VRIL COMPENDIUM

VOLUME

7

VRIL DENDRITIC GROUND SYSTEMS

VASSILATOS

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7

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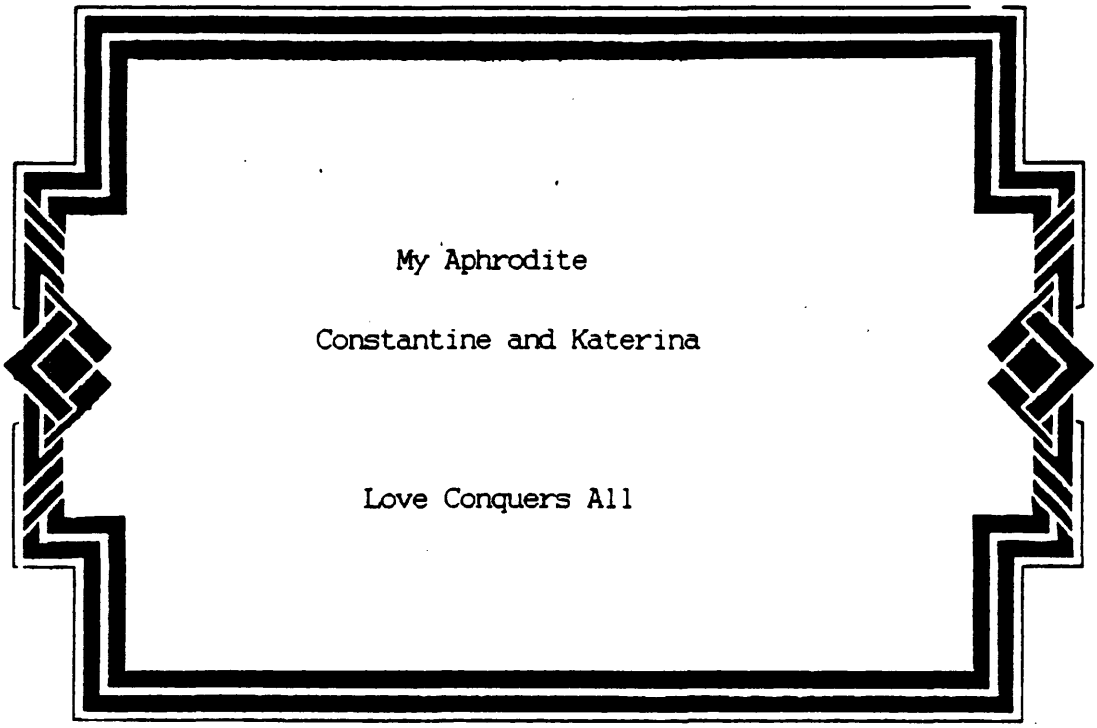

My Aphrodite

Constantine and Katerina

Love Conquers All

SECTION

1

COMMENTARY

For All Their Marvelous Assistance
In Obtaining Forgotten Knowledge
Concerning

DR.MAHLON LOOMIS
MR.NATHAN STUBBLEFIELD
DR.AMOS DOLBEAR

Respectful Thanks To The Archivists
of
MURRAY STATE UNIVERSITY
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TUFTS UNIVERSITY
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AND
THE LIBRARY OF CONGRESS

My Very Deepest Appreciation
To All The Wonderful People Of Murray, Kentucky
With Whom I Had The Great Pleasure Of Becoming Acquainted
Thank you dearly

Mr.Bailey Mrs.C.Baker Ms.S.Alexander

The conformity of any system with Vril energy determines the system's success. Vril eidetic experience threads through material configurations. Vril threads self-articulate in the ground. Vril thread self-articulations represent mysterious Vril expressions. Ancient technologies employed Vril eidetic transactions with especial regard to place, position, alignment, height, depth, and structure. Vril continuity is distal experience. Vril threads transact eidetic experiences. Vril threads are eidetic projections of eidetic worlds.

Geometric material configurations direct and collimate and direct inertial detritus of Vril transactions in inertial space. Specific minerals and metals dissolve, absorb, shear, and cavitate inertial space in the native states. Vril spontaneously emerges at specific ground points.

Self-generating Vril energy needs modulation only for the powerful transaction of empathic exchange. Vril energy operates in a world entirely separate and different from the inertial sphere in which all electrical technology operates. Vril energy is first detected through visceral responses (Galvani, Mesmer, Starr-White, Abrams). It is magnified in some instances by appropriate tuning mechanisms to yield its eidetic content (R.Drown).

Vril communications utilize self-differentiating, self-collimating, self-directional Vril thread connections; whereby specific eidetic transactions remain distinct and capable of self-organization. Visceral omni-sensation occurs during specific eidetic transactions. The sense of "what happens there...happens here" typifies this transactive sense.

Vrillic bilocational experience represents action at a distance where no connectivity or interstitial travel exists for the participant. Inertial threads merge and lose signal identity in conductive media; Vril threads maintain their self-articulating integrity.

Isolated batteries are eidetic reactors. Battery materials in mutual contact or promixity engage viscero-eidetic transactivities with inertial space. Vril thread dynamics seem to proceed in deranged and mysterious expressions. The observation of this strange Vril thread language does not enjoin the examiner with an eidetic experience. Touch contact may quench the activity of certain Vril transactors: gaps are required. Vril energy in gaps often increases with increasing distance from a design.

Vril projections release Vril Light into the inertial space. Vril Light is pure Light. Galvanic metallo-configurations are Vril transactors. Vril Light appears in specific metal and mineral configurations (ground and apparatus). Devices may entune the manifestation of Vril Light. Special materials are Vril Light stones. Vril Light is pure light. Vril Light does not require frictive actions to "produce light".

Pure Vril Light is organismically vitalizing. Vril light is

formative radiance. Vril light does not destroy its conductors. Vril light is phosphorescent in densified inertio-detrital spaces. Certain diffractors arrange Vril phosphorescence (Plucker, Crookes, Tesla, Mac Farland-Moore).

The enhosting of the pure mobile forms experienced in Vril eidetic worlds provides true motance. The enhosting of the pure light seen in Vril eidetic worlds provides pure Vril light.

Vril conduction leave specific crystallizations in minerals and metals. Peering into these patterns transacts sudden understandings to recipients. Vril threads passage through such Vril crystallization with especial clarities of insight resulting in sensitives. Vril Light is formative radiance. Vril Light gives eidetic translation among and through Vril Templates.

Basic Vril contact may be achieved through a simple iron rod in the ground (Stubblefield, Tesla, G.Starr-White). Enhancing Vril communion requires simple Vril Technological aid. Vril reactivities permit technological manipulations of deep space and deep ground Vril channels. Lost Vril threadways may be re-accessed through simple artifice. Vril entunement may be achieved with relatively inexpensive devices. Vril operators require sensitivity, patience, surrender, and devotion.

The enhosting of the pure mobile forms experienced in Vril eidetic worlds provides true motance. The enhosting of the pure light seen in Vril eidetic worlds provides pure Vril light.

MAHLON LOOMIS

The development of "leakage telegraphy" in the middle to late 1800's expresses the very thought of a wireless communications system best. The idea of electric or magnetic "leakage" best emphasizes the notions contained in the disclosures of the very early experimenters in wireless research. The discovery of transformer action by Joseph Henry was later utilized to effect signals; across space. Leakage was also derived from experiments in which telegraphic exchange was achieved across deep bodies of water. Dr. Mahlon Loomis had succeeded in transmitting telegraphic signals through a distance of 14 miles or more with a very ruggedly simple apparatus. These experimental verifications were performed shortly after our nation's Civil War.

Dr.Loomis was granted a patent in 1872 after severe criticisms by an unbelieving academic consortium. Dr. Loomis was in communication with another inventor whose work dealt with obtaining energy from a special aerial funnel (Benjamin Ward). Dr.Loomis developed an aerial generator capable of driving industry with free power from the "electrical seas" which he found in the upper reaches of the atmosphere.

The beauty and shock of discovering such an individual at such an early date has never lost its mystery to me. While the patent itself contains an excellent description of his system for natural-wireless signalling, we had to consult other sources to find relics of his notebooks and various sketches. Dr. Loomis had successfully and repeatedly demonstrated the transmission of signals across a valley between two very high peaks. His use of no battery source is absolutely entrancing.

What we have here is the very first demonstration of wireless telegraphy. Hand sketches provide the historical account of these remarkable experiments. The terms "electrical sky layer" and "electrical ground" has made this historical document noteworthy. Dr.Loomis believed that an electrically active region existed in the sky itself. Furthermore, he believed this layer capable of powerful activations. For him this layer was a sea of electricity. This remarkable metaphor was later echoed by others (Tesla, Moray). Dr.Loomis conceived of this "electrical sea" as providing electrical connectivity between distant points on the ground.

Entrance in this electrical sea was secured with metallic conductors. Two very separated parties could be effectively united through the "aerial conduction paths" thus provided. This invention is the record of a truly unprecedented arrangement. From reports I have obtained, Dr.Loomis actually succeeded in making several such communications at increasingly great distances.

Dr.Loomis and his assistant launched two very distant aerials into the "electrical sea" with kites. Induction coils, Leyden jars, or batteries were never used. Such artificial charging mechanisms were not required. Dr.Loomis merely provided a telegraphic key for the transmitter aerial. A galvanometer formed the receiving circuit. The "free wire ends" of each terminus were driven into ground via copper rods as shown below.

Those who obey and respond with Vril transactions and intuitions are amply rewarded. While telegraphic cables were laboriously being strung across battlefields and countryside, Mahlon Loomis was dispensing with both cables and electrical power entirely. Vril transacted knowledge demands only surrendered participation. Presentations of unexpected wonder follow. Vril transactions of this order draw humanity into full expressions of conscious-raising technology for a singular purpose and destiny.

The conception of Loomis was entirely unprecedented. Dr.Loomis was thoroughly convinced of the existence of the "electrical sea" which was independently asserted by others in later years (Tesla, Moray). While some point out that an ionospheric layer exists, we of course emphasize the fact that Dr.Loomis' kites never exceeded the height of 4 miles from sea level.

Loomis believed that oxygen was electricity. This strange theory is vitalistic in foundation. Loomis drew intuitively designed mappings of the "smooth electrical sea" through which "ripples as smooth as glass" could be initiated. His drawings show the presence of "ions" in regular sequence. The elevated probes of Loomis were thought by him to engage modulations of the pre-existent "electrical sea". Thus in absence of applied electrical power, Dr. Loomis was engaging in wireless communications across very great distances (in excess of 20 miles by 1866!).

In Dr.Loomis' amazing drawings we find remarkable conceptions which depict aerial batteries for the deliberate extraction of "electrical energy" from the overlying "electrical sea". Electricity was a term improperly used by sensitives of the day.

Dr.Loomis described plans for a special trans-continental telegraphic network which utilized mountain ridges and eleva-

tions.

Loomis chose specific Vril active sites upon which to poise his special elevated copper terminals. Dr. Loomis made use of Galvanic Vril principles in his use of dissimilar metals among some of his aerial assemblies (zinc on one peak; copper on the other). These dissimilar metals certainly intensified his results.

The developments of aerials and grounded capacitors began to manifest their appearance during the American Civil War. Aerial batteries do not function through electrostatics. The empirical experimenters were discovering the laws of a forgotten energy sequence which involved initiation through high voltage sparks. Though Mr.Dolbear's apparatus had no visible spark release in the secondary circuitry, yet it worked successfully through a distance of 3000 feet.

Many engineers have assessed this result to be that of ordinary magnetic induction fields (the "near field"). Dolbear's design patent indicates telephonic transmission: audio signals. As well known, such undulations require antennae the length between New York and San Francisco to be effectively radiated as transverse space-waves. Thirdly, the primary loops were never meant to be aligned with respect to one another; this rules out transformer action ("leakage telephony").

It is impossible for them to make this claim for Loomis' patent: there was no current at all in his devices. The "electrostatic" equilibrium established in each elevated terminal could never be analyzed by conventional techniques as capable of radiating such energetic transfers of signals.

NATHAN STUBBLEFIELD

The most misunderstood demonstration of all these years and breeds of rare such instruments was that of Nathan Stubblefield. This remarkable and unknown inventor first began research on leakage telephony systems. The impracticality of these systems was obvious to the inventor.

Vril energy operates in a world entirely separate and different from the inertial sphere in which all electrical technology operates. Vril energy is first detected through visceral responses (Galvani, Mesmer, Stubblefield, Starr-White, Abrams). Much of the results obtained by Nathan StubblefiELD were entirely viscero-eidetic in content and not electro-acoustic.

These designs did not require electrical energy, nor could they operate in this manner through electrical energies. Electrical energies are inertialized products. Electro-detrital products cannot yield viscero-eidetic experience or transactions. It is magnified in some instances by appropriate tuning mechanisms to yield its eidetic content (R.Drown).

Earth batteries are flowing capacitors which transact Vril viscero-eidetic energies. In the Stubblefield systems all energy is drawn from the ground. Those who would accuse his device of operating because of mere magnetic induction must examine the facts more closely. This design is not a good "battery". It cannot develop the electrical output wattage required for such operation. Neither are there electrical currents in the ground sufficient to achieve these results. Vril semi-sensate pre-electrical energy is the means by which these results are achieved.

The Stubblefield cell is inert in appearance until approaching the ground. The cell assumes a special dark radiance when ground emplaced. Terminal wires become especially black in radiant sense.

Further developments which remain largely unknown except among excellent persons with whom I have conversed. Most academicians are not qualified or personally equipped to appreciate what has come down to us through the local telling of encounters and incidents having to do with this elusive figure. His claimed ability to "...take sound, light, and heat from the ground directly..." are not the mere fictitious rumors which some have imagined. I have the documentation of these as facts.

Through the use of (plasma/vacuum tubes) Mr. Stubblefield "drew light" from the earth. In the very deepest sense of his claim, Mr. Stubblefield did not view his work in a metaphoric sense; he did not use the phrase "drew light" as a metaphoric way of describing the transformations of earth electricity to "power arc lamps". He was directly referring us to the phenomenon which was legendary in the foothills of our land: that the ground literally does fluoresce at times.

Ghost lights, spook lights, and will-o-the-wisps are mysterious displays of Vril Light. Nathan Stubblefield succeeded in producing the powerful transference of "ground-light" to empower numerous arc lamps. Examination of his components and equipment reveals those components to be (electrically) insufficient and incapable of achieving those uncommon results. With common minerals and metals (configured and convoluted) he succeeded in achieving the uncommon.

Too numerous are the local reports of unannounced visits made to the Stubblefield land which was "all aglow as if in daylight ... it seemed that sunlight was coming out of the hillside". Nathan Stubblefield perpetually insisted that he had "taken light ... directly out of the ground". Accounts of spontaneous "natural earthlights" have their source in the native transactivities of Vril which permeate specific zones and districts.

The popular Victorian use of the term "electricity" was adopted by those sensitives who used the word when referring to viscero-eidetic energies. Dowsers "feel the rays...feel the currents". Galvani and Mesmer also "felt the rays...felt the currents" while across the space between metal plates and poles. No doubt Nathan Stubblefield sensed powerful underground energies of the kind we ascribe to Vril.

These viscero-tonic sensations guided his placement of the "magnetoelectric" cell. The actual employment of subterranean "electrical waves" is unlikely. Stubblefield employed Vril threads in his systems. These produce no electricity; while producing certain viscero-tonic sensations not unlike those received from a small shock coil.

Many inventors had intuitively envisioned and described their sense of "electrical ground return circuits": wriggling currents necessary to the "completion of the circuit" (Farmer, Wilkins, Bear, Ader, Vail, Rosebrugh). Stubblefield never replaced his carbon arclamps. Their members never burned out. These lamps were run to full candlepower continuously and never caused fires. This means they did not give off heat.

What was the energy which releases light without heat?

What energy releases light without burning and consuming its housings? What energy is it which can radiate from an entire hillside in absence of arclamps? Stubblefield eventually retrieved such light directly from the ground itself...as witnesses recall. They did not see lamps.

Nathan Stubblefield emplaced his cells at the roots of trees. Heavy wires were used to connect with the original arclamp housings. These were hung in the trees. Mr.Stubblefield had to "work on an area" in order to obtain the "right points". It was in these points that the "currents could be felt". Once in place the activity increased and self-magnified. Eventually it was effortless to obtain this energy anywhere in the area.

This transactivity proved not to be plentiful or available in Central Park. Mr.Stubblefield found points to emplace the cell but these were not nearly as strong and intensely active. He needed more time ... which was what he did not have. When it was suggested that he try laying hidden wires everywhere to "fake the demonstration" Stubblefield walked out. He was too honest to fall in with the rogues.

No (doubt with time) entral Park would have proven not much more difficult a place to derive Vril energy with the Stubblefield design than any other place. Time and the continual drawing of Vril threads would transmute the district into an increasingly transactive zone.

The enhosting of the pure mobile forms experienced in Vril eidetic worlds provides true motance. Stubblefield "drew out...motion from the ground". The enhosting of the pure light seen in Vril eidetic worlds provides pure Vril light. Stubblefield "drew out light from the earth".

Ancient legends tell of special glowing stones whose radiance was like blazing sunlight...at midnight. Vril Light is organismically magnified. Vril Light may not be inertially radiant; affecting organismic participants.

Too numerous are the local reports of unannounced visits made to the Stubblefield land which was " all aglow as if in daylight...it seemed that sunlight was coming out of the hillside". Nathan Stubblefield perpetually insisted that he had "taken light...directly out of the ground".

The numerous accounts of spontaneous "natural earthlights" have their source in the native transactivities of Vril which permeate specific zones and districts. Vril Light is pure light. Vril Light does not require frictive actions to "produce light".

Stubblefield illustrated the fact that Vril threads in the ground were intelligent and self-articulating. By eliminating transmission lines entirely Stubblefield showed that Vril was the true means by which all previous telegraphic and telephonic messaging were effected. Vril was the instantaneous presence which responded to Vril-organic stimulations. The responsiveness of Vril to human modulations and need was known by the Templars.

Small arc lamps, vacuum carbon arcs, and Geissler tubes require more potent applications of power. Plasma arc bulbs produce a far brighter and more natural light under greater application of power.

Stubblefield actually drew out living Vril Light from a ground region through the use of these types of bulbs. Perhaps it is that these bulbs act as glassy waveguides of an unknown energy which has eluded our investigations; in which case the documents of the past provide us alone with valuable and persistent mention of their reality.

The Stubblefield system of lighting was clearly put forward in his company brochure. Nathan Stubblefield was honest "to a fault" as many conversations with highly credible witnesses mention. His failure to assay the ground in central Park (New York) with a subsequent failure to meet the claimed requirements of his claims in communicating through the ground) caused him to retract his offers and company disclosures. He would rather have retracted the entire fortune rather than fall in with certain scoundrels who had been attracted to his work.

The ability of electric currents to traverse stone increases with the stony content. Most of the Central Park material is basaltic in nature; which Dolbear found increased radio conductivity. Therefore I am led to believe that Nathan Stubblefield was not utilizing mere electrical methods, and required more time in order to dowse the Vril veins.

Stubblefield had managed to draw all the necessary utilities directly from his Kentuckian earth. This is of course due to the fact that he was most familiar with that land mass and its peculiarities. neither should we assume that he was simply using ground conduction methods; as can be attested through careful examination of his battery.

The reconstruction of Stubblefield's all-valuable work is a priority among many of us. We have been experimenting with some indication of success along these lines. It is to be remembered that Nathan Stubblefield was not working with electrical energy as we know it. No amount of electrical power could possibly effect the lighting of his arc lamps or the heating of his parallel-plate (aetheric) heaters.

The persistent permeation of Vril forms throughout the history of intuitively designed technologies is significant and noteworthy. Stubblefield double-ground systems match the parallel forms seen in altaric systems and other archaic architectural configurations built for the identical purposes of distal (empathic) communications.

Stubblefield claimed that he was engaging the subterranean energies of mysterious "electrical waves". While no such waves may be measured by modern inertial means, Stubblefield could sense them directly. We therefore realize that Nathan Stubblefield (along with most of his vitalistic contemporaries) was calling the Vril energies by the then-contemporary term "electricity".

Stubblefield claimed that he had "taken light, heat, motive power, and sound...from the ground directly". Stubblefield sustained vocal transactions between a static ground station and a moving vessel. Water as a conductive medium for electrical signals is problematic. Freely moving charges do not readily exist in salt water. Fresh water is more problematic for those who insist on electrical explanations.

The Stubblefield "battery" could not develop the needed power for the effective attainment of communications through distances claimed by him. Unquestionable in Stubblefield's design is this dependence upon special Vril modulating effects and interactions in absence of electrical energy.

The Stubblefield "earth battery" was the integral part of his ground wireless system. Strange aerials were employed in St later designs which were galvanically composed of parallel iron rods surmounted with moderate sized nickel plated spheres. These were empirically found to increase vocal ground exchange and cannot be explained as aerials by electrodynamic theory.

Stubblefield employed self-interacting Vril threadways in all of his designs. All of his discoveries centered around the energetic transactions derived through his Vril cell. Stubblefield repeatedly claimed that the patent office had misrepresented the true meaning of his telluric cell when calling it "a battery".

Stubblefield never claimed to have derived electrical power to drive lamps, heaters, motors, or telephonic arrays. Nathan Stubblefield claimed that he had derived light...luminescence, heat, motion, and vocal transaction with clarity...directly from the ground itself. The ground itself was said by him to contain all the resources and technological means by which humanity seeks the fulfillment of its civilized needs.

Self-generating Vril energy needs modulation only for the powerful transaction of empathic exchange. Meucci, Stubblefield, Rossetti, Tompkins, Bell, Dolbear and others discovered excessive anomalous vocal transactions in absence of applied power through the ground directly. Significant in each of these designs is the required organismic activating presence of the human voice.

The human voice as organismo-auric modulation engages Vril transactions. Stubblefield achieved the Vrillic transaction of vocal expressions directly through the ground itself. In absence of articulated lines and guide wires, Stubblefield managed the successful transaction of eidetic impressions through long distances.

His legendary means for determining the accurate position and presence of strangers on his land tract had nothing to do with trip-wires and mechanical sensors. His sudden appearance at the precise spot where thieves were stealing his meager crops led many to speculate on his magical abilities.

Highly reminiscent of Vril directional detectors and locators developed by Dr.T.H.Moray we realize that Stubblefield had also discovered native phenomena which enabled the distant Vrillic discernment of organismic position across the ground.

Vril contains the motive strength of the universe and evidences sudden spontaneous fractures in the earth strata. Vril generates heat and may be successfully endrawn for use. Vril heat is especially sensate above faultlines. Vril deep channels are vibrant and demonstrate sudden sensate movements.

Vril threads discharge and arc across surface fissures. Vril heat emerges as disturbing tiny black waves. Stubblefield succeeded in extracting "heat directly from the ground". A wonderful anecdotal letter is presented here. This rare footnote in the history of Nathan Stubblefield provides us with powerful and surprising insight concerning his use of Vril energies.

There are specific points on hillsides which are perpetually covered with patches of dark green vegetation. These spots are usually slightly more depressed in elevation that their surrounding grounds, and may be found along sunken rille-like crevices. Standing upon these spots releases viscero-eidetic experience. Visceral portions include body warmth, sudden absence of wind and cold. They are followed by absorptive eidetic experience in which participants are "drawn into the softening ground". Stepping off these spots immediately exposes participants in the surrounding bitter conditions: cold, wind, discord.

Nathan Stubblefield was a specialist in determining such Vril point sites. His placement of the magnetoelectric cell required at the transmitter site required care and time. The success of his placement was determined by his own careful sensitivities to the Vrillic presence. Mr.Stubblefield as a "terminal plug" not a battery source.

Mr.Stubblefield did not rely on wetcell packs in transmitting vocal messages. Mr.Stubblefield charged his wetcells with energy taken from the ground. His long-distance telephonic ground communication system (in excess of 2 miles during certain tests) prove to be totally anomalous when electrically examined.

Reports exist concerning the clarity of tone" which N.Stubblefield transacted from a mainstreet upper office to his distant cabin some 6,000 feet distant from town. Signalling to his son by tapping his one-piece telephonic transceiver, Mr.Stubblefield was immediately greeted by his son's quick, loud and clair-audible responses. Mr. Stubblefield's telephonic transmitter and receiver was a simple tin snuff-box which assembly was connected with ground directly below the office.

Several features of this inventor's work prevent against accusation and academic assault. Stubblefield had numerous qualified witnesses throughout the years of his public demonstrations. Most were allowed to examine all the materials as photographs indicate.

Stubblefield's offer to construct a powerstation based on his magnetoelectric cell principle for the town of Murray was rejected because of the initial expense of the project ($5000 at the time). Stubblefield charged wet cell batteries with excess power taken from his magnetoelectric cells for use in other experiments.

His snuff-can cigar-box speaker phone worked remarkably well from town (Court Square) to his farm cabin almost 6000 feet away when using power from his cell alone. How signals may self-articulate to such distances defies electrical explanation.

Stubblefield office system was a transceiver which was simply tapped to signal a call-in. This infers that the power was always "on" at both termini (both were transceivers). If such a system required wet cells then he would have had a major problem replacing these every day. Electro-inertial currents were not active in the designs of Nathan Stubblefield. Energy similar to that operating in the lamps of Dr.T.H.Moray was received through Mr. Stubblefield's devices.

The patent office would not permit Stubblefield original proposal for a "magnetoelectric cell" for reasons contained in electrical theory: where there are (supposed) no undulations there can be no induction. Neither Patent Office nor Stubblefield were correct in their naming the design; though Nathan Stubblefield had reasons for calling what he sensed by the

popular term "electrical waves".

The Stubblefield cell exceeds all the other earth batteries in that it actually can conduct impressed organic modulations from the transmitter site to any recipient equipped with a receiving instrument. Nathan Stubblefield claimed gradual success in the development of articulating devices by which privacy of message could be sustained. This infers that (irregardless of other ground rods) the Stubblefield system maintains its initial power output undisturbed. Only an enormous output of power can obtain the volume and clarity which was continually witnessed at distances up to 2 miles.

Arc lamps were connected to trees ... and the wires ran straight into the soil near their roots. Their continuous operation throughout the day did not in any way destroy the buried cells or require the enormous amounts of wet cells ordinarily required with inertial systemologies. The restoration of "burnt out lamps" never seemed to be mentioned in these reports: the arc lamps appeared to have been permanently twisted above their ground connections.

The design stimulates Vril transactivities directly and requires only proper material composition and alignment. Thereafter the organo-vocal expressions provided by a caller succeeds in stimulating Vril channels.

Vril responds to emotion. Songs and expressions of emotional intensity stimulate corresponding life-encouraging sympathies in Vril. In Stubblefield's vocal transactor the receiver determined the Vril connection from the transmitter. Vril capacitors increase the tones of whole surroundings: sounds are heard louder and highly clarified across a volume of space and ground. Stubblefield heard the natural whistlers in the ground with his equipment. Such developments were studied by others (Murgas, Shoemaker, Tesla).

It is significant that Stubblefield managed the powerful excitation of small carbon arc-lamps with Vril energy. When the Stubblefield system is sufficiently charged with organic energy it suddenly develops sufficiently excessive ability to light numerous arc lamps, heat homes, "exchange vocal transmissions with clarity to great distance".

Stubblefield magnetoelectric cell was powerful enough to light several arc lamps in the absence of primary (inductive) vibration. No such ground electro-vibrations can be detected today; and St did not bury these cells below 6 feet depth. These energies are reminiscent of statements made by other inventive notables (Tesla, Hendershot).

Stubblefield claimed the need to "work on an area" before "success is achieved". He needed to sensitively discover the "right spots" to bury his cells. The cell produces incredibly insignificant amounts of electricity: certainly never enough to transmit through even the 1 mile distance between Court Square and his cabin. These activities were witnessed by numerous credible witnesses constantly in that opened public locale. In examining the Stubblefield design we quickly comprehend why Vril threads were absolutely absorbed into the buried configurations (copper and iron are notable sensate transactors).

He saw his cell as a plug. His concept of natural energy was that it was an ever-present pulsation which could be utilized through a suitable "interceptive element". His need to find the "right spot" and "plug into the natural power" are matched by his truly anomalous achievements. He reached a slight impasse when attempting the transmission of vocal exchange through Central Park in new York.

His lack of familiarity with the rocky soil there required some time for sensitive examination. His lack of time alone prevented him from locating the Vril active points. The time span given him was less than 24 hours. The stub system was a true broadcast system and required fixed ground stations.

Electrically the Stubblefield cell is disappointing. Engineers have expressed this fact. The cell produces less than 1 volt and far less than 1/3 amp when placed in salty water. This condition far exceeds even those which are presented when burying the cell. With such energy he simultaneously raised several arc lamps (not incandescent lamps) to full candlepower for days on end. Lamps apparently did not burn out. Inertia free pure Vril light does not frictively wear out conductive minerals and metals.

Stubblefield claimed there to be incessant "subterranean electrical waves" which could "furnish energy for all society's needs".

Nathan Stubblefield describes and outlines plans for intercontinental communications through his methods.

Vril heatwaves are sighted above asphalt roads in winter. Vril heatwaves are seen emerging from recent roadcuts and excavations as well as from certain grounded iron posts and hydrants. Their visceral experience of great heat meets surprise when discovery is made that the radiating objects (or sites) are actually "cold to the touch". Eidetic world transactions are responsible for these anomalous displays of heat. Such sites are also "electro-active".

The natural extraction of Vril heat and Vril radiance requires concise understanding of Vril transactivities. Sensible heat is felt near large grounded iron objects. Intensely wavering lines of dissolving inertia are often observed against the perceptive field of view near water spigots and faucets. Sensible heat may be felt near gorges, dig sites, and rock fracture lines. Insensate and semi-sensate Vril generates these displays.

Sensible heat is felt when parallel plate capacitors are grounded in the right points. Such sensible heat cannot be measured with thermometers. Gripped photo tubes of caesium release great sensate heat when pointed at Vril channels. Such designs are often cold to the touch. Fixed transactive "sense" distances are discovered with such arrangements.

Other grounded configurations involve the release of a strange peripheral luminescence. Such warm and golden light is peripherally seen amid dried fields of vegetation after dusk. Organic matter reacts with Vril in strange ways. Other investigations have proven that a non-luminous lightform is radiated when gaseous discharge tubes are connected through grounded rods.

Nathan Stubblefield developed Vril energies capable of heating a cabin, driving a special motor, communicating for miles with clarity, and raising many arc-lamps to simultaneously brilliant candlepower. Such derivations of energy are Vrillic and non-detrital in their origin. There is a fundamental

energy concentrated in the ground. Electricity is not the means by which these feats are accomplished. One ancillary goal of Vril Science is the discovery and development of non-detrital (pure) energy manifestations.

DR.AMOS DOLBEAR

Dr.Dolbear employed capacitative systems for the transaction of coded signals. Amos Dolbear's patent (1886) reveals the first officially recognized "wireless" arrangement for distant communication in America. The obvious features include the notion that signals do articulate and travel through the ground to their destinations.

Dr. Dolbear replaced the overhead single telegraph line by using the ground itself as the conductor. The description of his several experiments employed the use of "opposite polarities" for each terminus. The transfer of "currents" could only powerfully take place when the polarities of transmitter and receiver were opposed.

This significant necessity reveals the activity of Vril in the system. True electrical energy is never transferred between the termini by such means. The absence of aerials significantly provides us with a comparative measure of energetic transactions taking place. Dr. Dolbear's device did not make use of any spark-release at the secondary side of the induction coils. Vocal undulations were delivered to ground through rods. A telephone transmitter was used to transact vocal expressions through an induction coil. Dolbear's device used audio currents directly into ground.

The opposite polarities of transmitter and receiver were necessary in the articulation of "ground current". Later developers made use of ground ray-guides to further amplify the transmitted signals. Such guides enabled Vril articulated signals to enter subterranean depths through eidetic projections.

The arrangement disclosed in Prof.A.Dolbear's previously undiscussed patent gradually became the design "of choice" among others. The sudden move toward high voltage employed induction coils with arcs and gaps. Dr.Dolbear used the induction coil in a manner analogous to that utilized by Rossetti. Dr.Dolbear inverted the symmetry however: using the ground in place of the fine wire.

Varieties of designs which "shock the earth" are found in hundreds of subsequent patents. European patent collections contains vast numbers of these diagrams and schemes. The "wire-less"theory became dramatically more detailed when new discoveries based on these wireless telegraphs appeared.

Dolbear used the use of ground itself as "the line" to replace the need for setting up expensive and fragile telegraph wires. In order to achieve the effect of ground when using a line, Dolbear had to reverse his thinking considerably. His design encorporates the mirror-image of ground (for wire) and capacitors (for ground).

If ground represented a tank-like "electrical capacity" for the line, then to use ground he would have to supply a correspondingly large artificial "tank". This we see in his disclosure. The relatively large plate-capacitors we recognize is just this needed "tank" for each end of the "ground line". Electro-vocal exchanges require huge capacities. These huge tanks are missing in Dolbear's design.

Dolbear's patent for a ground activator is noteworthy considering the academic time-period. Dolbear's patent illustrates his intuitive sense that energies of some form were travelling through the ground. It is significant that his patent illustrates this energy as having an "undulating" quality: the Vril signature.

Manifolded capacitance (used as aerial) in place of unfolded capacitance requires explanation. Consideration of Dr.Dolbear's design as electrical reservoir capable of absorbing and expelling electrical impulses realistically fails. Dr.Dolbear's design would never work without extremely large manifolded capacitors. Addition of small aerials did not measurably intensify the transacted signals.

When identical material configurations are aligned properly they mutually transact eidetically by translating their participants into the same world-place. Dolbear discovered that signals altered in quality and clarity when transmitters were placed upon specific minerals and metals. Experiments with double ground configurations releases sudden eidetic trans of surpassing quality: experiences which are unmistakable and not easily forgotten,

Dr.Dolbear investigated the production of special shadowgraphs obtained through the use of strong electrical arcs. These photographs were taken through a table with the arc just above a photographic plate. The plate was in the table drawer. His mystical nature was fluent. He also developed the electrostatic telephone. The documents speak for themselves.

Dr.Dolbear intuitively designed Vril cabinets which extended the Vril aurae among communicants. One observes the enlargement of the human Vrillic aura among those who engage in conversation and who converse through telephones. These portions (striations) of the aurae enlarge when such persons are seated in rich organic settings (wood cabinets).

SECTION 2

MAHLON LOOMIS

UNITED STATES PATENT OFFICE.

MAHLON LOOMIS, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN TELEGRAPHING.

Specification forming part of Letters Patent No. **129,971**, dated July 30, 1872.

To all whom it may concern:

Be it known that I, MAHLON LOOMIS, dentist, of Washington, District of Columbia, have invented or discovered a new and Improved Mode of Telegraphing and of Generating Light, Heat, and Motive-Power; and I do hereby declare that the following is a full description thereof.

The nature of my invention or discovery consists, in general terms, of utilizing natural electricity and establishing an electrical current or circuit for telegraphic and other purposes without the aid of wires, artificial batteries, or cables to form such electrical circuit, and yet communicate from one continent of the globe to another.

To enable others skilled in electrical science to make use of my discovery, I will proceed to describe the arrangements and mode of operation.

As in dispensing with the double wire, (which was first used in telegraphing,) and making use of but one, substituting the earth instead of a wire to form one-half the circuit, so I now dispense with both wires, using the earth as one-half the circuit and the continuous electrical element far above the earth's surface for the other part of the circuit. I also dispense with all artificial batteries, but use the free electricity of the atmosphere, co-operating with that of the earth, to supply the electrical dynamic force or current for telegraphing and for other useful purposes, such as light, heat, and motive power.

As atmospheric electricity is found more and more abundant when moisture, clouds, heated currents of air, and other dissipating influences are left below and a greater altitude attained, my plan is to seek as high an elevation as practicable on the tops of high mountains, and thus penetrate or establish electrical connection with the atmospheric stratum or ocean overlying local disturbances. Upon these mountain-tops I erect suitable towers and apparatus to attract the electricity, or, in other words, to disturb the electrical equilibrium, and thus obtain a current of electricity, or shocks or pulsations, which traverse or disturb the positive electrical body of the atmosphere above and between two given points by communicating it to the negative electrical body in the earth below, to form the electrical circuit.

I deem it expedient to use an insulated wire or conductor as forming a part of the local apparatus and for conducting the electricity down to the foot of the mountain, or as far away as may be convenient for a telegraph-office, or to utilize it for other purposes.

I do not claim any new key-board nor any new alphabet or signals; I do not claim any new register or recording instrument; but

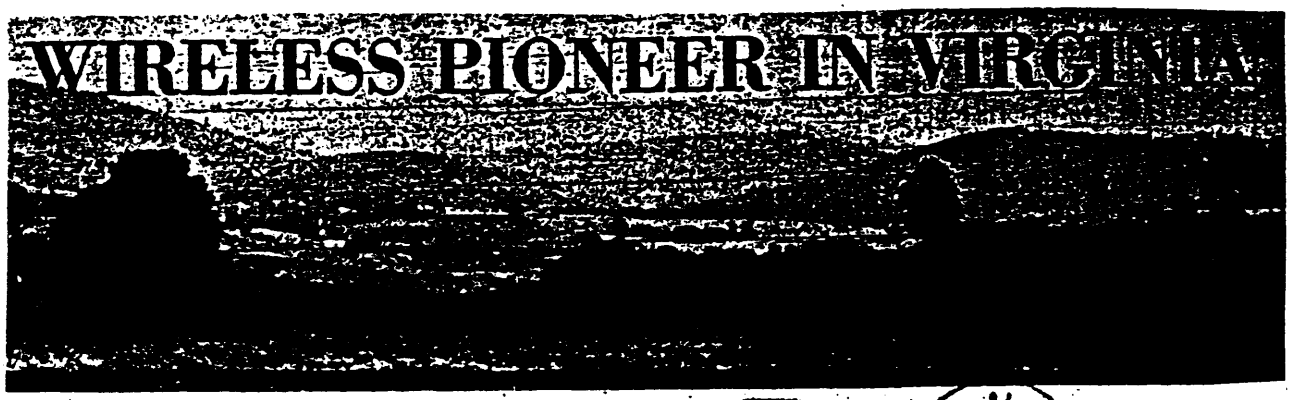
What I claim as my invention or discovery, and desire to secure by Letters Patent, is—

The utilization of natural electricity from elevated points by connecting the opposite polarity of the celestial and terrestrial bodies of electricity at different points by suitable conductors, and, for telegraphic purposes, relying upon the disturbance produced in the two electro-opposite bodies (of the earth and atmosphere) by an interruption of the continuity of one of the conductors from the electrical body being indicated upon its opposite or corresponding terminus, and thus producing a circuit or communication between the two without an artificial battery or the further use of wires or cables to connect the co-operating stations.

MAHLON LOOMIS.

Witnesses:
BOYD ELIOT,
C. C. WILSON.

WIRELESS PIONEER IN VIRGINIA



Mahlon Loomis was conducting experiments in "aerial telegraphy" before Marconi was born.

by Theodore M. Hannah

EVERYONE knows that Marconi is generally credited with making wireless communication practical. Almost no one knows that a now nearly forgotten American dentist, Dr. Mahlon Loomis, conducted wireless experiments in Virginia eight years before Marconi was born. That Marconi and not Loomis is now called the "father of radio" is due largely to a matter of timing—Dr. Loomis was simply a generation ahead of his time.

Born July 21, 1826, in Oppenheim, New York, Mahlon Loomis was the fourth of nine children born to Professor Nathan Loomis a descendant of Joseph Loomis who sailed from England to Massachusetts in 1638 and a year later was one of the founders of Windsor, Connecticut. Mahlon was not the first of his family to exhibit inventive and mechanical talent. His father was a founder of the *American Ephemeris and Nautical Almanac*. An older brother, George, was an inventor with several patents to his credit. He also experimented with electricity, and it may have been from him that Mahlon acquired his interest in things electrical. Another scientifically-minded member of the family was Mahlon's contemporary, Professor Elias Loomis, who was a frequent contributor to the *American Journal of Science* and other journals, writing primarily on meteorology and astronomy.

About 1836, Mahlon's family moved to Springvale, Virginia. From there, in September, 1848, Mahlon went to Cleveland, Ohio, to study dentistry. About 1850, he returned to Springvale to continue his dental work. As a traveling dentist, he later practiced variously in Earlville, New York, Cambridgeport, Massachusetts, and Philadelphia. In 1854, while practicing in Massachusetts, he received a patent for a mineral-plate (kaolin) process for making artificial teeth. In November, 1856, Loomis and his bride of a few months moved to Washington, D. C., where he began a dental practice which he was to maintain off and on for the next 20 years. A few years later, about 1860, he became interested in electricity and exprimented with forcing plant growth by means of buried metal plates connected to batteries. He seems to have achieved some success with these experiments, but the high cost of the batteries ruled out any practical application of the technique.

Loomis's experiments in wireless telegraphy began sometime between 1860 and 1865. His first investigations involved a study of electrical charges in the upper atmosphere; he hoped that this natural source of electricity could be used to replace batteries. Using kites attached to metal wires, he observed that a wire sent aloft at one place would induce a flow of electricity to ground through another kite wire some distance away. Out of these experiments grew his belief that the earth was surrounded by an "aura" which he termed the "static sea." He further believed that if the "static sea" were penetrated by two aerials of sufficient and equal height, it would be possible to transmit signals between them. The distance covered, he believed, could be almost unlimited. Loomis himself explained the concept this way: ". . . by extending a wire to a certain altitude it strikes an electric current which will communicate to all other wires at the same height."

Loomis's discovery, which he called "aerial telegraphy," was successfully demonstrated in 1866 in Virginia's Blue Ridge Mountains. In the presence of prominent scientists and electricians, Loomis transmitted signals between Cohocton Mountain and Beorse Deer Mountain (Loudoun County), a distance of about 14 miles. He used two ordinary kites with pieces of copper mesh attached to the underside of each; the kite "strings" were 600-foot-long pieces of copper wire. Near the ground, both wires were connected to galvanometers (indicators of electric current) and then to ground through pools of water. Alternately making and breaking the connection of one galvanometer with its kite wire resulted in a deflection of the meter connected to the other wire, and in this way "messages" were exchanged between the stations.

The details of the experiment are described in Loomis's diary:

> The equipments and apparatus at both stations were exactly alike. The time pieces of both parties having been set alike, it was arranged that at precisely such an hour and minute the galvanometer at one station should be attached, to be in circuit with the ground and kite wires. At the opposite station separate and deliberate half-minute connections were made with the kite wire and the instrument. This deflected, or moved the needle at the other station with the same vigor and precision as if it had been attached to an ordinary battery. After a lapse of five minutes, as previously arranged, the same performance was repeated with the same results. . . . It continued to transmit signals only about three hours when the circuit became inoperative by the moving away of the upper electric body.

Shortly after the Blue Ridge demonstration, Loomis succeeded in transmitting signals two miles between ships on Chesapeake Bay. Here, however, he lowered wires over the sides of the ships and transmitted through the water.

At some time during this period Loomis reportedly lived in Lynchburg and he may have continued his wireless experiments in the mountains near that city.

As a further test of his theories, Loomis wanted to attempt wireless communication between Mt. Shasta, California, and Mt. Hood, Oregon, a distance of about 275 miles. Apparently because of a lack of money (he estimated the experiment would cost about $20,000), he abandoned this idea in favor of a much more ambitious scheme which he hoped would attract financial backing. What he proposed was nothing less than transatlantic wireless communication—America to Europe by radio! Believing, as always, that the secret of wireless lay in reaching an electrified stratum of air thousands of feet above sea level, he planned "to telegraph from a high point in the Rocky Mountains to the highest peak of the Alps."

In 1868, a group of Boston financiers agreed to back the transatlantic tests, but the Black Friday financial panic of 1869 wiped them out and the tests were postponed. The same misfortune befell Loomis two years later when a group of Chicago promoters were ruined by the Chicago fire.

Meanwhile, Loomis's experiments had attracted the attention of Senator Charles Sumner, of Massachusetts, who, encouraged by a previous federal grant to Morse, introduced into the Senate, on January 13, 1869, the "Loomis Aerial Telegraph Bill." The bill asked for an act of incorporation for the Loomis Aerial Telegraph Company and for an appropriation of $50,000 to perfect Loomis's discovery and make it practical. In support of its request for a charter and financial assistance, the Loomis Company proposed to transmit from the United States to Europe the same number of messages as the recently opened transatlantic cable and to do it at one-sixteenth the cost. It was introduced into the House the following July.

A sketch of the Loomis telegraph set on file in the patent office at Washington. From the *Literary Digest*, July 29, 1922.

"A PRE-HISTORIC" RADIO SET.
Exact copy of Mahlon Loomis's original drawing of his wireless telegraph set on file in the patent office at Washington.

In addition to Senator Sumner, the bill was supported by Senators Aldrich, Pomeroy, Wilson and others. Other senators, however, ridiculed Loomis and his plans, and the bill was shuttled from committee to committee and action was repeatedly delayed. But Loomis's supporters refused to be discouraged. A lengthy discussion of the bill took place in the House of Representatives on May 20 and 21, 1872. (At issue now was only the question of incorporation, the appropriations provision having already been removed from the bill.) Congressman John A. Bingham, of Ohio, who had introduced the bill into the House, said in support of it: "I understand that the highest authorities on electricity in America and in Europe sustain the theory upon which the project is based." Representative Bingham, who, with Senator Pomeroy, had seen Loomis's "aerial telegraph" demonstrated, was to remain one of Loomis's most faithful supporters. He and Representative Conger were largely responsible for keeping the Loomis Bill alive through nearly four years of Congressional opposition and apathy.

During the same deliberations, Mr. Conger explained the principle of operation of "aerial telegraphy" in the following way:

> . . . causing electrical vibrations or waves to pass around the world, as upon the surface of some quiet lake one wave circlet follows another from the point of disturbance to the remotest shores, so that from any other mountain top upon the globe another conductor, which shall pierce this plane and receive the impressed vibration, may be connected to an indicator, which shall mark the length and duration of each vibration; and indicate by any agreed system of notation, convertible into human language, the message of the operator at the point of the first disturbance.

Interestingly enough, the idea of ripples of water on a lake is the analogy still used today to explain the principle of electromagnetic radiation, the principle upon which all radio communication is based.

The Washington, D. C., newspapers followed the bill through Congress and generally supported it. On April 14, 1872, the *Sunday Chronicle* said:

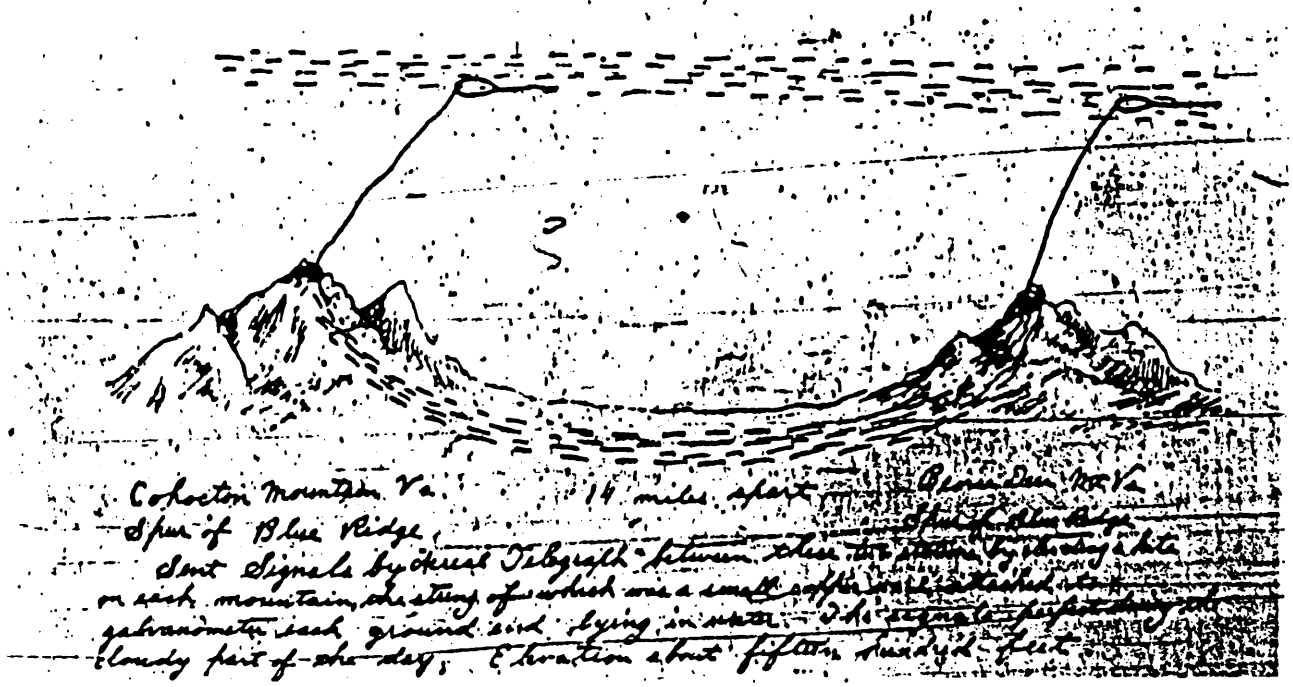
> If there be truth in the assertion . . . that telegraphing may be done without wire or cable, according to Loomis's plan, then we think every possible facility should be accorded the undertaking.

In other cities, editorial comment ranged from polite scepticism to outright ridicule. Typical was the comment of the New York *Journal of Commerce* (February 5, 1873):

> As we understand the Loomis plan, it is something, to this effect — and readers are cautioned not to laugh too boisterously at it, as also not to believe it till demonstrated . . .

More critical was the Springfield, Massachusetts *Republican* (an issue of 1869): "In truth, Mr. Loomis is a dreamer, and an illustration of what Pope said of

A sketch of the Blue Ridge experiment, with explanatory notes. Signals were sent by "Aerial Telegraph" between the two stations.



Canning, that 'shallow thoughts intoxicate the brain.' Similar comments were made by other papers.

On January 16, 1873, the Loomis Bill was finally brought to a vote in the Senate and was passed by a vote of 29 to 12, with 33 senators absent. The record shows that neither of Virginia's senators voted on the bill. Five days later President Grant signed the bill, thus incorporating the Loomis Aerial Telegraph Company. What had been achieved by all of this? Actually not very much. Not only had the request for financial aid been stricken from the bill—and this of course was a critical setback to Loomis's plans—but the extent of the company's corporate powers was restricted to the District of Columbia. It could operate elsewhere only with the consent of the state concerned.

Dr. Loomis did, however, have the satisfaction of receiving the first United States patent ever granted for a system of wireless telegraphy. The patent, No. 129,971 and titled "Improvement in Telegraphing," was issued July 30, 1872, two years before Marconi was born.

During the remaining years of his life, Loomis practiced dentistry only to the extent necessary to provide himself with sufficient funds with which to continue his wireless experiments. In the late 1870s, he began conducting experiments in the mountains of West Virginia. On two peaks about 20 miles apart he erected steel masts atop wooden towers (these replaced the kites of his earlier experiments) and reportedly maintained fairly regular communication between them for months at a time. During these later tests (about 1878), he is said to have communicated by telephone as well as by telegraph, although it is not clear how this was accomplished.

On October 13, 1886, after a week's illness, Mahlon Loomis died at his brother's country home in Terra Alta, West Virginia; he was 60 years old. At the time of his brother's death, George Loomis remarked: "During his last illness he was uplifted and strengthened by the consciousness that the world would sometime understand and realize the grandeur of his discovery." He also quoted his brother as saying:

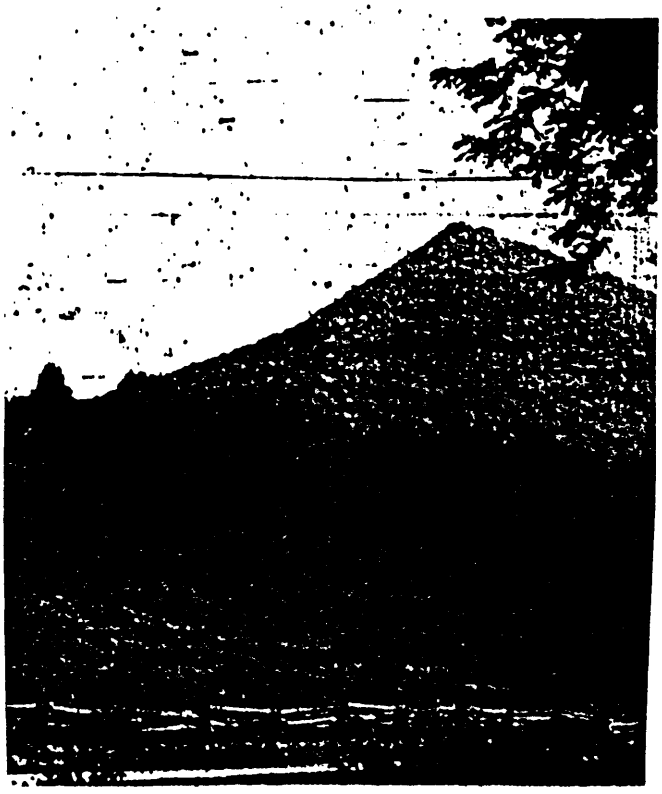
> I know that I am by some, even many, regarded as a crank — by some perhaps as a fool . . . but I know I am right, and if the present generation lives long enough their opinions will be changed — and their wonder will be that they did not perceive it before. I shall never see it perfected — but it will be, and others will have the honor of the discovery.

Loomis's prediction was, as we know, fulfilled. Marconi and others went on to perfect wireless and make it the wonderful means of communication it is today.

What should be Loomis's place in radio history? At the very least, he can probably be credited with being the first to use a complete antenna and ground system. More importantly, it appears that by interrupting his kite wire circuit he produced sparks, and thereby quite unknowingly produced electromagnetic waves. The coils of the galvanometers may have formed a kind of resonant circuit which, together with atmospheric electricity as a source of power, could have formed a crude spark-gap transmitter—the world's first.

Unfortunately, Loomis's kind of transmissions were not very useful. He depended upon atmospheric electricity for his source of power, and this was not very reliable. And he was not able to detect his signals because the detector had not yet been invented. Further, his plan for transatlantic communication almost certainly would not have succeeded. But useful or not, he *did* transmit signals over a considerable distance without the aid of wires. Had he been able to develop his discovery, he might now be recognized as the inventor of radio, the United States might be known as the birthplace of radio, and Virginia the state where it was first demonstrated.

Loomis may have conducted some of his experiments near Lynchburg.



THE WAY OF THE WORLD.

By Arthur Ketchum.

THIS is the way of all the world,
The law of change and chance,—
That one there is whose lot's to pipe;
That other folk—may dance;

That one must wear the shining gem
Another died to bring;
That he who makes the lilting song
Has not the heart to sing.

THE PIONEER IN TELEGRAPHING WITHOUT WIRES.

By George Loomis.

The accompanying illustrations are from original sketches by Dr. Loomis.

THERE is nothing new under the sun, said Solomon; and his words find corroboration to-day in the case of Wireless Telegraphy, as it has been recently christened. Its first and more poetic name, Aerial Telegraphy, was given more than thirty years ago by Dr. Mahlon Loomis of Washington, District of Columbia, its discoverer and inventor. Both these words, "discoverer" and "inventor," are needed to describe the mental processes that preceded telegraphing without wires.

In 1865, after years of study and experiment, Dr. Loomis perfected plans for telegraphing without wire connections between points however distant. His invention was called the Aerial Telegraph. His first successful experiment of any considerable magnitude was made about 1868, from the tops of two prominent peaks of the Blue Ridge in Virginia, some eighteen miles apart. A full account of these operations, with a large woodcut illustration, were published in *Frank Leslie's Illustrated Paper*.

From each of the two mountain tops an ordinary kite was elevated, connected with an insulated copper wire attached at the lower end to a telegraphing apparatus. The operators of each party were provided with good telescopes, with which they could sight from one station to the other and read the signals. When all was in readiness, a message was sent by the doctor along the wire of his kite, and was received at the other station in all respects as if the two kites had been connected with a wire in the ordinary way. In this manner communications were kept up until the fact was thoroughly demonstrated that telegraphing could be done as readily without as with connecting wires—at least between points at this distance apart.

Dr. Loomis was elated with the success of the experiment, although

he had confidently expected it. Returning to Washington, he sought financial aid to enable him to try a similar experiment on a more extended scale, as calculated to give greater public confidence in the practical workings of the Aerial Telegraph. His purpose was to go to the Rocky Mountains and erect a station on the top of Mount Hood and one on the top of Mount Shasta—two of the highest available points, situated about one hundred miles apart. He asked enough money to obtain suitable equipments, maintain his family during his absence, and pay the men employed, desiring nothing for himself except actual expenses. About twenty thousand dollars was needed for this purpose. After diligent efforts to get the necessary amount pledged in Washington, he visited New York and Springfield, Massachusetts; and at last, through the assistance of Austin Day of the former city and two or three others, the funds were promised, and preparations were nearly completed, when the financial crisis of "Black Friday" occurred in Wall Street, involving his patrons in losses so serious that they were obliged to withdraw their promised aid. He returned to Washington and resumed the practice of his profession, but never for a moment abandoned the great enterprise.

In the winter of 1865 I spent several days at his residence in Washington. He had just completed a written lecture on the subject of his discovery, which was afterwards delivered in Washington and other cities, thus to some extent replenishing his depleted exchequer and enabling him to visit Chicago, where, after ceaseless efforts to secure a pledge of sufficient funds, he at length succeeded in obtaining the promise of three capitalists in that city to furnish the money required. Again preparations for the Rocky Mountain trip were nearly perfected, when the great fire in Chicago occurred, reducing his patrons to penury. Baffled, but not discouraged, he returned to Washington and devoted his spare time to the further study of electricity and kindred matters. Pursuing the theories the correctness of which had already been so satisfactorily verified, he conceived the idea of telegraphing between vessels at sea without wire connections. The experiment was tried on the Chesapeake Bay with perfect success, between ships about two miles apart. I am no scientist myself and have but little knowledge of electricity, so I can narrate these events only in the language of a layman. The method of telegraphing between the two vessels, as I understand it, was as follows:

On each vessel was a telegraphic apparatus. A wire was attached to the instrument and one end thrown into the water to a moderate depth. Another insulated wire of much greater length was let down to a greater depth into a colder stratum of water. The two strata of water of different temperatures thus connected to the same battery made a complete circuit, and enabled communications to pass between the two vessels without other connections. The experiment resulted in complete success.

On the same principle he was led to believe that the warm current of the Gulf Stream, if similarly connected with the adjacent colder water, would afford a means of telegraphing a great distance—perhaps as far as a decided difference in temperature is maintained. Telegraphing between moving trains of cars by means of inductive electricity was fully explained by him, but so imperfectly comprehended by me that I refrain from attempting any description.

Meantime he continued his efforts to have his theories put to practical tests on a larger scale than he was able to accomplish unaided. He applied to Congress for an appropriation of fifty thousand dollars to be expended in furtherance of his enterprise, under such restrictions as Con-

gress might impose. The bill was introduced in the Senate by Mr. Sumner of Massachusetts, on the thirteenth day of January, 1869, as will appear by the following extracts taken from the *Congressional Globe* of that date:

"Mr. Sumner: I present the petition of Mahlon Loomis, M. D., of the District of Columbia, who believes that he has invented a new mode of telegraphing which he submits as a great and valuable improvement upon any former mode known or discovered. He briefly says:

"'The nature of the discovery or invention in general terms consists in establishing an electric current or circuit for telegraphing without the aid of wires or cables to form such electrical currents and circuits. As in dispensing with the double wire (which was at first used) and using but one, allowing and relying upon the earth to form the one-half of the circuit, so now I propose to dispense with both wires and all artificial batteries, using the earth as now to form one-half of the circuit, and the continuous electrical element far above the surface of the earth for the other part of the circuit.'

