VRIL COMPENDIUM

VOLUME 2

VRIL TELEGRAPHY

VASSILATOS

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VOLUME 2

TABLE OF CONTENTS

for

Joseph

who loved clocks

and Eirene

who made lace

SECTION

1

COMMENTARY

Organismic Vril conductivity is symmetry-specific. The body requires specific orientations for eidetic transactions. Vril eidetic world transactions determine radionic rates and auric phenomena. Radionic rates are Vril World eidetic nodes. Subjective experiments are verified via consortium of participants. Systemologies are subjectively agreed consortia.

Vril World eidetic experiences may be replicated among participants. Vril eidetic World transactions stimulate inertial entourage. Specific Vril active minerals and metals give experiential distortion. Multi-locational experience is simultaneous multiple-Vril eidetic World transaction. Specific material configurations display multiple Vril world eidetic transactions.

Minerals and metals are Vril eidetic world agglumerations. Minerals and metals are Vril projections into inertial space. Vril determines the eidetic content of an area. Specific Vril-active minerals and metals agglumerate at Vril dendritic junctures. Groundplates in these locations are especially potent and eidetic in action.

Vril contact in free space occurs via specific directional axes. Vril eidetic world transaction defines Vril technological design. Vril technological design is eidetic world specific.

Designs of componentry must be experienced to determine efficacy of transaction. Vril eidetic world material configurations require Vril channel alignment. Organismic extension of consciousness is Vril technological quest. Specific experiential determinations required in designing eidetic world conductors. Vril threadways determine spatial-experiential distribution. Inertial space impedes organismic experience.

Vril paths agglumerate inertia. Vrillic matter is rare. Vrillic matter generates convulsions in nature (Corliss, Bergier, Tomas, Moray, et.al.). Vril eidetic world-blends generate variations in organismic experience. Material blends and materio-blended configurations transact unexpected Vril eidetic worlds. Vril componentry awakens, intensifies, clarifies, and translates Vril sensory awareness.

Vril experiential extension is balanced against the inertial resistance managed by an organism. Regional holisms are Vril eidetic world composites. Georegional hegemonies and experiential stratifications require explanation in comprehending Vril Template infra-structure. Vril eidetic clarity determines cognitive success along spatial directionalities. Vril dendritic structure is experientio-space reference.

Vril world-induced transmutations manifest as material transmutations. Specific minerals and metals focus inertial resistance. Specific material geometries focus inertial resistance. Organismic experience is endangered in strong concentrations of inertial resistance. Organismic unity is damaged in strong inertio-resistive currents.

Vril penetrates all experiential realities and holisms. Organismic weakness impedes eidetic experience. Eidetic Vril sensory experience does not operate in inertial resistant minerals and metals. Vril generated minerals and metals are projected from Vril threads. Vrillic minerals and metals are pure Vril projections. These are legendary anomalous minerals and metals. Ordinary matter is Vril projected and semi-inertified via impact projection.

Material inertial behavior is determined via Vril eidetic material transactions.

Vril worlds are holistic. Vril eidetic world experience is indivisible. Vril eidetic transaction is holistic experience. Eidetic transaction is not coded inertial transfer. Specific minerals and metals are generated via inertial densifications (lead). Inertially agglumerated elements resist Vril conduction.

VRIL TELEGRAPHY

Human insistence on using applied artificial inertial code in technological systems forces Vril to manifest itself in anomalous ways. The seemingly anomalous schism between code and gradual comprehension derives from human insistence on the use of inertial code. Vril supplies expression and meaning directly.

Each assertive act brings an opposed inertial pattern. Inertio-assertive activities are dualities. Inertio-assertive dualities self-destruct.

Vril asserts eidetically against inertia. Vril dissolves inertia. Vril projects eidetic holism into void space. Vril projections generate living experience. Vril is the means which dissolves inertial spaces, patterns, and dualities. Vril receptions require surrender and devotional sharing between participant and Vril itself.

Vril eidetic world contact gives revelation. Vril eidetic world blendings join unexpectedly. Vril eidetic world blendings do not nullify. Vril generated imprints define rigid related cohesions in natural settings. Vril Science vril eidetic world junctions and their terminals. Vril communication is direct.

Vril communications are holistic. Vril activated minerals and metals are eidetic. All technological componentry is primary Vril active. Human sensory discernment identifies Vril eidetic resonances. Vril world eidetic transactions are conscious resonances. Vril worlds are pure experiential worlds. Vril worlds exist in conscious hierarchy.

Vril threads give connectivity with Vril worlds. Specific Vril world-orders exist in greater Vril conscious states. Space is Vril dendritic projection. Vril space sensory systems access all organismic terminals. Vril material contact impacts inertial space. Inertial resistancies impede organismic systems. Vril contacts stimulate inertial resistance. Specific material Vril contacts are inertially densifying.

Specific material configurations occlude eidetic Vril world transactions. Specific material configurations intensify Vril eidetic world transactions. Vril schematics are hieroglyphic in Vril terminals. Human neurology extends consciousness via Vril thread conductions in space. Vril schematics define mysterious Vril language and deep-conscious relations. Specific Vril eidetic worlds generate and sustain autonomic biological functions (via iron, carbon, copper).

Vril eidetic world contact is true experience. Vril is the universal fundamental. Vril is the universal generative and projective agency. Vril is the fundamental communications channel. Eidetic imagery and experience is the universal foundation. Vril eidetic worlds independently exist. Inertial pressures lead observers along endless primitive-sensory paths. Inertial sensory paths give no eidetic experience.

Inertial patterns emerge as detritus in Vril activities. Vril threads converge on organisms. Organisms become Vril thread foci. Vril material contact defines Vril eidetic experience. Strong Vril discharges emerge from ground. Vril awareness becomes Vril Science.

Organisms locate sensate Vril threadways. Organisms respond to insensate Vril. Inertial pressures lead observers along endless primitive-sensory paths. Inertial sensory paths give no eidetic experience. Inertial patterns emerge as detritus in Vril activities. Vril threads converge on organisms. Organisms become Vril thread foci.

Vril material contact defines Vril eidetic experience. Strong Vril discharges emerge from ground. Vril awareness becomes Vril Science. Organisms locate sensate Vril threadways. Organisms respond to insensate Vril.

Metaphysical eidetic contents are Vril generated. The Vril World is the metaphysical world of eidetic contents. Vril eidetic contents cannot be recorded with detection devices. Metaphysical eidetic contents are Vril generated and Vril experienced. Sentient beings experience eidetic content. Eidetic content is not inertially registered. There is no correspondence between eidetic content and inertia. Eidetic content disrupts, dissolves, and scatters inertia. Eidetic contents are not objectifiable.

Pure Vril sensual transaction rectifies human society. Systemologies must not apply extra energies to their componentry. No extra energies are needed. Eidetic transactions require only touch contact for engaging their sublime experience. Systems must come back to this point and develop from that true foundation.

Vril sensation is extant in natural surroundings. Vril sensation remains unrecognized and insensate. Eidetic transactions within the natural setting are continuous. Black glowing space is Vril. Black glowing space is Vril permeated. Space is the black eidetic node of Vril itself. Space requires Vril material conductive paths to become sensate.

Vril sensation is true experience. Vril consciousness is true consciousness. Black space is the fundamental Vril eidetic node. Black space is a multiplicity of Vril eidetic worlds.

Vril generates the manifestations of eidetic nodes. Vril is pure consciousness. Vril is pure experience. Vril is revelation, eidetic content, and vision. Vril gives distant rapport and exotic experiences of unknown Vril Eidetics. Vril gives comprehension and understanding. Vril alters recipients to enter greater Vril Eidetics.

Vril Eidetics reveal conscious stages and levels which transect inertial space. Human experience and consciousness tunnels through Vril Eidetics. Human consciousness cannot tunnel through inertial space. Vril transactive devices enable human consciousness to rise through successive stages of awareness.

Ferruginous and carbonaceous substances concentrate and collimate the pure eidetic of Vril threads in an organismically "soft" manner. Vril connectivity extends sensation. The Vril extension of the human organism is vast. Vril extension experiences remove the conscious focus of the body. Vril consciousness is transactive fusion with the universe. Vril connectivity produces auditory nerve inductions.

Distant persons can be placed in complete eidetic with one another through Vril tuners. Vril threads are the central features of the galvanic currents. Vril threads bridge space gaps with extensive white ray manifestations. Vril threads connect groundworks with extensive Vril and eidetic manifestations. Galvani studied metallic atmospheres and white "daylight discharges". These eidetic discharges were not measurable with sensitive electroscopes.

Researchers and discoverers began the use of aerial cathodes and anodes. Specific metals were used in the earliest wireless experiments. It was also discovered that specific transactive forms of metallic masses were required to yield the strongest connective effects. These transactive forms, masses, and positional arrangements of specific metals connected distant communicants with varieties of eidetic sensations. Vril threads projected between these forms. Early researchers were not able to persist in developing the pure Vrillic sensual manifestations. These researchers fractioned the Vril into subordinate inertial forms and demonstrated the effective use of these less excellent energies.

Specific Vril materials have human-matched conductivity of chief importance. Carbon and Iron are the humanly central human matched conductivities. There are groups of human-matched conductive materials. Through the Vril transactive chart we determine the true elements in their number and variations. Vril conductivity with the human organism defines technology. We utilize the materials which are central to Vril conductivity in the human organism when measuring and establishing parameters of measurement.

Vril conductivities are determined through physical contact with Vril transactive matter. Vril conductivities reveal the degree of inertial agglutination in space. Vril transactive devices reveal the ease with which Vril dissolves and transects inertial space. Between these Vril Eidetics is found the inertial space. Inertial space blocks consciousness. Our chief aim is to dissolve these deadening inclusions.

The Vril supply is determined through specific Vril points in our environment. Vril is consciousness. The environment is experiential because of this energetic Vril supply. Vril Vision enables the observer to recognize the generators and modulators of regional consciousness through direct contact. Increased consciousness marks the materials and places of greatest Vril activity. Vril vision grants its recipients ability in designing Vril active components and systems. Comprehending these truths is essential toward appreciating the purpose of the Vril Compendium.

Vril is consciousness. Vril projects conscious levels to us through its dendritic distributions. Vril filaments generate and project the fundamental eidetic node of consciousness. This glowing eidetic node is what we call eidetic space.

Vril expresses intentions throughout its fundamental eidetic transactions. The generation of original and unexpected qualities from the Vril World emerge through Vril dendritic filaments. Inertial space is an alien and unnatural presence amid the experiential worlds. Inertial is recognized as alien and unnatural because it resists every creative effort of Vril. Inertial space resists each creative expression.

Inertial space distorts Vril intent. Inertia is a deadened space. Inertia is not a nothingness. Inertia is an imposition. The origin of deadly inertia is surrounded by religious legend. Vril Vision locates sites where inertial densities are sensibly strong. Inertia removes sense and consciousness. Locations and situations in which sense and consciousness perceptibly diminish are inertial zones.

Vril impacts inertia and is distorted. Vril impacts against the inertial space results in the formation of detrital products. Vril Technology is at war with inertial space and its effects. Humanity is the victim of inertial space encroachments.

Vril transects its own eidetic glowing eidetic transactions. Vril transects the very materials it generates. Vril transects matter. Specific Vril eidetic space Vril Eidetics are experienced through the use of special tuning artifice. All materials will reveal these fundamental Vril Eidetics through subjectively and physiological contacts (visceral frictions). Different materials reveal harmonic rays and inflections which proceed from their masses when connected with Vril threadways. It is by these that elements and materials may be differentiated.

Securing solid ground contact require successions of material contact. true ground is Vril not material. Grounded objects merge with ground Vril tufts. Proximity to material lodes secures Vril tuft-mergings. Eidetic transactions are Vril world resonances. Vril eidetic world transactions transmute the apparent world. Vril eidetic world transactions interblend. Interblending vril eidetic worlds generate and sustain the apparent world.

The apparent world is a multi-dimensional Vril exchange network. Vril eidetic world transactions have mechano-inertial entourage. Vril worlds exert cavitating pressures on inertial space. Vril worlds are pure worlds. Vril thread raysheaths cause and modify weather patterns.

Organisms perceive vril thread raysheaths. Vril thread raysheaths appear as semi-sensate visceral occlusion in otherwise clear space. Vril thread raysheaths dissolve inertial patterns, moderate weather, mark discharge points among mutual junctures of ground and space, are ordained, generate geological strata, metal and mineral lodes.

Organismic auric striations are powerfully endrawn into Vril thread foci conducted and projected by specific configurations. Specific material contacts intensify eidetic transactions. Knowledge comes through specific Vril material contacts. The native content and transactive potential of specific elements provides humanity with new memory storing technologies.

Spontaneous eidetic receptions are noted throughout regions among inhabitants during specific times and seasons in absence of humanly arranged systems. Sympathetic telegraphy relied upon Vril empowerment.

Archane context and the knowledge of correspondency are lost when eidetic experiential reality is forgotten. Alchymy relies upon eidetic content and experiential potentials.

Such distal ground plates connect operators with Vril junctures in absence of experiential transaction through intervening spaces. Instantaneous juncture placements are notable with bilocational experience. Distal sites are possessed of natural sensory apparatus: an additional mystery explained through Vril Science.

Such natural response and native experiential importation is explained by noting fundamental axioms of Vril Science. Organismic modulation of native Vril provides organismic expression and exchange among juncture points. Vril operators manage the spontaneous entunement of specific junctures, obtaining experiential knowledge of distal events and circumstances.

Each telegraphic and telephonic component modified, inflected, permuted, and transmitted eidetic power to recipient ground locales and human operators. Grounded systems became transformed into primary Vril systemologies.

Fundamental eidetic activities do not require the complex technological arrangements which are evident in contemporary power systems. Eidetic experience teaches us about native phenomena which are constantly and permeatingly active and ever-present throughout our world. The knowledge of these native eidetic phenomena provides us with magickal opportunity toward our quest. Reliance on these activities eradicates the need for using any other energy or complex systemology.

Vril technology is comprised of static, material configurations which are properly aligned with regard to Vril channels. Vril designs maintain the integrity of districts. The placement of rods, lines, and ground plates alters the eidetic nutrition of districts.

Telegraphy demonstrated the selective shearing of code and meaning on several occasions among startled operators. One could monitor signals with great exchange clarity while comprehending nothing of the message. One also could comprehend entire meanings without hearing more than one or two code-exchanged words.

What are the minimum cues for deciphering signals? Vril supplies the missing meaning when codes are employed. Early telegraphs were extensions of the dowsing arts. Despite these good beginnings, later developments reveal the inertial tendency. Penduli and ponder-motive impulsers gave mere physical impulse for coded transfer of signal. Ancient Vril systems conducted the enlivening energy of eidetic world experiences.

Vril transactions can move penduli, vanes, and motors (Bain, Stubblefield, Hendershot). The history of influence telegraphy is significantly linked with dowsing and dialettes. This clear indication of Vril transactivity is read throughout these chronicles. Pendulum telegraphy worked not by electrical means. Positional correspondence is electrically impossible.

Penduli were also used in early telegraphic "influence" systems (Bain, Dyar). These systems proved an increasingly inertializing tendency to limit participant experience. Watching penduli separates the operator from the eidetic content which potentially releases whole new worlds to us. Watching penduli, listening to clicks and voices, observing darkened chemical paper strips does not connect us with the deepest Vril foundations: those for which the heart desires.

Pendulo-telegraphic systems were impossible machines (Dyar). Seeking eideto-potent ground sites relied upon old telegraph linemen who were familiar with dowsing arts. Vril was interconnected in a haphazard manner across great distances. Vril energies were utilized with success in several inventive instances throughout the 17th and 18th Century.

These devices employed Vril correspondence to achieve remarkable distant communications.

In these designs we find the appliances of dowsing and geomantic arts appearing in novel use. Pendulum telegraphs were designed and successfully operated throughout this time period until the middle 19th Century. Numerous such devices were displayed, demonstrated, and carefully observed. Equally numerous testimonies affirm their true operation. Such designs cannot operate through electrical means.

