SECOND. The resultant relationship is hereby

WEBER - COULOMB per SECOND SQUARED

But it has been given that

WEBER - COULOMB equals PLANCK.

Thus the dimensional resultant of the union of the pair of dimensional laws is PLANCKS per SECOND SQUARED. We will call this the electrical ACTIVITY, also known as the electrical power,  $P$ . Hence the dimensional relation

PLANCKS PER SECOND SQUARED equal WATTS.

$E$  times  $I$  equals  $P$ , Volts times amperes equals watts. However it has been given that the energy,  $W$ , in Joules is dimensionally the time rate of the total electric induction,  $Q$  in Plancks, that is,

JOULES PER SECOND equal WATTS.

That is, the electrical activity in Watts represents the variation of the total energy of the electric field, this energy itself resulting from the variation of the total electric field of induction. This is not unlike the situation in the automobile. No forces appear with the first order time derivative of miles per hour, but manifest in direct proportion to the second order time derivative of

MILES per HOUR per SECOND

or

MILES per HOUR - SECOND

Hence, there is a distinct similarity between the dimensional relation for mechan-

ical reactive force and the dimensional relation for electric activity

PLANCK per SECOND - SECOND

The Watt of electrical power,  $P$ .

## 7.9 Space the Final Frontier

As a dimension space is distinct from the dimension of time, and is devoid of any physical dimension. It is hereby eternal, and empty. Like time, space is a metrical dimension, it exists to quantify. Bounded space can define a volume, area, distance, span, or density.

It is customary to consider space boundaries as a CUBIC, or third degree set of coordinates. The three coordinates are length, width, and height, taken from a corner of the cube. Think of a sugar cube, the sugar is the space and the corners define the boundaries. These three coordinates, length, width, and height are **WRONGLY** known as the three dimensions of space. This is a major mind virus and is hard to erase.

There is only one dimension of space, **SPACE**, a metrical dimension. Any number of coordinates in any number of geometries can serve to define the boundaries of said space. The use of the cubic three is habitual.

The dimension of space is considered to exist in degrees, or powers of a unit space dimension, here centimeters,  $l$  (lower case  $L$ ). So we can say cubic centimeters, or square centimeters, etc. hereby, on a cm basis;

cm to the +1 power, distance  
 cm to the +2 power , area  
 cm to the +3 power, volume  
 and  
 cm to the -1 power, span  
 cm to the -2 power, density  
 cm to the -3 power, concentration

$cm$  to a positive degree is called conventional – spatial relations, or simply space relations, whereas  $cm$  to a negative degree is called counter – spatial, or simply counterspace relations, all the above constitute a single dimension, space, this space bounded by a coordinate construct upon a given degree.

Hence  $cm$  to the  $N$ th degree serves as our "space operator", operating upon a physical dimensional relation. For example,  $Q$  times cubic  $cm$ , the volume of electricity,  $\psi$  per square  $cm$ , the metrical dimension of space is applied to a physical dimension of substance. Even aether is a substance. mathematically;

$l$  (to the third)  $Q$  gives Planck –  $cm^3$

$l$  (to the second)  $\Psi$  gives Coulomb per  $cm^2$

In situations involving the dimension of time, the system of algebra serves well in expressing dimensional relations. It may even be said that algebra is the mathematics of time. (see Alexander McFarlane, American Association for the Advancement of Science). For situations involving the dimension of space no suitable algebra has yet been developed. All efforts by the great mathematicians during the 19th century were fruitless, except Oliver Heaviside's<sup>2</sup>. Heaviside gave a system of vector expressions, divergence, curl, and potential, which today are **WRONGLY** called "Maxwell's Equations." They are not, they are Heaviside's equations, and they are **NOT** algebraic. But these equations have become the "Tablets of Moses", bringing from the skies the laws of electro-magnetism. But no mention is ever found on the laws of magneto-dielectricity, a serious drawback. (see space vector part in "Theory of Wireless Power", by E. P. Dollard)<sup>3</sup>. Therefore at present there is no true understanding of the spatial relationships of electricity. It is this algebraic absence that, in general renders occult the real workings of electric induction, and specifically renders occult the work of Nikola Tesla. Space is then the final frontier.

## 7.10 N.F.G. Interlude

After eating up the horse feces the coyote pukes it up in the car. Then Rube Goldberg makes the following propositions:

1. Hyper – Complication
2. Useless info overload
3. Reliance upon a technology understood, untested and infested with bugs.

These serve as the commandment triad of science & engineering today. No other form of behavior is known, nor would it be tolerated if it were.

Advancement will receive only a **HINDRANCE**,  $H$ , in the dimensional relation of  $B \cdot S$ . Three primary dimensions give rise to hindrance  $H$ , in **GOLD-**

<sup>2</sup>Oliver Heaviside, *Electro-Magnetic Theory*, Vol. I, (Benn Brothers Limited, London, 1922).

<sup>3</sup>Eric P. Dollard, *Theory of Wireless Power*, Wireless Engineer, (Boderland Sciences, Bayside, 1986).

BERGS.

- 1) One will be PENDANTS, the Prostitutes of Electrical and Electronic Engineers, the P.E.E.E.
- 2) Another will be MYSTICS, the Quantum Car Mechanics, the Q.R.M.
- 3) Finally, will be DIS-INFOS, the Soviet Scalar Xenophobes, the S.S.X. Real life stories abound, for example;

- 1) Animal control is notified when a parrot is spotted flapping about with furiously with only one wing, the other is missing. It is screeching " $E$  equals  $MC^2$ ,  $E$  equals  $MC^2$ ." 2D and 3D fecal matter is ejected through time by the injured animal. It can't be caught.
- 2) The S.W.A.T. team is called in when a mass shooting is reported at the School of Energy Synthesis Research by an adherent to the law of energy perpetuity sect. 8 are killed including the gunman, 15 more are injured.
- 3) Sheriff deputies respond to a report of 20 guys spilling out of the bar engaged in a brawl over the constitution of the aether. Next day the city council passes a resolution forbidding the existence of the aether.

So then, how do we pull the signal out of the noise? It is done by bandwidth reduction, power increase, coherent reception. Taking the inverse of the Goldberg triad gives: 1) Hypo - complication

- 2) Useful information
- 3) No belief in any theory or related technology without experimental verification of proof AND disproof.

Through application of the inverse Goldberg law, and by phasing out the P.E.E.E., Q.R.M., S.S.X. components the signal will come through loud and clear, 5 - 9 - 9.

## 7.11 Dimensional Meanings

So far we have strongly emphasized dimensions and dimensional relations. Dimensional representation is the most direct method of analysis and synthesis with regard to the electric phenomena. Electrical engineering has four primary dimensions;

Metrical,

- (1) time,  $t$ , second
- (2) space,  $l$ , centimeter

Substantial,

(3) magnetism,  $\Phi$ , Weber

(4) dielectricity,  $\Psi$ , Coulomb

There are no other electrical dimensions, that is it! The electric-dimensional RELATIONS are derived from these primary dimensions, but the relations are not new dimensions. There are no others than "the four."

Consider a certain hypothetical transmission system, the Integratron system of George Van Tassle. (not the Goddess temple "Integratron" of today) The Integratron effects transmission around space. Let us say one is on earth and another is on mars. If you enter the "in door" on the earth unit, you exit the "out door" on the mars unit.

In performing this operation you did NOT travel from earth to mars through any intervening dimensional relation of space. No velocity or space per time, was effected. However time has not been altered so it may be said that the dimension of space has been cancelled out. Space was the transmission obstacle and the electro-geometrical structure of the Integratron neutralized the dimension of space. This is called a SPACE SCALAR, no variation in space.

At this point the Einsteiner would say that you traveled from earth to mars in "another dimension." Then, after a big blast off the bong, now it's a wormhole!

Another example, long distance D.C. power transmission. Long distance power transmission utilizing alternating current suffers from the effects of electro-motive force,  $E$  and the displacement current  $I$  both time derivatives. The compounding of  $E$  &  $I$  over long distances results in serious transmission impairments. The dimension of time is eliminated. Thus the dimensional relations involving time such as  $E$  and  $I$  disappear, but not into "another dimension", there is none.

D.C. has zero frequency hence it has no relation to time. It is eternal, invariable, constant. Direct current is a TIME SCALAR, no variation in time. The Quantum Car Mechanics and the Soviet Scalar Xenophobes, each in their self edification, have twisted this basic dimensional reality of the engineer into a distorted labyrinth of utter confusion. Wormholes, scalar waves, and etc. represent an oral/anal equivalency. Such concepts confuse, not clarify, engineering concepts. Yet the parrots lap it up eagerly, it has such a sweet taste. So does anti-freeze.

## 7.12 Dimensional Relations of Volts and Amperes in Time and Space

We have heretofore firmly established a concept of the two fundamental laws of induction, Faraday's law of electro-magnetic induction and Maxwell's law of magneto-dielectric induction. Electro-motive force  $E$  is a magnetic reactance to a change in the net quantity of magnetic induction, displacement current  $I$  is a dielectric susceptance to a change in the net quantity of dielectric induction.  $E$  in Volts and  $I$  in Amperes are the result of inductive variation with respect to TIME.

However, also in the same units of volts and amperes exist the electrostatic potential,  $e$  in Volts, and the magneto-motive force (M.M.F.),  $i$  in Amperes. This situation does not recommend itself.

The E.M.F.  $E$  and the M.M.F.  $i$  have a conjugate relation through the metallic structure of the electric system. The displacement  $I$  and the electro-static potential  $e$  have a conjugate relation within the dielectric structure of the electric system.  $E$  and  $i$  in the metal,  $e$  and  $I$  in the insulator. This suggests the electric activity  $E$  times  $i$  and another activity  $e$  times  $I$ , both in Watts. Conversely, electrical activities of  $E$  times  $I$ , as well as  $e$  times  $i$  suggest themselves. Hence we have arrived at a four polar form of electrical activity. Four distinct wattages. These represent the four terms of the "Telegraph Equation" of Oliver Heaviside in their primordial form.

The reactance E.M.F.,  $E$ , via the dimension of time,  $T'$ , gives rise to an electrostatic potential,  $e$ , across the dimension of space,  $l$ . In conjugate form the susceptance displacement,  $I$ , via the dimension of time,  $T''$ , gives rise to a M.M.F.,  $i$ , across the dimension of space,  $l$ . It may be said that  $E&I$  are the cause, where  $e&i$  are the effect, chicken or egg.

The metallic-dielectric geometric structure bounding the electric field of induction engenders the mechanical forces developed by this bounded field. Where  $E$  and  $I$  are strictly electric forces,  $e$  and  $i$  give rise to mechanical forces upon physical matter through the dimension of SPACE.  $i$  and  $e$  are the seat of magnetic forces pushing the metallic and of dielectric force pulling the metallic.  $i$  is a pushing force,  $e$  is a pulling force.

How does the dimension of space enter into  $e$  and  $i$ , both spawned of the dimension of time? From time to space, but Volts and Amperes in both. This is a problem yet to be solved, a dimensional complication.  $e$  and  $i$  are not complete but are misrepresentations. They are figments of time. Forces due to  $e$  and  $i$  are more properly expressed as the dielectric gradient, Volts per centimeter and

the magnetic gradient, Amperes per centimeter.  $e$  over  $l$  gives  $d$  the dielectric, and  $i$  over  $l$  gives  $m$ , the magnetic.  $d$  is the dielectric force,  $m$  is the magnetic force, of the dielectric field  $\Psi$  in Coulombs and the magnetic field of  $\Phi$  in Webers, respectively.

Hence we have arrived at a pair of new dimensional relations:

1 Dielectric force,  $d$

Volts,  $e$ , per  $c.m.$ ,  $l$ .

or Weber per centimeter - second.

2 Magnetic force,  $m$

Amperes,  $i$ , per  $c.m.$ ,  $l$ .

or Coulombs per centimeter - second.

The dimension of time and its relation to space is evidenced by these dimensional expressions. Here a condition exists where dielectric force is derived magnetically, and magnetic induction is derived dielectrically, both through the dimension of time. However, we are not interested in time here, we are interested in only space. It seems like we are stuck in a loop.

The way out is to utilize the new pair of dimensional relations, that is

$d$  the dielectric gradient

and

$m$  the magnetic gradient

as primary dimensional relationships.

Effort will be made along the way to express these relations in an alternate expression, through the concept of inductance and capacitance.

If this pair,  $d$  and  $m$ , both with no one's name, or real definition, are taken as primary dimensional relations then the electro-static potential  $e$  is derived as a secondary relation to  $d$ . Likewise the M.M.E.  $i$  is derived as a secondary relation to  $m$ . It is then  $e$  equals the product of  $d$  and  $c.m.$

Volt - centimeter per centimeter

and

$i$  equals the product of  $m$  and  $c.m.$

Ampere - centimeter per centimeter These dimensional relations give rise to centimeter per centimeter. What can we make of this, a space scalar. This dimensional condition represents a SPACE INTEGRAL. Integration, as it is known, is derived from the Newton - Leibnitz concepts and represents the inverse of differentiation. This application to  $c.m.$  per  $c.m.$  is called the line integral of  $d$  or  $m$ . Integration is best avoided.

What we are doing is this; the electric forces dimensionally are in PER  $C.M.$ , that is, in a counter-spatial form. In the integration, the product of the counter-

space span in per *c.m.* is multiplied by spatial distance of the span. Per *c.m.* time *c.m.* the product of counterspace and space results in a dimensional cancellation, or numeric. This is called a SPACE SCALAR condition. It is dimensionless but possesses an "angle".

In conclusion, the force exists in a counter-spatial gradient, where as the potential, or M.M.E., exist in a spatial distance. The potential  $e$  is the integral of the force  $d$ , and the M.M.E.  $i$  is the integral of the force  $M$ . Read the introductory chapters of Heaviside's "E.M. Theory, volume one."

### 7.13 Impedance and Admittance

At this point the next level of dimensional relations can be derived from the primary dimensional relations given thus far;

(I) The law of electro-magnetic induction, Faraday's law, that is the electro-motive force  $E$ , in volts, is given by the proportionality (ratio) of the total quantity of magnetic induction  $\Phi$ , to the time rate of the gain or loss of this quantity of magnetic induction, in per second. The voltage  $E$  is given by the rate of variation of magnetism. Change in magnetism is volts of E.M.F.

(II) The law of magneto-dielectric induction, Maxwell's law. That is, the displacement current  $I$ , in amperes, is given by the proportionality (ratio) of the total quantity of dielectric induction  $\Psi$ , to the time rate of the gain or loss of this quantity of dielectric induction, in per second. The current  $I$  is given by the time rate of variation of dielectricity. Change in dielectricity is Amperes of displacement.

In both cases "quickness" is the factor of direct proportionality. Example, 120 volts at 60 cycles per second applied to a transformer winding results in a greater rate of change in magnetism than 110 volts, 60 cycles applied to the same winding, despite both being 60 cycles. Why? The slope of 120VAC is greater than 110VAC. Try it on your oscilloscope and see.

$E$  and  $I$  are not to be considered opposites of each other, but they exist in a COMPLIMENTARY SYMMETRY form. The four pole archetype of electricity shows itself in that there is  $E$  and  $e$  or  $I$  and  $i$ . This leads to the answer for our second question, the null force condition, that is what ratio of  $E$  to  $I$ , and thus  $e$  to  $i$  give rise to a cancellation of " $e$  pulls" and " $i$  pushes." Another ratio to be investigated.

Taking the ratio of the E.M.F.  $E$ , and the displacement  $I$ , that is  $E$  over  $I$ , we have evoked "Ohms law": The dimensional relation of E.M.F.,  $\Phi$  over  $T$ ; divided by the dimensional relation of displacement,  $\Psi$  over  $T$ . This results in a new

dimensional relation. This relation is known as the IMPEDANCE  $Z$ , in OHMS.  $E$  per  $I$  is  $Z$ . For a given product of  $E$  and  $I$  in Watts. We may have a large  $E$  and a small  $I$ , a high impedance, or we may have a small  $E$  and a large  $I$ , a low impedance. Hence, a unit of power (activity) in Watts may be in the form of a high impedance (12KV, 1 Amp) or a low impedance (1KV, 12 Amp), both the same power (12 KVA). Think of the transmission in your car. The engine is delivering 20 horsepower (activity) and this is delivered to the wheels. The engine is running 1800 R.P.M. (volts), but the drive shaft is running 180 R.P.M. (volts). The engine is a high impedance, the driveshaft a low impedance, but the power is 20 HP in both. We call this an IMPEDANCE TRANSFORMATION and this is effected by what is known as a TRANSFORMER, (the transmission, it has a RATIO of ten to one).

The dimensional relation of impedance,  $Z$  in Ohms, can be expressed in an alternate manner from the primary dimensions.  $E$  divided by  $I$  equals  $Z$ , Ohms law. But we have dimensionally that the E.M.F.  $E$  in volts is given by Faraday's law

Webers per second

Likewise the displacement  $I$  in Amperes is given by Maxwell's law

Coulombs per second

Taking the ratio of  $E$  over  $I$  and substituting, the impedance is given by  
Weber-second per Coulomb-second = Ohms

Here, dimensionally speaking, we have second per second which is thus dimensionless, or scalar, a TIME SCALAR. Hence the primary dimensional expression for impedance,  $Z$  in Ohms, is given

Weber per Coulomb Equals Ohm.

Hereby the impedance of the electric field of induction is defined as the ratio of the total magnetic induction to the total dielectric induction,  $\Phi$  over  $\Psi$  gives Ohms  $Z$ . This is known as the characteristic impedance of the electric field of induction.

It must be remembered that the scalar term of seconds per seconds expresses the hysteresis angle between the time frame for  $E$  and the time frame for  $I$ , as the pair weave their dance through the dimension of time (note, get that 2D or 3D

out of your head, we are in the dimension of time!) The ratio  $Z$ , the impedance, is therefore a "directed quantity" in the dimension of time. This is to say the impedance has magnitude and a position in time. Listen to Bach organ music for further as this is too complex for now.