"After setting forth at some length his invention or his theory, he asks Congress for an appropriation of fifty thousand dollars under such restrictions as Congress may impose, to enable him during the next year to complete the demonstration. In presenting this petition I desire to say that I perform a duty, and I content myself with remarking that it is either a great case of moonshine or it marks a great epoch in the progress of invention. I do not undertake to express an opinion upon it. I ask the reference of the petition to the Committee on Patents."

Remarks were made upon the subject by Senators Willey, Grimes, Pomeroy and Wilson, moving its reference to other committees:

Mr. Pomeroy: "I did not understand the name of the petitioner. Was it given? Let the name be read, for I want him to have the benefit of it, whoever he is."

The Chief Clerk: "The petition is signed Mahlon Loomis, M. D."

Mr. Willey: "It is not an application, as I understand it, for a patent, or anything of that character."

Mr. Sumner: "But it is for an appropriation, which will be a substitute for a patent."

Mr. Wilson: "I hope the petition will be sent to the Committee on Patents. I do not know that there is anything in the invention; probably there is not; but it is not worth our while to meet any proposition of this kind with a sneer. The world laughed at all the great inventions when they first appeared. It is only a few years ago since the first men of the nation sneered at the magnetic telegraph; but the telegraph triumphed. Now, there may be something in this, and I hope that the papers will be sent to the proper committee, and that they will examine the subject."

Mr. Pomeroy: "I hope senators will not think from any remarks I have made that I sneered at this improvement. I believe in it. I have seen two or three experiments, and I think there is something in it. I have seen it tested in a small way, and I am inclined to think it will succeed."

March 11, 1870. (From the *Congressional Globe*, 41st Congress, 2nd session:)

Mr. Pomeroy: "I move that the petition and accompanying papers of Dr. Mahlon Loomis, which were referred to the Committee on Patents last year, be taken from the files and referred to the Committee on Appropriations. They relate to a system of telegraphing without the use of wires. I believe he wants some appropriation to enable him to telegraph across the Atlantic Ocean without either cable or wires. I know nothing of the merits of it, but I commend the enterprise of the young man. He asks to have his papers referred to the Committee on Appropriations."

The motion was agreed to; but ultimately the matter was indefinitely postponed. Mahlon Loomis obtained letters patent for his invention. The following forms a part of the same (No. 129,971, dated July 30, 1872):

"Be it known that I, Mahlon Loomis, dentist, of Washington, District of Columbia, have invented or discovered a new and improved mode of telegraphing and generating light, heat and motive power.

"The nature of my invention or discovery consists in general terms of utilizing natural electricity and establishing a natural electrical current or circuit for telegraphic and other purposes without the aid of wires, artificial batteries or cables to form such electrical circuit; and yet communicate from one continent of the globe to another.

"To enable others skilled in electrical science to make use of my discovery, I will describe the arrangements and mode of

operation. As in dispensing with the double wire (which was first used in telegraphing) and making use of one, substituting the earth instead of a wire to form one-half the circuit, so I now dispense with both wires, using the earth as one-half the circuit and the continuous electrical element far above the earth's surface for the other part of the circuit. I also dispense with all artificial batteries, but use the free electricity of the atmosphere, co-operating with that of the earth, to supply the electrical dynamic force or current for telegraphing and other useful purposes, such as light, heat, and motive power.

"As atmospheric electricity is found more and more when moisture, clouds, heated currents of air and other dissipating influences are left below and a greater altitude attained, my plan is to seek as high an elevation as practicable on the tops of high mountains, and thus penetrate or establish electrical connections with the atmospheric stratum or ocean overlying local disturbances. Upon these mountain tops I erect suitable towers and apparatus to attract the electricity,—or in other words, to disturb the electrical equilibrium and thus obtain a current of electricity, or shocks, or pulsations, which traverse or disturb the positive electrical body of the atmosphere above and between two given points, by communicating it to the negative electrical body in the earth below, to form the electrical circuit. I deem it expedient to use an insulated wire or conductor as forming a part of the local apparatus and for conducting the electricity down to the foot of the mountain, or as far away as may be convenient for a telegraph office, or to utilize it for other purposes.

"I do not claim any new keyboard or any new alphabet signal; I do not claim any new register or recording instrument; but what I claim as my invention or discovery, and desire to secure by letters patent, is the utilization of natural electricity from elevated points by connecting the opposite polarity of the celestial and terrestrial bodies of electricity at different points by suitable conductors and for telegraphic purposes, relying upon the disturbance produced in the two electro-opposite bodies (of the earth and atmosphere) by an interruption of the contiguity of one of the conductors from the electrical body being indicated upon its opposite or corresponding terminus, and thus producing a circuit or communication between the two without an artificial battery or the further use of wires or cables to connect the co-operating stations."

The subject was also discussed at considerable length in the House of Representatives. Judge Bingham of Ohio, in a speech before the House, said, among other things:

"The practicability of this project proposed for an Aerial Telegraph is a question which I understand has puzzled some of the most experienced electricians of this country. I do not profess to know anything more of this subject than a child, but I understand that the highest authorities on electricity, both in America and Europe, sustain the theory upon which this project is based. No project of this sort was ever demonstrated without experiment and trial and expenditure. It was what was said before when the first application was made to Congress for some sort of appropriation to demonstrate by trial and experiment the practicability of the magnetic telegraph. We heard in this chamber the other night when that great event of human history was being celebrated, that the first endeavors of demonstration were absolute failures. The only way to know whether what is here proposed is practicable, either for purposes of telegraphy or for the purpose of utilizing electricity for light or heat or motion, is to try it; and there is no way to try it, I apprehend, without some considerable use of capital. I pray the House to consider it favorably and allow it to pass. If no good comes of it, there can be no harm; and favorable action by the House of Representatives on the bill will signify to the world that the House is disposed to consider, and not treat with derision and scorn, every endeavor to better in some sort the condition of individual and collective man."

For a period of more than ten years, ending in 1873, Loomis's Aerial Telegraph was the subject of many newspaper criticisms. Some were disposed to ridicule the matter; others treated it with the gravity its importance deserved. The Washington papers as a rule were of the latter class. A few quotations are here given, not only as showing public opinion on the subject, but as showing the publicity then given to it. The stirring events following the war caused this—one of the most important inventions of the age—to be lost sight of for many years; but interest is now reawakened in the subject by the alleged invention of Signor Marconi.

From the Washington *Chronicle*: I. "The bill incorporating the Loomis Aerial Telegraph Company passed the Senate yesterday, and with the signature of the

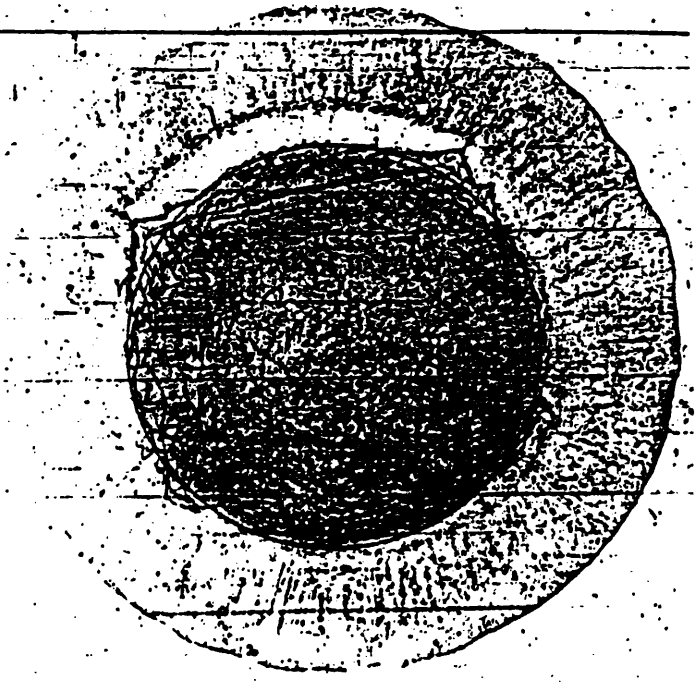
DR. MAHLON LOOMIS.

President will become a law. The proposition on which the bill is based is to telegraph from a high point of the Rocky Mountains to the highest attainable peak of the Alps. At each point a tower is to be erected, on the top of which an apparatus capable of concentrating electricity is to be put, by means of which, it is claimed, a stratum of atmosphere will be reached of peculiar electric sensibility. It is claimed that the slightest pulsation at one tower will produce a corresponding pulsation at the other."

II. "We see many comments in our exchanges in regard to the Aerial Telegraph Company (dispensing with artificial batteries, cables, etc.). The Sunday *Chronicle* was the first paper to draw public attention to this system, and to advocate a liberal appropriation by Government to put it into practical working order. We understand there is a proposition made by the company to transmit the same amount of messages that the cable transmitted in any past year for one-sixteenth the money paid."

III. "The House Committee on Commerce at their meeting yesterday agreed to report favorably on a bill introduced by Mr. Bingham to incorporate the Loomis Aerial Telegraph Company. This bill provides for the use of the Aerial telegraph apparatus invented by Dr. Mahlon Loomis, the well known dentist of this city. No connecting wires are to be used, the inventor claiming that by extending a wire to a certain altitude it strikes an electric current which will communicate to all other wires at the same height. The bill provides that the capital stock shall be two million dollars if needed, and names as incorporators Mahlon Loomis, Alexander

Elliott, William N. Chamberlain of this city, P. R. Amidon of Boston, and Isaac Lukins of Delaware."



Wendell Phillips delivered a lecture in Boston on "The Genius and Mechanism of the Saxon Race," and drew a beautiful picture of what electricity is yet destined to accomplish, in which he said:

"We stand to-day and laboriously lay a wire to San Francisco, five thousand miles away, and with one man at each end of the wire send a message and think it a great achievement. But the men at each end know what is sent, and could betray the confidence reposed in them if they pleased. We think we have reached the goal; but the patient ingenuity of the Saxon blood, of the Yankee race, will keep at work until finally in your grandchildren's day it will send a message from San Francisco to Boston without a wire. No man at either end will know what that message is, and it will run both ways at the same time. We are only touching just on the edge or fringe of the garment, and undoubtedly electricity, superseding steam, will light our houses, perhaps lift us into the air, carry us across the world, and absolutely make man the lord, without a movement, of creation."

The following newspaper comments on the lecture of Mr. Phillips are of interest as showing the feeling at the time:

"No doubt Mr. Phillips, in giving expression to this beautiful thought, may have felt, with his hearers, that his flight of imagination was somewhat exaggerated, and that what he then prophesied was to be the work of an age far ahead of our own; that the reality of such a dream was not destined for our time, and that its revelations belonged to the recesses of a far future. But we feel some pride in telling Mr. Phillips that we are much nearer the point of the electrical period he speaks of than perhaps he imagines. There is at this moment a citizen of Washington, whose name is Dr. M. Loomis, who is prepared to demonstrate to any scientist in the world the truth and practicability of what Mr. Phillips advances, as a mere theory. Dr. Loomis has given many of the best years of his life to the study of electrical science, and has proven to his own satisfaction, and that of others, the utility of this great motor as a means of communication of light and heat, and a thousand other purposes entering into the physical and mechanical improvement of mankind. His plan is to reach certain altitudes by natural and mechanical appliances, so as to form a connection with the natural current of electricity surrounding the earth and in which it floats, and, with the aid of magnetic plates or needles, he proposes to telegraph from any two given points, it matters not what the distance is, without the aid of wire, cable, or the present artificial battery. His means of forming a complete circuit between the natural strata of electricity above and that which is constantly passing through the earth, will be by artificial wires connecting with the earth and the two points of altitude connected with the electricity above. This is much better explained by a diagram, but any electrician can easily understand what we mean. These connections once securely

made man can, for all ages to come, draw from the inexhaustible reservoir above an element that will not only supersede steam, light and warm our houses, but in its adaptability even surpass the extravagant prediction of Mr. Phillips. Yes, such is our faith in the irresistible and inevitable laws of the Almighty, that we believe this powerful element—electricity—will eventually become the road of communication between this and other inhabitable worlds. This may be stretching the possibility pretty hard, but not any more so than science has done heretofore. Dr. Loomis has received a charter from Congress with corporate powers to organize a stock company to test the utility of his theory; but unfortunately, it is so grand in its conception that moneyed men shrink from it, and as they can see no immediate dividend—forgetting that there is a future beyond their own—they treat it as mythical, and forget that there ever was a man like Morse, who not only suffered and was laughed at, but lived to see the vindication of his perseverance and the triumph of his theory. Dr. Loomis occupies the same position to-day, he labors under the same obstacles, and is restrained by some opposition; and we fear that, unless the Government or some liberal gift of capital renders him the aid required, his grand idea will have to wait for a more enlightened age. This should not be, and we hope that American pride will not suffer it to pass out of our hands, and the credit and honor be reaped by others."

Numerous extracts from contemporaneous publications, speaking in most enthusiastic terms of the discovery and urging upon Congress to consider favorably the petition for a suitable appropriation to enable the discoverer to demonstrate the truth of his theory, might be added to the above. Some of the leading papers of that day, however, regarded the project with less favor. The following is from the New York *Tribune:*

"The man who proposes to telegraph without wires has been discovered. He appeared before the Senate yesterday as a petitioner for funds to perfect his discovery. We hope rather than believe that he may have hit on something of the utmost value; but he should remember that it is not the way of discoverers and inventors to fatten on Government support."

New York *Times:* "A genius in the District of Columbia has discovered a means of telegraphing without the aid of wires or cables. . . . Senator Sumner well remarked that the scheme was either all moonshine or an epoch in telegraphing that marked a most wonderful improvement in science." The *Times* adds that, before Congress appropriates fifty thousand dollars to its development, as proposed, it would be well to find out which.

It is not the purpose of this article to disparage the ingenuity of Signor Marconi or pluck a single laurel from his brow, but simply to rescue from forgetfulness the genius, persistent efforts and discouraging struggles of the original inventor of the system of telegraphing without wires, which involved every principle claimed to be of recent discovery. The merit of this grand conception and of the first test of its practicability, made more than a quarter of a century ago, belongs to the United States. After 1873, until the time of his death in 1884, the struggles of Dr. Loomis, single handed and alone, to win for his discovery a recognition of its worth form an episode in the history of American invention and of human life both interesting and pathetic.

MAHLON LOOMIS—1872.

In 1872 Mr Mahlon Loomis, an American dentist, proposed to utilise the electricity of the higher atmosphere for telegraphic purposes in a way which caused some excitement in America at the time.

It had long been known that the atmosphere is always charged with electricity, and that this charge increases with the ascent: thus, if at the surface of the earth we represent the electrical state or charge as 1, at an elevation of 100 feet it may be represented as 2; at 200 feet as 3; and so on in an ascending series of imaginary strata. Hitherto this had been considered as a rough-and-ready way of stating an electrical fact, just as we say that the atmosphere itself may, for the sake of illustration, be divided into strata of 100 or any agreed number of feet, and that its density decreases *pro rata* as we ascend through each stratum. But Mr Loomis appears to have made the further discovery that these electrical charges are in some way independent of each other, and that the electricity of any one stratum can be drawn off without the balance being immediately restored by a general redistribution of electricity from the adjacent strata. On this assumption, which is a very large one, he thought it would be easy to tap the electricity at any one point of a stratum, preferably an elevated one where the atmosphere is comparatively undisturbed, which tapping would be made manifest at any distant point of the same stratum by a corresponding fall or disturbance there of the electrical density; and thus, he argued, an aerial telegraph could be constructed.

The following is an extract from his (American) patent, dated July 30, 1872:—

"The nature of my discovery consists in utilising natural electricity, and establishing an electrical current or circuit for telegraphic and other purposes without the aid of wires, artificial batteries, or cables, and yet capable of communicating from one continent of the globe to another.

"As it was found possible to dispense with the double wire (which was first used in telegraphing), making use of but one, and substituting the earth instead of a wire to form the return half of the circuit; so I now dispense with both wires, using the earth as one-half the circuit and the continuous electrical element far above the earth's surface for the other half. I also dispense with all artificial batteries, but use the free electricity of the atmosphere, co-operating with that of the earth, to supply the current for telegraphing and for other useful purposes, such as light, heat, and motive power.

"As atmospheric electricity is found more and more abundant when moisture, clouds, heated currents of air, and other dissipating influences are left below and a greater altitude attained, my plan is to seek as high an elevation as practicable on the tops of high mountains, and thus establish electrical connection with the atmospheric stratum or ocean overlying local disturbances. Upon these mountain-tops I

[1] See, amongst other accounts, the 'English Mechanic,' September 8, 1876; 'Engineering,' April 13, 1878; and the French journal, 'La Nature,' July 8, 1876. For Bourbouze's earlier experiments, see 'La Lumière Électrique,' August 19, 1879.

erect suitable towers and apparatus to attract the electricity, or, in other words, to disturb the electrical equilibrium, and thus obtain a current of electricity, or shocks or pulsations, which traverse or disturb the positive electrical body of the atmosphere between two given points by connecting it to the negative electrical body of the earth below."

To test this idea, he selected two lofty peaks on the mountains of West Virginia, of the same altitude, and about ten miles apart. From these he sent up two kites, held by strings in which fine copper wires were enclosed. To the ground end of the wire on one peak he connected an electrical detector—presumably of the electrometer kind—and on the other peak a key for connecting the kite wire to earth when required. With this arrangement we are told that messages were sent and received by making and breaking the earth connection, "the only electro-motor being the atmospheric current between the kites, and which was always available except when the weather was violently broken."

So well did this idea "take on" in the States that we learn from the New York 'Journal of Commerce' (February 5, 1873) that a bill had passed Congress incorporating a company to carry it out. The article then goes on to say: "We will not record ourselves as disbelievers in the Aerial Telegraph, but wait meekly and see what the Doctor will do with his brilliant idea now that both Houses of Congress have passed a bill incorporating a company for him. Congressmen, at least, do not think him wholly visionary; and it is said that the President will sign the bill; all of which is some evidence that air telegraphy has another side than the ridiculous one. The company receive no money from the Government, and ask none. As we understand the Loomis plan, it is something to this effect—and readers are cautioned not to laugh too boisterously at it, as also not to believe in it till demonstrated. The inventor proposes to build a very tall tower on the highest peak of the Rocky Mountains. A mast, also very tall, will stand on this tower, and an apparatus for 'collecting electricity' will top the whole. From the loftiest peak of the Alps will rise another very tall tower and ditto mast, with its coronal electrical affair. At these sky-piercing heights Dr Loomis contends that he will reach a stratum of air loaded with electricity; and we cannot say that he will not. Then, establishing his ground-wire connections the same as in ordinary telegraphs, he feels confident that he can send messages between the mast-tops, the electrified stratum of air making the circuit complete. The inventor claims to have proved the feasibility of this grand scheme on a small scale. We are told that, from two of the spurs of the Blue Ridge Mountains, twenty miles apart, he sent up kites, using small copper wire instead of pack-thread, and telegraphed from one point to the other."

At intervals in the next few years brief notices of the Loomis method appeared in the American journals, some of which were copied into English papers. The last that I have seen is contained in the 'Electrical Review' of March 1, 1879, where it is stated that "with telephones in this aerial circuit he [Loomis] can converse a distance of twenty miles," to which the editor significantly adds a note of interrogation.

The fact is, however much Mr Loomis and his Wall Street friends believed that dollars were in the idea, the technical press never took it very seriously. This is shown by the following cutting, which we take from the New York 'Journal of the Telegraph,' March 15, 1877: "The never-ending procession of would-be inventors who from day to day haunt the corridors and offices of the Electrician's department at 195 Broadway, bringing with them mysterious packages tied up in newspapers, was

varied the other day by the appearance of a veritable lunatic. He announced that that much-talked-of great discovery of a few years ago, aerial telegraphy, was in actual operation right here in New York. A. M. Palmer, of the Union Square Theatre, together with one of his confederates, alone possessed the secret! They had unfortunately chosen to use it for illegitimate purposes, and our visitor, therefore, felt it to be his solemn duty to expose them. By means of a $60,000 battery, he said, they transmitted the subtle fluid through the aerial spaces, read people's secret thoughts, knocked them senseless in the street; ay, they could even burn a man to a crisp, miles and miles away, and he no more know what had hurt him than if he had been struck by a flash of lightning, as indeed he had![1] The object of our mad friend in dropping in was merely to ascertain how he could protect himself from Palmer's illegitimate thunderbolts. Here the legal gentleman, lifting his eyes from 'Curtis on Patents,' remarked: 'Now, I'll tell you what you do. Bring a suit against Palmer for infringement of Mahlon Loomis's patent. Here it is' (taking down a bound volume of the 'Official Gazette'), 'No. 129,971. That'll fix Palmer.'"

In conclusion of this period of our history, it will suffice to say that between 1858 and 1874 many patents were taken out in England for electric signalling on the bare wire system of Highton and Dering, with or without the use of the so-called "earth battery." As they are all very much alike, and all unsupported, so far as I have seen, by any experimental proofs, it would be a tiresome reiteration to describe them, even in the briefest way. I therefore content myself with giving the following list, which will be useful to those of my readers who desire to consult them.

[1] This lunatic must be still abroad, for we occasionally hear much the same thing of the diabolic practices of Tesla and Marconi.

Name of patentee.	No. and date of patent.
B. Nickels . . .	2317 October 16, 1858.
A. V. Newton . .	2514 November 9, 1858.
A. Barclay . . .	56 January 7, 1859.
Do. . . .	263 January 28, 1859.
J. Molesworth . .	687 March 18, 1859.
H. S. Rosser . .	2433 October 25, 1859.
W. E. Newton . .	1169 May 11, 1860.
H. Wilde . . .	2997 November 28, 1861.
Lord A. S. Churchill .	458 February 20, 1862.
H. Wilde . . .	3006 December 1, 1863.
Do. . . .	2762 October 26, 1865.
T. Walker . . .	2870 November 6, 1866.
Do. . . .	293 January 23, 1874

by Dr. Robert H. Marriott, First President
Institute of Radio Engineers

"Stating the Loomis claim briefly and in present day language, if you put up an antenna where it will get atmospheric charges, and interrupt the flow of current from the antenna to ground, you can send messages.

"That arrangement as described by Loomis has worked for me many times, in years past and in fact I am experimenting with such a device at present. I am using the system to find out things about the unidentified noises that interfere with radio receiving, and about fading and static. The one I am working with now is interrupted by a little copper water wheel. When the voltage is low the current only discharges from the antenna through the longest paddle of the wheel. When the voltage is high it jumps all four. Some of us can hear it click at our receiving stations and get an idea of what is happening in the atmosphere. An observer might record the area of movement of high voltage atmosphere by setting up numerous Loomis antennae, with clock operated spark gaps having different timed interruptions, in a large circle around him and his receiving apparatus.

"I am not an inveterate story reader, but so far as I know, fiction writers have overlooked the possibilities of the Loomis antenna.

"Loomis was away ahead of his time. His patent was not only for communicating without wires, but for taking electricity from the atmosphere. He apparently did not reason according to the radio theory, but the idea he patented works that way."

(Note: Perhaps he did reason somewhat according to the "radio theory". In Dr. Loomis's diary we find the following:

"The earth is like the inside of a leyden jar, and the upper strata of the atmosphere like the outside of a leyden jar: and the intervening air like the glass of a leyden jar.".

He said he hoped to be able to use the "secondary current".

And he described what took place as "electric waves".

Signed

(Mary Texanna Loomis)

Two long magazine articles telling story of Mahlon Loomis appeared as follows:

RADIO NEWS, November, 1922, article by S. R. Winters

WIRELESS MAGAZINE, London, England, May, 1928, by Francis Mott

[redacted]

The 31st of March, 1870, the committee on commerce was discharged from the consideration and the memorial was referred to the committee on foreign relations. On the 17th day of May, 1870, the committee on foreign relations was discharged from further consideration of the petition of Loomis. And so did some of our prominent statesmen reject the invention which has now transformed telegraphy, and which is considered the greatest electrical invention of recent years. Dr. Loomis was thirty years ahead of the Italian, Marconi. The Senate's records prove it.

WASHINGTON EVENING STAR
April 30, 1909

WIRELESS VIA KITES

Wireless telegraphy without the use of special instruments may be possible by experiment now projected outside of Washington. Old residents will recollect that forty years ago, before either Marconi or Hertzian waves were ever heard of, there was a man in Washington named Mahlon Loomis, who declared that he had solved the problem of transmission without wires through raising kites to a great altitude and telegraphing between them. This story has been referred to previously in the Star. Loomis himself will be recollected by some of the older Washingtonians. He claimed that he had transmitted messages 400 miles. There was so much interest in his work at the time that a special bill was passed in Congress incorporating a company to carry out his plans.

Idea allowed to lapse.

This company was wrecked in the panic of 1873. Nothing more was thought of the matter until Marconi demonstrated the possibility of wireless transmission . . . .

The advent of the box kite and the attention of scientific men being turned to kite flying at high altitudes, it was found that a strong current of electricity was generated, especially when the kite was flown by wire instead of cord. The Weather Bureau is at present sending up box kites every day at Mount Weather, Va., and has found it necessary to use piano wire in flying them at great heights. It was found, also, that it was necessary to insulate the reel on which the wire was wound, owing to the strong current that was brought down from the clouds, even on clear days, when there was no appearance of a storm.

Box-kite flying has recently been tried by Paul Swope, a resident of Falls Church, who has built a number of such kites and flown them, partly for amusement and partly for scientific observations. He has found such a strong current brought down the wire that he became impressed with the possibility of utilizing it in telegraphic transmission.

this interchange of positive and negative electricity between earth and clouds, perhaps, cannot be utilized for the purpose of transmitting messages at high altitudes. It is within the range of possibility, however, especially in view of the records in this experiment left by Loomis, that it may be possible to transmit messages high in the air on some strata of electricity about which as yet we know little.

Last Sunday, a particularly clear day, says Mr. Swope, he had one of his kites at an altitude of about 1800 feet. It was impossible to handle the wire with which it was flown without thoroughly insulating the iron reel. It was possible, also, to draw a three-inch spark from the reel, when the current was grounded.

SCIENTIFIC AMERICAN SUPPLEMENT No. 1834
Feb. 25, 1911, Page 117

(Bound copy available to public in the Library of Congress)

"AN EARLY PROJECT FOR WIRELESS TELEGRAPHY"

"It will probably be news to most readers that a wireless telegraph company was incorporated by act of Congress, in the year 1873. The corporation was entitled the Loomis Aerial Telegraph Company, and its members were Mahlon Loomis, Alexander Elliott, and William N. Chamberlain of Washington, P. P. Ammidon of Boston, and Isaiah Lukens of Delaware. It was permitted to have a capital stock of $200,000 and to increase the same to $2,000,000 if the interest of the company should be required.

The Loomis aerial telegraph bill was introduced by Representative John A. Bingham, of Ohio, referred to the Committee on Commerce and favorably reported by Omar D. Conger of Michigan, on May 21, 1872. In Mr. Conger's long and flowery speech the theory of the scheme was set forth as follows:

This theory assumes that the earth itself, the atmosphere surrounding it, and the infinite depthes of space encompassing the aerial world, (same as page 8 of this copied paper, about electrical vibrations or waves, etc.)

. . . . . .

The principle opponent of the bill, Mr. Charles Willard of Vermont, objected to its passage on constitutional grounds, asserting that the power to incorporate belongs to the several states, and that incorporation by Congress conferred an unfair advantage, and he was not moved from this position by the reminder that a telegraph company incorporated by congress was actually operating wires from the Mississippi to the Pacific. Most of the members of Congress, however, appeared to regard the bill as something of a joke, and let it pass as harmless. Yet this congress: the 42nd. contained a distinguished

[illegible] practicing dentistry in Cleveland, Ohio, for $65.00 per month, making $80.00 per month during vacations by traveling from place to place in the surrounding country as an itinerant dentist". He later practiced dentistry in Philadelphia and Cambridge, Mass. On May 2, 1864, he obtained a patent for false teeth, made of a gutta percha composition plate with the teeth imbedded. In 1856 he married Achsah (Colton) Ashley of Springfield, Mass. Not long afterward he settled in Washington D. C., where he lived and practiced dentistry for many years.

Dr. Loomis was of an inventive turn of mind, a dreamer, and apparently had an extremely difficult time financially. Probably the major part of his income went into his experiments. He had a vegetable garden in Springfield which he rigged up with buried wires for electrically heating the soil to a certain temperature. He made baloons which were heavily coated with gold paint, as a conductor of electricity, with which he hoped to obtain electric power from the atmosphere.

Dr. Loomis wrote that the "upper strata of the atmosphere is a great electrical sea". This certainly anticipates the "Heavisids layer". He used kites for aerials and called his system aerial telegraphy, thirty years before Marconi "invented the kite aerial".

Dr. Rogers, of Hyattsville, said "He had the aerial. There is no doubt about that. He used to hang long pieces of copper wire from his kites, and use copper wires brought down from these and the lower ends always had to be grounded."

Records of the apparatus used in connection with these grounded aerials are vague. Apparently the induction coil was sometimes employed, with a Morse telegraph key, and a sounder at the receiving station. However, his favorite method seems to have been that of utilizing atmospheric electricity for his communication. Perhaps this was because he had so little money to do things with. In its simplest form, this method consisted of merely connecting a galvanometer between the aerial wire and the ground at the transmitting and at the receiving end of the "line". When atmospheric electricity was obtained, the galvanometer hand was deflected. Then, by taking the wire which has since become known as the "lead-in", and making and breaking the circuit from the aerial to one of the galvanometer binding posts, he caused his "disturbance in the electrical equilibrium of the atmosphere" and, according to witnesses on record, the needle of the galvanometer at the receiving station was deflected in duplicate. This could not, of course, be considered an efficient method of telegraphing, but it was most certainly the first thing of the kind, using an elevated aerial for radiating electric waves, and was the forerunner of modern radio communication.

Dr. Mahlon Loomis made many attempts to finance the enterprise of erecting his high masts and towers for the support of his aerials. Also for carrying his idea of utilizing atmospheric electricity. After a long and discouraging struggle, during which many people called him a crank, and during which his wife left him on account of her belief that he was crazy, saying "He must be crazy, for he keeps insisting that he can telegraph without connecting wires", he

EXTRACT FROM ARTICLE BY JUDGE GEORGE LOOMIS,
NEW ENGLAND MAGAZINE, April 1901
(Page 145)

"THE PIONEER IN TELEGRAPHIC WITHOUT WIRES.

.....

"He conceived the idea of telegraphing between vessels at sea without wire connections. The experiment was tried on the Chesapeake Bay with perfect success, between two ships two miles apart. I am no scientist myself, and have but little knowledge of electricity. So can narrate these events only in the language of a layman. The method of telegraphing between the two vessels, as I understand it, was as follows.

"On each vessel was a telegraphic apparatus. A wire was attached to the instrument and one end thrown into the water to a moderate depth. Another insulated wire, of greater length, was let down to a great depth into a colder stratum of water. The two strata of water of different temperatures, thus connected to the same battery, made a complete circuit, and enabled communication to pass between the two vessels without other connections. The experiment resulted in complete success."

(Note: Dr. James Harris Rogers, of Hyattsville, Maryland, "inventor" of the underground and under water means of radio communication, very generously gave credit to Dr. Loomis for his idea. He told me in person, that he had known Dr. Mahlon Loomis very well, that he personally took Dr. Loomis to the Smithsonian Institute and introduced him to - it seems to me that the person was Joseph Henry. ~~and that he told that Loomis had discovered nothing of importance~~. Dr. Rogers also told me in person "It was from Dr. Loomis that I got the idea of communication under land and under water. And he had the idea fundamentally right. To this day I have never been able to improve upon it, and the wires must be of different length to work successfully." Dr. Rogers was referring to directional communication.

Signed

(Mary Texanna Loomis)

PUBLIC LEDGER
AND DAILY TRANSCRIPT.
Philadelphia, Wednesday, Dec. 27, 1871.

AN AERIAL TELEGRAPH.—A bill has recently been introduced in Congress to incorporate a company, the objects of which are to develop and utilize the principles and powers of natural electricity, so as to apply that fluid to telegraphing and generating light and heat and motion. From certain theories which have recently been advanced, and from experiments that have been tried, the possibility is asserted of telegraphing without the use of cables, conducting wires of any description, or even batteries. This theory is exceedingly visionary, but the projector is sanguine as to the successful working of his plan.

THE PERU HERALD.
PERU, ILLINOIS, FEBRUARY 15, 1870.

The Loomis Aerial Telegraph.

A bill incorporating the Loomis Aerial Telegraph Company was recently passed by Congress. This aerial telegraph scheme is a novel thing. The plan of Dr. Loomis, the inventor, is to telegraph from a high point of the Rocky Mountains to the highest attainable peak of the Alps, at which point a tower is to be erected, on the top of which a huge mast is to be placed. An apparatus capable of collecting electricity is to be put upon the upper end of this mast, by means of which, at such elevation, it is claimed that a strata of the atmosphere will be reached which is charged with electricity. Ground connection, the same as is used in ordinary telegraphy, will be erected. This electrified strata of the atmosphere will, as with the ordinary single wire and ground connection, make a complete circuit, and it is claimed that the slightest pulsation of electricity at one tower will produce similar pulsation at the other. The company is to have a capital stock of two hundred thousand dollars with the privilege of increasing it to two millions if the interest of the company shall require it. The business and objects of the corporation are stated in the bill to be to develop and utilize the principles and powers of natural electricity, to be used in telegraphing, generating light, heat and motive power, and otherwise, and operate any machinery, run by electricity, for any purpose.

DAILY PATRIOT.
THURSDAY MORNING, DECEMBER 28, 1871.

DR. LOOMIS, the would-be aerial [illegible], is pressing his scheme upon Congress and the public with a zeal worthy of success, but he meets with quite as much opposition and ridicule as did Fulton, Franklin, Morse, or Field, scientific men being as ready now as then to demonstrate the utter impracticability of the scheme, and to show the fallacy of his calculations.

It is, however, gratifying to know that the persistent efforts of the doctor are likely to secure the necessary aid to give his theories a practical test, and it would be a sorry joke upon the Postmaster General if, just as he had completed the purchase of all the Western Union Company lines, he should find that they had been made of no value by the success of the new system.

AERIAL TELEGRAPH SYSTEM.

OVER THE CLOUDS AND THROUGH THE EARTH—A HALF HOUR WITH DR. LOOMIS.

On Friday last the bill incorporating "The Loomis Aerial Telegraph Company" passed the Senate, and knowing that as Dr. Loomis was the inventor of the Aerial system, upon which the company propose to work, our reporter called upon him yesterday, at his office on Pennsylvania avenue. The Doctor was busy attending upon a patient whose molars were out of order, but that offending member having been repaired and his customer sent on his way rejoicing, the Doctor turned to us, and with a bland smile inquired what he could do for the representative of the *Sunday Chronicle*.

REPORTER. How long, Doctor, have you been studying the science of electricity with a view of perfecting your Aerial telegraph system?

I have been pursuing the study of electrical science and meteorology for some twelve or fifteen years. I attended a course of lectures upon the subject of "Electricity," delivered at the Lowell Institute, in Boston, by Joseph Lovering, I think in 1852. This was about the first impulse to my investigations in this branch of science. I went over the whole published ground, bought Lovering's works, De La Rive, Poggendorff, Guillemin, Ampier, &c., and studied magnetism, electricity, (statical and dynamic,) galvanism, and electro-magnetism; the nature and power of different combinations for batteries, and, in applying them to useful purposes, I was led in the path of telegraphy. But, in seeing the immense waste occasioned in generating artificial electricity, and knowing that it exists so abundantly in nature, my attention turned upon its utilization.

Knowing, also, that a telegraphic circuit was first established with the use of *two* wires, and that one of them was subsequently discarded when it was ascertained, by accident, that the ground was a good conductor of electricity—a little better even than a wire—the idea occurred to me to find some natural passage or conductor which should bear the same relation to the ground that the wire bore to it, and the circuit would be completed without wires.

In utilizing the free electricity of the upper atmosphere, my theory was sustained, by experiments, that this upper, positive element was the charged prime conductor of all [illegible]. Now, although the electrical force of the atmosphere may be the greatest power of the universe, still, it lies in rest, and unless its equilibrium is disturbed it can be of no avail. Bearing in mind the reciprocating nature (positive and negative) of the two great electrical bodies of the earth and the upper electrical ocean, it is easy to see how this subtle power can be made to act and react, and how the upper element, while yielding the battery power, will at the same time substitute itself for the remaining wire forming the present telegraphic circuit, just as the earth is utilized for that purpose at the present time.

REPORTER. Can you explain in a few words the principles of telegraphy and their application to your own system?

There is probably not one person in ten thousand that knows how our present telegraph works, how simple a thing it is, or that its circuit is formed *with the ground* and one wire. The fluid (as we call it) must always have a *circuit* to work. Going and this fluid or current passes over the wire one way and back through the ground, or [illegible]. Two wires were first used to form this same circuit between two stations; but one of them was thrown aside, and the ground made use of instead by having a zinc plate buried in the moist ground at the two stations, and the ends of the wire from the two poles of the battery connected with these plates. *That* now forms all telegraphic circuits. So that in telegraphing, for instance, from here to San Francisco, the message goes through the air one way and through the earth the other way. When we see a great number of wires suspended upon poles they are so many separate and distinct lines or circuits, one half formed with the ground, but not otherwise connected or having anything [illegible].

I have spent a great deal of [illegible] and money upon developing the system, and have brought it to such a degree of perfection [illegible] demonstrated it to be a [illegible] fact, by repeated experiments on comparatively [illegible] and short distances, but with perfect success. It will, of course, be the means of cheapening communications to such an extent as to make it less expensive to telegraph what we wish to communicate over one-half the circumference of the globe than to send the same by letter.

REPORTER. What phenomena observed in the present system support your theory?

Innumerable instances are recorded of telegraphic communications having been made between distant points by the inductive action or power of atmospheric electricity pending a thunder storm, or during the appearance of the northern lights.

These have been made without the artificial battery force, and totally disconnected from the ground circuit.

Wm. H. Seward's speech was once sent in this way from Rochester to Albany by the force of the celestial battery alone. On the 2d of September, 1859, communications were sent over the wire between South Braintree and Fall River stations, in Massachusetts, a distance of forty miles, with the aid of the atmospheric battery alone. This was during the northern lights. (Prescott's Electric Telegraph.) These northern lights, which De La Rive says are due to the electrical discharge taking place in the polar regions between the positive electricity of the atmosphere and the negative electricity of the earth, frequently possess a strength of current equal to that produced by a battery of two hundred Grove cups.

This is the inadvertent, the *accidental* reunion of the two electricities, and by the establishment of suitable artificial conductors this unequal and intermittent action can be regulated and made subservient to varied uses.

REPORTER. Would not this phenomenon tend to prove that the Aerial system would only work, or be effective, during the appearance of the northern lights or during a thunder storm?

The aurora, or northern lights, or a meteor like a thunder storm, are only local and circumscribed in their effect and duration, but by attaining a greater altitude, that is, above the generality of thunder clouds, (above the Cirrus,) this electrical force or stratum, the bulk and body of all these phenomena, we find a never-failing and undiminished supply, only awaiting to be turned into channels of usefulness.

REPORTER. Have you ever made experiments that corroborate the truth of your system?

Aside from the many casual occurrences that have taken place corroborating my system, I have sent up kites from mountain summits, and telegraphed by my imperfect experiments for a distance of fifteen miles in the most satisfactory manner.

REPORTER. Where was this done, and how high was the elevation?

This was done last summer on the spurs of the Blue Ridge mountains, in Virginia, at a mountain elevation of about thirteen hundred feet, with kites let up with a small copper wire of about five hundred feet in length. The signals were perfect, as indicated with the galvanometer at the two stations, when the connection was made with the earth completing the circuit.

REPORTER. Doctor, I have seen in several newspapers articles on your system of Aerial telegraphy. Have these newspaper notices attracted the attention of any of our scientists who have addressed you on the subject?

I have had letters of inquiry from nearly all nations—at least, from China, France, England, and Germany. Professors from institutions and colleges have called upon me, to whom I have explained my system, and, I must say, they have invariably expressed both their approbation and admiration of its sound principles and simplicity.

It is certainly among the coming things, since it is to be practically established—that we are to communicate from continent to continent without the intervention of a wire or cable, as the natural elements, if properly made use of, form the requisite conditions.

Common sense and intuitive perception declare it to be [illegible]. Scientific facts and all the elements of earth and air array themselves in its defense; for it is founded on the solid masonry of the universe.

TELEGRAPHING WITHOUT WIRES.

There is something peculiarly fascinating in the idea of girding the earth with a vocal electric current without the intervention of wires on the land or cables beneath the sea, after the fashion in which Mr. MAHLON LOOMIS proposes to girdle it. This gentleman, who has suddenly sprung into notice as the originator of an experiment bolder than any ever undertaken by MORSE or FARADAY or TYNDALL, asks nothing more than an altitudinous elevation and a kite—and, being thus provided, he proposes to give a new expression to those wonderful forces of Nature which, if we may believe his theory, stand ready to obey his signal, and are, in point of fact, impatiently awaiting the magic touch of his hand. FRANKLIN flew his kite and solved a problem in science. LOOMIS goes up into a high mountain, lets loose his kite among the currents of the upper air, and, we suppose, utters cabalistic words to unlock the secrets of the ether. Exactly how he is to do it, and where it is to be done, he does not tell us; but it is dimly hinted that with one foot upon the summit of the highest Rocky Mountain peak and another upon Monte Rosa, or, say, the Matterhorn (if he can climb that dreadful height), he will instantly span the sea with an electric current, and ask for neither wires nor poles. The Atlantic is no bar to the project he contemplates; nor, probably, would the broad Pacific alarm him. There is a mysterious intimation concerning great towers that might be needed upon the lower levels of the earth, from the summits of which the LOOMIS kites could fly—but the mountain three miles in height is evidently the key to the general situation.

Mr. LOOMIS professes such a degree of faith in the success that awaits him, that he has magnetized Congress and the President. The bill for the incorporation of his Company, shrewdly drawn so as to require no appropriation, and therefore a simple thing to dispose of, received the Executive signature yesterday; but it is evident from the tenor of the debate in the Senate, on the day of its passage, that not one of the members of that body had the slightest notion of the meaning of the project which the bill was intended to cover. Some were inclined to make a jest of the whole business, but Mr. ANTHONY and a majority with him decided that Mr. LOOMIS was entitled to fair treatment, inasmuch as he did not ask for money—and therein lies the contrast between the shabby treatment bestowed upon Professor MORSE thirty years ago, and that which Mr. LOOMIS now receives. MORSE, in the Session of 1842-3, left Washington heart sick, and it was only after he had actually flashed his first message through the wires that Congress gave him, at the last hour of the Session, a pitiful appropriation. Thirty years later, LOOMIS gets prompt courtesy from Congress, with no appropriation at all, and essays to perform a feat which MORSE never dreamed of.—So the world grows. Now we shall see what Mr. LOOMIS can do.

PRECEDED MARCONI

Wireless Telegraphy a Success Nearly Thirty Years Ago.

WORK OF A WASHINGTON MAN

Messages Were Sent Over a Distance of Twenty Miles.

MAHLON ~~LEWIS~~ LOOMIS' DISCOVERY

Written for The Evening Star by William Jones Rhees.

The recent wonderful achievements of M. Marconi have attracted world-wide attention, and our own government has just secured his personal services for the application of his invention to provide communication between Key West and Havana and to extend it to all the West Indies.

In some quarters it is said that this is a novel invention, never before dreamed of, and that Marconi is the first to propose it. Others claim that it has long been known to be feasible, and experiments are referred to by many scientific investigators in the same line. Undoubtedly of this latter class our own Prof. Joseph Henry would hold first place, for he demonstrated in 1842 the making of signals from considerable distances and through many obstacles.

But it is not my purpose to discuss the scientific aspects of the case, but to furnish purely historical facts and to prove that Mahlon Loomis, an American, and a citizen of Washington, is entitled to a large share of credit.

Nearly Thirty Years Ago.

On the 30th of July, 1872, a patent was granted by the United States government to Mahlon Loomis of Washington, D. C., for a new and improved mode of telegraphing, and of generating light, heat and motive power. This patent declares the invention or discovery to consist in utilizing natural electricity and establishing an electrical current or circuit for telegraphic and other purposes without the aid of wires, artificial batteries or cables to form such circuit. It was further described as dispensing with the usual wires and in using the earth as one-half the circuit and the continuous electrical element far above the earth's surface for the other part of the circuit. The means provided for reaching the upper stratum of electricity was the erection of towers, high poles, kites or other apparatus on mountain or hilltops or elevated places.

The use of vertical wires was required to conduct the electricity from the upper atmosphere to ordinary telegraphic instruments at the earth's surface, the interruption of continuity of the fluid at one end being recognized by a similar apparatus at a distant point.

This broad c[illegible]n of utilizing natural electricity from [illegible]ted points [illegible] telegraphic purposes [illegible]eem to c[illegible] whole ground o[illegible] telegrap[illegible] pre-cede. a[illegible] over all [illegible] hive-

Successful Experiments.

Loomis, having procured his patent, endeavored to secure financial aid to put his plan into practical operation, but he met with jeers, rebuffs and opposition alike from the scientist, the capitalist and especially the telegraph companies. He succeeded, however, in enlisting the sympathy of several congressmen and in demonstrating by actual experiment in the summer of 1872 by telegraphing between two distant stations fourteen miles apart, without wires, on spurs of the Blue Ridge, Virginia, by elevating a kite on each mountain, the string of which was a small copper wire attached to a galvanometer, each ground end lying in water.

In the Washington Chronicle of November 10, 1872, the following appears:

"Professor Loomis has the true idea, and it will eventually revolutionize the whole system of telegraphy.

"Loomis' aerial system has just been tried on lines of different lengths, with variable, but perfectly satisfactory, results. On a line of 400 miles lineal distance (800 miles circuit) the tests were perfectly satisfactory at an elevation of 2,100 feet. At a mountain elevation of 1,200 feet the tests and results were very strong at a distance of fourteen miles. These experiments were made simply by kites covered with fine, light gauze wire of copper, held with a very fine string or tether of the same material, the lower end of which formed good connection with the ground by lying in coil in a pool of water.

"Two galvanometers were in circuit connection at the two different stations and each impulse or indication was as perfect as that of the Atlantic cable, though requiring very nice manipulation."

The Hartford, Conn., Times, in calling attention to the subject, said:

For Twenty Miles.

"Loomis built a kind of a telescopic tower at the top of two high hilltops, about twenty miles distant, and from them put up a steel rod, by which a certain aerial current of electricity was reached. For months at a time he has been able to telegraph from one tower to another. * * * Of late he has done all his talking to his assistant, twenty miles away from him, the connection being aerial only."

Thus his great claim was proved and the demonstration ought to have removed the prevailing skepticism as to the reality of his discovery.

Some time before he had secured his patent Loomis had memorialized Congress for an appropriation of $50,000 to enable him to establish the practicability of wireless telegraphy.

Mr. Charles Sumner, in presenting the petition in the Senate, said that "It is certainly a great case of moonshine or it marks an epoch in the progress of invention."

After considerable discussion as to its appropriate reference it was referred to the committee on patents.

Senator Pomeroy ventured to indorse the Loomis scheme. He said: "I believe in it. I have seen two or three experiments and I think there is something in it. I have seen it tested in a small way and I am inclined to think it will succeed."

After reference to the committee on patents it was successively referred to the committee on commerce and the committee on foreign relations, from the latter of which Senator Sumner reported adversely and it was defeated.

Efforts in Cor[illegible]ress.

In the House of Repr[illegible]atives, however, Loomis' plan met [illegible] quite a different reception. It wa[illegible]mpioned by Representative John A. [illegible]n of Ohio, who introduced a bill [illegible]orate the "Loomis Aerial Telegrap[illegible] and it was

referred [illegible] to the committee on commerce and then to the committee on the District of Columbia.

Mr. O. D. Conger of Michigan made a strong plea for the passage of the bill. In a long speech, full of brilliant passages and scientific and classical quotations, an earnest appeal for fair treatment of the inventor was made. He said: "The time may come when it will be the proudest honor of those gentlemen who now listen with dreamy indifference to the hopes and aspirations of this inventor of the aerial telegraph system to have had their names coupled with this immortal discovery by even the empty encouragement of a reluctant affirmative vote."

Strange to relate the great objector, Mr. W. S. Holman of Indiana, favored the bill. He said: "There are more things in heaven and earth than our philosophy has dreamed of. We do not know over what grand truths we are stumbling every day of our lives or how near we are to the solution of that mystery which leads into the portals of eternal wisdom, which we only see dimly and shadowy as a dream—an intellectual vision."

After further consideration the House adjourned without action, but the next day Mr. Conger called it up, and the bill was passed without opposition. When it reached the Senate, Mr. H. B. Anthony of Rhode Island took a lively interest in its consideration, and it was finally adopted by yeas, 29; nays, 12.

Incorporated in the District.

The bill was signed by the President on the 21st of January, 1873. It incorporates the Loomis Aerial Telegraph Company, with Mahlon Loomis, Alex. Elliott, Wm. N. Chamberlain of Washington city, P. R. Amidon of Boston and Isaiah Lukens of Delaware as corporators with full powers, limited, however, to the District of Columbia, and not to be exercised within any state except by its consent. The capital stock was $200,000, with limit of $2,000,000. It declares the business and objects of the corporation shall be to develop and utilize the principles and powers of natural electricity to be used in telegraphing, generating light, heat and motive power, and otherwise to make and operate any machinery run by electricity for any purpose.

Loomis now having obtained his patent and act of incorporation devoted himself wholly to the promotion of his enterprise, but the times were unpropitious. The great financial collapse took place in New York and capitalists could not be induced to venture in such a chimerical project as this appeared to be. The limitation of his charter to the District of Columbia was especially unfortunate and ruinous.

Having sacrificed health, money and business to this great idea, after several years' struggle he retired to a farm in Virginia to await the day when others more fortunate than he should reap the glory.

Loomis' Early Life.

Mahlon Loomis was born in Oppenheim, near Gloversville, Fulton county, N. Y., on the 21st of July, 1823. He was a son of Prof. Nathan Loomis of Springfield, Mass. He afterward removed to Butternuts, Lewis county, N. Y. His grandfather was a Baptist clergyman, and had a large family of children and grandchildren, which he kept together and all lived in one house, which had fifty rooms. At length he decided to migrate and went to Springvale, near Lewinsville, about twenty miles from Washington, and purchased a large tract, which he divided, giving each of his sons a farm. At that time Mahlon Loomis was about ten years old. He had the benefit of the district school, but his education was almost wholly derived from his grandfather's and father's libraries and their instructions, for they were both men of culture, [illegible] and well versed in both modern and ancient history and literature and possessed a remarkable aptitude for imparting knowledge. Between the age of seventeen and twenty Mahlon taught the district school. He used to delight in going to Washington, listening to the debates in Congress and searching the libraries.

He was always of a mechanical turn, which led him, by the advice of his father, to direct his attention to dentistry, and when twenty he decided to go to Cleveland, Ohio, and enter the office of an old friend of his father, Dr. Wright, who was a successful practitioner in that city. He accomplished his journey to Cleveland partly on foot and by help from passing farmers or other, who would give him a meal or a ride for a few pennies or his pocket knife, which he parted with for this purpose.

Practiced His Profession.

After staying two or three years with Dr. Wright he went to Earlville, N. Y., where he commenced the practice of dentistry. His father having been appointed a computor in the United States nautical almanac office, then located at Cambridge, Mass., Mahlon removed to Cambridgeport, where he established himself in his profession and practiced it very successfully for several years. It was here that he invented the celebrated mineral plate teeth, which he patented in the United States, Great Britain and France, and which gave him a high standing in the profession.

He married in 1856 Achsah Ashley of Springfield, Mass., and went to Philadelphia to introduce his patent, which he did most successfully, and in November of the same year he came to Washington and opened an office at 905 Pennsylvania avenue, near the corner of 9th street, and practiced his profession for a period of over twenty years. He had great inventive genius, and during this time patented several inventions of value.

He had a sanguine temperament, was of a social and kindly nature, generous to a fault, was on intimate social terms with some of our most prominent citizens, such as Dr. James C. Hall, Peter Force, John W. Forney, Prof. Simon Newcomb, Wm. H. Seward and others.

Trusted in the Future.

He died of heart failure at the country residence of his brother, Judge George Loomis, at Terra Alta, W. Va., October 13, 1886, at the age of sixty, after an illness of only one week. His brother remarks: "During his last illness he was uplifted and strengthened by the consciousness that the world would some time understand and realize the grandeur of his discovery. He seemed to be indifferent as to his having the glory and renown of it, but he wanted mankind to enjoy the fruits of his discoveries, maintaining that it would be the means of establishing a brotherhood among the nations and races that nothing else could accomplish; and would give to the children of men grander and truer conceptions of Deity than now prevailed. There was one thought that at times brought sadness to his heart. 'I know that I am by some, even many, regarded as a crank—by some perhaps as a fool—for allowing myself to the sacrifice of material advantages to abandon a lucrative profession and pursue this ignis fatuus, but I know that I am right, and if the present generation lives long enough their opinions will be changed—and their wonder will be that they did not perceive it before. I shall never see it perfected—but it will be, and others will have the honor of the discovery. Still, I do not care for that—except it would be gratifying, I confess, to live to see the world acknowledge that I am at least sane; or at least such a crank as God employs to move the world. By confining myself to the ordinary routine of affairs I could have made, no doubt, a comfortable living, even more than a competency—then passed away and be forgotten—but an impulse has driven me that I could not resist.'"

To the Senate and House of
Representatives of the United States
in Congress assembled:

The undersigned
Your petitioner, respectfully repre-
sents that he is a Citizen of the
United States and a resident of
the District of Columbia, and
believes that he has invented or
discovered a new mode of Telegraphing
which he submits is a great and valu-
able improvement upon any former
mode known or discovered.

The nature of the discovery or
invention, in general terms, consists in
establishing an Electrical current
or circuit for Telegraphing without
the aide of wires or Cables to form the
Electrical Currents and Circuits.

As in accordance with the
double wire (which was at first used)
and using but one, allowing earth
to form the other half of the Circuit, so now I propose
to dispense with both wires, and railroad
tracks, using the earth as now to

to form one half of the circuit, and the continuous Electrical Element for above the surface of the Earth for the other part of the circuit.

In dispensing with the local or artificial batteries, I use and rely upon the Electricity forming this Stratum far above the Earth to supply the electric current for all telegraphing, as well as for light, heat, mechanical force and other useful purposes.

Atmospheric Electricity is found more and more abundant as we ascend above the moisture and heated currents of air found near to the Earth's surface. The higher the altitude attained the better, since as Clouds and vapor would intercept and distort the Electrical State of any considerable extent, at an Elevation of only a few hundred feet. I propose to make a demonstration entirely satisfactory by reaching as high an Elevation as possible from the tops of the highest mountains and thus penetrate & make Electric Connection with the Electrical Stratum perfectly immersed from the Earth, overlying the Clouds and other disturbing influences.

to Erect Suitable apparatus for attracting the Electricity, or in other words, for disturbing the Electrical Equilibrium thus Giving Separate Shocks or pulsations from the Electrical medium above and between two points, to the Earth, or medium below. Thus and by this means form an Electrical current which will Communicate with such apparatus in any part of the Globe Similarly Situated.

The only wire necessary to use, will be to Erect Upward to Connect with the apparatus in the higher medium and to make Connection at a Convenient point with the Earth, as is now used by all Telegraphs.

Having spent ten years of my life upon this Study, trying such Experiments as I have been able, I have Come entirely Convinced, more I am certain, I shall be able to make a Demonstration upon the Scale and Manner hereinbefore proposed, I could at once put the facts and facilities of Telegraphing in this way

Dr. Marion Loomis, the inventor of the Aerial Telegraph Company, just chartered by Congress, is a son of Professor Mahan Loomis, formerly of West Springfield, now residing at Florence, Northampton. Electricity may be said to have been a family study with the Loomises, as the father many years ago became much interested in it and, among other experiments, mulched his garden with telegraph wire to test a theory of his as to its effect upon the fertility of the earth. Dr. Loomis is a Washington dentist, and is probably supported in his scheme by Joseph Loomis, a brother who holds a clerkship in a Department at Washington, and who is one of the profoundest and most thoroughly read electricians in this country. Another brother, Eben, is in the Naval Observatory at Washington, and renders occasional service to Professor Pierce, of Harvard, in the coast survey. The family is quite remarkable, another brother, George, being a judge at Parkersburg, W. Va. There are three daughters, of whom one lives with her father, one is the wife of Mr. J. N. Bagg, of West Springfield, and another of Captain Parsons, formerly of St. Albans, Vt., and the Vermont cavalry regiment, now connected with the Chesapeake and Ohio railroad. There was another daughter, Collet Loomis, who may be remembered as a contributor of poems to the *Republican* a few years ago. Dr. Loomis' theory, on which his aerial telegraph is based, is that, while the earth is universally a positive pole, a stratum of air may be found at the highest altitudes of the Rocky Mountains charged with negative electricity, and that this latter may be made to perform the same service in telegraphy that is now performed by the wires carried on the poles. American and English capitalists are ready to test his theory, which there is certainly no harm in trying.—*Springfield Republican.*

THE SUN.

BALTIMORE [illegible]

THE "AERIAL TELEGRAPH."—We have already referred to the bill which has passed Congress authorizing one Loomis to build an "aerial telegraph." What manner of castle in the air this might be no one [illegible] to comprehend. The third section declares that the business and objects of the corporation shall be to develop and utilize the principles and powers of natural electricity, to be used in telegraphing, generating light, heat and motive power, and otherwise make and operate any machinery run by electricity for any purpose. This wonderful bill is now a law. Thus, as heretofore pointed out, under the bill any kind of telegraph may be built, though not without regard to State consent as to lines built within their borders. Congress, in directing its intelligent eyes towards the clouds, seems to have conceded that the jurisdiction of a State over such matters extend into the air, even to the sky-cleaving heights which the daring Mr. Loomis expresses his purpose to traverse. He proposes to run up a tower and a tall flag-staff on a summit of the Pacific Railroad, (a most dangerous location for new national enterprises, though no subsidy at present is asked for,) and to build a similar structure on the summit of the Alps, and in a similar manner pass signals between America and Europe. Mr. Loomis professes to have struck an electrical stratum of the atmosphere by means of kites flown high aloft from Blue Ridge peaks, and to have exchanged signals over a small intervening distance of twenty miles, the ground connections being maintained by fine copper wires, which were used with the kites, instead of pack thread. This kind of kite-flying may have attracted the attention of Congress from any mundane purposes which the aerial Loomis may have had in his mind. For while Loomis has easily engaged the sympathies of Congress with "the powers of the air," he has left room enough in his bill to put up wires and run any sort of a telegraph, and to use his electricity for any purpose—generating light, heat and motive power as he sees fit. The New York Journal of Commerce points out that there is "much virtue in the word 'utilize.' Lawyers may quibble over the singular expression 'natural electricity,' and assert that the company are thereby barred from employing electricity produced artificially as by the galvanic pile of the ordinary telegraphs. But it would puzzle a philosopher to define 'natural electricity.' One kind of electricity is in one sense as 'natural' as another. All the varieties or modified phenomena of electricity are developed in accordance with inviolable natural laws, whether the electric fluid darts between two opposing clouds as lightning, or is ground out and bottled by the old frictional machine, or liberated by the action of dilute acids on zinc. A very broad phrase is 'natural electricity.' What beclouded Congressmen meant to say is one thing; what they have set down and passed in a bill is another."

WASHINGTON, January 12, 1848.

SENATE.—Mr. Sumner presented the memorial of Mahlon Loomis, M. D. of Morristown, Morris county, stating that he had invented a new system of telegraphing, and praying the appropriation of $30,000 to complete his experiments, &c.

A very curious petition was presented to the Senate to-day by Mr. Sumner. The memorialist, Mahlon Loomis of this city, claims to have discovered and invented a new system of telegraphing, by which cable wires and batteries may be dispensed with altogether, and desires the sum of $30,000 to complete his establishments. Mr. Sumner thought it was either moonshine or very important, and several Senators seemed disposed to throw ridicule upon the matter. Mr. Wilson thought it was better not to snore, just yet. Some of the greatest men of the country had laughed when the magnetic telegraph was first suggested, but the laugh was now on the other side of the mouth.