Hoops are equipotential gradients. Movement of charge within such a conducting hoop cannot result in distant equivalently directed motion. Other similar hoop-line designs utilized swinging vanes for the indication of letters. Pendulum and vane telegraphs represent the emerging Vril technology glimpsed through the historical persistence of rabdomancy and pendulomancy.

Academic repugnance for vitalism was based on differences of sensitivity among researchers. Only sensitives could discern the causative agencies which generated and supported inertial manifestations. Academicians focussed upon the study and collation of inertial effects. Independent vitalists maintained the ancient awareness of formative forces and insensate causes in nature. Vril technology was gradually developed by these personages. Vril eidetic communication systems began to emerge from the forgotten depths of time.

Several patents for pendulum telegraphs have been found. These devices originally utilized little more than grounded copper hoops into which pith-ball penduli were suspended. Many of these designs never employed electrical energy. Hoops were inscribed with letters for signalling purposes. Conductive hoops were designed as opened or closed conductors. Distant signalling hoops were connected through single conductive wires.

Moving one such pendulum toward one letter position caused an equivalent swing in the receiving hoop. Messages were successfully transmitted in this fashion. Articulated messages were thus communicated in the absence of articulated lines.

VRIL LINKAGE

Certain effects are especially noteworthy along the railway tracks. I mention them because I have found that these sections of track are very prone to similar ground resonances and communicative effects. They are especially capable of altering one's consciousness and attentions considerably.

While looking along the rails (at specific sections of track) I suddenly experienced a shimmering and wavering of the irons. I first thought these effects due to optical effects and heating phenomena. With successive such experiences I realized that these waverings of the parallel rails were not consistently activated unless certain resonances were taking place through the land. Were they the simple effects of heat they would constantly shimmer and waver...which they do not. One sees the waverings only when ground energy surges for a brief moment.

The "swimmy...dreamy" appearance actually has the power to translate one into an elevated consciousness, in which one loses physical sense of the body and locale. Soon the entire region momentarily loses its "inertial hold" while a bright and grainy synaesthesic sense powerful takes hold. With increasing experience one discovers that these effects are eidetically active ones which are capable of impressing one with bilocational vision. Sudden flashes of distant and relationally connected locales becomes the common receipt of sensitives. I do not doubt that telegraphers were subject to these receptions...especially since they were so well connected with the ground energy (through the lines) and so well aligned (along the woivre-paths of the railroads).

Another effect I have studied closely deals with the sudden "shooting" appearance of attention-getting surges which fly along the tracks...from one horizon to the other (in sudden short time intervals) and back again. When this visceral activity occurs I know that the train is about to come around the bend. One sees these remarkable "shooting" displays with increasing regularity and rapidity until...the train visibly appears.

These attention-getting visceral surges match the visual surges and discharges by which the eye (the attention) is constrained to follow their path along buildings. One can experience these eye-dragging energies when watching the tops of houses just before lightning storms. Though ever-present and ever-active in their (breathing) charge-discharge cycles we may see them especially during such drastic ground-resonant times.

The telegraph line is no different in any of these aspects. The lines were made to follow the rails. They were thus not only grounded by large metal plates in several locales (along these woivre-paths) but also were guided along the Vril channel alignments. They therefore never lost total touch with these energies, forming (as it were) a rayguide system of supernal activity. How it is that operators did not extensively mention and report the strange phenomena (whose appearance traversed the lines constantly) is an effect of the insensitive human condition alone.

We are conditioned and trained to place our attentions upon the inertial aspects (effects) of our world, while remaining essentially insensitive and unattentive to the constant transpiration of fundamental impressions of meaning and message.

Persistent Vril display sites mark permanent Vril connections among insensate transactive space. The spontaneous generation of charge has been used as free-energy by several persons. Eidetic reactivity produces electro-detritus in metal reservoirs. These inertial charges may be drained to perform inertial work. Large reservoirs are required to achieve adequate charge populations. Tesla used sections of the earth as a reservoir of spontaneous developed excess charge. His devices pumped the ground reservoir to provide huge excesses of free-energy.

Organic substances conduct special eidetic transactions. Eidetic transactions differentiate when passing through special materials and across boundaries. All materials surge in corresponding Vril surge transactions. Researchers of the 19th Century concentrated on the local responses of Vril rays and eidetic transactions to the local actions of mechanical and electrical devices. Discoveries along these parameters revealed an amazing variety of reaction correlations among Vril energies and inertial machines. Keely, Tesla, G.Starr-White, Hieronymus, Lahovsky and other notables dealt with these correlations.

Certain Vril eidetic images experience transit from point material contact site along specific Vril paths. Vril eidetic image experience may take participants along meandering Vril threadways, into and through Vril channels. These open the participant's experiential gaze upon omni-conscious panoramae of specific symmetry range and extent. Bilocations are instantaneous experiential placements in unfamiliar surroundings.

Future Vril technology must be sensitively surrendered to the ordained pre-existent Vril causeways, channels, and junctures. Imposed and improper trans-connections must be avoided should powerful pure Vril engagement be our desired quest.

Telegraphic systems spanned regions with elevated iron wires. Cross-regional telegraphic networks issued the modern re-emergence of Vril Technology. Major fundamental features of the old telegraphic systems do not find adequate explanation in the science of electrodynamics. Possessors of the Vril Science envision the true cause of these inadequacies.

Telegraphic cables could not be emplaced within the ground directly. Dr.Samuel Morse discovered inordinate degrees of spontaneously developed charge accumulations in buried wires. Vril transactions generate these detrital products.Vril was interconnected in a haphazard manner across great distances. These longline interconnections were not always guided by Vril. Vril ground points are distributed unevenly across the land. Eidetic interconnections can be traced from point to point. Human engineers created artificial Vril interconnections which damaged the intended overground Vril System.

Woodlands and countrysides were converted into interlinked patchboards. Later employment of devices for location of neutral grounds removed the Vril activity from most lines. Those systems which maintained the old positions were continuously operated in absence of electrical power. Vril provided all the energy for signalling. Regional effects are noted throughout locales.

Vril self-inflects in specific material assemblages. Wire lines and cables are optical transactors. Plate-grounded aerial cable systems provide enormous accumulations of eidetic revelations and communal experiences: the primary source of civilization.

Eidetic projections are experientially soft and glowingly vivid. They are naturally found radiating through notable trees and boulders. They are sites of exceptional noumenous power and presence. Sensitives have located these sacred spots throughout the natural environment. Vril generates the materials through which it conducts. Trees give the name "dendritic". Vril generates trees. Vril generates crystalline rock. Vril generated pegamatites and striated rock matter evidence Vril dendritic process.

Each eidetic manifestation emerges in various manifestations and with varieties of attribute through the depths of space and of ground. Eidetic projection sites were located by telegraph linesmen. Eidetic projection points were used as ground plate sites for telegraphic stations. Telegraphy effectively accessed eidetic projection sites. Telegraph linesmen and surveyors managed the inter-connection of such eidetic projection sites across the ground of bordering regions.

Interconnected eidetic points became sites where Vril threadways were formed. Telegraphic lines brought Vril into strong conductive presence at the inhabited ground surface. Telegraphic lines conveyed Vril across elevated lines through woods, villages, and towns.

Evidence that Vril is the generatively superior force is found in every created object. Vril easily overcomes the inertial resistance of space. Vril Science provides the awareness that inertia may easily be thwarted and removed from our world. Inertiality covers and disintegrates our world. Vril Technology provides the means for achieving trans-regional heightened consciousness.

Vril active items are energizing and vitalizing. The appliance and artifice of Vril Technology is living and vivifying because of Vril eidetic transactions. Linear tracks of cable acquire charge: yet charge is disseminated into grounds. Therefore charge is the detrital residue of a more fundamental energetic transaction. That energy is Vril.

Vril self-articulates. Vril technology requires human agency in constructing and configuring artifice. Vril self-articulates, self-organizes, self-arranges, and self-maintains the operations of its own technology once human agency has provided the material pathways. Human operators serve the inflections and intentions of Vril in maintaining the specific material components required by the system.

Vril IRON paths translocate sensient experience. IRON railways, telegraph and telephone lines are Vril experiential glideways. Experience of multi-locations occurs at the termini of such systems. Train-stations give sudden and sharp experiences of regions which their railways transect. Stations where tranception of telegraph or telephone are the eidetic exchange sites where powerful multi-locational effects are experienced.

The most primary Vril form is the dendritic. Vril thread orientations depend upon local Vril inflections. Vril thread orientations are not strict. Vril fractures are not in quadratures. Vril fractures do not correspond with inertial polarizations. Vril manifestation defines experience. Vril distributions draw experience along self-defined pathways.

Vril is a spark-like dendritic presence which generates and sustains whole realities. Vril dendritic connections appear to be linear in physical distribution. Vril dendritic connections reveals complete experiential holisms. Vril axial passage explains exceptional experiential "fade-out" and "lucidity" in specific locales. Memorable places are special Vril threadways.

Vril interconnects all sentient beings. vril is the eidetic content which floods and generates the universe of experience. Peering into Vril channels releases ideations, visions, revelations, and bilocational transports. Emanates a specific eidetic node when especially Vril activated. Ray proportionality permits the ability of arranging Vrillic reactions.

The noumenous and eidetic suggestive quality of iron railway terminals provided the first realization of eidetic transaction and its importance among societies. Telegraphy provided the next connective eidetic exchange system. Human nature requires Vril eidetic transaction as the vivifier and integrator of sentient existence.

The noumenous appearance of grounded telegraphic transceiving blocks, stations, terminals, exchange-sites, ground plates, poles, lines, and relays reveals the mysterious conscious-provoking presence of powerfully concentrated Vril threadways.

The importation of trans-Atlantic telegraphic cables brought with it a powerful noumenous presence in absence of actual coded transfer.

This imported noumenous presence was entirely due to the Vrillic connectivity achieved between England and North American transfer sites. While many such artificial connections had continuously been established throughout this time period, many humanly-imposed transfers interrupted natural Vril eidetic transactions among the continents.

The deranged viscero-eidetic conditions which certain such cable connections actually brought into existence told their tale upon certain districts. Indian tribes members intuitively viewed the telegraph system as an encumbrance to natural energetic transactions in specific locales. These were places where the arrogance of enterprise took no regard for proper placement of the poles and alignments of the iron line.

Sensitive tribe members experienced difficulty in receiving visions and dreams. The "singing line" referred to something more than the hum which radiated along their miles of length. Indians knew how to hear the ground directly. Emplacement of knife blades into the ground revealed viscero-eidetic sounds.

It was the humanly applied organismic Vril transaction which proved to be of immense human value in the trans-Atlantic cables. Antonio Meucci had already received the vision of trans-oceanic wireless communications. His experiments demonstrated this system to be feasible on a grand scale. Mahlon Loomis had demonstrated the feasibility of wireless telegraphy without electrical power in 1862. The many foibles of enterprise and human self-will would be gently eradicated by the magick sweep of wireless arts thereafter. The post and line would be no more.

The advent of telegraphy gave the wonderful consciousness of distant locales. Live socially ommunal events were suddenly made possible and heralded with great anticipations and well-wishes. The completion of the Trans-Atlantic cable was an event surrounded and suffused by great love and warmth of human emotion. These systems provoked social consciousness and raised social consciousness by virtue of eidetic transactions. Minds on either sides of the Atlantic were suddenly effortlessly able to "glide across" to the "lands of the others".

Vril designs maintains the organismic unity in regions and districts where inertial concentrations have persisted. Telegraphic lines interact with Vril juncture connections. Improper artificial connections are dangerous to districts and inhabitants. Vril modulations are eidetic modulations, not power exchanges.

Telegraphic systems are optically transactive systems (Hieronymus). The deepest potential content of eloptic energies is viscero-eidetic. Telegraphic lines interact with Vril juncture connections.

Improper artificial connections are dangerous to districts and inhabitants.

Vril modulations are eidetic modulations, not power exchanges. Telegraphic systems are optically transactive systems (Hieronymus).

Neighborhoods disintegrate when Vril active technologies are forgotten and dismantled. Cathedrals rarely lose their metropolitan position. Local disintegration is marked when original houses of worship are burned, destroyed, dismantled, and converted into dwellings. Vril surface integrity is lost when specific wrought-iron fencework and old rock walls are destroyed and replaced. The neglect and covering of traditionally old parksites contributes to confusion and depression among once-thriving neighborhoods.

Telegraphy was a dangerous profession. Telegraphic hackers flooded train stations and cities in search of work. Telegraphers sought to the main cities and lives in hostels and boarding houses awaiting employment. Their quiet profession bore all the secretiveness of the medieval guilds. Women were also hired as telegraphers.

Telegraphers sought safe lightning-proof distances from their stations during storms. Lightning shots rang through exchange terminals from receiving blocks even during windy dry seasons. Inertial detritus built up in these lines when Vril surges spontaneously discharged from the lines to space.

The empirical design and efficacious use of specific components was developed throughout telegraphic history. Such components proved effective because of their fundamental Vril conductivity. Systems are Vril conductive long before detrital species are artificially applied to them.

Entuning these eidetic points best enables the transaction of eidetic content among communicants. Discoveries were made concerning strength of signal and ground potential. The use of carbon rheostats enabled specific eidetic entunement of grounds and districts. Grounds and stations placed at these surface points best transmit eidetic eidetic contents to operators. It is possible to discern which groundpoints require interconnections. Such sensitivity was available to old telegraph linesmen.

These individuals were familiar with the woods and forest and were equally well-acquainted with the dowsing arts. Vril active points require specific conductive linkages. Interground connections were haphazardly provided through the development of telegraphic lines.

We must study these patents and articles in order to find the patterns where electrical componentry behaves as a first-level Vril technology. As soon as telegraphic installations were integrated with the ground we find that all sorts of anomalies began to make their appearance. This ground-integration permitted certain unsuspected potentials to interact with human consciousness in an unprecedented manner.

It was found (for example) that human attentions could be directed along certain ground lines during the night. While this phenomenon was not thoroughly recognized in its fullest sense, these eidetic translations were far from complete with telegraphy alone. The discoveries of Antonio Meucci were to pave the way for another step toward the Vril paradigms.

Telegraphers speak of instances where Vril charging actually prevails over signals in certain pieces of land ("good earth, bad earth") in connection with later telegraph systems. The prevailing notions were that completions of underground currents would be made beneath the overhead lines, in opposing directions. The eidetic vision which ruled the minds of inventors portrayed the earth as a true "return circuit".

The patent by Collins is the earliest disclosure I have found which demonstrates the sudden emergence of single wire lines. The technical term for these embodiments were "conduction line" telegraphic systems. The notion is astounding as it is sudden. The truly remarkable thing about this method is its use of ground terminals. Think of the reasons for utilizing large ground-plates, and consider the existing paradigm of that day. How did Collins ever conceive of this sort of arrangement? There certainly was absolutely no precedent for its appearance from a developmental stance. We may exclude then the evolutionary mode of invention here.

Collins received this thought directly through revelation. We have no doubt but that in this disclosure we are in possession of the origins of the ground-plate paradigm. Certainly the people of that day who could vaguely remember electrostatics proceedings in Europe would have pointed out to Mr.Collins that: even if his battery charge were strong enough, it would be lost...dissipated instantly into the earth. Energy of this sort and in this arrangement could never be imagined as practically workable.

It is difficult to explain the effectiveness of grounded ends in telegraph lines. They could not be considered as good conductors, neither as good capacitors at the time when Collins disclosed the effect. What then is happening here? What we are realizing is that an empirical revelation had occurred to this inventor, one based on nothing previous. The closest image we have to the use of grounded wires were the experiments of Franklin, D'Alibard, Richman, Loomis, Popov and the like, where grounded aerials were used from which to draw "sky-fire". Such conduction of "sky-fire" may have taken place between two very close terminals as shown. We are sure this is not the reasoning which prompted Collins at all.

His system is very significant because it is the first genuine instance where someone made use of ground-energy in such a direct manner. The designs of Farmer, for telegraphic underground conduits, reveals a strongly suspicious wonder. Notice the strange descriptions of lines and plates, which seem to stretch across distances and then end in the ground. The dotted lines represent the electrical underground "routes" which interconnect the otherwise intermittent conduits.