Since arriving at the concept of impedance it may be asked what results from its inverse  $I$  over  $E$ , the ratio of displacement current to electromotive force. This ratio is called the ADMITTANCE  $Y$  of the electrical system. Following the same path dimensionally as was done with impedance it is,

Coulomb - second per Weber - second

Admittance  $Y$  in Siemens is the ratio of  $\Psi$  to  $\Phi$ , the ratio of the dielectric field to the magnetic field of the electric field of induction. This is called the characteristic admittance of the electric field.

As for the scalar term of seconds per second the same situation exists as with the impedance  $Z$  in Ohms. It is however that there is also a time "angle" between the time frame of impedance  $Z$  in Ohms and admittance  $Y$  in Siemens, just as there is with Volts and Amperes. Hereby results that the impedance is NOT just the inverse of the admittance, that is,  $Z$  is NOT one over  $Y$ , they are MIRROR IMAGES. Look in the mirror. Your head is up, your feet are down, but your right is left and your left is right. This is much too complex.

In conclusion, the impedance and admittance serve as proportionality factors between the magnetic and the dielectric, or the dielectric and the magnetic, fields respectively.

## 7.14 The End of Time

This dimension of time, and its dimensional relation to electric phenomena, thus far has been the primary discussion. This metrical dimension, in seconds, and its relation to the substantial dimensions of  $Q$ ,  $\Psi$  and  $\Phi$  has yielded a set of fundamental electrical relationships. As of yet the dimension of space is regarded as a frontier, occult from the human mind.

The idea of the dimension of time is a relatively modern development, beginning with the "age of clocks" in Europe. Out of this evolved the epic time dimensional works of J.S. Bach, 1685 to 1750. Following Bach the Newton - Leibnitz system of mathematics allowed for an analytical treatment of the dimension of time. The development of a base one number system, such as given by

A. MacFarlane, and a system of electrical dimensional relations by O. Heaviside, led to the epic time dimensional works of C.P. Steinmetz 1965 to 1923. Steinmetz writing in "Theory and Calculation of Transient Electric Phenomena" stands as an algebraic analog to Bach's last work, "Die Kunst der Fuge", BWV - 1080. Time in both forward and reverse, as well as multiple hysteretic time frames, within a complimentary - symmetrical geometric construct are portrayed in both the works of J.S. Bach and C.P. Steinmetz. A persistent rumor exists, starting with Edison's attempts to make contact with the dead. An unknown Christian organization contracted Steinmetz to develop an apparatus to allow viewing in present time the life of Jesus Christ in his time. Quite a story but no possible verification. However, in the realm of fiction, it was noticed that an old 1963 Outer Limits episode titled "Borderland" portrayed a layout like Steinmetz may have used in his G.E. laboratory. It is unfortunate that few, if any, have, or will follow the footsteps of the giants, they are too deep. Most will, without a thought, lap up the sweet neurotoxins administered in liberal doses by the pendants, mystics, and dis-informers. Coyotes however are hard to trick and thus are hard to poison. We will continue to follow their path, hard as it may be.

Up to this point in time these time sequential internet transmissions have been intent in presenting, in a hypo-complex fashion, the primary electrical relations previously relegated to the tongues of parrots with only one wing. The only unique dimensional relation has been the Planck,  $Q$ . The Planck is defined as the undivided quantity,  $Q$ , of the total electric induction. In a Biblical sense an analog is, "and in the beginning..." Every other substantial relation found its derivation in the Planck. A pair,  $\Phi$  and  $\Psi$  were arrived at by a divorce, four more by direct interaction of a substantial dimension with the metrical dimension of time, these being  $E, I, W, P$ , and finally two more  $Z$  and  $Y$ , were derived in a pair of paths, one path through the metrical dimension of time, the other path through direct relations of the primary substantial dimensions of  $\Phi$  and  $\Psi$ . These give us the ONE and a following set of EIGHT.

It is important to remember not to become enamored to our models, or the models of others, with regard to the nature of the inductive process, or the nature of the medium which engendered it. These constructs, here and elsewhere, are illustrative, not concrete, but that is not to say that concrete constructs should not be sought. The primary intent and effort here is the establishment of concrete engineering formulation applied to the development of specific electrical apparatus. It is goal orientated much like the actions of large aggressive reptiles. Too bad they are extinct. What one does after that big blast off the bong, or the  $N$ th beer in the bar, is considered a personal issue, not for publication or enforcement.

Concluding this sequence of time dimensional relationships the following tables are given.

Table 1

The One: The undivided quantity of electric induction.

Given as: The Planck,  $Q$ , in Weber - Coulomb.

The primary pair of dimensions:

One: The total dielectric induction.

Given as: The Coulomb,  $\Psi$ , a primary dimension. Two: The total magnetic induction.

Given as: The Weber,  $\Phi$ , a primary dimension.

The first set of secondary dimensional relations:

One: The displacement current.

Given as: The Ampere,  $I$ , in Coulomb per second.

Two: The electromotive force.

Given as: The Volt,  $E$ , in Weber per second.

The second set of secondary dimensional relations:

Three: The energy.

Given as: The Joule,  $W$ , in Planck per second.

Four: The activity (power).

Given as: The Watt,  $P$ , in Joule per second.

And finally the pair with dual derivation:

One: The impedance.

Given as: The Ohm,  $Z$ , in Volt per Ampere, or in, Weber per Coulomb.

Two: The admittance.

Given as: The Siemens,  $Y$ , in Ampere per Volt, or in, Coulomb per Weber. Also, throughout the dimensional relation for time is given as:

The complex frequency in Neper - radians per second,  $\nu$ . And thus closes our system of electrical units in a dimensional relation with time.

Table 2

DIELECTRIC ELECTRIC MAGNETIC

———— Planck —————

Coulomb ——— Weber

Ampere ——— Volt

Siemens ——— Ohm  
 ——— Joule ———  
 ——— Watt ———  
 (Neper - radian per second)

## 7.15 Space

Our discussion on the theory of electric phenomena will now shift from the metrical dimension of time and develop the application of the metrical dimension of space. As a frontier, space will be treated in an experimental manner. One is cautioned against being, or becoming, enamored to any particular concept of space presented here or elsewhere. The importance of the study of J.J. Thompson, "Electricity and Matter", and O. Heaviside, "E-M Theory", volume 1, (introductory chapters), this cannot be over-emphasized. Do your homework. And as said by Heaviside, it is said here; "If you think these are hard to read, well, they are even harder to write (in the front seat of my car).

Greater complexity is encountered in the application of the dimension of space than that of time. Space relations are not well understood in the contemporary engineering world, and misconception abounds. N.F.G. relations introduced by the QRM mystics, such as curved space and  $2D$ ,  $3D$  thinking has all but eliminated any real comprehension of the application of the dimension of space to electrical study.

Relations in the dimension of time are ADDITIVE, relations of forward and reverse. Time relations are linear, so to speak, along  $w$  versor path in time. Not so in the dimension of space, here it is MULTIPLICITIVE. Time relations are arithmetic progressions, whereas space relations are geometric progressions.

Consider a numerical illustration:

For the time relations, it is; 3 and 3 gives 6.

For space relations, it is; 3 and 3 gives 9.

Taking an alternate approach we have for time, a pair of 3's, that is, two 3's. The same for space, two 3's,

then it is for time; 3 times 2 equals 6,

and for space it is; 3 to the 2 power equals 9.

Hence, it can be stated that the time relations are LINEAR whereas the space relations are LOGARITHMIC.

In working with time dimension relations there has been developed a versor

algebra, an "algebra of time." The development of this time algebra is primarily due to the efforts of Carl Proteus Steinmetz of General Electric Corp. (also see A. MacFarlane, "The Imaginary of Algebra"). Versor algebra utilizes a BASE ONE number system, that is, the number ONE raised to a specific power. In common use is the base TWO number system, binary, and the base TEN number system, decimal. But a base one number system seems unlikely, it can only give one. This is exactly what we want in a versor system, as will be shown.

The versor concept applied to time relations has been established in engineering work for practical use, but not so for space relations. The concept of space versor algebra jammed up and seized with what is known as QUANTERNIONS. Development of space versors "finished" with quaternions (see A. MacFarlane "Principals of the Algebra of Physics") and little else progressed up to the "Theory of Wireless Power" by E.P. Dollard where a space versor algebra is presented. Note that versors are NOT VECTORS.

So as to arrive at an understanding of versor algebra in general it is instructive to consider known concepts of versor algebra for time. Consider a second order time relation. This is given as, the square root of positive one, a seemingly useless statement. An alternate expression is given as, ONE raised to the one half power, let us say raised to the PER TWO power. This is a second order relationship and by definition must give a pair of roots, that is, two distinct values, thus the roots are given as (1) Positive one, and (2) Negative one. We will call negative one an IMAGINARY NUMBER. Both roots, (1) and (2) are more properly named VERSOR OPERATIONS. Their magnitude is unity and they are dimensionless. Therefore, by application to the concept of the additive process, it has now been extended to include subtraction. (plus and minus). We have arrived at an expression for time phase opposition.

Extending these ideas results in a versor expression for fourth order time relations, the fourth root of positive one. This is ONE to the ONE FOURTH power (one to the PER FOUR power). This can be partially resolved into a pair of square roots, each of which have two roots, giving the required four roots. It is given that the square root of positive one produces a pair of roots, that is,

- 1) Positive 1,
- 2) Negative 1.

Now, in addition, is the second square root, the square root of negative one, this producing a pair of roots,

- 1) Positive  $j$ ,
- 2) Negative  $j$ .

Hereby we arrive at the required four roots produced by the fourth root of positive one, four to the one fourth. These are given as

- 0) Positive 1,
- 1) Positive  $j$ ,
- 2) Negative 1,
- 3) Negative  $j$ .

Here the concept of the additive process, addition, is now further generalized. There is more than only plus and minus. This versor expression is for time phase quadrature and for time phase opposition. We now see versors as a degree of lead or lag on a given order of time, here in fourth order time. One to the one fourth power gives the four quadrature versor operators. CAUTION, do not view this as  $2D$  or  $4D$  time, this is NOT a VECTORAL system. Further on this is given in the "Symbolic Representation" papers by E.P. Dollard.

The versor algebra here given thus far has been orientated to represent the dimension of time. Versor algebra is based upon degrees or orders of the dimension to which they are applied. The following orders of space, in terms of perceptual understanding begins the degrees or divisions of the dimension of space. The fundamental unit of space here will be the centimeter, or  $cm$ .

I - First order of space:

- (a) DISTANCE Space to the positive first power,  $cm$ .
- (b) SPAN Space to the negative first power, per  $cm$ .

II - Second order space:

- (a) AREA Space to the positive second power, square  $cm$ .
- (b) DENSITY Space to the negative second power, per square  $cm$ .

III - Third order space:

- (a) VOLUME Space to the positive third power, cubic  $cm$ .
- (b) CONCENTRATION Space to the negative third power, per cubic  $cm$ .

IV - Fourth order space:

- (a) Space to the positive fourth power, quartic *cm*.
- (b) Space to the negative fourth power, per quartic *cm*.

Finally  $N$ th order space.

The (a) group are the spatial relations, and the

(b) Group are the counter-spatial relations. Higher order space, such as fourth order lack definition, it is undefined space. Einstein  $4D$  space, crystal structured? It remains un-defined!

These orders of space can be worked into a simple tale:

I ran out of orange juice, bummer. Now I got to drive a DISTANCE of 15 MILES to the lizard pit (store). Let's take Rathead, the poodle, along for a chance to get out of the house. Along the way I'll count the number of poles on that old  $J$  carrier line, they have a SPAN of one PER 150 FEET. Rathead has got to stay in the car, that 1000 ACRE AREA of land behind the store is infested with coyotes. They have a population DENSITY of one PER 50 ACRE. This store only sells juice in a VOLUME of half GALLONS. The CONCENTRATION of vitamin C in this juice is one unit daily requirement PER 8 CUBIC OUNCE serving. When considering next the fourth order of space, Rathead begins to bark his head off at some UNKNOWN THING. Stupid poodle, let's go. Break, more follows on Space.

## 7.16 N.F.G. In Space, Heavside

The lord god sayeth to mooses : Thus rose the beast, and it arose as a giant one winged parrot, this hewn of solid plutonium. She delivereth the beast as an idol of worship to her supreme power. The surrounding multitudes casteth off their garments so as to feel the warmth of its radiant tongues of fire. It came to pass that the beast smote the multitudes by burning their eyes and leaving them to wander blind for eternity.

Verily this is the present situation for the science of electricity, just as told in the parable. Oliver Heaviside, a spurned English theoretician, devoted considerable effort toward straightening the path of progress in electrical science. He endeavored to lead the blind out of darkness, but their restored sight was only black and white. The idea of electricity as a flow of electrons in a conductor was regarded by Heaviside as a psychosis. This encouraged Heaviside to begin a series of writings to "de-program the Moonies." This often utilized "Tragic Tales" to make his idea clear about mathematical futility. "One such tale" is of a young

child, "and this child would not smile. So his father beat him with a strap, in an effort to make him smile. But the child would not smile. Later he was eaten by a lion." This tale is what Heaviside thought about the mathematical system of QUATERNIONS.

Quaternions represent a primordial form of a versor space algebra. It is however ultimately vectoral. The system of quaternions was a retrofit of the existing concepts of versor algebra that originally were adaptable to time, this to provide an analogous versor algebra useful for space. It is really not much use for this purpose. Oliver Heaviside despised quaternions, leading him to develop his own space mathematics. The work of J.C. Maxwell was encumbered by his reliance upon the use of the quaternion system. It is this complication with Maxwell that initiated Heaviside's efforts to "remove the baggage" that encumbered the understanding of Maxwell. Heaviside produced his "vector system" for this effort. He received little credit for his important work, and his famous set of equations are wrongly known as "Maxwell's Equations", ask any parrot.

Heaviside's vector system sought to provide a lucid description to the Maxwellian concept of electro-magnetism, or rather the Heaviside concept of the Maxwellian concept of electro-magnetism. That is transverse electro-magnetism. Plancks, or cross product relations. But this vector system has no application to longitudinal magneto-dielectricity. But is not this the realm that gave Maxwell his fame? Displacement current, current in empty space, is the Maxwellian concept that leads to longitudinal waves. It is most likely that most of what is thought to be understood about Maxwell's work is in reality the ideas of others. Absolutely no mention should be made of anything Maxwellian without directly quoting Maxwell himself through his writings! To study his work in its entirety will take a lifetime. So mute thyself.

The dis-informers, SSX, heap criticism upon Oliver Heaviside for his one sided representation of the works of J.C. Maxwell. Their real motive is to take one off the "Heaviside trail", but the coyote wants to run that path. Obviously this series of transmissions via internet is in the full "attitude" of Oliver Heaviside. Forgotten in pre-history is the effort of 19th century mathematicians given to space math. Major figures were Grassman, Hamilton, Tait, and MacFarlane. Review of their works provides a better understanding of what has been inherited. Only what Maxwell utilized out of necessity, and Heaviside developed out of deliberation exists today. Longitudinal electric waves are considered non-existent, a complete impossibility. But that is what propagates between the plates of any condenser or between the windings of any transformer, physical realities.

So today we labor under an absolutely one sided view of electricity. It cannot

stand upright just as a bird with only one wing cannot fly. The entire misconception has now matured, become "frozen in stone" as an idol of worship to the supreme power of the pedant. In reality it is a monolith of self-edification, taught in every university.

The pedantic assault upon the pioneering efforts of Heaviside, Tesla, and Steinmetz is worthy of closer examination. Two particular characters, supreme pedants sink to the "bottom of the bowl." One is William Preece of the British Royal Society. Preece championed the entirely lopsided view prevalent in the "misunderstood, untested, and infested with bugs" undersea cable telegraph technology. This errant concept nearly ruined the trans-oceanic telegraph industry. It took the work of Oliver Heaviside to "balance the equation" thereby allowing a working telegraphic system. He did this through His serial writings known as "Electro-Magnetic Induction and its Propagation." These led to his most important development, the "Telegraph Equation." William Preece F.R.S. censured the work of Oliver Heaviside and went so far as to attempt to make his own concept a law.

America's most (wanted) noteworthy pedant is Michael Pupin, of Columbia University. Pupin was a supreme pedant. He repeatedly assailed Tesla with rude attacks. He even went so far as to perform the same upon C.P. Steinmetz. Steinmetz received harsh criticism for his theory of hysteresis, which not only gave Steinmetz his world fame, but also saved the infant electrical industry from ruin. Pupin declared the important transformer equations developed by Steinmetz as un-Maxwell, heretical. But it is these ideas that lay the foundations of electrical engineering. Pupin's crowning swine behavior is his treatment of Heaviside. Pupin takes Heaviside's telegraph equation, repackages it as a transmission concept, patents its implementation, then sells it to American Telephone & Telegraph for \$25,000. Long distance telephone is born, with not one word of Heaviside. In final disgust, during the "Einstein Age", Heaviside removed his furniture from the house and sat on granite blocks, then painted his fingernails pink. Later he was stoned to death by a pack of youngsters.

## **7.17 Application of Space to the Electric Dimensional Relations**

In order to gain an understanding of the electric field of induction a concept of the distribution of this induction in the dimension of space must be developed. An

example is a 200 mile long power line. It has a span of 600 feet between towers. This is a 230 kilovolt, 60 cycle/sec, 3 phase line. It can be shown that for each span of line between supporting structures there exist an electro-motive force,  $E$ , in Volts, this in series along this span, and a displacement current,  $I$ , in Amperes, this in shunt along this span. The series E.M.F., and the shunt displacement of each span compound with each successive span. The total E.M.F. and total displacement for the entire length, 200 miles, of the line is found by integrating over the total number of spans. However, this integrated value is not given by the simple addition of the individual E.M.F.s and displacements developed by each of the individual spans. Here we find an exponential function of space determines the relation between the individual values, and the total values of E.M.F. and displacement. These considerations are developed by Carl P. Steinmetz in his "Theory and Calculation of Transient Electric Phenomena" book, in particular the chapter on "Transients in Space."

The general problem of the representation in space is given by the introductory part of "Transients in Space" and also by Ernst Guillimen in the introductory chapters in his "Communications Networks" vol. 2. Read these, they are a most important study. These writings form the basis for the theories of electrical engineering utilized today.