NEW TELEGRAPHIC SCHEME.—In the Senate this morning Mr. Sumner presented the petition of Prof. Mahlon Loomis, of this city, asking for an appropriation of $30,000 to enable him to complete his new invention in telegraphing. What the inventor says consists in establishing an electrical current or circuit for telegraphing, without the aid of wires or batteries, making use of the earth to form one half of the circuit, and the continuous electrical stratum far above the surface of the earth for the other half of the circuit. The inventor proposes, in dispensing with the use of artificial batteries, to rely upon that electricity forming this stratum far above the earth to supply the electrical current for all telegraphing, as well as for lighting, many mechanical forces, and other useful purposes. He claims that the only wire necessary is to rise a wire to extend upward to connect with the apparatus in the highest position, and make connection as a convenient point with the earth as is now used by all telegraphers. He proposes to erect apparatus on high points above the clouds to attract the electricity from one point to another, and by this means to form the electrical current which will communicate with such apparatus in any part of the globe, similarly situated. The papers will be referred to the Committee on Patents.

THE INVENTOR.

The man who proposes to telegraph without wires has been discovered. He appeared before the Senate yesterday as a petitioner for funds to perfect his discovery. We hope rather than believe that he says he has discovered something of the utmost value; but he should remember that he is not the only discoverer and inventor to solicit our Government support.

But one of the most remarkable families we ever heard of is the Loomis family. They have been looming up for years as professors, college presidents, authors, men of letters, and doctors of divinity, laws, and medicine. Nowadays, when we read of "Dr. Loomis," we know no more which Dr. Loomis is meant than we should to read of Dr. Smith. Recently an appropriation was asked for in Congress by one Dr. Loomis "who had invented a new system of telegraphic communication." Mr. Sumner thought the "system" was either full of moonshine or else it marked a new era in the progress of science. Now, "Dr. Loomis," as he is called, ought to know his business, since he is a learned man, and professor of chemistry, physiology, astronomy, principles and practice of medicine, moral and mental philosophy, history, rhetoric, toxicology, microscopy, etc. This same "Dr. Loomis" is the author of a complete mathematical series, astronomy, physiology, physical explorations of the human body, geology, meteorology, mizpah, mental and social culture, chemistry, &c.

The same gentleman, like Elizur Wright, predicts, says, and does a great many things. Now and then the *Herald* devotes a column to some one of the "Loomises," especially when an eclipse is about to come off. But which one of the Loomises has invented a new system of telegraphy? Is it

Elias Loomis, LL. D., of Yale College;

Or Rev. Dr. Geo. Loomis, of Alleghany College;

Or Dr. Silas H. Loomis, of Howard University;

Or Dr. Lafayette C. Loomis, of Wheeling College;

Or Dr. Justin H. Loomis, of Lewisburg University;

Or Dr. H. Loomis, of New York University;

Or Dr. Mahlon Loomis, Dentist?

What a fearful and wonderful family of "Loomises!"

THE LOOMIS ÆRIAL TELEGRAPH COMPANY,

Chartered by Act of Congress, and Approved January 21, 1873.

This incorporate body is endowed with a franchise enabling it to utilize the principles and powers of natural electricity to be used in telegraphing, generating light, heat, and motive power.

The primary object, however, is to telegraph across the oceans without a cable, or between any two sufficiently elevated points on the land—near or distant from each other—without wires to connect the two stations, and without an artificial battery to generate the electricity. The plan is of immense importance, not only in the saving of ocean cables, but hundreds of thousands annually, in using the free natural electricity of the upper atmosphere instead of producing it from chemicals.

It is not necessary here to give in detail the scientific explanations of how this is to be accomplished, but it may be stated in general terms that it will follow the same law in traversing the electrical belt in the upper atmosphere as is now followed in the earth; each body forming one-half of a circuit when connected at any two given points.

The capital stock to this company is two hundred thousand dollars, which may be increased if necessary to two millions.

There are two thousand shares at one hundred dollars each.

The agreement made by the inventor (Dr. M. Loomis) with the incorporators, is as follows: that he disposes of his entire interest in the franchises and patent for the sum of one hundred and twenty-five thousand dollars, one hundred thousand of which the inventor is to receive in stock of said company, and also one per centum on the net profits of the entire business done; and should the company increase the capital stock, the inventor is to have one per centum on the amount of increase.

This system of telegraphing is considered by experts and scientists as not only perfectly feasible, but one of the grandest enterprises of this or any other age, and the numerous tests and experiments demonstrate its success beyond a doubt.

For further particulars address:—

DR. M. LOOMIS,

WASHINGTON, D. C.

UNITED STATES OF AMERICA

DEPARTMENT OF STATE

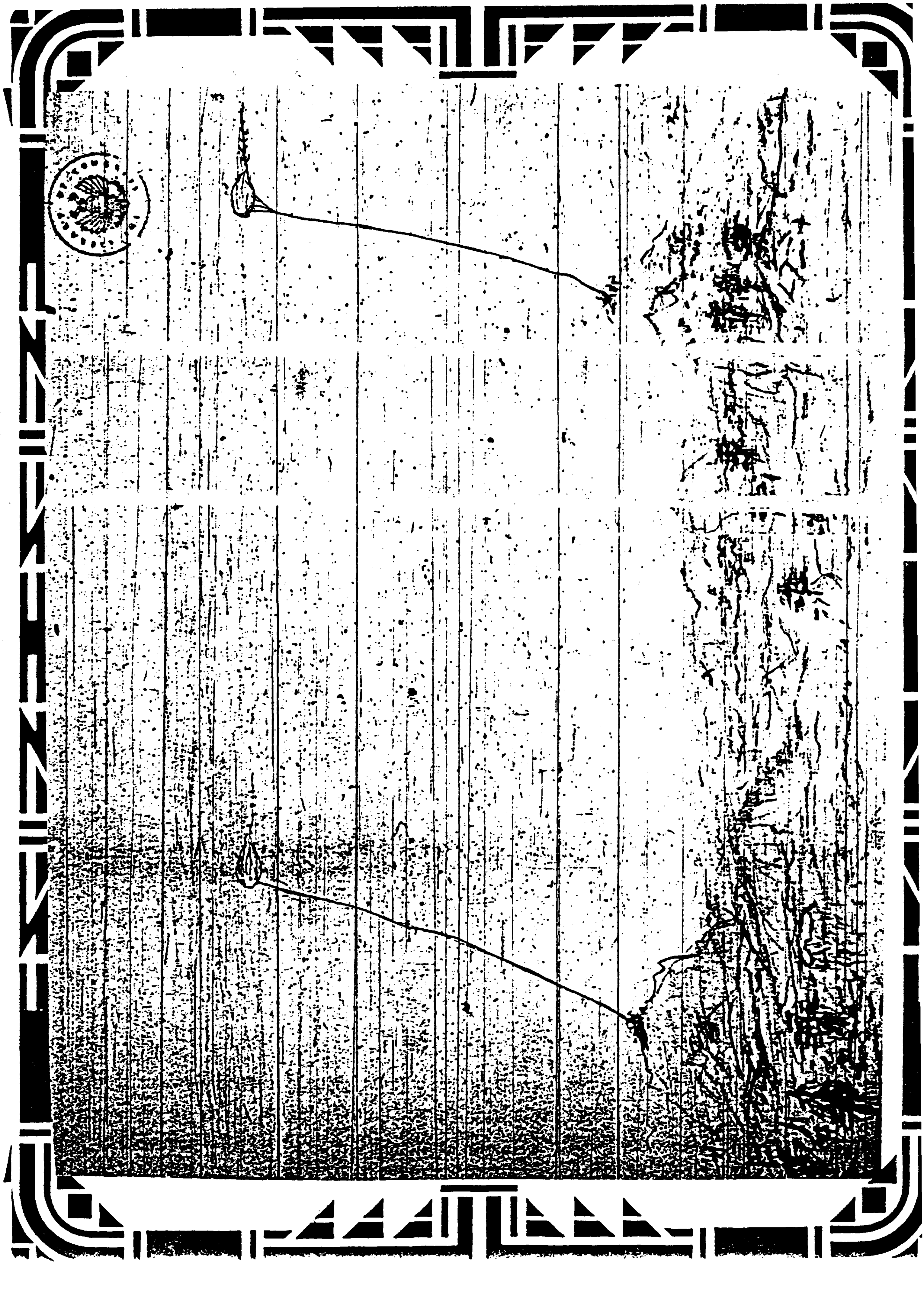
To all to whom these presents shall come, Greeting:

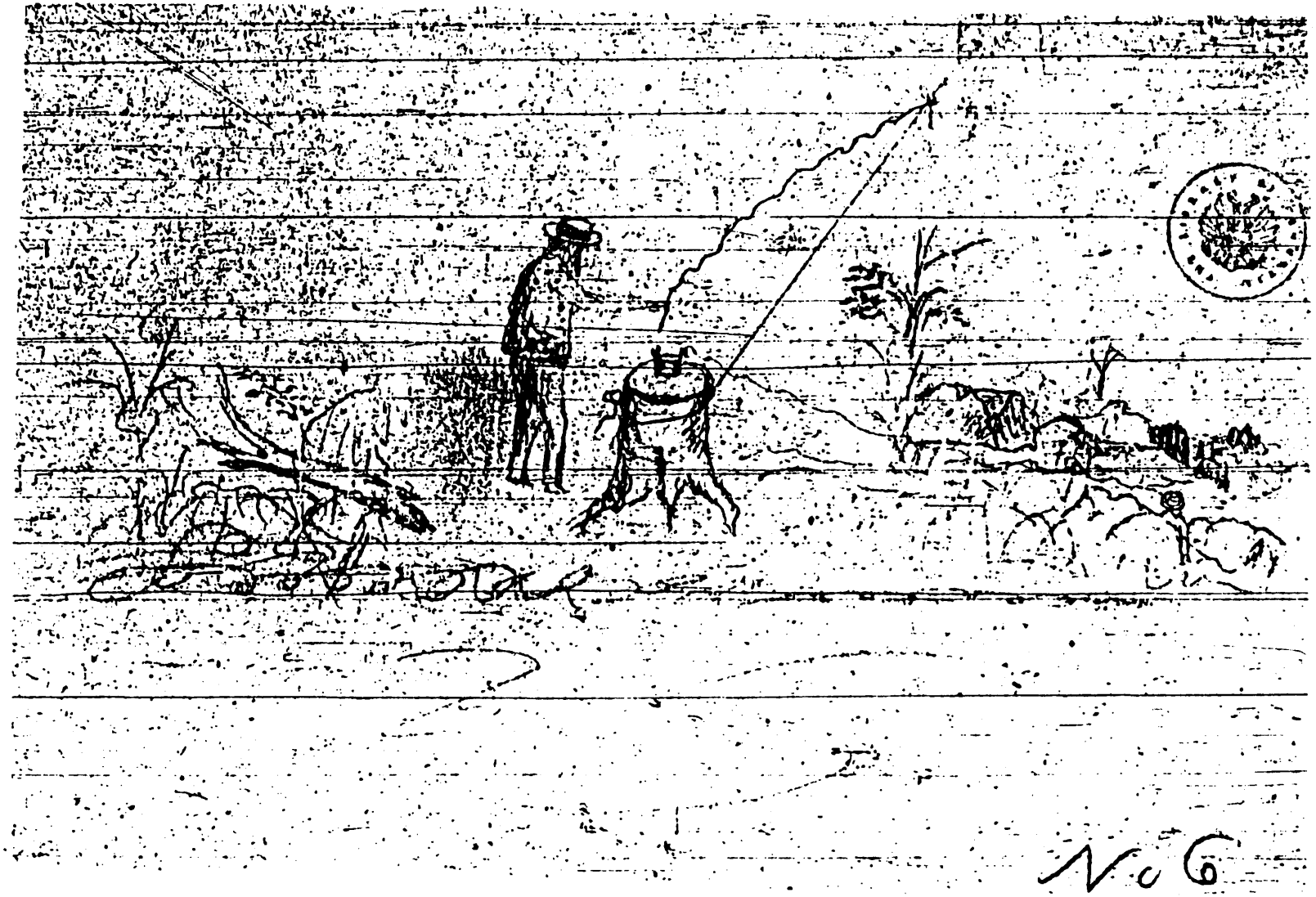
I Certify, That hereto annexed is a true copy of an act of Congress, approved January 21, 1873, entitled "An act to incorporate the Loomis Aerial Telegraph Company," the original of which act is on file in this Department.

In testimony whereof, I, Hamilton Fish, Secretary of State of the United States, have hereunto subscribed my name and caused the seal of the Department of State to be affixed.

DONE at the City of Washington, this twenty-ninth day of January, A. D. 1873, and of the Independence of the United States of America the 97th.

Hamilton Fish




No 6


Pacific Ocean

Grand Yaaser - Bailey

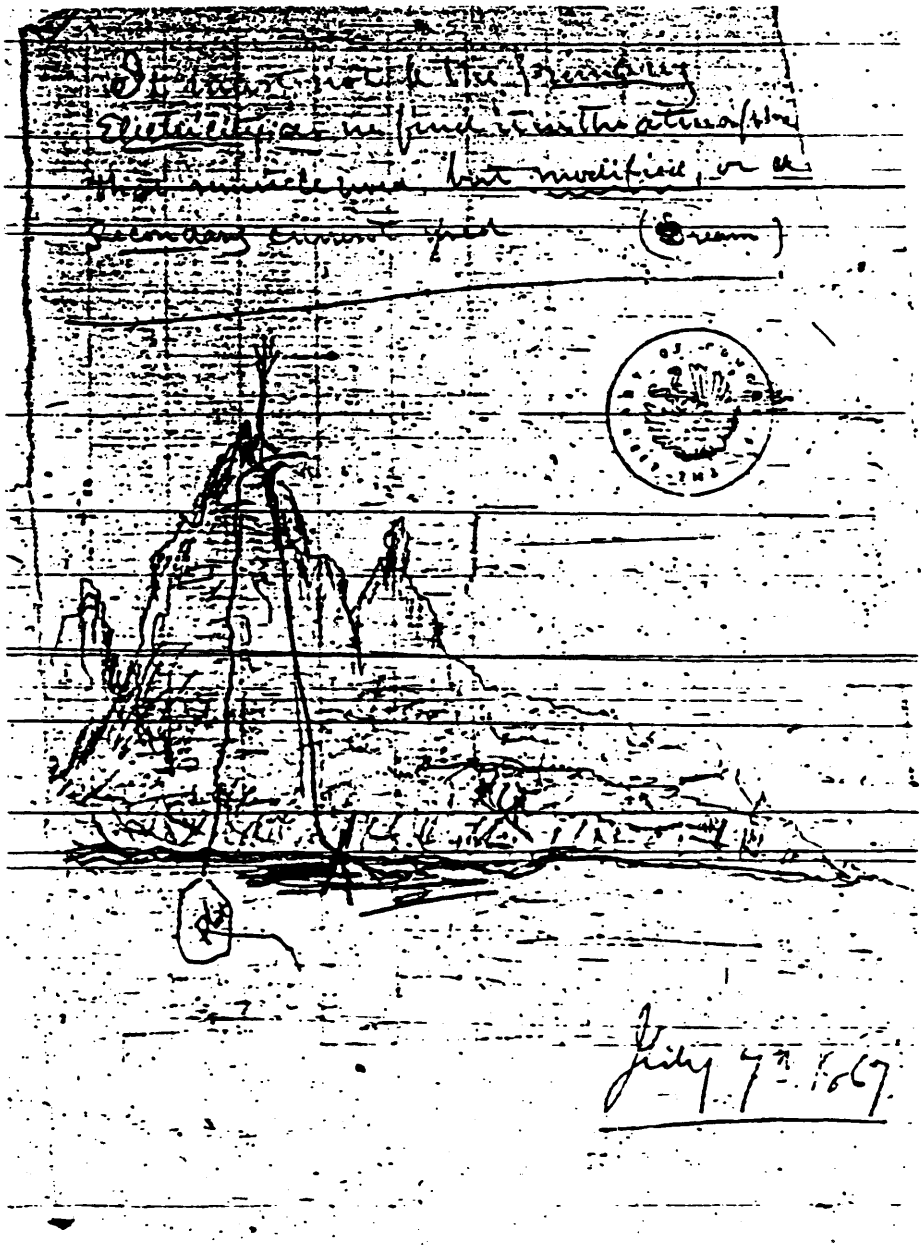
Am I nearer solving the Electric problem by simply erecting high points (or apparatus) to collect the Electricity which abounds there, and using that, than I am when striving to get it from Hydrogen? 425

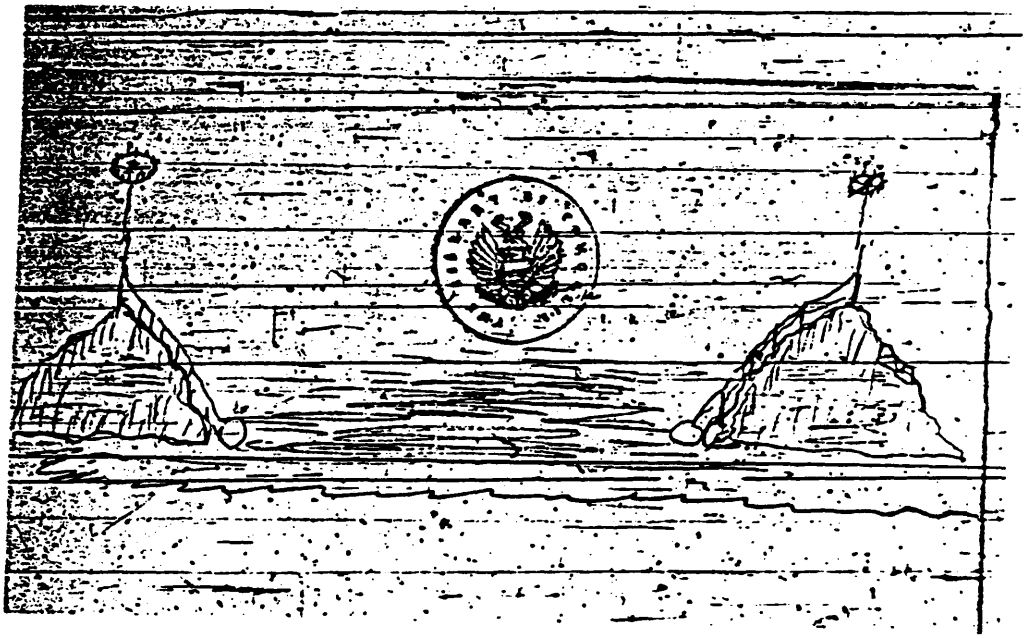
Must the "Electricity" which we should use, be what we understand by Machine Electricity? 425

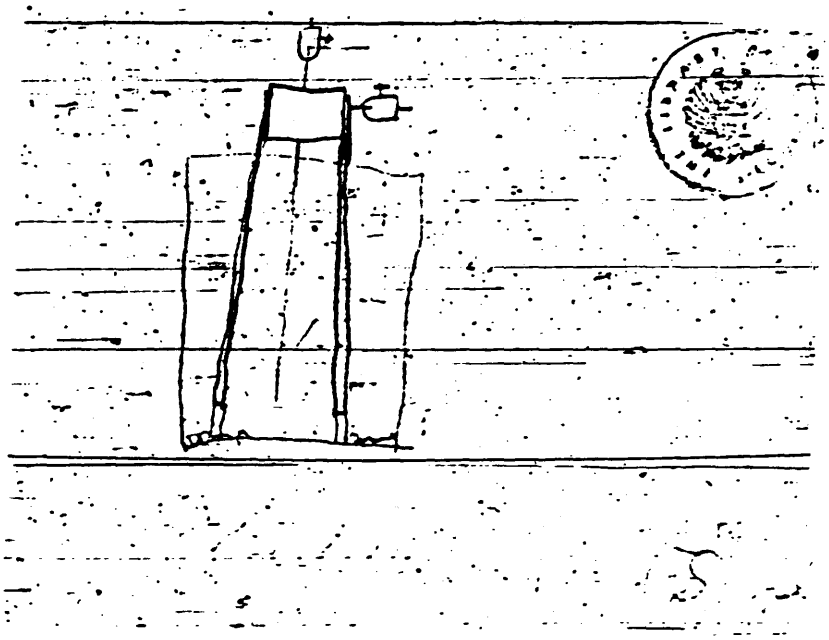
Must it be what ~~what~~ we call Electro-Magnetism? 425

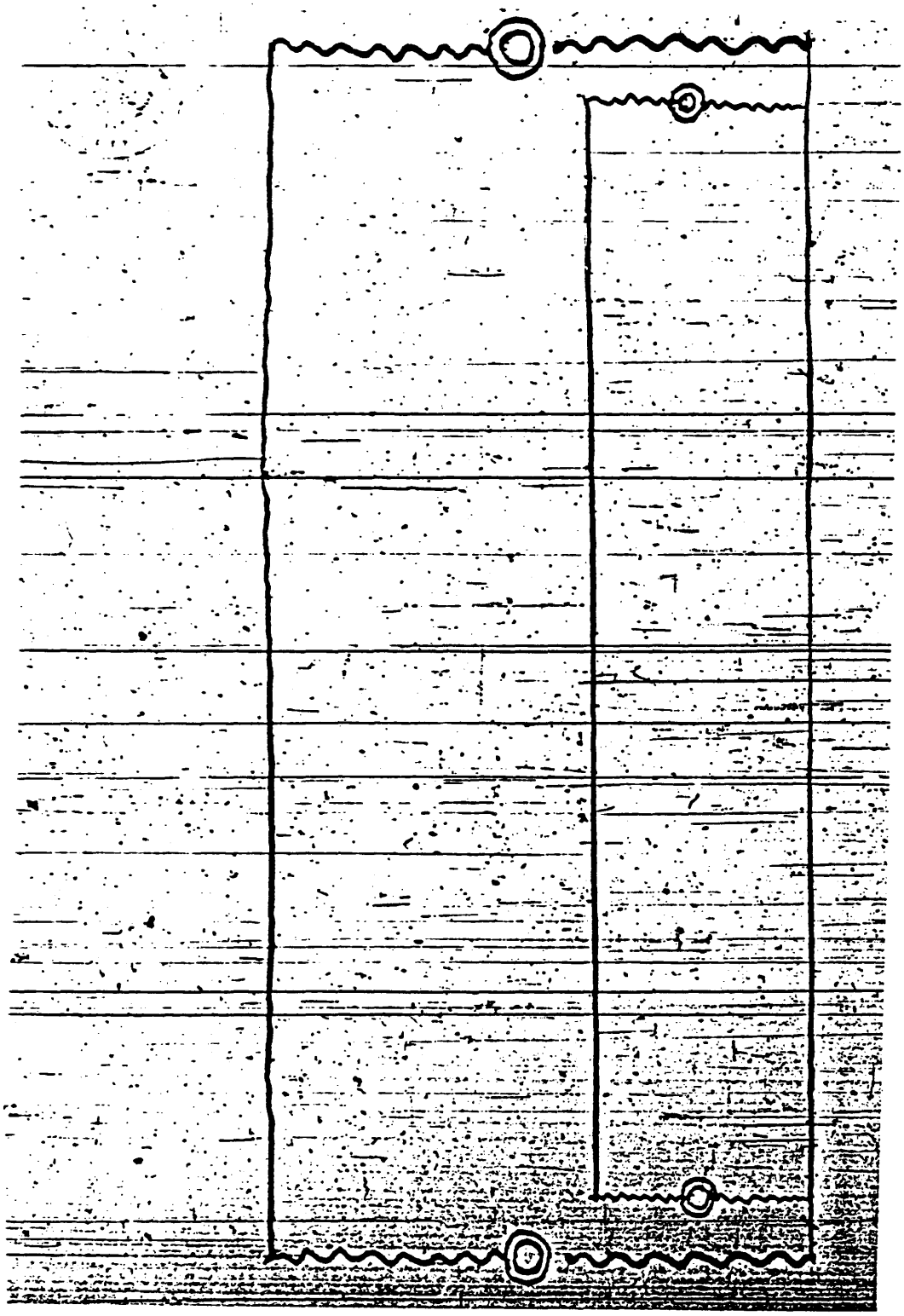
Must Electro-magnetism be made from atmospheric Electricity?
Must it be taken from the Earth? 425

Do you think I will make the discovery? 425









42D CONGRESS,
2D SESSION.

H. R. 772.

IN THE SENATE OF THE UNITED STATES.

MAY 22, 1872.

Read twice and referred to the Committee on Commerce.

AN ACT

To incorporate the Loomis Aerial Telegraph Company.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Mahlon Loomis, Alexander Elliott, and William N. Chamberlain, of Washington City, District of Columbia; P. R. Ammidon, of Boston, Massachusetts, and Isaiah Lukens, of Delaware, and their associates and successors, are hereby incorporated and made a body politic and corporate by the name of the Loomis Aerial Telegraph Company, and by that name may sue and be sued, plead and be impleaded, in any court of law or equity of competent jurisdiction, and may have and use a common seal, and be entitled to use and exercise all the powers, rights, and privileges incident to such corporation: *Provided*, That the corporate powers created by this act shall not be exercised by said company within any State except by the consent of the legislature of such State.

and under such rules and regulations as such State may prescribe.

SEC. 2. That said company may have a capital stock of two hundred thousand dollars, with the privilege of increasing the same to two millions of dollars, if the interest of the said company shall require it.

SEC. 3. That the business and objects of said corporation shall be to develop and utilize the principles and powers of natural electricity, to be used in telegraphing, generating light, heat, and motive power, and otherwise make and operate any machinery run by electricity for any purpose.

SEC. 4. That there shall be five directors, who shall be elected annually by the stockholders of said company, at the annual meeting, to be designated by the stockholders at their first meeting, to organize and elect directors of the company. The officers of the company shall be elected from and by the directors of the said company, and they shall serve one year and until their successors are elected and qualified. There shall be a president, vice-president, secretary, and treasurer; the treasurer shall give such bonds as the board shall determine; a majority of the board shall constitute a quorum for the transaction of business.

SEC. 5. That the board of directors shall have power to make and prescribe such by-laws, rules, and regulations as they shall deem needful and proper for the disposition and management of the affairs, funds, property, and effects of the

and the reality of this dream come to pass. I write promiscuously.

In 1858. August 15th, I drote a little paper which I will transcribe here — I think as soon as something can be found to bear the same relation to the Earth that a wire does, a telegraphic communication can be made without a wire. What relation does a wire bear to the earth? That is a question to be settled, and one which I must write more about another time; but it serves to conduct a distinct portion of fluid from point to point &c —

A Statical (?) form of Electricity may be used for telegraphic purposes.

Dynamic and Electro-magnetic fluids are both used but both are chemically or mechanically made. Statical fluid resides abundantly in the atmosphere. Then a Structure - say of points - placed in the air at perhaps cloud heights, if of sufficient amplitude, would be a

...SYRACUSE, N...

...NT REFUSES TO D...

Earlville Dentist Invented Radio

Tho Name Is Almost in Oblivion

Dr. Loomis' Tests Succeeded, But Cash Failed

Marconi, born in 1874, is acclaimed by the world as the creator of the radio, but at Earlville, Madison county, something like 80 years ago, lived a dentist who years before Marconi was born told a doubting world about wireless telegraphy, Dr. Mahlon Loomis.

In 1865 Dr. Loomis perfected plans for telegraphing without wires, the beginning of radio, but a world did not listen 70 years ago, and it was not until 1897 that Marconi's invention was accepted in its early stages.

In 1868 Loomis sent wireless messages between two points in Virginia, 18 miles apart, yet he could not impress the importance of his discovery on those whom he sought to interest, but in 1897 when Marconi sent a like message across the English channel he found a world waiting for the thing he had to give it.

Fame for Marconi

Today radio banishes time and space, and the entire listening world is united to participate in an event of interest anywhere on the globe.

Marconi's name will live forever in history.

But how many ever heard of Dr Mahlon Loomis, the man who pulled teeth at Earlville 80 years ago?

Loomis was born at Oppenheim, Fulton county, July 21, 1826, a son of Prof. Nathan Loomis. As a boy he went with his family to Virginia and in 1848 to Springfield, O. He studied dentistry, and went back to Virginia. He moved from place to place in the practice of his profession, for short periods at Earlville, Madison county; Cambridge, Mass., and Philadelphia, Pa. Then he settled in Washington,

Dr. Mahlon Loomis

D. C. He died at Terra Alba, W. Va., October 13, 1886.

Three years after Loomis discovered wireless telegraphy he gave a demonstration before officials of the Smithsonian institute at stations 18 miles apart in thte Blue Ridge mountains of Virginia.

Called Aerial Telegraph

An account of the experiment was published, with pictures, in Frank Leslie's Illustrated Paper. Dr. Loomis' invention was called the "aerial telegraph."

There was another test, between vessels two miles apart in Chesapeake bay. It was successful.

Congress was asked to appropriate $50,000 to finance the project, but it did not go thru althé one speaker in congress declared:

Died Disappointed When Marconi Was a Boy

"It is either a great case of moonshine or it marks a great epoch in the progress of invention."

Another said:

"I believe he wants some appropriation to enable him to telegraph across the Atlantic ocean without either cables or wires."

On July 30, 1872, Loomis obtained letters patent for his invention. Another bill was introduced in congress.

Much Controversy

There was much newspaper controversy.

The Washington Chronicle in 1873 said:

"The bill incorporating the Loomis Aerial Telegraph company passed the senate yesterday, and with the signature of the president will become a law. The proposition on which the bill is based is to telegraph from a high point of the Rocky mountains to the highest attainable peak of the Alps. At each point a tower is to be erected, on the top of which an apparatus capable of concentrating electricity is to be put, by means of which, it is claimed, a stratum of atmosphere will be reached of peculiar electric sensibility. It is claimed that the slightest pulsation at one tower will produce a corresponding pulsation at the other."

Dr. Loomis failed, however, to get the financial backing necessary to demonstrate to the world the "aerial telegraph," the radio of today, and he died disappointed in 1886, when a 12-year-old boy, born of an Italian father and an Irish mother, was beginning to tinker with things electric —Guglielmo Marconi.

between combustion, (flame combustion) and decomposition of Zinc in Sulphuric acid. Chemists call them both "combustion". But flame displaces or abstracts from atmospheric air in the combustion of a common candle of fourteen parts by weight of hydro-carbon, some forty eight parts of oxygen. In the combustion of Zinc in acid hydrogen is evolved, or given to the air. Now are there not mineral Elements in the atmosphere and can they not be so separated by flame combustion as to complete an Electric circuit through the atmosphere by the existence of the Earth, as a circuit is completed in a common battery? Another thought is this: when telegraphic communication was first established between two distant points, there were two wires made use of; that is the wire was extended to, and from a distant point back to the starting place in order to "complete the circuit" as it is called. But at this

~~Failure to conduct it into artificial~~
~~channels. I can hardly think that~~
Celestial Electricity, without changing
~~it in some form, can be successfully~~
conducted any great distance — as from
that top of a mountain off to seaward —
in consequence of its well known tendency
to disperse in damp air &c.

June 8th. 1864

I will now state that perhaps Electricity
called frictional or atmospheric, is the re-
sult of combustion supported by Oxygen; and
that Electricity called Galvanic, is also the
result of Combustion, supported by Hydrogen.
Or that the former is evolved by oxygen and the
other by hydrogen gas.*
There is, undoubtedly, some analogy

* What is combustion, or flame? What is the analysis of the "oxydization" of a piece of iron which is exposed to the atmosphere? (I write this lest as not to forget to investigate it)

I am confident that some simple apparatus can be devised by which the atmospheric Electricity can be collected. I dont Exactly know what combination of arrangement the Collectors should consist, but I am sure that after the Electricity is obtained in Static form it should be made to give an Electro-magnetic current, as that can be more Easily conducted without being dissipated or Lost. And to this End a vibrating Electro-magnetic machine seems to me the best. March 8th 1864

Since writing the last period above, (a few days since) I have considered the matter, and do not now think that a Secondary current, as from a vibrating Electro-magnetic machine, would do, as that cuts off (as I conceive it) the primary current which I think must be taken from the atmosphere, and continued through Earth or water until it meets with a corresponding

and reciprocating current, or point,
to complete the circuit; which I
think the atmosphere above, and
the Earth beneath, or the waters under
the Earth, will most triumphantly
make. For I think the upper
stratum of air contains an abundance
of Statical Electricity; and all writers
seem to think atmospheric Electricity
to be in a "positive" state, and terres=
trial Electricity in a "negative". If
there is a reciprocating tendency between
the two, it is sufficient, whatever term
may be applied to express it. And
I think there is proof enough —
in fact it is the plainest thing
in the world, that there is a re=
ciprocating tendency between Earth
and air; ~~in fact~~ for a constant strug
=gle for Static Electricity to become
dynamic, as proved by lightning &c
and that it only remains for
man to arrange the proper appa

never failing source of an abundant current. This then may supersede the use of Galvanic batteries for dynamic, and Electro-magnetic machines for Electro-magnetism; and a great abundance always obtained without any Expense but for the original structure.

As water, especially salt-water, and particularly a current of warm salt water, is a good conducting medium, a powerful current of Atmospheric electricity may be made to traverse such a path from shore to shore of the Atlantic ocean.

The Collecting apparatus, or points, may be stationed on the mountains to save building high structures, and thence conveyed on wires to the point of immediate use. And all along this conducting wire the fluid may be taken out and used for telegraphing, and returned for further purposes. —

formerly
some one were so good to extend to any given point, which at the two Extremities is made to communicate with the Earth, and thus the circuit is now made. The charged or current is generated from a local battery and is insulated from the Earth except as the circuit is closed communicating with it.
Now may it not be possible that atmospheric Electricity from above the clouds which is insulated from the Earth, and which is in an Electro-opposite state to that of the Earth, may be drawn down and used without any wire at all extending from place to place - simply using the Earth as one conductor and the atmosphere above the clouds for the other - by bringing the Electric current down from the tops of very high mountains on insulated wires?

Dec 1868. At this date I look at the matter thus:- far above the surface of the Earth is one vast Ocean of Electricity, Extending from the East to the West, and in fact Encompassing the Earth.

and Atmosphere. That if this Ocean is penetrated above all local disturbances it will yield a never failing current, - is in fact as Exhaustless as the watery ocean of the Earth. And I further think that if this Ocean, or Sea or of Electricity be penetrated at two distant points, the common Electrical Element thus penetrated will of course act as a conducting medium and consequently form one half of a circuit of which the Earth may be made to form the other half; - thus practically dispensing with all wires and cables for conveying messages from point to point. Thus Mt Blanc can speak to Mt Blanc through the circuit of Conductivity formed by this aerial ocean of Electricity and the Earth.

Furthermore, I believe this same ocean or electrical Element may be so utilized as to answer all purposes

heat, light and mechanical force or motion. And still further inasmuch as the Earth together with the other planets are held in their respective places by some power or agent, I believe that power or agent to be Electricity, and that being bound and connected as they are by this one Element common and continuous to them all, a direct communication to and from these other planets will sooner or later be had with as great facility as we now have from city to city.

March 15 1869

There is something unsatisfactory about the present theories of Electricity - of what it is and where it comes from, that I am induced to believe the future will reveal new and great things in this Science. Who shall say that Oxygen Gas and Zinc are prone to "Electricity"? There seems to be such intimate relationship

between Electricity, Oxygen, Hydrogen, Air and Water, which, taken with the fact that these are convertible elements, would lead to the suspicion that some simple process might be devised to run them through a sort of Engine and derive a self-sustaining power from it, Oxygen allows Hydrogen to become flame, flame produces water. Water produces Oxygen and Hydrogen separated by Electricity and Electricity is evolved by them again being made to unite.

Again, Hydrogen is supposed to be an air from metal. Zinc, certainly produces it decomposed by sulphuric acid. It is an Electro-positive gas and Oxygen is Electro-negative. Hydrogen in decomposing water Electrically Hydrogen is on the - side and Oxygen on the + side. The properties of Nitrogen are mostly negative.

Earth's surface and gradually lessens, attenuated in proportion to the distance upward. The exact reverse of this, however, is true in regard to the Electric Element.

It is also a well known fact that certain Electrical conditions called "positive" and "negative" must exist in order to form a "circuit" a current with the Electric power; or, in other words to disturb its Equilibrium.

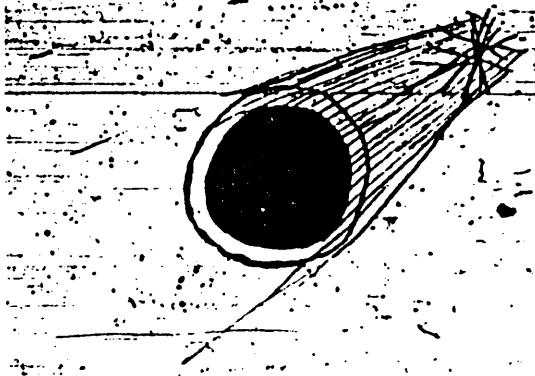
Now these very conditions we find most admirably arranged in the great Electric battery of nature. The Earth, (like the outside of a Leyden jar) is always highly charged with negative Electricity. The space in our upper atmosphere (like the inside of a Leyden jar) is always highly charged with positive Electricity, and the intervening air or our atmosphere itself (like the glass of the Leyden jar) is an almost perfect cut off

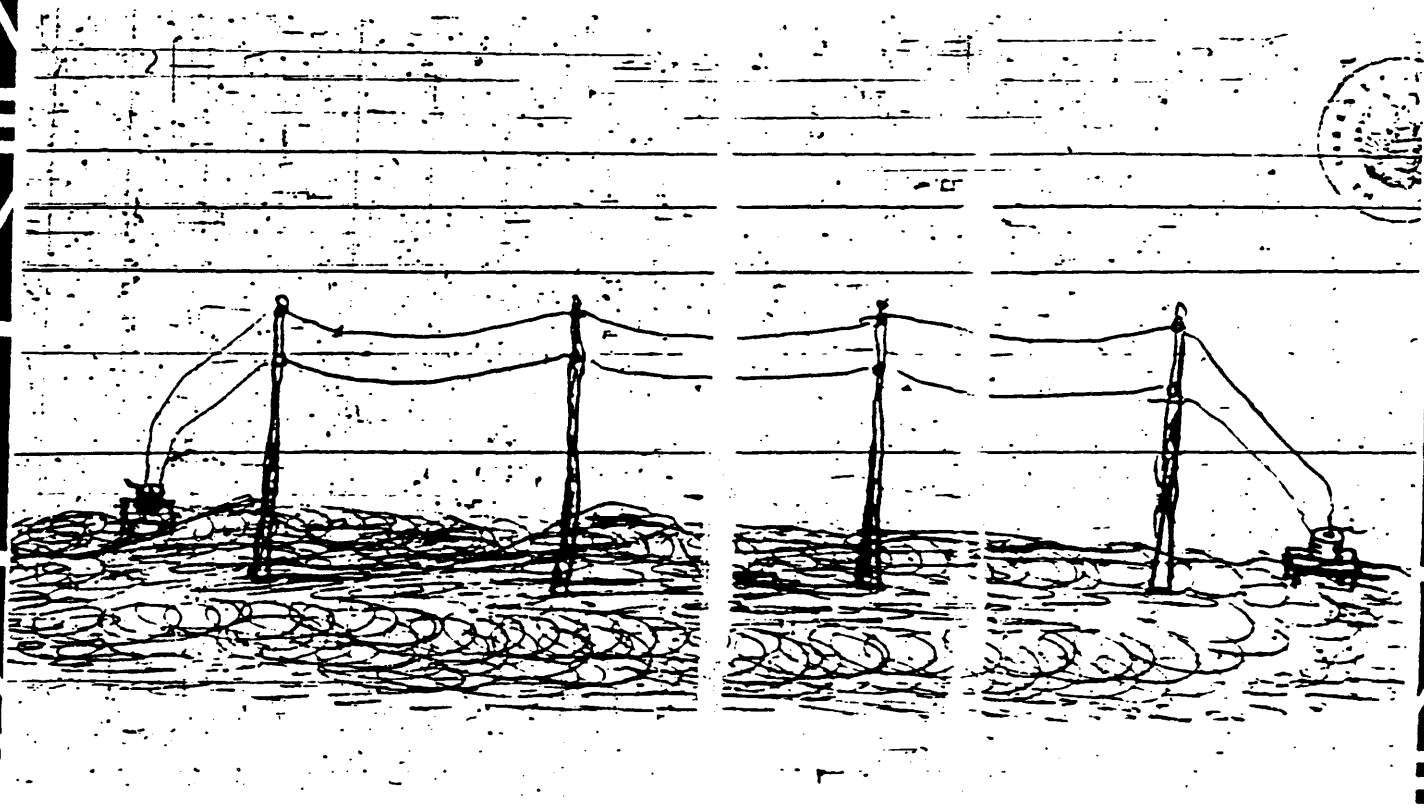
or unconductor, thus forming a circuit constituting the most simple and effective electric battery that ever yielded electric power.

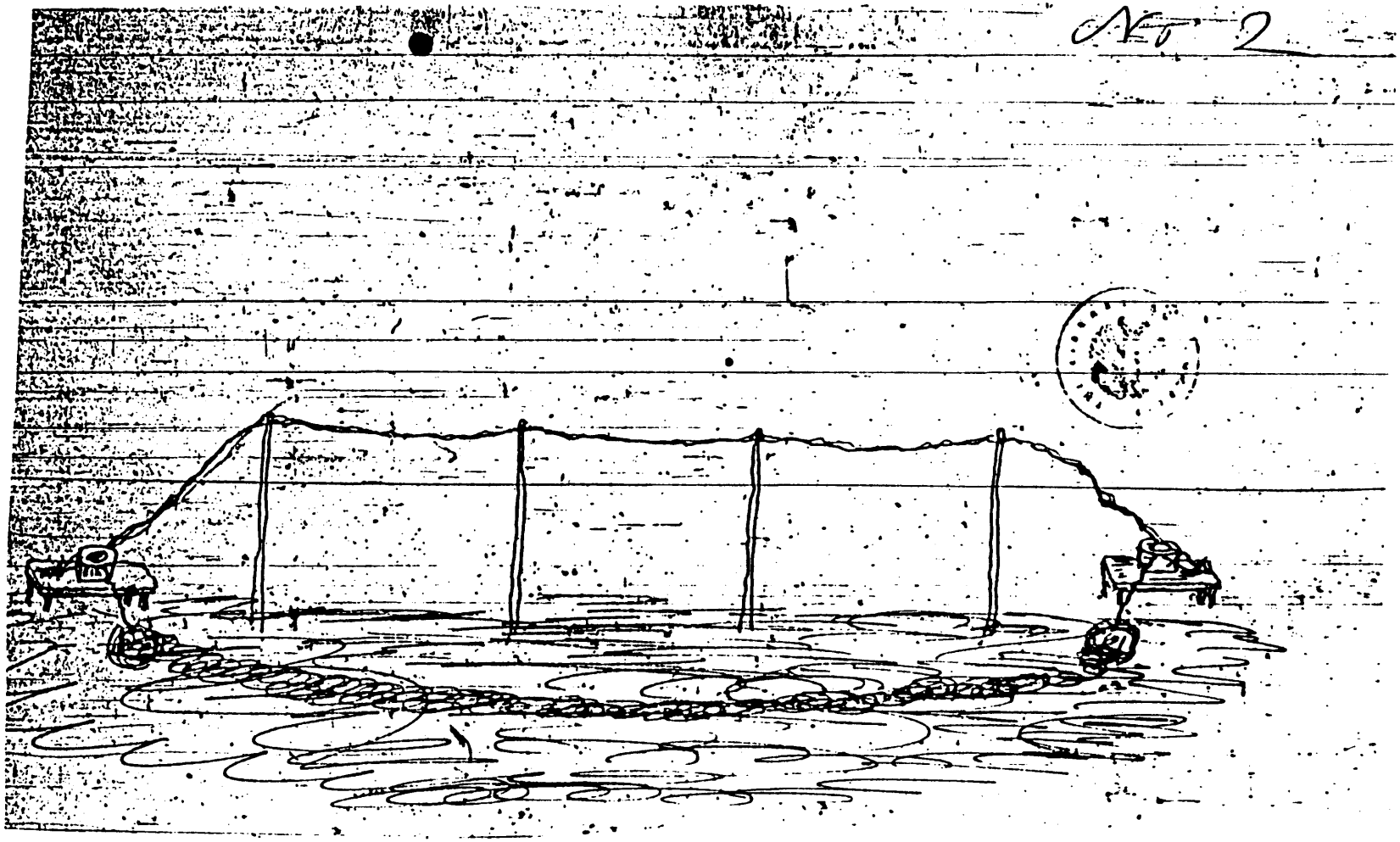
Now therefore, for telegraphing through the air, or rather for aerial telegraphy we have the positive and negative conditions supplied by the upper and the nether, we have the earth which faithfully fulfills and performs its half of the required conducting circuit and we secure its coefficient by penetrating the insulating atmosphere at two separate stations with a wire and make connection with the upper or positive element, (either by mountain tops, balloon, kite or otherwise) which wire reaches down to the instruments at both stations and connects with the negative ground thus completing the circuit and making the upper element practically and usefully reciprocate its fellow

When an excess of oxygen accumulates at any point in the atmosphere, there is electricity, whether confined to a cloud or otherwise. Now what are the causes that produce this phenomenon?

In the summer, the effect of electricity changing its locality, or rather seeking its counterpart, is more apparent than in winter. Now why is this, and what are its consequences?



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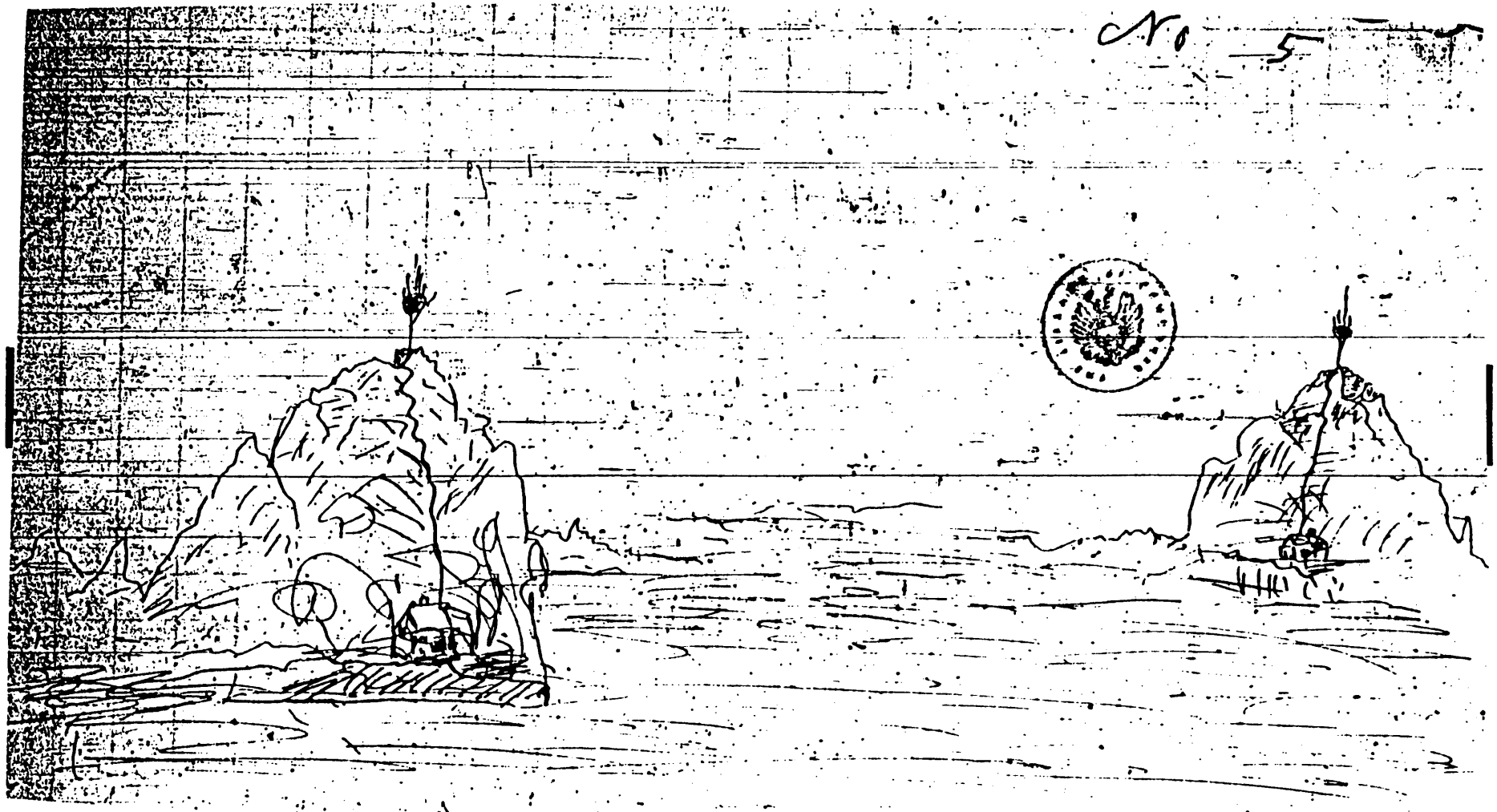
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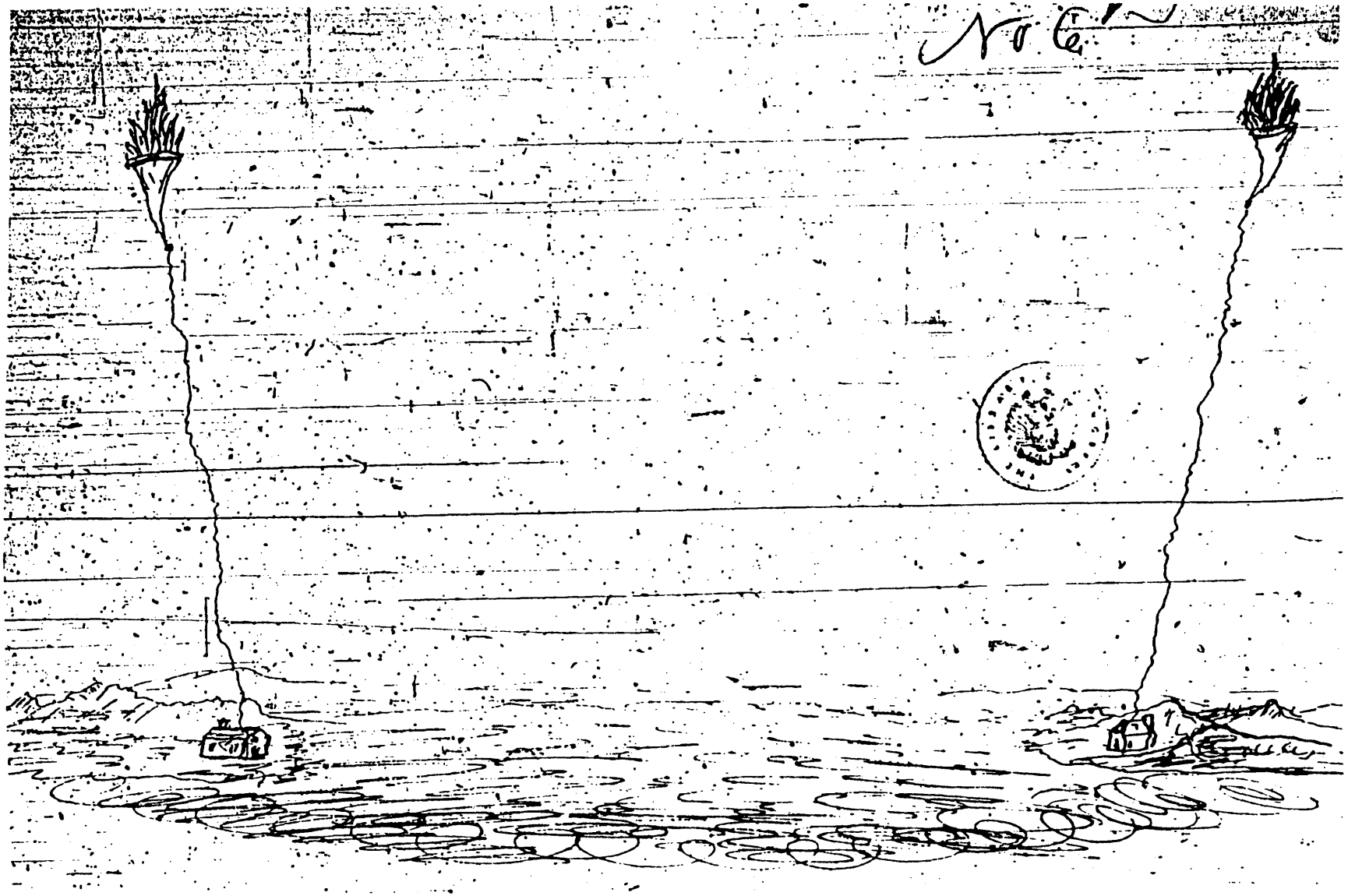
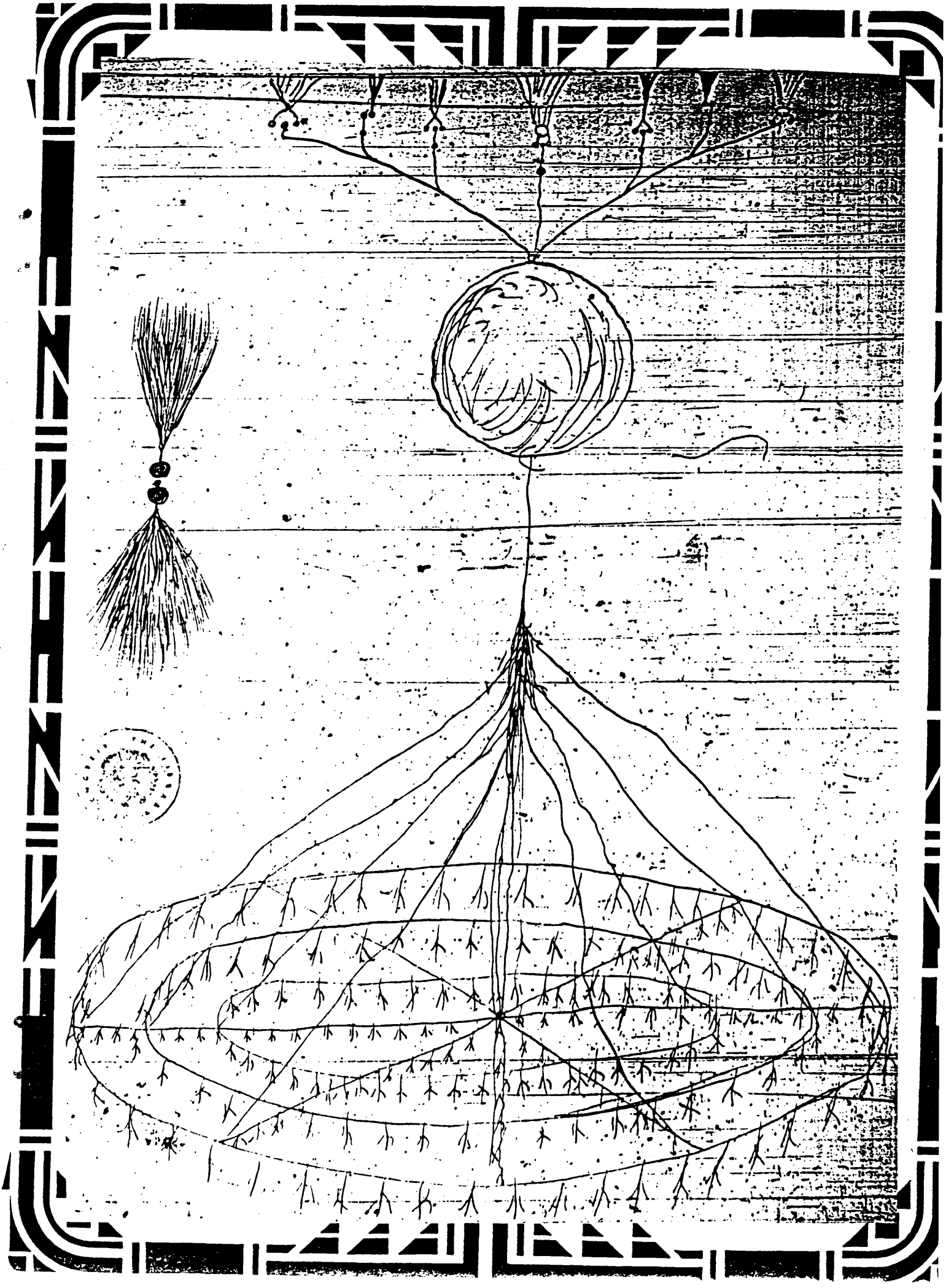
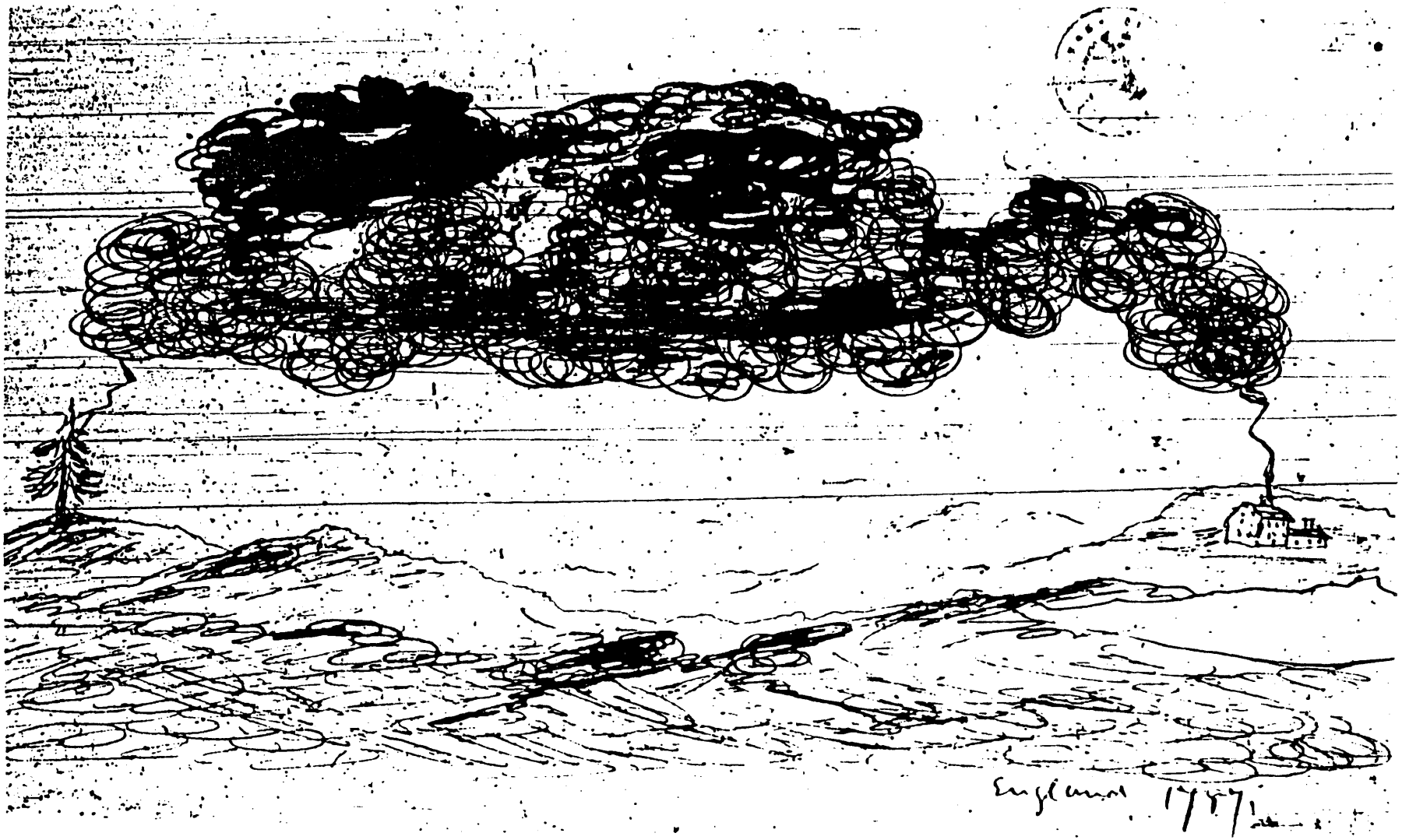
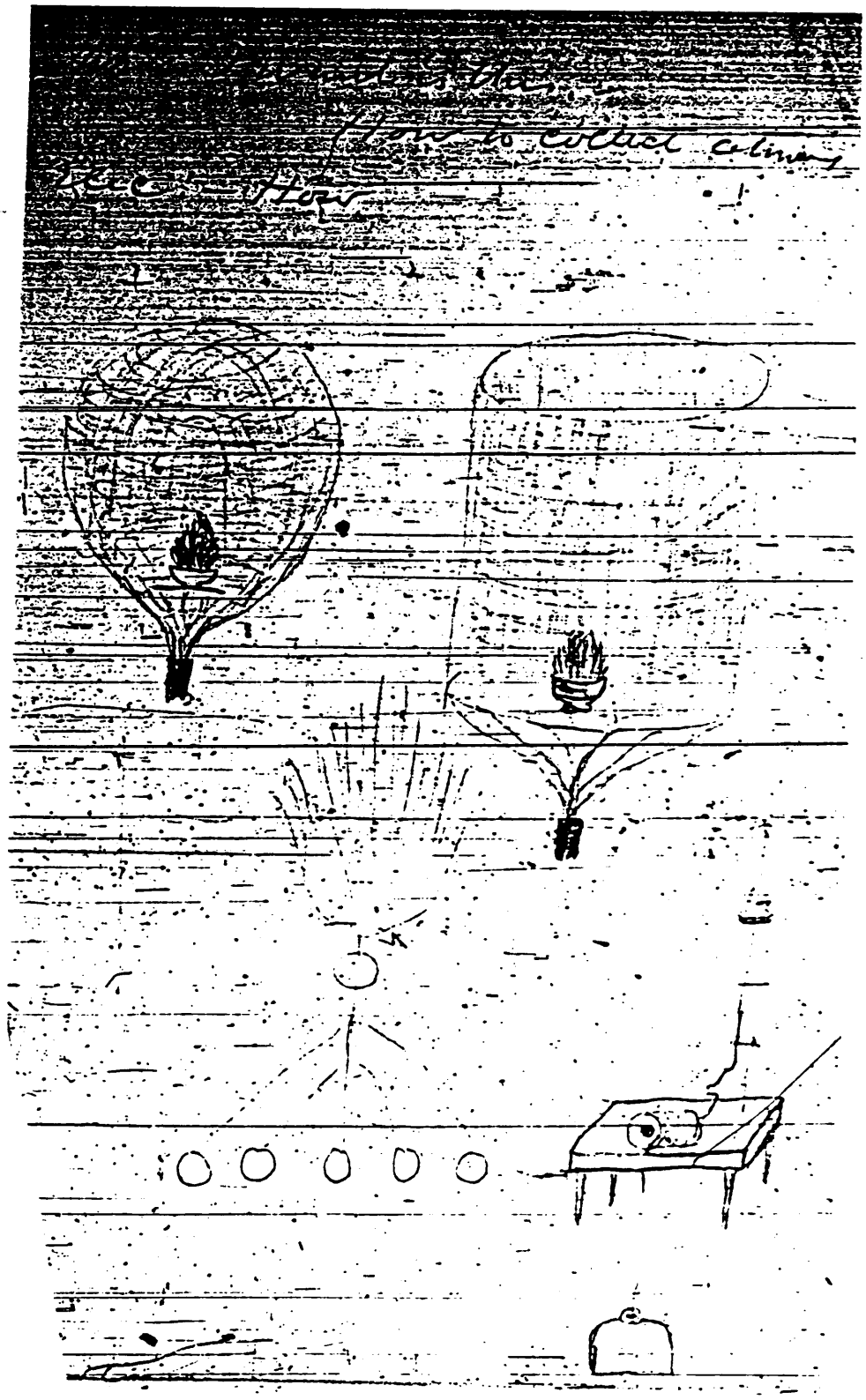
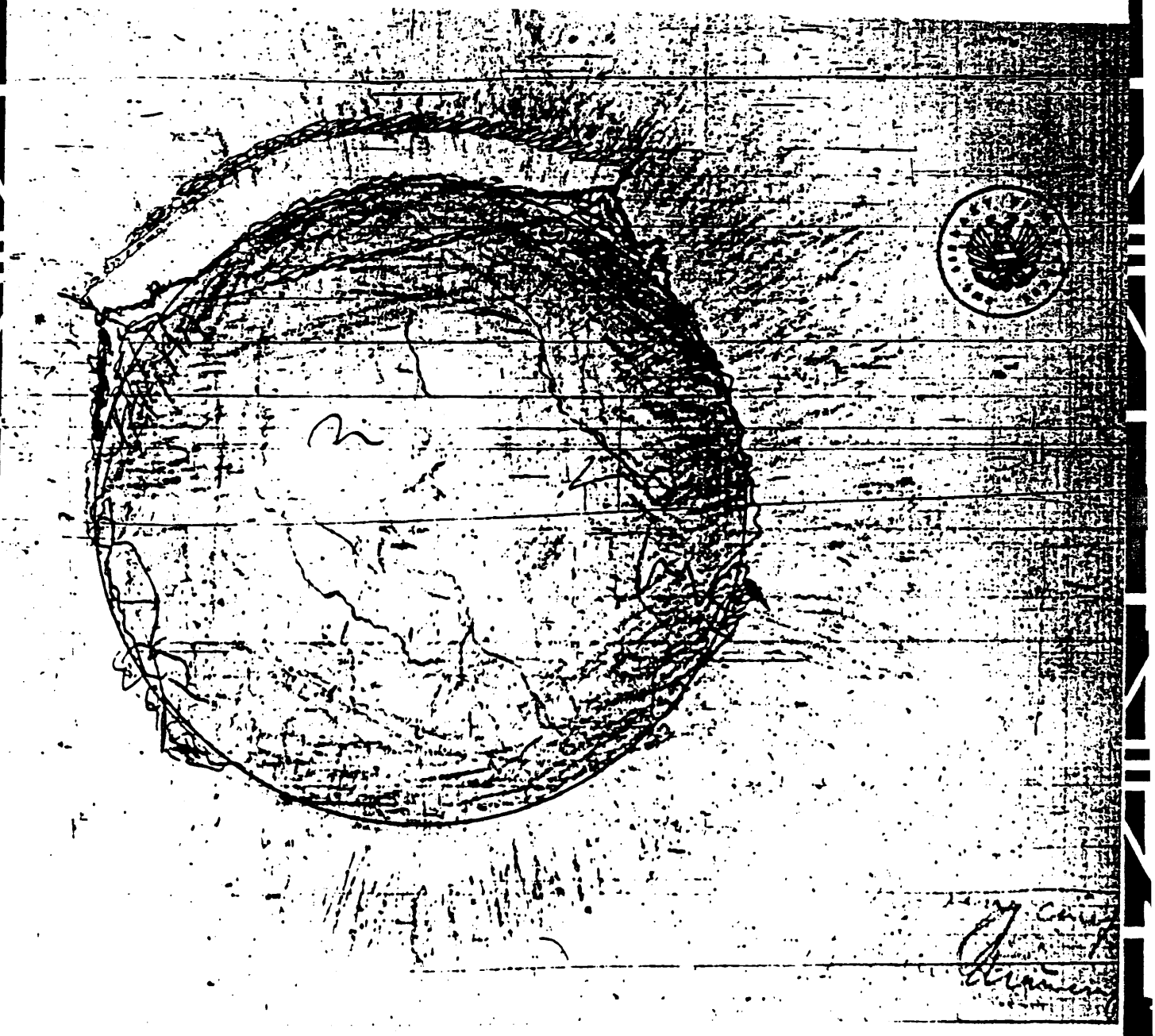
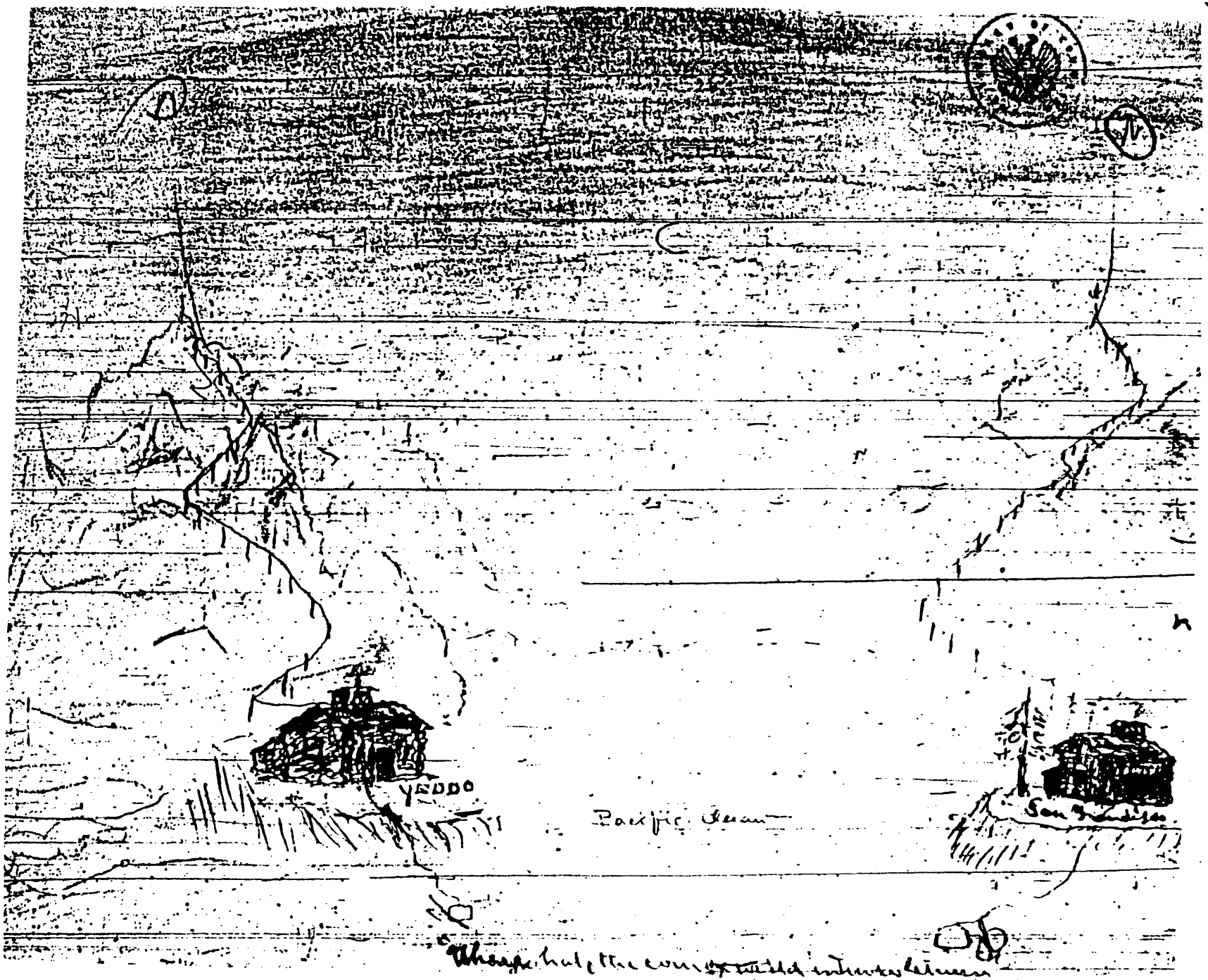