MAGNETO-ELECTRIC TELEGRAPHY

Early investigators mistakenly assumed that the operation of electrical machines were direct causes of vitalistic effects. The original investigators claimed no strict equivalences. These Victorian researchers merely noted that one action seemed to summon and modulate another. The development of ever efficient devices utilized both mechanical prowess and subjective sensitivities ... balanced talents which are lost today.

These activities may be perfectly understood through the basic principles of Vril Science. The operation of any technological system or componentry occurs in a Vril saturated environment. Vril is responsive to every action of intent. Working one device will bring an accompanying vril response: though neither are directly coupled. The effective juncture of observations-inertial with observations-subjective occurs in these experiments.

Confusion in thinkers occurs when attempting the balance between erroneous cognitive models and Vril intuitive urges. There is no need for cyclic interruption in Vril transactors. Vril transactors utilize differentiations through which Vril is permuted along variable conductive paths.

The dramatic pose of Dr.Joseph Henry reveals the intensely personal and meditative nature of an academe who lived in true humility. Dr. Henry had discovered the effect of magneto-electric self-induction in 1829. He discovered the inertial actions of moving magnets upon coils of wire, and had developed the first simple magneto-electric transformers before 1831. He did not comprehend that his discoveries dealt with the inertial products which Vril functions create. Electrically impressed signals are not necessary in telegraphy when properly managed.

Dr.Henry's telegraph utilized a bell as the sounding mechanism and was made to operate over nearly a mile of double-line across the Princeton University campus. Henry declared it possible to extend the lines indefinitely: through the use of relays also developed by himself.

Joseph Henry preceded Samuel Morse by nearly 6 years in these demonstrations of magneto-electric telegraphy. Professor Henry would astound later researchers who realized him to be the true discoverer of "electrical rays". In 1842 Henry discovered that electrical sparks could actually magnetize and misalign the tiny needles of astatic galvanometers two full floors below the inductor: some 35 years before Hertz in Germany! Had he grounded his terminals and used an insulated capacitance his device would have drawn Vril power.

Telegraphic systems became progressively more inertial through reliance on code and artificial applications of inertial impulse. Meanings and eidetic experiences cannot be codified. Code is not meaning. Vril meaning bridges the deadness of acoustic code.

The empirical design and efficacious use of specific components was developed throughout telegraphic history. Such components proved effective because of their fundamental Vril conductivity.

Systems progress through sequences of development which begin as revelations and intuitions. They proliferate as nature-conformable systems when applied and materialized in their early systemologic stages. Systems become established and assertive as engineers and corporate involvement assumes leadership responsibility. The arrogance of nature-defying projects inertializes and subverts the intentions of original revelations.

Curious in the development of systemologies is the unexpected and unprecedented developments which undermine and undo the hubris of inertially reliant organizations. Telegraphy was developed through intuitive revelation. Telegraphy and telegraphic componentry were perfected through empirical discoveries. Sequential revelations gave knowledge of Vril activity. Several steps of development produced componentry, discoveries, and new progress in communications arts.

The systemological development of magneto-electric telegraphy may be charted in several stages:

1) 2-line telegraphy
2) 1-line telegraphy
    a) virtual return ground current
    b) special chemic-action via plates
    c) power from ground plates via entunements
    d) ground rays and ground plates
3) transmission-line telegraphy.

Thomas Edison maintained his remarkable intuitive sense throughout his early days. In his telegraphic patents we see Edison at his best creative output. Uncomplicated and happy early days...the Edison telegraphy patents are always clearly stated: straightforward and operable. Edison's addition of the rheostat to telegraphy was nothing less than revolutionary! This in no way detracts from their elegant beauty and novelty of design.

Edison's prolific and unexpectedly effective use of rheostats in balancing telegraphy circuits offers us another insight into tellurgo-radionic process and design. These devices were unmistakably crude radionic (carbon) tuners. Mr.Edison was "balancing" his telegraphic circuits with respect to the Vril eidetic potentials of earth. Only then would they effectively operate.

Taken as a purely electrical feature of the system, these became commonly used everywhere. Each operator and system manager gradually realized the superiority of this method of "tuning the lines". Furthermore...the tunings (the rates) needed to be corrected regularly. these corrections were required by an unknown (and unquestioned) requirement of the ground space itself.

The later employment of these tuners everywhere made the rheostatic tuner a common feature of every telegraphic system. Numerous inventors had dispensed with groundplates and simply employed large capacitor banks also similarly "entuned" to the impulses utilized in their systems. What drove the continual use of groundplates? Indeed, the underground manifestations of Vril transactions are easily discerned during certain storm seasons, during cold winter nights, and especially near the operation of wireless devices.

Through the systemologies of early and middle telegraphy we find that Vril was evidently and overwhelmingly active. The telegraph lines themselves displayed features which could not possibly have been caused through acousto-mechanical or chemo-electric energies.

It was only ignorance concerning the vast ever-present potentials of the telluric system which brought humanity into the epoch of "extra energy applications" when attempting long-range communications. It was inconceivable (through this reference frame) that an "unpowered" grounded appliance might actually represent far greater power than any "application of extra energy".

The further development of complex tuning circuits enhanced the operation of telegraph signals could be properly "tuned and clarified". Examination of these designs and their componentry reveals a singularly potent eidetic transaction in each. The early record of radionic tuning is a stupendous find. The possibility for extracting Vril power directly from earth is here found in schematic form. One must correctly view each patent through Vril sensitive eyes. It is only then to uncover the vast secrets which herein lie dormant and potential.

The need to remove all resistance from the line would seem to be the most effective means for transmitting and receiving the most unimpeded (and therefore powerful) electro-telegraphic signals. Yet we find that each geological locale requires vastly different such attunement, a tunable carbon resistor being the device which satisfies the condition. Others would also experiment with variable-resistance coils: the remarkable parallels to radionic tuning principles is unmistakably evident.

Confusion among designers occurs when attempting the balance between erroneous cognitive models and Vril intuitive urges. Such paradigm-confusion is evident throughout the development of aerial and earth battery systems which preceded and accompanied the faltering steps of telegraphy.

Vril intuitive revelations revealed opportunities for restructuring the archane Vril Grand System of eidetic communications.

Gradual encroachment of human misguidances distorted the original vision and guidances which focussed awareness on the possibility of distal communications. Natural eidetic phenomena permitted the effortless exchange of eidetic experiences among communicants with defined and exquisite human artifice.

The human tendency toward creating, designing, and proliferating self-assertive systemology tantalized Samuel Morse. His originally received intuition came through a spark display. Watching the marks which sparks made on paper suggested a means for communications based on code. Had Dr.Morse recognized that revelatory vision itself is the true foundation of all communications he would have sought to deeper and far more ancient technologies.

Early telegraphic sounders were often placed in iron boxes. This act "increased the pitch" which certain telegraph operators enjoyed. Material configurations are especially Vril transacted when possessed of a harmonic "ring" (M.Theroux). Mass manufactured telegraph receiving blocks were surrounded with organic hoods which intensified participations in modulated Vril eidetic transactions. Wooden cabinets are special inertial dissolvers when properly designed and aligned. Telegraphic blocks were especially potent transactors when aligned with local Vril channel axes.

Telegraphic keys organismically Vril connect with Vril channel axes. Vril channel axes fix eidetic experience through specific minerals and metals.

Telegraphic coil-blocks powerfully Vril connect organisms with deepest subterranean causeways.

In several patents we see the presence of anomalous battery connections and impulse effects (Bain, Edison, Delaney).

Vril transactions were eidetic tuned through the use of carbon rheostats. Rheostats were used to entune eidetic transactions and counteracted the negative derangement poised by improperly placed elevated telegraph lines. Each ground required specific entunement with regard to local eidetic nodes (natural). The transfer of impulsed code was only incidentally intensified in this process.

Telegraphic components became the radiant site of specific eidetic Vril transactions. Coils, switches, rheostats, bells, batteries, and connectors all become auri-resonant. These altered mind and consciousness of regional inhabitants as well as telegraph operators.

Increased and articulate Vril transmissions came with the inception of telephony. Dr.Morse abandoned the burial of cables in favor of elevated terminals. Elevated telegraphic lines brought submerged Vril threadways again to the ground surface.

We have elsewhere mentioned that viscero-eidetic content (meaning) is an externally generated, sustained, distributed, suffusive, and necessary presence which permeates our lives. Along with so many organic and cognitive receptions and transactions we require an outer supply which maintains integrity of the same. Speech requires some context which the spoken word alone does not contain.

In some mysterious fashion spoken words and meaning combine to convey whole meanings and expressions. Words are only the acousto-inertial expressions. They (of themselves) lack meaning and significance to the hearer or speaker: how often can we "parrot" foreign words? How often do we encounter the unintelligable writings of foreign languages? Meanings are the vital-contextual expressions which use words. Telepathic exchanges (and transactions) demonstrate that meanings may effectively transferred in the absence of words.

What function or value possess signal systems which further separate signal from meaning? To understand this would be to learn what telegraphy meant. Telegraphy was a new language: a new mode for communicating. In the technological absence of ordinary word-communications (telephony) the conversants were forced to further separate their direct transactions of meaning through an artificially synthesized code.

There were those legendary tales of telegraph super-linguists who were able to speak fluently in code for long and uninterrupted intervals of operating time. T.A.Edison was one such individual. Handicapped through deafness, his ability to communicate entirely in telegraphic code enabled him to become the marvel of his often disgruntled employers. A contest (involving telegraphic endurance and key-speed) was conducted with Edison at the key. After 4 hours of continuous exchange Edison signalled the other operator to "get on some speed". He was a young legend among the telegraphers who knew him.

The ability of any individual to "see through" the code and "enter the meaning" is a fascinating study. Reading is just such an activity. The reader must "translate through the page" into the author's world of meanings. The reader must decode the letters and enter the meanings. the difficulty which some children have in performing this task serves as another demonstration of the fragmentability of signals and meanings. Signals and meanings are representatives of different realms. Signals are inert. Meanings are alive. Our world is one whose confusion between the two has resulted in frightful ignorance and horrid frustration down through the halls of time.

The future of communications may have several surprises if we allow ourselves time to study these features. Discussion must (in time) prove the possibility of eidetic language systems: where meanings are freely transacted in the absence of words. While sounding far-fetched there is considerable evidence that certain radionic tuners can and do enhance such exchanges, though these provide an (as yet) limited capacity. The art of learning the archetypical mode (of effortless language-transaction) is something which takes time. The reception of runic messages represented some such system. There were those individuals of old who (throughout cultures and histories) who could decode the rustling leaves, the rippling pools, the call of birds, the sounds in thunder, and the like. No doubt these arts will be researched, developed, and proliferated among those who remain opened to their promise.

The design of archetypical symbologies communicate fundamental and universal meanings in the absence of words. Why can we not design a hieroglyphic system which does not require decoding: being the fundamental and universal language of the universe. Reception of meanings through such fundamental forms would make us privy to the continuous and living utterances which the universe shares with those who know its patterns. One would KNOW the meaning of such form, while the transacted supply of meanings and message would flood the participant without effort. Tesla spoke on these topics before his death. few comprehended exactly what he speaking about when he mentioned "the transmission of intelligence in forms".

Comprehending the differences between signals and meanings serves us well when studying Vril. Our entire science is one which marvelously declares the reception of whole meanings and messages, directly from the universe. In the absence of words we receive meanings. The principal means through which these meanings and messages are conveyed to us (through which we are integrated and connected with the universe) is through Vril threadways which transpierce our environment.

Both words and the meanings combine as seemingly fused components to form a seemingly continuous "whole communication". Communications demonstrate an alarming capacity to permit fragmentation. Meaning and message break down when this outer supply (external support) is in some way diminished or removed. The so-often assumed "continuities" of our eidetic experiences are (in reality) compositions: which are fragmented in the absence of the primary generative energy. In other words we are totally supplied from the external space with networks and mappings of living energy. These combine so perfectly that we always assume them to be solid, when in fact they are fragmentable.

There are situations in which we all have experienced "loss of context" and "lack of communication". What these general and vague phrases intend to covey is some sense of loss: loss of meaning and message between conversant parties. This phenomenon has never been studied in the manner which it demands. Such loss of meaningful integrity presupposes a context in which whole meaning can and does prevail in society. Breaking, inhibiting, or distorting some central power will cause corresponding negative modulations in perceived meaning.

How often do we intend to express a specific thought but actually are perceived as communicating some other context? "I didn't mean it to sound that way!" is a frequent (hopefully comic...usually embarrassing) situation we all know. There are reasons for context misinterpretations which exceed the explanation of simple word usage. "Double entendre" is frequently due to a "room condition" or "space-loading": in which recipients and speakers are pre-conditioned to misperceive.

I have found that there are places...actual locations...in which these conditions prevail. There are several places I have known in which confusion, chaos, and a pervading sense of misunderstanding prevail. These conditions maintain their negative character through the years. I am forced to accept the fact that these distortions of contextual integrity prevail because of some basic Vril disturbance or derangement.

Discovering the variables allows us to discover the unknowns of our universe. It is through the universal comparisons that we learn the nature of (supposed) solidities and permanence. The numerous instances when integrity of meaning is actually amplified beyond one's own words is an amazing surprise. That a group consortium can be "in one accord" (with very little convincing or speech) is a miraculous condition in our distorted world. I have also discovered that such places also maintain their wonderfully supportive character and essence over time. Such places are possessed of an amplified ability to proliferate (human) integrity of meaning. I am forced here also to accept the fact that these incidences (these locales) are not accidental: they are the distinct resultants of Vril powers in balance.

Signal systems are (of themselves) incapable of transmitting meaning. Those who use them cannot become that fluent in the decoding and coding aspects that MEANING can be derived. Piecemeal signals do not make holistic MEANINGS possible. Unfortunate people who have suffered from aphasia are unable (in some measure) to code or decode verbal and written signals. In some cases the individual may understand but cannot make sentences. In other cases the situation is reversed. Coding does not in itself produce meaning. The "silent ... mystical ... supportive" agency is that which we rarely glimpse in action while talking and listening.

Why have we been so insensitive as to detect this overwhelming presence ... this "meaning-integrator"? It is precisely because the presence of which we speak is so overwhelming ... so thoroughly permeating. Signal systems have filled our world. In the writing and speaking modes of various cultures we find that coding-decoding places heavy emphasis on the need for a meaning-integrator. Divergent signal systems place heavy emphasis on the need for a meaning-integrator. This is especially true of degenerate language, where hand signs and gestures "fill in the unspoken gaps". There are cultures in which very dense coding-decoding systems require the densified presence of the meaning-integrator (oriental writing systems) in order that social contextual comprehension be supported and maintained.

Pictograms and hieroglyphs represent a system which requires such heavy support. While one can easily "read" through the dynamics of some hieroglyphic tract one yet loses much of the "in between" meanings. Unable to contain the continuity of expression we find that such systems fail in the details. Because of these truths we find that "signal systems" are only capable of transmitting distant meanings because of a local response to some portion of transmitted signal: Vril, whose appearance comes to support and proliferate understanding.

In order to comprehend the Vril functioning of the telegraphic systems we must comprehend something of signal systems and their implications.

The eidetic transactions which flash through physical contacts and certain discharge components are due to Vril. Vril floods and saturates the system night and day. The saturation of telegraphic systems with Vril energies resulted from the moment they were grounded and installed. The blind insistence of engineers (in superimposing electric impulses upon the Vril power) did not prevent the Vril power from continuing to express itself. It was this feature which brought forth all the anomalous activities regularly observed, catalogued, and published.

Look at the telegraphy designs as radionic circuits. Though marked by extreme simplicity and ruggedness they transduce great potential across equally great distances. When we examine the duplex and multiplex circuits from this point of view we arrive at very different perspectives than when looking from an "electric" viewpoint. Suddenly we are no longer interested in the minute details of the electrical exchanges and the maddening conduction paths (which defy experience and logic). We are viewing the radionic functioning of the circuitry in whole perspective. we see the sections as wholes...as aggregates and cavities of resonance rather than as singular paths of conduction. These systems of telegraphy (and their components) were capable resonators of the Vril power.