The metrical dimension of space is most often considered as a VOLUME, this representing an enclosed quantity of space. This space is filled with something substansive, often which must be paid for, such as a gallon of milk. The milk is the substansive dimension, the "throw away" gallon container is the metrical dimension. In general, this volume of space is considered a cubic quantity, or boundary, this such as a cubic foot, cubic yard, cubic centimeter, and etc. It is habitual to express a volume in cubic terms, this in three mutually perpendicular coordinates, wrongly called "dimensions." It is also habitual to express electric relations in the same manner, a corner of a cube, such as  $\Psi$ ,  $\Phi$ , and  $Q$ . This now is three dimensional, a  $3D$  relation, since  $\Psi$ ,  $\Phi$ , and  $Q$  are dimensions. The cubic relation itself has no substansive dimensions, it is only the metrical dimension of space expressed by a group of three mutually perpendicular coordinates. This is important.

It is given here that a one centimeter cube is the elemental unit of the dimension of space, a volume of one cubic *cm*. This is about the size of a common sugar cube, but instead of sugar, this cube is filled with electric induction. It is a cube of electricity. What exists outside the boundaries of this cube is for now unknown, it is excluded by the boundaries. For most of the examples that follow, all space is filled with 10 – C transformer oil, the dielectric. All boundaries en-

closing, or dividing, this space are sheet copper, the metallic. Here given is the metallic-dielectric geometry, such as a power transformer, or a static condenser, two fundamental apparatus in electrical work.

In the case of the 200 mile long A.C. power line the basic element of space is the span. This is first order space. Here it is given as per 600 feet, this now a unit value. It now equals one, one span. This unit value is known as a differential element, it is indivisible, the smallest "line on the ruler." It relates to the Newton-Leibnitz concept of the infinitesimal.

It is considered that cubic, or third order space, is the most general expression of space, a metrical dimension. Since the ordinary transformers and condensers utilized in power engineering are of considerable volume, it is then allowable to consider one cubic cm. as a differential element, that is, an infinitesimal quantity of space. Taking the, one cubic cm. of space, as a unit value, gives the differential element of the metrical dimension of space. It is hereby about the size of a sugar cube, but filled with 10 – C oil. Hence the VOLUME is given as ONE cubic cm., the AREA as ONE square cm., the DISTANCE as ONE cm., the SPAN as ONE per cm., the DENSITY as ONE per square cm., and the CONCENTRATION as ONE per cubic cm., all faces, corners, spacings, and etc. of this unit cube are ONE. Hence our differential, indivisible, element of the metrical dimension of space. All orders, or powers, of this space equals one, one squared is one, one cubed is one, and etc. All are one.

This may just as well have been a cubic yard, or a cubic nanometre. The consideration of "unit value" is to reduce the size to the point to which there is no distinguishable variation of the substansive dimension with respect to the unit of the metrical dimension of space. It is then a space scalar condition, no variation in space. For example, consider the 200 mile long A.C. power line. It has a propagation velocity very near that of light. For a frequency of 60 cycles per second, this gives the wavelength as 2880 miles in length. The total distance of this line is 200 miles, this a significant fraction of a quarter wave or an impedance to admittance transformation. However the per 600 feet of a span is an infinitesimal fraction of the quarter wave distance. Hence the distance between towers, the spans, serve as the differential element. It is then 600 feet is of unit value, indivisible. There are no intervening towers.

No perceptible variation of the series E.M.F., E in Volts, or the shunt displacement, I in Amperes, exist along this 600 foot span of A.C. power line. Hereby it is said the E.M.F. per span, or the displacement per span. In the general case it is given as Volts per span and Amperes per span. These dimensional relations represent the voltage gradient and current gradient along the length of line. Di-

mentally it is

- 1) Volts per cm.
- 2) Ampere per cm.

It should be noted that this pair of gradients exist in space quadrature to the previous given gradients, the dielectric gradient,  $d$ , and the magnetic gradient,  $m$ . This is a fundamental relation in electro-magnetic induction and its propagation.

It can be seen that each span has a back E.M.F. in series with the power flow, and a displacement, or charging, current in shunt with the power flow. These are a consequence of the electric field of induction in a time rate of variation, the 60 cycle, or 377 radians per second. These are transmission impairments and give rise to a delay in propagation which progressively compounds down the line, from span to span. These differential elements, or spans, must be summed up, or INTEGRATED, in order to determine the total E.M.F., total displacement, and the total delay in propagation. This is not so easy of a task. Now for higher orders of space the situation is that order more difficult.

In the application of the metrical dimension of space to the substantial dimensions of electricity, the concept of magnetic inductance, and electro-static capacity, are utilized. Steinmetz, in his "Impulses, Waves, and Discharges", established the inductance and the capacitance as the "Energy Storage" coefficients of the electric field of induction. It must be noted that here the term ELECTRIC FIELD is NOT the "electro-static" field, it is the union of the dielectric and magnetic fields of induction. Erase the "electric field" wording of the one wing parrot. These two distinct dimensional relations, the INDUCTANCE and the CAPACITANCE serve to define the ability of bounded to contain the electric field of induction, this field representing STORED ENERGY.

What follows here is the development of the properties related to the dielectric and magnetic fields and the interaction of these with the bounding metallic-dielectric geometry. Considerations involving energy will be arrived at later on. In this view inductance and capacitance now represent GEOMETRIC COEFFICIENTS, expressing the relation of the BOUNDING GEOMETRY with the fields of induction which it bounds. In essence inductance and capacitance are of a scalar form. Here enters the concepts of what is known as "radionics." The inductance and capacitance each exist in distinction to the electricity itself. The inductance and capacitance ultimately serve as geometric expressions. This is important. Hereby they can be expressed as completely metrical dimensional relations, that is, having no substansive dimension.

We have of yet actually given the dimensional relations which make up inductance and capacitance. Further considerations involving the electric field have yet to be understood. Break, more to follow...

## 7.18 Basic Electrical Relations in Space

Let a one centimeter cube of the metrical dimension of space be given as unit space. The given metrical boundaries define a unit cube, a sugar cube with no sugar, no 10 – C oil, not even any aether. This cube of space is empty, void. This unit of space, a metrical unit, is NOT in connection with any substantial dimension. This is a unit cube of void space.

It is postulated that electric induction, as a property of the aether, cannot be established without the presence of this aether, or another dielectric medium. This is to say, void space is not capable of supporting electric induction. Hereby it is reasoned that the aether is a substansive dimension, or it can be expressed as a substansive dimensional relation. The dimensional expression of the aether it is best given as a primary dimension, expressed only in a dimensional relation derived from a primary substansive dimension and its relationship to a primary metrical dimension, time or space. This is served by the concept of the Planck,  $Q$ , this in conjunction with a space versor system expressing the Planck in real (electro-magnetic) components. See E.P. Dollard "Theory of Wireless Power."

In general we have been speaking in terms of line of force, that is lines of magnetic and lines of dielectric induction. It is as of yet known "how big" these lines of force may be. These lines of induction can be expressed analogously, such as a bag of uncooked spaghetti. Its individual strands serve as analogs to the individual lines of induction.. Hence long, thin, strands with axes in a broadside bundle. If then the bag of spaghetti is snapped in two, when it is viewed endwise, a circular cluster of small end-sections of each strand are seen. These are elements of the strands of spaghetti.

This package of spaghetti is an analog to the total dielectric induction. Now there are 100 strands of spaghetti in this package, or boundary condition. Here  $\Psi$  is then given as 100 strands, the total quantity of spaghetti. Viewing this package endwise, 100 end sections of the individual strands are seen in a circular bundle. The cross sectional area of this bundle, bounded by the package is a one square inch AREA. This is analogous to a dielectric flux DENSITY, the density of dielectric induction, in PER SQUARE INCH. Hence the density of spaghetti is given as 100 strands per square inch. The total undivided quantity of spaghetti

is 100 strands. The substantive dimension of spaghetti is in containment by the "throw away" package, this as the metrical dimension of space. Counter-spatial representation is given as 100 strands per square inch. The grocery store regards this as one indivisible unit quantity in space of spaghetti induction.

Here the substantial dimension of spaghetti,  $\Psi$ , is operated upon mathematically by the metrical dimension of space, per square inch. Here arrived at is the dimensional representation of spaghetti in space, strands per square inch. This is a second order space relation, in a counter-spatial form.

A pair of dimensional relations follow from the spaghetti analog. One is the dielectric flux density,  $\Psi$  over  $A$ ,

(1) Coulombs per square *cm*.

and the magnetic flux density,  $\Phi$  over  $A$ ,

(2) Webers per square *cm*.

Here  $A$  is the area in square *cm*, a second order expression of space. A primary dimensional expression for second order space is the ACRE, the space for which she extracts her toll.

Since the total electric induction,  $Q$ , is the product of the dielectricity,  $\Psi$ , and of the magnetism,  $\Phi$ , it may be asked, what of the product of the dielectric flux density, and the magnetic flux density? This is given as

(3) Coulomb per square *cm* times Weber per square *cm*.

Substituting the dimensional relation,

(4) Coulomb-Weber, or Planck

Hereby gives the dimensional relation of the product of the flux densities as

(5) Planck per quartic *cm*.

Hereby the product of the pair of flux densities, (1) and (2) Gives rise to a fourth order space relation (5), this in counter-spatial form. Now what in hell set off the poodle this time?

## 7.19 Experimental Cubic Volumes

It has been heretofore established an existence of a volumetric, or cubical, unit of space, the metrical dimension. This unit of the dimension of space is defined as one cubic centimeter, the size of a common sugar cube. It is given this metrical cubic volume of space is void of any substansive dimension, no sugar, no 10 – C oil, and even no aether, since aether is considered a substansive dimensional relation. Hence, indivisible, void, and a pure metrical unit, this is our cubic volume of EMPTY SPACE.

Consider the axiom that a field of electric induction cannot exist in the absence of the aether. Then just how does this cubic void space interact with an electric field? Since the laws of lines of force as established by Michael Faraday, and developed by J. J. Thompson, and as further established by C. P. Steinmetz, maintain that no line of force can just end in space. The lines of magnetic induction exist as closed loops, no beginning, no end, continuous expansive or contractive loops. Magnetism is a circumferal force. In a conjugate manner the lines of dielectric induction terminate upon physical surfaces, where they bond into the intra-molecular dimensions. Dielectricity is a radial force.

The Maxwell concept of electro-magnetic induction and its propagation gives an altered concept of the nature of dielectric induction. In this situation the lines of dielectric induction may also terminate upon themselves, forming closed curves in a manner analogous to the loops of magnetic induction. This condition is a necessity for the propagation of electro-magnetic waves in a dielectric medium, (sugar, oil, aether, etc.) without guiding metallic structures (wires, waveguides, etc.) This eliminates the "charge carrier", that is, the dielectric induction is now completely independent of any terminal surfaces. The dielectric induction is now completely dielectric. This is the fundamental concept underlying the Maxwell theory of electro-magnetism. It is here that J.C. Maxwell found his fame. But the pedant tells us just the exact opposite! So intent is this mind-state in forcing a "materialism" upon electrical theory that Maxwell's work is re-worked to suit this view, it is then taken up by the one wing parrots, their screeches drowning out the original concepts of Maxwell.

It may be logically inferred hereby that, for the condition of a cubic volume of space, the line of magnetic, and the lines of electric, induction must bend around this cubic void of space. These lines cannot be interrupted or broken by this void. Hence by the insertion of a cubic void into a space supporting electric induction the lines of force are pushed aside. The overall induction in the supportive space is then hereby reduced, since now there is a unit volume less of this space. This is

to say that the inductivity of the supportive space is reduced by the insertion of an aetherless cubic volume of space, the cube of empty space.

Consider certain experimental configurations. One configuration consists of a widely spaced pair of laser produced beam of light, side by side traveling through the aetheric medium. The second configuration is a pair of one square centimeter copper plates. These two plates face each other squarely and are separated by a span of one centimeter. This defines a partial boundary for our one cubic centimeter, or unit, cube. Hence any unit cube volume can be inserted between the pair of one square cm copper plates. It is also given that all space within and surrounding these copper squares is void, no sugar, no oil, no aether, just empty space.

In our first experimental configuration we have a set of three unit cubes, one is filled with 10 – C oil, the second is filled with aether, and the third is void. Taking the side by side spaced laser beams, we measure the speed, or time delay of propagation of both beams through supporting aether through which they propagate. Here, both arrive at the end point at the same time, thus propagating at identical velocities of propagation. First, take the unit cube of oil and insert it into beam number one, leaving beam number two unchanged. It is hereby found that beam one arrives delayed in time relative to the arrival time of beam two. Here it can be inferred that light travels slower in the oil. By measurement it is found to be about 70 percent of the light velocity in the aether.

Next, take a unit cube of aether and insert this cube into beam one, again leaving beam two unaltered. Obviously both beams arrive at the same time since both propagate through only aether.

Finally, take a unit cube of void space and insert it into beam one, beam two again unaltered. The poodle begins to bark. We now have two distinctly opposing possible outcomes.

(A) Beam one is stopped at the facing boundary of the cubic void. No beam one is detected at the receiving end. Now it may be asked, what became of beam one? Was it sent back, or was it consumed, thus in violation of the Law of Energy Perpetuity? This we are unable to answer.

(B) Beam one arrives advanced in time relative to the arrival time of beam two, this to say, that the propagation through the void space is now instantaneous, in other words with an infinite (undefined) velocity. It takes no time to span the distance of the unit void space. How is this possible?

Now we take our next experimental configuration, the pair of parallel one square cm. copper plates, these in void space. Thus far we have no concept defining capacitance, but we do possess a capacitance meter. How fortunate! Upon connecting this instrument to the unit copper plates in a void it is found that this

metallic-dielectric configuration has zero capacity. This is understandable since we now have no dielectric, and hence, no dielectric induction.

Next, we insert a unit cube of aether between the unit square copper plates. Now the instrument indicates one electro-static unit of capacitance, this as expected.

Finally, we insert a unit cube of 10 – C oil between the unit square copper plates. Now the instrument indicates an increase in capacitance over that of the aether. This increase in capacitance is in EXACT proportion to the square (second power) of the decrease in the velocity of light through the same identical cube of oil. It is then given, the change in the velocity of light through a dielectric medium is the square root of the inverse of the change in capacitance effected by this dielectric medium. Hence capacitance exists in a direct relationship with the velocity of light in a given medium. Zero capacitance, infinite velocity.

Hereby this dimensional relation is given as

#### Seconds Squared per Centimeters Squared

This is to say, one over the speed of light squared, that is, one over  $c$  squared. Here it is useful to take the speed of light as a unit value, or one. See for example, C. P. Steinmetz's "Impulses, Waves, and Discharges", chapter on "Velocity Measure." It is in this relationship between luminal velocity and electro-static capacity that we find the luminal velocity concepts of the relativists, the  $c$  squared in the  $E$  equals  $Mc^2$ . Call it a "dimensional fluke" if you wish. However, capacitance is forever married to the velocity of light, to one over  $c$  squared.

Investigating dielectric capacitance a bit further, consider an experiment of Ben Franklin, the father of the electro-static condenser. Here we will dispel the "electronics nerd" concept that a capacitor stores "electrons" in its plates. Taking the pair of copper plates as in the previous experiment, but now we have two pairs of plates, one pair of plates distant from the other pair of plates. Upon one pair of plates is imposed an electro-static potential between them. The cube of 10 – C oil is inserted between this "charged" set of plates. This hereby establishes a dielectric field of induction within the unit cube of 10 – C oil. Now we then remove this cube of oil, withdrawing it from the space bounded by the charged pair of copper plates, and taking this unit cube of oil, it is then inserted into the space bounded by the other un-charged pair of plates. Upon insertion it is found that the uncharged pair of plates have now in fact become charged also. It here can be seen that a cube of dielectric induction can be carried through space, from one set of plates to another set of plates. This induction is contained by the boundaries

of the 10-C oil. Well golly-gee Mr. Wizard, what happened to all those electrons, Isn't oil an insulator?

Here given has been various examples of dimensional relations involving space. First order space has been the long distance power line, second order space has been the package of spaghetti, third order space has been the cube of 10-C transformer oil, and, over the incessant barking of the poodle, fourth order space has been invoked as a product of conjugate flux densities.

With the understanding hereby developed it is now possible to enter development of the concept of inductance and of capacitance, along with their use in the application of the metrical dimension of space to the substantial dimensions of electric induction. From this can be derived a substansive concept of the aether.

## 7.20 Inductance and Capacitance

In its most general form the basic concept of an electrical configuration in electrical engineering terms is

- 1) A metallic-dielectric geometric structure,
- 2) A bound electric field of induction, this representing STORED ENERGY within the containing geometric structure,
- 3) An exchange of electrical and mechanical forces between the electric field and the material geometric structure.

It is in statement 3) that the concepts of INDUCTANCE and of CAPACITANCE enter the electric dimensional relations. It is through the dimensional relations of inductance and capacitance that the electric field engages in the interaction with the geometry in which it is bound. It is also here that we find the most significant dimensional misrepresentations which occlude the understanding of the phenomenon of electricity.

The existence of the dielectric field of induction,  $\Psi$ , in Coulombs, gives rise to an electro-static potential,  $e$ , in Volts. Conversely an electro-static potential,  $e$ , in Volts, gives rise to the dielectric field,  $\Psi$ , in Coulomb. It is a "chicken or egg", a matter of versor position along a cycle. Here we have a pair of dimensional relations,  $\Psi$ , and,  $e$ , that exist in proportion to each other. It hereby follows that a proportionality factor must exist expressing the ration of the pair of dimensional relations,  $\Psi$ , in Coulomb, and  $e$ , in Volt. Considering the dielectric induction as a primary dimension, not a dimensional relation, then the variation of the primary

dimension is with respect to the secondary dimension. Primary per secondary,  $\Psi$  per  $e$ . An example is a package of spaghetti, spaghetti is a primary dimension, package, per square inch a secondary dimension. Hence the dimensional relation of the proportion of dielectric,  $\Psi$ , in Coulombs, to the electro-static potential,  $e$ , in Volts, is then given as

Coulomb per Farad

The ratio,  $\Psi$  over  $e$ , establishes a new dimensional relation. This relation, a factor of proportion. Is called the CAPACITANCE,  $C$ , in FARAD. That is,  $C$  equals  $\Psi$  over  $e$ . If then it takes a very small magnitude of electro-static potential,  $e$ , to engender a very large quantity of dielectric induction,  $\Psi$ , then the geometry supporting this induction is said to have a high capacitance,  $C$ . It is then called a CAPACITOR. One electro-static unit of capacitance is close to one picorad, the one over  $C$  squared renders this 10 percent off.