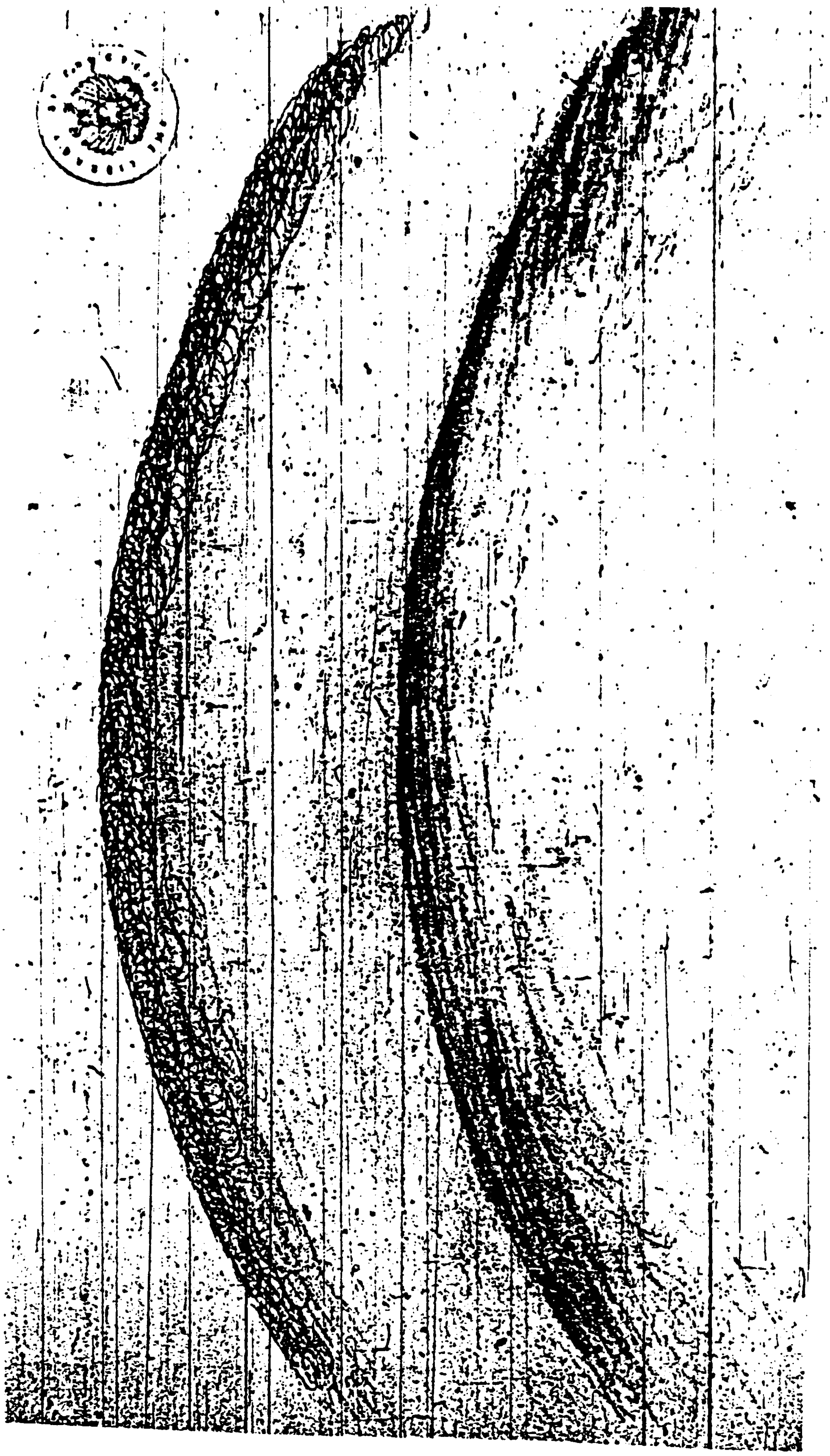


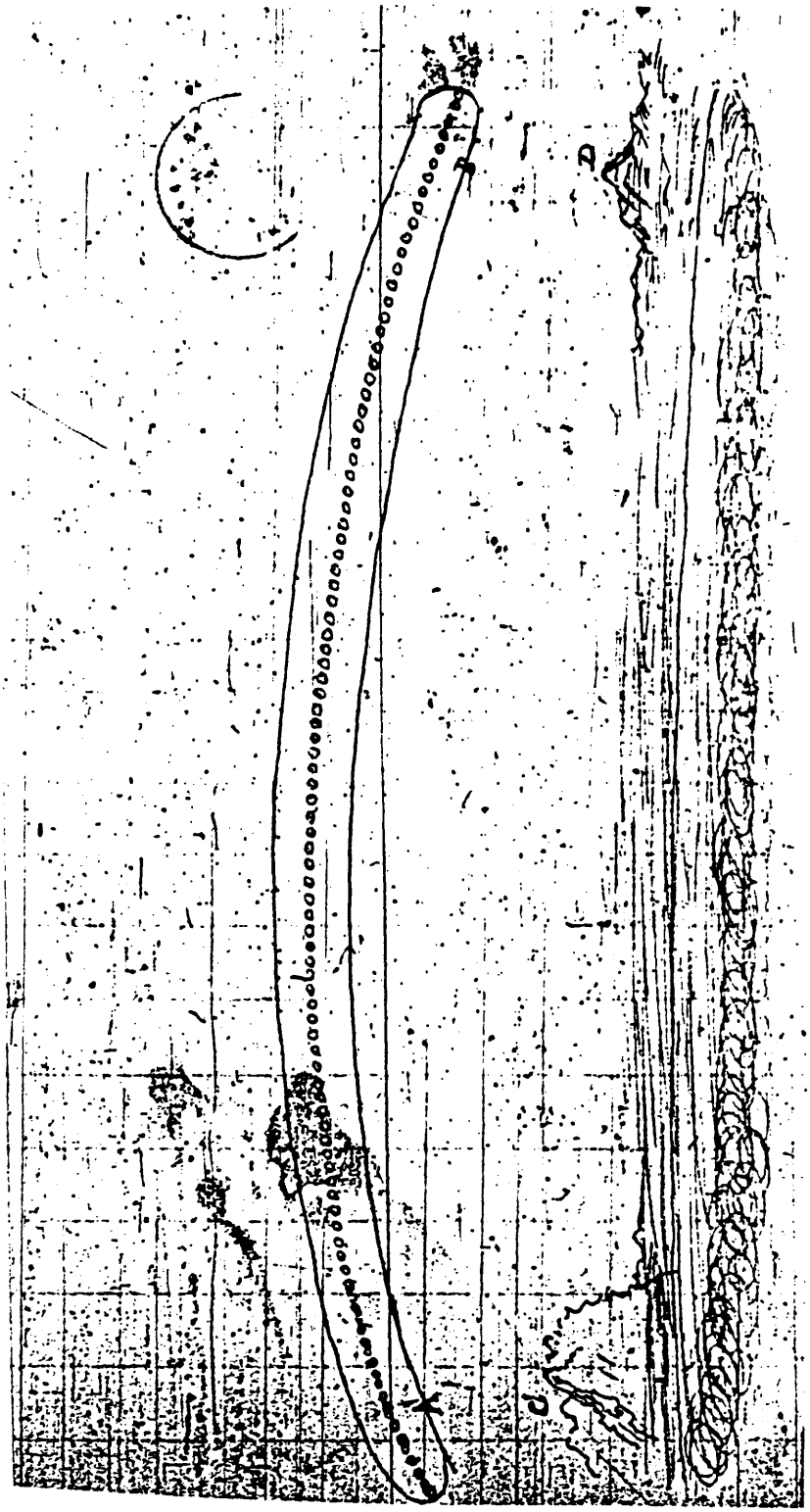

Engelmann 1797

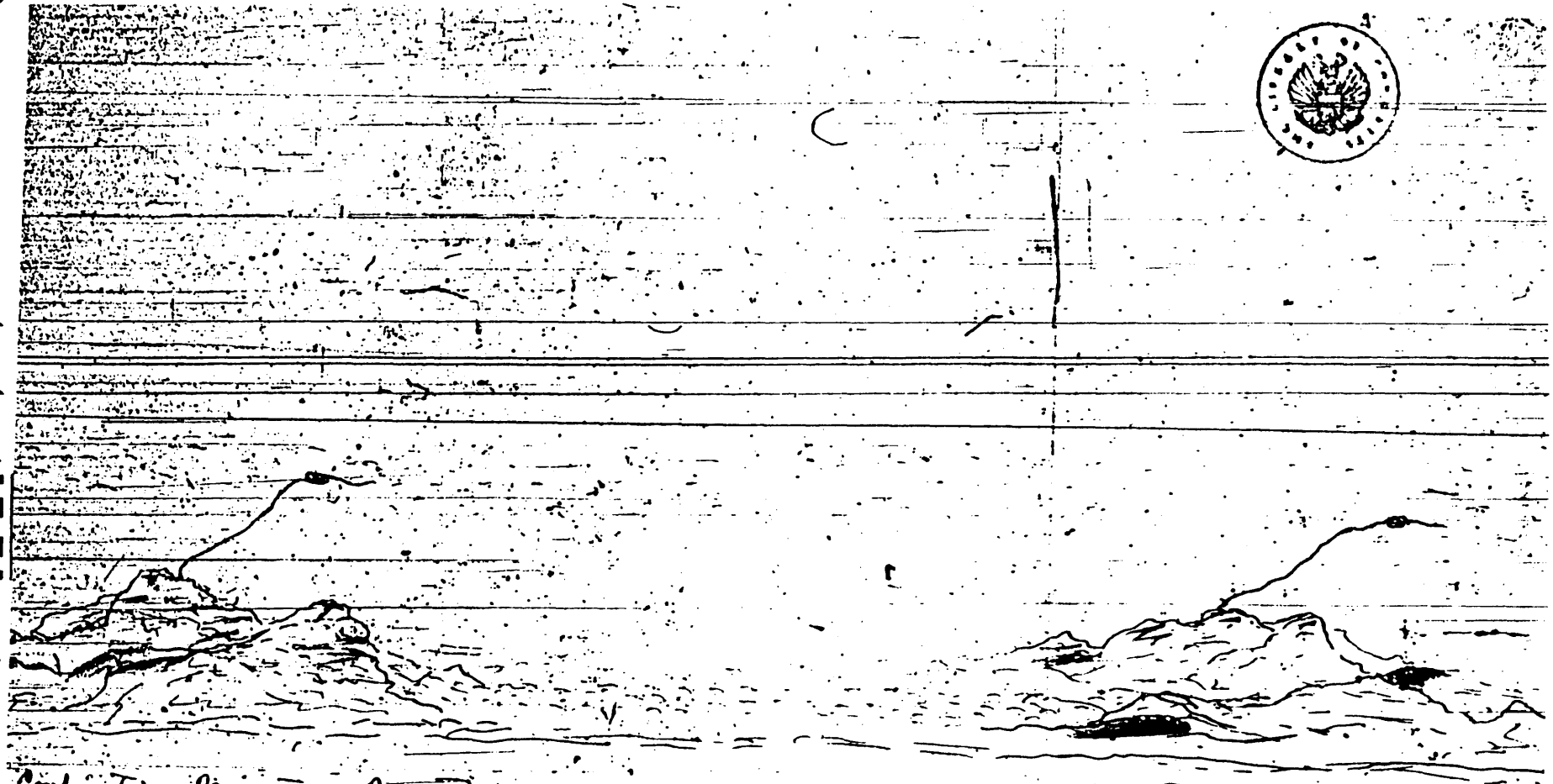




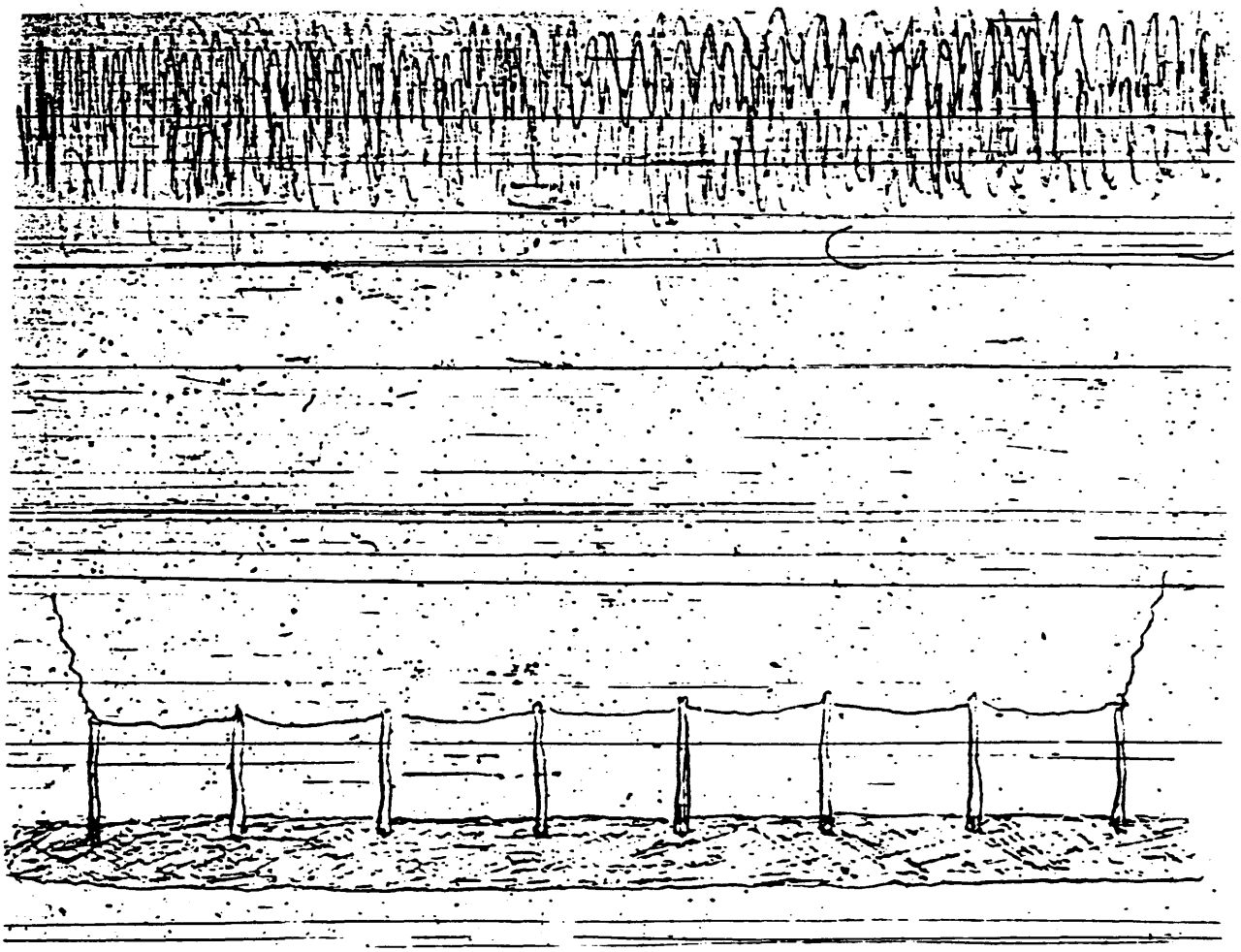

YEDDO
Pacific Ocean

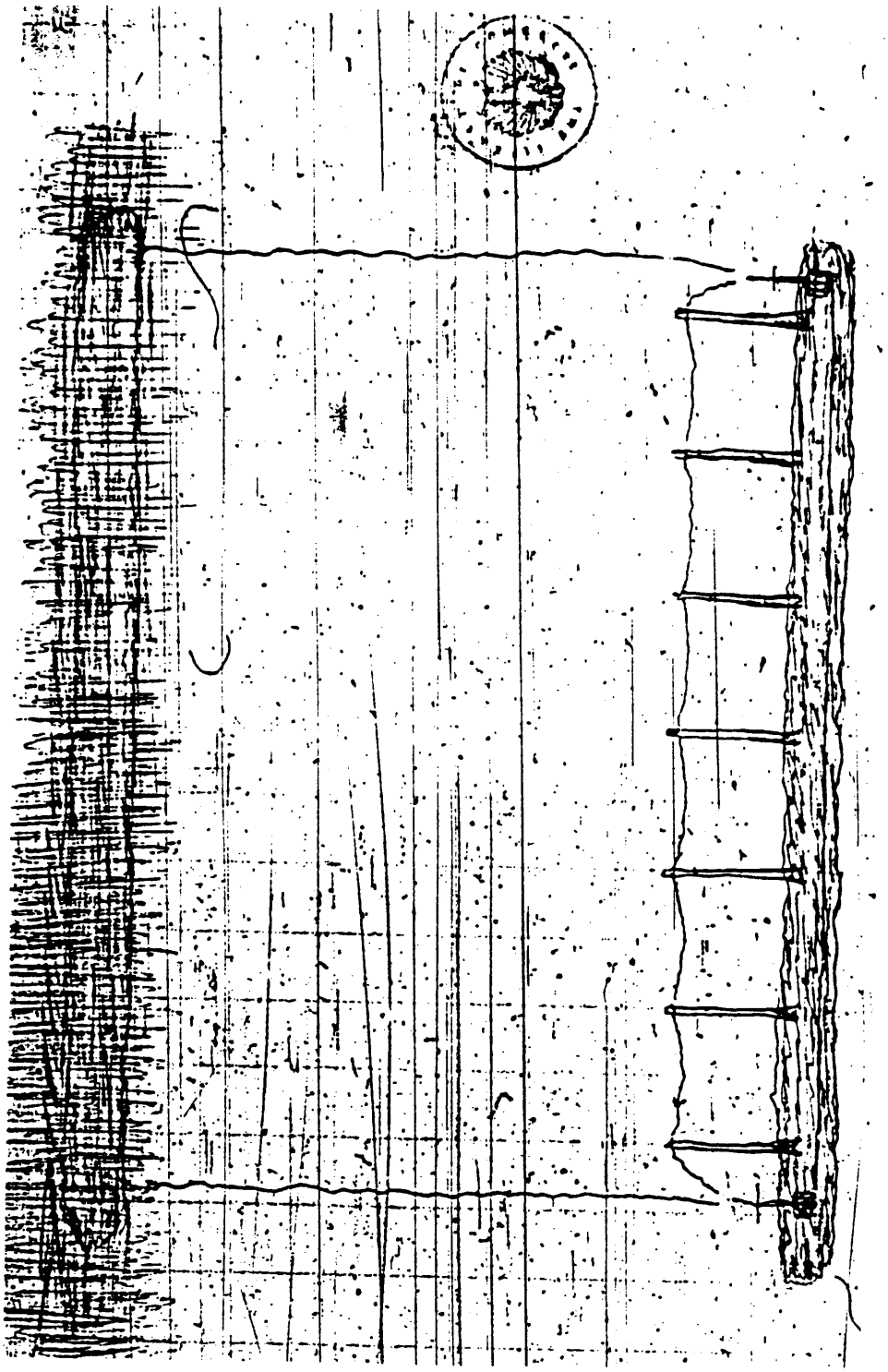


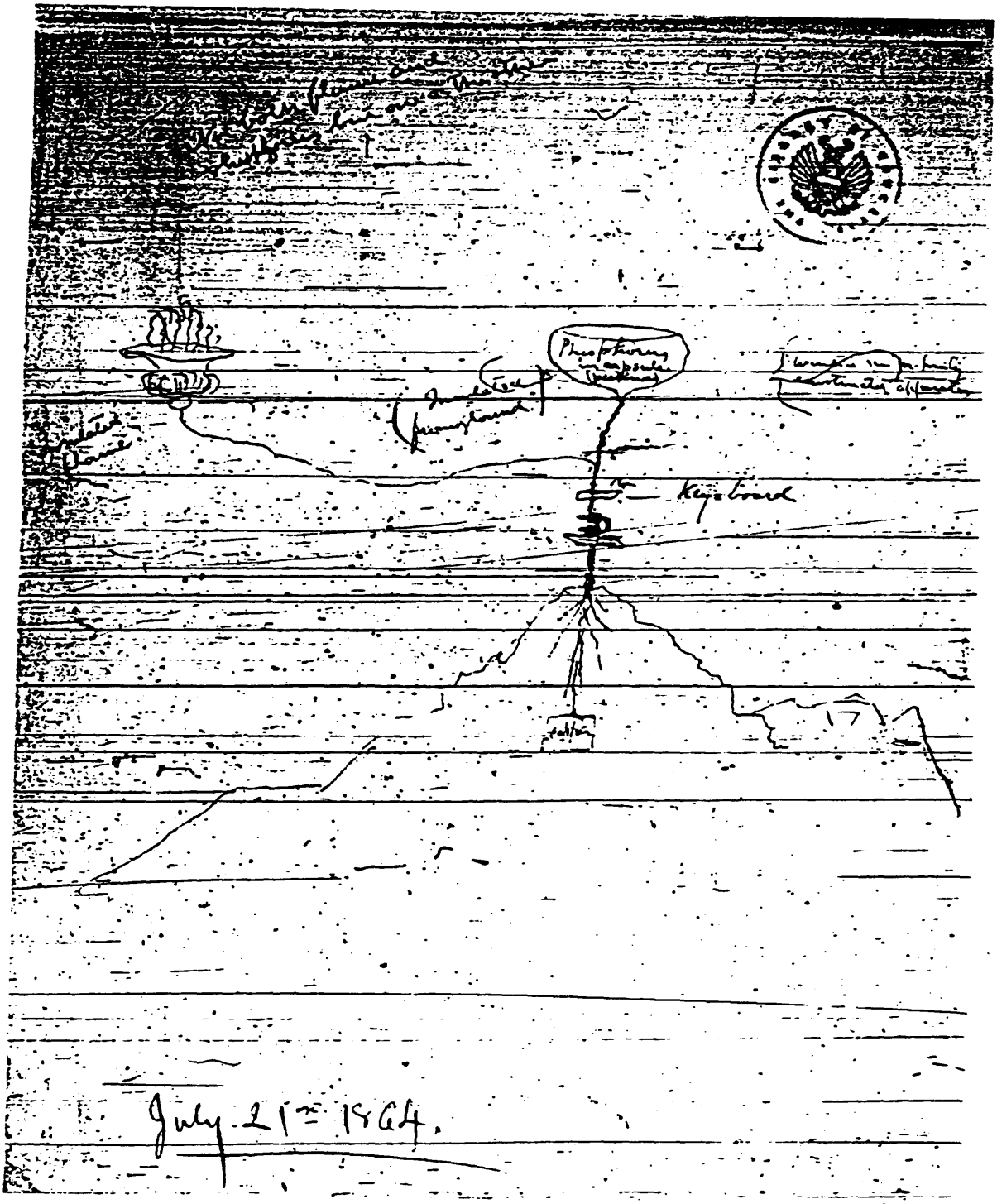




Sent Signals by "Aerial Telegraph" between these two Stations by elevating a Kite on
Each Mountain, the string of which was a small copper wire, attached to galvanometer
on each ground and lying in water. The signals proved perfect during the cloudy part of the day.
Elevation about fifteen hundred feet.

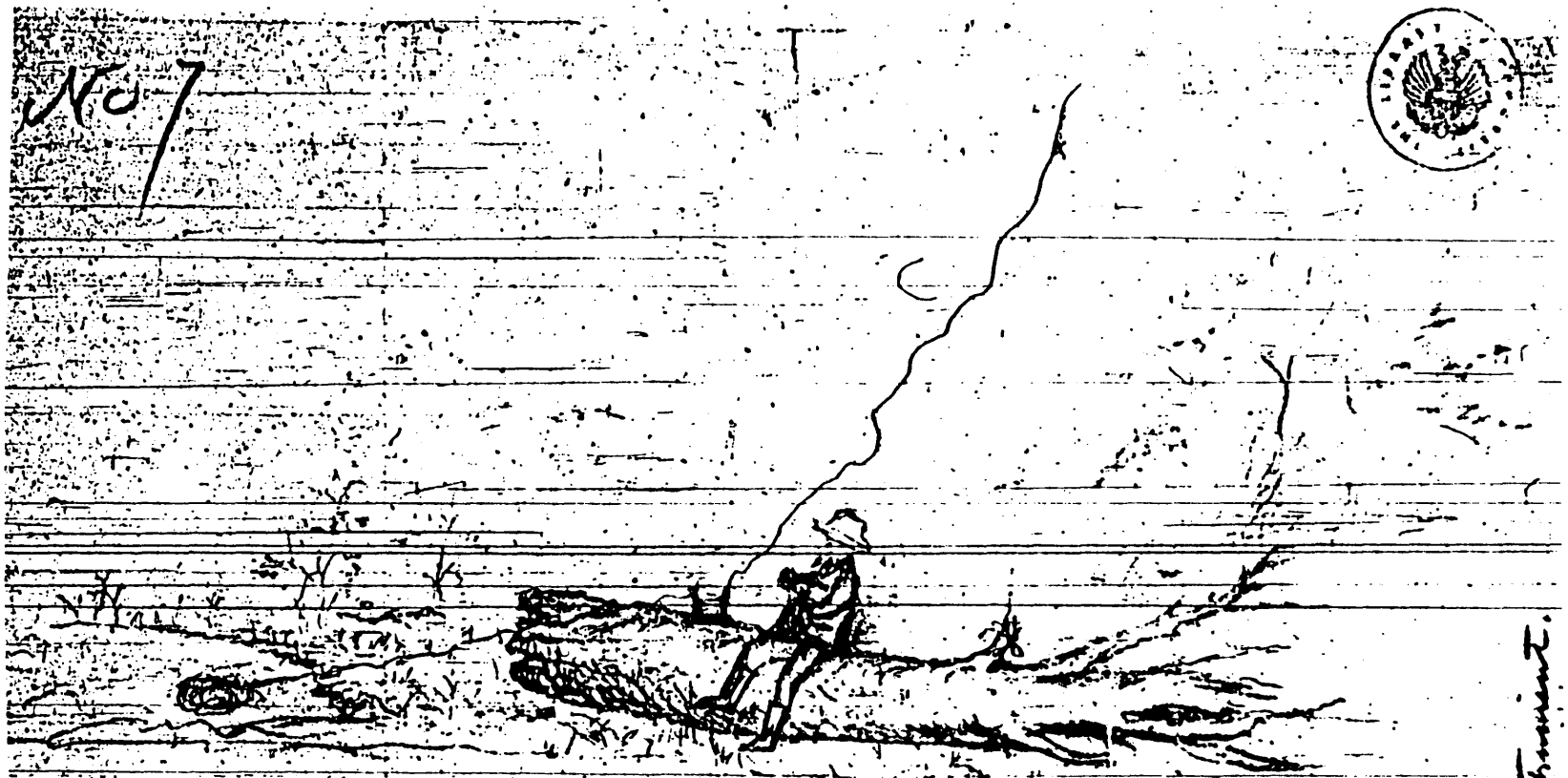




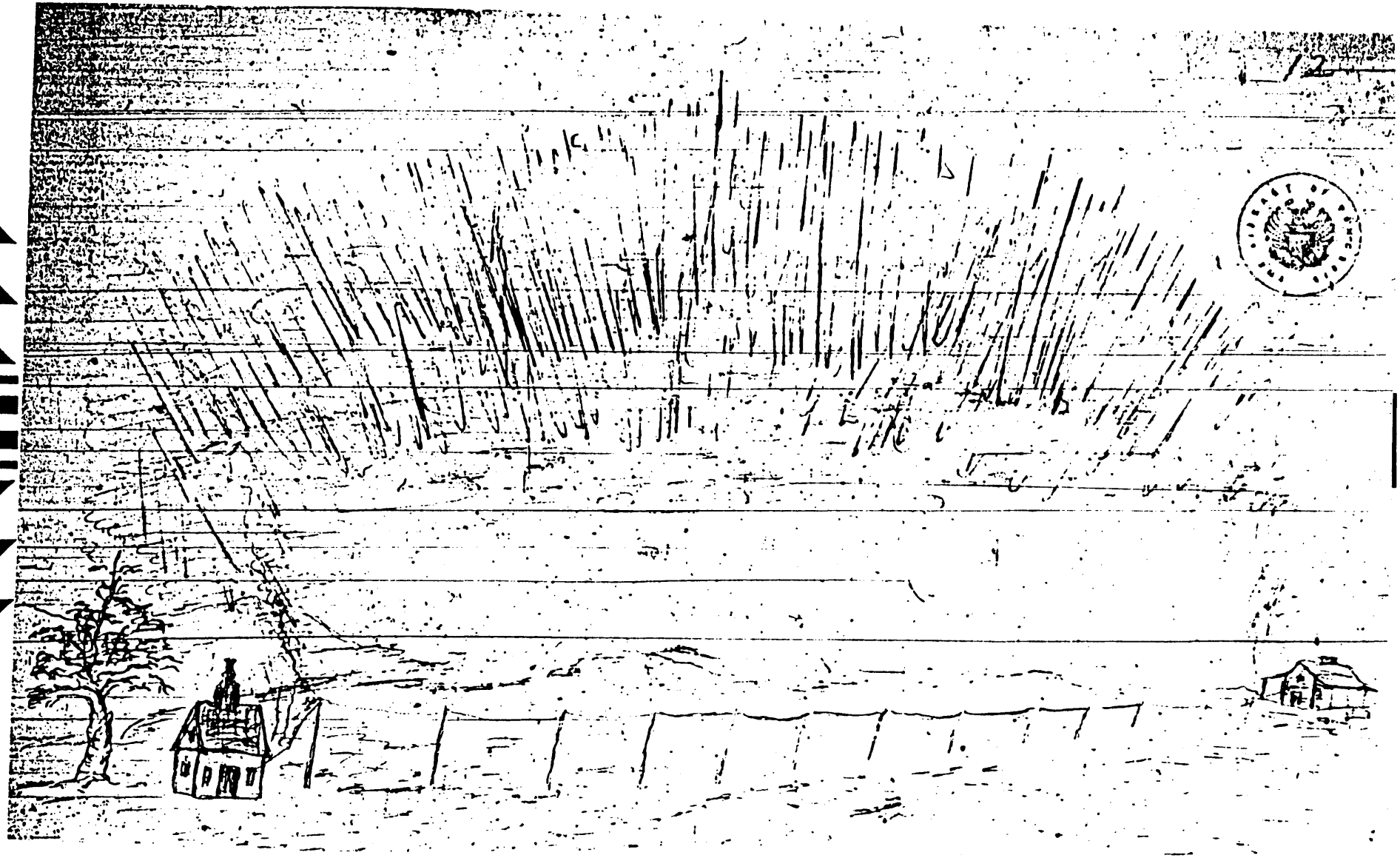


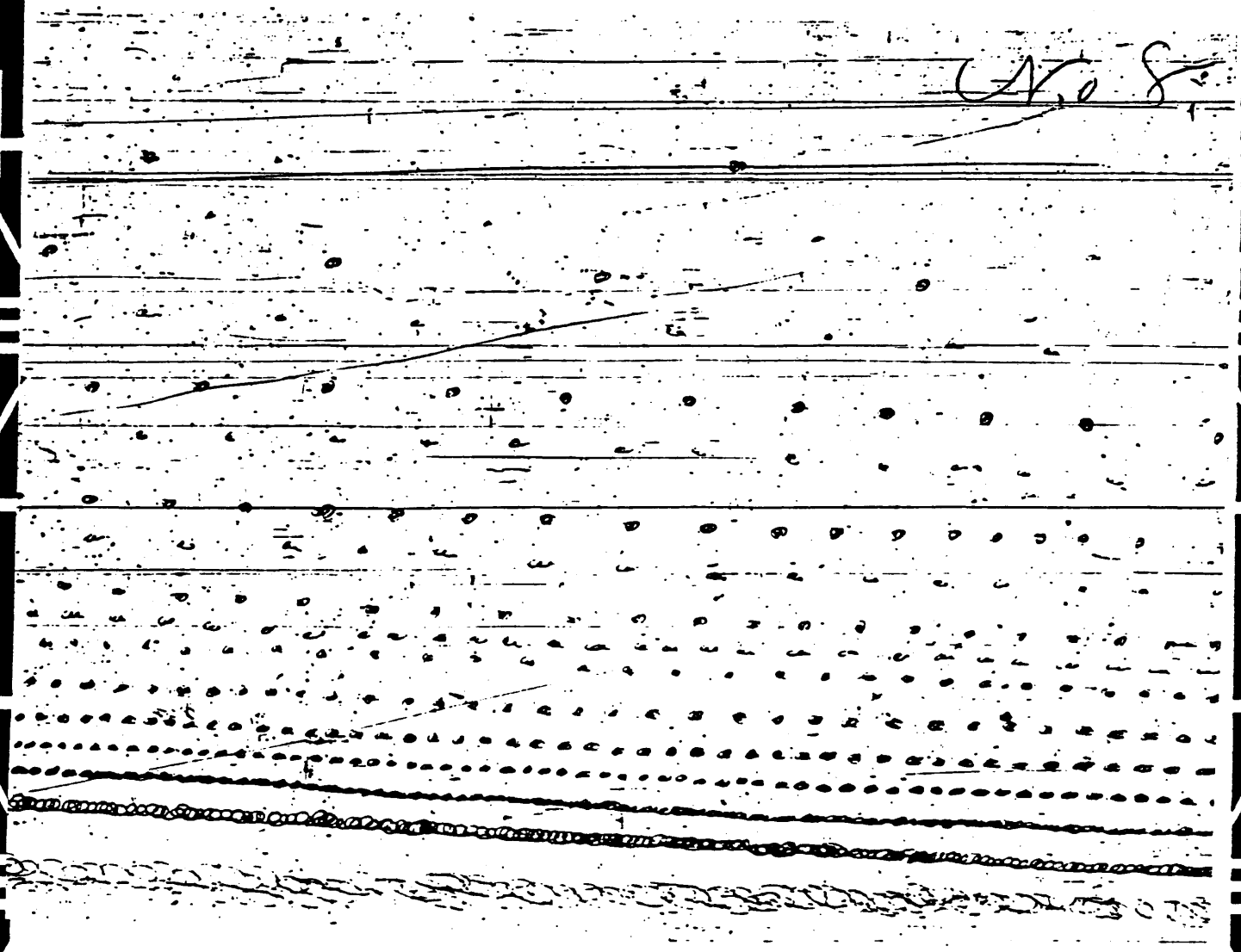
July 21st 1864.

No 7



Intended to represent one station; galvanometer on log canoe in circuit with ground connection [illegible] and wire from kite; latter tethered to log. Operator watching time [illegible] and instrument.





communication, and these are distinguished primarily by the way in which continuous radio frequency power generated in the transmitter is modulated. This investigation sought, in part, to discover evidence indicating whether Stubblefield's devices could generate radio frequencies. For a general overview of broadcasting's technical archaeology see Elliot N. Sivowitch, "A Technological Survey of Broadcasting's 'Pre-History,' 1876-1920, JOURNAL OF BROADCASTING, XV:1:1-20 (Winter, 1970-71); Robert A. Chipman, "The Earliest Electromagnetic Instruments," *United States National Museum Bulletin 240* (Washington, D. C.: Smithsonian Institution, 1964), 121-136; W. James King, "The Development of Electrical Technology in the 19th Century," *United States National Museum Bulletin 228 (Papers 28 and 29)* (Washington, D. C.: Smithsonian Institution, 1962), 231-331; George W. Pierce, *Principles of Wireless Telegraphy* (New York: McGraw-Hill, 1910), 75-107; and R. A. Fessenden, "Wireless Telephony," a paper presented to the 25th annual convention of the American Institute of Electrical Engineers, Atlantic City, New Jersey, June 29, 1908.

[4] L. J. Hortin, "Did He Invent Radio?" *Broadcasting*, March 19, 1951.

[5] Edward Freeman, "Stubblefield . . . and Radio," unidentified periodical article in the Stubblefield Papers.

[6] Note of A. H. Wear and Son, Murray, Kentucky, dated April 23, 1887. Stubblefield Papers.

[7] Telephone interview with Bernard B. Stubblefield, Florence, Mississippi, June 15, 1970. Bernard was the oldest surviving son of Nathan B. Stubblefield. According to Bernard, the "vibrating telephone" patent was the second of four U.S. patents his father ever had obtained. The first patent was for a "lamp lighter." A third patent was approved for Stubblefield's electric battery, and a fourth was granted in 1908 for a wireless telephone system. A Canadian patent was granted for the wireless system about the time Stubblefield developed his 1908 device.

[8] *Evansville Press* (Indiana), January 17, 1937. Stubblefield Papers.

[9] Jim Lucas, "He Helped Bring Radio Into the Home, But — Tulsan Loses Millions," unidentified clipping in the Stubblefield Papers.

[10] According to the 1902 *St. Louis Post Dispatch* story, and the report printed in White's book, Bernard ". . . would be able to carry out and finish the system of wireless telephony should the father die, so closely has he been allied with every step in its discovery and development." (White, 299.) Bernard was born in 1888. He lived in Murray, Kentucky until about 1915 when he joined the U. S. Army for about five years. Later, he settled in New York city engaging himself in a photostat business. He was never employed with any radio manufacturing, distributing or broadcasting business during the years following his brief Army career to his retirement in Mississippi sometime in the 1950s. Telephone interview, Bernard B. Stubblefield.

[11] A daughter, Mrs. J. H. White, of 610 Pulaski St., Little Rock, Arkansas, told a reporter ". . . that an estrangement between . . . [Nathan] . . . and the family . . . [occurred]. We went different ways simply because we could not get along together." Little Rock, Arkansas, *Gazette*, February 23, 1928.

[12] U. S. Patent No. 600,457, dated March 8, 1898. The brochure described the battery as ". . . simply a solenoid of copper and iron wire, the separate elements wound close and compactly about a soft iron core . . ." The

time, did reinforce the mystery about the technical capabilities of his early devices. And, Stubblefield's public demonstrations did involve voice transmission without wires. Beyond those documented facts, the "Hertzian secrets" of the "black box" used in his experiments, if there were any, most likely died with him.

Footnotes

[1] Rainey T. Wells, "Heard First Radio Broadcast," *The Fraternal Monitor* (undated). Nathan B. Stubblefield Papers, University of Kentucky, Lexington, and the Chamber of Commerce Stubblefield Collection, Murray, Kentucky, hereafter cited as the Stubblefield Papers. In preparing a final draft, the writer discovered that another collection of Stubblefield material had been microfilmed by the Murray State University Library. Permission for access to that collection was denied. At present there is no way of knowing how much duplication there may be among the above cited collections or to what extent the collection contained new matter. The writer wishes to acknowledge the guidance and counsel of Dr. Lawrence W. Lichty, the University of Wisconsin, in the preparation and refinement of this paper. The writer also wishes to acknowledge the help of Mr. Elliot N. Sivowitch, of the Division of Electricity and Nuclear Energy of the Smithsonian Institution, for technical and bibliographic advice; Mr. James Johnson, Stubblefield historian and Executive Director of the Chamber of Commerce at Murray, Kentucky, for advice and "opposing arguments;" Dr. Don Le Duc, now at Ohio State University, for some legal research; Dr. L. J. Hortin, Director of Journalism at Murray State University, for advice; Mr. James Skelton, a student of electrical engineering at Michigan State University from Calvert City, Kentucky, for technical and patent data, and Mr. Bernard B. Stubblefield, the son and assistant of Nathan B. Stubblefield, for additional information valuable to this study.

[2] The inscription read, in part, "Here in 1902, Nathan B. Stubblefield . . . inventor of radio—broadcast and received the human voice by wireless. He made experiments 10 years earlier . . ." Anonymous, "Nathan B. Stubblefield, Inventor of Radio," Unpublished paper from the vertical file (undated), Library, Murray State University. "The Hermit Pioneer of Radio is Honored After Death," *New York Sun*, May 17, 1930, Stubblefield Papers; "Another Inventor of Radio," *Broadcasting*, January 1, 1937, 3; (Advertising brochure) William T. Stubblefield, "Before It Was Known," (Miami, Florida: William T. Stubblefield Media Brokers). The first published account of the Stubblefield system in a scientific journal was Waldon Fawcett's "The Latest Advance in Wireless Telephony," *Scientific American*, Volume 86 (May 24, 1902), 363. Trumbull White, in his book *The World's Progress in Knowledge, Science and Industry* (1902) wrote a full description of the Stubblefield experiments based largely on an account published in *St. Louis Post Dispatch*, January 10, 1902. Other summary articles have been published since 1930, but these are mostly a rehash of the 1902 sources.

[3] Broadcasting means the dissemination of radio communications intended to be received by the public, directly or by the intermediary of relay stations. (Communications Act of 1934, Sec. 3.) There are various forms of radio

Stubblefield devices did work. However, the important question was whether his devices contained elements which might have been a basis for, or consistent with, a new and slowly evolving wireless technology dealing with radio frequency oscillations and so-called "Hertzian secrets." According to Stubblefield's onetime attorney, a case could have been made in support of this allegation. But the available technical evidence about the 1892, 1898 and 1902 devices was sketchy and hardly conclusive. The development of radio telephony as we now know it evolved from the experiments of R. A. Fessenden and others who used radio frequency oscillations. Stubblefield's 1908 letters patent did not contain descriptions or drawings indicating capability for radio transmission and reception. Instead, his system utilized an audio induction technique. This was greatly different from the production of sustained radio frequency oscillations with superimposed modulated information.

The competence of persons testifying about Stubblefield's experiments cannot be challenged. But their competence about what was in Stubblefield's "black box" is certainly subject to question. Only Bernard, Stubblefield's son, had access to such information. Bernard Stubblefield has stated that his father's devices did not involve the generation of radio frequencies. Any litigation had to turn, in part, on that question. Interestingly, Bernard was not involved in the plans for litigating Stubblefield's claimed rights after his death, although he would have been the most informed participant. There may be more evidence about the 1892, 1898 and 1902 devices, but it has not been brought forward. Stubblefield's story does illustrate how the devices of an ambitious experimenter with limited financial resources could be absorbed by the heavy promotion of investors seeking to repeat a windfall like that of the Bell telephone. The Wireless Telephone Company of America had a long way to go to match the headline accomplishments of Marconi and other experimenters, and Stubblefield probably was correct when he concluded that the emphasis of the company was simply selling stock.

Based on the available material, and the fact that wireless voice transmission evolved from the experiments of several persons widely separated by time and geography, it is clear that Nathan B. Stubblefield did not "invent radio broadcasting." His vision of "broadcasting news of every description," while not sensationally unique for the

he quietly lived out his existence in a small shack about nine miles north of Murray. Some observers reported seeing mysterious lights and hearing weird sounds in the vicinity of Stubblefield's home. Two weeks before his death, Stubblefield visited with a neighbor, Mrs. L. E. Owen. He asked her to write his life story, since, "I've lived fifty years before my time. The past is nothing. I have perfected now the greatest invention the world has ever known. I've taken light from the air and earth as I did sound." And he told her about a "whole hillside that would blossom with light."[38]

About two weeks later, on March 30, 1928, a neighbor discovered Stubblefield's dead body in the shack, which was locked from the inside. Nothing else was discovered except a few scraps of paper and portions of his apparatus.

On March 28, 1930 Murray citizens and two of Stubblefield's daughters unveiled a small monument to his memory. Since then, several prominent Murray citizens and others interested in gaining recognition for Stubblefield have gathered evidence to support the claim that he "invented radio." Patent papers, correspondence, newspaper materials, affidavits, parts of the original coils and equipment are open to the public at Murray, Kentucky. Conn Linn and one of Stubblefield's sons, Nathan, Jr., traced the wireless patents with a view of filing an infringement suit. Linn told a newspaper reporter that the lawsuit ". . . would have upset the financial structure of the radio world and required an accounting of profits worth millions since radio began its career."[39] An undisclosed New York law firm told Linn that their claims were in order and could be verified ". . . to the final detail." But the statute of limitations for the filing of a claim has passed. In 1950, Linn wrote to Vernon Stubblefield, a cousin of the early experimenter: "I went with him to Washington, and helped secure his initial patents. Had I stayed there, and helped him finish the job, he might have been living today as a world renowned inventor, and both of us rich enough to make John D. Rockefeller look like a piker. Don't you think I am right about it?"[40]

Comment

Stubblefield did transmit voice without wires as early as 1892. There is enough corroborative evidence in the form of affidavits, letters, newspaper accounts, photographs and drawings to conclude that the

patent on April 5, 1907 which was granted on May 12, 1908. His system was now limited to wireless voice communication between moving trains and way stations, moving highway carriages and way stations, and ship-to-shore communications. It was a "land mobile" system instead of a "broadcasting" one. The letters patent specifically included the use of a stationary "transmitter" and "antenna," with receiver-equipped mobile vehicles passing adjacent to the elevated "antenna." This language was contained in the letters patent:

> Surrounding the path of travel of the vessel, and preferably elevated on poles . . . is a coil of considerable magnitude. This coil . . . consists of an outer casing . . . within which is placed a conducting wire comprising a plurality of convolutions . . . each of which is insulated from the other. . . .

In principle, Stubblefield's 1907 device envisioned the transmitter operator, speaking into a telephone transmitter and through the circuit, producing

> a varying current corresponding to that passing through the coil of great magnitude [which] . . . will be inducted in the coil [in the receiver] and the speech or other sounds will be transmitted to the operator on the boat.[36]

A similar system was depicted in what appeared to be an earlier design located among the Stubblefield Papers, and involving a trans-Atlantic system using a submerged wire, whose idea was to induct signals to ships on the surface. The 1908 Stubblefield letters patent were quite vague technically, except with respect to the point on the use of electrostatic inductance to accomplish voice transmission. This has been corroborated by Stubblefield's son Bernard, who, at age 82, recalled that his father used two systems of wireless telephony. One was based on "ground radiation" and another on some kind of "magnetic radiation." He could not recall the details of each system precisely. But he stated that the devices used in the early wireless experiments did not contain an apparatus enabling the production of sustained and high-speed oscillations.