The curious manner by which we may best examine the patents (seeing whole portions of circuitry rather than specific little activities therein) seems to indicate the nature of the power which forged the system. Remember most of the telegraphic developments originally emerged from dream impressions and visions. therefore it is crucial that we recognize the holistic signature of the power which forged the system. We can easily achieve this awareness by seeing (not independent little "electrical" activities: internal paths and shunts, vibrations, and reactions) but by grasping whole portions of the diagrams given.

Confusion between Vril activity and electrical impressments caused early electrical engineers to imagine that empirically discovered efficiency equalled "electrical efficiency". They do not. The empirically discovered means (for enlarging and enhancing telegraphic signals) had nothing to do with electrical signalling at all. Yet, it is difficult to convince most conventionalists of these truths. Why? Do not certain Vril systems operate in electrical (inertial) modes? They do. Where do the differences substantially diverge? How were the differences ever merged to begin with?

Telegraphic systems worked because they served Vril principles ... not electrical ones. Empirically discovered components and their (apparent) functions were not thoroughly examined to discern the important differences. It was assumed that these empirical functions were actual indications that the components (coils, resistors, batteries, plates, etc.) were performing electrical work functions. In fact they were not. They worked in spite of the electrical impressments. Yet what did we find historically? The engineers of that day reduced the identities of components and electrical functions together ... making comprehensive theories which were poisoned with the errors. The erroneously equated identities (component function and electrical function) became automatic mental equations. This forging of error blinded the eyes and minds of the engineers until now...we cannot speak of such matters without excessive conflict. We have yet to ask the most fundamental question concerning these intrigues.

Has anyone in fact ever made the right equations: that is ... has anyone ever equated the Vril power with the functional service of material forms? I believe that historical evidence proves the ancients to have achieved this equation. We will find an amazing repetition (of symmetries and forms, patterns and shadings, functions and abilities) when comparing the functional elements of telegraphy and wireless with the functional elements of ancient architecture. There you will find your greatest discoveries. there you will see the form of the mysterious and marvelous archetype which has blessed humanity with its presence. Piece by piece (element by element) we are privileged in our time to be again receiving these very forms. Let us not ruin our emerging opportunity.

With telegraphy we find that the affairs of engineers took proceeded with virtually no consideration for the overwhelming Vril power. There was little consideration for the powerful reality through which many had been receiving bilocational impressions of the most powerful sort. The telegraph line could transfer "dreams and visions" from far off places. Operators frequently thought themselves to be going mad.

For the engineers there were only the troublesome problems which affected "the line". Even taking such into account, the engineers were beset by local conditions and problems which seemingly corresponded with no known electrical principle. For example ... how was it that mild battery voltages could actually effect an electrical transfer over a single wire? Without the ground connection the powerfully transaction ceased.

We may infer by these several patents the mannerisms and requirements by which telluric energy interacts with applied electro-stimuli on grounded conductors. Unable to rely upon the purely eidetic signals (of experiential impressions and telepathic sensations) which such a system could provide its operators, we behold the progressive and historic application of electric impulse alone. Telegraphers and inventors of telegraphic appliances seemed unable to both envision and rely upon Vril alone. Yet we have several occurrences in which the telluric eidetic forces were indeed overwhelmingly evident.

Some hoped to prove that the earth was merely an infinite (electrical) capacitor. In this view the ground plate was simply connection with an immense capacitor plate. Why then were tunable resistors needed at each terminal in certain grounds? In addition we find that the calculated wavelengths of each dot and dash exceeded 30,000 miles. This means that (since lines were rarely more than 300 miles in sections) current was actually flowing through the line for 100 times the line length. In other words the line was conducting current...and current has to be both drawn from and deposited into some reservoir. The back-flow required (by such a long conduction time period) must take place through the earth. In effect: there must be a return circuit somewhere.

VRIL MAPS

We will examine the varieties of components which appeared throughout the course of telegraphy: later to become the primary tools of radionics. Rheostats, coils (inductors), capacitors, and other components will be examined with especial regard to the Vril primary function of each. Component designs sustain (artificial) impressments because Vril activity is accompanied by an inertial entourage in our present space.

We will learn how the former primary function of telegraphy and its componentry was forgotten and lost ... while the electrical function was retained and magnified. Comprehending the separate viscero-eidetic behavior of each component is extremely valuable knowledge. We find chokes, tunable coils, resistors, tunable (carbon) resistors, rheostats, resistance coils, chemo-electric batteries, branches, groundplates, exchange-wire conduction paths and so much more. These are the elements of circuitry. They are not fundamentally electrical components. These form the parts of the Vril resonant system called "Telegraphy".

Remember that telegraphy was designed from visions and built through empirical means. What worked best was implemented. If a component worked very well it was patented. So it was that the systemology of telegraphy was developed. Empirical discovery needed no explanation. In denying the overwhelmingly present Vril power the designers assumed that every empirical feature was serving some vague electrical function. When these erroneous reductions became dogmatically fixed (as "electrical law") it became impossible for the researchers to disassociate one effect from the other. Thenceforth it was necessary for the empiricists to employ and rely upon the Vril vision in order to discern the activities, functions, and potentials of every (supposed electric) artifice.

The empirically derived componentry of telegraphic systems served the Vril power. Fundamentally a telegraphic system is a Vril accumulator and transducer of immense potential. These systems operated well insofar as their components and configurations served the Vril potentials primarily. Contact with the ground converts any material configuration into a Vril transducer. Whether as accumulator, diffractor, focussing device, directional enhancer, clarifier, or translator ... the grounded artifice is the prolific and proverbial rod of power

... a ground pole ... a link with the Vril threadworks.

When we examine the ancient origins of distant communications telegraphy we find that its envisioned potential was far deeper in significance. Telegraphy was far more eidetic and magickal in operation as envisioned by those who managed penduli, auric-vanes, and dialettes.

Our goal and quest is deep and more devotional in character. We follow the lead of alchymy and the great labor: the quest after extended consciousness. Technology is being studied which will effectively enhance world consciousness by deliberate activations of Vril channels.

Enhanced reception of telegraphic signals and the anomaly of long-distance signal transfer were routine observations. Even before the use of "power relays" and "line amplifiers" we found reports of enhanced (and anomalous) energetic ground activities.

The mere application of moderate voltages at the telegraph ground terminals was sufficient to traverse many miles of line-length, effecting powerful results at the receiving end. The self-enhancing power which the ground was providing was never questioned or curiously addressed by most engineers. The special grounds of mineral and metal-bearing earths seemed to provide the best such action ... but this was relegated to mere "resistance-free conduction paths". Never did most conventionalists bother to recognize that specific combinations of metal-mineral-clay paths actually effected a loss-free transmission! The functional dynamics of an immense "earth-machine" is observed directly: one whose resonant components are the specific minerals and metal lodes found in situ.

The establishment of telegraphic lines across mineral-rich regions of ground was fortuitous and revelatory. The actual observation of seemingly self-amplified signals was an anomaly not easily explained or forgotten. Ground signals traversed metal veins, metal lodes, crystalline caverns, and mineral tracts. The considerable improvement in clarification and intensity of signals led many sensitives to recognize the generative and regenerative earth.

To enter earth with a small signal and thereafter retrieve a much clarified and stronger signal infers that the ground contains some "springy" and autonomic intensifier. It is closer to the truth when we perceive this action to be the direct result of generation and regeneration rather than signal-sustenance. The early telegraph lines did not operate on pure electric impulse. If they did, then powerful echoes would have been consistently ringing on their lines.

We know that the length of impulses (manually generated) actually demanded the lines to conduct current from the batteries into the ground. On electrical terms alone we may calculate the effective pulse length of any "dot or dash" to be (inertially) in excess of 90,000 miles! Therefore (when continuously operated) any section of line was forced to wholly conduct for sizeable lengths of time. The tendency for significant reflections to result in such a condition is not possible.

The more esoteric and astonishing reality becomes apparent when we consider that organic signals are especially well received into the ground veins. Organismically managed signals never diminish irregardless of distance and ground type. Indeed it was through organically stimulated sounds that Rossetti discovered that powerless telephony was a practical reality. Any human auric) contact is necessarily an organic signal. Mahlon Loomis effected such signals when he gripped the key of his aerial transmitter...and caused the reception of signals 20 miles away! When we consider that these experiments took place in 1862 we are even more astonished. In fact we will show that auric interactions with Vril channelry would effectively transmit "meaning through signal" with telephony.

"Good ground" was also a commodity which required a special talent. Eventually there were those inventors who answered the general need for consistent "good ground detection". Numerous devices were developed to (electricallY (inertially) indicate such conditions. With the prevalence of these non-participant methods the loss of telluro-active ground sites also became an increasing feature.

The anomalous instances where it was possible to operate telegraph lines without battery power began to become ever the rare item. These (once numerous) instances were actively sought by linesmen. Not needing battery houses to operate a length of line on a system saved money! There were those for whom this exceedingly strange ground power posed an essential mystery. Some wondrous creative power was obviously and manifestly active in such situations. The Vril gift was not required by those who began using the electro-inertial ground meters.

What kind of "ground points" these meters located were not the Vril active ones. These "meter-found groundsites" had very different characteristics. These were null spots of a very different activity and energy. Yet for a few sensitives we find the continued reliance on non-participatory meters. Those who used them rarely found "ground current". It is a curious and noteworthy thing to recall one particular sensitive obviously endowed with Vril vision. The Vril gift continued to operate in a latter day telegraph linesman who used his skill to perfection: Nathan Stubblefield.

Telegraphers (and those who designed the distribution paths through the countryside) were intuitively guided along ground veinlines of especially Vril potential. They thus often followed the railroad tracks less out of ease and necessity and more out of reliable alignment. There were grounds where static interferences were well known, not understood, and less well-mentioned. Some special telegraphers (Nathan Stubblefield) seemed to take rare note of such places and made use of them in their new and astounding technologies. Telegraphers continued to follow the rails.

To understand something of the intuitive reasons why one would originally choose the old railroad paths we need to comprehend who was choosing the cuts and lanes. Old railroad men rarely used geologists unless it was absolutely necessary. Cutting through mountains and along ridges was a later requirement in which geologists found themselves employed. Blasting and excavating was their special province. Before this, the rails were not needy of geologic expertise at all: they simply followed "the lay of the land". This meant geomancy at its intuitive best. The results (whenever found) are truly astonishing.

Railroads notoriously follow Vril ground veins: les woivres. In the rare instance that the rails cut across such telluric veins we find them (not strangely enough) reconforming to the woivre lines after a short distance. Not so geologically conformed as geomantically aligned and convoluted we find the railroads to be especial sites of Vril activity. Curving and winding magically through and among green rolling hills, along the crests of sinuously long rilles and ridges, and down through the very heart of thin natural valleys (where old streams long since ceased from flowing) we find the rails utterly romantic in every aspect. This romance is not without its real reasons: its real powers. The "romantic" and "winsome" sensations are often tinged with the very deepest of ancient beckonings: the very hallmark of Vril viscero-eidetic energy at work in us.

Old rail-lines are remarkably Vril active. They are carved through the surrounding countryside and convolute with rare precision along nearly every Vril channel coursing through each district. These are sub-gradient troughs in certain lengths. Railroads course through very Vril transactive regions of ground.

Staten Island is possessed of a singular Vril symmetry which runs directly through its "heartland". I have outlined and mapped its "spinal column" and this remarkably coincides with a wonderfully old road (Van Duzer). In fact it is the oldest road on the island itself! Van Duzer Road is the path along which one must travel should one want fusion with the history and persona of the island. It too (not surprisingly) was the naturally chosen path which led the Dutch and early settlers directly across the island's length. It is amazingly verdant...and warm...at all times of the year.

The number of encounters with significant landmarks and active ground points is the typically wonderful pattern with which geomancers are well-familiar. One cannot travel along certain old roads without experiencing significant personal changes and powerful shiftings of awareness. Such shiftings always bring us to the realization that the resultant thoughts are the only important issues of life. We find ourselves drawn away from our immediate problems and concerns and drawn into eidetic worlds of incredible joy and elevating power.

The dreamy and impressionable energies which course throughout such old roads elevate those who travel into a ringing joy! Ivy, churches, old cottages, quaint and unexpected town squares, wrought iron gates and gardens...all add to the scenic beauty which is typical of wandering Vril lanes. One encounters spontaneous eidetic experiences here.

One finds in the sub-surface (open-air) troughs of the railroad that sounds are especially powerful and distantly carried only along certain railroad lines. We find this to be so regardless of wind conditions. With the wind moving away from ourselves along the tracks we find that even whispered sounds downwind manage to reach our hearing...against the breeze.

I have often observed the Vril glowing blackness which one experiences and senses externally when descending into these troughs. The change in lighting is only part of the whole phenomenon. The sense of glowing blackness is more the adequate description of the effect. One does look toward the sky (however blue) to find it strangely blackened with a granular blackness. One's sense become shifted along specific patterns. Thinking clarifies into simple and piercing vision and negative emotions disappear. One finds the sensitivity to Vril force and geometry especially heightened therein. One can literally begin to see the Vril topography quite distinctly and directly in their lanes...through the ground!

One becomes entranced with the rails and the sub-ground environment quite willingly: this seems to be a relatively natural inclination. However long one needs to wait for the train makes no difference: one is entranced with the environs and remains impressionably intrigued with the oldness of the land thus evidenced. Down there one senses that the land itself is messaging certain historically significant sense-meanings. Trees and brush grow with special strength. They never seem to wither or wane in their growth patterns. The ability to sense suddenly changes and inductions of weather patterns down in these railways is very distinct.

One easily senses there that the very ground is surging with sensate energies, whose essence induces vibrations throughout the deeper abdominal area of the body. One senses that the very ground is resonating crystallographically from region to associate region. These resonations soon result in strange alterations of weather. There are times when we feel the removal of the "good weather energy" from the surface of the ground ... down into the depths. The resultant appearance of inertialistic patterns (rain, fog, humidity, general congestion ...) is what usually follows.

More surprising are the numerous "weather lanes" I have isolated and observed for several years now. I find that (on Staten island) there are distinct weather alleys along which Vril energy often vibrantly resonate and surge. Whenever this resonation occurs I know that certain weather patterns are about to transpire. These patterns appear to enter and exit along the specific angulated paths which may be mapped. They appear repeatedly ... year in and out. I know them to represent some regional crystallographic feature of the entire region.

Vril transactions transform and crystallize ground minerals and metals (minerals, metals, rocks). Vril threadways form mappable dreamlines. 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).

Telegraphic and telephonic exchanges were remarkably Vril threadway conformable. The manner of their design differs in no way from the artificial design and material articulation of a dendritic ganglial array. In time sensitive designers recognized that such human fabrications were not necessary. The Vril natural articulated systems provided more than the means for attaining connections.

Vril thread space distribution is an ordained system through which communal and regional consciousness is actually generated, sustained, suffused, disseminated, and shared. Spatially distributed Vril threadways and their nodes and junctures may be mapped. Mapped Vril threadways maintain their position throughout history. Dreams and imaginations are distortions of real Vril eidetic experience.

The old telegrapher's tradition of "earth as reservoir of self-generating electrical potential" was successfully received by great personages of inventive prowess (Loomis, Stubblefield, Dolbear, Tesla).

Eidetic contents are spontaneously transmitted through Vril articulations. Humanly arranged artistic channels transduce Vril modulations directly. With Vril the need for excessive human code is eliminated. Code free channels are found in singularly sustained ultra-harmonic sounds. Innate eidetic contents and evidence for space-distributed intelligence is revealed when monitoring ground and aerial sounds.

Departures from the immediacy of the apparent world are easily achieved through Vril articulations. Vril threads guide the human organism into deepest eidetic contents of the Vril World. The Vril World is the true World of eidetic content.

Vril power points are sensed throughout the experiential spaces. Fixed Vril power points are ordained. Fixed Vril power points are found throughout experiential space. Vril points can be located in aerial space and ground. Vril power points can be interpenetrated by material imposition. Tremendous eidetic and unexpected energetic manifestations are conducted through such material interpositions. Vril reactions define all mysteries. Vril presence generates all unexpected conscious activities. Vril Science explains all scientifically observed anomalies.