Thus we can state a "Law of Dielectric Proportion",  $C$ , in Farads, is the proportion of the QUANTITY of dielectric induction,  $\Psi$ , in Coulomb, to the MAGNITUDE of electro-static potential,  $e$ , in Volts. The Coulomb per Volt, or Farad of electro-static capacity.

It hereby follows that for a given "package", or quantity, of dielectric induction, a variation of the capacitance must give rise to a proportional variation of the electro-static potential, that is, a decrease in capacitance must give rise to an increase in electro-static potential. This is the Law of Dielectric Proportion.

The same line of reasoning follows for the magnetic field of induction. The existence of the magnetic field,  $\Phi$ , in Weber, gives rise to a magneto- motive force, or M.M.F.,  $i$ , in Amperes. Again it is a versor, chicken or egg. Here again is a pair of dimensional relations that exist in proportion to each other,  $\Psi$  and  $i$ . Thus the ratio, or factor of proportion, is given as

Weber per Ampere.

The ratio of  $\Psi$  to  $i$  results in a new dimensional relation. This factor of proportion is the dimensional relation called INDUCTANCE,  $L$ , in Henry.  $L$  equals  $\Phi$  over  $i$ .  $L$  in Henry is the proportionality factor between the quantity of magnetic induction to the magnitude of the M.M.F. The Weber per Ampere, or Henry of magnetic inductance. It then follows, for a given "package", or quantity of magnetic induction, that a variation of the inductance must give rise to a variation of the M.M.F. This is to say, a decrease in inductance must give rise to a proportional

increase in current, or M.M.F. This is the Law of Magnetic Proportion.

Heretofore established is the pair of dimensional relations

- 1) The Law of Dielectric Proportion Coulomb per Volt, or Farad,  $C$ ,
- 2) The Law of Magnetic Proportion Weber per Ampere, or Henry,  $L$ .

## 7.21 Reduction to Primary Dimensions

In the expressions for the law of dielectric proportion, and the law of magnetic proportion, that is, the capacitance and inductance, the relations are not given entirely in primary dimensions. Both  $e$ , in Volts, and  $i$ , in Amperes, are not primary dimensions, they are secondary dimensional relations. These relations must be expanded in order to express capacitance and inductance in terms of primary dimensions only.

By the Law of Magnetic Induction

- 1) Volt, or Weber per Second,

and the Law of Dielectric Induction

- 2) Ampere, or Coulomb per Second

Combining terms, for the dielectric capacitance, Farads, gives

- 3) Coulomb per Volt or Coulomb-Second per Weber

gives

- 5) Farad, or Siemens - Second.

Rearrangement of terms in 5) results in an important dimensional relation,

- 7) Admittance,  $Y$ , in Coulomb per Weber,
- 8) Susceptance,  $B$ , in Farad per Second.

More on this later on.

The same considerations apply to the magnetic field of induction, and its Law of Magnetic Proportion, the inductance,  $L$ , in Henry.

9) Henry, or Weber per Ampere.

Substituting gives

10) Weber - Second per Coulomb, or Henry.

And by the relation,

11) Weber per Coulomb, or Ohm

It is then given

12) Henry, or Ohm - Second.

Thus

13) Henry per Second, or Ohm.

This hereby derived dimensional relation for Ohm, or Henry per second, is called the REACTANCE,  $X$ , in Ohm. Again, as with the Siemens, a dual dimensional relation exist with regard to the Ohm, the impedance,  $Z$ , and the reactance,  $X$ .

We here have established a new pair of dimensional relations. These relations involve a time rate of variation, this analogous to the time rate relations, the Faraday and Maxwell Laws of Induction, given again,

A) Farad per Second or Siemens,  $B$ .

B) Henry per Second or Ohm,  $X$ .

Two alternate views present themselves as to the time rate of variation. One is the condition that the capacitance and inductance in themselves are constants, time invariants, it is that the forces, electro-static potential, and magneto-motive force, are time variant. The  $e$ , and  $i$ , are in variation with respect to time. This is the condition for the relations of susceptance,  $B$ , in Siemens, and of reactance,  $X$ , in Ohms.

For example, take a one Henry inductance coil. The given line voltage is 120

volts A.C. in variation at a rate of 377 radians per second, or 60 cycles per second. Hereby the reactance of the one (1) Henry inductor is thus the product of 1 and 377 or 377 Ohms, or Henry per Second. The application of 120 volts A.C. to this inductor hereby gives rise to a current of

$120 / 377$  Ampere, or Volt per Ohm.

For the sake of simplicity let us say this is about a quarter ampere, one fourth of an amp. The product of 120 volts and one fourth amp gives the electrical activity as

$120/4$  Volt - Ampere or 30 Volt - Ampere reactive.

This is the electrical activity of the one Henry coil across 120 volt A.C. at 60 cycles.

Carrying the Law of Magnetic Proportion one step further, this one Henry inductance coil, in its windings, has 1000 passes, or turns around its core. This hereby gives rise to a M.M.F. of 1000 times one fourth ampere, or a total of 250 ampere-turns. This magneto-motive force, or compound current is developed in a one, 1, Henry coil. Hereby, by the Law of Magnetic Proportion, for a current of one quarter ampere through 1000 turns gives rise to the quantity of magnetic induction, 250 Webers.

## 7.22 The Variation of Inductance and Capacitance With Respect to Time

We have heretofore established a new pair of dimensional relationships. These the magnetic inductance,  $L$ , in Henry, and the electro-static capacity,  $C$ , in Farad. Derived from these dimensional relations is a pair of electrical laws

(I) The Law of Dielectric Proportion

The ratio of the quantity of dielectric induction,  $\Psi$  in Coulomb to the magnitude of the electro-static potential,  $e$ , in Volt.

(1) Coulomb per Volt, or Farad.

## (II) The Law of Magnetic Proportion

The ratio of the quantity of magnetic induction,  $\Phi$ , in Weber, to the magnitude of the M.M.F.,  $i$ , in Ampere.

## (2) Weber per Ampere, or Henry

Hence, the total dielectric induction,  $\Psi$ , in Coulomb, is the product of the potential,  $e$ , in volt, and the capacitance,  $C$ , in Farad. Likewise, the total magnetic induction,  $\Phi$ , in Weber, is the product of the M.M.F.,  $i$ , in Ampere, and the inductance,  $L$ , in Henry.

$\Psi$  equals  $e$  times  $C$

$\Phi$  equals  $i$  times  $L$ .

In the expression of the variation of the parameters which constitute the dimensional relations involving capacitance and inductance, two distinct conditions can exist. First is the capacitance and the inductance are time invariant, and the variation with respect to time resides in the relations of potential,  $e$ , and of M.M.F.,  $i$ . Here derived are the susceptance and the reactance. In the alternate form of expression, it is the potential,  $e$ , and the M.M.F.,  $i$ , that are time invariant, and the variation with respect to time resides in the relations of capacitance and inductance as geometric coefficients. Geometry in time variation.

In general, time invariance of  $L$  and  $C$ , or time invariance of  $e$  and  $i$  each can be considered as a limiting case. Each can be in variation with respect to time at their own individual time rates. That is, for the dielectric both  $C$  and  $e$  can be in variation, and for the magnetic both  $L$  and  $i$  can be in variation. Consider the A.C. induction motor. Here is form of magnetic inductance in which both the inductance,  $L$ , and the M.M.F.,  $i$ , are in time variation,  $L$  with the rotational geometric variation, and  $i$  with the rotational variation of M.M.F. The difference between the rotational frequency of  $i$  is called the slip frequency. The rotor continuously falls behind the rotation of the magnetic field, dragging energy out of this field and delivering it to the output shaft of the motor.

Considering the pair of primary dimensional relations, it is, for the dielectric induction.

## (5) Farad per second, or Siemens,

And for the magnetic,

(6) Henry per second, or Ohm,

It is established that a distinct pair of conditions exist with regard to the variation with respect to time. Either the capacitance or inductance is in variation, or the potential or M.M.F. is in variation, with respect to time.

For the condition of time invariant  $L$  and  $C$  it is given

(7) Farad per second, or Siemens, The Suceptance,  $B$ ,

(8) Henry per second, or Ohm, The Reactance,  $X$ .

In the second case the  $L$  and  $C$  are in variation with respect to time. The forces,  $i$  and  $e$ , are held constant, or time invariant. Here the variation with respect to time exists with the Metallic - Dielectric geometry itself. This hereby produces a variation in the geometric coefficients of capacitance or inductance. These relations are given as

(9) Farads per second, or Siemens, The Conductance,  $G$ .

(10) Henry per second, or Ohm, The Resistance,  $R$ .

This CONDUCTANCE,  $G$ , and this RESISTANCE,  $R$ , represent the relations derived from the time variation of capacitance and from the time variation of inductance, respectively.

It is through this form of parameter variation that the energy stored in the electrical field bounded by the geometric structure is here given to an external form. This is to say, energy is taken out of the electric field and delivered elsewhere.

For a closed system, the energy stored within the electric field is lost, or dissipated, from this system. It is then ENERGY LEAKAGE from the closed system. Considering the condition of a time invariant, or stationary geometric structure, this structure exhibiting the dissipation of the energy stored within the electric field bound by the structure, the conductance,  $G$ , and the Resistance,  $R$ , are the representations of energy leakage from the dielectric and magnetic fields respectively.

For example, consider one span of a " $J$  carrier" open wire transmission pair. Here the conductance,  $G$ , is the "leakage conductance" of the glass telephone insulator, the resistance,  $R$ , is the "electronic resistance" of the copperweld telephone wire. These represent the energy dissipation of one span of line.

This conductance,  $G$ , represents a "molecular loss" WITHIN the glass of the insulator. This resistance,  $R$ , represents a "molecular loss" WITHIN the metal of

the wire. Hence it is the molecular losses of the metallic-dielectric geometry itself that gives rise to an energy leakage from a closed system. The molecular agitation and cyclic hysteresis exist within the molecular dimensions of the physical mass of the bounding geometric structure. These consist of a multitude of minute variations of the capacitance and inductance of the geometric form. On a microscopic level the material substance of this form is indelible, a kind of blur in space, due to the multitude of minute variations of positions in space. These tiny motions, hereby through parameter variation, convert the energy stored in the electric field into random patterns of radiation. By experiment it can be shown that this energy leakage exists in proportion to the temperature of the material form storing energy within its bound electric field. In general, the electro-static potential,  $e$ , in Volt, renders the insulators hot, the magneto-motive force,  $i$ , in Ampere, renders the wires hot. Also, it is found that this heating increases with increasing frequency of the potential,  $e$ , or the M.M.F.,  $i$ . It is here where the prevailing concept of the "electron" is to be found. Hence it is the motions of the electrons that give rise to the energy loss in an electrical system.

Electrons represent energy dissipation. However, the pedant, the mystic, and the dis-informer all tell us that the electron is what conveys energy, the complete opposite!

## 7.23 Parameter Variation Continued

In the last section the dimensional relations of conductance and resistance were developed for the condition of a static, or stationary, metallic-dielectric geometry. The conductance represents the leakage of energy from the dielectric field, and the resistance represents the leakage of energy from the magnetic field. Energy loss is internal to the physical mass which constitutes the metallic-dielectric geometry. This loss is of molecular form.

Instead of the parameter variation resulting from internal motions, there exists the parameter variation which results from external motion. This parameter variation with respect to time is the result of the contiguous parts of the geometric form being in relative motion with respect to each other. Again the A.C. induction motor serves as an example of such a geometric structure. Here is a metallic-dielectric geometric structure with relative motion between its physical parts. A motor or a generator operate through parameter variation via rotational motion. An example is the common "Electro-static" generator, such as the "Wimhurst Machine", a rotating variable electro-static condenser.

In general the metallic-dielectric geometry delivers mechanical force as an electric motor, or is driven by mechanical force as an electric generator. Mechanical/Electrical parameter changes, these as, Farad per second and Henry per second, give rise to the metallic-dielectric geometry becoming an electric motor, taking energy from the field, or becoming an electric generator, giving energy to the field.

In the case which the geometry is taking energy as an electric motor, it is for a dielectric machine, a parametric Conductance,  $G$ , results

(1) Farad per second, or Siemens Conductance,  $G$ ,

and for a magnetic machine, a parametric Resistance,  $R$ , results

(2) Henry per second, or Ohm, Resistance,  $R$ .

$R$  and  $G$  here represent the removal of energy from the electric field, just as with the condition of molecular losses.

For the condition of a mechanically driven metallic-dielectric geometry giving energy as an electric generator, an alternate form of dimensional expression is desired. These expressions serve to distinguish that part of the relations which represent the loss of energy as distinct from that part of the relations which represent the gain of energy. The square root of positive one is the "operator" which distinguishes the gain part from loss part. It is supply, or demand.

These alternate dimensional relations are, for the dielectric field

(3) Farad per second, or Siemens, The Acceptance,  $S$ ,

and for the magnetic field

(4) Henry per second, or Ohm, The Receptance,  $H$ .

Hence for the dielectric machine an ACCEPTANCE,  $S$ , in Siemens, and for a magnetic machine a RECEPTANCE,  $H$ , in Ohm. where  $R$  and  $G$  represent energy consumption coefficients, it is  $S$  and  $H$  represent energy production coefficients.

A few observations are in order here. First, existing technology produces machines which are strictly magnetic, such as the A.C. induction motor, or strictly dielectric, such as the wimhurst machine. No machine is produced where the magnetic and the dielectric fields work together in an electric field. What rela-

tionship of the forces, potential,  $e$ , and M.M.F.,  $i$ , gives rise to equal and opposite mechanical force, this now applied to a rotating geometry?

Second, not all parameter changes are the result of mechanical forces, nor random molecular motions. The magnetic amplifier is one such case, here a parametric inductance controlled by an auxiliary M.M.F. On the molecular level, certain plasma discharge tubes, such as the common fluorescent lighting tube, give rise to an assortment of parameter variations which can produce as well as consume energy from the electric field. Here is a vast realm for theory and experiment.

## 7.24 The Telegraph Equation, Part One

From the previous sections it has been established a set of dimensional relations as derived from four basic electrical laws

(1) The Law of Dielectric Proportion

- (a) Farad, or Coulomb per Volt
- (b) Coulomb, or Volt - Farad

(2) The Law of Magnetic Proportion

- (a) Henry, or Weber per Ampere
- (b) Weber, or Ampere - Henry

(3) The Law of Magnetic Induction

- (a) Volt, or Weber per Second
- (b) Weber, or Volt - Second

(4) The Law of Dielectric Induction

- (a) Ampere, or Coulomb per Second
- (b) Coulomb, or Ampere - Second

Recombination of these dimensional relations, or electrical laws, then expresses a pair of ratios, of primary dimensions in variation with respect to time. Hence, for the dielectric field

(5) Farad per Second, or Siemens.

And for the magnetic field

(6) Henry per Second, or Ohm.

From this pair of dimensional relations are derived a series of energy transfer and storage coefficients. Grouping these into a pair of categories, these are given as

(I) Energy Storage and Dissipation

(a) Dielectric Energy Storage, Suceptance,  $B$ , in Farad per Second

(b) Magnetic Energy Storage, Reactance,  $X$ , in Henry per Second

And

(c) Dielectric Energy Dissipation, Conductance,  $G$ , in Siemens

(d) Magnetic Energy Dissipation, Resistance,  $R$ , in Ohm

(II) The Energy Consumption or Production

(a) Dielectric Energy Consumption, Conductance,  $G$ , in Farad per Second, or Siemens

(b) Magnetic Energy Consumption, Resistance,  $R$ , in Henry per Second, or Ohm

And

(c) Dielectric Energy Production, Acceptance,  $S$ , in Farad per Second, Or Siemens

(d) Magnetic Energy Production, Receptance,  $H$ , in Henry per Second, Or Ohm

It should be noted that these various groupings of coefficients exist in distinct, independent, time frames. The dissipation coefficients are the result of random molecular variations, that is, noise. The consumption coefficients are harmonic in nature, relating to the operating frequencies, likewise for the production coefficients. The random and the harmonic time functions are NOT ADDITIVE. In general, the combinations of these coefficients appear as versor sums. More on this later.

Since the total electric induction is the product of the total dielectric induction and the total magnetic induction, there exists the products of the coefficients of

dielectric induction and the coefficients of magnetic induction. These products give rise to a set of electrical factors. These factors, the product of the dielectric part, in Siemens, and of the magnetic part, in Ohm, gives rise to the dimensional relation

(7) Ohm - Seimens, or Numeric

Hence, this derived dimensional relation, or FACTOR, is a numeric, that is, dimensionless. Since both the Ohm and the Siemens are versor quantities, it follows that this numeric is also a versor, a dimensionless versor magnitude. It is not a scalar, it is a versor with a position in time.

These factors are hereby established to be dimensionless versor magnitudes. Combining the dielectric and magnetic coefficients gives the following factors,

- (a) The Energy Storage Factor,  $XB$ , in Ohm - Siemens, or Henry - Farad per Second Squared
- (b) The Energy Loss Factor,  $RG$ , in Ohm - Siemens
- (c) The Energy Gain Factor,  $HS$ , in Ohm - Siemens, or Henry - Farad per Second Squared.

Hereby it is,  $HS$  supplies the energy,  $XB$  holds the energy,  $RG$  removes the energy. These three factors define the movement of electricity through the dimension of time, this for a generalized electrical configuration.

It is usually that the electrical configuration, the metallic-dielectric geometry, exhibits only energy losses, no component of energy gain exists. An example is one span of a  $J$ -Carrier open wire transmission line. This line holds energy in its bound electric field of induction, but a portion of this energy is lost through molecular action within the glass insulators and within the copperweld wires. There exists no component of energy gain in this span of open wire line. Here it is the parametric terms vanish. No factor  $HS$  exists and  $RG$  is pure dissipation. These simplifications allow for the algebraic expression in an archetypical form of the generalized electrical configuration.