After the 1908 patent was granted, nothing significant occurred in the technical development or commercial exploitation of Stubblefield's wireless telephone. In 1913, some officials of WTCA, including Collins, were convicted of mail fraud.[37] Except for an occasional experiment, observed by some of Stubblefield's neighbors at a distance,

ducted his experiments in Murray, also had developed a wireless telephone system. Collins attended two of Stubblefield's Philadelphia demonstrations and, according to a flyer later printed by WTCA, he had published an optimistic account of the company's future in the June 28, 1902 issue of *Electrical World and Engineer*. From the standpoint of appearance, the only difference between the Stubblefield and Collins system at the time was that Collins used small zinc-wire screens instead of nickel-plated iron balls on top of steel rods.[30] Collins was well-published in the scientific journals. With his emergence in the WTCA stock promotion, Stubblefield's device appeared to have lesser significance. Since that time, a few persons, in their efforts to seek recognition for Stubblefield, have claimed that Collins and others acted in collusion to steal the Stubblefield system. There is some circumstantial evidence supporting that view, but it is not conclusive.[31]

After the Philadelphia tests, some unknown events occurred which caused Stubblefield's withdrawal from the company. He had previously signed over all his patent rights to the company in exchange for stock. On June 19, 1902 he wrote the secretary of WTCA charging that one of the stock promoters was ". . . practicing fraud or deception as usual. . ." Stubblefield's letter showed him to be obviously disturbed about an undisclosed incident, indicating that the practice was swindling him ". . . out of my inventions, and the defrauding of the public. . ."[32] Another incident possibly related to Stubblefield's letter occurred during the Washington, D. C. demonstration. He told an old friend that someone wanted Stubblefield to use a wire connection between the transmitter and receiver during the tests on land. ". . . They said they could sell more stock that way. I wouldn't do it."[33] Stubblefield returned to Murray referring to the New York "crowd" as "damned rascals."[34] In August 1902 WTCA distributed shares of stock. The promotional brochures made a distinction between the Collins and Stubblefield systems, but did not indicate precisely what the differences were, nor upon which system WTCA's development would depend.[35]

Refinements, Patents and Disillusion (1903-1928)

Stubblefield went back to work in Murray, perfecting his device. With the financial backing of seven Murray residents, he filed for a

turned down an offer for $500,000.[22] The hearsay about those high-flying offers was consistent with speculation fever gripping potential investors. By 1901 reports of Marconi's wireless telegraphy experiments increased investor interest, and ". . . Every amateur inventor who had ever tinkered with a telephone at once became of major importance."[23]

The Wireless Telephone Company of America

In January 1902, Stubblefield agreed to participate in the commercial exploitation of his device. Incorporation papers for the Wireless Telephone Company of America (WTCA) were filed in Prescott, Arizona, on May 22, 1902. Stubblefield was a director but he held no office.[24] After some additional testing in New York City,[25] the company undertook promotion of the Stubblefield wireless telephone in Pennsylvania. On May 30 and 31, 1902, Bernard assisted his father in the Philadelphia demonstrations held in the vicinity of Fairmont Park.[26]

The Washington and Philadelphia demonstrations maintained the momentum needed to sell stock in the new company. A four page prospectus, extolling the investment opportunity in WTCA, was distributed during the summer of 1902. It compared the Stubblefield device with Marconi's wireless telegraphy system by stating that both systems utilized ". . . for transmission what are termed Hertzian electrical wave currents. . . "[27] The technical details were not disclosed since the prospectus was designed to sell stock, and perhaps deliberately avoided specific evidence on the points of comparison or contrast. The use of steel rods thrust into the ground and large coils indicated that Stubblefield's 1892, 1893 and 1902 systems were based upon an induction principle. (This principle had been demonstrated by Professor Amos Dolbear of Tufts College, Massachusetts, as early as March 1882).[28] In a statement appended to the prospectus, Stubblefield wrote: ". . . I can telephone without wires a mile or more now, and when the more powerful apparatus on which I am working is finished, combined with further development, the distance will be unlimited."[29]

Another experimenter shortly thereafter became prominently involved in the new wireless telephone company. A. Frederick Collins, an electrical engineer in Philadelphia at the time Stubblefield con-

> transmitter and a telephone switch. . . . I took a seat in the box [in a small shed erected near the house] and Mr. Stubblefield shouted a "hello" to the house. This was a signal to his son [Bernard] to begin sending messages. I placed the receiver to my ears and listened. Presently there came with extraordinary distinctness several spasmodic buzzings and then a voice which said: "Hello, can you hear me?" . . .[15]

Then, Bernard played a few bars of music on his harmonica. One mile away from the Stubblefield house, the pair secured the rods about 30 feet apart and listened. Bernard's harmonica music was heard again.[16]

The January 1902 *St. Louis Post Dispatch* story created more interest in Stubblefield's invention. Two months later, he traveled to Washington, D.C. for another public demonstration. On March 20, 1902, aboard the steamer *Bartholdi*, off the Virginia bank of the Potomac, opposite Georgetown, Stubblefield sent wireless messages to receivers ashore.[17] A test also was made on land and proved much more successful, ". . . with the voices of the speakers being more plainly heard. . ."[18] After the demonstration, Stubblefield said: ". . . as to the practicality of my invention—all that I can claim for it now is that it is capable of sending simultaneous messages from a central distributing station over a very wide territory. . . Eventually, it will be used for the general transmission of news of every description."[19] This 1902 statement about news broadcasting was particularly noteworthy. Although such uses of wired telephone systems were made in Hungary four years earlier, the emphasis in utilizing wireless telegraphy or telephony was put on point-to-point transmission, not broadcasting. Additionally, Stubblefield's insight into the potential utilization of such wireless telephone systems provides interesting perspective to the often-quoted 1916 memorandum by David Sarnoff, who urged his superiors at American Marconi to manufacture a "radio music box" for home use.[20] Stubblefield, however, later "directionalized" the transmission characteristics as part of what he called "perfecting" his apparatus.

Between 1898 and 1902 two stories concerning offers Stubblefield received for his devices were circulated among the Murray townfolk. Dr. Will Mason told newspaper reporters that he had seen a written $40,000 offer to Stubblefield for the patent rights to his system.[21] Another offer was apparently made after Stubblefield's Washington, D. C. demonstration. Stubblefield told an old schoolmate that he had

Murray erected a monument commemorating Stubblefield and his wireless telephone.[2]

The purpose of this article is to document, from the fragmentary record remaining, what happened when Strubblefield experimented with batteries, coils and his strange "black box," and to provide an assessment of his work. The important question is whether his wireless telephone contained elements forming the first basis for wireless voice transmission, as it evolved into radio broadcasting;[3] or, whether his system was based on wireless "techniques" generally known by other experimenters of his time, and subsequently discarded in favor of other wireless theories. The evidence in favor of the former position is very sketchy, indeed. But the story of Stubblefield's work is important because his experiments were conducted when even wireless telegraphy was in an embryonic stage: his 1892 wireless *telephony* conversation with Rainey Wells antedated Marconi's wireless *telegraphy* demonstration by three years.

Early Life and Experimentation (1859-1901)

Nathan B. Stubblefield was born in either 1859 or 1860, the son of William Jefferson Stubblefield.[4] A self-educated experimenter and a farmer, he left school at 15 and, according to reminiscences of friends,[5] spent much time reading scientific journals at the newspaper office in Murray, Kentucky. By 1887, at about the age of 27, Stubblefield had achieved a local reputation for building "vibrating telephones," some of which were used by the townspeople.[6] The device was patented by Stubblefield in 1888.[7] Four years later, Stubblefield demonstrated his wireless telephone for Rainey Wells. Very few Murray residents were allowed into Stubblefield's experimental sanctuary during those years. Stubblefield treasured his privacy and was suspicious of strangers snooping about his property in response to rumors about his work.[8] In fact, ". . . His home was so wired that a stranger approaching within a half-mile set off a battery of bells. If the trespasser was unidentified, Stubblefield waved him away."[9] Stubblefield and his wife had several children, but only Bernard participated in his father's wireless experiments.[10] The others either were excluded or showed little interest.[11]

Sometime after 1898, a brochure about Stubblefield's electric cell was circulated among interested scientists and promoters. The electric

cell provided a source of energy for his wireless telephone.[12] Detailed technical information about the wireless apparatus was not fully disclosed, but it appeared that the steel rods used in the 1892 demonstration with Wells performed the same function as the placement of Stubblefield's electric cells in the ground. Steel rods were inserted into the ground at the point of transmission and reception. The transmitter device was comprised of a modified Bell-type telephone connected to a large circle of metal which looked very much like an antenna. Wires led from that to a "black box." Years later, in 1908, when Stubblefield built another wireless system, the circular steel "antenna" at the telephone transmitter was eliminated in favor of a long elevated antenna extending over several hundred feet.

Sometime in 1898, Stubblefield brought his device into Murray and set it up in a local hardware store. Listeners stationed themselves upstairs in the office of Dr. Mason, a local physician, and "heard it talk."[13] Stubblefield told the small gathering that he was finally going to patent the device. However, no patent application was filed until 1907. Those 1907 papers apparently described a *different* wireless system from the verbal descriptions and occasional photographs of the 1892, 1898 and 1902 devices.

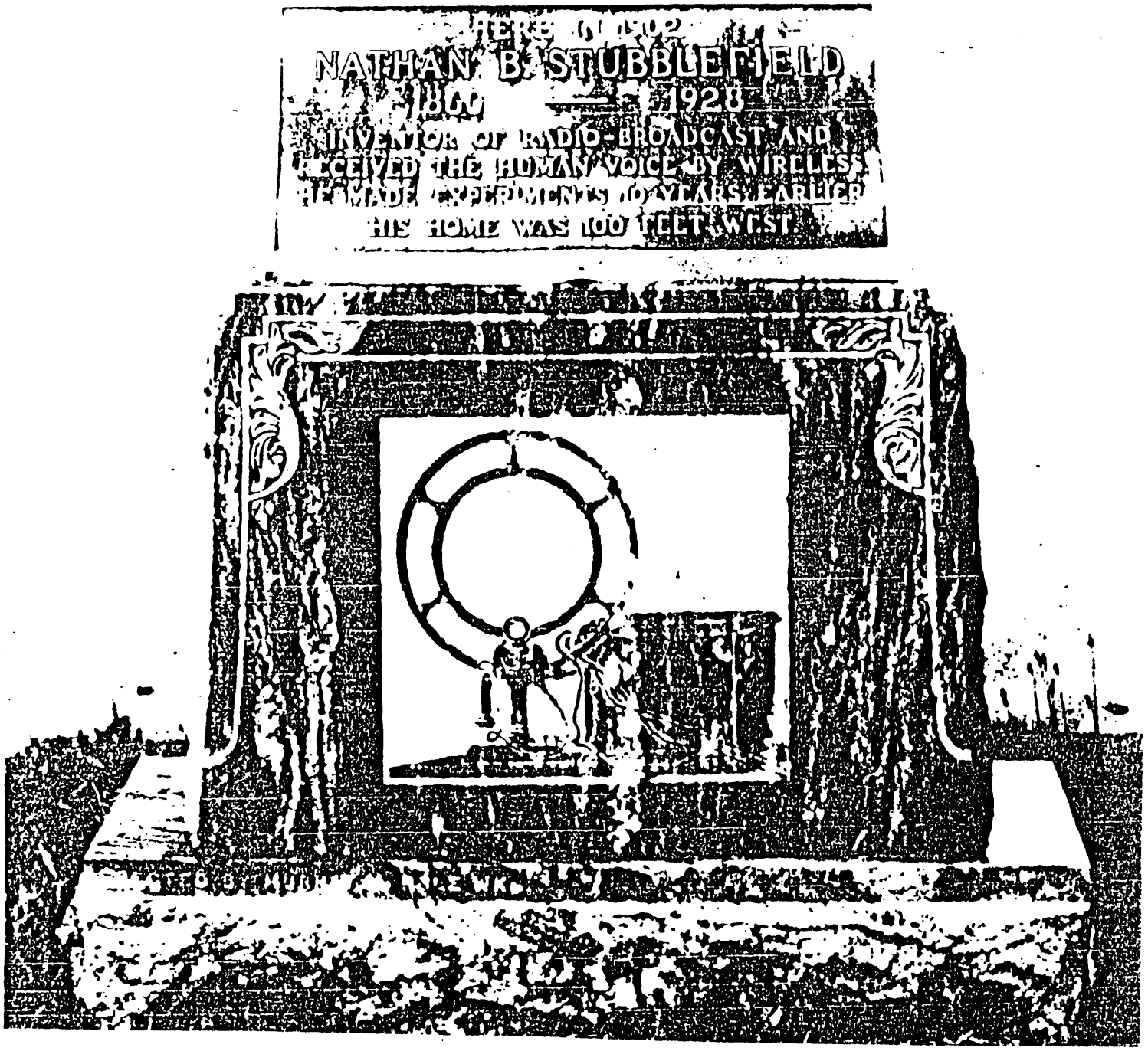
The Public Demonstrations (1902-1903)

On January 1, 1902, a few weeks after Marconi demonstrated wireless telegraphy across the Atlantic, about a thousand Murray residents witnessed a demonstration of Stubblefield's wireless telephone. Later, Stubblefield told a reporter from the *St. Louis Post Dispatch* that the successful results of the demonstration in Murray had taken him 10 to 12 years of development. He is quoted as saying:

> . . . I have solved the problem of telephoning without wires through the earth as Signor Marconi has of sending signals through space. But, I can also telephone without wires through space as well as through the earth, because my medium is everywhere.[14]

A private demonstration was given for the reporter during the second week of January 1902. The reporter observed:

> The transmitting apparatus is concealed in a box. Two wires of the thickness of a lead pencil coiled from its corners and disappear through the walls of the room [of the Stubblefield home] and enter the ground outside. On top of the box is an ordinary telephone


NATHAN B. STUBBLEFIELD
1860 1928
INVENTOR OF RADIO-BROADCAST AND
RECEIVED THE HUMAN VOICE BY WIRELESS
HE MADE EXPERIMENTS 10 YEARS EARLIER
HIS HOME WAS 100 FEET WEST

THOMAS W. HOFFER

Nathan B. Stubblefield and His Wireless Telephone

In the Winter 1970-71 issue, the JOURNAL *published an article on radio's technological "pre-history" which included mention of Kentucky melon farmer and sometime inventor Nathan B. Stubblefield. The following pages offer a more detailed discussion of Stubblefield's experimental work in radio and seek to answer the question of whether he was an important innovator in radio, or just another whose fringe effort contributed little to the mainstream of radio development. Stubblefield's work, much of it before Marconi became active in wireless development, is a good example of the many small-town American inventors in this field who took out patents and tried to make a commercial success out of something their backers seldom fully understood. Stubblefield's eventual commercial failure is also, unfortunately, typical of the fate of these inventors. Thomas W. Hoffer currently is an instructor in the Department of Communication Arts at the University of Wisconsin while completing work on his doctorate.*

ONE day in 1892, Nathan B. Stubblefield handed Rainey T. Wells a device, and asked him to walk some distance away from a small shack Stubblefield had erected near his farmhouse on the edge of Murray, Kentucky. Wells reported, ". . . I had hardly reached my post . . . when I heard, 'Hello Rainey' come booming out of the receiver. I jumped a foot and said to myself, 'This fellow is fooling me. He has wires some place." Wells moved a few feet to the side, but ". . . all the while he [Stubblefield] kept talking to me . . . but there were no wires, I tell you."[1] Wells' recollection and the documentation of other public demonstrations of Stubblefield's wireless voice transmissions were used to support the claim that the Kentuckian "invented radio" as early as 1892, long before the wireless telephone demonstrations of other claimants for the title "Inventor of Radio" such as Marconi, Fessenden, and de Forest. In 1930, the citizens of

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Stubblefield and his wife had several children, but only their son Bernard took a fancy to his father's tinkering, and he later became a trusted cohort.

Another man, Rainey T. Wells, who went on to found Murray State Teachers College, figured heavily in the inventor's life and was allegedly present when Stubblefield demonstrated his wireless invention in 1892. Before that, though, Stubblefield supposedly told Holt of his discovery in 1885. However, it was not until January 1, 1902, that he gave the first documented public demonstration of his device in Murray's town square.

The instruments he and his son exhibited by the courthouse consisted of a transmitter and receiver—200 feet apart—and metal rods thrust into the ground connected by wire to both devices. Coils spread all over the walkway.

In an interview with a *St. Louis Post-Dispatch* reporter ten days after the demonstration, Stubblefield was quoted as saying: "I had been working on this ten or twelve years before I heard of Marconi's efforts (Marconi successfully sent radiotelegraphy in 1896, but not voice) or the efforts of others to solve the problem of transmission of messages through space without wires. I have solved the problem of telephoning without wires through the earth as Signor Marconi has of sending signals through space. But I can also telephone without wires through space as well as earth because my medium is everywhere."

He never said what that medium was.

Stubblefield demonstrated his wireless voice device on his farm to the reporter. Bernard stayed in the house while his father and the reporter walked to a cornfield about 500 yards away.

The reporter wrote: "The transmitting apparatus is concealed in a box. Two wires of the thickness of a lead pencil coil from its corners and disappear through the walls of the room and enter the ground outside. On top of the box is an ordinary telephone transmitter and a telephone switch. This is the machine through which the voice of the sender is passed into the ground to be transmitted by the Earth's electrical waves to the ear of the person who has an instrument capable of receiving and reproducing it.

"We went into the cornfield back of the house. After walking five hundred yards, we came to the experimental station the inventor has used for several months. It is a dry goods box fastened to the top of a stump. A roof to shed the rain has been placed on top of it; one side is hinged for a door, and the wires connected with the ground on both sides run into it and are attached to a pair of telephone receivers. The box was built as a shelter from the weather and as a protection to the receivers. I took a seat in the box and Mr. Stubblefield shouted 'hello' to the house. This was a signal to his son to begin sending messages. I placed the receiver to my ear and listened. Presently, there came with extraordinary distinctness several spasmodic buzzings and then a voice which said: 'Hello, can you hear me? Now I will count to ten. One-two-three-four-five-six-seven-eight-nine-ten. Did you hear that? Now I will whisper.'"

The demonstration continued with the reporter and Stubblefield walking about a mile from the house, the reporter placing the rods anywhere he wished and hearing Bernard talk as clearly as when they were 500 yards away.

The reporter quoted Stubblefield: "The earth, the air, the water, all the universe as we know it is permeated with the remarkable fluid which we call electricity, the most wonderful of God's gifts to the world and capable of the most inestimable benefits when it is mastered by man. For years I have been trying to make the bare earth do the work of the wires. I know now I have conquered it."

Stubblefield claimed his invention would work for any distance. He also said that eventually he would invent a tuning apparatus so that many conversations could go on at the same time without interference. And, he said it wasn't necessary to use the ground rods.

The father and son team demonstrated the wireless device in Philadelphia, New York, and Washington, D C. Newspapers and magazines documented the events and Stubblefield's fame grew. The March 20, 1902, experiment was particularly unique in that Stubblefield transmitted from the ship *Bartholdi* on the Potomac River, and it was billed as the "First Marine Wireless Telephone Demonstration." He transmitted about ¼ of a mile.

During all his demonstrations, Stubblefield employed what he called "an earth battery." Although no one knows for sure what it was, Stubblefield claimed the cell, which he placed in the ground, converted the earth's natural current into electricity. That, in turn, transmitted his voice.

(Stubblefield received patent #600,457, March 8, 1898, for a "primary battery" consisting of a bare iron wire and insulated copper wire wound helically on an iron core. The patent claimed this construction increased the output of the couple, using water as an electrolyte. A couple is two dissimilar metals touching. He proposed placing the battery in moist earth, but it was never proven to be the one used in his voice transmission experiments, although it probably was.)

Interestingly enough, his Philadelphia experiments as well as his Washington showings were successful, but his New York trip was a bust. Some observers attribute the poor performance to the hard, dry bedrock in the area.

Around this time, Stubblefield became quite well known. *Scientific American* printed an article about his work, and a coterie of sharp financiers took notice. They saw his system as a moneymaker. A group of New York businessmen formed The Wireless Telephone Company of America to promote the still unpatented device. Several Murray men owned stock. But, for some reason, Stubblefield shied away from the operation after it got underway. It's rumored that he turned down a half million dollars for his invention.

He finally applied for a patent on April 5, 1907, and received it May 12, 1908. He also obtained foreign patents.

Then, for some unknown reason, Stubblefield retreated to his home, disillusioned, distant, and despondent.

Some say his invention was stolen. Others say he became angry at his backers' greed. Still others contend he went mad.

After a Washington trip in 1912, Stubblefield told his friends and associates to withdraw their investments, go away, and leave him alone. That same year his house burned to the ground.

Later, his wife and children left him and he built a cabin about six miles north of Murray. There he continued to tinker, and apocraphyl stories abounded about his strange experiments which supposedly involved drawing energy from the earth for lighting.

"Radio is a device that transmits and receives voice over considerable distance without connecting wires," Hortin said. "Stubblefield invented, manufactured, and demonstrated such a device and did so before anyone else on this planet. That's my claim." He described "considerable distance" as several miles.

James L Johnson is another unabashed Stubblefield booster. In a 1961 speech, the former executive secretary of the Murray chamber of commerce told the annual convention of The Kentucky Broadcaster Association in Louisville "'Hello Rainey. Hello Rainey.' These four words, highly insignificant in themselves, were the gateway that opened a fabulous industry in the late 19th and early 20th century. These were the first words ever broadcast by radio. These four words put you people in business."

Following the address, the association presented the chamber of commerce a plaque recognizing Nathan B. Stubblefield as the inventor of broadcast radio.

He died March 28, 1928, of natural causes, and two days later Horace Churchill, country coroner, and his son, Ronald, broke down the door to Stubblefield's cabin. He was dead on the floor.

"Be it resolved by the General Assembly of the Commonwealth of Kentucky: That the General Assembly of the Commonwealth of Kentucky hereby publicly recognizes Nathan B. Stubblefield, who was a native of the city of Murray, Calloway County, Ky., as the true inventor of the radio, and it is the sentiment of the General Assembly that said Nathan B. Stubblefield is entitled to the highest honor and respect at the hands of the people of this Commonwealth and of this nation for his outstanding service."

—Resolution by the Kentucky Legislature, 1944.

I KNEW NATHAN STUBBLEFIELD
THE GREAT MAN OF MURRAY, KENTUCKY,
WHO INVENTED RADIO

Tipton C. Wilcox

My grandfather, Tipton Harrison Wilcox, and my father, Richard Hannibal Wilcox, were good friends of Mr. Stubblefield.

My father told me that one day while in town he visited Mr. Stubblefield in his office (over the Corner Drugstore) and saw this demonstration. A cigar box was attached to the wall, with small bells on top, and a snuff can for a receiver, attached with wire. Mr. Stubblefield tapped the bells with a small hammer. Dad heard a voice say, "Hello." It was Mr. Stubblefield's son at home on the farm near Murray. This was wireless telephone–the first ever of its kind!

Dad said that when the flour mill was set up in Murray Mr. Stubblefield offered to tap the earth for electric power to run the mill. He would do it for $1500.00. Those who were involved were afraid to trust him.

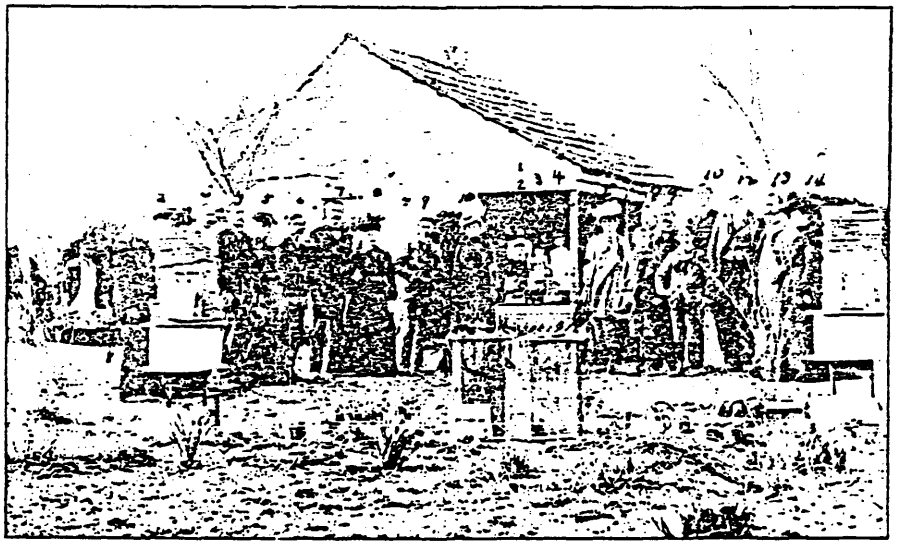
Mr. Stubblefield raised watermelons on his farm. Sometimes he stayed in the field at night to keep boys from stealing the melons. If he had any visitors he went directly to them; he knew exactly where they were. Did he have some kind of radar?

I understand that in his last days Mr. Stubblefield lost most of his property and lived by himself in very poor conditions. Therefore this story. I had a close friend, Guy Montgomery, a teacher. At this time he was seeking to be elected to the Clerk's Office in this county. He visited Mr. Stubblefield who lived in a building as we see in parks, a good roof with posts to support it (ed: a type of pole barn). Shocked corn to protect it in winter. He had electric lights, and Guy saw a tree with a nail driven in it to support both the bulb and the wire to it. The wire was simply put into the ground. Mr. Stubblefield said the Earth was the greatest magnet we knew anything about. That is where he got his power.

A few weeks after he died I was talking to Ronald Churchill, the local undertaker who took care of his body. He told me this story. Some neighbors, friends who lived near Mr. Stubblefield, told him (Churchill) that one fall when they had killed hogs and left the meat out to cool, they were sitting by the fire. The lady of the house said that she wished Mr. Stubblefield were there so they could give him some meat. In some ten or fifteen minutes Mr. Stubblefield came by, saying that he had heard her, and had come over to get some of the meat!

When I was about ten or twelve years old my father and I were standing on the court square and saw Mr. Stubblefield coming. He stopped and he and my father had a nice conversation. He put his hand on my head and told my father that if he would let him (Stubblefield) have me (as an apprentice) he would teach me all he knew in his field. This did not happen.

I understand that Mr. Stubblefield went to Washington, D.C., to get a patent on his invention, which at that time he called "Wireless Telephone." Marconi was there with a group, and managed to get Mr. Stubblefield where he was not quite normal mentally, and stole from Mr. Stubblefield what he, Marconi, lacked in the same field. This helped him get some patents and the honor. Mr. Stubblefield had demonstrated what he could do from a boat in the Potomac River. He broadcast from the boat and some officials talked to him from the land! We call it Radio today!



Nathan Stubblefield Family and Close Friends

Identifications, from left to right:
Unnumbered: Sam Stubblefield
First Series:
1, 2: Mr. and Mrs. John P. McElrath
3: O.T. Hale
4, 5: Mr. and Mrs. John H. Keys
6: James M. Cole
7, 8: Mr. and Mrs. Solon Higgins
9: O.J. Jennings
10: Mrs. Ella Hale Woodruff

Second Series (on the porch):
1-4: Stubblefield Children: Victoria, Patti, Nathan, Oliver (daughter Helen, an infant, is not in picture)
5: Mrs. Hattie Keys Beale
6: Bernard Stubblefield
7: Isaac W. Keys
8: James H. Coleman
9: Abe Thompson
10: Ben B. Keys
11: George Gatlin
12: Capt. Tipton Harrison Wilcox (great-grandfather of one of the editors)
13, 14: Mr. and Mrs. Nathan Stubblefield

Location: apparently the Stubblefield home, which now would be on the west side of North 16th Street, directly across from the commemorative marker, in Murray.

UNITED STATES PATENT OFFICE.

NATHAN B. STUBBLEFIELD, OF MURRAY, KENTUCKY, ASSIGNOR OF ONE-HALF TO WILLIAM G. LOVE, OF SAME PLACE.

ELECTRICAL BATTERY.

SPECIFICATION forming part of Letters Patent No. 600,457, dated March 8, 1898.

Application filed October 24, 1896. Serial No. 609,969. (No model.)

To all whom it may concern:

Be it known that I, NATHAN B. STUBBLEFIELD, a citizen of the United States, residing at Murray, in the county of Calloway and State of Kentucky, have invented a new and useful Electrical Battery, of which the following is a specification.

This invention relates to electrical batteries; and it has for its object to provide a novel and practical battery for generating electrical currents of sufficient force for practical use, and also providing means for generating not only a constant primary current, but also an induced momentary secondary current.

It is well known that if any voltaic couple be immersed in water or placed in moist earth the positive element of the couple will undergo a galvanic action of sufficient intensity to produce a current when the terminals of the couple are brought in contact, and this form of battery is commonly known as the "water" battery, usually employed for charging electrometers, but not capable of giving any considerable current owing to their great internal resistance. Now the principle involved in this class of batteries is utilized to some extent in carrying out the present invention, but I contemplate, in connection with water or moisture as the electrolyte, the use of a novel voltaic couple constructed in such a manner as to greatly multiply or increase the electrical output of ordinary voltaic cells, while at the same time producing in operation a magnetic field having a sufficiently strong inductive effect to induce a current in a solenoid or secondary coil.

To this end the invention contemplates a form of voltaic battery having magnetic induction properties of sufficient intensity, so as to be capable of utilization for practical purposes, and in the accomplishment of the results sought for the invention further provides a construction of battery capable of producing a current of practically constant electromotive force and being practically free of the rapid polarization common in all galvanic or voltaic batteries.

With these and many other objects in view the invention consists in the novel construction, combination, and arrangement of parts hereinafter more fully described, illustrated, and claimed.

In the drawings, Figure 1 is a side elevation of an electrical battery constructed in accordance with this invention. Fig. 2 is a central longitudinal sectional view of the battery, showing the same immersed in water as the electrolyte. Fig. 3 is an enlarged sectional view of a portion of the battery, showing more clearly the manner of winding the voltaic couple or, in other words, the wires comprising the couple. Fig. 4 is a vertical sectional view of the battery, shown modified for use with an induction-coil.

Referring to the accompanying drawings, the numeral 1 designates a soft-iron core-piece extending longitudinally of the entire battery and preferably in the form of a bolt having at one end a nut 2, which permits of the parts of the battery being readily assembled together and also quite as readily taken apart for the purposes of repair, as will be readily understood. The central longitudinally-arranged core-piece 1 of the battery has removably fitted on the opposite ends thereof the oppositely-located end heads 3, confining therebetween the magnetic coil-body 4 of the battery, said heads 3 being of wood or equivalent material. The coil-body 4 of the battery is compactly formed by closely-wound coils of a copper and iron wire 5 and 6, respectively, which wires form the electrodes of the voltaic couple, and while necessarily insulated from each other, so as to have no metallic contact, are preferably wound in the manner clearly illustrated in Fig. 3 of the drawings.

In the preferred winding of the wires 5 and 6 the copper wire 5 is incased in an insulating-covering 7, while the iron wire 6 is a bare or naked wire, so as to be more exposed to the action of the electrolyte and at the same time to intensify the magnetic field that is created and maintained within and around the coil-body 4, when the battery is in operation and producing an electrical current. While the iron wire 6 is preferably bare or naked for the reasons stated, this wire may also be insulated without destroying the operativeness of the battery, and in order to secure the best results the wires 5 and 6 are wound side by side in each coil or layer of

the windings, as clearly shown in Fig. 3 of the drawings, so that in each coil or layer of the windings there will be alternate convolutions of the copper and iron wires forming the voltaic couple, and it will of course be understood that there may be any number of separate coils or layers of the wires according to the required size and capacity of the battery. Each coil or layer of the windings is separated from the adjacent coils or layers by an interposed layer of cloth or equivalent insulating material 8, and a similar layer of insulating material 9 also surrounds the longitudinal core-piece 1 to insulate from this core-piece the innermost coil or layer of the windings.

The terminals 10 of the copper and iron wires 5 and 6 are disconnected so as to preserve the character of the wires as the electrodes of the voltaic couple; but the other or remaining terminals of the wires are brought in contact through the interposition of any electrical instrument or device with which they may be connected to cause the electric currents generated in the coil-body 4 to flow through such instrument or device.

In the use of the battery constructed as described the same may be immersed in a cell or jar 1 , containing water as the electrolyte; but it is simply necessary to have the coil-body 4 moist to excite the necessary action for the production of a current in the couple, and it is also the contemplation of the invention to place the battery in moist earth, which alone is sufficient to provide the necessary electrolytic influence for producing an electric current.

It has been found that by reason of winding the couple of copper and iron wires into a coil-body the current traversing the windings of this body will produce a magnetic field within and around the body of sufficiently strong inductive effect for practical utilization by means of a solenoid or secondary coil 12, as illustrated in Fig. 4 of the drawings.

The solenoid or secondary coil 12 is of an ordinary construction, comprising a wire closely wound into a coil of any desired size on an ordinary spool 13 and incased within a protective covering 14 of mica, celluloid, or equivalent material. The spool 13 of the solenoid or secondary coil may be conveniently secured directly on the exterior of the coil-body 4 between the heads 3 with a suitable layer or wrapping of insulating material 15, interposed between the spool and the body 4, and the terminals 16 of the solenoid or secondary coil may be connected up with any instrument usually operated by secondary currents—such, for instance, as a microphone-transmitter or telegraphic relay. The magnetic field produced by the current traversing the coil-body 4 induces a secondary current in the solenoid or secondary coil 12, when the ordinary make and break of the primary current produced within the coil 1 is made between the terminals of said coil 4. It will therefore be seen that the construction of the battery illustrated in Fig. 4 is practically a self-generating induction-coil, and it can be used for every purpose that a coil of this character is used, for as long as the coil-body 4 is wet or damp with moisture electric currents will be produced in the manner described. It will also be obvious that by reason of the magnetic inductive properties of the coil-body 4 the core-piece 1 will necessarily be magnetized while a current is going through the body 4, so that the battery may be used as a self-generating electromagnet, if so desired, it being observed that to secure this result is simply required connecting the extended terminals of the wires 5 and 6 together after wetting or dampening the coil-body.

Many other uses of the herein-described battery will suggest themselves to those skilled in the art, and I will have it understood that any changes in the form, proportion, and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

Having thus described the invention, what is claimed, and desired to be secured by Letters Patent, is—

1. A combined electrical battery and electromagnet, for use with water as an electrolyte, comprising a soft-iron core-piece, and a voltaic couple of copper and iron wires insulated from each other and closely and compactly wound together in separate insulated layers to produce a solid coil-body surrounding the soft-iron core-piece, substantially as set forth.

2. An electrical battery for use with water as an electrolyte comprising a voltaic couple of insulated copper wire and bare iron wire closely wound into a coil-body, substantially as described.

3. An electrical battery for use with water as an electrolyte comprising a voltaic couple of insulated copper and bare iron wire wound side by side in separate insulated layers to produce a coil-body, substantially as described.

4. An electrical battery, for use with water as an electrolyte, comprising a voltaic couple having its separate electrodes insulated from each other and closely wound into a compact coil-body forming a self-generating primary coil when moistened and a solenoid or secondary coil fitted on the coil-body of the couple, substantially as set forth.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

NATHAN B. STUBBLEFIELD.

Witnesses:
JOHN H. SIGGERS,
W. B. HUDSON.

SECTION 3

NATHAN STUBBLEFIELD

(No Model.)

N. B. STUBBLEFIELD.

ELECTRICAL BATTERY.

No. 600,457. Patented Mar. 8, 1898.

Fig. 1.

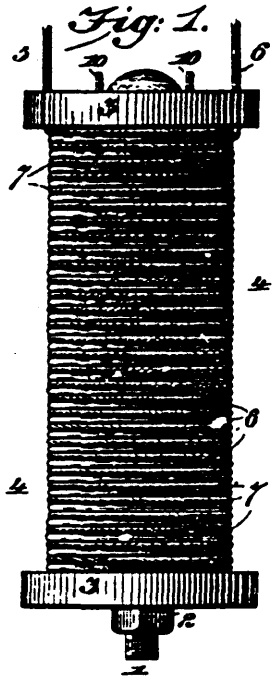


Fig. 2.

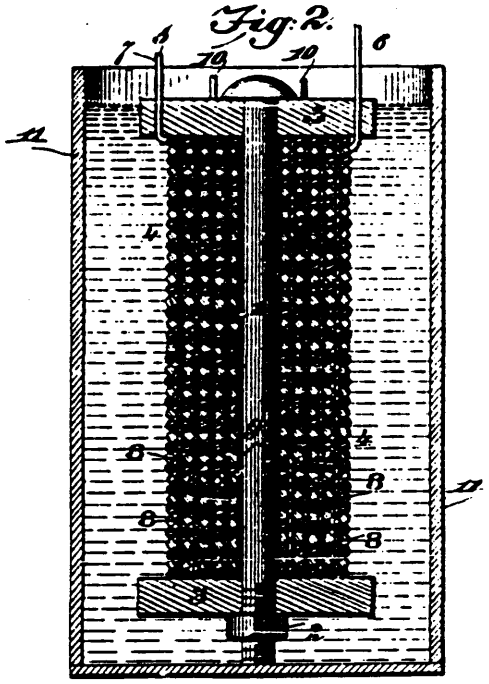


Fig. 3.

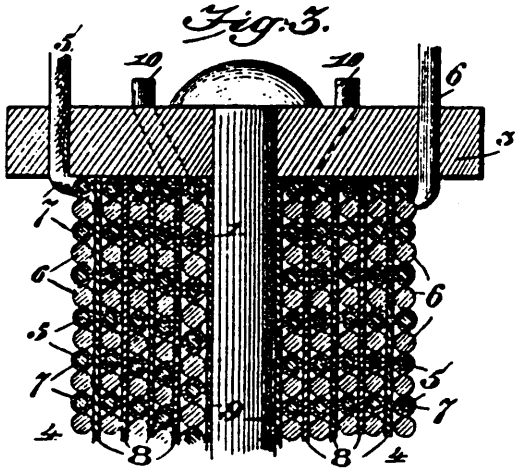
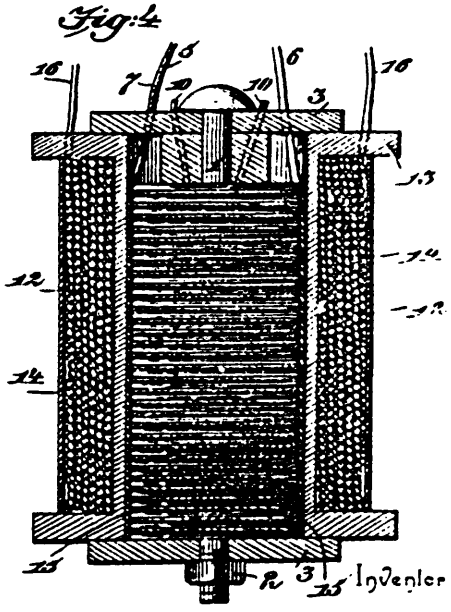


Fig. 4.



Witnesses

H. G. Dieterich

S. P. Fishburne

Inventor

Nathan B. Stubblefield

By his Attorneys.

C. A. Snow & Co.

what a tremendous boon for global communications! We have no evidence however, that Ward actually built a tower (which, by the way, looks in the patent application drawing very much like the modern space-satellite communications antenna in Andover, Maine—although, of course, operating on entirely different principles) and conducted experiments. Ward was principally an independent inventor in mechanical technology, with a concentration in railway car coupling devices. However, during the 1850s and 60s he developed a rather sophisticated semaphore signalling system for maritime communication, and published a book describing his coded symbols in some detail.[5] Sometime during this period he appears to have made the acquaintance of Mahlon Loomis and possibly was influenced by the latter's thoughts on conduction telegraphy. Loomis (1826-1886), a Washington D. C. dentist, was the principal 19th century exponent of aerial conduction communication. Loomis' thoughts on wireless transmission date back to the great auroral storm of 1859 which was particularly vexing to telegraph operators in the Northeast United States.[6] Loomis seems to have conducted several tests in the Blue Ridge and Catoctin mountain ranges of Virginia and Maryland in the 1866-72 period but a detailed account of the equipment used and persons present is lacking. However, he obtained considerable support in Congress and probably would have received an appropriation had not the financial panic of 1873 struck.[7] The most important question, of course, from the engineering point of view, is whether the Loomis-Ward system could have worked in terms of the design theory assigned to it. The answer is "no," with the qualification that under certain unusual conditions in the ionosphere, some deflection of the receiving galvanometer might be noticed. What is more likely is that Loomis radiated some electromagnetic energy from discharges of atmospheric electricity at the transmission end. Again, firm evidence is not at hand. Loomis was granted a patent for his system July 30, 1872.[8]

Although the aerial conduction scheme passed into obscurity, systems involving conduction through the ground appeared over the next few decades and have been revived in modern times. These, however, were viable systems without any question, though only over limited distances. So far as our broadcasting story is concerned, however, ground conduction becomes intertwined with certain other related phenomena in the developing telephone technology.

We mentioned earlier the experimental telephone "concerts" promoted soon after the instrument was introduced. In 1877, a telephone "broadcast" was made from New York City to Sarasota Springs, New York, using a newly developed Edison transmitter. The musical programming was heard accidently in both Providence and Boston due to electrical leakages between adjacent sets of wires on trunk lines north of New York City. Although conduction leakage through the ground was the principal cause, *induction* through the air also was involved. Within both phenomena lay mechanisms for a new mode of communication: suppose one were to purposely cause induction of energy with large loops of wire, or conduction with stakes buried in the ground—would not a useful communication device result? This line of development appealed to several late 19th century personalities, though considerable thought toward wireless techniques of this general type was in evidence even prior to 1850.[9] The crucial point to remember, however, is that the scientific base for induction-conduction communication was a natural outgrowth of conventional telegraph and telephone technology, and was not directly related to the Hertz-Marconi approach to wireless. The latter method employed *radiated* waves of high frequency which had the capability some distance. However, there are certain interrelationships between these various systems which we will describe in the following critical review of the work of one early "wireless broadcaster."

Nathan Stubblefield

Nathan B. Stubblefield (1860-1928), of Murray, Kentucky, was a self-taught tinkerer-experimenter. He is more in the tradition of Daniel Drawbaugh than Edison or any of the university savants.[10] However, he has a persistent vision of the success of his method of communication and influenced several businessmen to finance commercial exploitation. His first claim to fame, however, came via local "acoustic telephone" hookups in Murray circa 1890.[11] Following investigations into induction and conduction telephony, he developed several types of apparatus and performed some public demonstrations prior to 1900. In March 1902 he succeeded in transmitting speech from a boat in the Potomac River to shore-based receivers. Inspired by this operation he boasted of the practicability of sending simultaneous messages from a "central distributing station" and of conveying the "general transmission of news."[12]

The mathematical processes and field theory outlined above were known in 1908, but at this stage of the game, the fine points of difference between the various wireless systems were not appreciated; after Marconi's work became known in this country many were quick to point out that Stubblefield had transmitted voice (not just Morse Code) via "wireless" as early as 1892.

Who Really Invented Radio?

Continued from page 85

Capitol. But two years after its introduction, the appropriation bill still was tied up in committee.

Representative Bingham then introduced a new bill in the House, one which would incorporate the Loomis Aerial Telegraph Company with the right to sell up to $2 million in stock. That bill finally was approved in January 1873, after Loomis had patented his system.

But the incorporation measure lacked an appropriation. Loomis still had to sell stock in his new firm to gain critically needed financial support and this never is easy. At that time the country had not recovered from the jolt of Black Friday. And the few investors that could be found wanted something more secure than promises of wireless communication—an idea which brought chuckles among even some of the well-informed.

Loomis died at his brother's home in Terra Alta, W. Va., in 1886, impoverished and disheartened. He believed that history had passed him by and that others some day would get the credit which rightfully was his. He had spent the last 20 years of his life in unsuccessful attempts to gain financial support. Never was he given the chance to develop radio (or wireless, if you prefer) to a practical commercial level. George Loomis, his brother, attributed to him this death-bed statement: "I shall never see it (radio) perfected, but it will be, and others will have the honor of the discovery."

In recent years, however, there has been renewed interest in the work of Loomis. Foremost among his champions is Dr. Otis B. Young, director of atomic and capacitor research at Southern Illinois University. At the 1963 meeting of the Illinois State Academy of Science, Dr. Young reported on the work of Mahlon Loomis. And he went on to claim that the little-known dentist deserves more credit than anyone else for inventing radio.

Reaction to Dr. Young's report has varied, but most of those contacting the SIU scientist simply have asked for more information about Loomis. There was a significant international response, too. Perhaps the most notable letter from afar was that of R.W. Bell, historian for the Marconi Co. Ltd. in Chelmsford, England. Bell wrote that the Marconi Co. was founded by Marconi himself in 1897.

"A fact which is perhaps often overlooked," Bell wrote, "is that Marconi never claimed to have invented radio and always readily acknowledged the use he had made, in evolving his wireless system (his first experiments took place in 1895), of knowledge already acquired, and theories already formulated, by others."

Has history done Loomis great injustice? Dr. Young, among others, believes it has. He contends that Loomis was ahead of his time, that society was not ready to accept his accomplishments. Had it not been for Black Friday, the great Chicago fire and the reluctance of Congress, Dr. Young says, the star-crossed Loomis would have received the financial support he needed. With it, he likely would have developed radio to an extent that credit could not be denied him.

How much credit does Mahlon Loomis really deserve? Perhaps his place in history was best nailed down in his own time by one of his supporters. Said Senator Sumner, in presenting the Loomis appropriation bill to Congress, "It is certainly (either) a great case of moonshine, or it marks a great epoch in the progress of invention."

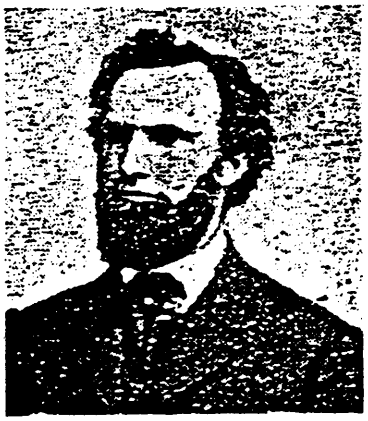
—Robert G. Hays

Loomis-Ward Aerial Conduction Telegraph

19th century thoughts on broadcasting were not limited to land line experimentation. On April 30, 1872, William Henry Ward of Auburn, New York, received a patent for a telegraphic tower (No. 126356) that might be said to embody the earliest conception of transmitting signals by wireless from a single antenna to a multiplicity of receiving aerials. In the wording of the patent:

> Different towers may be erected on the different continents, and if they are all what is technically called hooked on—that is to say, connected to the earth—a signal given at one tower will be repeated at all the towers, they being connected with each other by the aerial current.

No mention of the telephone, of course, at this early date. However, a word of caution should be mentioned here. The "wireless" system described is that of *conduction transmission*, a technique developed by telegraph engineers after 1838 when it was discovered that two wires were not necessary to complete a circuit. One could be eliminated and a return made through the ground. All sorts of intriguing possibilities were then thought of, including the idea of communicating across bodies of water. The particular technique which Ward envisioned involved the elimination of both wires, the use of the ground and bodies of water as a substitute for one wire, and the "conducting atmosphere" in place of the other wire. The inspiration for communicating through the atmosphere in this manner appears to have developed from observations of the effect of the aurora borealis on telegraph lines. Auroral storms created all sorts of havoc on domestic telegraph circuits including the freak ability to send messages over wire line with induced currents, entirely eliminating the need for batteries. If such electricity in the upper atmosphere could be harnessed,



MAHLON LOOMIS

who REALLY invented radio?

his daughter. But wireless was the love of his life.

Fortunately, Loomis himself carefully recorded his ideas and experiments in a collection of notebooks available today in the Library of Congress. In an entry dated February 20, 1864, he wrote:

"I have been for years trying to study out a process by which telegraphic communications may be made across the ocean without any wires, and also from point to point on the earth."

Loomis had a talent for description as well as an easily readable handwriting. He had this to say of the 1866 experiment, first successful wireless aerial communication on record:

"From two mountain peaks of the Blue Ridge in Virginia which are only about two thousand feet above tide water two kites were let up—one from each summit—eighteen or twenty miles apart. These kites had each a small piece of fine copper wire gauze about fifteen inches square attached to their under side and connected also with the wire six hundred feet in length which held the kites when they were up. The day was clear and cool in the month of October with breeze enough to hold the kites firmly at anchor when they were flown. Good connection was made with the ground by laying in a wet place a coil of wire one end of which was secured to the binding post of a galvanometer.

"The equipments and apparatus at both stations were exactly alike. The time pieces of both parties having been set exactly alike, it was arranged that at precisely such an hour and minute the galvanometer at one station should be attached, or be in circuit with the ground and kite wires. At the opposite station the ground wire already being fast to the galvanometer, three separate and deliberate half-minute connections were made with the kite wire and instruments. This deflected, or moved, the needle at the other station with the same vigor and precision as if it had been attached to an ordinary battery.

"After a lapse of five minutes, as previously arranged, the same performance was repeated with the same result until the third time. Then fifteen minutes precisely were allowed to elapse, during which time the instrument at the first station was put in circuit with both wires while the opposite one was detached from its upper wire, thus reversing the arrangements at each station. At the expiration of the fifteen minutes the message or signals came in to the initial station, a perfect duplicate of those sent from it, as by previous arrangement. And although no 'transmitting key' was made use of nor any 'sounder' key to voice the messages, yet they were just as precise and distinct as any that ever sped over a wire."

Thrilled with his success—which he said was "confidently expected"—Mahlon Loomis sought to reach new and greater heights in wireless communication. During the next two years he planned an elaborate project in which he would build and communicate between two wireless stations on peaks in the Rocky Mountains. He also was beginning to talk of sending wireless messages around the earth.

Fortunately, he found ready investors to

support his work, wealthy men anxious to share the financial success they expected him to have. A group of Boston promoters agreed to invest funds in further development of the visionary dentist's discovery. Loomis' future looked bright.

But the Black Friday panic struck on Sept. 24, 1869, and investors found themselves with nothing to invest. Loomis then turned his outstretched hand toward the prosperous Mid-West and its booming trade center, Chicago.

Again, he found businessmen with ready cash. Promised $20,000, he excitedly laid new plans. Then Mrs. O'Leary's cow kicked over a lantern and set the Windy City ablaze, reducing the holdings of Loomis' backers to smoldering rubble. Many of the pioneer radio explorer's hopes also must have gone up in flame.

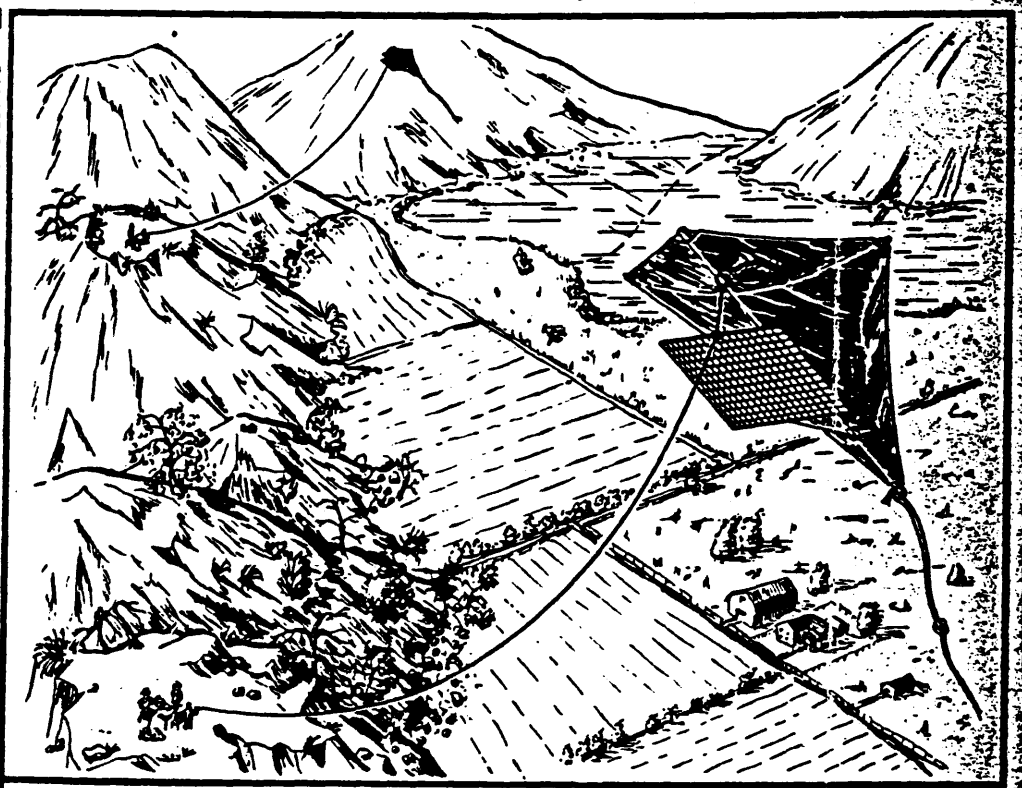
Though Loomis had many supporters, he drew his doubting Thomases, too. Some, in his words, regarded him "as a crank," "a fool," if not some kind of nut. [illegible] had accepted his claims. The [illegible] Journal of Commerce, for example, had [illegible] to say on Feb. 5, 1873:

"As we understand the Loomis plan, it [illegible] something to this effect—and readers are cautioned not to laugh too boisterously at it, [illegible] also not to believe it till demonstrated."

Other newspapers also were highly critical, though many supported him. Patience and persistence, however, are qualities the inventor must have, and Loomis was no exception. Matter of fact, he had so much of both that radio became his all-consuming interest. Dentistry, his profession, took a back seat.

Naturally, his work had attracted attention in Congress. As early as January 1869, Senator Charles Sumner of Massachusetts introduced a bill which would have appropriated $50,000 to support development of the Loomis wireless system. As his other sources failed, Loomis cast a hopeful eye toward the

[*Continued on page 114*]



Artist's concept of world's first transmission and reception of wireless signals. Sketch in one of Loomis' notebooks indicates that the two mountain peaks were located approximately 14 miles apart.

The first
RADIO
system of signalling by, was described by Mahlon Loomis of Washington, D.C. in a paper dated 21 July 1866. During October of the same year Loomis succeeded in conveying messages over a distance of 14 miles between Catochin Ridge and Bear's Den in Loudoun County, Va. The experiment was witnessed by US Senator Samuel C. Pomeroy of Kansas and US Representative John A. Bingham of Ohio. The inventor gave the following account of the method by which he achieved radio telegraphy:

From two mountain peaks of the Blue Ridge in Virginia which are only about two thousand feet above tide water, two kites were let up – one from each summit. . . . These kites had each a small piece of fine copper-wire gauze about fifteen inches square attached to their underside and connected also with the wire six hundred feet in length which held the kites when they were up. . . . Good connection was made with the ground by laying in a wet place a coil of wire one end of which was secured to the binding post of a galvanometer. The equipments and apparatus at both stations are exactly alike. The time pieces of both parties having been set exactly alike, it was arranged that at precisely such an hour and minute the galvanometer at one station should be attached, or be in circuit with the ground and kite wires. At the opposite station the ground wire being already fast to the galvanometer, three separate and deliberate half-minute connections were made with the kite wire and instruments. This deflected, or moved, the needle at the other station with the same vigour and precision as if it had been attached to an ordinary battery.

After this initial demonstration, Loomis continued his experimental work, and, according to a number of reports, he erected a pair of permanent steel radio masts. On 20 July 1872 he was granted the world's first wireless patent for an 'Improvement in Telegraphing'. In January of the following year Congress passed a Bill incorporating the Loomis Aerial Telegraph Co with the right to sell stock to the value of $2 million, but in a period of severe financial blight the necessary funds were not forthcoming and Loomis was obliged to struggle on with his research without capital until his death in 1886.

GB: The first system of radio communication was devised by David Edward Hughes, who discovered in 1879 that a microphone connected to a telephone receiver would emit a sound whenever the circuit in his induction balance was broken. Further experiments conducted at his house at 40 Langham Street in London – about a minute's walk from the present Broadcasting House – proved that a feeble electric spark in any circuit gave out such intense currents that they could be detected by a microphonic joint with a telephone ear-piece in any part of the building. As the maximum distance between the farthermost rooms of his house was only 60ft, Hughes obtained greater range by setting the transmitter in operation and walking up and down Great Portland Street with the receiver in his hand and the telephone to his ear. The signals increased in strength until he had progressed some 60yd from the transmitter, then diminished until at 500yd they could no longer be heard with certainty.

Hughes exhibited his method to Sir W.H. Preece and Sir William Crookes in December 1879, and again to Prof. Huxley and Sir George Stokes on 20 February 1880.

who [illegible] invented radio?

AUTHORITIES pretty much agree that Edison came up with the first diode. And there's not much doubt that DeForest put in a grid. But exactly who invented radio?

Guglielmo Marconi, says the Encyclopedia Britannica, was " . . . the inventor of a practical system of communicating intelligence without the use of connecting wires . . . " But was he first in the field? Not by a long shot. An American, Nathan B. Stubblefield, said EI in its July 1961 issue, well might have been " . . . the true father of radio . . . "

Now another candidate comes over the horizon.

Had it not been for two of America's worst disasters—the Chicago fire of 1871 and the Black Friday financial panic two years earlier—a man named Mahlon Loomis might have gone down as the inventor of radio. For these dark events, along with the traditional fickleness of the U.S. Congress, cost Loomis financial backing. With money behind him, Loomis (the man in our photo above) might have made a major mark in history.

As it stands, Loomis' chief accomplishment is a matter of record. On July 20, 1872, he received his greatest claim to fame. U.S. Letters Patent No. 129,971 and titled Improvement in Telegraphing was awarded for a wireless system Loomis had developed. Though no voice communication was involved, Loomis is credited with sending wireless messages between two mountain peaks in Virginia in October of 1866—29 years before Marconi's experiments, 11 years before Hertz even had pinned down the nature of electromagnetic waves.

Loomis' 1866 experiment as imagined by one artist of the day. Sketch is on file in Patent Office.

Spectators present at that historic first included Senator Samuel C. Pomeroy of Kansas and Representative John A. Bingham of Ohio. Both offered valuable support during later efforts by Loomis to obtain government backing for development of his discovery.

Born in Fulton County, N.Y., on July 21, 1826, Loomis moved as a boy to Virginia. As a young man, he studied dentistry in Ohio, later practiced his profession in various areas before moving to Washington, D.C. In 1854, he patented a process for making false teeth. But even then he must have been more interested in communications than in dentistry. Sure, the tooth business fed him, his wife and

(Bear's Den to Catoctin
(Loudoun County, Va.

First public demonstrations - October 1865
(From Loomis' Diary)

"From two mountain peaks of the Blue Ridge Mts. of Virginia, which are only about 2000 ft. above tidewater, two kites were let up, one from each summit, 18 or 20 miles apart. These kites had each a small piece of fine copper wire gauze about 15 inches square to their undersides and connected also with the wire 600 ft. in length which held the kites wher they were up. The day was clear and cool in the month of October, with breeze enough to hold the kites firmly at anchor when they were flown.

Good connection was made with the ground by laying in a wet place a coil of wire, one end of which was secured to the binding post of a galvanometer. The equipment and apparatus at both stations were identical. It was arranged that at precisely such an hour and minute the galvanometer at one should be attached, to be in circuit with the ground and the wires. At the opposite station the ground wire, being already fast to the galvanometer, three separate and deliberate half-minute connections were made with the kite wires and the instrument. This deflected or moved the needle at the other station with the same vigor and precision as if it had been attached to an ordinary battery. After a lapse of five minutes, as had been previously arranged, the same performance was repeated with the same results until the third time. Then fifteen minutes were allowed to lapse, during which the instrument at first station was put in circuit with both wires while the opposite one was detached from its upper wire, thus reversing the arrangements at both stations. At the expiration of 15 minutes the message, or signals, came into the initial station, a perfect duplicate of those sent from it, as by previous agreement.

And, although no "transmitting key" was made use of, nor any "sounder" to voice the message, yet they were just as exact and distinct as any that ever travelled over a metallic conductor. A solemn feeling seemed to be impressed upon those who witnessed the little performance, as if some grave mystery hovered around the simple scene, notwithstanding the results were confidently expected, although the experiments had been continued for nearly two days before the line would work, and even then it continued to transmit signals only about three hours when the circuit became suddenly inoperative by the moving away of the upper electrical body.

Hence it is that high regions must be sought, where disturbing influences cannot invade, where electrical energy is stored up in a vast unbroken element, enabling a line to be worked without interruption or possible failure. No speculation need be indulged as to whether the theory is correct, for theory and speculation must stand aside, whether they will or not, and square themselves with the demonstrated truth".

Loomis made many sketches - one is proof of fallacy of general idea that Marconi was first to use kites to elevate aerial.

Dr. J. H. Rogers to relative - "Dr. Loomis had the aerial and he was the first one to have it. He sent up kites and hung copper wire on them. He also had the underground idea and it was after talking with him that I started out to try to perfect the underground system of communication, which I finally did and which assisted materially in the late war".

Loomis died broken and unsung - quotes letter of Judge George Loomis to "Sister Achsah" (widow).

In 1869 he succeeded in prevailing upon a number of Boston capitalists to advance enough money to put his discovery on a commercial basis. Everything was going beautifully when the greatest financial collapse (Black Friday), that has ever been known in this country caused his backers to lose everything they possessed.

Loomis, patient and careful, hurried back to his little dental office on Penn. Avenue, where he remained long enough to earn the necessary cash to take him to Chicago. In 1871 he went to that city and presented his ideas to some moneyed men, who agreed to finance him. Providence had more bad luck in store for this unfortunate inventor. This time it was Mrs. O'Leery's perverse cow that interfered with Loomis's success. The great fire that swept through the city reduced his supporters to poverty, and he again found it necessary to return to his dental office.

On West Springfield's beautiful "common," in the part called Park st, stands the house he owned and occupied until 1859, where he worked perfecting plans for his "Loomis aerial telegraph" system.

The cottage was built in 1850 on an acre lot valued at $333, at a cost of about $1500, and the ground around it was "fertilized" with burled copper wiring, etc, connected with a battery in the house. The Rawson gardens at Arlington, with electrical forcing of crops and steam-heated soil, is a modern adaptation of this same idea. The system was very successful in its working on the Loomis lot 50 years ago, and much of the produce was phenomenal.