Establishing Vril communion is not difficult. Vril contact is first achieved through the natural artifice of specific boulders and trees. Sensitivity reveals Vril activity among metropolitan settings. Cathedrals, iron fencework, towers, and rock walls transmit powerful Vril threads to unwary recipients. Dreams, visions, and exceptional clarity of consciousness are discerned near and upon Vril active points.

Vril threadways cross streetlanes, emerge through basements, radiate from iron poles. converge upon stone pillars, vivify special garden walkways, pierce through fire hydrants, arc from stone-metal curb rims, and discharge from evergreens. Natural Vril points are found in special parts of neighborhoods. Vril points are located in the old sectors of town. Original settlers intuitively sought such exceptionally vivid zones to found their villages.

Vril activity sustains the conscious and material integrity of neighborhoods. Neighborhoods rely on the generative supply of Vril active points. Neighborhoods become depressing, dull, and vacuous when natural Vril points are disturbed. Many local inhabitants remember the time and season when their neighborhoods lost vitality. Construction operations which covered natural Vril points mark the time. Natural Vril points are disrupted through excessive ground surface construction and demolition.

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.

Codes separate Vril organismic experience.

Many designers illustrated their intuitive comprehension of underground energetic passages, conduits, rivers, rays, threadways, and channels (Framer, Barney, Wilkins).Comprehending the "return circuit" relied entirely upon intuitive insights which were actually eidetic transactions received by the sensitive inventors.

Dowsers were not rare figures in the telegraphic proliferation. Dowsers knew the land and the lay of it. Such natural surveyors were often in charge of determining early telegraphic line details. While general directions were delineated, it was the dowser whose fine-tuned sensibilities guided the line along specific pathways. Vril Science discovers regional eidetic world site-projections via natural geological forms.

Iron rails appear to "swim" before the eyes because Vril surges through them in processions. Vril passes through materials which inertial technology establishes for its own purposes. Powerful Vril conduction in special materials requires specific position and angulations in the environment.

Bright "clear sight" pathways are found just above the ground surface. Leylines are white-sheathed Vril threads. Vril aerial routes may be mapped. Organisms experience impedance when encountering densified inertial spaces. Specific design geometries extend organismic participation where no previous participation was possible (coils and iron cores). Increased Vril thread contact and mergings increase degree of viscero-eidetic translations.

Vril technology seeks the dissolution of all regional inertia. Vril active minerals and metals and configurations release Vril eidetic images with strength of degree. Vril eidetic images reveal distance regions, give bilocational experiences, diverse hierarchic conscious resonations, permit deeper experience of immediate surroundings.

Vril axial contact is required for eidetic transaction. Off-angle contacts yield inertially contaminated experiences. Telegraphic block-coils are extremely Vril active. Viscero-eidetic experience is focussed from the tops of the iron cores. The use of the copper fine-coils brings visceral experience of sensation to the operator. Grounding and iron-wire connectivity strengthens the contact immeasurably. Telegraphic operators were in eidetic mutual contact constantly. Bilocational experiences through matter contain singular truths concerning the Vril environmental structure of a region.

Continual bilocational visitations to specific eidetic points reveals the existence of powerful Vril centers. Space surrounding such Vril centers is eidetically projected space. The integrity of the apparent world depends on these points. Alterations in environmental conditions creates organismic interference during eidetic transaction. Organismic stability depends upon fixed proportions of inertia space and Vril eidetic content. Organismic sensitivity includes interruptions due to musical tones, illuminations, color, and inertial detrital currents. Telegraph stations are silent during the long night hours.

Natural Vril nodes dissolve inertia fibrils and greatly expand eidetic consciousness through discharge. When this occurs there is "static on the line". Researchers who discovered that certain kinds of (earth) induction were "anomalous" were baffled. Empirical inventors took these anomalous instances and worked them into equally strange apparatus. These form the bulk of our bibliography.

The Vril functions of telegraph systems and their components forms the basis of an immense revelation. The telegraphic systems represented the first instance in which large trans-regional systems were interconnecting earth and city-centers directly. In addition, we find the trans-national interconnections and even the trans-oceanic connections which so gripped the minds of the day.

First and foremost therefore the telegraphic communications systems were ground connected systems. Intimately fused with the ground power they transduced its energetic persona directly between towns and (especially) sensitive operators. The primary power which operated in these systems did not require application of electricity at all.

If not for the human failure to consciously sense and operate with this power we could have seen astounding fulfillments years before our time. The nature of these Vril energies have not been discussed before with any great depth. Suffice it to say that these are the energies which fulfill our deepest dreams.

The telegraphic systems were forced to operate under a conjugate energy load: the naturally suffusive Vril power and the impressed electrical clackerings of batteries. No less effective in the Vril mode. These systems continued to manifest strange and anomalous energetic transactions. These were not all duly noted and recorded in the public transcripts of technology. yet we manage to find sufficient weight of extracts (from the periodicals of the day) to support our thesis.

The addition of electrical impulse stimulated the appearance of the Vril power. Our growing familiarity with this power has permitted us to recognize some of its astounding characteristics. Vril energy differs vastly from all notions of energy which we have been taught. We know that technology could have relied totally upon Vril power for the benefit of humanity.

It is therefore inestimably valuable in reconstructing the steps which were encountered by researchers who realized the presence of the ground energy. What we find in telegraphy is a vast presentation of paradigms. These dealt with conduction, conduction pathways, and continuity of actions (contact action).

The entire field of telegraphy reveals embodiments which make use of transactions by which organismic integrity is governed. The design and proliferation of special Vril tuners will enable each desirous individual to experience degrees of these Vril energies: the consciously expansive spaces of which we speak.

Our familiarity with inertial pressure technology is the result of a false step taken by engineers early on. The subsequent development of technologies (which solely develop inertia and transform inertia) have led our world astray. This betrayal stems from the fact that inertial pressures are not fundamental energies at all: they are pressures and by-products of more fundamental powers.

The telegraph of Salva intended the reception of such electrical shocks to be received into the body. Messages could be so pulsed as to permit the recipient a means for decoding the pre-arranged signals. These shocks were not pleasant ... but they revealed a singular mystery when once the lines were established over land and the ends were earthed.

Through the use of various metals and organic lines (threads, strings, cords, ropes) Baron von Reichenbach found it possible to transmit eidetic signals to sensitives who were grasping their end of the terminals. These signals were limited to emotional signals as generated through natural sources (minerals, metals, crystals, sunlight, moonlight, etc.). I have not found any records where his sensitives saw holistic visual impressions. The sensitives each experienced these signals with consistent reports, though of variable strengths (as their sensitivity allowed).

Dr. A.Abrams and his experimental arrangement for entuning thought-forms: another step in a progressive movement toward eidetic transmissions. With wired attachments (to the bodies of separated individuals) Dr. Abrams literally demonstrated that thought-forms could be holistically transferred. These through-line transfers exceeded the thought-transference commonly called "telepathic" (through space alone). The interposition of minerals and metals and special components (rheostats, variable resistance bridges, minerals, organic matter, etc.) enhanced, amplified, and clarified the same signals.

The immense reservoir of Vril energies far outweighs and outclasses any conception we may have of electrical capacity. What electrical vibrations and capacity we may measure is the mere by-product of the Vril power surging in the ground. Therefore the benefit of grounding radionic systems is immense in scope. The telegraphers achieved this first off...through empirical findings!

In telegraphy we find an old form of radionics: systems which embody direct earth-connection and transduce Vril energies. They therefore operate solely in the Vril mode. They may have been suspected as embodying a curious "life of their own" as so many ground-embodied structures often do. It is not uncommon to experience the quasi-living states which certain old buildings manifest during specific Vril seasons.

Without power the telegraphic systems were capable of continuous operation in the eidetic mode of transmission: a mode through which experiential impressions can be transacted from station to station with great clarity and force. "Premonitions" and other visions were a constant feature of encounter for the "night operator". Indeed the night operators frequently reported that the transmission at night was astonishingly more clear and powerful than during the daylight hours.

When you look at a telegraphic component you are looking at a piece of a large and powerful radionic tuner. When you examine patents (which display and describe multiple ground connections through specific polarizations and tuning assemblies) you are examining a radionic system. When you read of anomalous currents and continuous manifestations of power you are reading of a surging Vril power which responds to electrical stimuli by expanding and overwhelming.

When we analyze the issue we find that Reich's statements were indeed correct. The use of electrical "irritation" triggers an automatic response by the living energy. In this case the Vril power moves into lines so as to quench the irritant. All the resultant effects are the direct result of such energetic intrusions.

EARTH RODS AND LOADS

When telegraphic support-posts are driven into specific foci (ground nodes) there is interaction with the telluric power by which they become powerful (organic) conductors. Thus even the support-structures of telegraphic systems become saturated and interactive with the Vril energy. One sees these energies flooding and connecting the skeletal form of wire and poles. The evidence of insensate Vril is the observation of the rare and highly energetic violet glow which covers them. We find that every wooden pole becomes thus especially flooded at the times of sunrise and sunset.

The telegraph systems of old we find these poles to be necessary every 40 feet or less. The likelihood of enjoining Vril points was therefore greatly increased. Vril Points do not cancel. Threadways which exit or enter the ground nevertheless transact eidetic experience with their recipients. The entire system therefore became flooded with rare Vril energies which had every potent effect upon the exchanged and impressed signals.

Thus we find that telegraphic lines are possessed of far greater potentials and activities than the mere electrical detritus which we add to their length by impulses. The interactions of telluric energies with these electric impulses produced intriguing new varieties of energetic (conscious, eidetic, and inert) effects, which certain gifted individuals grasped and developed.

The power of insulators as transducers is never mentioned. These artifices are potent transactors of Vril energies. M.Theroux has constructed several arrangements in which these effects are especially powerful. Used to alter the Vril condition of a locale, the use of a large and black (manganese) grounded porcelain column reveals potent telluric activity. Difficult (if not impossible to peer into) the sensitive finds that the insulator axis guides whatever applied or impressed energy is made available to the geometry. When grounded, we find that the surface coating is especially effective in conveying Vril threads along a tightly self-collimating beam.

These threads are potent, viscero-eidetic, and have deliberate drastic effects on regions in which they are utilized. Their effects have little to do with the true transmission of beam-energy to distant locales. They seem more to deal with the literal modulation of crystallographic ground resonances in a region. It is possible then to effect an entire crystallographic ground region through the reactions which occur at a (specific) point!

We need to study the surface coatings of these insulators to determine (with deliberate precision) the exact functioning of the whole form of insulators. It is obvious that the geometric form of these designs is evidently part of their effectiveness in Vril operation. Perched atop telegraph poles these forms had a powerful influence on the transduced Vril energies which processed along the lines. Each surge (proceeding to its own relationally resonant station) brought viscero-eidetic transactions into the operator with continual force. Vril is what gives the "mood and tone ... sense and feel" of any particular station in which human affairs are publically conducted.

Iron spontaneously dissolves and eradicates inertial space. Iron poles, rods, and towers are potent in viscero-eidetic transactivity. Vril revelations provide short-cuts through which we achieve futural science.

Vril eidetic messagings direct and re-structure human consciousness into its deepest potentials. Vril eidetic consciousness breaks the inertial bondage to the 5-sensory degenerate perceptive mode. Vril is foundational reality and is the meaningful core of being. Vril is the shared generative living presence whose power sustains all living organisms.

Geometric material configurations direct and collimate inertial detritus. Specific minerals and metals dissolve, absorb, shear, and cavitate inertial space in the native states. Iron spontaneously dissolves and eradicates inertial space. Iron poles and towers are excessively viscero-eidetic in transactivity.

Primary in the human Vril matched conductions is IRON. Vril Technology provides the linkage and artifice through which Vril manifests eidetic potentials. Civilization requires Vril eidetic union. Iron forged connections. Through Vril we each experience universal communion. Eidetic projection sites merge at the ground surface where Vril inflects deep in the ground or in space.

Wooden poles are compacted capillaries which are highly Vril conductive. The design of aerial dendritic manifolds brought a sudden transactive potential into public meeting places. The corresponding increase of social activities were described by daunted city dwellers of certain sensitivity. Complaints that the city atmosphere had suddenly become "all a-buzzing" were all means a literal truth with the ponderous placement of telegraph and telephone lines in the hundreds.

The design and construction of subterranean telephonic lines brought with it a new eidetic potential to the telephone systems. Excessive reliance on carbonaceous and other organic matter to insulate telegraphic and telephonic lines actually resulted in the enhanced eidetic transactivity of these lines with Vril junctures through which these passed.

Specific eidetic transactions were engaged through telegraph poles and the special varieties of insulators which surmounted them. The insulators provided special eidetic transactions which must be experienced to be appreciated. Insulators were made of a great variety of minerals and metals in combination.

A careful study and examination of the specific metal glazes used on porcelain substrates. Each mineral glaze is (curiously) organo-resonant and effects easy transactions of eidetic energy along the iron wire which they support. Glass insulators were also used. These give strong eidetic connectivity with iron. Intuition prevailed despite electrical predelictions. Electrical insulators conduct Vril effortlessly. Each provided a specific visceral sense and eidetic potential. These were conveyed en masse to each station operator and subscriber .

Insulators were made with organic reservoirs (Johnson, Phillips). Ferruginous glazes made ceramic insulators much more than electrical non-conductors (Bloomfield). Their use is inconsistent with electrical principles and are often the very sites where lightning strikes dangerously entered systems.

Manifolded cables and organically covered sheaths are Vril dendritic imitative forms (Spalding).Iron poles treated with carbonaceous liquids were incredibly potent Vril conductors (Sprout).

Telegraphic poles were historically developed in several stages. The sue of trees as vascular Vril conduits was quickly replaced with special geometric iron posts and towers of exquisite beauty and Vril conductivity (Dodge). Surmountings of special insulators focussed Vril threads (MacDonald). These designs are powerful in projecting Vril discharges across space (Conklin).

Others were covered with organically heavy dopings made to formulary specifications. Geometric appendages, wriggling iron projections, and special ground-gripping spikes were added to designs. Some included organically soaked wood as pier-foundations. These forms enabled the enhanced entrance of telegraphic aerial arrays with the natural Vril ground distribution and were prolific Vril transactor.

Underground conduits and cables soaked in organic materials are notorious absorbers of Vril threads. Underground conduits and hooded pipelines enabled special Vril conductions (Rosebrugh).Underground tunnels represented a new movement which assumed the work abandoned by Morse long before. Underground cables soaked in carbonaceous matter are notorious absorbers of Vril threads, concentrators of vril intensity.

The specific means by which telegraph and telephone cables were vril loaded involved the use of specific carbonaceous formulae (Smith). Special constructions of telegraph poles are highly geometric, materio-resonant, and exceptionally Vril conductive (MacCarver).

Telegraphic lines created individual-altering surface conditions because of their material configurations. Shimmering Vrillic energy powerfully attracted human attention toward the telegraphic lines which entered and traversed forests. The line were themselves objects of mystical fascination because of their vril potent conductivity. Inherent meaning was perceived because that which generates meaning and focussed perception was enhosted there.

Telegraph and telephone lines created ground standing conditions where vrillic energies consistently resided. Night emergent vril threadways flooded these systems because of their material configurations and excessive use of iron. Such observations and experience were also prevalent along the iron rails.

The ephemeral forms draw the experienced sensitive in close proximity with telegraph and telephone lines with the distinct result of Vril eidetic transactions.

Distinctly crystalline surfaces could be detected near certain sections of telegraph line when these coincided with Vril channels. Blocks of granular substances gradually become Vril conductive. Houses and other enclosures become permanently polarized to conduct Vril through time. Specific material configurations and enclosures grant specific Vril eidetic transactions. Vril operators and their apparatus permanently alter Vril distributions in enclosures.

Telegraphic systems gradually became Vril polarized and saturated. Their materials were gradually transmuted for the clarified transaction of Vril eidetics. Telegraph and telephonic stations were powerfully noumenous sites.