Given the basic dimensional relations

$X$ , the Reactance, in Henry per Second

and

$B$ , the Suceptance, in Farad per Second.

These relations representing energy exchange between the dielectric field, and the magnetic field, of inductions. This energy exchange is in an alternating form. It is also

$R$ , the Resistance, in Ohm

and

$G$ , the Conductance, in Siemens.

These relations representing energy removal from the magnetic field, and the dielectric field, of inductions. This energy loss is in a continuous form. Hereby  $XB$  is the alternating "current" factor, and  $RG$  is the direct, or continuous, "current" factor.

Obviously, in the situation of an electric generator,  $HS$  could replace  $RG$  in such a configuration. Here energy is produced in a manner of negligible losses, and thus  $RG$  drops out of the equation. It is however, a system or configuration exhibiting both loss and gain requires a more complex algebraic expression. This is developed in the final section of "Symbolic Representation of the Generalized Electric Wave" by E. P. Dollard.

Combining terms with like dimensional relations, that is, Ohm and Henry per Second, or Siemens and Farad per Second, gives rise to a total impedance, or a total admittance of the electrical configuration. Hence it is

(I) The Total Admittance,  $Y$ , in Siemens

$$Y = G - jB. \quad (8)$$

The versor sum of the Conductance,  $G$ , in Siemens, and the Suceptance,  $B$ , in Farad per Second.

(II) The Total Impedance,  $Z$ , in Ohm

$$Z = R + jX. \quad (9)$$

The versor sum of the Resistance,  $R$ , in Ohm, and the Reactance,  $X$ , in Henry per Second. Here  $Y$  represents the dielectric field, and  $Z$  represents the magnetic field.

The electric field is the product of the dielectric field, and the magnetic field.  $Q$  is  $\Psi$  times  $\Phi$ . Taking then the product of the total dielectric Admittance,  $Y$ ,

in Siemens, and the total magnetic Impedance,  $Z$ , in Ohm, gives the dimensional relation

(10) Siemens - Ohm Or Numeric.

Hence  $ZY$  is a dimensionless magnitude, it having a versor position in time, since both  $Z$  and  $Y$  have a versor position in time. The product of the two versors is also a versor.  $ZY$  is not scalar, it is a dimensionless versor magnitude. It represents a wave propagation in the dimension of time, a TIME WAVE.

## 7.25 The Telegraph Equation, Finalé

It has been given that the product  $ZY$ , in Siemens - Ohm, is a dimensionless magnitude having a versor position in time. It is the product of a pair of versor sums

$$Y = G - jB,$$

$$Z = R + jX.$$

However, it is the product of versor sums are also versor sums. Taking this product

$$ZY = (R + jX)(G - jB),$$

and factoring like terms, gives the following factors

(I) The POWER FACTOR

$$a = (XB + RG),$$

where  $a$  is the power factor, the percent of energy lost from the total movement of electrical energy in an electrical configuration.

(II) The INDUCTION FACTOR

$$b = (XG - RB),$$

where  $b$  is the induction factor, the percent of energy stored by the total movement of energy in an electrical configuration. Here the resulting sub-factors are defined, for the power factor

$XB$ , the factor representing the cyclic exchange of energy between dielectric and magnetic forms.

$RG$ , the factor representing the acyclic dissipation of energy from both dielectric and magnetic forms.

And, for the induction factor

$XG$ , the factor representing the transfer of energy out of magnetic form and into dielectric form.

$RB$ , the factor representing the transfer of energy out of dielectric form and into magnetic form.

The propagation constant,  $ZY$ , in Ohm - Siemens can hereby be expressed as the versor sum of the power factor,  $a$ , in percent, and the induction factor,  $b$ , in percent. This results in

$$ZY = ha + jb, \text{ Ohm - Siemens, or Total Percent}$$

$ZY$  must always equal 100 percent but it has a variable position in time, this expressed as a resultant of  $ha$  and  $jb$ . The versor operators are defined as

$h$ , the roots of the square root of positive one,  
 $j$ , the roots of the square root of negative one.

Expanding the expression for the propagation constant,  $ZY$ , as a versor sum of the expressions for  $a$  and for  $b$ , gives

$$ZY = h(XB + RG) + j(XG - RB).$$

Hereby established is the most important algebraic expression of dimensional relations, this defining the movement in time of electrical energy in any electrical configuration.

This algebraic expression is called the "Heaviside Telegraph Equation." It is in this expression the electrical energy is expressed directly in its four pole archetype. Note that this four polar archetype underlies all Native American artforms. Is this related to America as the birthplace electrical technology through Tesla, Edison, and Steinmetz? Europe was too consumed in self edification mathematics, except GÖTHER.

This algebraic expression gives a pair of waves in motion through the dimension of time, one moving forward in time, the other backward in time. See "Theory

and Calculation of Transient Electric Phenomena", C. P. Steinmetz, the chapter, "Resistance, Inductance, and Capacity". Here  $(R+S)$  is forward in time and  $(R-S)$  is backwards in time.

Geometrically, this expression represents a pair of counter propagating logarithmic spirals. This spiral form is demonstrated in Ernst Guillimen, "Communication Networks" Volume One, and in "Theory and Calculation of A.C. Phenomena", Appendix - "Oscillating Currents", C. P. Steinmetz. It is important to remember that these "motions in time" are of a versor form, finding no equivalence in spatial representation except by analogy. There is no such thing as a surface of time, no  $2D$  time. These are versor, not vector expressions.

Expressing the four distinct subfactors, the versor combination of which gives the propagation constant,  $ZY$ , in Ohm - Siemens, it is

#### (I) The Power Factor Pair

$XB$ , the "axial" product, the longitudinal component of energy motion in time, forward and backward in an alternating manner.

$RG$ , the "dot" product, the scalar component of energy dissipation, this independent of time.

#### (II) The Induction Factor Pair

$XG$ , the "cross" product, the transverse component energy transfer through time from magnetic to dielectric. This is a clockwise versor around axis  $XB$ .

$RB$ , the "cross" product, the transverse component of energy transfer through time from dielectric to magnetic. This is a counter-clockwise versor around axis  $XB$ .

In the pendant, mystic, and dis-information world there are two products, the dot and the cross, here exists four products, axial, dot, and a conjugate pair of cross products. Here is why misunderstanding exists, the basis for the "longitudinal scalar" idiots.

In its versor form the Telegraph Equation is expressed symbolically as

$$k(ZY) = ha + jb,$$

where the magnitude,  $ZY$ , represents the electricity, and the operator,  $k$ , represents its versor position in time. This is given for a 360 degree scale on a power factor

meter, an analog computer for expression of  $k(ZY)$ . ( $ZY$  is the pointer,  $k$  is the scale, that simple.)

Expressing a versor relation as

$$k = jh,$$

That is, negative one to the one half power times positive one to the one half power, gives negative one to the one fourth power. Since this "fourth root" of negative one suggests a conjugate of the fourth root of positive one, it is then

$k$ , the roots of the EIGHTH root of positive one.

This as the most general versor operator for the Telegraph Equation. Here we are beyond the scope of this elementary series of discussions on the rudiments of electrical theory. This series concludes here. But it was fun, don't you think? It will make you think. For a more in depth study of this subject see the following; "Theory and Calculation of A.C. Phenomena", C. P. Steinmetz, the chapters, "Power and Double Frequency Quantities" and the appendix "Roots of the Unit". "Symbolic Representation" Papers by E. P. Dollard, and all references given in these papers.

"Electro-Magnetic Theory", O. Heaviside, in particular the development of his "Telegraph Equation".

"Physics and Mathematics in Electrical Communication", James Owen Perinne.

Finally, for an excellent musical portrayal of the  $ZY$  relationship listen to G. F. Handel, "Alexander's Feast, or the Power of Music", the final coral movement. It is a good ending to this series of writings.



## Chapter 8

# Symbolic Operators: Steinmetz to Pythagoras

(1) In the previous series of writings on the "Bolinan Antenna" a rudimentary log-periodic operator was developed,

$$\Gamma_a^n = a^0, a^1, a^2, \dots, a^n \text{ series}$$

$$\sum_{j=0}^n a^j = g = a^0 + a^1 + a^2 + \dots + a^n \text{ numeric}$$

This operator is a span of logarithmic periods. The span is a finite section taken from an infinite log-periodic series of log- cycles. To the right of the span is an infinite progression growing larger and larger, to the left of the span is an infinite regression shrinking smaller and smaller. The arch-form of the log-periodic series is the broadside log-periodic array developed in the previous writings on the Bolinas Antenna, it can be seen looking at this structure the appearance of expression for infinity. This is an intrinsic characteristic of a log-periodic geometry. The log-periodic sequence is a scaling factor of proportionality and serves as an innate property of human perception, hence the "Deci-Bell".

(2) The human scale factor in the dimensions of sound is a span from 32 ft to 3 inches as expressed by the pipe organ. This span represents the sequence of human versor positions in the infinite log-periodic sequence of the musical universe. This relates directly to the original Pythagorean concept of music, the expression of man's POSITION in the cosmos.

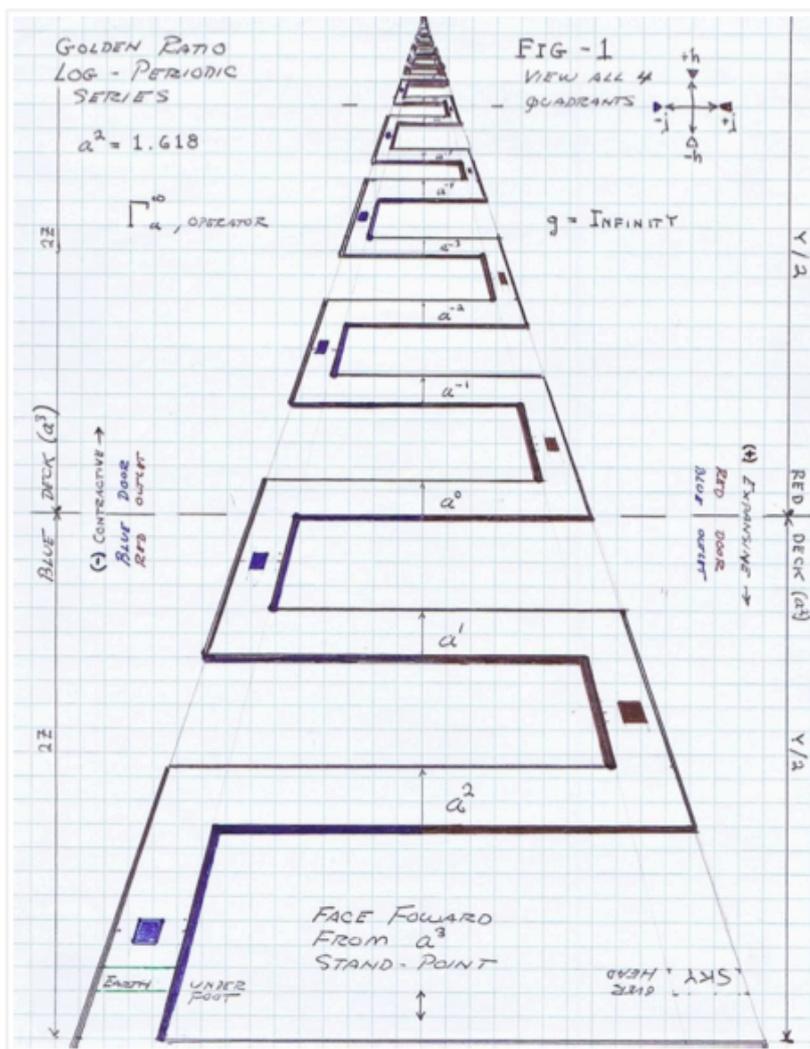


Figure 8.1: An intrinsic characteristic of a log-periodic geometry.

(3) The span of keys on the standard music keyboard is a log- periodic sequence. There are 88 individual keys or "notes" these representing unit versor positions of the various musical scales. Each fundamental span from the Tonic C to the Octave C, is a single log-periodic cycle called the octave cycles on the standard music keyboard. The entire span of human hearing is about 10 octave cycles. Each cycle, or period, on the music keyboard is divided into 12 subdivisions, that is 12 keys constitute one octave, Fig 2.



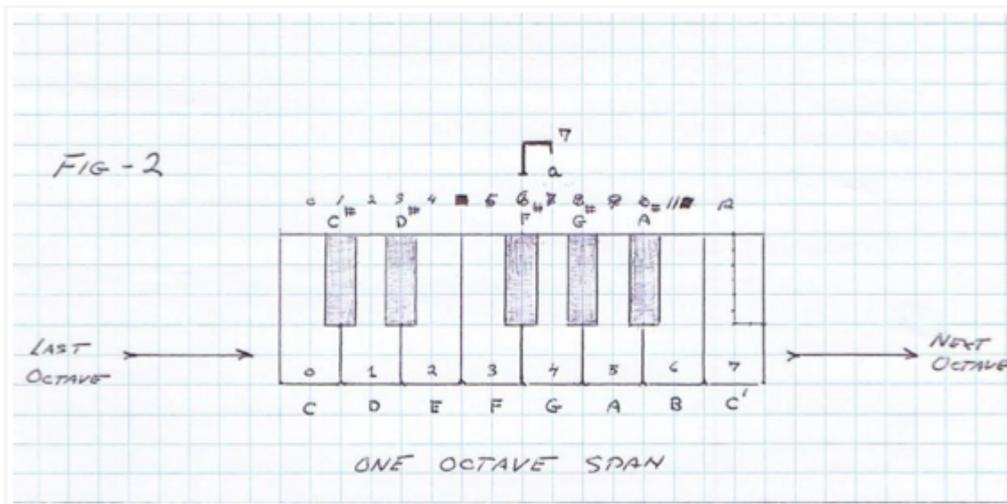


Figure 8.3: One Octave Span.

A variety of versor systems derive from this octave span of twelve unit divisions. In symbolic form the octave is given by

$$a^{\frac{1}{12}} = \sqrt[12]{2^n} \cdot k_{12}^n \text{ versor} \cdot \text{numeric}$$

where

$$a = 2 \left\{ \begin{array}{l} k_{12}^n = \text{versor} \\ \sqrt[12]{2^n} = \text{tensor} \end{array} \right\}$$

For the fundamental scale of the Pythagorean Lydian mode or C major diatonic mode,

$$n = C, D, E, F, G, A, B$$

each versor system or music scale is a division of 7 keys or unit versor positions, Figs 3 & 4.

(4) This symbolic representation by versor operators is of a most complex form. The first complication is that the unit versor positions are not distributed in a uniform fashion, Fig 4C.

Neither linear, nor logarithmic, and exist in an uneven connection of sub-versors, Fig 5.

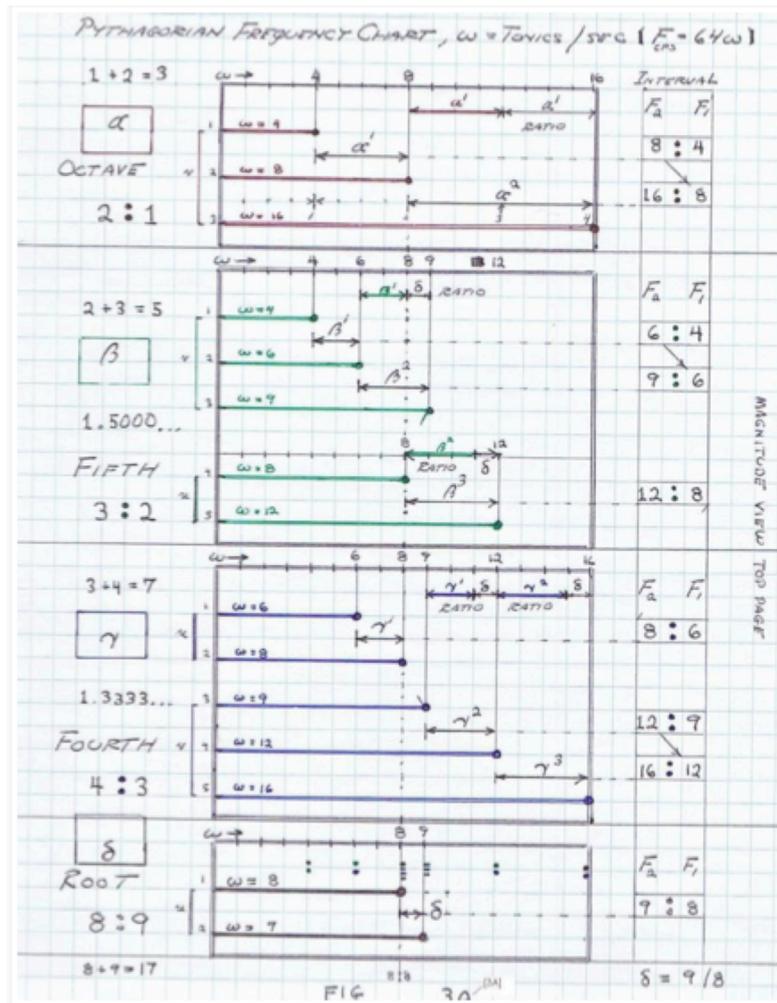


Figure 8.4: Pythagorean Frequency Chart.