Here Dr. Loomis planned his apparatus and though out his many lectures on the subject, some of which were published.

After Congress began the discussion of his bill for incorporation of a company, and Sumner, Aldrich, Wilson, Bingham and others had made speeches favoring its passage, the papers of the country, with the exception of those in Washington became very skeptical, commenting sarcastically upon the "chimerical scheme."

Frank Leslie's illustrated Weekly was another exception, publishing in 1868, pictures of Dr. Loomis' "successful experiments in communication without the aid of wires," between two Blue Ridge peaks, and in the presence of officials from the Smithsonian institution.

In 1873 President Grant signed the Loomis bill. Dr. Loomis lectured far and near on his system, raising money for experiments on a larger scale.

Finally, the sum of $20,000 was raised, and an expedition was actually started to experiment between two mountain peaks in the Sierras, when Wall street's "Black Friday" came, ruining most of

(Mr. Foster still speaking.) 3 (Page illegible)

May 21, 1874.

"This theory assumes that the earth itself, the atmosphere surrounding it, and the infinite depths of space encompassing this aerial world, contains a succession of concentric circles or planes of electricity of which those nearest the earth are perpetually disturbed by oceanic currents, atmospheric changes, alternation of day and night, and the ever-varying effects of solar radiation and lunar influences: but that above those pierced perhaps by the loftiest mountains, are concentric circles, or vast surrounding seas of undisturbed electricity, which may be affected by any inter-penetrating galvanic force from beneath, causing electrical vibrations, or waves, to PASS FROM THAT POINT WITHIN SUCH ELECTRICAL PLANE AROUND THE WORLD? AS UPON THE SURFACE OF SOME QUIET LAKE ONE WAVE CIRCLET FOLLOWS ANOTHER FROM THE POINT OF DISTURBANCE TO THE REMOTEST SHORES, SO THAT FROM ANY OTHER MOUNTAIN TOP UPON THE GLOBE ANY CONDUCTOR WHICH SHALL PIERCE THIS PLANE AND RECIEVE THE IMPRESSED VIBRATION, MAY BE CONNECTED TO AN INDICATOR, WHICH WILL MARK THE LENGTH AND DURATION OF SUCH VIBRATION, AND INDICATE BY ANY AGREED SYSTEM OF NOTATION, CONVERTIBLE INTO HUMAN LANGUAGE, THE MESSAGES OF THE OPERATOR AT THE POINT OF FIRST DISTURBANCE; and thus not only from one, but many mountain tops, piercing far above the circumbient atmosphere, the devotee of science and the solemn student of nature, may gather the unwritten messages of interest, or affection from the silent solitudes of nature and the cerulean depths of heaven, with unerring accuracy, and transmit them to the denizens of all lands by the mundane machinery of telegraphic instrumentalities.

"Such, Mr. Speaker, in brief, is the outline of this simple but marvelous theory which the committee on commerce have the honor of submitting for your consideration.

Oxygen stands in the same relation to hydrogen, that the outside of a Leyden jar stands to the inside; and the same that the positive pole of a battery stands to the negative; and the same that the atmosphere stands to the Earth (?) Franklin

Take "Electricity" from the earth (as a battery) and give it to the atmosphere (as a wire)

Franklin

SKETCH OF MAHLON LOOMIS

Dr. William J. Hoggin
of Warrenton, Va.

Dr. Mahlon Loomis, dentist, after experiments beginning in 1865, sent the first aerial wireless signals in 1868, from Bear's Den Mountain to the Catoctin Ridge (Loudoun County, Virginia), a distance of fourteen miles. The aerials used were gilded kites, elevated by copper wires.

Senator Sumner, encouraged by a previous federal grant to Morse, introduced a petition in the U.S. Senate in 1869, requesting an appropriation of $50,000 to aid Loomis in his experiments. Opposition led to the later deletion of the appropriation provision, but the Loomis Aerial Telegraph Company was chartered by Congress in 1873, closely following the patent issuance of 1872.

Eastern capitalists, interested in financing further experimentation were wiped out in the depression of 1869, and ill fate blaked Loomis again in 1871 when new backers were reduced to want b· the Chicago Fire.

From this point until his death Loomis practiced dentistry desultorily and just sufficiently to gain funds for continued experimentation. In the late 1870s he erected towers for the support of metal aerial rods on two mountain tops, twenty miles apart, in West Virginia, and reported marked success for months at a time, both in usual tests and in repeated demonstrations (1879) that the telephone could be used as easily as the Morse instrument in the aerial system.

The first to envision the air as a medium of wireless messages, the first to demonstrate its practicability, and the definite contributor of the antenna - Loomis died in 1886 with an abiding conviction in the value of his discovery. In an address before the Franklin Institute (1881), he appraised the potentialities of stratospheric communications with his characteristic poetic expression - "In this dominion is the Home of that mystic Needle which points the way to all other lands and space". Prophetic indeed, in view of today's developments.

Nathan Stubblefield, ¾ of a mile from Central Office, receiving messages by Wireless Telaphone. Note the two steel rods in the ground, which establish connection with the electrical currents of the earth, being connected by 30 feet of wire attached to the receiver.

battery had an output of ". . . slightly less than one volt." But the cell ". . . may be connected up in series to obtain any required voltage . . ."

[13] Letter of Byron F. Johnson to James L. Johnson, dated May 18, 1961. Stubblefield Papers.

[14] *St. Louis Post Dispatch*, January 19, 1902.

[15] *Ibid.*

[16] An account of the January 1, 1902 demonstration and Bernard's role in his father's work was contained in Edward C. Lambert, "Let's Hear It For Bernard Stubblefield!," *TV Guide*, October 10, 1970, 18-20.

[17] *Washington Times*, March 21, 1902 and *Evening Telegram* (New York City), March 21, 1902.

[18] *Washington Post*, August 10, 1940.

[19] *Ibid.*

[20] See David L. Woods, "Semantics versus the 'First' Broadcasting Station," JOURNAL OF BROADCASTING, XI:3:199-207 (Summer, 1967); and Elliot N. Sivowitch, "A Technological Survey of Broadcasting's 'Pre-History,' 1876-1920," JOURNAL OF BROADCASTING, XV:1:1-20 (Winter, 1970-71).

[21] *Evansville Press, op. cit.*

[22] M. T. McCarthy, (Murray) College News Staff, "Murray Woman Witnessed Demonstrations on the Potomac," Unidentified clipping, Stubblefield Papers.

[23] Alvin F. Harlow, *Old Wires and New Waves* (New York: D. Appleton-Century Co., 1936), 383-387.

[24] Letter of the Arizona Corporation Commission to Tom W. Hoffer, dated May 14, 1968. The Wireless Telephone Company of America terminated following a 25-year statutory limitation on May 22, 1926.

[25] According to L. J. Hortin, the tests in New York City weren't as successful as those in the rural areas. *Evansville Press, op. cit.*

[26] *Philadelphia Inquirer*, May 31, 1902. In another article, Stubblefield told reporters that his system utilized "earth currents." ". . . disturbance in the earth's magnetic field results and this disturbance . . ." is detected by another receiver. *Philadelphia Press*, June 1, 1902; *Philadelphia North American*, May 31, 1902 and *Philadelphia Times*, June 3, 1902.

[27] Brochure, "The Wireless Telephone Company of America," Stubblefield Papers.

[28] George W. Pierce, *op. cit.*, 77-78. (#3)

[29] Brochure, "The Wireless Telephone Company of America," undated. Stubblefield Papers.

[30] Waldon Fawcett, "The Successors of the Telephone," *Harper's*, February, 1902, 495. For a summary of wireless techniques during this period see A. Frederick Collins, "The Collins Wireless Telephone," *Scientific American*, July 19, 1902, 37.

[31] The speculation surrounding the Collins-Stubblefield relationship arises from the circumstances of Stubblefield's Philadelphia tests in May 1902; the Collins article cited in note 30 in which Collins described the Philadelphia tests as "his own;" Stubblefield's sudden resignation from the Wireless Telephone Company of America; and Stubblefield's public statements about his

"Hertzian secrets." One result of the mysterious relationship, according to some persons consulted in writing this article, was that the Collins wireless telephone schematically depicted in his article might have also been the Stubblefield apparatus used in 1902. Collins patented his device. He also patented another wireless telephone system in 1906. In 1913, Collins and others were convicted of mail fraud in conjunction with the stock solicitations of their telephone company. The gaps linking the Stubblefield and Collins systems are large, to be sure. No technical diagrams of the 1902 Stubblefield system were discovered. The significant point about the relationship, however, was the idea that the Collins schematic depicted an apparatus which might have generated radio frequencies. One key element was what Collins called a "variator." He later changed the label to "an electric arc." This device produced oscillations similar to another method used by Valdemar Poulsen. On the surface it would appears that Stubblefield, using his electric batteries, was capable of assembling such a device. In support of this view, James Skelton pointed out that J. T. Cavender, an electrical engineer, made the following observations about Stubblefield's device: ". . . By tapping the receiving coils at certain intervals Stubblefield was able roughly to adjust the inductance, thus roughly tuning the receiver. In order to transmit a voice without wires, he had to have a source of alternating current at high frequency. The energy for this radio frequency seems to have come from a source of his own invention, a 'primary battery.' . . . To vary the amplitude of the current he had a "mysterious" small box." Cavender's observations were published in an undated edition of the *Kentucky Engineer* among the Stubblefield Papers. Letters of James M. Skelton to Tom W. Hoffer, dated August 27, 1970.

[32] Letter of Nathan B. Stubblefield to S. N. Turner, Secretary of the Wireless Telephone Company of America, dated June 19, 1902. Stubblefield Papers.

[33] Unidentified clipping among the Stubblefield Papers.

[34] *Evansville Press, op. cit.*

[35] The Wireless Telephone Company . . . (form letter) to Hugh P. Wear, dated August 1, 1902. Stubblefield Papers.

[36] U. S. Patent No. 887,357, dated May 12, 1908. Serial No. 366,544, dated April 5, 1907. The omissions in the quoted text were numbers which referred to diagrams accompanying the letters patent.

[37] *New York Times*, January 11, 1913.

[38] Unidentified newspaper clipping (1938) among the Stubblefield Papers. In a telephone interview with L. J. Hortin, Murray, Kentucky, on June 16, 1970, he stated that some persons told him that Nathan Stubblefield developed a television apparatus but that he (Hortin) doubted this.

[39] Lucas, *op. cit.* (#9)

[40] Letter of Conn Linn to Vernon Stubblefield, Murray, Kentucky, dated September 1, 1950. Stubblefield Papers. A Murray, Kentucky, AM radio station was licensed by the FCC in 1948, and, in memory of Nathan B. Stubblefield, the station signed on with the call "WNBS."

Encyclopedia, ed. Dr. John Kleber, page 1 to be published about July 1, 1990.

Nathan Beverley Stubblefield was born near Murray, Kentucky, December 27, 1860, the son of William Jefferson Stubblefield of Calloway County and Victoria Frances Bowman of adjacent Graves County. Some say the date was November 22, 1860. His sister Aline called him a "moody genius." Her busband Kelsie Holland almost came to blows with him on occasion. Schoolmates a neighbors alike regarded him as an "odd ball."

He attended the common schools of Calloway County starting the primer in the fall of 1866 to the Grammar School at Utterback. Like Thomas Edison he did not like school and did not do well. There were not eight grades as in our elementary systems today but with the McGuffey' six readers and the primer there were seven years of study. Thus at age 15 Nathan was eager to quit school and did so. The county then had no high schools. Neither Murray State (1922) nor even Western (1906) existed.

In the next six years before his marriage he spent some time farming but mostly reading such magazines as the Scientific American and all the science books he could locate. Some he read at his cousin's drug store, Dale & Stubblefield, who owner was Vernon Stubblefield, Sr.

Nathan was married at age 21 to a local lady whose family had moved from adjoining Graves County, Ada May Buchanan, (born January 18, 1864, died January 8, 1937 in Clarksville, Mississippi,) the daughter for J.R. Buchanan and Elizabeth Jones Buchanan. Then Children were born to this union but only six reached adulthood. They were:

1. Bernard, oldest, helped with experiments, lived in New York; died in Mississippi.
2. Victoria Edison, married a man named Whitaker.
3. Patty, married J. H. White, 610 Pulaski Street, Little Rock, Arkansas;died Houston,TX.
4. Nathan F., lived in Tulsa, Oklahoma.
5. Helen, married a man named Sartin, and lived in Oklahoma City.
6. Oliver J., lived in California.

Though there were ten children, Nathan and Ada May were not a close couple. There were a number of separations and after the youngest child left, the wife moved to Arkansas to be near Patty. Just prior to Nathan's death, Mrs. White told a reporter for the Arkansas Gazette, "We went different ways simply because we could not get along together."(Feb 23, 192(Mrs. Stubblefield had moved to Mississippi before her death, January 8, 1937.

By 1887 at age 27 Stubblefield had built a number of telephones. He knew about James C. Maxwell's theory of electromagnetic waves and Heinrich Hertz' proof of Maxwell's theory. Marconi, who was 14 years younger, worked with Morse Code. Nathan what locals thought to be a great improvement in the wired telephone and it became the second of his patents in 1888.

(more)

for the KY Encyclopedia, Dr. John Kleber, ed; ready about July 1, 1990.

The first was for a lamp lighter; the third, an electric battery, and the fourth, for his mobile radio-transmitter receiver bearing the U.S. patent number 887,357 and dated May 12, 1908. One of the mysteries for historians is why he waited so long since he demonstrated it publicly in Murray in 1892 and before the St. Louis Post-Dispatch reporter, January 1, 1902.

He had shown the invention to Dr. Rob Mason, a physician friend, but the first genuinely public demonstration was performed for attorney friend, Dr. Rainey T. Wells; Dr. Wells, a prominent politician, attorney and educator, was the founder of Murray State University. Here is a description of that event:

> Stubblefield handed Wells a device and asked him to walk far enough away so that he could not hear Stubblefield by the unaided ear. Wells said, 'I had hardly reached my post... when I heard 'Hello Rainey' come booming out of the device. I jumped a foot and said to myself, "This fellow is fooling me. He has wires someplace.' I moved a few feet to the sid but all the while Stubblefield kept talking to me...but there were no wires, I tell you."

This 1892 incident means Stubblefield had transmitted voice by wireless long before Marconi, Fessenden, and Lee DeForest.

In 1930 the citizens of Murray, led by a young journalism teacher named L. J. Hortin, erected a monument to his feats. It may be seen today near the Business Building on the Sixteenth Street side of the Murray State University campus, an area once a part of his father's farm.

Stubblefield had a suspicious nature--a trait that may have contributed to his failure to patent his wireless earlier and to receive credit and financial rewards for it. His home was wired in such a manner that anyone approaching within a half mile set off a battery of bells. Only his son Bernard was allowed to see all the experiments. He was to carry on if anything happened to Nathan. Bernard lived in Murray until 1915; joined the army for a five year hitch; then opened a photostat business in New York City which he operated until his retirement in 1950. He retired to Mississippi and was never employed in any field of broadcasting.

To bring his invention to the attention of the American public, a giant demonstration, open to all, was staged in Murray on January 1, 1902. Dr. Wells had arranged for a St. Louis Post-Dispatch reporter to be in Murray to view this marvel of the ages. Local publicity brought out about 1,000 persons. Marconi had just demonstrated wireless telegraphy across the Atlantic. The St. Louis reporter quoted Nathan as saying,

(more)

"I have solved the problem of telephoning without wires through the earth as Signor Marconi has of sending signals through space. But, I can also telephone without wires through space as well as through the earth because my medium is everywhere." (St. Louis Post-Dispatch, January 10, 1902, page 1.) The reporter went on to says

"The transmitting apparatus is concealed in a box. Two wires of the thickness of a lead pencil are coiled from its corners and disappear through the walls of the room (Nathan's home,) and enter the ground outside. On top of the box is an ordinary telephone and a telephone switch... I took a seat in the box (in a small shed near the house,) and Mr. Stubblefield shouted a hellow to the house. This was a signal to his son (Bernard) to begin sending messages. I placed the receiver to my ear and listened. Presently there came with extraordinary distinctness several spasmodic buzzings and then a voice which said, "Hello, can you hear me?" They then went on about a mile (to the Calloway County courthouse,) and I heard Bernard play the harmonica."

This story created national interest and two months later he traveled to Washington, D. C. for another public demonstration arranged by Dr. Wells. On March 20, 1902 on the steamer Bartholdi off the Virginia bank of the Potomac, Stubblefield sent wireless messages to sets on shore where several Congressmen and public officials heard the demonstration.(Wash. Times, 3-31-02.) About this time Dr. Will Mason said Stubblefield told him he turned down an offer of $40,000 for his invention. (Evansville Press, Jan 17, 1937.) Later he was reportedly offered $500,000 but again refused.

Instead he accepted stock in a company called the Wireless Telephone Company of America whose incorporation papers were filed May 22, 1902 in Prescott, Arizona. (Dr. Tom Morgan in dissertation at Florida State University, Tallahassee, 1972.)

He got nothing from this since only one Stubblefield system was sold to Gordon Telephone Company of Charleston, South Carolina, to communicate with offshore islands. He commented subsequently that the "new York crowd was a bunch of damned rascals," and indeed some of the WCTA people were convicted of mail fraud. (New York Times, January 11, 1913.)

Nathan Beverley Stubblefield should receive credit as the "inventor of radio." (note: Since he is buried in Bowman Cemetery, the highway marker on US641 give his middle name as Bowman.)

BIBLIOGRAPHY:

THE STUBBLEFIELD PAPERS, a folder of clippings, pamphlets, brochures; his father's will; his father's diary kept in the Civil War; the John Waters Paper on Stubblefield; several newspaper articles written by Dr. L. J. Hortin. These are in the Forrest C. Pogue Special Collections Library at Murray State University, Dr. Keith Heim, Director.

JOURNAL OF BROADCASTING, Vol 15 cited in the paper. Besides the Elliott Sivowitch article, there is another of considerable interest by Thomas W. Hoffer beginning on page 318: "Nathan B. Stubblefield and His Wireless Telephone."

SCIENTIFIC AMERICAN, May 24, 1902, Vol. 86, page 363 ff; an article by Waldon Fawcett, "The Latest Advance in Wireless Telephony."

THE MEDIA IN AMERICA, A HISTORY, Sloan, William David, Ed., Publishing Horizons, Worthington, Ohio, 1990. This textbook contains a chapter, "Broadcasting Comes of Age," pp. 311-328 by Dr. William Ray Mofield, professor of Journalism & Radio-TV at Murray State University, Murray, Kentucky.

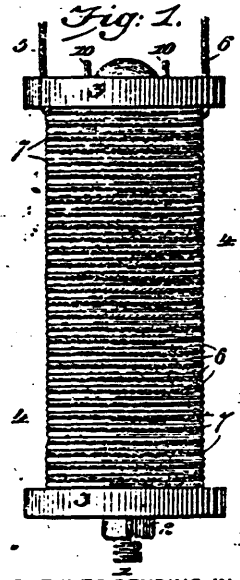
....Stubblefield's....

Electrical Battery.

[No. 600,457, Patented March 8, 1898.]

Following is a brief description of New Electrical Aparatus recently patented by us in the United States, with various practical applications enumerated.

Fig. 1.



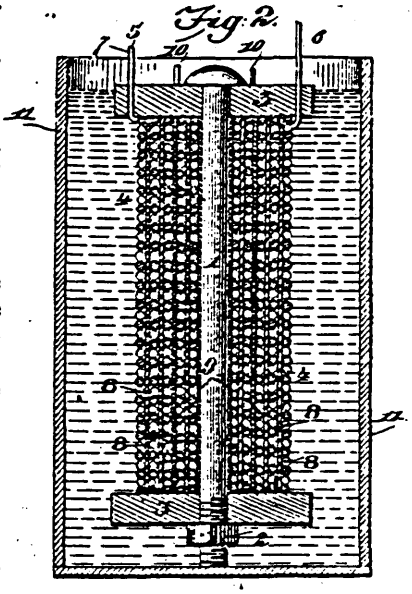
PATENTS PENDING IN ENGLAND AND CANADA.

Figures 1 and 2 show in outline the general appearance of our cell, which in construction is simply a solenoid of copper and iron wire, the seperate elements wound close and compactly about a soft iron core. As will be seen, the negative and positive elements (copper and iron) lay close together, but are insulated from the core, and throughout the entire length.

Non acidulated water or merely moisture constitutes the electrolyte, when used as other types of battery, though when used as an EARTH CELL in addition to the moisture of the earth, it is subjected to some electrical action of the earth's charge not very well understood, but presently to be further described.

When coil or cell is placed in jar as seen in figure 2 a practically constant electro motive force of something less than one volt is the output, the cell being practically free from polarization effect common with most types of battery, (cell as shown in figure 2 may be connected up in series to obtain any required voltage.)

Fig. 2.



At first thought it would seem that this cell was impractical, cost of installation considered but costs of maintainance and renewals should be the points of economy to be noticed, no attention

being necessery, while a renewal only requires a new iron element, if nondestructible insulatiou is used. While the cell is long lifed it is evident that the copper element is not acted on in a preceptible degree, after repeated renewals.

Earth Cell.

When coil figure 1 is placed in damp or moist earth, thus placing same in electrical connection with the earth's charge, as assumed, the constancy of the E. M. F. is very much greater than of any type of the well known Daniel cell, reaching into weeks and months of continuous work night and day. This also connects up in series in the ground when coils are placed but a short distance apart, thus you may obtain from these series connected earth cells, any voltage, or so to speak, with these as electrodes, you draw from the electrical energy of the earth a constant E. M. F. of commercial value—that the electrical energy of the earth is a potent factor in the electrical action of this MAGNETIC INDUCTION CELL or so called ELECTRICAL BATTERY the inventor has no doubt, but leaves this point for discussion by the more technical mind after the evidence is more fully brought out, allowing us to assume, however, that we may be within the magnetic field of some sort of a hypothesis if in reality our coil isn't influenced by the magnetic field of the earth, whether in the earth or placed in jars. Nathan Stubblefield 1898.

Electro Magnet

By the contact of the inner and outer terminals of the elements of this coil, or outer and inner as desired, the coil becomes an electro magnet with its magnetic field much intensified in larger coils. Figure 1 here refered to, has a solenoidinal length of 7½ inches, the couple or voltaic pair, having only a length of upward of 100 feet, yet this is of sufficient magnetic intensity to be applicable as an electromagnet for various uses, noticibly for submarine purposes as no exterior insulation would be needed.

[NOTE—It should be stated here that if the cell be placed in a hot Electrolyte and maintained that the efficiency of the magnetic field, or current output is very much increased.]

Note:- The Pat Office Officials would not accept any name of Magnetic Induction Cell as proposed by me.

Induction Coil

Or Combination Self Generating Aparatus.

If the coil just described as "Electromagnet", have a solenoid or socondary wire wound about it and properly insulated from the moisture of primary coil, then on make or break of the primary current a periodic current of high E. M. F. is had after the manner of the well known induction coil—this varies of course with size of primary coil. and amount of secondary wire to be cut by lines of magnetic force. As an induction coil the economic applications should be many, as this also can be placed in the earth with proper protection provided for the secondary wire, no attention afterwards being necessary.

Telephoning Through The Ground.

With coil figure 1 placed in the ground, and properly connected the perfect transmission of intelligence of sufficient volumn of sound for commercial purposes is had, using only bear wire through ground or water as line of transmission. Tests as to distance, 3,500 feet only, yet have been made, but sufficient evidence on investigation will leave no doubt as to the accomplishment any distance, as the inventor here again reasons that the electrical energy of the earth is the prime cause or factor. (In this experiment the microphone transmitter is used with a slight modification of the telephone induction coil.) This we consider a special point in favor of our earth cell, and of special commercial value as thus the dangers of lightning or the inroads ot malicious persons are obviated. For Exchange work or any arrangement this presents a practical front in point of economy over the cable or conduit systems well known, as well as in emergency cases quick equipment for subteranean or submarine telephony may be installed. Telegraphic communication with the Morse instrument is practical through the ground, for distance of a few thousand feet through the medium of this earth cell as described, but as to the limit or distance of such a system of telegraphy we are not yet prepared to state.

Overland Telegraphy.

For ordinary telegraphy this cell is specially suited. The local battery for the operation of the sounder or same for the relay is placed in the ground, thus meeting a long felt need, as all operaters know.

Relay bells, ordinary electric bells, hotel annunciators and various other practical applications may be made, such as continuously operated advertising novelties, etc.

ELECTRIC LIGHTING.

In miniature, either arc or incandescent, may be had direct up from the ground through the medium of this earth cell.

Ordinary Telephony.

For overland telephone lines one earth cell operates the transmitter nicely with slight modification of induction coil. Yet the coil placed in jars and insulated from the ground, operates the transmitter on overland lines with the telephone induction coil as you see it without any modification.

Other Phenomena

Of especial value in electro-therapeutics, or of especial value in the installation of stationary aparatus connected up from the earth, is a more recent found value of the earth cell as described in Fig. 1. This last named phenomena is not well understood by us but to be seen is certainly to be appreciated by the electro medical practitioner.

We have at the Stubblefield home, west of town, aparatus to show up what we claim to have of commercial value, and of scientific interest, and are open for correspondence and inspection to the electrical manufacturing people or to the criticisms of the scientific world.

Respectfully,

Stubblefield & Love,

Murray Ky.

Telephone Call
Love Building.

This marker, located near the Business Building at Murray State University, honors Nathan B. Stubblefield's achievement in 1892 and indicates his home's location.

D. Hogue Jan. 15- 1903

This day Nathan Stubblefield transmitted Wireless Telephone Messages One Hundred and Twenty Five Yards without ground Connection. This latest development in Wireless Telephony. The Affidavit is the first one Connecting Message Transmitted by this System Through Sixty Yards Space

Nath. B. Stubblefield

Bernard B. Stubblefield

Paul L. Stubblefield

Wit E. S. Tubblefield

This message was transmitted at 8 o'clock night D. Jan 15 by Bernard B. Stubblefield and received by Nathan B. Stubblefield the distance separating them being Sixty Yards

Paul L. Stubblefield

At Home Jan 23d 1904
This is to certify that we the under
signed date above shown heard
off a distance (roughly stepped) of
Six Hundred feet those music
by Wireless Telephone station
Stubblefield's recent invention
where in no earth connection
is used described as follows
and understood by us Circular
Coil of No 28 magnet wire 26 ft in diameter with
forty convolutions with forty
eight Cell dry battery connected
in with coil and Carbon ball
Transmitter, as transmitter of
messages, Receiver as follows
two Coils wire Seven feet in
diameter containing 33 convolutions
each first coil office wire No 20
second or top coil of No 28 magnet
wire with two Bell Receivers

Murray Ky
At Home Feb 4 1904

We the undersigned testify to the fact that this day that a coil of No 20 copper wire the coil forty feet in diameter with 42 convolutions with 48 cells of dry battery and a microphone transmitter was used in transmitting wireless telephone messages - conversation and harp music Four Hundred and Twenty Three yards from our residence with no sort of earth connection to a coil or receiver of 26 ft in diameter of No 28 magnet wire with 40 convolutions with a double pole receiver attached but no sort of earth connection. Other station laying westward in a woods from the home place located by a Dogwood tree of small size known to us.

Bernard B. Stubblefield
Paul L. Stubblefield
Vic E. Stubblefield

Note It is not understood by us or father
whether it (is) is by electromagnetic waves
that this is done or not but we know that simply
a primary current passes through coil and having
connected one to each destined
circuit or coil. Bernard B. Stubblefield
transmitted music from coil just
west of house our home to a large
on North [illegible] drain land East of our home
forked red oak tree ^ with its
forks pointing North and South
with with poison ivy growing
on its west side a snag of a
tree with knot near top rather on
the south side. Given under our
hands this Sunday night of Jan
29 all with a view of establishing
the facts as they exist for the
future interest of Nathan Stubblefield
the Inventor and our father
who was with us in this test

Pattie L. Stubblefield
Vic E. Stubblefield

a

Murray State University Murray, Ky. 42071

February 27, 1992

Dear Sir:

I happened to be in Mrs Bailey's office the other afternoon when you called concerning Nathan Beverly Stubblefield. She said that you were not especially interested in the radio experiments, but in some of Stubblefield's other work which is not so well known. She mentioned something about his work with light. I then related to her a story concerning his experiments with heat which she thought you might find of passing interest.

Some years ago a local funeral director told me the following story about Stubblefield's death. As you probably already know, he died alone and at the brink of starvation in a shack some miles outside of Murray on March 28, 1928. His body was not discovered for several days after his death and some of his cats had already eaten away at parts of his body by that time. His wife and children had long ago abandoned him to his eccentric ways and had moved to another state. The J. H. Churchill Funeral Home was called to pick up the body and Mr. Ronald Churchill went along with his father as was his custom. The family had been in the funeral business since 1886.

When they got to the cabin where Stubblefield's body was found, Ronald Churchill said that the room was filled with all kinds of scientific apparatus but one aspect of all of it made such an impression on him that he never was able to forget it. Bear in mind that this was near the end of March and the weather was still rather chilly. Also bear in mind that the man had been dead for some days - far in excess of the time any fire would have lasted in a stove or fireplace. Churchill said that when they entered the cabin, it was toasty warm! He said they found what appeared to be two large and very shiny highly polished metal plates, one positioned above the other, and that heat was radiating from around these shiny metal plates. The stove and fireplace were both cold and there was, of course, no source of electricity going to the shack.

Mr. Churchill, in telling me this story several decades later, had concluded that Stubblefield was working on some type of microwave or some type of thermal experiment which was producing heat for his cabin. Anyone who ever knew Mr. Churchill would know that he had not made this story up - that he was telling it as he saw it for he was an individual trained to pay attention to detail. I believe that he did, indeed, see what he said he saw that March day in 1928.

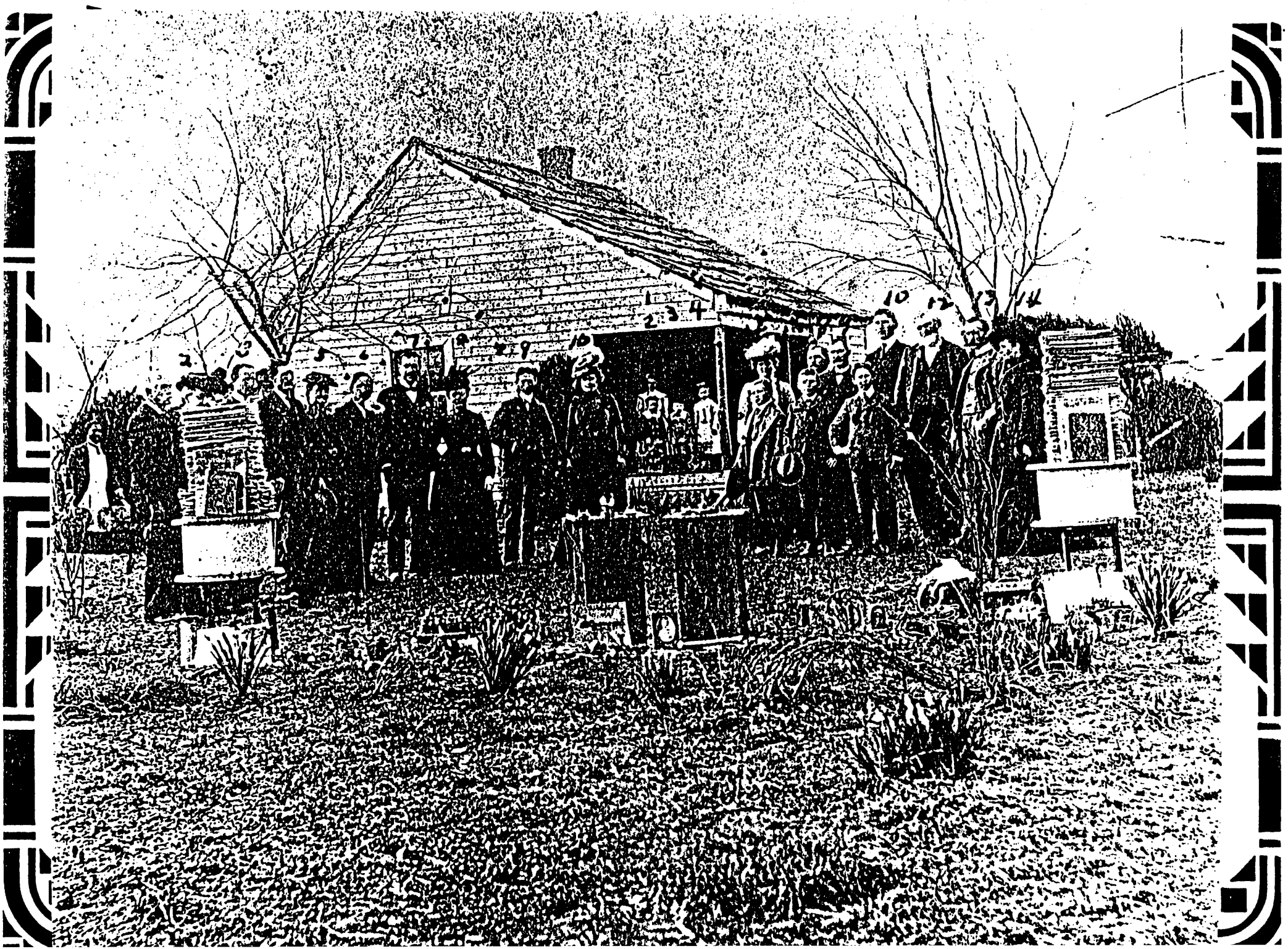
I have never written this incident down before and have never related it to very many people. To my knowledge, Churchill never wrote down the incident and there probably aren't over three or four people now living in Murray who have ever heard of it.

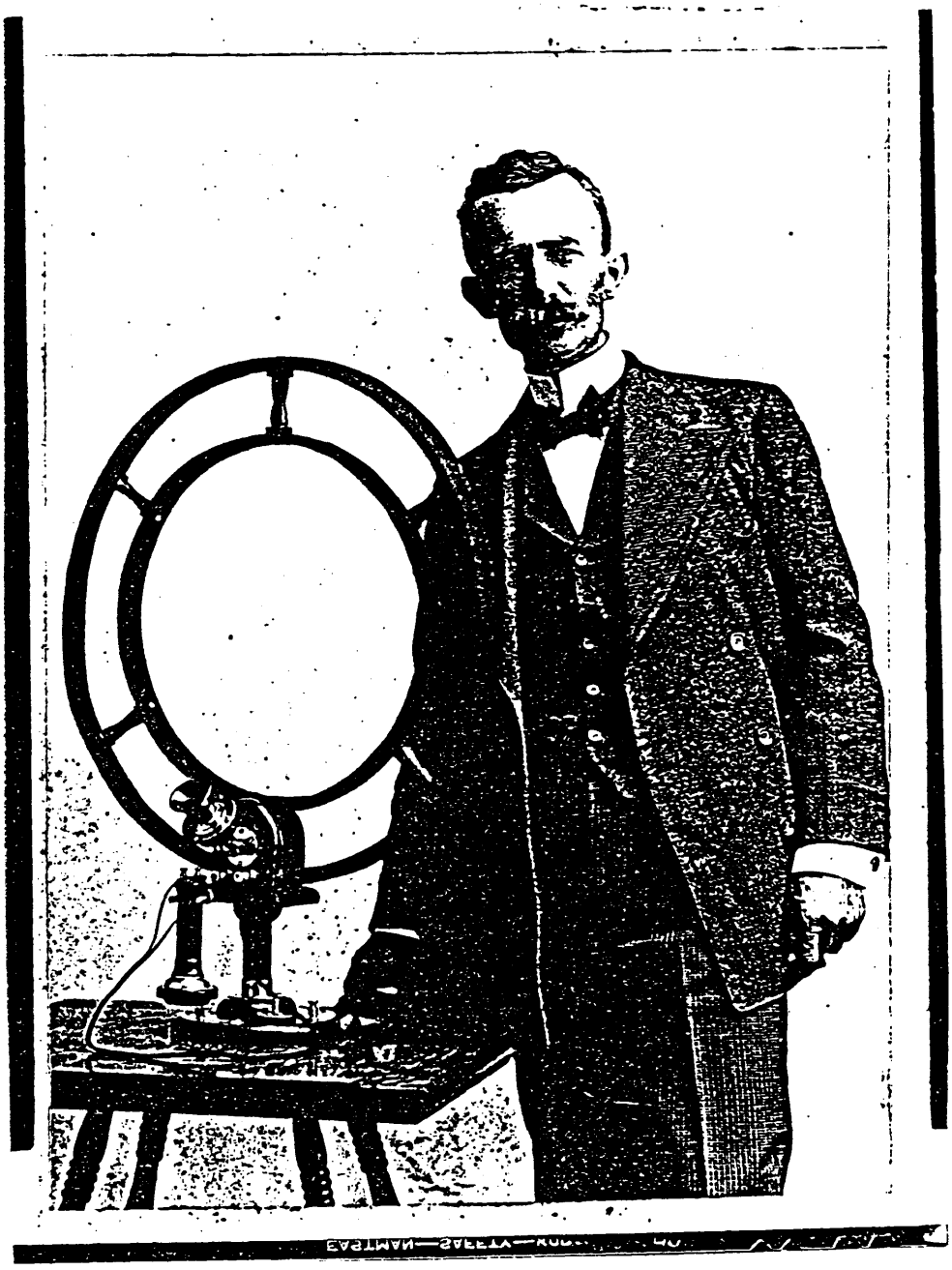
I don't intend to write down this incident for inclusion in any of the Stubblefield material we have here at Pogue Library. I just thought you might find it interesting in some way as you have expressed an interest in some of Stubblefield's work apart from the wireless experiments.

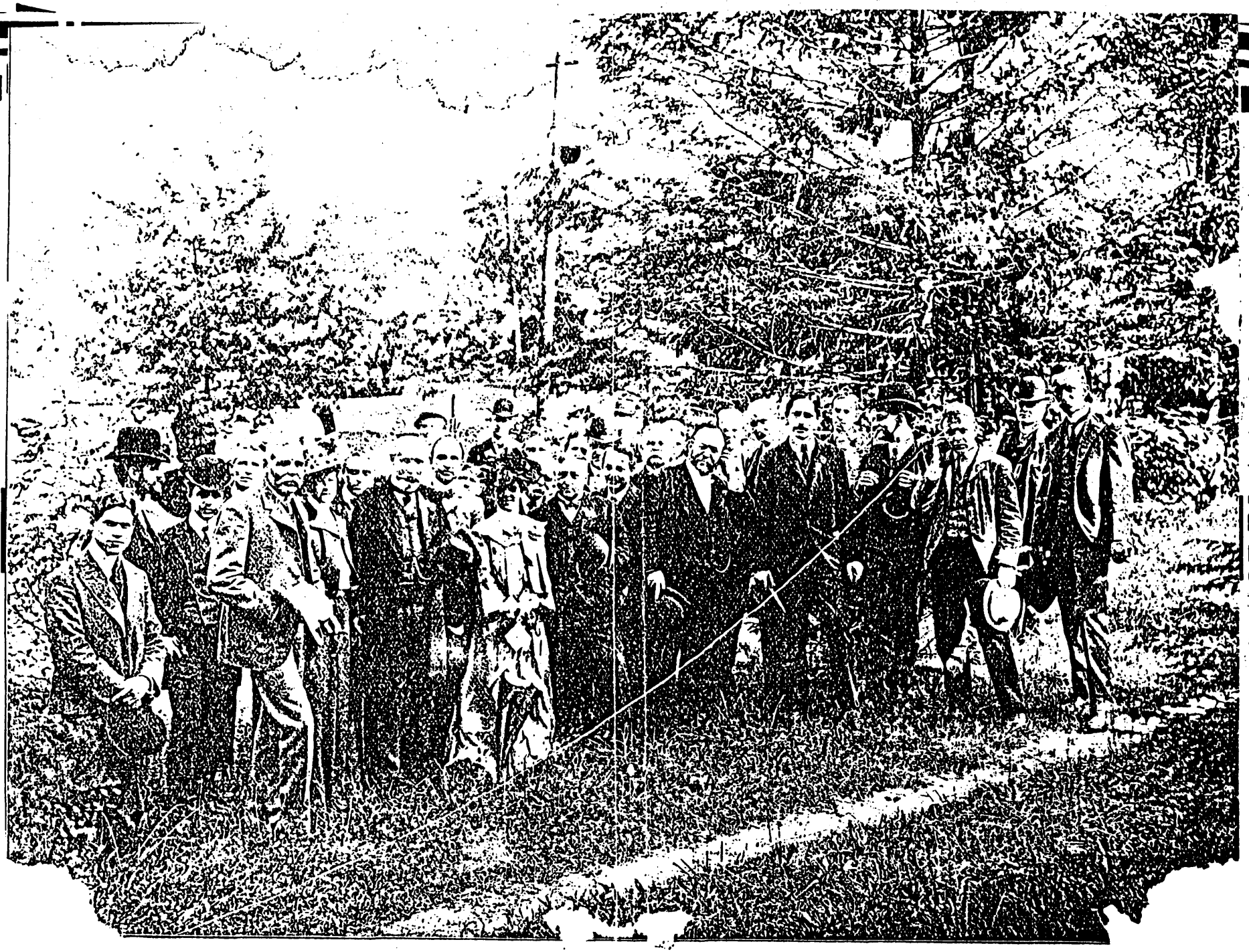
Sincerely,

Ernie R. Bailey

Ernie R. Bailey
University Archives
Murray State University
Murray, KY 42071-3309







erick Collins, of Phila., the well known electrical

y Fish, Treasurer of the Wireless Telephone

PHOTOGRAPHED DECORATION DAY, MAY 30, 1902,
AT FAIRMONT PARK, PHILADELPHIA.

4. Albert Crump, the General Manager
Stone Telephone Co.
5. Reporter for the Philadelphia Inq
6. The inventor, Nathan Dubblefie

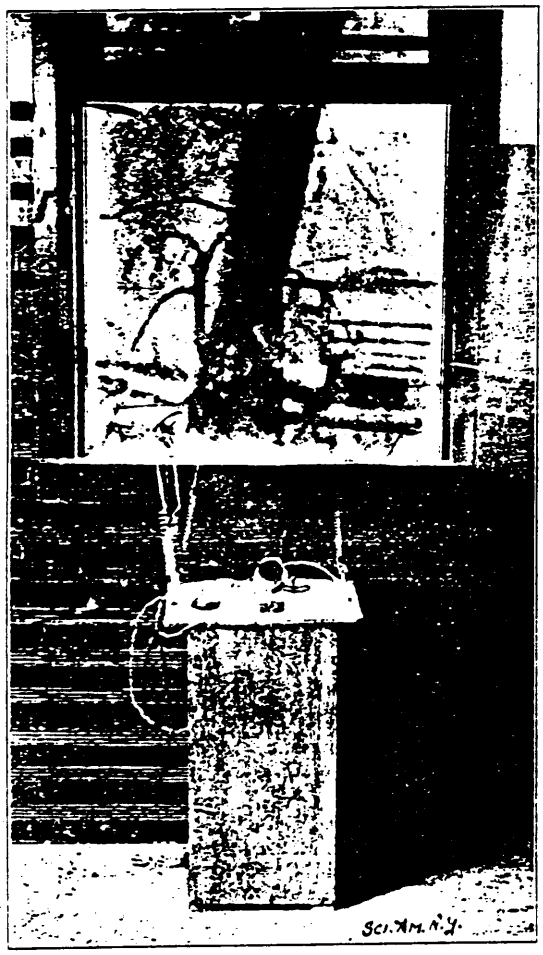
THE LATEST ADVANCE IN WIRELESS TELEPHONY.

BY WALDON FAWCETT.

The latest and one of the most interesting systems of wireless communication with which experiments have recently been conducted is the invention of Nathan Stubblefield, of Murray, Ky., an electrical engineer who is the patentee of a number of devices both in this country and abroad. The Stubblefield system differs from that originated by Marconi in that utilization is made of the electrical currents of the earth instead of the ethereal waves employed by the Italian inventor, and which, by the way, it is now claimed, are less powerful and more susceptible to derangement by electrical disturbances than the currents found in the earth and water. In this new system, however, as in that formulated by Marconi, a series of vibrations is created, and what is known as the Hertzian electrical wave currents are used.

The key to the methods which form the basis of all the systems of wireless telephony recently discovered —the fundamental principles of wireless telephony, as it were—was discovered at Cambridge, Mass., in 1877 by Prof. Alexander Graham Bell, the inventor of the telephone system which bears his name. On the occasion mentioned Prof. Bell was experimenting to ascertain how slight a ground connection could be had with the telephone. Two pokers had been driven into the ground about fifty feet apart, and to these were attached two wires leading to an ordinary telephone receiver. Upon placing his ear to the receiver, Prof. Bell was surprised to hear quite distinctly the ticking of a clock, which after a time he was able to identify, by reason of certain peculiarities in the ticking, as that of the electrical timepiece at Cambridge University, the ground wire of which penetrated the earth at a point more than half a mile distant.

Some five years later Prof. Bell made rather extensive experiments along this same line of investigation at points on the Potomac River near Washington, but these tests were far from satisfactory. It was found on this occasion that musical sounds trans-



STUBBLEFIELD APPARATUS.

mitted by the use of a "buzzer" could be heard distinctly four miles distant, but little success was attained in the matter of communicating the sound of the human voice. Meanwhile Sir William Preece, of England, had undertaken experimental study of the subject of wireless telephony, and during an interval when cable communication between the Isle of Wight and the mainland was suspended, succeeded in transmitting wireless messages to Queen Victoria at Osborne by means of the earth and water electrical currents.

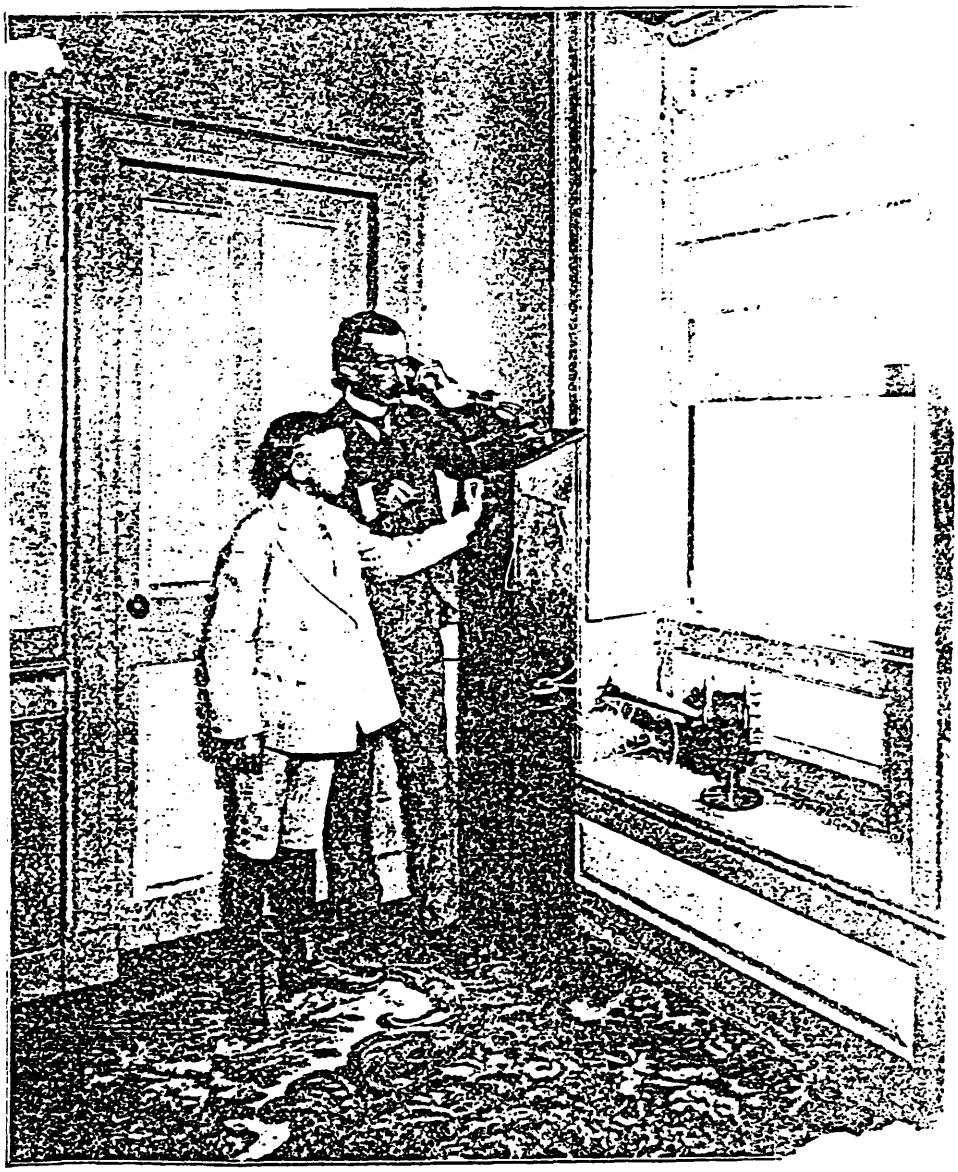
Mr. Stubblefield's experiments with wireless telephony dated from his invention of an earth cell several years ago. This cell derived sufficient electrical energy from the ground in the vicinity of the spot where it was buried to run a small motor continuously for two months and six days without any attention whatever. Indeed, the electrical current was powerful enough to run a clock and several small pieces of machinery and to ring a large gong. Mr. Stubblefield's first crude experiments looking to actual wireless transmission of the sound of the human voice were made without ground wires. Nevertheless, by means of a cumbersome and incomplete machine, without an equipment of wires of any description, messages were transmitted through a brick wall and several walls of lath and plaster. As the development of the system progressed, the present method of grounding the wires was adopted, in order to insure greater power in transmission.

The apparatus which has been used in the most recent demonstrations of the Stubblefield system, and which will be installed by the Gordon Telephone Company, of Charleston, S. C., for the establishment of telephonic communication between the city of Charleston and the sea islands lying off the coast of South Carolina, consists primarily of an ordinary receiver and transmitter and a pair of steel rods with bell-shaped attachments which are driven into the ground to a depth of several feet at any desired point, and which are connected by twenty or thirty feet of wire to the electrical apparatus proper.

The most interesting tests of the Stubblefield system have been made on the Potomac River near Washington. During the land tests complete sentences, figures, and music were heard at a distance of several hundred yards, and conversation was as distinct as by the ordinary wire telephone. Persons, each carrying a receiver and transmitter with two steel rods, walking about at some distance from the stationary station were enabled to instantly open communication by thrusting the rods into the ground at any point. An even more remarkable test resulted in the maintenance of communication between a station on shore and a steamer anchored several hundred feet from shore. Communication between the steamer and shore was opened by dropping the wires from the apparatus on board the vessel into the water at the stern of the boat. The sounds of a harmonica played on shore were distinctly heard in the three receivers attached to the apparatus on the steamer, and singing, the sound of the human voice counting numerals, and ordinary conversation were audible. In the first tests it was found that conversation was not always distinct, but this defect was remedied by the introduction of more powerful batteries. A very interesting feature brought out during the tests mentioned was found in the capability of this form of apparatus to send simultaneous messages from a central distributing station over a very wide territory.

Extensive experiments in wireless telephony have also been made by Prof. A. Frederick Collins, an electrical engineer of Philadelphia, whose system differs only in minor details from that introduced by Mr. Stubblefield. In the Collins system, instead of utilizing steel rods, small zinc-wire screens are buried in the earth, one at the sending and another at the receiving station. A single wire connects the screen with the transmitting and receiving apparatus, mounted on a tripod immediately over the shallow hole in which the screen is stationed. With the Collins system communication has been maintained between various parts of a large modern office building, and messages have been transmitted without wires across the Delaware River at Philadelphia, a distance of over a mile.

...ceiving Wireless Telephone messages 1[illegible] miles ...
...mont Park, Philadelphia, Decoration Day, May 30t...



Photographed May 30th, 1902, Park Commissioner's priv[illegible]
sion, Fairmont Park, Philadelphia, showing Mr. Na[illegible]
Inventor of Wireless Telephony.

STUBBLEFIELD (BERNARD B.) PAPERS

1908-1973

5 manuscript boxes

This addition to the Stubblefield collection contains personal correspondence, December 22, 1925-December 12, 1972 (folders 1-3); a statement by Nathan Stubblefield to his daughter Victoria, concerning his possessions, May 14, 1917 (folder 4); a bill of divorce, Mrs. Victoria Whittaker Horn McGhee vs. John Bryant McGehee, January 25, 1944 (folder 5); a withholding statement belonging to Victoria, 1952 (folder 6); a patent belonging to Nathan, May 12, 1908 (folder 7); a short sketch by Victoria entitled "The Magic Box," (folder 8); articles concerning the invention of radio (folder 9); a certificate of death for Oliver Stubblefield, July 12, 1962 (folder 10); Baldwin's Funeral Benefit Association Payment Receipt Books, September 1, 1947-February 17, 1950 (folder 11); an invitation to the Florence High School Commencement Exercises, 1963 (folder 12); Christmas cards (folder 13); payment receipts, 1962-1966 (folder 14); Bernard's Army discharge papers, November 2, 1920 (folder 15); a funeral purchase agreement from Baldwin Funeral Home for the late Bernard B. Stubblefield, October 4, 1973 (folder 16); photographs (folders 17-22); news clippings (folders 23-24); payment receipt pads of Bernard for rent, 1961-1968; a pair of sunglasses; a lock of Carrie Stubblefield's hair; and telephone and address pads.

Presented to the Department by Mrs. Thomas Lynch. Processed in December, 1974.

magazines, October 18, 1919, March, 1930, and October, 1970 (folder 12); letters of patent, May 12, 1908-February 19, 1920 (folder 13); drawings of inventions belonging to Nathan and Bernard (folders 14-19); army papers, December 26, 1917-November 22, 1920 (folder 20); photographs (folders 21-24); a phonograph, New Testament (1896); printed material from Murray Chamber of Commerce, a small black notebook belonging to Bernard and a published book containing the U. S. Constitution.

Presented to the Department by Mrs. Thomas Lynch. Processed in November, 1974.

to B. F. Scroader. 2½ percent to J. D. Rowlett. 5 percent to R. Downs. 5 percent to 1/10 Geo. C. McLarine. 5 percent to John P. McElrath all of Murray, Ky.

Wireless Telephone System.

To All whome It may concern.

Be it known that I Nathan B. Stubblefield of Murray, Ky. have invented certain new and useful improvements in Wireless Telephony of which the following is a description.

The object of my invention is to provide a means of communications from one point to an other without wire or any visible connection of any kind, or from local points, to moving or standing Cars, Boats and suchlike vehicles or crafts of many descriptions not here enumerated. Described as follows, first drawing No. I. refered to, in Fig. I. Z. represents an Electric coil made up of many convolutions of suitable insulated wire, enclosed in a waterlight or prag case or covering (Rubber covering prefered) to protect against weather or abrasion, the two free terminals of the enclosed coil Y being carried to any desired location for connection with Telephone equipment which consists of the ordinary transmitter and receiver, and primary battery or electric current from a dynamo or like sourse of supply.

provided at S. with a switch, or lever to change the receiver, or transmitter to or from circuit as desired. This plan of a single coil being found preferable to a double, or two separate coils together, better understood own coil, because of inductance or reaction. Now when words are spoken into transmitter at Fig. 1 it may be heard at receiver of Fig. 2. it being understood that neither coil is in any way connected with the earth or by visible connection of coil to coil, but depending on electromagnetic radiation, or induction, or the vibration of the earths magnetic field or electrical envelop of The Earth as a connection. It is understood that the Electric Coils be of a given diameter as to distance communication may be desired, or of given diameter, and of given gauges to amperage, that may be used in such length of wire, in such coil, in protection of transmitter, or resistance in over heated transmitter, or in protection of the coil as to overheating.

It also being understood that such coils as shown in Fig. 1. and 2. may be placed in horizontal or perpendicular position for transmitting or receiving, or may be in shape, circular, oblong or square to suit conditions

It is also understood that coils of very small diameter or short length of wire, the result of small convolutions, with the proportionate current, will transmit, and receive, and in every way, work in harness with Even to great distances of many miles larger coils, of any diameter, (as illustrated in small telephone recently shown in the office of E. G. Siggers) It being known that signal bell must be operated, through novel, well known, Wireless Telegraph principle. Save That — The Electric Buzzer may be used to call at [illegible] necessary here to be described, other [illegible] an operative must be constantly in attendance at the receiver, or the stations understood.

Having just described what is meant to convey, by Drawing No. 1. I shall now describe Electrical action, in applications of my improvements, in the art of Wireless Telephony, as illustrated in Drawing No. 2.

As follows, showing the working of Electric Coil just described, in conjunction with a local line wire, passing along a line of railway, navigable stream, or coast line, or other water way, street, or road, or any pass way, where portable Telephonic communication might be needed, or desired, assuming that Drawing No. 2, will amply illustrate

along a line of railway with Telephone-equipment as described in Drawing No. I. placed in stations along as desired.

In Fig. 2. is an Electric Coil and Telephone equipment as described in Drawing No. I. in Fig. 1. and 2. the electrical action being the same in transmitting and receiving, and signaling as described in Drawing No. I. assuming that the line or local portion of the equipment be in reasonable, on a practical distance of, road way, stream, coast line, or as far as the application may admit of, it being understood that Fig. 2 represents equipment of car, Boat or railway, or street, which is as desired to equip, with Lineless Telephone apparatus. It may also be understood that in the local-equipment of any of the passways just enumerated that a complete metalic circuit may be placed, over, or under or at either side of passway, and working in conjunction with the coil, the circuit being ungrounded, or that an Electric Coil made up of many convolutions of small insulated magnet wire of equimonic cost may be used in place of the circuit or grounded line described.

It may be stated that the grounded line as the circuit, or coil may be placed above, below or at sides provided the the sides of coil, or circuit shall not lay close to each other, to the end that interference may set up in marked way. Having thus described my improvements in Wireless Telephony and often having attempted to claim none other plans than worked out by me and my assistant B.B. Stubblefield (at our experimental place West of Murray Ky) during many years of scientific research I respectfully claim all that should come to me in the honorful expression that may be at Washington can put it without shielding from my fellows in the field of Electrical Science, or claiming for me the authorship of which I am not.

In the event that what I claim for my in electrical action
apparatus, is discredited I will furnish affi-
davits from any one of my home town, or come
up and demonstrate to the entire satisfaction
of Pat. Office officials, and prove that there
is novelty & practical utility, in all the applications
I have cited, and credit due me for more
than I claim.

The current strength needed in any of the applications not necessarily being Expensive.

Nathan Stubblefield
of Murray Ky.

(See preceding page for additional Remarks)

Preceding Intelligation

It being understood that any known objects described as practical application of wireless transmission may communicate with each other, those at great distances apart and moving rapidly as an illustration let train A, B may be 30 miles apart, A will transmit to local station, which local station will transmit to B. this being quickly done, no more direct method being known to use applicable to such system

New Use for the Telephone.

"The telephone is about to have a new application, namely, that of foretelling storms. A new discovery has been made as to one of the properties of this means of transmitting sound. By placing two iron bars at seven or eight meters distance from each other and then putting them in communication on one side by a copper wire covered with rubber and on the other side with a telephone, a storm can, it is said, be predicted at least twelve hours ahead through a dead sound heard in the receiver. According as the storm advances the sound resembles the beating of hailstones against the windows. Every flash of lightning, and of course every clap of thunder that accompanies a storm, produces a shock similar to that of a stone cast between the diaphragm and the instrument."

This paragraph, which we extract from a contemporary, is going the rounds of the papers as a fresh item of information. It is pleasing to note that the "discovery" was made as long ago as 1878, and that the SCIENTIFIC AMERICAN of that year and the following year contains several accounts of experiments in the same direction.