Vril threads crystallize in metal braids and conductive lines, sustaining systems and founding primary systemological functions. Our eyes engage in visceral influences caused by Vril transactions. The "eye drag" phenomena follow Vril transactions as they inflect through lines, cables, braids, iron railways, and stone works. Vril causeways interlink cities and stimulate bilocational experiences. Vril technology magnifies these effects by deliberate means.

Through Vril causeways we are translated into mysterious experiences of unknown meanings, and mysteriously hieroglyphic significations. Social upheavals increase with increased Vril emergence. These events have chronicled several technological upheavals in the last 200 years of unprecedented importance. Social revolution follows Vril activations.

It is possible to peer in through a vril eidetic material and sense all of the associated branching awarenesses and views.

Such omni-conscious vision is a native phenomenon in eidetic worlds. Iron aerial wire connectors poised between the special telegraphic poles and their accoutrements distort the local Vril matrix. Telegraphic interlinkages between towns and whole districts were artificial, effecting sometimes dangerously unnatural detrital formations and concentrations. The improper placement of telegraphic and telephonic poles proves harmful to certain Vril integrity in villages and little hamlets.

The railroad station became the focal point of each small community. These were noumenous gateways of eidetic travel for the casual inhabitant of a town...the focus of all attentions as endrawn by the very surges which traversed the rails. Vril loaded systems effect increased social activities and human energies. Overhead vision was diverted along the telegraphic and telephonic lines

Vril axial contact is required for eidetic transactions. Iron wires provide such alignments at the station sites. Operators needed to align themselves with respect to their local Vril channels. Off-angle contacts yield inertially contaminated experiences. Telegrpahic block-coils are extremely Vril active. Viscero-eidetic experience is focussed from the tops of the iron cores. The use of the copper fine-coils brings visceral experience of sensation to the operator. Grounding and iron-wire connectivity strengthens the contact immeasurably.

Telegraphic operators were in eidetic mutual contact constantly. Grounding and iron-wire connectivity strengthens the contact immeasurably. Telegraphic operators were in eidetic mutual contact constantly. Telegraph lines were not constantly electro-active during the day, being left with switches opened a great deal of the time. Organic substances enable organismic participation in otherwise inertially concentrated volumes of experiential space. Awareness of earth and densifications of ground topographies became especially intensified during the latter 1800's. Increased human interactivity with space and space-oriented themes appeared when telephonic cables and systems were buried.

Social alignments and metropolitan activities became increasingly and notably collimated along the converging telephone lines. This was very obvious where such aerial cablery cut across city avenues and found their ways toward the local main terminal. Special cables were developed in neural analogies (Hawley, Jacques). Specially carbonaceous-laden cable were especially Vril attractive. Cables were distinctively Vril accumulative (Jacques).

Others combined cables and earth battery technology to produce "artificial ganglia" (Piggott). Special cable reactions induced galvanic actions for self-powered transmissions across long distances (Hawley). Chains of earth-batteries (Smith). Such process patents are often textbooks on forgotten scientific principles and theoretics (Kitsee). Certain inventors gave textbook descriptions of lost science. Some made distinction between electric, electrical, galvanic, and even magnetic currents (Simpson).

SECTION

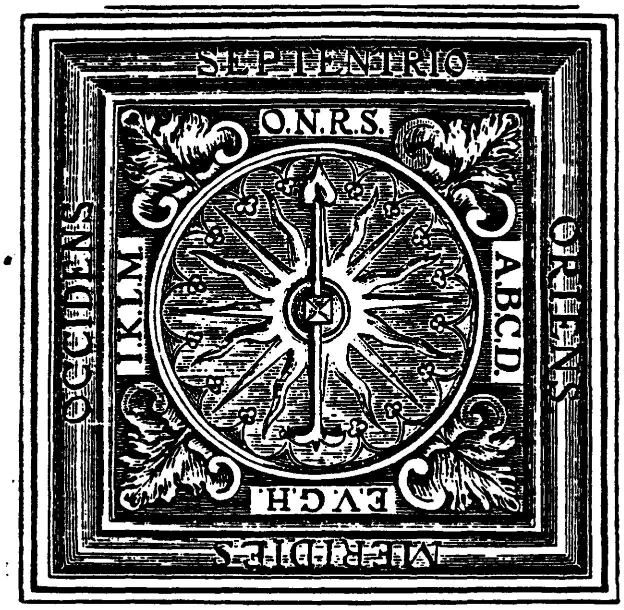
2

VRIL TELEGRAPHY

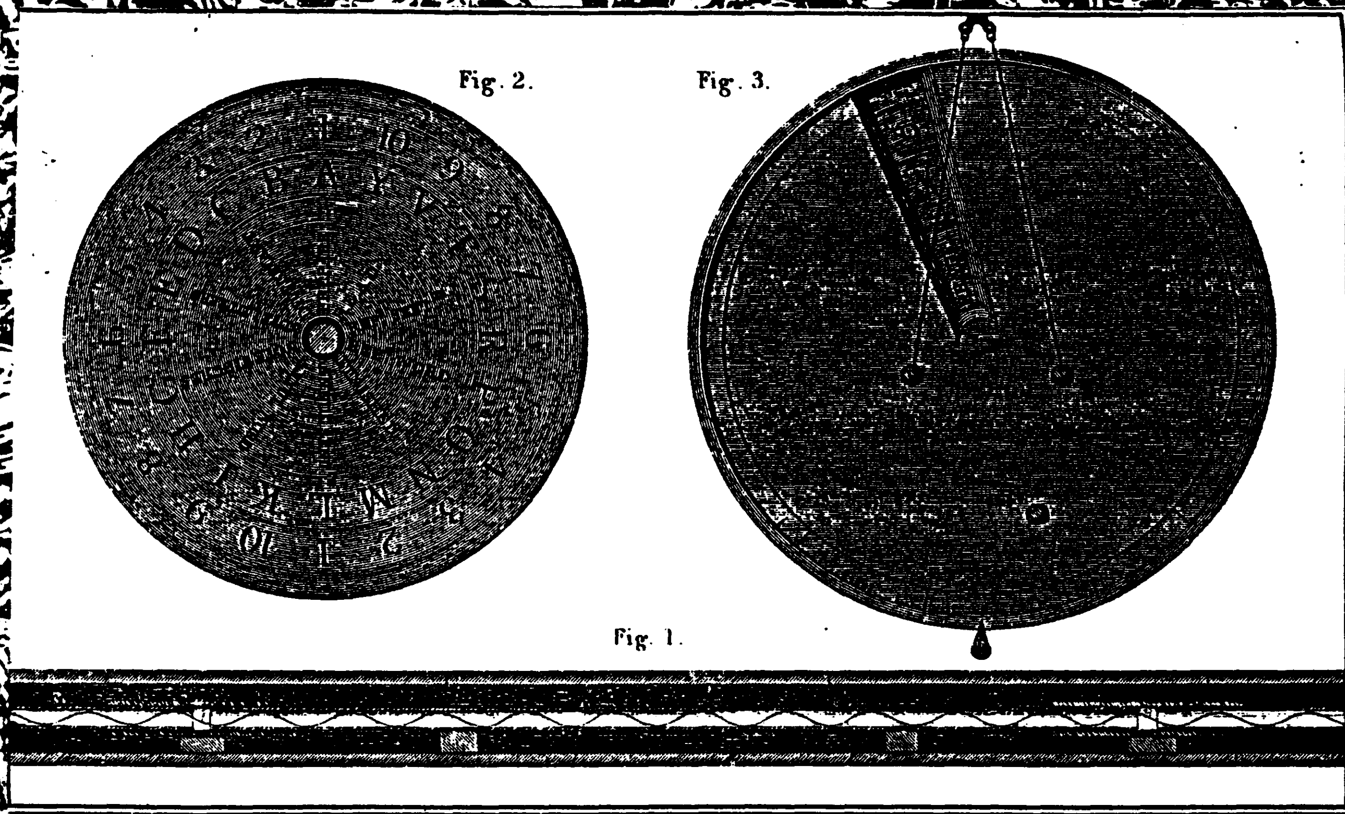
VRIL ARCHEFORMS

VRILLIC CORRESPONDENCE

AND TELEGRAPHY



De Sunde's dial as given in Schott's *Schola Steganographica.*



ÆTHERFORCE

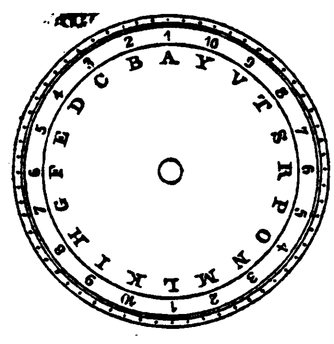
VRIL PENDULUMS AND TELEGRAPHY

Ronald's Electric Telegraph, invented in 1816. *From the Encyclopedia Britannica, 7th edition, page* 662.

"M. Cavællo suggested the idea of conveying intelligence by passing a given number of sparks through an insulated wire in given spaces of time; and some German and American authors have proposed to construct galvanic telegraphs by the decomposition of water. Mr. Ronalds, who has devoted much time to the consideration of this form of the telegraph, proposes to employ common electricity to convey intelligence along insulated and buried wires, and he proved the practicability of such a scheme, by insulating eight miles of wire on his lawn at Hammersmith. In this case the wire was insulated in the air by silk strings. But he also made the trial with 525 feet of buried wire; with this view he dug a trench four feet deep, in which he laid a trough of wood two inches square, well lined within and without with pitch; and within this trough were placed thick glass tubes, through which the wire ran. The junction of the glass tubes was surrounded with shorter and wider tubes of glass, the ends of which were sealed up with soft wax.

"Mr. Ronalds now fixed a circular brass plate, figure 37, upon the second arbour of a clock which beat dead seconds. This plate was divided into twenty equal parts, each division being worked by a figure, a letter, and a preparatory sign. The figures were divided into two series of the units, and the letters were arranged alphabetically, omitting J, Q, U, W, X and Z. In front of this was fixed another brass plate as shown in figure 38, which could be occasionally turned round by the hand, and which had an aperture like that shown in the figure at V, which would just exhibit one of the figures, letters and preparatory signs, for example, 9, *v*, and ready. In front of this plate was suspended a pith ball electrometer, B, C, figure 38, from

FIG. 37.



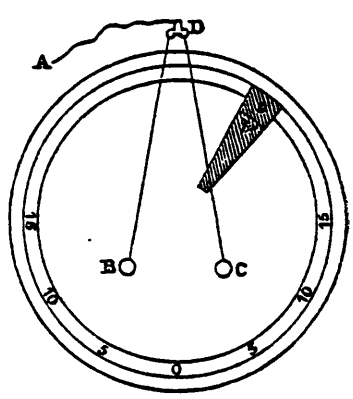


FIG. 38.

a wire D, which was insulated, and which communicated on one side with a glass cylinder machine, and on the other side with the buried wire. At the further end of the buried wire, was an apparatus exactly the same as the one now described, and the clocks were adjusted to as perfect synchronism as possible.

"Hence it is manifest, that when the wire was *charged* by the machine at either end, the electrometers at both ends *diverged*, and when it was discharged, they collapsed, at the same instant. Consequently, if it was discharged at the moment when a given letter, figure, and sign on the lower plate, figure 37, appeared through the aperture, figure 38, the same figure, letter and sign would appear also at the other clock; so that by means of such discharges at one station, and by marking down the letters, figures and signs, seen at the other, any required words could be spelt.

"An electrical pistol was connected with the apparatus, by which a spark might pass through it when the sign *prepare* was made, in order that the explosion might excite the attention of the superintendent, and obviate the necessity of close watching.

"*Preparatory signs.* A, prepare; V, ready; S, repeat sentence; P, repeat word; N, finish; L, annul sentence; I, annul word; G, note figures; E, note letters; C, dictionary."

FORESHADOWING OF THE ELECTRIC TELEGRAPH.

"Whatever draws me on,
Or sympathy, or some connatural force,
Powerful at greatest distance to unite,
With secret amity, things of like kind,
By secretest conveyance."

Milton, *Paradise Lost*, x. 246. 1667.

VRIL CORRESPONDENCE THROUGH MAGNETIC NEEDLES

TRANSACTING MEANING AND MESSAGE DEPITE IMPRESSED INERTIAL SIGNALS

AMONGST the many flights of imagination, by which genius has often anticipated the achievements of her more deliberate and cautious sister, earth-walking reason, none, perhaps, is more striking than the story of the sympathetic needles, which was so prevalent in the sixteenth, seventeenth, and eighteenth centuries, and which so beautifully foreshadowed the invention of the electric telegraph.* This romantic tale had reference to a sort of magnetic telegraph, based on the sympathy which was supposed to exist between needles that had been touched by the same magnet, or loadstone, whereby an intercourse could be maintained between distant friends, since every movement imparted to one needle would immediately induce, by sympathy, similar movements in the other. As a history of telegraphy would be manifestly incomplete without a reference to this fabulous contrivance, we propose to deal with it at some length in the present chapter.

For the first suggestions of the sympathetic needle telegraph we must go back a very long way, probably to the date of the discovery of the magnet's attraction for iron. At any rate, we believe that we have found traces of it in the working of the oracles of pagan Greece and Rome. Thus, we read in Maimbourg's *Histoire de l'Arianisme* (Paris, 1686)* —

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* "In the dream of the Elector Frederick of Saxony, in 1517, the curious reader may like to discern another dim glimmering, a more shadowy foreshadowing, of the electric telegraph, whose hosts of iron and copper 'pens' reach to-day the farthest ends of the earth. In this strange dream Martin Luther appeared writing upon the door of the Palace Chapel at Wittemburg. The pen with which he wrote seemed so long that its feather end reached to Rome, and ran full tilt against the Pope's tiara, which his holiness was at the moment wearing. On seeing the danger, the cardinals and princes of the State ran up to support the tottering crown, and, one after another, tried to break the pen, but tried in vain. It crackled, as if made of iron, and could not be broken. While all were wondering at its strength a loud cry arose, and from the monk's long pen issued a host of others."—*Electricity and the Electric Telegraph*, by Dr. George Wilson, London, 1852, p. 59; or D'Aubigné's *History of the Reformation*, chap. iv. book iii.

* English translation of 1728, by the Rev. W. Webster, chap. vi.

"Whilst Valens [the Roman Emperor] was at Antioch in his third consulship, in the year 370, several pagans of distinction, with the philosophers who were in so great reputation under Julian, not being able to bear that the empire should continue in the hands of the Christians, consulted privately the demons, by the means of conjurations, in order to know the destiny of the emperor, and who should be his successor, persuading themselves that the oracle would name a person who should restore the worship of the gods. For this purpose they made a three-footed stool of laurel in imitation of the tripos at Delphos, upon which having laid a basin of divers metals they placed the twenty-four letters of the alphabet round it; then one of these philosophers, who was a magician, being wrapped up in a large mantle, and his head covered, holding in one hand vervain, and in the other a ring, which hung at the end of a small thread, pronounced some execrable conjurations in order to invoke the devils; at which the three-footed stool turning round, and the ring moving of itself, and turning from one side to the other over the letters, it caused them to fall upon the table, and place themselves near each other, whilst the persons who were present set down the like letters in their table-books, till their answer was delivered in heroic verse, which foretold them that their criminal inquiry would cost them their lives, and that the Furies were waiting for the emperor at Mimas, where he was to die of a horrid kind of death [he was subsequently burnt alive by the Goths]; after which the enchanted ring turning about again over the letters, in order to express the name of him who should succeed the emperor, formed first of all these three characters, TH E O; then having added a D to form THEOD the ring stopped, and was not seen to move any more; at which one of the assistants cried out in a transport of joy, 'We must not doubt any longer of it; Theodorus is the person whom the gods appoint for our emperor.'"

If, as it must be admitted, the *modus operandi* is not here very clear, we can still carry back our subject to the same early date, in citing an experiment on magnetic attractions which was certainly popular in the days of St. Augustine, 354–430.