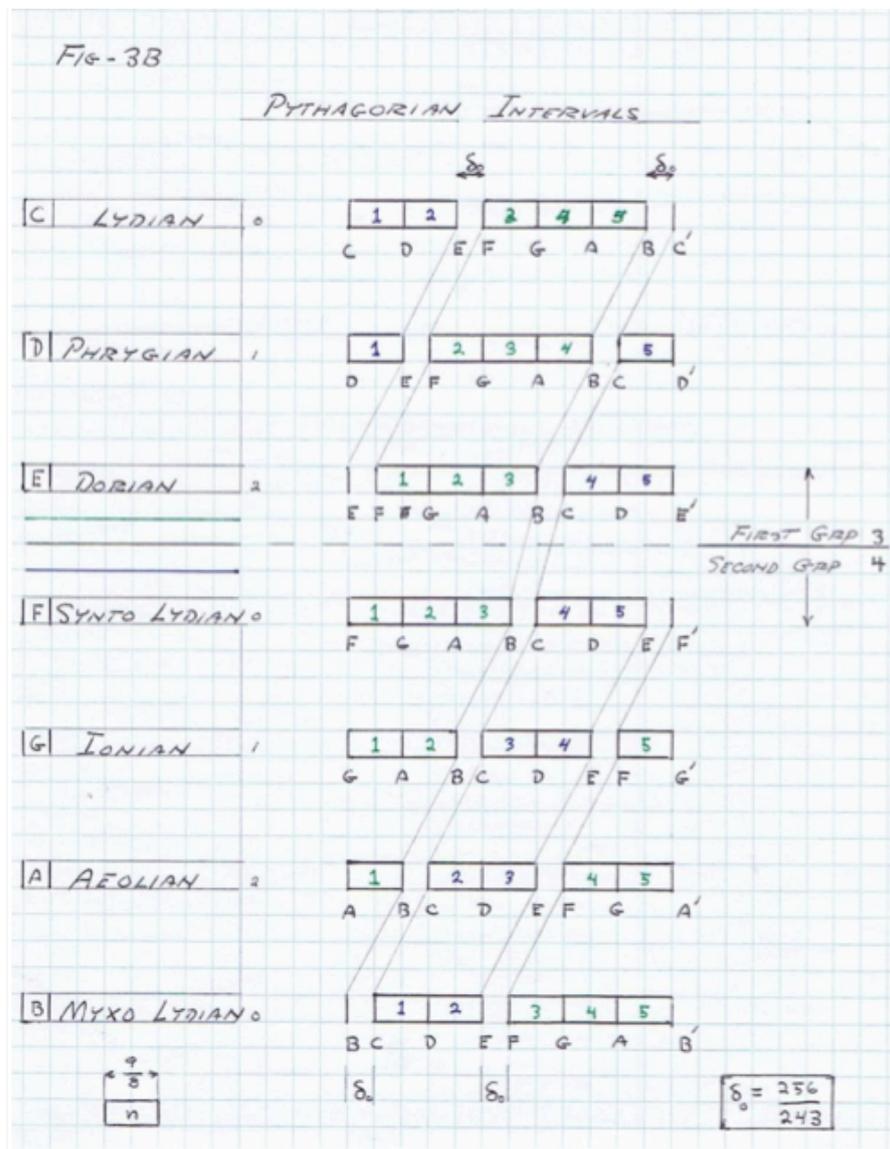


Figure 8.5: Pythagorean Intervals.

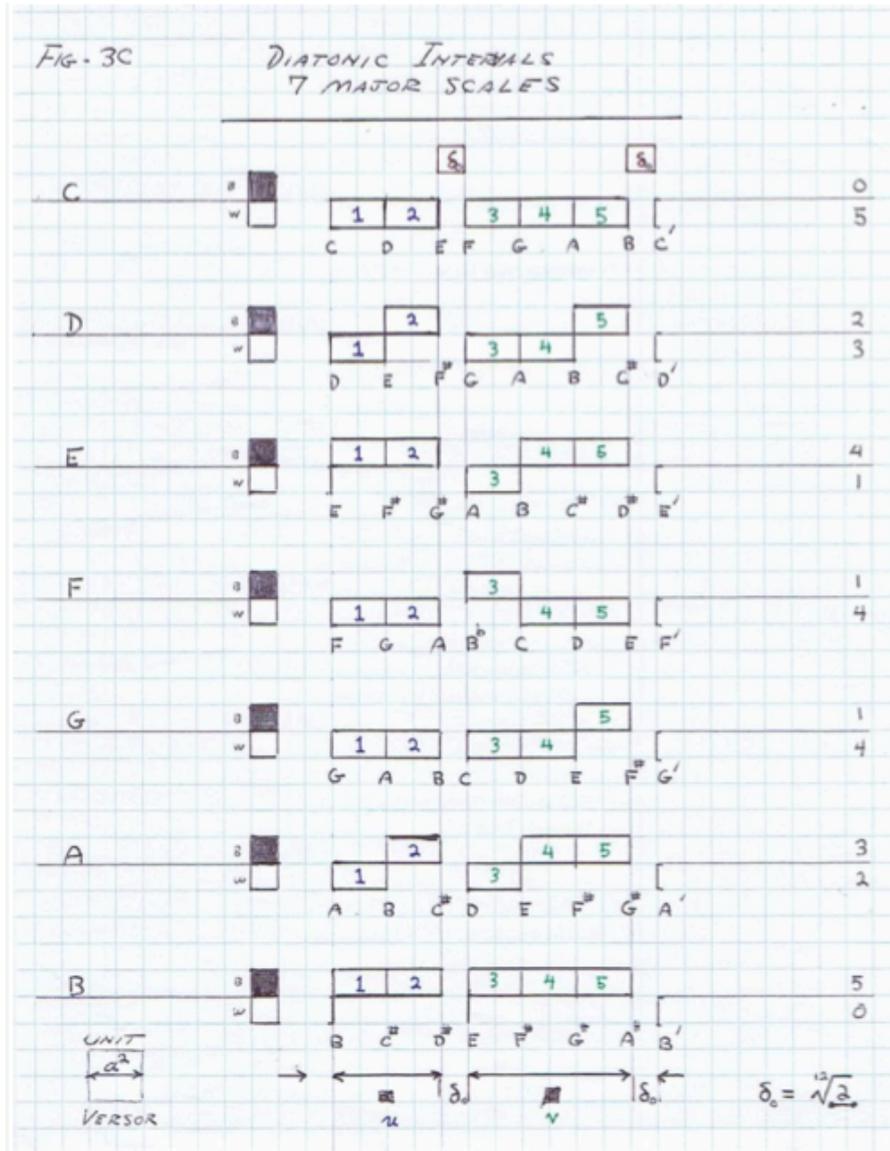


Figure 8.6: Diatonic Intervals 7 Major Scales.

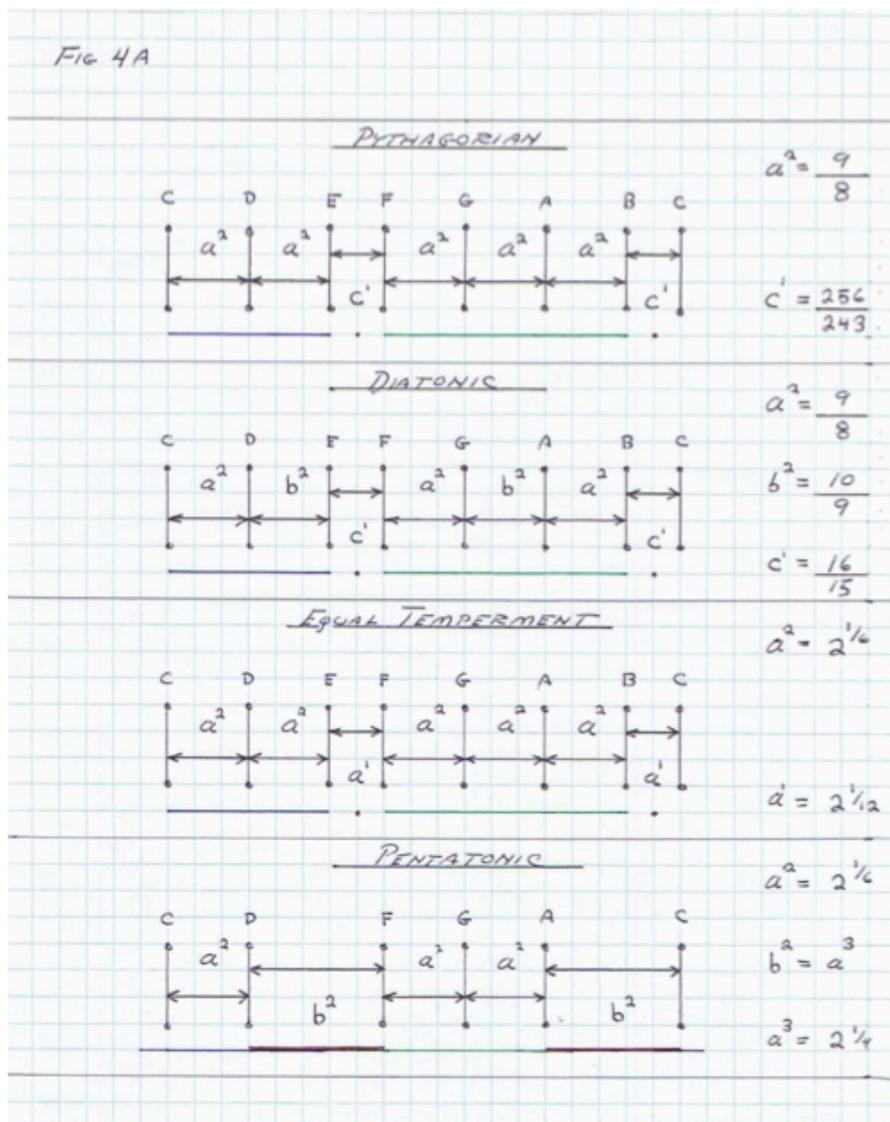


Figure 8.7: Various Diatonic Intervals.



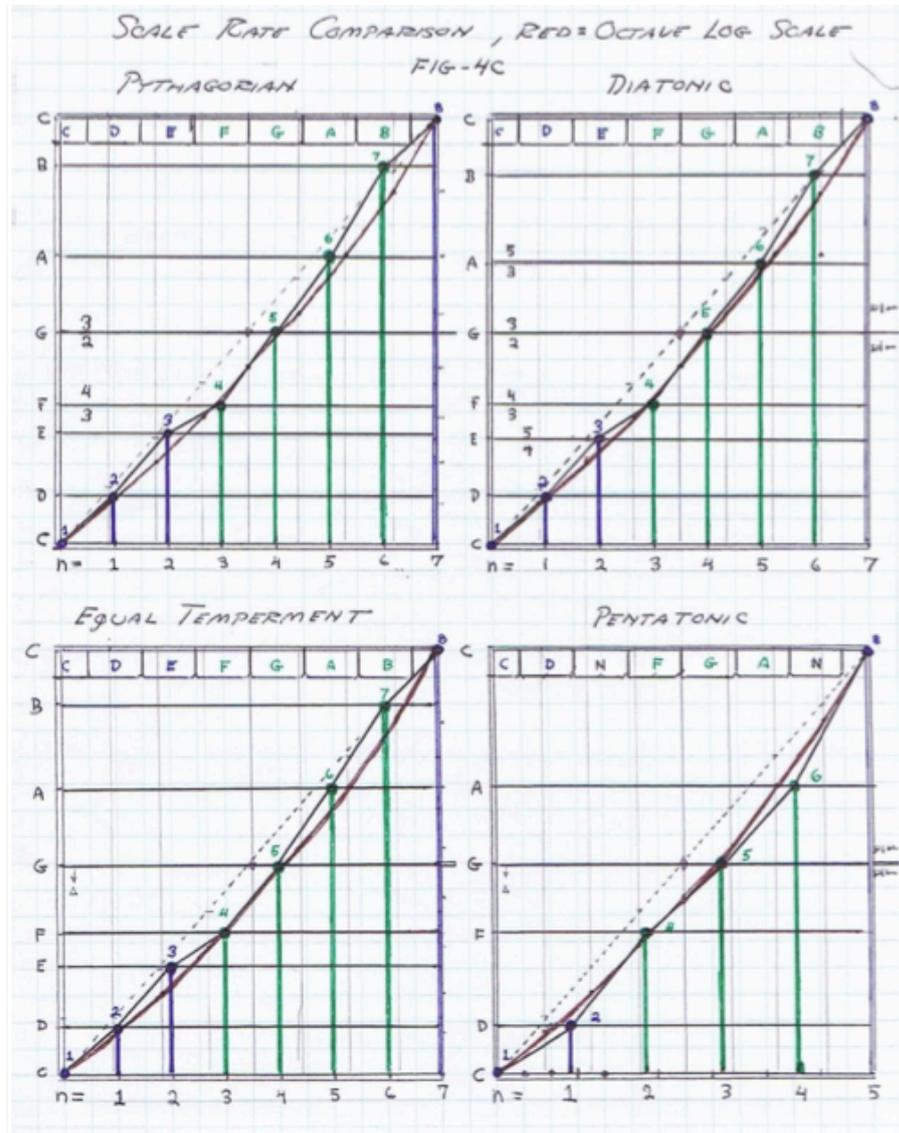


Figure 8.9: Scale Rate Comparison.

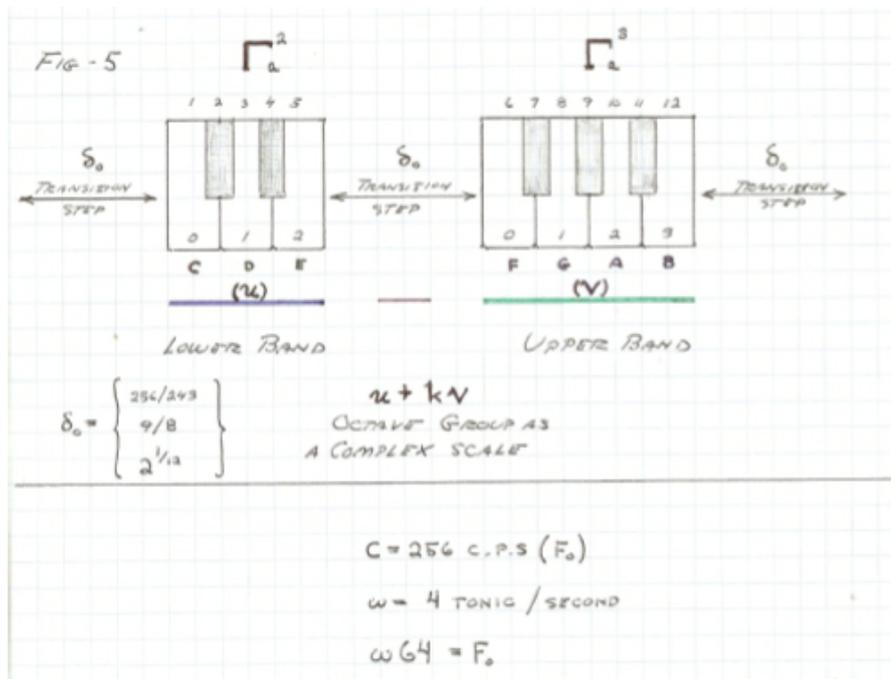


Figure 8.10: Scale Rate Comparison.

Another complication is that a pair of dimensions exist rather than only one. Here exists both the dimension of space as a wavelength, and the dimension of time as a pitch. The product of this pair of dimensions, length and one over Time, is the dimensional relation for velocity, a constant. Hence a velocity versor, and a similar relation to the light-second of Steinmetz. The product of two terms equal to a constant is a hyperbolic function, zero pitch ? infinite wavelength, and zero wavelength ? infinite pitch. This relation is shown by the logarithmic curve that is characteristic of a rank of organ pipes.

Moreover another complexity is a third dimension, that of the human mind. The mind regards the log-periodic span of one octave as once complete cycle, a circular function, whereas the log-periodic cycle is a hyperbolic function. Hereby the complete symbolic, or versor, operator for musical expression has a complex interrelation in three distinct dimensions.

- (I) Mind (Melody)
- (II) Time
- { "M/T" } (Velocity)
- (III) Space

Because of this complex situation the symbolic operator for music has never been fully resolved. What has developed is a distributed correction factor resulting in the musical intervals becoming a bit out of tune. A complete Pythagorean cycle of unit versor positions results in the terminal pitch being a bit high in frequency. This represents a distortion factor known as the "Pythagorean Comma",  $\delta$

$$\delta = \left(\frac{3}{2}\right)^{12} : 2^7$$

$$\delta = \frac{b^{12}}{a^7}$$

$$\delta = 1.013643 \dots = 1.4\%$$

(5) The various geometric forms established by log-periodic networks, transient or oscillatory electric waves, and musical scales, engender the concept of a hyperbolic versor operator. The primordial elements of this operator are to be found in the writings of ; Dr. Alexander Macfarlane, University of Austin, Texas;



Figure 8.11: Pipe Organ.



And of Arthur Kennelly, Edison General Electric. The symbolic operators of antiquity serve as templates of a hyperbolic versor operator, and hence enter the subject.

The hyperbolic versor operator exists in contra-distinction to the circular versor operator. The familiar circular versor operator was employed by Steinmetz but the hyperbolic versor remains an enigma. Steinmetz rejected the hyperbolic versor, but then Pupin rejected Steinmetz's circular operator, the usual sequence of rejection, ask Oliver.

(6) The circular operator is expressed in one of two forms;

Cycles per Second,  $F$ ,  
or Radians per Second,  $\omega$ .

And the hyperbolic operator is expressed in one of two forms;

Decibels per Second,  $dB$ ,  
or Nepers per Second,  $u$ .

Radians and Nepers are the proper expressions for use as exponents of the natural log based  $e$ , exponential,  $e$  is defined by the relations

$$e = \left(1 + \frac{1}{n}\right)^n, \quad n \rightarrow \infty$$

$$e^h = h^0 + \frac{h^1}{1!} + \frac{h^2}{2!} + \frac{h^3}{3!} + \frac{h^4}{4!} + \dots,$$

where

$$h = \sqrt[2]{+1} = 1^{\frac{1}{2}}.$$

This infinite series gives a pair of numerical values for  $e$ ,

$$e^{h^0} = 2.178 \dots, \quad \text{growth,}$$

$$e^{h^1} = 0.3868 \dots = \frac{1}{e}, \quad \text{decay.}$$



Figure 8.13: Dr. Arthur Kennelly (December 17, 1861– June 18, 1939)

(7) In contemporary engineering mathematics the circular and hyperbolic functions are derived by means of the natural log base. The circular functions are derived from the infinite series as powers of the square root of negative one

$$(-)\gamma = j^0 + \frac{j^1}{1!} + \frac{j^2}{2!} + \frac{j^3}{3!} + \frac{j^4}{4!} + \dots,$$

$$\sin = \frac{j^1}{1!} + \frac{j^3}{3!} + \frac{j^5}{5!} + \frac{j^7}{7!} + \dots,$$

$$\cos = j^0 + \frac{j^2}{2!} + \frac{j^4}{4!} + \frac{j^6}{6!} + \frac{j^8}{8!} + \dots.$$

The hyperbolic functions are derived from the infinite series as powers of the square root of positive one,

$$(+)\gamma = h^0 + \frac{h^1}{1!} + \frac{h^2}{2!} + \frac{h^3}{3!} + \frac{h^4}{4!} + \dots,$$

$$\sinh = \frac{h^1}{1!} + \frac{h^3}{3!} + \frac{h^5}{5!} + \frac{h^7}{7!} + \dots,$$

$$\cosh = h^0 + \frac{h^2}{2!} + \frac{h^4}{4!} + \frac{h^6}{6!} + \frac{h^8}{8!} + \dots.$$

The functions of the natural log base,  $e$ , introduces the limitation that operation is only possible in Cartesian relations, that is, a system of rectangular co-ordinates or the octaves thereof. This log-base and its related functions, sin, cos, etc. are incapable of expressing numerical versor divisions not derived from the log-periodic series of the octave,

$$a^n = 2, 4, 8, 16, \dots.$$

$$a = 2, \quad h^1 = -1,$$

and it's versor operators,

$$1^{a^{h^1}n} = 1^{\frac{1}{2}}, 1^{\frac{1}{4}}, 1^{\frac{1}{8}}, \dots,$$

$$n = 1, 2, 3, 4, \dots,$$

Therefore a division of three units such as encountered in three phase electrical systems cannot be expressed as exponents or functions of the natural log base,  $e$ .