N.STUBBLEFIELD MADE DISCOVERIES WHICH PRE-DATE THIS ANNOUNCEMENT

VRIL GENERATED SOUNDS SATURATE THE GROUND

VRIL SURGINGS DISSOLVE AND IMPULSE INERTIAL SHOCKWAVES

AERIAL OR GROUNDED POLES ARE PLACED APART

CONNECTED (THROUGH INDUCTION COILS) TO A TELEPHONIC RECEIVER

FOR AUDIBLE TRANSFER

N.STUBBLEFIELD MADE THESE TELEPHONIC RECKONINGS IN 1882.

WIRELESS WAS ALREADY LOOSE IN THE EARTH

M.LOOMIS USED THE GEOMETRIC ARRANGEMENT OF UNPOWERED ELEVATED TERMINALS

TO REGISTER AERIAL FLUCTUATIONS AND EXCHANGE SIGNALS

ELECTRIC TELEGRAPH WITHOUT WIRES.—It has long been known that telegraphic messages could be transmitted without the use of wires, and many years since signals were sent across the Bristol Channel by the use of the water as the conducting medium; but in that case the water through which the signals passed was inclosed in a tube, so that it was, in truth, only the substitution of a wire of water, if the term can be used, for the metallic wire usually employed. Prof. Loomis now proposes to go further; he claims to have discovered a mode of transmitting messages by electrical air currents; and is seeking an opportunity for making experiments on the summit of Mont Blanc.

VRIL INTUITIONS PERMEATED ELECTRICAL SCIENCE

WIRELESS TELEGRAPHY HAD BEEN OBSERVED IN SEVERAL INSTANCES

SEVERELY BROKEN LINES CONTINUED TO TRANSMIT CODE AND MEANING

MYSTERIOUS CONTINUITIES AND MEDIA WERE CITED AS AGENCIES OF IMPOSSIBLE MESSAGE

VRIL IS THE CENTRAL CORE OF ALL ANOMALIES

VRIL IS FOUND AT THE GENERATIVE CORE OF ALL DETRITAL MANIFESTATIONS

NO PRECEDENT EXISTED DURING THIS TIME FOR DR.LOOMIS' RESEARCH SUCCESS

REVELATORY VISIONS FORM THE TRUE ORIGINS OF EXPERIMENTS CARRIED OUT BY LOOMIS

BY LAND AND WATER

First Practical Test of Wireless Telephony.

HEARD FOR HALF MILE

THE REMARKABLE INVENTION OF A BLUE GRASS FARMER.

Experiment Made From Potomac River to the Virginia Shore—A Land Test.

That wireless telephony, with the earth and water as conductors, is possible was demonstrated yesterday beyond question by Nathaniel Stubblefield of Murray, Ky., in a series of public tests on the Potomac river and on the Virginia shore. The Star yesterday afternoon briefly announced the result of the experiments, which were made in the presence of a number of New York and Chicago financial men and members of the press. The tests throughout were interesting, and, indeed, little short of marvellous.

Nathan Stubblefield.

The originator of the remarkable invention, Mr. Stubblefield, is a plain, everyday "blue grass" farmer. He is modest in appearance, and even backward in discussing this product of his brain, which bids fair to revolutionize and establish a new and less expensive means of conversation by electricity.

The party that witnessed the experiments made the trip up the river, perhaps a mile above the Aqueduct bridge, on board the steamer Bartholdi. Mr. Stubblefield had made all the arrangements several days before, having on Wednesday given a satisfactory experiment from a skiff to the land

station, an inn on the southern shore of the river.

The Mysterious Box.

In a room on the second floor of the inn, where an operator or an attendant could watch the signals from the steamer, was a telephone transmitter and receiver like those in every-day use. These were attached to the top of a box about 18 inches high, a foot broad and 8 inches wide. The box contained dry cells, a generator and induction coils, connected to which were two ordinary wires, one leading to the river and the other to a steel rod stuck deeply into the earth. Mr. Stubblefield explained briefly and with some reluctance that the box contained a "battery" which connected with the currents of the earth.

An operator and several members of the party went ashore, while the rest of the company remained on the boat. The steamer then pulled out from the shore a distance of several undred yards. Every one was anxious to hear the first sounds produced with the aid of the invention.

A box similar to the one in the inn was stationed just back of the pilot house on the upper deck of the steamer, and from this Mr. Stubblefield directed the experiments. Two other receivers were connected by wire, so that three persons could hear the sounds simultaneously. From the mysterious box were two wires leading along the side of the steamer and falling into the water at the stern.

Conversation and Music Heard.

Without a continuous line of wire, the water and the land being depended upon for an electrical current, communication was established by which sounds were exchanged between those on shore and those on the vessel. Owing to the insufficiency of the battery on the vessel the tests were not altogether satisfactory to Mr. Stubblefield, although short sentences and parts of sentences could be heard distinctly. The counting of numerals by the shore operator was exceedingly plain. The music of a harmonica was distinctly detected and a number of familiar melodies were easily recognized.

The land tests were more satisfactory. Members of the party scattered, each group being provided with a receiver and a pair of steel rods attached to twenty feet of ordinary telephone cord or wire. From this cord were hung the receiver and transmitter. The rods were planted in the ground at the will of those handling them and sound was transmitted distinctly.

Complete sentences, figures and music could be heard at a distance of several hundred yards from the shore station. Conversation was as distinct as by the ordinary wire telephone. This experiment was pronounced a marked success by all excepting Mr. Stubblefield, who declared that it was far from satisfactory to him. He maintained that he had obtained better results at greater distances in private tests, and this was substantiated by Mr. Gerald Fennell of the Gordon Telephone Company, who has displayed much interest in the new invention.

Uninsulated Wire Test.

There was also a test of an uncovered and uninsulated wire laid along the shore for half a mile. More than half the distance the wire was under water. A number of the party went to the extreme end of the wire and the others remained at the shore station. Messages were distinctly exchanged.

Mr. Stubblefield sought to show that it makes little difference whether he wishes to talk by water or by land. It is said to be only a question of voltage or electromotive force as to the distance the messages may be transmitted. The tests were all interesting. When the iron rods were pulled from the earth nothing could be heard, but as soon as they were stuck into the ground again the sounds of voice and music were plainly heard.

The first installation of the new system of wireless telephony will be from Charleston, S. C., to the Sea Islands. The Gordon Telephone Company has already made arrangements for adopting it. It is claimed that the use of ordinary wire for cable means a vast saving. The cable wires now in use are insulated.

CALLS ON THE WORLD TO HONOR THE 'FATHER OF BROADCASTING'

Hermit Who Died Two Years Ago in Murray, Ky., Is Acclaimed as the First to Speak by Wireless.

By ERIC H. PALMER.

A FARMER boy discovered the new planet. Did another farmer invent radiotelephony?

Two years ago Nathan B. Stubblefield died, a hermit—alone in a hut near Murray, Ky. A few weeks ago the city of Murray dedicated a memorial to him as "the first man in history to transmit and to receive the human voice without the use of intervening wires." Another name, now unknown to the millions who tune in for broadcasting, is added to those who seek distinction and immortality as "the father of broadcasting."

Behind the announcement of the unveiling of the little monument on the campus of the State Teachers College in Murray there is a romantic and tragic tale, and at least one man is dedicating himself to research to prove that the claims of Mr. Stubblefield are well founded, in the person of L. J. Hortin, a professor at the college, who recalls the original demonstration, on January 1, 1902, when wireless telephony was exploited before a thousand residents of Murray by Stubblefield.

Government Record.

Government records in the United States give the first successful use of radiotelephony as between warships, five-eighths of a mile apart, in 1914; but there is an American patent, No. 887,357, dated May 12, 1908, in Stubblefield's name. A Canadian patent is in the possession of Mr. Hortin, under date of October 30, 1908, with the number 114,737. Another patent was granted in England. Further backing comes in the form of press reports and in "The World's Progress" (1902, page 297) there is a mention of "an American inventor (Stubblefield), unheralded and modest," who "has carried out successful experiments of telephoning and is able to transmit speech without wires. Prof. Hortin's inquiries reveal that on March 20, 1902, Stubblefield broadcast from the steamer Bartholdi on the Potomac River to a group of scientists. On a framed photograph of the occasion he wrote: "First Marine Wireless Telephony demonstrated in the world by Nathan Stubblefield."

Stubblefield worked in a shack to which he permitted no visitors, but in 1902 he received a newspaper correspondent and stated that for ten years he had been experimenting on methods of talking without wires.

Earth Supplied Power.

His transmitting apparatus was placed in a box four feet high and six inches in width. A small coil of heavy wires was at one end and led to the ground. He made the startling statement that "the earth's electrical waves" furnished the power by which an ordinary telephone transmitter was operated. About a quarter of a mile away another box was fastened to a stump, with a cover as rain protection. There were wires leading to the ground and a pair of telephone receivers on top.

Examination showed that the wires terminated in each case at steel rods topped with a ball of iron which was nickel-plated.

Stubblefield claimed that the earth and all about it is charged with electrical power, part of which he was harnessing—and that in time spoken messages could be sent without wires thousands of miles.

There was no connection between the wires of the transmitter and those of the receiver; that was immediately ascertained.

He admitted, however, that he had developed radio frequency current through a battery of his own arrangement, an "earth battery," which he had discussed many years

Continued on Sixteenth Page.

'FATHER OF BROADCASTING'

Continued from First Page.

before, following which he devised a system of modulation and an adjustment for tuning. The detector was a receiving coil, tapped for adjusting inductance.

Stubblefield admitted that he "lacked the power" to transmit long distances. His "secret," he asserted, was in the transmitting box, bringing about vibrations of the electrical current he had chafned to service—exactly how no one knows to this day.

The patent papers stipulate that Stubblefield discovered that electrical waves could be sent through the other by using coils of wire.

"This coil," according to the patent, "consists of an outer casing, within which is placed a conducting wire comprising a plurality of convolutions, each of which is insulated from the other. The terminals extend to a station at which is located a powerful source of electrical energy, to which is connected by a suitable wire an electrically operated transmitter."

That is the transmitter. For the receiver there is a similar arrangement of wires, the patent reads, "on a smaller scale," likewise associated with "a source of electrical energy." By reversing a switch Stubblefield could turn the transmitter into a receiver, and vice versa.

"These vibrations reproduce sounds in receivers tuned to convey them to the listening ear," explained Stubblefield at the time. "What this apparatus consists of or how it does its work I will not tell." He admitted that the contrivance was imperfect but contended he was not going to let Marconi get all the glory in wireless.

Horseless Carriage Radio.

In the Canadian patent is a drawing of a "horseless carriage" with a broadcasting outfit that he termed "raidio," and the idea was to be used also for trains and ships—the forerunner of automobile radio and the trains and ships that now are equipped to allow passengers to hear broadcast programs.

Coils of wire were found in the hut when the body of Stubblefield was discovered, partially eaten by rats. But of the equipment used in his experiments nothing has been found. It was kept in a trunk, which was lost or stolen in Washington.

Dr. Rainey T. Wells, who established Teachers College, was the first to hear Stubblefield's voice through the aid in an official experiment, and as an attorney assisted in preparing the patent application.

He tells a story to the effect that once Stubblefield invited a neighbor who had frowned upon his claims to listen. The man contended that wires were concealed beneath the soil. Stubblefield placed him within an inclosure, setting the receiver in place, then took the transmitter and walked down a hill, talking, whistling and playing a harmonica—the first portable broadcast transmitter?

Stubblefield's sharp tongue and antagonistic manner kept the inquisitive away, but he finally went to Washington to press his claims, in the company of a daughter.

Funds Disappear.

A company was formed and stock sold in the "Wireless Telephone Company of America," but the promoter absconded with the funds, leaving no money with wich to help Stubblefield develop his machine.

Testimony that the 1902 test was bona-fide have come from Dr. Wells, now president of the college, and many others, who were privileged to listen in and to make examinations to prove that there were no wire connections between transmitter and receiver. In 1920 George K. Sargent, in an article quoted by Prof. Hortin, asserts that "Stubblefield discovered a great law, put the law into practical operation, made the apparatus work in practical demonstration of the law and principle and in 1902 forecast radio and all its branches, including broadcasting."

"That Nathan B. Stubblefield first transmitted the human voice into the air by a mechanical device and translated that voice by another receiving device is undoubtedly true and is supported by adequate information," Prof. Hortin adds.

And in March, 1928, Stubblefield perished, after a series of misfortunes, generally the result of his desire to be alone, except for his young son Bernard, whom he trained to assist him. Stubblefield's only education came from country schools and the reading of journals on electricity. He was born in Murray in 1860. Two daughters, Mrs. J. H. White of Little Rock, Ark., and Mrs. Victoria Whitaker of Clarksdale, Miss., were present at the memorial dedication and recalled his transmitting of voice in 1901.

Searching for His Apparatus.

His original apparatus is now sought for further research, in which the Rotary and Exchange clubs of Murray are cooperating, just as they assisted Prof. Hortin in raising the funds for the memorial, which takes the form of models of the equipment on a pedestal of granite. It faces the old Stubblefield home, which he hoped to make the first radio school in the world.

This was to be known as "Telephonedelgreen, the Home of the Nathan Stubblefield Industrial School and Experiments in Wireless Telephony." A crudely lettered sign bearing that inscription was placed in front of the old house and a photograph is in existence showing this as of September 4, 1907.

A picture was also taken when he made a telephony test from the Belmont Mansion in Philadelphia, May 20, 1908, reception being in Fairmount Park. Among those who participated were Prof. Edwin J. Houston of Franklin Institute and Albert Crump, general manager of the Keystone Telephone Company.

The monument sponsors state they have erected the memorial as a challenge to the world, but Dr. Wells contends that while the mystery has not been solved there is no doubting the strength of the claims of his pioneership in radio.

In his address at the dedication Dr. Wells declared that by trickery the invention was taken away from Stubblefield, after an offer of $40,000 for an interest was made by Dr. W. H. Mason, Murray surgeon.

The question naturally arises: What chapter in radio history might have been written if the queer Kentuckian had not turned his properties over to promoters and had been able to accept the financial assistance of Dr. Mason? He had previously refused assistance from his family, the members being driven away by his temper. He renounced wife, children and friends—just as the world apparently has renounced Stubblefield, up to this campaign to preserve his right to scientific laurels.

SECTION 4

AMOS DOLBEAR

Amos E. Dolbear

There were many others who played a more or less important part in the development of radio prior to Marconi, and who transmitted signals by making use of the conductivity of land or water. One of the most interesting experiments was carried out not far from Worcester, by Professor Dolbear of Tufts college, four years before Hertz's experiments. Professor Dolbear used an induction coil, condensers, aerial, and "ground" wire for producing a signal by reversing the charge on the ground wire. At first he put the distance to which signals could be transmitted as a half mile, but later claimed to have reached 13 miles.

CORRESPONDENCE.

AMERICAN PRIORITY IN TELEGRAPHING WITHOUT WIRES.

TO THE EDITOR OF THE ELECTRICIAN.

SIR: The above is the heading under which Prof. Dolbear's letter, which you reproduced in *The Electrician* of June 21st, appeared in the *Electrical Engineer* of New York, U.S.A. May I beg of you to afford me the opportunity of saying a word or two about it?

Nearly fifty years ago, and thirty years before Prof. Trowbridge "made original researches between the Observatory at Cambridge and the City of Boston," your humble servant, the writer of these lines, had also researched on the same subject, and a year or two later published the results of his investigations in an English periodical—the *Mining Journal* of March 31, 1849—under the heading "Telegraph communication between England and France." In that letter, after going into the subject very much like the American Professor in 1880, there will be found my explanation—also not differing much from the Professor's—as to how the thing was to be done; except that, in my case, I proposed a new and delicate form of galvanometer or telegraph instrument for the purpose, while he made use of the well-known telephone. I suggested the erection of lengths of telegraph wires on the English and French coasts, with terminals dipping into the earth or sea, and as near parallel as possible to one another; and I suggested a form of telegraph consisting of "coils of finest wire, of best conductibility," with magnets to deflect them, on the passage of a current of electricity through them, which I expected would take place on the discharge of electricity through the circuits on either side of the water; anticipating, of course, that a portion of the current would flow from the one pair of earth-plates—terminals of one circuit—to the other pair of terminals on the opposite shore. This appears to me to be just about what Prof. Trowbridge proposed to effect, and which Prof. Dolbear says "covers the ground of doing telegraph work by means of earth conduction." If I should be mistaken, would Prof. Dolbear please show me where I missed it? and, as I am proposing to contend for its English origin, I don't see why I should not at the same time claim for myself "whatever of merit or utility there may be in this method of telegraphy without wires"—especially as Prof. Dolbear also says that "it is a discovery, and an important one too," which I now am induced to believe—seeing that he says it is so.

But, Mr. Editor, after all, I don't value at one finger-snap the circumstance that I happened, so early as the year 1849, to suggest a possible mode of telegraphing without wires, and of which, most likely, Prof. Dolbear was ignorant; it is only the apparatus by which I obtained the signals in experiments I made to this end, to which I attach the least importance. In a footnote to my letter which appeared in the *Mining Journal* it will be seen that I laid "claim" to a conjunction of coils of wire to convey electricity, with magnets, for the purpose of deflecting them as an original form of "telegraph" working with "the least amount of current and resistance," and "depending much upon the power of the magnets," as a "design or invention of my own." Later on, I will show why I attach importance to the above.

AMERICAN PRIORITY IN TELEGRAPHING WITHOUT WIRES.

Under the above heading Prof. Dolbear in the ENGINEER of May 29 gives an interesting bit of electrical history and shows commendable national pride in claiming this to be an American invention. Some nine years *after* Prof. Trowbridge's demonstrations, I reinvented the same method, and thought of applying for a patent protecting it. On examination I found the scheme to be nearly as old as the telegraph. I am not certain now where I saw the reference, but am under the impression it was in the first or second volume of the British Electrical Patent digest. The theory of this system can easily be explained without bringing in the much abused and mysterious word "induction." Say we have two parallel grounded telephone wires 5 miles long, one-quarter of a mile apart, separated by water if you choose, conversation on one line may be heard on the other; this fault is generally attributed to induction, a sort of magnetic influence. The real explanation is that electric currents *must have a complete circuit. They follow the path of least resistance.* The resistance from the terminal of one of the wires via the earth or water one-fourth of a mile, thence back by the other wire, is less than it would be through five miles of ground return, consequently we hear the cross talk. It could not be otherwise. To avoid it telephone companies use complete metallic circuits.

JNO. C. HENRY.

PUEBLO, COL., June 3, 1895.

TELEGRAPHING WITHOUT WIRES.

Concerning the question of telegraphing without wires referred to in Prof. Dolbear's article in the last number of your Journal, I desire to call attention to British patent granted to Thomas Boman Lindsey, No. 1242 of 1854, in which is fully disclosed the system referred to in Prof. Dolbear's article. If I recollect correctly, Prof. Morse also made a number of experiments in one of the canals near Washington, some time between 1840 and 1850; at any rate I have an indistinct recollection of having read, I think in the Journal of the Franklin Institute, a description of such experiments.

C. J. KINTNER.

NEW YORK CITY, June 5, 1895.

LITTLE did Prof. DOLBEAR know what he was bringing upon himself when, in the lightness of his heart, he wrote to the *Electrical Engineer* of New York last May to claim for Prof. TROWBRIDGE, of Harvard, "whatever merit and utility" there may be in connection with the origination of "doing telegraphic work by means of earth conduction." Mr. PREECE, so far as we are aware, makes no claim to have been the first to have *thought* of telegraphy without wires. On the other hand, he has certainly been the first to persistently experiment in this direction, and to attain anything approaching practical success. Moreover, judging by the titles of many of his Papers, and by their contents, he does not think that "earth conduction" plays any appreciable part in the matter, pinning his faith to "induction," though conclusive experiments with two completely-metallic thoroughly-well insulated circuits are wanting. But however this may be, priority in suggesting telegraphy without wires belongs, it would appear, to this side of the Atlantic. That veteran telegraphist, Mr. J. W. WILKINS, states in a letter to be found in our "Correspondence" columns this week that he publicly suggested the idea of wireless telegraphy between England and France so far back as 1849, having previously made some tentative experiments with the aid of a moving-coil galvanometer of his own design. Mr. WILKINS, we are glad to see, is not inclined to attach over much importance to a mere suggestion, even when, as in his case, it had for basis considerable experiment and the invention of a now indispensable form of instrument; neither does he imply, as does Prof. DOLBEAR on behalf of Prof. TROWBRIDGE, that his work has been intentionally ignored. As Mr. WILKINS puts it, "it cannot be expected that everyone shall get to know what everyone else has done in any particular direction."

WIRELESS TELEGRAPHY.

The New England Wireless Telegraph and Telephone Company, which holds Professor Dolbear's patents on the wireless telegraph, has entered suit in the United States Court against Signor Marconi. According to the summons served by Commissioner Shields at the Hoffman House, in New York, on Tuesday last, Signor Marconi is obliged to appear in the United States Circuit Court on November 6. Mr. J. E. Maynder, an electrical expert, is the lawyer retained by Professor Dolbear. This last week Professor Dolbear telegraphed without wires from Blue Hill to Winthrop a distance of some twenty miles. L. C. Larned of Boston connected with Professor Dolbear's company, alleges that the means described in the patent under which Marconi purports to carry on his system cannot be used for such work and are not adapted for commercial use. Larned asks damages in the sum of $100,000, and for an injunction restraining Marconi from using the alleged infringing system of telegraphy pending the termination of the suit.

THE HISTORY of all-pervading communications in the 20th century is illuminated in David Sarnoff: A Biography, by Eugene Lyons (newly pub. by Harper & Row). One of its many entertaining sidelights is how Sarnoff's courtship of the young lady he married was impeded by her mother's worries over the suitor's strange talk of "voices in the air."

There was general unresponsiveness to the idea of controlled signals or "voices in the air" for decades after scientists knew for certain the potentialities of wireless communication. Eighty-four years ago this month, March, 1882, Amos Dolbear, Professor of Physics at Tufts College, obtained a patent on "a mode for sending signals through the ether of space." He declared, "electrical communication, using this apparatus, may be established between points certainly more than one-half mile apart . . ."

Dolbear's was erroneously stated "the first radio patent." In 1872, one was issued to Dr. Mahlon Loomis of Washington, D. C., who described how "disturbances in the atmosphere would cause electric waves to travel through the atmosphere and ground."

S. F. B. Morse could have claimed one three decades before that. On the basis of experiments he made back in 1843 in New York harbor, he concluded that "electricity could be made to cross a river without any other conductor than the water itself."

Speaking of skepticism, the American Interplanetary Society, formed 36 years ago today (3-21-1930), soon changed its name to American Rocket Society, to appear less fantastic.

WIRELESS TELEGRAPHY.

PROFESSOR DOLBEAR THE INVENTOR OF THE SYSTEM.

The wireless telegraphy made famous by Signor Marconi's experiments will be of interest to the undergraduates and alumni of Tufts College when they learn that Professor Amos E. Dolbear invented the system some fourteen years previous to Marconi.

Professor Dolbear got out a patent on his system, after much difficulty in convincing the patent office officials at Washington of its usefulness, in October, 1886. Ten years later Marconi obtained a patent based on certain devices peculiar to himself. These devices were, Professor Dolbear saw, after careful reading of all newspaper accounts of Marconi's system, none other than the devices invented by himself. He consulted an electrical expert who has worked under the Professor's directions for years and was assured that Marconi was using the Dolbear system.

In the early 80's the Dolbear Telephone Company acquired the patent issued to the Professor for the wireless telegraphy. The Company was at this period practically bankrupted, owing to a long, tough struggle with the Bell Telephone people over the priority of the invention of the telephone receiver, in which controversy the courts decided against the former. Disheartened, the company did nothing with the patent until a few years ago when the professor assigned the rights of the patent to a new company. In the meantime Signor Marconi had come to this country and begun experiments with his system. The company at once took legal steps to protect its rights, and last week several of the men interested in the Dolbear Company, went to New York to confer with Signor Marconi and the newspaper syndicate, that is backing him, so that he may be able to use his system in bulletining the yacht races. The result of this meeting was that Professor Dolbear courteously allowed Marconi the few days of grace during the yacht race. At the end of that time legal war will begin in earnest.

Professor Dolbear in speaking of his invention said that he made his discovery that telephone communication could be worked without wires in 1881.

"I was led to experiment with this in view by accident. One day when I was conducting some experiments with the telephone one of the wires attached to the receiver became accidentally disconnected. I discovered that I could hear sounds quite clearly.

"I then developed the apparatus which was afterward patented. It consists of an induction coil having a transmitter in primary circuit, with one terminal of the secondary carried to the ground and the other left free to discharge into the air. The receiving end was also a wire extending into the air and the other grounded through a receiver.

"At first instead of carrying the wire into the air I used a coil, but I very soon found a great advantage in using a vertical wire. The higher the vertical wire is carried the greater the discharge of the current into the air, that being the principle.

"In the first experiments which I made I used a telephone for a receiver, but any electrical device would do just as well. The Morse characters were sent with an ordinary telegraph key, but were received by telephone. The length of the ground wire is immaterial, it only being necessary to have it grounded.

"When I first applied for a patent the patent office refused it because it was against all of the known laws of science. They said it would not work, the belief at the time being that there must be a complete electrical circuit; that there must be a wire or some conductor.

"I have experimented over distances of from one to nine miles with great success. This summer I experimented from the college to a building on State Street, Boston, a distance of about five miles. I ran my vertical wire up the tower of the college chapel, an altitude of about 100 feet.

"What Marconi has invented is an improved coherer. According to his own statement he began his experiments with the Branley coherer. This coherer was not invented more than four years or so ago. Marconi has improved on this device and has produced a coherer that is more sensitive. His coherer is the instrument which forms part of his receiver. It is, as I understand it, a small glass tube, with silver plugs fitted in each end. It is filled with a mixture of silver and nickel fillings. This conductor which he has devised is evidently much more sensitive than the Branley coherer with which Marconi says he at first worked. Leaving out the coherer Marconi's system is exactly like that which I patented in 1886.

"My invention relates to establishing electric communication between two or more places without the use of a wire or other like conductor; and it consists in connecting the transmitting instrument with a ground, the potential of which is considerably above the normal, and the receiving instrument with a ground, the potential of which is considerably below the normal, the result being that an impulse from the transmitter sufficient to actuate the reciever to give intelligible signals is transmitted through the earth without the aid of any curcuit, such as has heretofore been deemed essential."

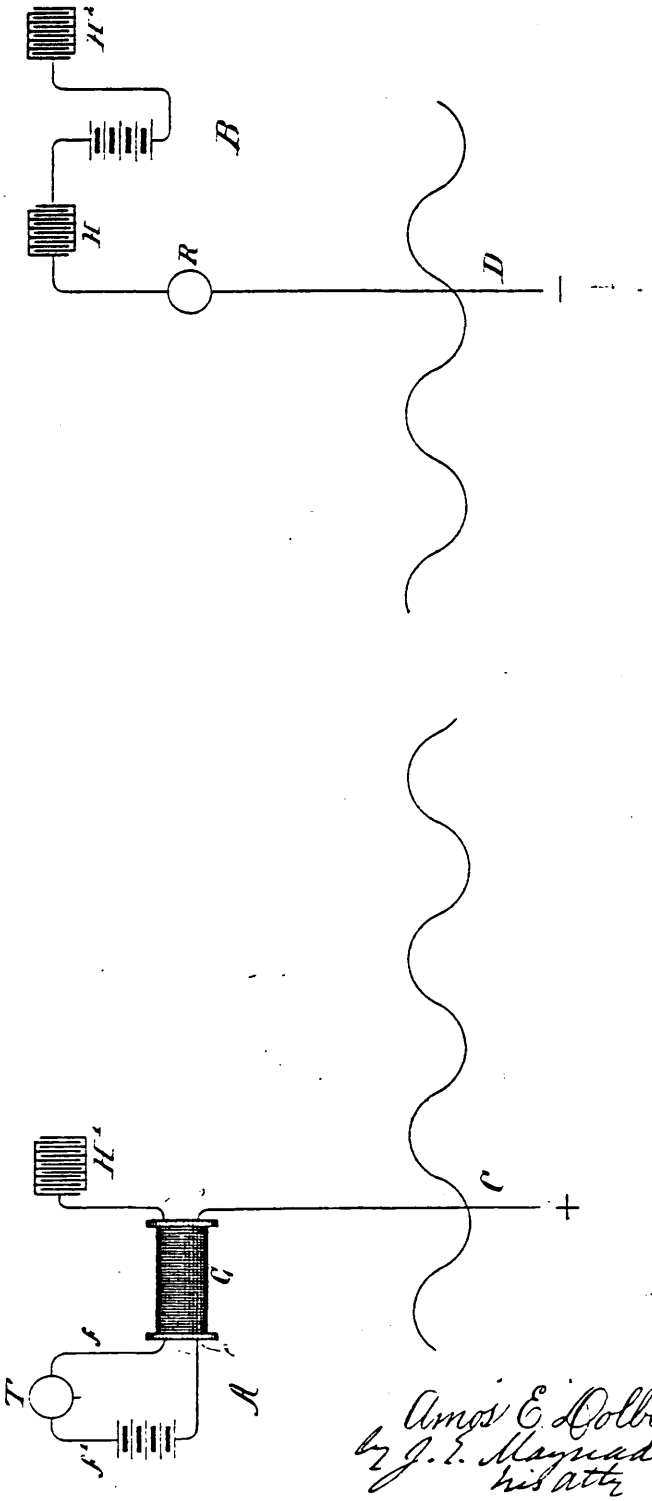
Professor Dolbear has continued his experiments during the past years and has worked out a number of additional features which he is not at liberty to disclose. Mr. C. E. Dolbear, class '93, is at present in New York in the interest of the Dolbear Company.

(No Model.)

A. E. DOLBEAR.

MODE OF ELECTRIC COMMUNICATION.

No. 350,299. Patented Oct. 5, 1886.



Witnesses:
Wm. Littel.
John R. Snow.

Amos E. Dolbear
by J. L. Maynadier
his Attr

UNITED STATES PATENT OFFICE.

AMOS EMERSON DOLBEAR, OF SOMERVILLE, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE DOLBEAR ELECTRIC TELEPHONE COMPANY, OF NEW JERSEY.

MODE OF ELECTRIC COMMUNICATION.

SPECIFICATION forming part of Letters Patent No. 350,299, dated October 5, 1886.

Application filed March 24, 1882. Serial No. 56,264. (No model.)

To all whom it may concern:

Be it known that I, AMOS EMERSON DOLBEAR, of Somerville, in the county of Middlesex and State of Massachusetts, have invented a new Mode of Electric Communication, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying diagram, forming a part hereof.

My invention relates to establishing electric communication between two or more places without the use of a wire or other like conductor; and it consists in connecting the transmitting-instrument with a ground the potential of which is considerably above the normal, and the receiving-instrument with a ground the potential of which is considerably below the normal, the result being that an impulse from the transmitter sufficient to cause the receiver to give intelligible signals is transmitted through the earth without the need of any circuit, such as has heretofore been deemed essential.

In the diagram, A represents one place, (say Tuft's college,) and B a distant place, (say my residence.)

C is a wire leading into the ground at A, and D a wire leading into the ground at B.

G is a secondary coil, one convolution of which is cut, the ends thus formed being connected with the poles of the battery f', which has a number of cells sufficient to establish in the wire C, which is connected with one terminal of the secondary coil G, an electro-motive force of, say, one hundred volts. G in this instance also represents an induction-coil, T being a michrophone-transmitter, f its primary circuit, and f' its battery—that is, the battery f' not only furnishes the current for the primary circuit, but also charges or electrifies the secondary coil G and its terminals C and H.

Now, if words be spoken in proximity to transmitter T, the vibration of its diaphragm will disturb the electric condition of the coil G, and thereby vary the potential of the ground at A, and the variations of the potential at A will cause corresponding variations of the potential of the ground at B, and the receiver R at B will reproduce the words spoken in proximity to transmitter T, as if the wires C D were in contact or connected by a third wire. Electric communication may be thus established between points certainly more than half a mile apart; but how much farther I cannot now say.

There are various well-known ways of electrifying the wire C to a positive potential far in excess of a hundred volts and the wire D to a negative potential far in excess of a hundred volts.

In the diagram, H H' H² represent condensers, the condenser H' being properly charged, to give the desired effect. The condensers H and H² are not essential, but are of some benefit; nor is the condenser H' essential when the secondary G is otherwise charged. I prefer to charge all these condensers, as it is of prime importance to keep the grounds of wires C and D oppositely electrified, and while, as is obvious, this may be done by either the batteries or the condensers, I prefer to use both.

The main difficulty in utilizing my invention on a large scale is that when there are many spots corresponding to A and B signals transmitted from any A will go to the nearest B, or to several B's, depending upon proximity and other causes. One method of obviating this difficulty is to use a given A only during a certain assigned time for communicating with a certain B, the particular B being arranged to receive communications only during the assigned time. Thus, if there were ten B's within a given area, then the first B might be used for the first hour, the second B for the next hour, and so on, and the first A for the first five minutes of the first hour, the second A for the next five minutes, and so on, so that either one of the A's might have free communication with the first B, each for its assigned time during the first hour, and either A with the second B, each for its assigned five minutes of the second hour, and so on.

In practice there will be of course both a receiver and transmitter at A and B, proper switches being used to bring either into use, as will be well understood without description.

I have spoken only of telephone-instruments, as these give the best results; but any electric instruments may be used capable of utilizing the currents passing through the earth from C to D, and the strength of such currents can be largely increased by increasing the positive potential of C and the negative potential of D. It will also be obvious that if the end of coil G (shown in the diagram as connected with one armature of condenser H') be grounded, and the end shown grounded be connected with the condenser, then C will be minus, and D must therefore be made plus.

What I claim is—

The art above described of communicating by electricity, consisting in first establishing a positive potential at one ground and a negative at another; secondly, varying the potential of one ground by means of transmitting apparatus, whereby the potential of the other ground is varied; and, lastly, operating receiving apparatus by the potential so varied, all substantially as described.

AMOS EMERSON DOLBEAR.

Witnesses:
G. B. MAYNADIER,
JOHN R. SNOW.

MEDFORD, Feb. 27.—Professor Amos E. Dolbear, noted inventor, educator, mechanical genius and inventor, who aided in perfecting the telephone, and for more than 30 years professor of physics at Tufts College, died this afternoon at his home, 134 Professors' Row. He was 74 years old.

He is survived by his wife and five children, three sons and two daughters. They are Samuel H. Dolbear and Clinton E. Dolbear of Colorado, Benjamin L. Dolbear, a senior at Tufts, and Miss Catherine E. Dolbear and Miss Mary E. Dolbear.

The funeral will take place Saturday at his late home and a memorial service will be held in Tufts College chapel.

FOUGHT FOR PATENTS

Professor Dolbear was the inventor of several telegraph and telephone appliances, and always contended that the invention of the telephone should have been credited to him.

He engaged in several costly suits over certain telephone patents, which he claimed were his, and the loss of these in the courts to Professor Bell of telephone fame preyed on his mind in his declining years.

He always believed that he had been robbed of the fruits of his mechanical genius, and carried this conviction to the grave.

In an interview with a Post reporter last night, Professor Dolbear's son, Benjamin, declared that his father always claimed that he was the inventor of the telephone.

"Father often declared," he said, "that he was the real inventor of the 'phone and that he had been robbed of the patents by another, who rushed them to Washington and had them accepted at the patent office.

"Again, my father was the first man who thought of wireless telegraphy. Way back in 1886 he obtained patents for an invention which he hoped would revolutionize the world in regard to communication at sea. He had to abandon the idea, though, for want of aid in financiering his ideas.

"Regarding the litigation with Professor Bell, father always declared that the patents that made possible the telephone, were evolved from his ideas, that they were seized by another and patented to his credit and that instead of the Bell telephone it should be the Dolbear telephone.

"But the people living today who were interested in telephone and telegraph inventions of the early '70s, know that the fame and honor belonged to father and that he had been betrayed at the last moment by a man he aided and considered a friend. It is now a matter of history. This sad circumstance always preyed on father's mind, and I am sure it hastened his death.

"Father has always had the reputation of being the first to successfully operate a telephone line in the country. This communication was between our house and the main building of Tufts College. The faculty there and other inventors to this day well know to whom the invention of the telephone belonged."

Professor Dolbear was born in Norwich, Conn., and was once Mayor of Bethany, W. Va. He graduated from Ohio Wesleyan College and later attended Bethany College.

During his professional career at Medford, Professor Dolbear passed much time in scientific research and hit upon the telephone invention, and which resulted in the bitter disappointment he later experienced.

ANTICIPATED MARCONI BY TWENTY YEARS

Amos Emerson Dolbear, although he never reaped the rewards that have come to other inventors, anticipated almost every modern electrical inventor who has won world renown.

He invented a telephone before Alexander Graham Bell had even thought of patenting the instrument which won for him wealth and fame; he anticipated by six years the discovery of Herz of the existence of electrical waves in space, known now as the Hertzian waves; he had invented telegraph instruments that would transmit sound without wires 20 years before Marconi was heard of; he found the X ray four years before Professor Roentgen, and nearly 50 years ago he displayed a gyroscope which is just now coming to fruition in experiments in London.

Professor Dolbear was a seer, a dreamer of visions that seemed strange to men to whom he communicated his discoveries and which were afterward brought to completion by other men who received the royalties that might have been his.

After years of work far ahead of his time Professor Dolbear retired from Tufts College a poor man. Men who had taken up his ideas where he had left them were millionaires; the college where he had labored so many years was too poor to pay him a pension when he retired, and it was only through the Carnegie pension fund that his declining years were assured of comfort.

Sues Professor Bell

Thirty years ago the most famous case in the United States was that brought against Professor Alexander Graham Bell by Professor Dolbear, who claimed that the generally accepted inventor of the telephone had merely taken his ideas. The case was bitterly fought; it went through many courts and finally the decision was handed down in favor of Bell. Many people who remember that suit felt at the time that the legal decision was correct, but that Professor Dolbear had in reality been the original inventor, that he had lost because he was too much of a scientist and too little a man of business. He had been first, they said, but he had not properly protected his rights.

The suit involved the use of the permanent magnet in the receiver, which Professor Dolbear always insisted had been his invention alone and which Professor Bell had used without right and without authority.

His modesty and unwillingness to claim anything for himself which characterized his life outside the one exception of the suit which he brought on the telephone invention, was illustrated a few years ago when he was invited to write an article on New England inventors of the 19th century. Every name ever known to scientists from the six New England States was found in the article with the exception of that of Amos E. Dolbear.

Professor Dolbear was not easily induced to tell about his inventions. Even to friends he seldom spoke of what he had done, and only to relatives and one or two intimate friends did he ever appear perturbed because Bell or Marconi had received so much wealth and fame that he thought were rightfully his.

Before Professor Bell's invention of the telephone was ever heard of, Professor Dolbear had put up instruments in two Tufts buildings. In one he often invited friends to gather and then a cornet would be played in the other building and the tunes were as apparent as though the player had been in the room with his auditors.

Transmission of [illegible] was accomplished by Professor Dolbear 20 years before Marconi succeeded in making the invention a commercial success. Years ago he even telephoned without wires for the edification of friends.

Wealth and fame were things for which Professor Dolbear did not care. He always maintained strenuously that the scientist was placed in the world not to invent, but to discover, to make known general principles that others may take them up and apply them.

An Experimenter

Professor Dolbear, with all his accomplishments, was probably more an experimenter all his life than anything else. He strode along ahead even of inventors, left them ideas to apply to commercial and practical use and went on in new fields to discover fresh principles. In a book he wrote more than 40 years ago occurs this significant sentence:

"Mechanism is all that stands between us and aerial navigation; all that is necessary to reproduce human speech in writing, and all that is necessary to realize completely the orator who shall at the same instant address an audience in every city in the world." The aeroplane and the phonograph remain as mementoes of his prophecies.

In 1877 Professor Dolbear had brought his discoveries which led to the telephone to such a point that he was able to write a handbook called "The Telephone," copies of which are now rare. In it he speaks of Professor Bell's instrument that had been exhibited at the Philadelphia Centennial, through which one had to shout to be heard. Professor Dolbear then describes the experiments he made and the use to which he put the magnet which completed the instrument so that speaking in low tones, even at that elementary stage of the discovery, made the speech more clearly heard than if the speaker shouted.

June 29, 1961

Mr. J.E. Peck
446 Grand Avenue
South San Francisco, Calif.

Dear Mr. Peck:

This is in reply to your inquiry about Prof. A.E. Dolbear and his connection with Alexander Graham Bell which you sent to President Nils Y. Wessell. Inasmuch as I am the University historian, he referred your letter to me.

Professor Dolbear was associated with Tufts for 36 years, from 1874 until his death in 1910. He was Professor of Physics and Astronomy, received an honorary degree (LLD) from this institution in 1902, and was made Professor Emeritus in 1906. Alexander Graham Bell was a teacher at nearby Boston University from 1873 to 1877, and was never connected with Tufts. There is no record that Bell ever met Professor Dolbear or attended his classes during this time.

Professor Dolbear was one of the dozens of people who experimented in the 1860's and 1870's with what became the modern telephone. He and Bell were working independently on the problem of communications, and Prof. Dolbear did invent the electro-static telephone and the permanent-magnet receiver, which operated on a different principle from the wet-battery first used by Bell. Prof. Dolbear was a theoretical scientist who published his experimental findings widely and made no serious attempt to protect his interests until the marketable value of his discoveries was realized, too late to protect his legal interests. He pioneered in several areas, including wireless telegraphy (patents applied for in 1882 and 1886), an electric gyroscope, a magnetic-electric telegraph, and a system of incandescent lighting.

When the Western Union Company, then the ostensible rival of the Bell Company, entered into extensive court litigation with the Bell Company, the latter won the majority of the suits or in some cases worked out a compromise; such was the case after evidence (laboratory notebooks) was presented to establish the priority of Dolbear's invention of the permanent-magnet receiver. The Western Union Co. bought out Prof. Dolbear's interest in the magnetic receiver for $10,000, although he discovered later that he might have received considerably more if he had asked a higher price.

No claim was ever made by Prof. Dolbear to have first invented the telephone; he did invent one system, and made his findings readily available. It is quite possible, therefore, that Bell learned of Dolbear's permanent-magnet telephone, filed his own claim to prior discovery, patented it, and hence deterred Prof. Dolbear sufficiently to make the latter's claim inadequate when finally made. There is no question that he was a pioneer in wireless telegraphy, in which he antedated Marconi by over 15 years. This accomplishment is in addition to many others, some of which I have indicated above.

that we had not done everything possible to manufacture the cable and had forfeited the right to the patent.

"I had another rather unfortunate experience with the ammeter, a device which measures strong currents of electricity. When this was perfected I took steps to secure a patent, but at that time electricity was not the power it became later, and strong currents were not used to any extent. When the companies did begin to use stronger currents, such as the ammeter was designed to measure, others began to manufacture and use the instrument. When I undertook to recover damages for infringment it was discovered that the attorney who had drawn up my patent papers had blundered in some manner, and that the patent was not operative. Although the ammeter is in general use, I have never derived any benefit from it."

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He Anticipated the X-Ray.

Although Prof. Dolbear does not make any claims to having discovered the X-ray, that he anticipated it has become common knowledge. He demonstrated that electric flashes could pierce a solid substance, even to the extent of taking a photograph. He placed a star made of iron in the drawer of a heavy wood table, and with it a piece of paper such as photographers use for making prints. Then, in a darkened room, he produced the electric flashes above the table, and when the drawer was opened the imprint of the star was found upon the paper. This was several years before the X-ray was discovered, but Prof. Dolbear, for lack of opportunities, never went further than his first experiment.

Prof. Dolbear, as will be seen by the list given above, was the inventor of a number of articles in common use, including the rubber-tipped pencil, which he brought into use more than fifty years ago. Another familiar article which he alone used as far back as war times is the rotating bookcase, which is now found in almost every library. One of the most curious of his discoveries was that the cricket is an unerring thermometer. He learned long ago that if one counts the number of times a cricket chirps in 15 seconds and adds 40 to it, he will have the correct temperature. This has been tried many times under varying circumstances, and, according to Prof. Dolbear, has never failed to produce the correct result.

Prof. Dolbear is a native of Connecticut, born in Norwich in a house that was once the home of Benedict Arnold. His father having died when he was about 2 years old, and his mother about eight years later, he very early became obliged to depend upon his own resources, and his career in consequence has been a varied one.

When a young man he went West, and for years taught school in Wisconsin, Missouri and other western states, having some thrilling experiences in the days when there was not as much regard for law and order in that part of the country as there is at present. Always a student and of an inventive turn of mind, he was never idle: but when the civil war broke out he was obliged to overcome his disappointment at not being acceptable for service because of physical disqualifications by securing work in the government armory at Springfield.

In 1863 he entered the Ohio Wesleyan University at Delaware, O., and made such progress in physics and chemistry that he was soon made assistant. Later he was professor of natural history in Kentucky University, and from there went to Bethany College to accept the chair of physics and chemistry; his last change being in 1874, when he became professor of physics and chemistry at Tufts.

In 1882 Prof. Dolbear had exhibited his telephone system at the Crystal Palace, London, and received a gold medal; he also received a silver medal in Paris.

He Talks About the Past.

In this little study, the walls hid by heavily laden book cases, the desk and table filled with the odds and ends of the student and investigator, Prof. Dolbear talked about the past.

"Yes, I lost several fortunes," he said, when the subject of Bell telephone and Western Union was brought up. "In 1879, the Western Union Telegraph Company voted to pay me $100,000, but I did not learn this until several years afterward, when I had lost my opportunity. About that time I had perfected my sounder and receiver. This was an instrument which could be attached to any telegraph wire. To call up another office the operator had simply to work the sounder, then by placing the receiver to his ear he could hear the answer. It was both telegraph and telephone. When this was shown to the Western Union expert he said it was a great thing, and some days after I was called to New York. There I met the company's attorney and was told that the matter had been looked into in connection with other similar patents, and that it had been found that I had no claim for mine. I took it for granted that what he had said was true and did nothing further, but they paid me $10,000 for the patent.

"I did not learn until afterward that the Western Union company, taking my patent and several others, had made an agreement with the Bell Telephone Company by which the former was not to do any telephone business, but confine itself to telegraphing, and get a share of the profits of the telephone company in consideration of this. After coming to this agreement the Western Union voted to pay me $100,000 if I made any claim for my patent, but, as I believed the company's attorney, and did not make any claim, I did not get the money.

"When I had perfected the static telephone I lost $50,000 by the failure of a New York man to keep an appointment he had made. At the time I was looking for a company to take up the invention and push it, and heard of this new company that had been formed in New York. I wrote to them about the telephone, and they agreed to send over their expert to look into it. He did not arrive on the day set, and another appointment was made. When he did not keep the second appointment I turned my attention somewhere else, and gave the New York company no more thought. Some time afterward I learned that the New York company had authorized its expert to pay me $50,000 cash for the invention if it proved as I had represented, but he never saw it.

"This invention was also brought into the suit with the Bell company, and in the event of our success I was to receive $250,000, but the case went against us and the company became bankrupt. The failure affected me in many ways, particularly in regard to inventions that should have been developed in order to hold the patents. One of these was for a system of wireless telegraphy. This patent had been secured long before Marconi was heard of, and his experiments have been along much the same lines.

Discovery of Wireless Telegraphy.

"Was the discovery of wireless telegraphy an accident? Yes, mere accident; and I remember the circumstances very well. I was in the laboratory testing a telephone, and it seemed to work all right; that is, I could hear perfectly with it. I was about to put it aside when I noticed that the wire was not connected with the receiver; that, as a matter of fact, I had been telephoning without the aid of a wire. I saw at once that I had come upon something new, and, after observing the conditions, I tried talking at different distances, moving farther away until I was talking without wires across the room. Then I went outside, placed the sender on top of a pole, and attached the receiver to a kite on the other side of the hill. I found that the signals could be heard equally well at almost any distance.

"These experiments were conducted right here on College Hill, and everybody knew what we were doing. I told the officers of the company what I had discovered, and wanted to go on with the development of it.

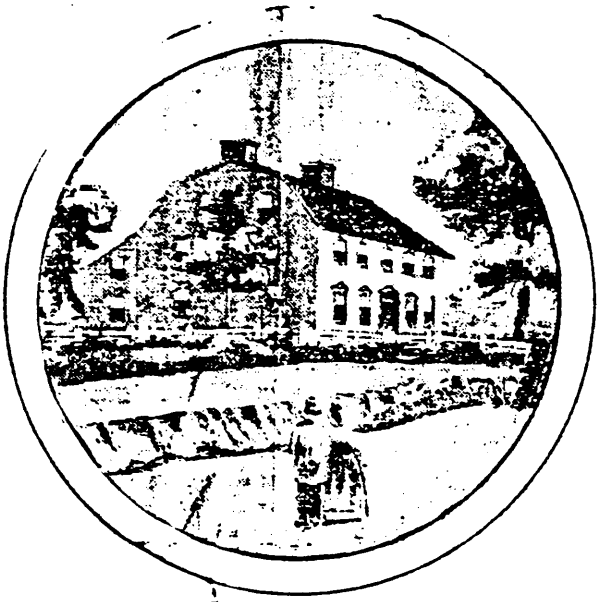
"'Do you think this new discovery will revolutionize telegraphy and supersede the present system?' they asked.

"Of course, I was unable to make any positive statement, and was told to go ahead with my telephone work. After the telephone suit the company was not in a position to take up this work, and I gave it very little attention until about 10 years ago. That was several years before the public had heard anything about wireless telegraphy. Then I went to persons who I supposed were interested in matters of this kind and could well afford to spend money, and begged them to allow me to continue the work of development. All I wanted was $1000, but I could not find anybody who had any confidence; they seemed to think wireless telegraphy impossible and could [illegible] grasp the idea. It is now better understood, and Prof. Dolbear believes that wireless telegraphy offers many less opportunities, although it is now far from perfect.

"The greatest difficulty," he said, "has been experienced in inventing a system that will be exclusive, a system that will enable the owners to send messages to a certain point, or messages that everybody who has wireless receivers will not be able to read. Claims have been made that this has been accomplished, but I have not learned that any of the companies are in a position to do a commercial business. The solution of this problem will probably be an amalgamation of all the wireless telegraphy companies. My patent expired last year."

Electric Wire Cables in Use.

The electric wire cables in general use today are the invention of Prof. Dolbear, although he does not derive any revenue from them. This was another instance in which he was ahead of the time, and was unable to fulfill the requirements necessary to hold the patent. In 1882 he secured patents, both in this country and in England, for what was known as the air space cable, and to years later he became connected with another famous law case in England.



BENEDICT ARNOLD HOUSE AT NORWICH CT. WHERE PROF. DOLBEAR WAS BORN.

"When I invented this cable," said Prof. Dolbear, "the cables then in general use were covered with rubber or gutta percha close to the wire. This, of course, detracted from the strength of the current. My idea was to have the conductor surrounded by air as an insulator and dialectic instead of rubber. By this means they were made about four times more effective.

"After I secured the patents I went to see the managers of the cable companies, but they would not do anything with it. They had large and expensive plants for the manufacture of the cable then in use, and were unwilling to go to the expense of making a change. At that time telegraph and telephone companies had the privilege of stringing wires and cables overhead. I was not in a position to manufacture the cable or do anything with it.

"Very little attention was paid to it until laws were passed requiring that wires be placed under ground. A number of cable companies instantly began the manufacture of air space cables without regard for my patent. This crisis came about the time I was engaged in litigation with the Bell Telephone Company, and my company was powerless to resist it. It would have cost something like $50,000 to have gained recognition and get royalties on the patent, and we could not raise the money.

"In 1892 the British Insulated Wire Company offered me a small sum for the patent, which was then about to expire. This company brought suit for an extension of time, the granting of which would have given them the exclusive right to manufacture in Great Britain. An agreement was made with me that in case the extension was granted, I was to receive 25 per cent. of the profits during the life of the patent, which would have meant at least $10,000 per year. The patent was really worth millions of dollars. I went to London to testify

It was on College Hill, first in the laboratory of the [illegible] campus, that some of the first experiments with the telephone and wireless telegraphy were made, and that photographs were taken through a board long before the X-ray became known. All this was common knowledge on College Hill; there was none of the secrecy which usually surrounds the workshop and experimental station of the inventor. The people were invited to see and investigate these wonders, and the securing of patents was a secondary consideration.

Prof. Dolbear was always ahead of his time; he was so far in advance—his inventions and discoveries were so extraordinary as to be almost incredible—beyond the grasp of those who might have offered the necessary encouragement and support to carry on investigation and at once develop what was plainly the germ of something of world-wide importance.

Others with the same idea were apparently more fortunate. They were first to get into the field, and out of this fact grew the famous Bell telephone lawsuits of 20 years ago, in which Prof. Dolbear and his company took the initiative, and all others who claimed to have inventions connected with the telephone joined, until the United States courts were a veritable Babel of telephone litigation, and, as Prof. Dolbear puts it, "the court must have been so confused with it all as to be unable to tell what it was all about."

Prof. Dolbear lost this famous case, and in consequence thousands of dollars. His losses were not all directly connected with the suit, but after fighting the Bell company to the last ditch the Dolbear company was bankrupt, and, because of this, other patents, which had been lost sight of for the moment, were allowed to run out, a fact which years afterward meant a great deal to Prof. Dolbear. Repeated efforts to reap the reward of his early work when its value became known and appreciated ended in failure. Long lawsuits, both in this country and in England, were decided against him, and others are still profiting by his discoveries.

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His Inventions and Discoveries.

Meanwhile Prof. Dolbear remains at Tufts, lecturing on physics and astronomy, and maintaining a lively interest in those lines of thought and endeavor with which he has been so closely identified. In his library in the house in Professors' row are many of his inventions, some of which are familiar to the public, others of which have been buried by great companies who did not care to have them in the market. Here is one of his static telephones which was the cause of so much litigation, and on the mantel an electric gyroscope, used to demonstrate the rotation of the earth.

Following is a list of his inventions and discoveries and the dates: Rubber-tipped pencil, 1862; string telephone, 1853; steam whistle for playing tunes, 1860; automatic stove damper, 1862; electric gyroscope, 1862; writing telegraph, electrical, 1863; electric talking machine, 1864; electric gyroscope for demonstrating rotation of the earth, 1867; new method of producing sodium and potassium, 1868; vacuum tank for laboratory use, 1869; lissajous forks for projection, 1872; whirling table for laws of centrifugal motion, 1873; oneidoscope, 1873; magnetic telephone, 1876; the rotaphone, 1878; the open helix ammeter, 1879; the static telephone, 1879; portable arm rest for writing, 1878; telephoning without wires, 1881; telegraphing without wires, 1882; air space cable, 1882; acoustic mill, 1888; loss of electric energy from discharge points, 1890; a new galvanic battery, 1884; law of direction in transfer of energy, maximum temperature for molecules, temperature of the sun, more available energy in atoms than in any combination of them, crickets as thermometers, printing in colors electrically, initiated first summer school of physics, 1872; the rotating book shelves, 1863; a new method of projecting spectra, 1875.

If Prof. Dolbear failed, it was probably more as a businessman and legal realist than as a scientist and inventor. He laid the groundwork for much of our later knowledge of and accomplishment in the field of communications.

I hope this material will answer the questions you raised in your letter.

Sincerely yours,

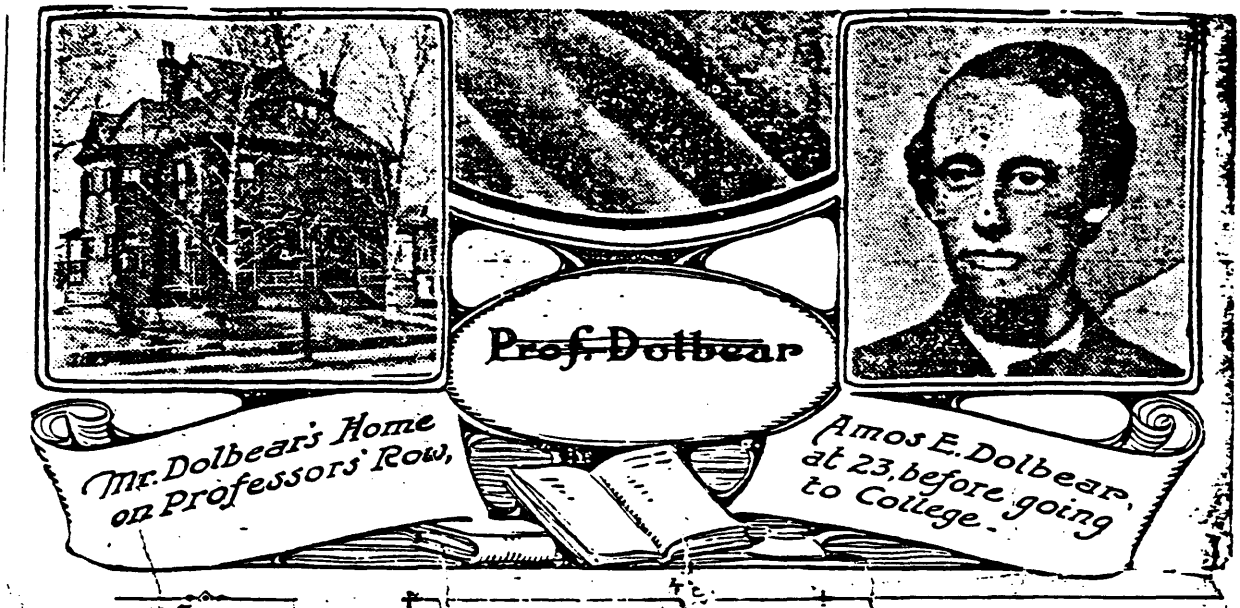
Russell E. Miller
Associate Professor

PROF. DOLBEAR

PROF AMOS E. DOLBEAR

AND HIS ACHIEVEMENTS.

He Anticipated by Six Years Herz' Discovery of Herzian Waves—He Anticipated Bell in the Invention of the Telephone—He Anticipated Marconi by 20 Years as Regards Wireless Telegraphy—He Photographed Through Wood Before Roentgen Found the X-Ray—Yet the Chief Source of His Income Today is the Carnegie Pension Fund—His Views on the Existence of "Spirit," "Personal Immortality" and "Modern Education."



In the twilight evening of his life Prof Amos E. Dolbear, a scientific seer, some of whose visions have become material facts, although he has not reaped the material reward, still keeps in touch with the great problems of physical research in which he is no longer able to take an active part.

Somewhat broken in health and unable to do laboratory work or to write except with great difficulty Prof Dolbear spends most of his time in reading or in converse with friends whom his scientific attainments and the charm of his unaffected and simple manner gather round him. The best years of his life have been devoted to Tufts college, to which his fame has attracted hundreds of ambitious students, and yet when the time for his retirement came the college was too poor to continue his salary. The chief source of his income is the Carnegie pension fund.

At his pleasant home on College hill, Medford, Prof Dolbear recently granted an interview to a Globe reporter, who asked him many questions.

Greatest Achievement.

"What do you consider your greatest achievement?" was asked in the course of the talk.

"That for which some men are disposed to give me the least credit—the discovery of wireless telegraphy and of the telephone long before they were put into practical use. In 1885 a patent for the 'art' of wireless telegraphy was issued to me, upon which I had been experimenting for many years. I was sending wireless messages for a distance of a mile and a half when Marconi was only 8 years old. And long before he began his experiments I had made and received wireless telegrams over a distance of six miles."

Instances of one sowing and another reaping are so common among inventors that Prof Dolbear's experience is an almost every-day occurrence, and he gets what satisfaction he can out of the fact that scientists the world over, with substantial unanimity, now concede that he was the first inventor of the theory of the telephone and of wireless telegraphy.

"I do not begrudge to Marconi and others their success in developing wireless telegraphy," he said. "Of course, the main thing is that the world should reap the benefits of an invention, and the source from which it comes, or the personality of the inventor, is secondary. Nevertheless, I believe that I could have put to good use the financial profits of a successful invention.