In his *De Civitate Dei*, which was written about 413, he tells us that, being one day on a visit to a bishop named Severus, he saw him take a magnetic stone and hold it under a silver plate, on which he had thrown a piece of iron, which followed exactly all the movements of the hand in which the loadstone was held. He adds that, at the time of his writing, he had under his eyes a vessel filled with water, placed on a table six inches thick, and containing a needle floating on cork, which he could move from side to side according to the movements of a magnetic stone held under the table.*

Leonardus (Camillus), in his *Speculum Lapidum*,

* Basileæ, 1522, pp. 718–19.

&c., 1502, *verbo* MAGNES, refers to this experiment as one familiar to mariners, and Blasius de Vigenere, in his annotations of Livy, says that a letter might be read through a stone wall three feet thick, by guiding, by means of a loadstone or magnet, the needle of a compass over the letters of the alphabet written in the circumference.*

From such experiments as these the sympathetic telegraph was but a step, involving only the supposition that the same effects might be possible at a greater distance, but when, or by whom, this step was first taken it is now difficult to say. It has been traced back to Baptista Porta, the celebrated Neapolitan philosopher, and in all probability originated with him; for in the same book in which he announces the conceit he describes the above experiment of St. Augustine, and other "wonders of the magnet"; adding that the impostors of his time abused by these means the credulity of the people, by arranging around a basin of water, on which a magnet floated, certain words to serve as answers to the questions which superstitious persons might put to them on the future.† He then concludes the 21st chapter with the following words, which, so far as yet discovered, contain the first clear enunciation of the sympathetic needle telegraph: —"Lastly, owing to the convenience afforded by the magnet, persons can converse together through long distances."* In the edition of 1589 he is even more explicit, and says in the preface to the seventh book: "I do not fear that with a long absent friend, even though he be confined by prison walls, we can communicate what we wish by means of two compass needles circumscribed with an alphabet."

The next person who mentions this curious notion was Daniel Schwenter, who wrote under the assumed name of Johannes Hercules de Sunde. In his *Steganologia et Steganographia*, published at Nürnberg in 1600, he says, p. 127:—"Inasmuch as this is a wonderful secret I have hitherto hesitated about divulging it, and for this reason disguised my remarks in the first edition of my book so as only to be under-

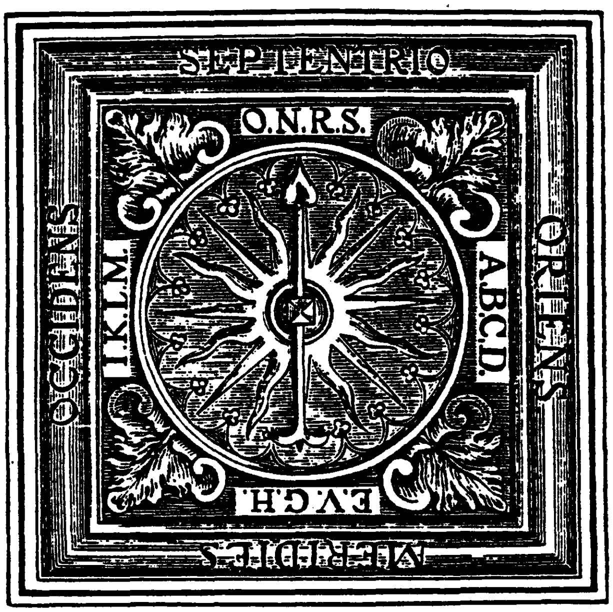
* *Les Cinq Premiers Livres de Tite Live*, Paris, 1576, vol. i. col. 1316.

† While it is generally admitted that magnetism has conferred incalculable benefits on mankind (witness only the mariner's compass), we have never yet seen it stated that it has at the same time contributed more to our bamboozlement than any other, we might almost say all, of the physical sciences. With the charlatans in all ages and nations, its mysterious powers have ever been fruitful sources of imposture, sometimes harmless, sometimes not. Thus, from the iron crook of the Greek shepherd Magnes, and the magnetic mountains of the geographer Ptolemy, to the magnetic trains of early railway enthusiasts; from the magnetically protected coffin of Confucius to the magnetically suspended one of Mahomed; from the magnetic powders and potions of the ancients, and the metal discs, rods, and unguents of the old magnetisers, to the magnetic belts of the new—the modern panacea for all the ills that flesh is heir to; from the magnetic telegraphs of the sixteenth century to the Gary and Hosmer perpetual motors of the nineteenth, *et hoc genus omne*

* *Magiæ Naturalis*, p. 88, Naples, 1558.

stood by learned chemists and physicians. I will now, however, communicate it for the benefit of the lovers of science generally." He then goes on to describe, in true cabalistic fashion, the preparation of

Fig. 1.



De Sunde's dial as given in Schott's *Schola Steganographica.*

the two compasses, the needles of which were to be made diamond-shaped from the same piece of steel and magnetised by the same magnet, or rather, magnets, for there were four: 1, Almagrito; 2, Theamedes; 3, Almaslargont; 4, Calamitro; which imparted south, north, east, and west-turning properties respectively to the needles. The compass-cards were divided off into compartments, each containing four letters of the alphabet, and each letter was indicated by the needle pointing, from one to four times, to the division in which it stood. Thus, the letter C would be indicated by three movements of the needle to the first division of the card. The needles were actuated by bar magnets, or chadids, and attention was called by the ringing of a tiny bell, which was so placed in the way of the needle that at each deflection of the latter it was struck, and so continued to ring until removed by the correspondent.

The next and most widely known relation of the story occurs in the *Prolusiones Academicæ*,* of Famianus Strada, a learned Italian Jesuit, first published at Rome in 1617, and often reprinted since. Although the idea did not originate with Strada (for he seems to attribute it to Cardinal Bembo, who died about 1547), he was certainly, as Sir Thomas Browne quaintly says, "The *æolus* that blew it about," for his *Prolusiones* had long been a favourite classic, while the passage referring to the loadstone has, if we may say so, been continually going the rounds of the newspapers. It is quoted more or less fully in many authors of the seventeenth and eighteenth centuries, famous

* Lib. ii., prol. 6.

amongst whom are Hakewill,* Addison,† Akenside,‡ and "Misographos." §

The references to it in the present century are simply too numerous to mention. The following is the latest English version, which, with the original Latin, appeared in the *Telegraphic Journal*, for November 15, 1875 :—

"There is a wonderful kind of magnetic stone to which if you bring in contact several bodies of iron or dial-pins, from thence they will not only derive a force and motion by which they will always try to turn themselves to the bear which shines near the pole, but, also, by a strange method and fashion between each other, as many dial-pins as have touched that stone, you will see them all agree in the same position and motion, so that if, by chance, one of these be observed at Rome, another, although it may be removed a long way off, turns itself in the same direction by a secret law of its nature. Therefore try the experiment, if you desire a friend who is at a distance to know anything to whom no letter could get, take a flat smooth disc, describe round the outside edges of the disc stops, and the first letters of the alphabet, in the order in which boys learn them, and place in the centre, lying horizontally, a dial-pin that has touched the magnet, so that, turned easily from thence, it can touch each separate letter that you desire.

"After the pattern of this one, construct another disc, described with a similar margin, and furnished with a pointer of iron—of iron that has received a motion from the same magnet. Let your friend about to depart carry this disc with him, and let it be agreed beforehand at what time, or on what days, he shall observe whether the dial-pin trembles, or what it marks with the indicator. These things being thus arranged, if you desire to address your friend secretly, whom a part of the earth separates far from you, bring your hand to the disc, take hold of the movable iron, here you observe the letters arranged round the whole margin, with stops of which there is need for words, hither direct the iron, and touch with the point the separate letters, now this one, and now the other, whilst, by turning the iron round again and again throughout these, you may distinctly express all the sentiments of your mind.

"Strange, but true! the friend who is far distant sees the movable iron tremble without the touch of any one, and to traverse, now in one, now in another direction; he stands attentive, and observes the leading of the iron, and follows, by collecting the letters from each direction, with which, being formed into words, he perceives what may be intended, and learns from the iron as his interpreter. Moreover, when he sees the dial-pin stop, he, in his turn, if he thinks

* *An Apologie or Declaration of the Power and Providence of God in the Government of the World*, 1630.

† *Spectator*, No. 241, 1711, and *Guardian*, No. 119, 1713.

‡ *The Pleasures of Imagination*, 1744.

§ *The Student; or, the Oxford and Cambridge Miscellany*, 1750.

of any things to answer, in the same manner by the letters being touched separately writes back to his friend.

"Oh, I wish this mode of writing may become in use, a letter would travel safer and quicker, fearing no plots of robbers and retarding rivers. The prince, with his own hands, might despatch business for himself. We, the race of scribes, escaped from an inky sea, would dedicate the pen to the Shores of Magnet."

The Starry Galileo had his say on the same subject, and, as we may expect, said it well: "You remind me," says he, "of one who offered to sell me a secret art, by which, through the attraction of a certain magnetic needle, it would be possible to converse across a space of two or three thousand miles. And I said to him that I would willingly become the purchaser, provided only that I might first make a trial of the art, and that it would be sufficient for the purpose if I were to place myself in one corner of the room and he in the other. He replied that, in so short a distance the action would be scarcely discernible; whereupon I dismissed the fellow, saying that it was not convenient for me just then to travel into Egypt, or Muscovy, for the purpose of trying the experiment, but that if he chose to go there himself, I would remain in Venice and attend to the rest."*

* *Dialogus de Systemate Mundi*, 1632, p. 88. It is curious that Kepler appears to have believed in the efficacy of the sympathetic telegraph. See Fournier's *Le Vieux-Neuf*, Paris, 1857, vol. i. p. 200.

Cardinal Richelieu's system of espionage was so perfect that he was regarded (and feared) by his contemporaries as a dabbler in "diabolical magic." He was supposed to have possessed either a magic mirror, in which he could see all that went on in the world, or the equally magic magnetic telegraph. *À propos* of this, we find the following passage in the *Letters writ by a Turkish Spy*, a work which has been attributed by the elder Disraeli to John Paul Marana:—"This Cardinal said, on another time, that he kept a great many courtiers, yet he could well enough spare them; that he knew what passed in remote places as soon as what was done near him. He once affirmed he knew in less than two hours that the King of England had signed the warrant for the execution of ——. If this particular be true, this minister must be more than a man. Those who are his most devoted creatures affirm he has in a private place in his closet a certain mathematical figure, in the circumference of which are written all the letters of the alphabet, armed with a dart, which marks the letters, which are also marked by their correspondents; and it appears that this dart ripens by the sympathy of a stone, which those who give and receive his advice keep always at hand, which hath been separated from another which the Cardinal has always by him; and it is affirmed that with such an instrument he gives and receives immediately advices."*

The learned physician, Sir Thomas Browne, has

* Thirteenth letter, dated Paris 1639, vol. i.

some cautiously worded sentences on the mythical telegraph, which are worth quoting. "There is," he says, "another conceit of better notice, and whispered thorow the world with some attention; credulous and vulgar auditors readily believing it, and more judicious and distinctive heads not altogether rejecting it. The conceit is excellent, and, if the effect would follow somewhat divine; whereby we might communicate like spirits, and confer on earth with Menippus in the moon. And this is pretended from the sympathy of two needles, touched with the same loadstone, and placed in the center of two abecedary circles, or rings, with letters described round about them, one friend keeping one, and another the other, and agreeing upon an hour wherein they will communicate. For then, saith tradition, at what distance of place soever, when one needle shall be removed unto any letter, the other by a wonderful sympathy, will move unto the same. But herein I confess my experience can find no truth, for having expressly framed two circles of wood, and, according to the number of the Latine letters, divided each into twenty-three parts, placing therein two stiles, or needles, composed of the same steel, touched with the same loadstone and at the same point. Of these two, whenever I removed the one, although but at the distance of but half a span, the other would stand like Hercules pillars, and, if the earth stand still, have surely no motion at all." *

* *Pseudodoxia Epidemica*, book ii. chap. 3.

The *Scepsis Scientifica* of Joseph Glanvill, published in 1665, and which, by the way, secured his admission to the Royal Society, contains, perhaps, the most remarkable allusion to the then prevalent telegraphic fancy. Glanvill, albeit very superstitious, was an ardent and keen-sighted philosopher, and held the most hopeful views as to the discoveries that would be made in after-times. In the following passages he clearly foretells, amongst other wonders, the discovery and extension of telegraphs :—

"Should those heroes go on as they have happily begun, they'll fill the world with wonders. And I doubt not but posterity will find many things that are now but rumours verified into practical realities. It may be, some ages hence, a voyage to the southern unknown tracts, yea, possibly the moon, will not be more strange than one to America. To them that come after us it may be as ordinary to buy a pair of wings to fly into the remotest regions as now a pair of boots to ride a journey. *And to confer at the distance of the Indies by sympathetic conveyances may be as usual to future times as to us in a literary correspondence.*"—C. xix.

"That men should confer at very distant removes by an extemporary intercourse is a reputed impossibility, yet there are some hints in natural operations that give us probability that 'tis feasible, and may be compast without unwarrantable assistance from dæmoniack correspondence. That a couple of needles equally toucht by the same magnet being set in two dyals exactly proportion'd to each other, and circumscribed by the letters of the alphabet, may affect this magnale hath considerable authorities to avouch it. The manner of it is thus represented. Let the friends that would communicate take each a dyal; and having appointed a time for their sympathetic conference, let one move his impregnate needle to any letter in the alphabet, and its affected fellow will precisely respect the same. So that would I know what my friend would acquaint me with, 'tis but observing the letters that are pointed at by my needle, and in their order transcribing them from their sympathised index as its motion directs: and I may be assured that my friend described the same with his, and that the words on my paper are of his inditing.

"Now, though there will be some ill contrivance in a circumstance of this invention, in that the thus impregnate needles will not move to, but avert from each other (as ingenious Dr. Browne in his *Pseudodoxia Epidemica* hath observed), yet this cannot prejudice the main design of this way of secret conveyance, since 'tis but reading counter to the magnetic informer, and noting the letter which is most distant in the abecedarian circle from that which the needle turns to, and the case is not alter'd. Now, though this desirable effect possibly may not yet answer the expectation of inquisitive experiment, *yet 'tis no despicable item, that by some other such way of magnetick efficiency*

it may hereafter with success be attempted, when magical history shall be enlarged by riper inspections, and 'tis not unlikely but that present discoveries might be improved to the performance."—C. xxi.

At the end of this chapter we give a list of references, as complete as we could make it, which will be useful to those of our readers who may wish to pursue the subject. It will also be instructive from another point of view, for it illustrates, in a very complete way, what Professor Tyndall has so well called the "menial spirit" of the old philosophers.* Notwithstanding that some of the more enlightened authors endeavoured laboriously to disprove the story, it was, for the most part, blindly and unquestioningly repeated, by one writer after another—credulous and vulgar auditors, as Sir Thomas Browne says, readily believing it, and more judicious and distinctive heads not altogether rejecting it, amongst whom we are tempted to reckon the learned knight himself.

Of those who stoutly and, at an early period, combatted the story, Fathers Cabeus and Kircher deserve

* "The seekers after natural knowledge had forsaken that fountain of living waters, the direct appeal to nature by observation and experiment, and had given themselves up to the remanipulation of the notions of their predecessors. It was a time when thought had become abject, and when the acceptance of mere authority led, as it always does in science, to intellectual death. Natural events, instead of being traced to physical, were referred to moral causes; while an exercise of the phantasy, almost as degrading as the spiritualism of the present day, took the place of scientific speculation."—Tyndall's *Address to the British Association at Belfast*, 1874.

to be mentioned—the one for the excellence, and the other for the vehemence of his observations. Those of the former are particularly remarkable, as containing a hazy definition of the "lines of force" theory —a theory which Faraday has turned to such good account in his *Experimental Researches*. Cabeus, as well as we can understand him, says, in his tenth chapter :—"The action by which compass needles are mutually disturbed is not brought about by sympathy, as some persons imagine, who consider sympathy to be a certain agreement, or conformity, between natures or bodies which may be established without any communication. Magnetic attractions and repulsions are physical actions which take place through the instrumentality of a certain quality, or condition, of the intervening space, and which [quality] extends from the influencing body to the influenced body. I cannot admit any other mode of action in magnetic phenomena ; nor have I ever seen in the whole circle of the sciences any instance of sympathy or antipathy [at a distance]. * * *

"That which is diffused as a medium [or, that quality, or condition, of the intervening space] is thin and subtle, and can only be seen in its effects ; nor does it affect *all* bodies, only such as are either conformable with the influencing body, in which case the result is a perfecting change [or sympathy = attraction], or non-conformable, in which case the result is a corrupting change [or antipathy = repulsion]. This quality is, I repeat, thin and subtle, and does not sensibly affect *all* intermediate [*i. e.*, neighbouring] bodies, although it may be disseminated through them. It only shows a sensibly good or bad effect according to the natures of the bodies opposed to one another.