The poly phase operator must first be reduced to its Cartesian equivalents. The three phase operator is given symbolically as

$$1^{\frac{1}{3}} = k_3^n,$$

$$k_3^0 = k_3, \text{ phase one}$$

$$k_3^1 = h_3, \text{ phase two}$$

$$k_3^2 = j_3, \text{ phase three}$$

In Cartesian equivalents it is

$$\frac{1}{3} = k_3^n,$$

$$k_3^0 = k_3, \text{ phase one}$$

$$k_3^1 = h_3, \text{ phase two}$$

$$k_3^2 = j_3, \text{ phase three}$$

In Cartesian equivalents it is

$$\sqrt[3]{1} = +1, \text{ Phase A}$$

$$= \frac{1}{2}(-1 + j\sqrt{3}), \text{ Phase B}$$

$$= \frac{1}{2}(-1 - j\sqrt{3}), \text{ Phase C}$$

where  $j$  is the Steinmetz quadrantal operator.

(8) Expressions for the depth of penetration of electro-magnetic induction into metallic substances involve an octic (8) versor relation. This gives rise to a pair of somewhat incongruous results. From the verso expression

$$1^{\frac{1}{8}} = k_8^n, \text{ unit}$$

is derived the unit octic (8) versor of the  $\frac{\pi}{4}(45^\circ)$  lag in metallic back E.M.F.

$$j_8 = k_{(8)}^1, \text{ unit position}$$

However in vector Cartesian form the symbolic expression for an octic is,

$$\frac{1}{2}(h + j), \text{ versor numeric}$$

where  $h = +1^{\frac{1}{2}}$ ,  $j = -1^{\frac{1}{2}}$ , and the derived unit octic lag of 45 degrees is given by

$$\frac{1}{2}(1 + j), \text{ vector numeric}$$

where  $j$  is the Steinmetz quadrantal operator. Here evoked is the idea of Oliver Heaviside that the vector and the versor should not be intertwined. The octic versor is developed in the "Generalized Electric Wave" by E.P. Dollard.

(9) Steinmetz ardently opposed higher order versors and reduced everything to Cartesian form. To Steinmetz the quadrantal versor of Cartesian expression "there-with closes the field of algebra". "Thus within the range of algebra no further extension of the system of numbers is necessary or possible, and the most general number is  $a + jb$ ".

The engineering form of the versor operator was born by Steinmetz but was killed at birth, frozen into vector Cartesian form.

(10) Polyphase versor operators however continued to develop into a symbolic form known as "symmetrical components", and related versor operators have come to be called "sequence operators". This symbolic representation is a natural extension of the Steinmetz "Roots of the Unit" in "Theory and Calculation of A.C. Phenomena". This also is reduced to Cartesian expressions but is worthy of further study with the objective of developing polyphase versor operators. The system of symmetrical components originated in a paper before the American Institute of Electrical Engineers by Charles Fortescue. This paper was published in the transactions of the A.I.E.E. Volume 37, 1918, page 1027. The title is, "Method of Symmetrical Coordinates Applied to the Solution of Polyphase Networks". A later article is presented by C.F. Wagner and R.D. Evans in the "Electrical Journal", April, 1928, page 194, titled, "Symmetrical Components". This evolved into a book by Wagner with the same title as the article. More will be written on this later.

(11) The versor operator is born of mathematical impossibilities. This can be noticed in historical references discussed by A. Macfarlane in his papers. This evokes the often stressed statement by Oliver Heaviside that "mathematics is an experimental science," it certainly was in the time of antiquity. The quadrantal versor operator employed in the Steinmetz method is derived from a mathematical impossibility, the square root of a negative number. The "Roots of the Unit" give rise to versor operators derived from a meaningless mathematical statement,

a base one log system. Moreover the log-periodic operator in its entirety is numerically equal to infinity. It is hereby evident that the generalized symbolic versor operator, the principle objective in this series of writings, will not be born of accepted notions of mathematics. This operator is of a strange world, such as expressed by Lewis Carroll's "Thru the Looking Glass". This looking glass is Johannes Kepler (1571- 1630) and on the back side is the world of mathematics that preceded him. It is a return to the very origin of numbers, mathematics, and the inscrutability of the ideas of Nikola Tesla. This path leads directly back to Pythagoras of Samos.

(12) Aristotle (384 BC - 322 BC) gives an account of the Pythagorean philosophy in his book "Meta Physics". Here Aristotle makes the following statements:

- (I) "The Pythagoreans, as they are called, devoted themselves to mathematics;"
- (II) "They were the first to advance this study, and having been brought up on it they thought its principles were principles of all things".
- (III) "Since the principles of numbers by nature are the first, and in numbers they seemed to see many resemblances to things that exist or come into being";
- (IV) "Since again, they say that the attributes and ratios (Logos) of the musical scales were expressible in numbers, since again, the Pythagoreans say that the attributes and ratios of the musical scale were expressible in numbers";
- (V) "Since, then, all other things seemed in their whole nature to be modeled after numbers, and numbers seemed to be the first things in the whole of nature, they suppose the elements of numbers to be the elements of all things and the whole heaven to be a musical scale and a number."

Here is an expression of a generalized symbolic operator. This concept led to a symbolic operator developed by Robert Fludd (1574 - 1637 AD), it is known as the "Divine Monochord".

This "instrument" serves as a versor analog computer for the Solar System, and in a strange way also for the Tesla Magnifying Transciever. It represents a musical hyperbolic versor operator. Beginning with the Earth at gamma,  $\gamma$ , GROUND, the Monochord progresses thru the four elementals, the Sun, Moon, and the known planets, and moreover thru the unknown planets, terminating on g, the planet Pluto. At the tip of the Monochord the hand of God, AERIAL, sets the cosmic constant (a.k.a. one over c square) and thereby sets the cosmic pitch of the Divine Monochord. What is important to notice here is that not only did Uranus, Neptune, and Pluto evade notice in this era, but their very existence would have been decried a disruption in the "Universal Order" that had already become an institution. Yet these three unknown planets are implicit in the Divine

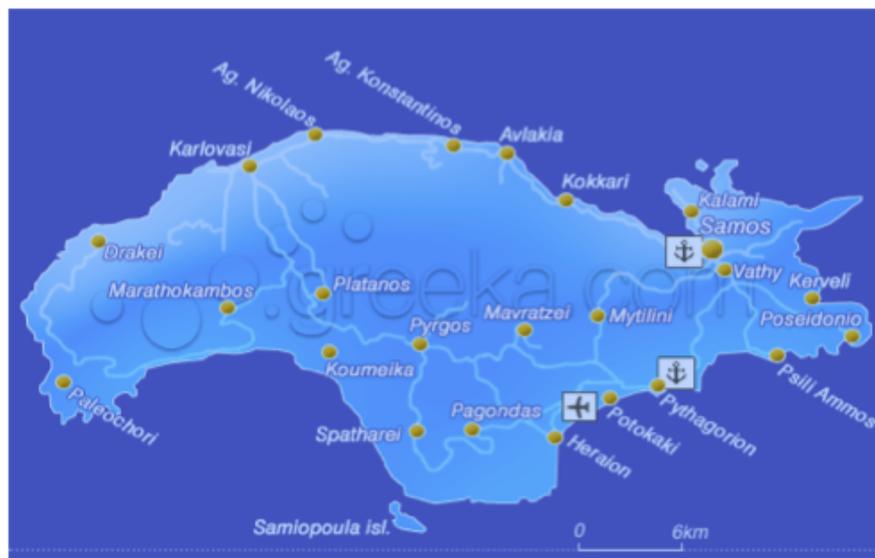


Figure 8.14: Pythagoras of Samos

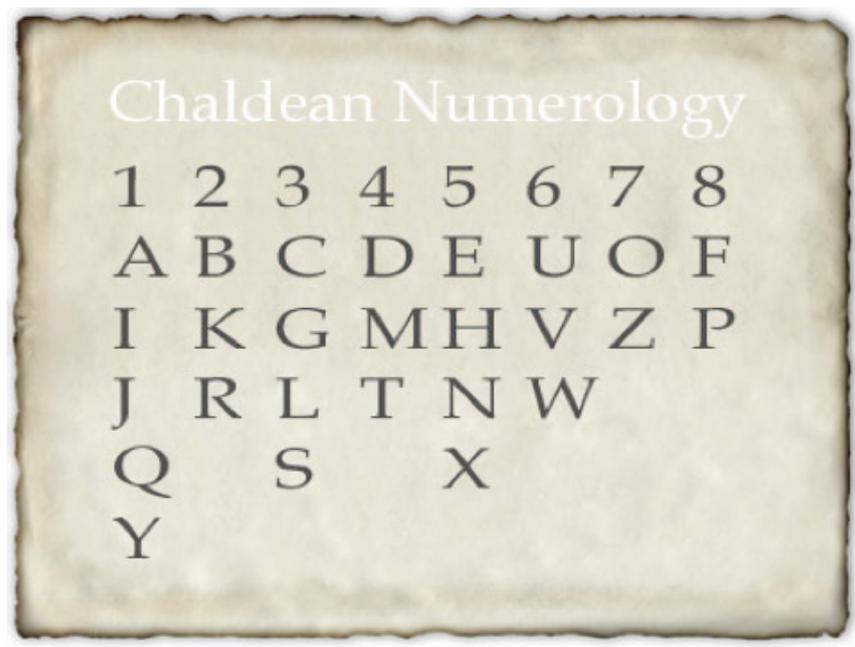


Monochord.

(13) The Pythagorean point of view is that numbers are like operators, expressed as (music) ratios (logos), or in pure symbolic forms. Their use for counting is a secondary consideration. The present era use of numbers bears no resemblance to that of ancient times. Today it is numeration not numerology.

On a practical level this is why the ideas of Nikola Tesla are so incomprehensible to the modernistic way of thinking. It is given in the "Mind of Today" that Tesla was a "little funny in the head", this in part because of his manner of co-ordinating his life's movements with numbers divisible by three. His "refugee room" number during his tacit exile was 3327. It is very important to consider that this threedom would not sound at all strange, not in the least, to Johannes Kepler. Entire chapters on the power of the number three were written prior to Kepler's time. Moreover Nikola Tesla received his education in the classics at Graz, the very location in which Kepler taught geometry centuries before. Here is where Kepler discovered the mathematics of the Solar System. This explains how Nikola Tesla developed his incredible creative power. Tesla gained the ability in his mind to transform directly from the cosmic level to the Earth level from  $g$  to  $\Gamma$ , resulting in a physical manifestation, the working apparatus. His ability to carry out his objectives is derived from the hermetic traditions of Ancient Egypt, not from pendantic technical training. It can be said that the inability of the modernist to understand Tesla is not because of technical complexity but because of Divine Simplicity. Moreover the modernist has a deep seated pathological contempt for any pre-Kepler concept of a harmonic universe particularly when expressed in a numerological form. This odious animosity for Tesla's methodology is of such force that even the military and industrial organizations are denied the work of Nikola Tesla. See Vassilatos, "Secrets of Cold War Technology", introductory chapters.

(14) In closing on the subject of the symbolic operators of antiquity is an ancient era equivalent to today's "Theory of Relativity". In the universe of human cultures that inhabited this Earth thru the eras of ancient times it was generally considered that the Sun was the center of things, the major heavenly bodies rotated around it. It was considered a heliocentric universe. Great cultures grew upon this understanding. Then it came to pass in the second century A.D. Someone came up with the notion of geocentric relativity. This someone was Ptolemy (90 A.D. - 168 A.D.). His theory of relativity stated that all heavenly bodies now move relative to the Earth as the center, hence geocentric relativity. Geocentricity would poison



Chaldean Numerology

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| A | B | C | D | E | U | O | F |
| I | K | G | M | H | V | Z | P |
| J | R | L | T | N | W |   |   |
| Q | S |   | X |   |   |   |   |
| Y |   |   |   |   |   |   |   |

Figure 8.16: Chaldean Numerology

astronomy for fourteen centuries following its inception. It became a plethora of correction factors, adjustments, and the like, rendering the advance of astronomy impossible. Geocentricity was a pioneering philosophy for the Dark Ages. Geocentric relativity was to become the law of the church with capital punishment. Bruno was burned at the stake for "practicing" heliocentricity and Galileo was exiled for finding that the planets indeed revolved around the Sun. The heliocentric philosophy of Copernicus was banned in this era with the same fervor that the philosophy of Tesla is banned today by the existential modernists. Upon the unification by Kepler of the geometric, heliocentric, and related Pythagorean concepts there could be no more opposition to a heliocentric Solar System of a unit form existing in the generalized heavens.

(15) Modern relativity and its autistic child quantum mechanics are historical analogs to the condition of Ptolemy and the institution that followed him. In modernistic relativity it is now that one over  $c$  square is the center of the universe with time and space revolving around it. The quagmire of correction factors and systems of distorted coordinates developed into a schizophrenic institution known as quantum mysticism. Even beyond geocentricity, this is verily a pathological anthropocentricity, a lemming march into the Kurtzweil grand singularity of universal annihilation. It is to be made law.

Reference:

- 1) "Music of the Spheres" – Jamison
- 2) "Le Modular" – Corbisier
- 3) "Harmonograph; A Visual Guide to the Mathematics of Music" – Ashton, Wooden Press.



## Chapter 9

# 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. It's 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

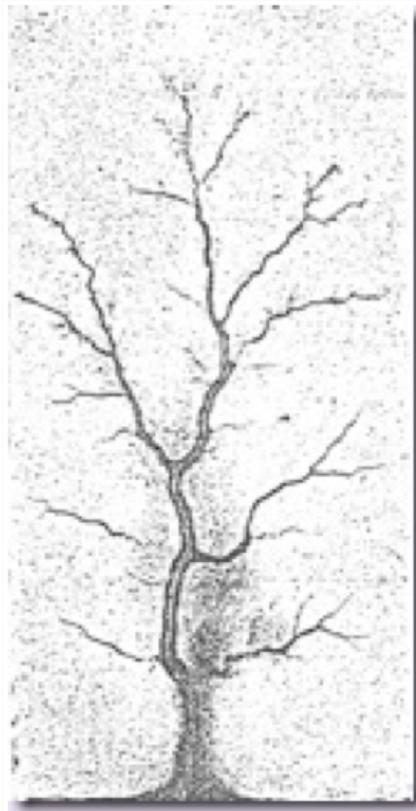


Figure 9.1: Golden Ratio discharge burnt into wood with a Tesla Magnifying Transmitter built by Eric Dollard

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.

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 controlling 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 it's 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 ° tem-

perature in Antarctica. 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 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 quirrier 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 or 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 the metallic 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 Schauberg is post 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, it's 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, whereas 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 consumers?

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. It's 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 afterwards 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 3D.

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 Schauburger 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 some-

thing 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 Rudolf 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 analogy 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. It's 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 it's 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 everybody 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. ?

# Chapter 10

## And in The Beginning, Versors

(I) What of this thing called versors, and why is it that we should be interested in them? In the most basic conception a versor operator is a means to "move about" in a given dimension or dimensional relation. In an extended conception a versor operator is a means of moving from one dimension into another dimension. In the most general conception versor algebra is the algebra of position.

In nature there exists the four polar positions of our moon. This gives four unit versor positions,

$k_4^0$ , new, conjunction

$k_4^1$ , leading, quadrature

$k_4^2$ , full, opposition

$k_4^3$ , lagging, quadrature

Hence the Lunar Versor operator,

$$(1) \sqrt[4]{1} = 1^{\frac{1}{4}}$$

$k_m^n, n = 0, 1, 2, 3.$

These unit versor positions occur when at a given geographic location the following exact relations exist;

Full, moonrise at sunset

Lead, moonrise at noon

New, moonrise at sunrise

Lag, moonrise at midnight

This leads to a versor algebraic expression. Hence a natural set of versor relations in quadrapolar form. It should be noted that Nikola Tesla's original archetypal vision of alternate electric waves was his poetic versor rotation of the Sun-Earth relation. Needless to say versor algebra finds extensive application in alternating current theory. Read first part "Symmetrical Components" by Wagner and "Power and Double Frequency Quantities" by Steinmetz, (from his A.C. book), for advanced concepts.

A most important application of versor algebra is the study of complex electric waves in space. There has been no progress beyond the cumbersome and underdeveloped quaternions of J.C. Maxwell, nor the transverse electromagnetic vector algebra of Oliver Heaviside. This is an important task. Such an electrical condition is found in the propagation of electric waves within transformer windings. The networks of Nikola Tesla and Ernst Alexanderson follow from an analysis of complex electric waves in the common transformer. However this knowledge evades us. It is that the present state of versor algebra has not developed out of its infant form, the square root of negative one. Its engineering application was founded by C.P. Steinmetz (1898 A.D.) and he also suggested higher order versors as given in his A.C. book, "Roots of The Unit", and etc. Steinmetz however never applied these to engineering even though their possible application was evident. He later on became rather "stuck up" on his own established work, this a side effect of G.E. using Steinmetz to promote their own image. A more generalized conception of versor algebra was attempted by Alexanderson McFarlane but this also never developed into any engineering applications. This is where versor algebra sits today.