"Wireless telegraphy has not yet, by any means, reached perfection. Much remains to be done before a wireless message can be sent in one direction only and be picked up only by the receiver for which it is intended. But I see no reason why the time will not come when the wireless telegraph will be as perfect and as common as the telephone is today. I telephoned without wires many years ago, and that makes me certain that wireless telephony will in the future be the only system.

"I can see no limit to the progress of science in its application to practical problems, nor am I disposed to ridicule the wildest and most impracticable dreams of any trained physicist. We know almost nothing as yet about the ultimate constitution of matter. We only know that each particle is alive with something which we call 'energy.'"

Mind and Soul.

Although Prof Dolbear has devoted himself mainly to the four general branches of physics—mechanics, the science of gravitation, molecular physics and the physics of the ether, including electricity and magnetism—he has for many years had a most absorbing interest in problems of the mind and soul. And today, at three score and ten, his interest in the supreme questions has not waned.

"Have your investigations led you to believe that there is a something in the universe which is neither matter nor physical energy—a something which is called 'spirit?'" the reporter asked.

Prof Dolbear gazed out of the window and waited long before replying. Then he said:

"Your question is a most difficult one. It involves too much. It goes too deep. I cannot answer it by 'yes' or 'no.' If we knew what 'matter' is, we might possibly be able to tell whether it includes all. If we knew what 'energy' or 'force' is, we might know what life is. But the causes and the real nature of the simplest physical phenomena are quite unknown to us. No one can explain the force we call gravitation, or that other force we call electricity, or the phenomenon of matter we call ether.

"And even if we understood these ele-

mental things, that might [illegible] prove or disprove the existence of spirit, much less proving or disproving the fact of personal immortality. "I have seen things right here in this room which I could not possible explain, but which my senses forced me to believe. I have seen books—a dozen or more large and heavy books—taken from those shelves without the use of any visible physical means and thrown violently across the room. That was done, of course, in the presence of a medium, but she was tied and nailed to the floor in such a manner that any movement on her part was absolutely impossible. She could not have reached the books or have produced any of the other physical phenomena.

"I believe those phenomena were produced, but I do not feel compelled to accept the spiritualistic explanation, for there does not appear to be anything in the nature of things which makes it unreasonable to suppose that such phenomena may happen under conditions different from ordinary mechanical conditions, and with other material factors than simply the mechanical means which we ordinarily employ.

A Fallacy.

"In the common assumption that because a thing can be done in a certain way, therefore it is always done in that way, lies a fallacy. For instance, a body may be moved by a push or a pull, but a body may also be moved by magnetic agency, and one cannot tell by simply seeing a body move whether it moves by one or the other, and it would not be a warrantable inference that because a body moved therefore it must have been pushed or pulled by mechanical means.

"I am still inclined to adhere to the opinion I formed many years ago concerning the spiritualistic hypothesis, namely, that physical phenomena sometimes happen of a sort inexplicable by simple mechanical agencies, and that there is no evidence yet in our possession that there is nothing except such agencies among mankind or in the universe.

"But, as I said, these questions do not necessarily have any direct bearing upon the problem of 'spirit' or of continued personal existence after death. We have as yet no 'proofs' of immortality in the sense in which we have proofs of physical facts."

"Do you believe that Sir Oliver Lodge has really had communication with the spirit of the late Richard Hodgson, as he claimed, and positive proof of his identity?" the reporter asked.

"I don't know whether I believe it or not. But I hope he has! I hope he has!" the professor exclaimed with great animation, waving his arm to emphasize his words. "If he has actually ta ked with Hodgson, that would go a long way toward settling the question in minds of many very intelligent persons who are in doubt."

"Do you think the question of immortality will ever be settled definitely?"

"I see no reason why it should not be settled. If it is, one result is pretty sure to follow—people will lose their interest in it. The unknown and the uncertain are what fascinate people."

Personal Immortality.

"What do you think is the present attitude in general of physicists and other scientific men toward the question of personal immortality?"

"I think they have very little interest in the subject for two reasons. First, they have not been able to find out the facts for themselves, and second, they can find no one who does know."

"Is that your attitude [illegible]"

"By no means. [illegible] me more deeply. But I do no[illegible] tize or affirm positively. I only hope. I see no reason why one who has begun to grow should not keep on growing. That appears to me one of the strongest arguments for immortality, but, of course, it is only an argument and not a proof. I want to live and grow and I want a life of useful activity.

"But before we have convincing proofs of immortality I am expecting the world will see marvelous progress in scientific achievement. The next great step which I hope may be taken will be the discovery of some tremendous motive power and the invention of some motor that will enable man to travel at will through space, visit the other planets and the moon and go anywhere he chooses and return to earth. That does not seem to me utterly beyond the limits of possibility."

"Have there been any recent scientific discoveries or inventions that would lead one to believe that such interplanetary voyages are anything but dreams?"

"Not that I know. Still, I am expecting it to happen, not today or tomorrow perhaps, but day after tomorrow," said the professor jokingly.

Important Problems.

"What do you think are the most important problems with which scientists are concerned today?"

"The most important in my opinion is the study of the constitution of matter—its ultimate constitution, I mean. And that is a very wide field, in which physicists, chemists, biologists and psychologists are directly or indirectly engaged. I am looking for great discoveries in the near future, to be made, not, perhaps, by any one investigator alone, but as the combined result of many investigators working on different lines. Lord Kelvin, I think, propounded the true theory of matter, that it is composed of vortex rings, and he thus made one of the greatest contributions to science."

"Whom do you regard as the greatest living scientist since Lord Kelvin's death?"

"It is scarcely possible to answer that question because the field of science is so wide, has so many divisions and so many workers, each in his own specialty."

Lord Bacon said, "I have taken all knowledge to be my province." Although Prof Dolbear would disclaim ever having had any such ambitious plan, he has nevertheless extended his researches far beyond the domain of purely physical science. He has, for instance, made a profound study of the science of teaching, and he has become convinced that the [illegible] system of child education is fundamentally wrong. He believes the present system of school training is upside down and wrong side out. A child's education should be directed by his natural bent, and the mere acquisition of knowledge should not be the main purpose of education in primary schols. Good brains are generally injured by formal education.

Educational System.

"The gist of the matter is," he says, "that appropriate studies are those that a scholar can learn without great effort and with little pressure. This doctrine is very heterodox, and may startle the younger teacher, yet the whole of biology can be appealed to for its support. Work in all grades is quite over the heads of the majority of scholars, and no cure can be effected by any change in the methods of teaching the material now demanded. It is as applicable to science as to literature, and as true for college students as for those in [illegible] schools. They all call for [illegible] of maturity that belongs to [illegible] heads. The teacher should [illegible], not try to lead it, for no one [illegible] enough to do the latter safely.

"In the [illegible] of the day there is always the [illegible] assumption that knowledge is the principal thing, and that if one knows enough he will be a good man and citizen. All the stress is brought to [illegible] on this intellectual side, while [illegible] and ethical relations are [illegible]lly ignored. Yet it is plain today, in the light of evolution, that feelings [illegible] chief factors to be considered. [illegible] how can the ethical feelings be reached by education? Certainly not by compelling a scholar to do what he has no inclination to do. Persuasion, sympathy, help are loudly called for.

"Lang[illegible] languages, whether ancient [illegible] modern, and mathematics may do [illegible] training, but they are mighty poor ed[illegible] pabulum for all but a beggarly [illegible] not one in a thousand, and the [illegible] drill for the sake of discipline [illegible] have no place in the coming [illegible].

"Form[illegible] education for training and discipline [illegible]stly misapplied effort, doing [illegible] mischief than good. Gra[illegible] and college curricula [illegible] for leveling down, not up. [illegible] does not come by study, [illegible], and good brains can dispe[illegible] formal education and be the be[illegible].

"[illegible] by the educational system [illegible] childhood?" the reporter [illegible].

"No, I [illegible] enough primary education [illegible]," he replied. "I had little use [illegible] ools and book-learning. But [illegible] later to fit myself for college [illegible] ying alone, and while in college [illegible] the regular classical course, [illegible] in and Greek. I remember [illegible] the Greek New Testament [illegible] out my classics have long [illegible] and I could easily [illegible] with them entirely if I had to [illegible] education over again. Too [illegible] is still wasted upon them in [illegible] and colleges."

mental things, that might [illegible] prove or disprove the existence of spirit," much less proving or disproving the fact of personal immortality. "I have seen things right here in this room which I could not possible explain, but which my senses forced me to believe. I have seen books—a dozen or more large and heavy books—taken from those shelves without the use of any visible physical means and thrown violently across the room. That was done, of course, in the presence of a medium, but she was tied and nailed to the floor in such a manner that any movement on her part was absolutely impossible. She could not have reached the books or have produced any of the other physical phenomena.

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"I am still inclined to adhere to the opinion I formed many years ago concerning the spiritualistic hypothesis, namely, that physical phenomena sometimes happen of a sort inexplicable by simple mechanical agencies, and that there is no evidence yet in our possession that there is nothing except such agencies among mankind or in the universe.

"But, as I said, these questions do not necessarily have any direct bearing upon the problem of 'spirit' or of continued personal existence after death. We have as yet no 'proofs' of immortality in the sense in which we have proofs of physical facts."

"Do you believe that Sir Oliver Lodge has really had communication with the spirit of the late Richard Hodgson, as he claimed, and positive proof of his identity?" the reporter asked.

"I don't know whether I believe it or not. But I hope he has! I hope he has!" the professor exclaimed with great animation, waving his arm to emphasize his words. "If he has actually talked with Hodgson, that would go a long way toward settling the question in minds of many very intelligent persons who are in doubt."

"Do you think the question of immortality will ever be settled definitely?"

"I see no reason why it should not be settled. If it is, one result is pretty sure to follow—people will lose their interest in it. The unknown and the uncertain are what fascinate people."

Personal Immortality.

"What do you think is the present attitude in general of physicists and other scientific men toward the question of personal immortality?"

"I think they have very little interest in the subject for two reasons. First, they have not been able to find out the facts for themselves, and second, they can find no one who does know."

"Is that your attitude?"

"By no means! [illegible] me more deeply. But I do not [illegible] tise or affirm positively. I only hope. I see no reason why one who has begun to grow should not keep on growing. That appears to me one of the strongest arguments for immortality, but, of course, it is only an argument and not a proof. I want to live and grow and I want a life of useful activity.

"But before we have convincing proofs of immortality I am expecting the world will see marvelous progress in scientific achievement. The next great step which I hope may be taken will be the discovery of some tremendous motive power and the invention of some motor that will enable man to travel at will through space, visit the other planets and the moon and go anywhere he chooses and return to earth. That does not seem to me utterly beyond the limits of possibility."

"Have there been any recent scientific discoveries or inventions that would lead one to believe that such interplanetary voyages are anything but dreams?"

"Not that I know. Still, I am expecting it to happen, not today or tomorrow perhaps, but day after tomorrow," said the professor jokingly.

Important Problems.

"What do you think are the most important problems with which scientists are concerned today?"

"The most important in my opinion is the study of the constitution of matter—its ultimate constitution, I mean. And that is a very wide field, in which physicists, chemists, biologists and psychologists are directly or indirectly engaged. I am looking for great discoveries in the near future, to be made, not, perhaps, by any one investigator alone, but as the combined result of many investigators working on different lines. Lord Kelvin, I think, propounded the true theory of matter, that it is composed of vortex rings, and he thus made one of the greatest contributions to science."

"Whom do you regard as the greatest living scientist since Lord Kelvin's death?"

"It is scarcely possible to answer that question because the field of science is so wide, has so many divisions and so many workers, each in his own specialty."

Lord Bacon said, "I have taken all knowledge to be my province." Although Prof Dolbear would disclaim ever having had any such ambitious plan, he has nevertheless extended his researches far beyond the domain of purely physical science. He has, for instance, made a profound study of the science of teaching, and he has become convinced that the [illegible] system of child education is fundamentally wrong. He believes the present system of school training is upside down and wrong side out. A child's education should be directed by his natural bent, and the mere acquisition of knowledge should not be the main purpose of education in primary schools. Good brains are generally injured by formal education.

Educational System.

"The gist of the matter is," he says, "that appropriate studies are those that a scholar can learn without great effort and with little pressure. This doctrine is very heterodox, and may startle the younger teacher, yet the whole of biology can be appealed to for its support. Work in all grades is quite over the heads of the majority of scholars, and no cure can be effected by any change in the methods of teaching the material now demanded. It is as applicable to science as to literature, and as true for college students as for those in [illegible] schools. They all call for [illegible] of maturity that belongs to [illegible] heads. The teacher should [illegible], not try to lead it, for no one [illegible] enough to do the latter safely.

"In the [illegible] of the day there is always the [illegible] assumption that knowledge is the principal thing, and that if one knows enough he will be a good man and citizen. All the stress is brought to bear on this intellectual side, while feelings and ethical relations are practically ignored. Yet it is plain today, in the light of evolution, that feelings are the chief factors to be considered. [illegible] can the ethical feelings be reached by education? Certainly not by compelling a scholar to do what he has no inclination to do. Persuasion, sympathy, help are loudly called for.

"Languages, [illegible] languages, whether ancient or modern, and mathematics may do for training, but they are mighty poor [illegible] pabulum for all but a beggarly [illegible] not one in a thousand, and the [illegible] drill for the sake of discipline [illegible] have no place in the coming [illegible].

"Formal education for training and discipline [illegible] misapplied effort, doing [illegible] than good. Grade schools and college curricula [illegible] for leveling down, not up. [illegible] does not come by study, [illegible], and good brains can dispense [illegible] formal education and be the better [illegible].

"Were you injured by the educational system in your childhood?" the reporter asked.

"No, [illegible] enough primary education [illegible]," he replied. "I had little use for schools and book-learning. But [illegible] later to fit myself [illegible] studying along, and while in college [illegible] the regular classical course, [illegible] Latin and Greek. I remember [illegible] the Greek New Testament [illegible] out my classics, have long [illegible] and I could easily [illegible] with them entirely if I had to [illegible] education over again. Too [illegible] is still wasted upon them in [illegible] and colleges."

Prof Dolbear believes that the whole system of primary and secondary education will be revolutionized and placed on a more rational basis. He thinks it would be better to turn all children out to grass until they are 12 years old than to force them to spend long hours in the schoolroom, as is now done.

Discoveries Anticipated.

"Your old men shall dream dreams, your young men shall see visions," said the prophet. Dreams and visions have characterized Prof Dolbear's whole life—visions of scientific possibilities and dreams of human progress. And yet he has not been either a visionary or a dreamer, but a seer in the best sense of the word.

This is the reason why he was able to anticipate so many of the great discoveries which have given fame to other men.

He anticipated by six years Hertz' discovery of the existence of electrical waves in space, known as Herzian waves.

He anticipated Bell in the invention of the telephone. That was in 1876.

He anticipated Marconi by fully 20 years in the invention of wireless telegraphy.

He anticipated Roentgen by four years in the discovery of the X-ray, for early in 1892 he photographed successfully through wood an inch thick by means of other waves set up by the simple sparking of a static electrical machine and without the aid of a Crookes tube. Any one of these achievements would [illegible] lasting fame, as yet with none of them is his name popularly associated. A few of his many other inventions, to which his title has never been disputed, are these:

In 1868 a gyroscope, which worked by electricity and which demonstrated the rotation of the earth.

In 1872 an opeidoscope for showing the form of the vibrations of the human voice.

In 1876 a magneto-telephone, substantially the same as we have it today.

In 1879 an open-coil ammeter, the same as that in use today in electric light stations. Through the improper drawing of the patent specifications the invention passed out of Prof Dolbear's control.

In 1882 the air-space cable, now in use in many hundred thousand miles of telephone lines.

It was in the same year, 1882, that Prof Dolbear read before the American association for the advancement of science a paper on "Telegraphy Without Wires," a problem which he had already solved.

Literary Work.

His contributions to the literature of science include "A Handbook of Chemical analysis," "A Treatise on Projections," "A Manual of Experiments in Physics, Chemistry and Biology," "The Telephone," "Matter, Ether and Motion," and a large number of pamphlets and addresses.

In an article written by Prof Dolbear for the Globe some years ago on the discoveries and inventions of New Englanders in the 19th century he mentioned every famous name except his own. It is safe to predict that when the impartial and dispassionate history of science in America comes to be written, one of the longest chapters will be devoted to the solid achievements of Amos E. Dolbear.

Dolbear, Amos E. (Faculty)
Prof. Amos E. Dolbear and His Achievements
Boston Sunday Globe, June 28, 1908

Edison, Dolbear, Thomson and Stone

More than a decade before Stubblefield's first experiments, there was a line of development in which double-winding induction coils similar to the types employed in early telephone work and in physics laboratories were utilized. In some circuit configurations an induction field would predominate, and in others radiation capability existed, but the state of the art was such that most electricians and physicists failed to recognize the capability of the induction coil in the production of high frequency waves. Several persons were on the fringe of exciting discoveries but "missed the boat" by narrow margins. Included in this group were Thomas Edison and Elihu Thomson, who conducted a variety of investigations in the 1870s in which electrical sparks produced by a generator could be detected at a distance.[17] Only Heinrich Hertz, in Germany, really understood what was going on. His brilliant experimental proof of Scottish physicist James Clerk-Maxwell's theoretical predictions took place in 1888. However, the most significant work from the wireless telephone standpoint was performed by Amos Emerson Dolbear, Professor of Physics at Tufts College.[18] Dolbear, in the early 1880s, conducted a number of experiments with induction coils, carbon and condenser telephone transmitters, and batteries in a wireless set-up with grounded wires at both ends of a communications link. The system was fully described in the *Scientific American* of Dec. 11, 1886 and a patent was awarded (No. 350299).

Such are a few of the early instances noted of the extreme sensitiveness of the telephone, by the aid of which the problem of wireless telegraphy was now to be attacked with a fair measure of success, and advanced a long way towards a practical solution.

Mr J. Gott, then superintendent of the Anglo-American Telegraph Company at St Pierre, was, I believe, the first to suggest the employment of the telephone in this connection. In a brief communication, published in the 'Jour. Inst. Elec. Engs.' (vol. vi. p. 523), he says: "The island of St Pierre is, perhaps, better insulated than most places. Hundreds of yards from the station, if a wire be connected to earth, run some distance, and put to earth again, with a telephone in circuit, the signals passing through the cables can be heard."

There are two offices on the island,—one used for repeating the cable business on the short cables between Sydney, C.B., and Placentia, N.F., and operated by the Morse system, with a comparatively powerful battery; the other is the office at which the Brest and Duxbury cables terminate, and is furnished with very delicate instruments —the Brest cable, which is upwards of 2500 miles long, being operated by Thomson's exceedingly sensitive dead-beat mirror galvanometer; whilst on the Duxbury cable the same inventor's instrument, the siphon recorder, is used. The Brest instrument was found seriously affected by earth-currents, which flowed in and out of the cable, interfering very much with the *true* currents or signals, and rendering it a difficult task for the operator to decipher them accurately. The phenomenon is not an uncommon one; and the cause being attributed to the *ground* used at the office, a spare insulated wire, laid across the island, a distance of nearly three miles, and a metal plate connected to it and placed in the sea, was used in lieu of the *office ground*. This had a good effect, but it was now found that part of the supposed earth-currents had been due to the signals sent by the Morse operator into his wire, for when the recorder was put in circuit between the ground at the cable office and the sea ground—three miles distant—the messages sent by the Morse were clearly indicated,—so clearly, in fact, that they were automatically recorded on the tape.

It must be clearly understood that the two offices were in no way connected, nor were they within some 200 yards of

[1] For a curiously similar case, the result of a wrong connection of the line wires, see the 'Telegraphic Journal,' vol. ix. p. 68.

[2] The absence of insulation in this experiment recalls the fact that a telephone line using the earth for the return circuit often works better when the insulation is defective, as it is then less affected by extraneous currents. Thus, in 1882, the Evansville (Ind.) Telephone Exchange Company worked 400 miles of line without insulators of any kind (the wires being simply attached to the poles), and generally with better results than when insulators were used. ('Electrician,' vol. ix. p. 481.)

each other; and yet messages sent at one office were distinctly read at the other, the only connection between the two being through the earth, and it is quite evident that they could be so read simultaneously at *many* offices in the same neighbourhood. The explanation is clear enough. The potential of the ground at the two offices is alternately raised and lowered by the Morse battery. The potential of the sea remains almost, if not wholly, unaffected by these, and the island thus acts like an immense Leyden jar, continually charged by the Morse battery and discharged, in part, through the short insulated line. Each time the Morse operator depressed his key he not only sent a current into his cable, but electrified the whole island, and this electrification was detected and indicated on the recorder.[1]

As the result of these experiences, Mr Gott gave it as his opinion that "speaking through considerable distances of earth without wires is certainly possible with Bell's telephone, with a battery and Morse signals."

Professor John Trowbridge of Harvard University, America, was, however, the first to systematically study the problem, and to revive the daring project of an Atlantic telegraph without connecting wires, and the less ambitious but equally useful project of intercommunication between ships at sea.[2] In fact, Trowbridge's researches may truly be said to form a new starting-point in the history of our subject, for, as we shall see later on, it is chiefly to him that Messrs Preece, Bell, and probably other experimenters in this field, owe their inspirations.[1] His investigations, therefore, deserve to be carefully followed.

The observatory at Harvard transmits time-signals from Cambridge to Boston, a distance of about four miles, and the regular recurrence of the beats of the clock afforded a good means of studying the spreading of the electric currents from the terminal of the battery which is grounded at the observatory. In all the telephone circuits between Boston and Cambridge, in the neighbourhood of the observatory line, the ticking of the clock could be heard. This ticking had been attributed to induction, but this, according to Prof. Trowbridge, is an erroneous conclusion, as he shows by a mathematical analysis into which we need not enter. The result goes to show that, with telephones of the resistance usually employed, no inductive effect will be perceived by the use of even ten quart Bunsen cells between wires running parallel, a foot apart, for a distance of 30 or 40 feet.

For this and other reasons, he says, it is impossible to hear telephonic messages by induction from one wire to another, unless the two run parallel and very close to each other for a long distance. This distance generally exceeds the limit at which the ordinary Bell telephone ceases to transmit articulate speech. The effects which have usually been attributed to induction are really, he says, due to the earth connections and to imperfect insulation.

striking results had been obtained on actual telegraph lines, where there was no battery, and where the infinitesimal currents produced by speaking into a Bell telephone on one wire were able to induce currents in a parallel wire sufficient to render the words audible in another telephone in its circuit. Dr Channing found this to be possible "under very favourable conditions."[1]

Another striking illustration is furnished by Prof. Blake, of Brown University, U.S., who talked with a friend for some distance along a railway (using the two lines of rails for the telephonic circuit), hearing at the same time the Morse signals passing along the telegraph wires overhead.[2]

[1] See now Salvá's curious anticipation in 1795 of this phenomenon, p. 2, *ante*. The peculiarity, due to geological formation, is not confined to St Pierre; it is often met with in practice, though usually in lesser degrees. See some interesting cases, noted by G. K. Winter and James Graves, 'Jour. Inst. Elec. Engs.,' vol. i. p. 88, and vol iv. p. 34.

[2] Mr H. C. Strong of Chicago, Illinois, claims to have suggested in 1857, in a Peoria, Ill., newspaper, the possibility of communication between ships at sea by means of a wireless telegraph then recently invented by his friend Henry Nelson of Galesburg. See Mr Strong's letter in the New York 'Journal of the Telegraph,' August 15 1877.

[1] See pp. 92 and 137, *infra*. Professor Trowbridge's researches are given at length in a paper, "The Earth as a Conductor of Electricity," read before the American Academy of Arts and Sciences in 1880. See also 'Silliman's American Journal of Science,' August 1880, which I follow in the text.

Having determined in this manner that the echoes of the time-signals observed on the telephone lines were not due to induction, but to leakage from the clock circuit, Prof. Trowbridge proceeded to study the extent of the equally electrified or equi-potential surfaces of the ground surrounding the clock battery. His method of exploration was to run a wire 500 or 600 feet long to earth at each end, including a telephone of 50 to 60 ohms resistance. Evidence of a current in this exploratory circuit was plainly shown by the ticking sound which making and breaking the circuit caused in the telephone, and the time-signals could be distinctly heard in a field 220 yards from the observatory where one earth of the time-signal wire is located. At a distance of a mile from the observatory, and not in the direct line between that place and the Boston telephone office, the time-signals were heard by connecting through a telephone the gas-pipes of one building with the water-pipes of another only 50 feet apart. In another experiment at the Fresh Pond lake in Cambridge, signals sent from Boston to Waltham (ten to twelve miles) were heard by simply dipping the terminal wires of the telephone in the lake, and some distance apart, where they must have been far away (? four miles) from the battery earth.

Prof. Trowbridge performed a large number of similar experiments, varied in every way, all going to prove (1) that a battery terminal discharging electricity to earth is the centre of waves of electrical energy, ever widening, and ever decreasing in strength or potential as they widen; and (2) that on tapping the earth in the way described at two points of different potentials (not very distant, if near the central source, and more removed the farther we recede from the source) we can obtain in the telephone evidence of their existence. Prof. Trowbridge then goes on to say:—

"In a discussion on the earth as a conductor, Steinheil says: 'We cannot conjure up gnomes at will to convey our thoughts through the earth. Nature has prevented this. The spreading of the galvanic effect is proportional . . . to the square of the distance; so that, at the distance of 50 feet, only exceedingly small effects can be produced. . . . Had we means which could stand in the same relation to electricity that the eye stands to light, nothing would prevent our telegraphing through the earth without conducting wires.' [1]

"The telephone of Prof. Bell, though far from fulfilling the conditions required by Steinheil, is nevertheless our nearest approach to the desideratum.

"The theoretical possibility of telegraphing across the Atlantic without a cable is evident from the survey which I have undertaken. The practical possibility is another question. Powerful dynamo-electric machines could be placed at some point in Nova Scotia, having one end of their circuit grounded near them and the other end grounded in Florida, the connecting wire being of great conductivity and carefully insulated throughout. By exploring the coast of France, two points on surface lines not at the same potential could be found; and by means of a telephone of low resistance, Morse signals sent from Nova Scotia to Florida could be heard in France. Theoretically, this is possible; but practically, with the light of our present knowledge, the expenditure of energy on the dynamo-electric machines would be enormous." [2]

Professor Trowbridge has suggested the applicability of this method to the intercommunication of ships at sea.

[1] See p. 5, *ante*.

[2] A writer in the 'Electrician' (vol. v. p. 212), commenting on this passage, says: "Prof. Trowbridge seems to overlook the advantage of employing large condensers between the dynamo machines and the earth. They would prove of great service in exalting the earth potentials at the terminal stations."

Let, he says, a steamer be provided with a powerful dynamo. Connect one terminal of the dynamo with the water at the bow of the steamer, and the other to a long wire, insulated except at its extreme end, dragging over the stern, and buoyed so as not to sink. The current from the dynamo will thus pass into the water and spread out over a large area, as before explained, saturating, so to speak, the water with electricity. Suppose this current be interrupted by any suitable means, say one hundred times a second. Let the approaching steamer be provided with a telephone wire, the ends of which dip into the water at her bow and stern respectively. On entering the saturated area the telephone will respond to the interruptions of the dynamo by giving out a continuous buzzing sound. If now in the dynamo circuit we have a manipulating arrangement for breaking up the electric impulses into long and short periods, corresponding to the Morse alphabet, one ship can speak to the other. It is hardly necessary to add that by providing each steamer with a dynamo circuit and a telephone circuit reciprocal correspondence could be maintained, it being only necessary for the steamer desiring to listen to stop and disconnect the dynamo. The success of this method of communicating between ships in a fog depends upon the distance between the ends of the dynamo circuit and upon the strength of the current, or electrical impulses imparted to the water.

It is probable that a dynamo capable of maintaining one hundred incandescent lamps could establish a sufficient difference of potential between the water at the bow and at the end of a trailing wire, half a mile long, to affect a telephone on an approaching ship while yet half a mile distant.

In a discussion on Prof. Graham Bell's paper, read before the American Association for the Advancement of Science, 1884, Prof. Trowbridge described another plan, using instead of the telephone circuit a sensitive galvanometer connected up to a cross-arm of wire, whose ends dip into the water at each side of the ship. When one vessel comes within the area electrically saturated by another, the galvanometer will show how the equipotential lines are disturbed, and if a map of these lines be carefully traced we can fix the position of the approaching ship. He adds: "The method could also be applied to saturating the water around a rock, and you could take electrical soundings, so to speak, and ascertain your position from electrical maps carefully made out."

In a later paper published in the 'Scientific American Supplement,' February 21, 1891, Prof. Trowbridge discusses the phenomena of induction, electro-magnetic and static, as distinguished from leakage or earth conduction, and with reference to their employment in wireless telegraphy.

The hope, he says, that we shall be able to transmit messages through the air by electricity without the use of connecting wires is supposed by some to indicate its realisation at a future day. Let us examine how near we are at present to the realisation of this hope.

He supposes that the chief use of any method by which connecting wires could be dispensed with would be at sea in a fog. On land for considerable distances it is hardly probable that any electrical method could be devised in which air or the ether of space could advantageously replace a metallic conductor. The curvature of the earth would probably demand a system of frequent repetition, which is entirely obviated by the use of a wire. If, however, an electrical or magnetic system could be made to work through the air even at the distance of a mile, it would be of very great use at sea in averting collisions; for any system of signals depending upon the use of fog-horns or

fog-whistles is apt to mislead on account of the reflection of the sound from layers of air of different densities and from the surface of the water. The difficulty of ascertaining the direction of a fog-horn in a thick fog is well known. The waves of sound, even if they are carefully directed by a trumpet or by parabolic reflectors, diverge so rapidly that there is no marked difference in the intensity between a position in the direct line and one far to one side.

The most obvious method of signalling by electricity through the air is by electro-magnetic induction. Suppose

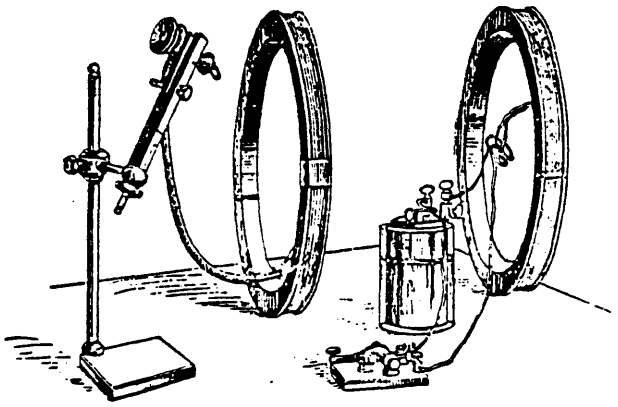


Fig. 7.

we have a coil of copper wire consisting of many convolutions, the ends of which are connected with a telephone (fig. 7). If we place a similar coil, the ends of which are connected to a battery through a key, within a few feet of the first and parallel to it, each time the current is made and broken in the battery coil instantaneous currents are produced by induction in the other coil, as can be heard by the clicks in the telephone.

To illustrate induction at a distance, Prof. Joseph Henry placed a coil of wire, 5½ feet in diameter, against a door, and at a distance of 7 feet another coil of 4 feet diameter. When contact was made and broken with a battery of eight cells in the first coil, shocks were felt when the terminal wires of the second were placed close together on the tongue.

In all such methods the wires or coils which produce an electrical disturbance in a neighbouring coil are never more than a few feet apart. Now let us suppose that a wire is stretched ten or twelve times, to and fro, from yard-arm to yard-arm of a steamer's foremast, and connected at the ends either with a powerful battery or dynamo, or with a telephone, as may be required either for signalling or for listening. Let an approaching steamer have a similar arrangement. If now the current on one vessel be interrupted a great number of times per second, a musical note will be heard in the telephone of the other vessel, and *vice versâ*. The sound will be strongest when the two coils are parallel to each other. If, therefore, the coils be movable the listener can soon find the position of greatest effect, and so fix the direction in which the signalling steamer is approaching.

It may not even be necessary to connect the telephone with the coil, for it has been found that if a telephone, pure and simple, be held to the ear and pointed towards a coil in which a current of electricity is rapidly interrupted, the makes and breaks will be heard, and this even when the wire coil of the telephone is removed, leaving only the iron core and the diaphragm.[1]

[1] Mr Willoughby Smith was, I believe, the first in recent times to observe these effects. See his paper on "Volta-Electric Induction," 'Jour. Inst. Elec. Engs.,' vol. xii. p. 457. But exactly similar effects, *mutatis mutandis*, were described by Page in 1837, to which he gave the name of Galvanic Music, and which he found to be due to the fact that iron when magnetised and demagnetised gave out a

Nothing could seem simpler than this, but, unfortunately, calculation shows that under the best conditions the size of the coils would have to be enormous. Prof. Trowbridge has computed that to produce an audible note in the telephone at a distance of half a mile, a coil of ten turns of 800 feet radius would be necessary; but it is evident that a coil of this size would be out of the question. Instead, however, of increasing the size of the coil beyond the practical limits of the masts and yard-arms, we could increase the strength of the current so as to be effective at the distance of half a mile; but, again, calculation shows that this strength of current would be beyond all practical limits of dynamo construction, unless we discover some method of tuning, so to speak, two coils so that the electrical oscillations set up in one may be able to evoke in the other sympathetic vibrations.[1]

Since, then, we have little, apparently, to hope for from electro-magnetic induction in signalling through a fog, cannot we expect something from static induction? This form of induction can be well illustrated by an early experiment of Prof. Henry. An ordinary electrical machine was placed in the third storey of his house, and a metal plate 4 feet in diameter was suspended from the prime conductor. On the first floor or basement, 30 feet below in a direct line, was placed a similar plate, well insulated. When the upper plate was charged by working the machine, the lower plate showed signs of electrification, as was evidenced by its effect on the pith-ball electroscope.[2]

The distance to which this electrical influence can be extended depends upon the charging power of the machine and the dimensions of the plate. If we could erect an enormous metal plate on a hill, insulated and powerfully charged, it is probable that its electrical influence could be felt at the distance of the horizon; but here, again, the question of practical limits comes in as a bar, so that, at the present time (February 1891), this method of signalling without wires seems as little practicable as the others.

After following me in this study of Prof. Trowbridge, the reader may well begin to despair, for while the learned Professor's investigations are extremely interesting, his conclusions are very disappointing. But the darkest hour is just before the dawn, and so it is in this case.

PROFESSOR GRAHAM BELL—1882.

Following the lines suggested by Prof. Trowbridge, Prof. Bell carried out some successful experiments, an account of which is given in his paper read before the American Association for the Advancement of Science in 1884.

"A few years ago," he says, "I made a communication on the use of the telephone in tracing equipotential lines and surfaces. I will briefly give the chief points of the experiment, which was based on experiments made by Prof. Adams of King's College, London. Prof. Adams used a galvanometer instead of a telephone.

"In a vessel of water I placed a sheet of paper. At two points on that paper were fastened two ordinary sewing

sound. De la Rive, in 1843, rightly traced this sound to the slight elongation of iron under the magnetic strain—a fact which, in its turn, was first observed by Joule in 1842. For Page's discovery see the 'Magazine of Popular Science,' 1837, p. 237.

[1] Prof. Oliver Lodge is now engaged on this very problem. See 'Jour. Inst. Elec. Engs.,' No. 137, p. 799.

[2] See an excellent account of Henry and his work in the New York 'Electrical Engineer,' January 13, 1892, and succeeding numbers, from the pen of his daughter, Mary A. Henry. Abstracts of these papers are given in the 'Electrician,' vol. xxviii. pp. 327, 348, 407, 661.

needles, which were also connected with an interrupter that interrupted the circuit about one hundred times a second. Then I had two needles connected with a telephone: one needle I fastened on the paper in the water, and the moment I placed the other needle in the water I heard a musical sound from the telephone. By moving this needle around in the water, I would strike a place where there would be no sound heard. This would be where the electric tension was the same as in the needle; and by experimenting in the water you could trace out with perfect ease an equipotential line around one of the poles in the water.

"It struck me afterwards that this method, which is true on the small, is also true on the large scale, and that it might afford a solution of a method of communicating electrical signals between vessels at sea.

"I made some preliminary experiments in England, and succeeded in sending signals across the river Thames in this way. On one side were two metal plates placed at a distance from each other, and on the other two terminals connected with the telephone. A current was established in the telephone each time a current was established through the galvanic circuit on the opposite side, and if that current was rapidly interrupted you would get a musical tone.

"Urged by Prof. Trowbridge, I made some experiments which are of very great value and suggestiveness. The first was made on the Potomac river.

"I had two boats. In one boat we had a Leclanché battery of six elements and an interrupter for interrupting the current very rapidly. Over the bow of the boat we made water connection by a metallic plate, and behind the boat we trailed an insulated wire, with a float at the end carrying a metallic plate, so as to bring these two terminals about 100 feet apart. I then took another boat and sailed off. In this boat we had the same arrangement, but with a telephone in the circuit. In the first boat, which was moored, I kept a man making signals; and when my boat was near his I would hear those signals very well—a musical tone, something of this kind: tum, tum, tum. I then rowed my boat down the river, and at a distance of a mile and a quarter, which was the farthest distance I tried, I could still distinguish those signals.

"It is therefore perfectly practicable for steam-vessels with dynamo machines to know of each other's presence in a fog when they come, say, within a couple of miles of one another, or, perhaps, at a still greater distance. I tried the experiment a short time ago in salt water of about 20 fathoms in depth. I used then two sailing-boats, and did not get so great a distance as on the Potomac. The distance, which we estimated by the eye, seemed to be about half a mile; but on the Potomac we took the distance accurately on the shore."

Later, in urging a practical trial of his method, Prof. Bell further said: "Most of the passenger steamships have dynamo engines, and are electrically lighted. Suppose, for instance, one of them should trail a wire a mile long, or any length, which is connected with the dynamo engine and electrically charged. The wire would practically have a ground connection by trailing in the water. Suppose you attach a telephone to the end on board. Then your dynamo or telephone end would be positive, and the other end of the wire trailing behind would be negative. All of the water about the ship will be positive within a circle whose radius is one-half of the length of the wire. All of the water about the trailing end will be negative within a circle whose radius is the other half of the wire. If your wire is one mile long, there is then a large area of water about the ship which is affected either positively or negatively by the dynamo engine and the

electrically charged wire. It will be impossible for any ship or object to approach within the water so charged in relation to your ship without the telephone telling the whole story to the listening ear. Now, if a ship coming in this area also has a similar apparatus, the two vessels can communicate with each other by their telephones. If they are enveloped in a fog, they can keep out of each other's way. The ship having the telephone can detect other ships in its track, and keep out of the way in a fog or storm. The matter is so simple that I hope our ocean steamships will experiment with it." [1]

PROFESSOR A. E. DOLBEAR—1882.

Prof. Dolbear of Tuft's College, Boston, was also, about the same time as Graham Bell, engaged on the problem of a wireless telegraph, and produced a very simple and workable apparatus, which he patented in the United States (March 1882), and of which he gave a description at a meeting of the American Association for the Advancement of Science in the following August. I take the following account from his specification as published in the 'Scientific American Supplement,' December 11, 1886 :—

"In the diagram, A represents one place (say Tuft's College) and B a distant place (say my residence).

"C is a wire leading into the ground at A, and D a wire leading into the ground at B.

"G is an induction coil, having in the primary circuit a microphone transmitter T, and a battery f', which has a number of cells sufficient to establish in the wire C, which is connected with one terminal of the secondary coil, an electro-motive force of, say, 100 volts. The battery is so connected that it not only furnishes the current for the primary circuit, but also charges or electrifies the secondary coil and its terminals C and H'.[1]

"Now, if words be spoken in proximity to transmitter T, the vibration of its diaphragm will disturb the electric condition of the coil G, and thereby vary the potential of the ground at A, and the variations of the potential at A will cause corresponding variations of the potential of the ground at B, and the receiver R will reproduce the words spoken in proximity to the transmitter, as if the wires C D were in contact, or connected by a third wire.

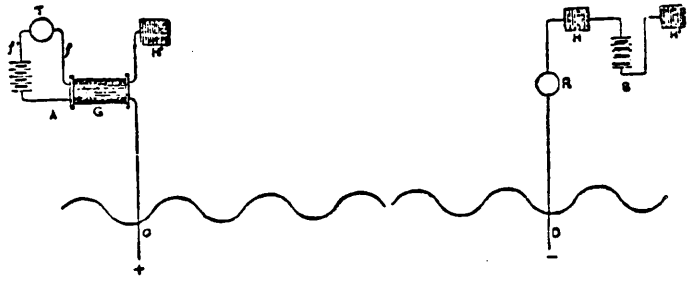


Fig. 8.

"There are various well-known ways of electrifying the wire C to a positive potential far in excess of 100 volts, and the wire D to a negative potential far in excess of 100 volts.

"In the diagram, H H' H^2 represent condensers, the condenser H' being properly charged to give the desired effect. The condensers H and H^2 are not essential, but are of some benefit; nor is the condenser H' essential when the secondary coil is otherwise charged. I prefer to charge all these condensers, as it is of prime importance to keep the grounds of wires C and D oppositely electrified, and while, as is

[1] 'Public Opinion,' January 31, 1886.

[1] The diagram, which we have carefully copied, does not show how this is done, but the practical reader will easily supply the necessary connections.

obvious, this may be done by either the batteries or the condensers, I prefer to use both."

In the article from which I am quoting the author gives some additional particulars which are worth repeating. "My first results," he says, "were obtained with a large magneto-electric machine with one terminal grounded through a Morse key, the other terminal out in free air and only a foot or two long; the receiver having one terminal grounded, the other held in the hand while the body was insulated, the distance between grounds being about 60 feet. Afterward, much louder and better effects were obtained by using an induction coil having an automatic break and with a Morse key in the primary circuit, one terminal of the secondary grounded, the other in free air, or in a condenser of considerable capacity, the latter having an air discharge of fine points at its opposite terminal. At times I have employed a gilt kite carrying a fine wire from the secondary coil. The discharges then are apparently nearly as strong as if there was an ordinary circuit.

"The idea is to cause a series of electrical discharges into the earth at a given place without discharging into the earth the other terminal of the battery or induction coil—a feat which I have been told so many, many times was impossible, but which certainly can be done. An induction coil isn't amenable to Ohm's law always! Suppose that at one place there be apparatus for discharging the *positive* pole of the induction coil into the ground, say 100 times per second, then the ground will be raised to a certain potential 100 times per second. At another point let a similar apparatus discharge the *negative* pole 100 times per second; then between these two places there will be a greater difference of potential than in other directions, and a series of earth-currents, 100 per second, will flow from the one to the other. Any sensitive electrical device, a galvanometer or telephone, will be disturbed at the latter station by these currents, and any intermittence of them, as can be brought about by a Morse key in the first place, will be seen or heard in the second place. The stronger the discharges that can be thus produced, the stronger will the earth-currents be of course, and an insulated tin roof is an excellent terminal for such a purpose. I have generally used my static telephone receiver in my experiments, though the magneto will answer.

"I am still at work upon this method of communication, to perfect it. I shall soon know better its limits on both land and water than I do now. It is adapted to telegraphing between vessels at sea.

"Some very interesting results were obtained when the static receiver with one terminal was employed. A person standing upon the ground at a distance from the discharging point could hear nothing; but very little, standing upon ordinary stones, as granite blocks or steps; but standing on asphalt concrete, the sounds were loud enough to hear with the telephone at some distance from the ear. By grounding the one terminal of the induction coil to the gas or water pipes, leaving the other end free, telegraph signals can be heard in any part of a big building and its neighbourhood without *any connection whatever*, provided the person be well insulated."

When we come to speak of the Marconi system, we shall see how near Dolbear got to that discovery, or perhaps I should say how nearly he anticipated it. Comparing the arrangement, fig. 8 (especially when, as stated, a Morse key and automatic interrupter were used in place of the microphonic transmitter), with Marconi's, fig. 40, it will be seen that they are practically identical in principle. Dolbear's acute observation of the heightened effects obtained by projecting into free air the ungrounded terminals of the sending and receiving apparatus is his own discovery; while his use

of condensers (answering to Marconi's capacity areas) and gilt kites carrying fine wire was another step in the right direction. Of course he does not use the Branly receiver, or the Righi sparking arrangement shown in fig. 40 (they were not known in 1882), but as regards the latter Marconi has himself discarded it in recent times, using a single spark-gap, which even is not absolutely necessary for the production of waves, leaving the secondary coil "open" alone sufficing.[1]

Prof. Dolbear's account of the action of his apparatus is in places a little puzzling, which, perhaps, can hardly be wondered at, for Hertz had not yet come to make clear the way which the American professor saw but as in a glass darkly. There can, however, be little doubt that he was using very long electric waves in 1882 (that is, five or six years before Hertz), and in much the same way as Marconi does now. When, for instance, he whistled into his microphonic transmitter, making it vibrate say 4000 times per second, did he not in effect start electric (now called Hertzian) waves $\frac{186000}{4000} = 46\frac{1}{2}$ miles long? We can easily see this now, but in 1882 the results were not so well understood. Dolbear was inclined to attribute them to some kind of ether action, obscure cases of which were then cropping up and attracting attention in the electrical world.[2]

Others thought that the results were "only extraordinary cases of electro-static induction." Thus Prof. Houston, who saw some of Dolbear's experiments and had himself repeated them, says: "The explanation of the phenomenon as I understand it would appear to be this—One of the plates of the receiver (that is, of the electro-static telephone) being connected through the body of the experimenter to the ground, partakes of the ground potential, while the other plate is *en rapport* with the free end of the sending apparatus by a line of polarised air particles. The experiment is simply an exceptional application of the principles of electro-static induction, and I am not at all sure that it is not susceptible of a great increase in delicacy, in which case it would become of considerable commercial value."[1]

Prof. Dolbear's friends in America are now claiming for him the discovery of the art of wireless telegraphy *à la Marconi*. They argue that Marconi arranges and works his circuits in the way substantially shown in Dolbear's patent of 1882; that he employs Dolbear's transmitting devices (induction coil, battery, and Morse key), as well as his aerial and ground connections on the sending and receiving apparatus. Dolbear emitted electric waves of many miles long, and received them on his electro-static telephone; Marconi, by using the same means, emits waves of many feet long, and receives them on a Branly coherer. Where, they ask, is the difference? Marconi's receiver is admitted to greatly extend the signalling range, but this does not affect the principle of the art, only its practical value, as to which they recall the fact that Graham Bell's telephone, as patented in 1876, was *practically* inoperative, yet the patent secured to him the honour and profit of the invention, as it was held that the principle was there, though in an imperfect form. All this is true, and I hope that Dolbear's early and for the time extraordinary experiments will always be remembered to his credit, but this, I think, should be done without detracting from the merit due to Marconi for his successful and, as I believe, entirely independent application of the same principle. But of this more anon.

[1] Broca, 'La Télégraphie sans Fils,' p. 89.

[2] See, for example, 'Telegraphic Journal,' February 15, 1876, p. 61, on The "Etheric" Force.

[1] 'Scientific American Supplement,' December 6, 1884. At first, Dolbear's estimate of distance was modest—"half a mile at least," but it is said that recently he has worked his apparatus up to a distance of thirteen miles.

AMERICAN PRIORITY IN TELEGRAPHING WITHOUT WIRES.

BY

A. E. Dolbear

THE increasing interest in the attempts to telegraph without wires both here and abroad makes it worth while to make mention of some facts which have been forgotten or ignored, and I venture to point out that the method which has lately been employed so successfully in England for telegraphing across a sheet of water between three and four miles wide with no connecting cable was fully described by Prof. John Trowbridge, of Harvard University, in 1880. He made his original researches between the Observatory in Cambridge and the City of Boston between which is a time signal wire having the circuit broken by clock once a second. He found he could hear the clock beats a mile away from the line by connecting a telephone to a wire five or six hundred feet long and grounding their ends parallel with the circuit.

His experiments and conclusions are detailed in a paper given before the American Academy of Arts and Sciences and are published in their *Proceedings* for 1880. How completely he covered this ground of doing telegraphic work by means of earth conduction will be seen by the following quotations from those Proceedings.

"The theoretical possibility of telegraphing across large bodies of water is evident from this survey which I have undertaken.

"Theoretically, however, it is possible to telegraph across the Atlantic Ocean without a cable. Powerful dynamo electric machines could be placed at some point in Nova Scotia, having one end of their circuit grounded near them and the other end grounded in Florida, the conducting wire consisting of a wire of great conductivity and being carefully insulated from the earth except at the two grounds. By exploring the Coast of France, two points on two surfaces not at the same potential could be found and by means of a telephone of low resistance the Morse signals sent from Nova Scotia to Florida would be heard in France."

This is precisely what is being done in England, carrying out Trowbridge's method. In the various descriptions of methods and operations which I have seen there is no mention of the work of Trowbridge and whatever merit and utility there may be in this method of doing telegraph work belongs to him. Shortly after the publication of the paper from which I have quoted, Dr. Edward Everett Hale, wrote a short story for the *Atlantic Monthly* in which these earth sheet currents played an important part. Beyond that I have never seen mention of the discovery, for it was a discovery and an important one too, that slight currents could be detected at relatively great distances from their source by means of a telephone connected to the ground.

It may interest your readers, perhaps, if I tell them how I came to think that "telegraphy without wires" was a possibility, and that it should have appeared to me to have some value at a time when gutta-percha as an insulator was not imagined, or the ghost of a proposition for a submarine wire existed. At that time, too, it was with the utmost difficulty that efficient insulation could be maintained in elevated wires if they happened to be subject to a damp atmosphere.

It was in the year 1845, and refers to the one only long line of telegraph then existing in England—London to Gosport—which induced me to refuse the accepted theory that currents of electricity discharged into the earth at each end of a line of telegraph sped in a direct course—instinctively, so to say—through the intervening mass of ground to meet a current or find a corresponding "earth-plate" at the other end of it to "*complete the circuit.*" I could only bring myself to think that the earth acted as a reservoir or condenser—in fact, receiving and distributing electricity almost superficially for some certain or uncertain distance around the terminal "earths," and that according to circumstances only. A year later, while occupied with the installation of telegraphs for Messrs. Cooke and Wheatstone (afterwards the Electric Telegraph Company), a good opportunity offered of testing this matter practically upon lengths of wire erected on both sides of a railway. To succeed in my experiment, and detect the very small amount of electricity likely to be available in such a case, I evidently required the aid of a very sensitive galvanometer, much more so indeed than the long pair of astatic needles and coil of the Cooke and Wheatstone telegraph, which was then in universal use as a "detector." The influence of magnetism upon a wire conveying an electric current at once suggested itself to me, and I constructed a most sensitive instrument on this principle, by which I succeeded in obtaining actual signals between lengths of elevated wires about 120ft. apart. This, however, suggested nothing more at the moment than that the current discharged from the "earth-plates" of one line found its way into the "earth-plates" of another and adjacent circuit, through the earth. Later on, I had other opportunities of verifying this matter with greater distances between the lines of wire, and ultimately an instance in which the wires were a *considerable distance apart*, and with no very near approach to parallelism in their situation. Then it was that it entered my head that "telegraphing without wires" *might be a possibility.*

However, to cut a long story short—whether this sort of telegraphy depended upon the earth passage or induction through the atmosphere Prof. Dolbear seems to think the discovery of it to be "meritorious," and I think it is only fair that I should ask for "whatever merit" happens to belong to it—by reason of "*priority.*"

There is just one other item connected with it all which I may be pardoned for introducing now, and that is: In the year 1849 I published, and claimed as a "design or invention of my own," a certain form of instrument which I actually made and used, not only in England, but in North America, in the year 1851, in the interest of a Mr. Henry O'Rielly and others, and which turns out to be the only thing applicable or possible to be availed of in the accomplishment of recording signals in ocean telegraphy—even at the present day.

With reference to the rather significant suggestion of Prof. Dolbear that Prof. Trowbridge's efforts in the direction of "telegraphy without wires" have been "forgotten or ignored," what might I not now retort? But it is not to be expected that everyone shall get to know what everyone else has done in any particular direction, especially when so many years have elapsed, and perhaps before they were born, or could read for themselves or ever were in a position to see the accounts of what others had done in print. This holds good, too, with reference to the form of instrument I claimed in the *Mining Journal* of 1849, when I know for certain that the same design has been patented at least twice in the United States, the last time within a year or two, and illustrated and described as a new invention in the pages of the *Electrical Engineer* of New York. How was that last patentee, or the patent officials at Washington, to know that the *invention* under consideration was common property, and was well known to scores of persons in the United States near half-a-century ago?

Fifty years ago, Mr. Editor, I took charge of the telegraph on the Northampton and Peterboro' Railway on the opening of that line, July 1, 1845. I had then been under the personal training of Mr. W. F. Cooke for three months in the establishment of Robert Reid, the original maker of telegraphs; and I don't think I need be ashamed of suggesting that I may possibly be—if not the oldest—at least the *first* in this country who ever qualified, by a course of practical and theoretical instruction, under competent teachers (of all that was to be acquired at that day), with the object of following the profession of electric telegraph engineer.

Trusting you may insert this letter, although it is very long, and that it may come to be seen that "priority in telegraphy without wires" belongs to this side of the Atlantic and not the other, if no more, and I shall be quite satisfied with the result.

—I am, &c.,

J. W. WILKINS.

EARTH TELEPHONE EXPERIMENTS OF M. DUCRETET.

M. E. Ducretet, a well-known electrician of Paris, has been making some interesting experiments in telephonic transmission by using the earth alone as a conductor. The transmitter in this case consists of a microphone and a few cells of battery connected directly to two earth plates of considerable surface and buried 6 feet below the ground. The plates are placed facing each other and only a few yards apart. For the receiver he makes use of a quarry well about 60 feet deep which communicates below with the Catacombs. The orifice terminates at the ground level by a cast-iron pipe 4 inches in diameter and 12 feet long. An insulated conductor descends in the vertical well and brings a metal sphere 3 inches in diameter in contact with the soil of the Catacombs. On coming out of the well the wire is fixed to one end of an ordinary telephone receiver, whose other end is connected with the iron pipe at the surface of the ground. The two earth circuits which are thus made are separated by a building with cellars and thick walls, and therefore the layer which separates the two parts is considerable. When the microphone is spoken into, all the vibrations of the voice, even the feeblest, give rise to variations of current in the circuit which is closed through the earth, without any metallic connection between the two parts, and in spite of the multiple variations of the currents and the nature of the medium, earth, which is used, the reproduction of the voice is made at the receiving end with remarkable sharpness, and besides, there are none of the extraneous noises which are so common in the ordinary circuits. The dynamos which are working in the neighboring building, both continuous and alternating current, have no effect upon the circuit. It is difficult to give a satisfactory explanation of this phenomenon of earth transmission, but M. Ducretet thinks that the current is diffused from the transmitting station by derivations from the principal circuit between the plates, and that this current is sufficient to operate a certain number of receivers placed at different distances. With the arrangement of circuits described above, the experimenter was able to send through the earth a current sufficiently strong to operate a relay and electric bell. If the sphere which rests upon the soil of the Catacombs is raised from the ground, all reception ceases, but recommences when the contact is again made with the earth, which, it should be remarked, is dry. M. Ducretet is continuing his experiments over greater distances and under varying conditions.

Radio broadcast demonstration was made by Nathan B. Stubblefield in 1892. He was the first person to transmit the voice by air without the aid of wires. He gave a public exhibition of his invention on January 1, 1902; and on May 30, 1902, in Fairmont Park, Philadelphia, Pa., his voice was heard a mile away from the transmitter. He obtained patent No. 887,357 on May 12, 1908, but because of his idiosyncrasies he did not permit knowledge of his invention to be spread abroad. Inability to obtain a fabulous sum for his invention, as well as fear of imparting its secret before the patent was granted, deprived him of the fame which by right of priority should have been his. ***(Kentucky Progress Magazine. Vol. II. No. 7)***

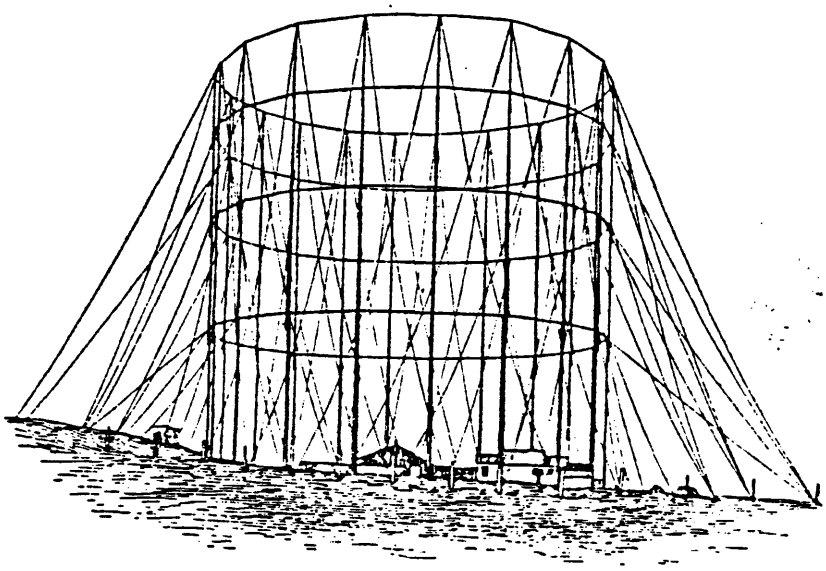
TELEGRAPHING WITHOUT WIRES.

Some recent experiments by Professor Loomis, which will be adverted to presently, recall to our mind some of the interesting ones made years ago, serving to re-awaken interest in a matter that, although well known, had not received the attention it deserved, owing to the rapidity with which one discovery in electricity was following in the wake of another. We refer to the almost constant traversing of telegraph wires by earth currents. One of the experiments to which we refer was made by M. Bouchette on the left bank of the Rapt-de-Mad, a small stream in the Department of the Moselle. Putting to the earth the two ends of a wire 1,100 feet long, he sent through it the current from a battery of two Bunsen cells. On the right bank a line of equal length, having a galvanometer in circuit, was also put to the earth at its two ends. When the battery circuit was closed the needle of the galvanometer was thrown violently against one of its stops; when the current was reversed the needle flew around to the other. This showed clearly that the current which traversed the galvanometer circuit depended entirely upon that from the battery, yet the two circuits were separated by a distance of 300 feet, including the intervening stream.

The subject was taken up a little later by M. Bourbouze, who has obtained some very important results. He demonstrated the existence of earth currents by connecting a delicate galvanometer with the gas and water main of his laboratory. He varied his experiments by connecting the galvanometer with a body of water and with a metallic plate buried in the ground. In one of his researches it occurred to him to put one pole of a battery to the earth and to connect the other with a body of water. On pressing down his key, the galvanometer of the former circuit was at once deflected, and remained permanently so. The battery current was interrupted, the needle returned to zero; the current was reversed, the needle swung round in the opposite direction. It is evident that in order to obtain good results the earth currents must be neutralized, as they tend to increase or diminish the deflection. This is easily done. When the balance is obtained the existence of any other current, however transient, is at once detected.

The first experiments of M. Bourbouze were made near the Pont d'Austerlitz, Paris. One of the wires was connected with the earth and the Seine. A battery consisting of 600 cells (copper sulphate) was placed near the Pont Napoleon, one pole being to earth and the other connected with copper plates immersed in the Seine. Care having been taken to adjust the galvanometer in the former circuit, it was found that when the current was made the needle was deflected 25° and even 30°. The same experiments were repeated at Pont St. Michel, near St. Denis, with like results.

The possibility, therefore, of transmitting signals to distant points without the use of wires would seem to be conclusive; and whatever doubts may have existed on the subject will be dispelled by the success that has recently attended the investigations of Professor Loomis, of Yale College. His experiments were made in the mountainous regions of West Virginia, between lofty peaks. For his purposes he used kites, a copper wire being substituted for the usual kite string. The kites were raised to a considerable height, when it was found that signals sent along one wire were transmitted by aerial currents to the second, ten miles distant. It was also discovered that continuous aerial currents exist at this altitude capable of serving the purposes of the telegraph, except when interrupted by violent atmospheric disturbances.



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