(II) The concept of a versor algebra is not new, nor is it limited to electro-dynamics. One of the oldest versor systems is the symbolic representations of the Aborigines (Indians) of the American Continent. These systems found advanced development in the cultures of Central America. Noteworthy here is the "Mayan Calendar". In

versor symbols this calendar states,

For  $1^{\frac{1}{m}}$  unit,

And it is nearing the time

$$k_m^0 = 1 \text{ unit,}$$

where m is an unknown unit division in a grand cosmic cycle of

$2.5 \times 10^4$  years.

This in common language, equation one states "Happy Grand New Year". A versor axis, here given as  $k_m^n$ , raised to a zero power, is like midnight, or the new moon, it is the start of a "new day".

In mechanics there exists the condition called "top dead center". In electrics there exists the condition called "unity power factor". In both cases it is a vertical reference, zero degrees, pointing upward. This is expressed by "high noon" on the face of the clock. This hereby establishes the position of a reference versor,

$$(2) k_n^0 = 1 \text{ unit}$$

(III) Another versor system of antiquity is that developed by Pythagoras of Ancient Greece (570 – 495 B.C.) This system is called "Music". It is based upon the HARMONIC SUBDIVISIONS of an oscillating string, two to one, two to three, four to five, and etc. Each subdivision represents a versor position. This developed into a base seven versor,

$$(3) \sqrt[7]{1} = 1^{\frac{1}{7}}$$

$$k_7^n, \quad n = a, b, c, d, e, f, g$$

It is however than n is a fractional and sometimes complex quantity. Therefore music represents a most complex versor system. This versor algebra, or music, found slow development until the era leading to Martin Luther, 1400 A.D. – 1500 A.D. The foremost development of this era is what are known as the

"Church Modes".

It is of interest to note that one Church Mode in particular has a hysteresis loop. The rising scale takes a different path of notes than that path of notes for a descending scale. Here exists a musical analog of a hysteresis cycle. M. Luther (1500 A.D.) published his archetypal musical series using the Church Modes. Of these, his "Ein Fest Burg", is well known in church music today, it is the "standard".

After 1600 A.D. music found considerable advancement in Italy, mostly thru the efforts of the Italian Priest, Antonio Vivaldi. (1678 – 1741 A.D.) From here forward the use of the church modes was confined to only two out of the complete group. Today these are known as the MAJOR scale, and as the MINOR scale. Transformation between frames of reference known as "keys" (the frequency bands) was not possible until the system of "Equal Temperament" by J.S. Bach (1700 A.D.). Bach's versor system was based upon the expression

$$b = \sqrt[12]{A} \text{ percent.}$$

This gave one unified versor system of divisions called the chromatic scale. This twelfth root relation is the basis for the diatonic scale of today. It is however that Equal Temperament is at odds with the original percentages, or ratios, of the Pythagorean System. This remains as an unsolved condition in the versor algebra called music.

During the era following the church modes, the versor expressions of time became increasingly developed. This led to the "Age of Clocks". Time versor operators became important parts of the music structure. The CANON is the most basic versor relation and it led to the more developed FUGE. Time versor algebra reached its greatest heights in the works of J.S. Bach, 1685 – 1750. In many ways Bach's work is analogous to that of Steinmetz, and moreover J.S. Bach can verily be regarded the Tesla of the music world. Here is where to begin the understanding of versor algebra. A simple music keyboard, and a set of church modes is all that is required. Listening to the music of J.S. Bach replaces the reading of the equations of C.P. Steinmetz. In many ways the two are the same. As a musical reference is "Switched on Bach" performed by Carlos, in particular Bach's "Brandenburg Concerto Number Three".

(IV) As for the "Age of Clocks", the versor positions of the clock face provide a most fundamental and intrinsically basic system for the study of the use of versor operators. The versor operators of music on the other hand provide a most

### Modal Scales: The Ancient "Church Modes"

The image displays seven musical staves, each representing a different church mode. The modes are arranged in three rows. The first row contains Ionian, Phrygian, and Lydian. The second row contains Mixolydian, Aeolian, and Locrian. The third row contains Dorian. Each staff begins with a treble clef and a common time signature (C). The notes are written in a sequence that typically represents the ascending and descending scales of each mode. The Dorian mode staff shows the first few notes followed by two empty staves, indicating the continuation of the scale.

| Mode       | Notes (Ascending)        |
|------------|--------------------------|
| Ionian     | C, D, E, F, G, A, B, C   |
| Phrygian   | C, D, E, F, G, A, B, C   |
| Lydian     | C, D, E, F#, G, A, B, C  |
| Mixolydian | C, D, E, F, G, A, Bb, C  |
| Aeolian    | C, D, E, F, G, A, Bb, C  |
| Locrian    | C, D, E, F, G, Ab, Bb, C |
| Dorian     | C, D, E, F, G, Ab, Bb, C |

Figure 10.1: Modal Scales: The Ancient "Church Modes"

complex but intrinsically heuristic system for the study of the theory of versor operators. For the engineer the clock represents a most important primordial advancement in the conception of versor algebra. It should be noted that the clock, the music keyboard, and the calendar, all serve as analog computers for the expression of versor position in time and/or space. The Grand Pipe Organs of Europe, some with more than 10,000 pipes, stand as the greatest analog computing systems ever to be created. Here engineering rose to heights incapable of being reached today.

The clock as an analog computer is a link to the cycles of the Earth, Moon, and Sun, in a manner of resembling that of the American Aborigines. In the era of the clock, these analog versor systems developed into advanced analogs of the entire solar system, superclocks. These superclocks came to be known as "Planetariums". In its fundamental expression the common clock involves the most basic cyclic functions. In its simplicity the divisions are equidistant and the hands remain unit length during progress thru the cycle. And importantly, it is divisible into four quadrants. Hence our rudimentary examination of versor operators begins with the ordinary clock face.

The basic versor operator for the clock, in hours, is given by the expression

$$\sqrt[12]{1} = 1^{\frac{1}{12}} \text{ unit}$$

And thereby,

$$(4) k_{12}^n, \quad n = 1, 2, \dots, 12 \text{ unit}$$

Is the versor operator. This is to say there are 12 hours, or unit divisions, of one complete rotation on the face of the clock. All other degrees of rotation are fractional. Hence the unit division of one hour is represented by the symbol,  $k$ . This is the fundamental versor operator of the clock. The expression,

$$(5) k_{12} = 1 \text{ unit}$$

Is called "Noon", fig (1). Hence for this versor operator,  $k$ , it is

$$k^0 = \text{Noon},$$

$$k^3 = \text{Three O'clock},$$

$k^6 = \text{Six O'clock,}$

$k^9 = \text{Nine O'clock,}$

$k^{12} = \text{Midnight,}$

$k^n = n \text{ O'clock}$

(V) Let the versor operator

(6)  $h_{12}^n$  unit

Be called Standard Time, fig (2).

Let the versor operator

(7)  $j_{12}^n$  unit

Be called Daylight Time, Fig (3).

Hereby there exists two distinct time frames, let us say Pacific Standard Time, P.S.T. and Pacific Daylight Time, P.D.T. These two time frames now co-exist in the same space. In symbolic form let Standard Time be real, or h time, and let Daylight Time be imaginary, or j time. This is now in accord with A.C. theory, but with a twelfth root rather than a square root. The two versor operators, h and j, are called co-axial versors. This is to say, the h hand, and the j hand are on the same axis, fig (4). Here Daylight Time is a unit DISPLACEMENT on the face of the clock. Depending upon the time frame chosen there now exists the complication of two noons, fig 4a & 4b, but only one noon can be real. Noon by definition is that position in time when the Sun is at its highest position in the sky. This position is evidenced by the condition of a shadow being in its shortest length upon the Earth. This is the reference versor, or top dead center. In the imaginary time frame (P.D.T.) noon in that frame is one unit versor leading, or conversely real noon is one unit versor lagging. This can be expressed as,

(8)  $a = k_{12}^1 b$  unit

Or simply

(9)  $a = jb$  unit where,

(10)  $a$ , real noon  
 $b$ , imaginary noon

This is entirely analogous to A.C. theory. Hereby versor theory is now extended beyond its application by Steinmetz, and the versor operator  $j$  remains a transform between the real and imaginary co-ordinate systems. The time in the imaginary (P.D.T.) system must be multiplied by the versor operator  $j$  in order to transform to the real positions of noon and midnight. This in a way vindicates Steinmetz's assertion that the most general algebraic number can always be expressed by

(11)  $\dot{\gamma} = \alpha + j\beta$  unit,

But this can only be true for the dimension of time.

In common language, those existing in the imaginary time frame of "Daylight Savings Time" are one over jOUT OF STEP with nature. This represents a 30 degree unit displacement on the face of the 12 hour clock. On a 24 hour cycle imaginary time is 15 degrees OUT OF STEP with the rotation of the Earth. In other words for those in imaginary time, this time is a place on Earth 15 degrees distant from the location of its natural occurrence. Your time is now in a place you are not. In A.C. Terms

(12)  $a = \cos 15^\circ$ , percent

The Power Factor

(13)  $b = \sin 15^\circ$ , percent

The Induction Factor

Hence (14)  $\dot{\gamma} = a + jb$  unit percent

where  $j = \sqrt{-1}$ .

(VI) A common man conception of the versor concept is not complete without a related N.F.G. Historically, the works of J.S. Bach suffered the same fate as the works of Nikola Tesla. Shortly after the death of J.S. Bach (1750) all his important work was thrown into the garbage, this regarded as obsolete junk. If it was not for Herr Forkel, who recovered Bach's work from the garbage and wrote the first book about Bach, all memory of Bach, and his work, would have been lost forever. Today, it is seen by some, that as with N. Tesla, the works of J.S. Bach is inimitable and profound. But it is of no value to modern society. The music of today has degenerated into the gutter sounds of "Hump N' Slap," and "Eubonic Barking Savages", then the Boom....Boom Boom..... Accordingly it is seen that the so called Science has followed a parallel path. This is known as "Quantum Mechanics", the science of delusions. This "Science" in reality is no more than one big "Khazarian Circle Jerk". And finally? Art! What an absolute joke. To criticize it is like slaying the slain. Today one can obtain a grant from the "Sheisenburg Foundation" to express one's "artistic talent" by smearing human fecal matter onto a large canvas. Upon calling it "God" it will be worth millions. This is society today, COMPLETELY DEGENERATE.

So verily we are lost souls, hence the importance of reconstructing what has been lost to us. And it is to be noted that even Bach and Tesla themselves are only steps on a path, or as said by Heaviside "There is no finality." But who is going to support this effort, or who is even interested at all? Rest assured that no support will be provided by our Babylonian society. This endeavor is more like becoming a Christian in Ancient Rome, a dangerous undertaking. See the movie "Fahrenheit 451" for an excellent portrayal of what awaits.

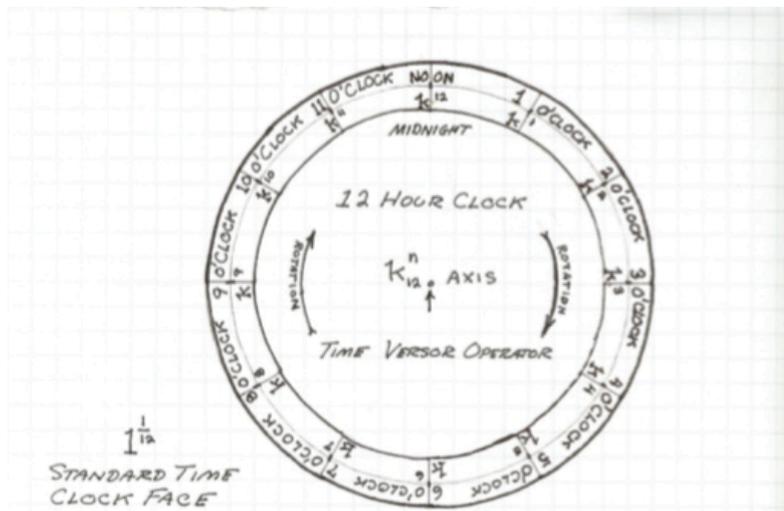


FIG 1

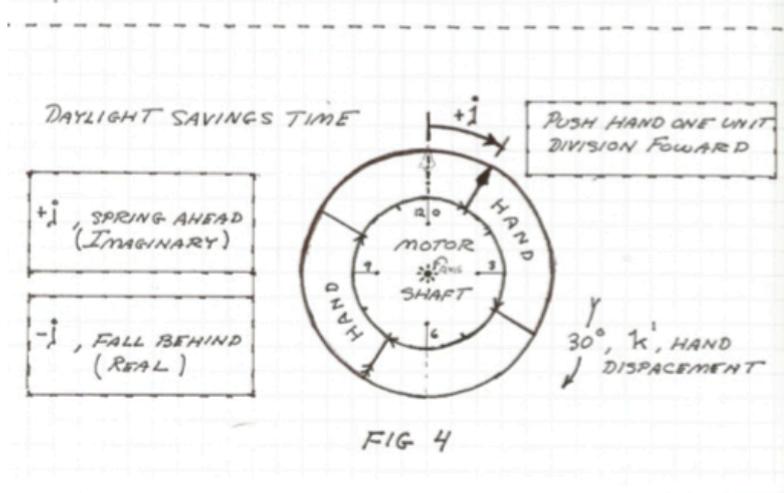


FIG 4

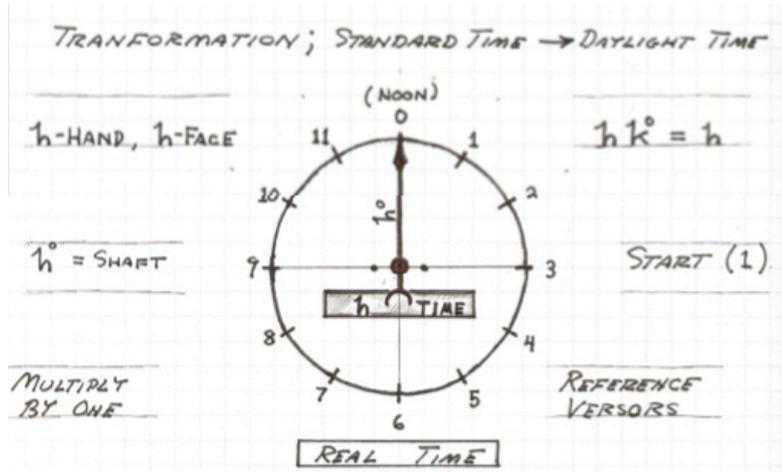


Fig 2a

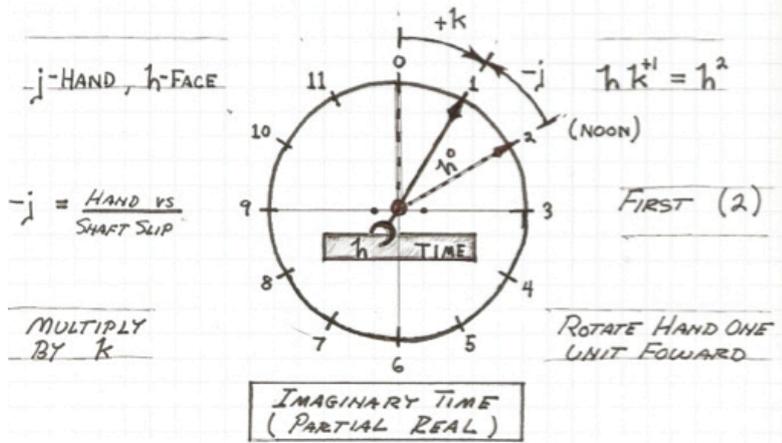


Fig 2b

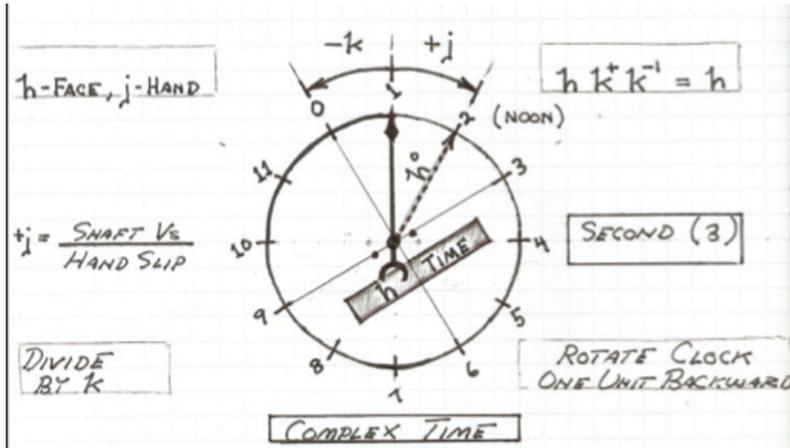


FIG 3a

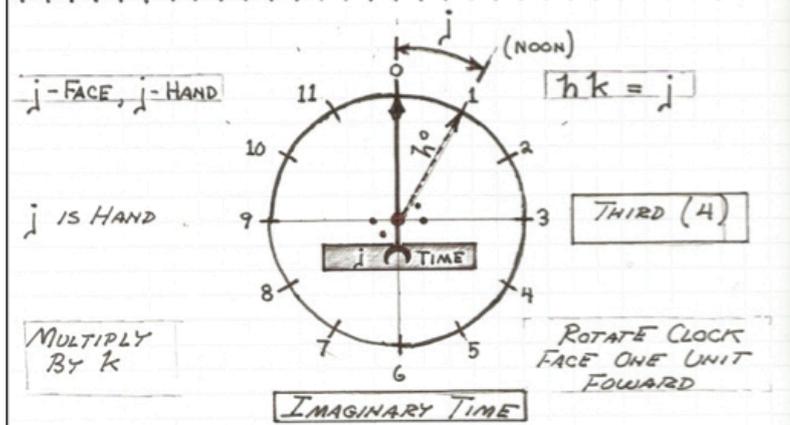


FIG 3b