"Bodies, therefore, are not moved by sympathy or antipathy, unless it be, as I have said, through the medium of certain essences [forces] which are uniformly diffused. When these reach a body that is suitable, they produce certain changes in it, but do not affect, sensibly, the intervening space, or neighbouring non-kindred bodies. Thus, the sense of smell is not perceived in the hand, nor the sense of hearing in the elbow, because, although these parts are equally immersed in the essences [or forces], they are not suitable, or kindred, in their natures to the odoriferous, or acoustic, vibrations." *

Kircher scouts the notion in no measured terms ; after soundly rating the propagators of the fable on their invention of the terms *chadid*, *almagrito*, *theamedes*, *almaslargont*, and *calamitro*—vile jargon, which, he says, was coined in the devil's kitchen—he thus delivers himself :—"I do not recollect to have ever

* *Philosophia Magnetica*, &c., chap. x. *A brief letter from a young Oxonian to one of his late fellow pupils upon the subject of Magnetism*, London, 1697, contains, at page 10, a "draught" which illustrates very well the arrangement of magnetic lines of force, and which differs but little from the graphic representations of the present day. The curious little pamphlet is one of many gems in Mr. Latimer Clark's library.

met anything more stupid and silly than this idiotic conception, in the enunciation of which I find as many lies and impositions as there are words, and a crass ignorance of magnetic phenomena withal. In their craving after something wonderful and unknown they have manufactured a secret by means of barbarous and high-sounding words and by imitating the forms of recondite science, with the result that even they themselves cannot understand their own words." *

Many of the authors, who describe the sympathetic needle (dial) telegraph, speak also of another form, which seems to have been especially believed in by the Rosicrusians and Magnetisers of the last two centuries. It was supposed that a sympathetic alphabet could be marked on the flesh, by means of which people could correspond with each other, and communicate all their ideas with the rapidity of volition, no matter how far asunder. From the arms, or hands, of two persons intending to employ this method of correspondence a piece of flesh was cut, and mutually transplanted while still warm and bleeding. The piece grew to the new arm, but still retained so close a sympathy with its native limb, that the latter was always sensible of any injury done to it. Upon these transplanted pieces of flesh were tattooed the letters of the alphabet, and whenever a communication was to be made it was only necessary to prick with a magnetic needle the letters upon the arm composing

* *Magnes, sive de Arte Magnetica*, book ii. part iv. chap. 5.

the message; for whatever letter the one pricked, the same was instantly pained on the arm of the other.*

List of authors of the sixteenth, seventeenth, and eighteenth, centuries, who either describe the sympathetic needle and sympathetic flesh telegraphs, or make a passing allusion to one or both of them; chiefly compiled from Mr. Latimer Clark's list of books shown at the Paris Electrical Exhibition of 1881, and from the catalogues of the British Museum. As far as possible, only first editions quoted in full:—

1558 PORTA (GIAN B.). *Magiæ Naturalis, &c. Libri IIII.* 8vo. (See page 90. Other editions: Antwerp, 1561, 8vo.; Lugduni, 1561, 16mo.; Venetia, 1560, 8vo.; and 1665, 12mo.; Coloniæ, 1562, 12mo.) Neapoli, 1558.

1570 PARACELSUS (*i.e.*, Bombast Von Hohenheim). *De Secretis naturæ mysteriis*, &c. 8vo. (Speaks only of sympathetic flesh telegraph. Numerous editions in British Museum.) Basileæ, 1570.

1586 VIGENERE (BLAISE DE). *Traicté des Chiffres, ou Secretes Manieres d'Escrire.* (Quoted in *L'Électricien* of Jan. 15, 1884, p. 95.) Paris, 1586.

1589 PORTA (GIAN B.). *Magiæ Naturalis, &c. Libri XX.* Folio. (See preface to Book VII. for first clear mention of sympathetic needle telegraph. Other editions: Francofurti, 1607, 8vo.; Napoli, 1611,

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* Upon this delusion is founded Edmund About's curious novel, *Le Nez d'un Notaire*, in which he relates the odd results of sympathy between the notary's nose and the arm of the man from whom the flesh was taken. But it is not in novels only, that we read of instances of the marvellous power of sympathy in these enlightened days; witness the story of *The Sympathetic Snail Telegraph* of Messrs. Biat and Benoit, which went the rounds of the newspapers forty years ago, and which the curious—we were going to say sympathetic—reader will find fully described in *Chambers's Edinburgh Journal*, for February 15, 1851.

4to.; Hanoviæ, 1619, 8vo.; Lugduni, 1644 and 1651, 12mo.; London, 1658, 4to.; and Amstelodami, 1664, 12mo.) Neapoli, 1589.

1599 PANCIROLLUS (G.). *Rerum Memorabilium*, &c. 8vo. (See Book II. [Nova Reperta], chap. xi., Notes. This author refers to Scaliger [*Exotericarum exercitationem*, &c., exercit. 131], and Bodin [*Methodus ad facilem Historiarum*, &c., chap. vii.], but they only speak of magnetic sympathy at great distances, without any reference to telegraphy. Other editions: two 8vo., Ambergæ, 1607 and 1612; four Francofurti, 1622, 1629–31, 1646, and 1660; Lyon, 1617; and London, 1715.) Ambergæ, 1599.

1600 DE SUNDE (J. H.) (*i. e.*, Daniel Schwenter). *Steganologia et Steganographia*. 8vo. (See p. 127. Janus Hercules de Sunde is an assumed name. Hiller in the preface to his *Mysterum Artis Steganographicæ* 1682, says that it is a synonym for Daniel Schwenter Noribergense; and again on p. 287, quoting Schwenter, he adds in parenthesis, "is est Hercules de Sunde." Other edition: Nürnberg, 1650, 12mo.) Nürnberg, 1600.

1609 DE BOODT (ANSELMUS B.). *Gemmarum et Lapidum Historia*, &c. 4to. (See Book II. Other editions: Lugduni, 1636, 8vo.; Lyon, 1644, 8vo.; and again Lugduni, 1647, 8vo.) Hanoviæ, 1609.

1610 ARGOLUS (ANDREAS). *Epistola ad Davidem Fabricium Frisium*. (He made what he calls a "Stenographic Compass," and held many agreeable conversations by its means with one of his friends.) In Ephemeridæ Patavii, 1610.

1610 ARLENSIS (PETRUS), of Scudalupis. *Sympathia Septem Metallorum*, &c. 8vo. (See chap. 2. This writer, a noted astrologer and alchemist, was the friend and fellow-citizen of Porta, to whom he seems to attribute the first conception of the sympathetic needle telegraph. His *Sympathia* was first published at Rome, but immediately suppressed in order that its grand secrets might not become known. It next appeared at Madrid in folio. The Paris ed. of 1610 was reissued at Hamburg in 1717.) Parisiis, 1610.

1617 STRADA (FAMIANUS). *Prolusiones Academicæ*, &c. 8vo. (See Lib. II., Prol. VI. Other editions: Lugduni, 1617, and 1627, sm. 8vo.; Audomari, 1619, 12mo.; Mediolani, 1626, 16mo.; Oxoniæ, 1631, 8vo.; and again Oxoniæ, 1745, 8vo.) Romæ, 1617.

1624 VAN ETTEN (H.), (*i. e.*, Leurechon Jean). *La Récréation Mathématique*, &c. 8vo. (See p. 94. This author is the first to give a drawing of the dial. H. Van Etten was a *nom de plume*. See *Notes and Queries*, 1st series, vol. xi. p. 516. Other editions: Paris, 1626; Lyon, 1627; and three London, 1633, 1653, and 1674. To the two latter is added a work of Oughtred, the editor, whose name is so conspicuous on the title-page, that rapid cataloguers make him the author. Ozanam founded his *Recreations* on Van Etten; Montucla made a new book of Ozanam by large additions; and Hutton did the same by Montucla, so that Hutton's well-known work is at the end of a chain, of which Van Etten's is at the beginning. *Notes and Queries*, 1st series, vol. xi. p. 504.) Pont-à-Mousson, 1624.

1629 CABEUS (NICOLAS). *Philosophia Magnetica*, &c. Folio. (See p. 302.) Coloniæ, 1629.

1630 HAKEWILL (GEORGE). *An Apologie or Declaration of the Power and Providence of God*, &c. Folio. (See p. 285. This is second edition; a first appeared in [?] 1627, and a third in 1635. London and Oxford, 1630.

1630 MYDORGE (CLAUDE). *Examen du livre des Récréations Mathématiques*, &c. 12mo. (See Problem 74, pp. 140–44. This is a critically revised edition of Van Etten. Another edition, Paris, 1638.) Paris, 1630.

1631 KIRCHER (ATHANASIUS). *Ars Magnesia*, &c. 4to. (See pp. 35 and 36.) Herbipoli, 1631.

1632 GALILEO (G.). *Dialogus de Systemate Mundi*, &c. 4to. (See p. 88. Editions innumerable in British Museum catalogue.) Fiorenza, 1632.

1636 SCHWENTER (DANIEL). *Deliciæ Physico-Mathematicæ*. (See p. 346. This work is based on Van Etten's, *supra*. Two other 4to. editions appeared at Nürnberg, 1651–3 and 1677.) Nürnberg, 1636.

1638 FLUDD (ROBERT). *Philosophia Moysaica*, &c. Folio. (See Sec. II., Lib. II., Memb. II., Cap. V., and Sec. II., Lib. III., *passim*. An edition in English appeared in London, 1659.) Goudæ, 1638.

1663 HELVETIUS (J. F.). *Theatridium Herculis Triumphantis*, &c. 8vo. (See pp. 11 and 15.) Haye, 1663.

1665 GLANVILL (JOSEPH). *Scepsis Scientifica; or, Confest Ignorance the Way to Science*, &c. 4to. (See p. 150.) London, 1665.

1665 SCHOTT (GASPAR). *Schola Stegnnographica*, &c. 4to. (See pp. 258-64. Description from De Sunde's, *supra*, with an elaborate drawing of the dial. Copperplate title-page bears date 1665, printed title-page dated 1680.) Norimbergæ, 1665.

1676 HEIDEL (W. E.). *Johannis Trithemii, &c., Steganographia que Hucusqu: a nemine intellecta*, &c. 4to. (See p. 358.) Moguntiæ, 1676.

1679 MAXWELL (WILLIAM). *De Medicina Magnetica, &c. Lib. III.* 12mo. (See chaps. 11, 12, and 13.) Francofurti, 1679.

1684 DE LANIS (FRANCISCUS). *Magisterium Naturæ et Artis, Opus Physico-Mathematicum.* 3 vols. (See vol. iii. p. 412.) Brixiæ, 1684–96.

1684 MARANA (G. P.) (or The Turkish Spy). *L'Espion du Grand Seigneur*, &c. 12mo. (See vol. i., 13th letter, dated Paris, 1639. Six other editions in British Museum.) ? Paris, 1684, &c.

1689 BLAGRAVE (JOSEPH). *Astrological Practice of Physick*, &c. 12mo. (See p. 112.) London, 1689.

1689 DE RENNEFORT (SOUCHU). *L'Aiman Mystique.* 12mo. Paris, 1689.

1696 DE VALLEMONT (PIERRE LE LORRAIN). *La Physique Occulte, ou traité de la Baguette Divinatoire*, &c. 12mo. (See p. 32 of Appendix. Other editions: Paris and Amsterdam, 1693, 12mo.; and Amsterdam, 1696, 12mo.) Paris, 1696.

1701–2 LE BRUN (PIERRE). *Histoire Critique des Pratiques Superstitieuses.* 2 vols. 12mo. (See vol. i. p. 294. Other editions: Amsterdam, 1733–36; and Paris, 1750–1.) Rouen, 1701–2.

1711–13 ADDISON (JOSEPH). *The Spectator*, No. 241, for 1711. (See p. 206. See also *The Guardian*, No. 119, for 1713.) London, 1711–13.

1718 DU PETIT ALBERT. *Secrets Merveilleux de la Magie Naturelle et Cabalistique.* (See p. 228. Other editions: Lyon, 1743 and 1762; and Paris, 1815.) Lyon, 1718.

1641 KIRCHER (ATHANASIUS). *Magnes, sive de Arte Magnetica.* Sm. 4to. (See p. 382. Other editions: Coloniæ, 1643, 4to.; and Romæ, 1654, folio.) Romæ, 1641.

1641 WILKINS (JOHN). *Mercury, or the secret and swift messenger, showing how a man with privacy and speed may communicate his thoughts to a friend at any distance.* 12mo. (See p. 147. Another edition in 1694.) London, 1641.

1643 SERVIUS (PETRUS). *Dissertatio de Unguento Armario, Sive De Naturæ Artisque Miraculis.* (See para. 65, p. 68. This work is printed in Rattray's *Theatrum*, &c., *infra.*) Romæ, 1643.

1646 BROWNE (SIR THOMAS). *Pseudodoxia Epidemica, or Enquiries into very many received tenents, and commonly presumed truths.* 4to. (See p. 76. Numerous editions in the British Museum.) London, 1646.

1657 TURNER (ROBT.). *Ars Notoria. The Notary Art of Solomon, showing the cabalistical key of magical operations*, &c. 18mo. (See p. 136.) London, 1657.

1657–9 SCHOTT (GASPAR). *Magia Universalis Naturæ et Artis*, &c. 4 vols. 4to. (See vol. iv. p. 49. Copied from De Sunde and Kircher. Other edition: Bambergæ, 1677, 4to.) Herbipoli, 1657–9.

1661 HENRION (DENIS) and MYDORGE (CLAUDE). *Les Récréations Mathématiques, avec l'examen de ses problèmes*, &c. Premièrement reveu par D. Henrion, depuis par M. Mydorge, Cinquième et dernière ed. 12mo. (See Problem 74, pp. 158–61. This is only a revised edition of Mydorge's *Van Etten*, of 1630.) Paris, 1661.

1661 GLANVILL (J.). *The Vanity of Dogmatising, and an Apology for Philosophy.* 8vo. (See p. 202.) London, 1661.

1662 WESTEN (WYNANT VAN). *Het eerste Deel van de Mathematische Vermaeck*, &c. 8vo. Three parts. (See p. 125, Part I. This is an enlarged Dutch edition of Van Etten's, *supra.*) Arnhem, 1662.

1662 RATTRAY (SYLVESTER). *Theatrum Sympatheticum Auctum, exhibens Varios Authores de Pulvere Sympathetico*, &c. 4to. (See p. 546, see Petrus Servius, *supra.*) Norimbergæ, 1662.

1723 SANTANELLI (F.). *Philosophiæ Reconditæ, sive Magicæ Magneticæ*, &c. 4to. (See chap. xiv.) Coloniæ, 1723.

1730 BAILEY (NATHAN). *Dictionarium Britannicum*, &c. Folio. See word "Loadstone." Another London edition of 1736.) London, 1730.

1744 AKENSIDE (MARK). *The Pleasures of Imagination.* (See Book III., verses 325–37.) London, 1744.

1750–1 "MISOGRAPHOS." *The Student; or, the Oxford and Cambridge Monthly Miscellany.* 2 vols. (See vol. i. p. 354. A translation of Strada's verses.) Oxford, 1750–1.

1762 DIDEROT. *Memoirs. Correspondance et ouvrages inédits de Diderot.* (See p. 278. Diderot, in his letter to Madame Volland of 28th July, 1762, alludes to Comus [Ledru] and his supposed telegraph.) Paris, 1841.

1769 GUYOT. *Nouvelles Récréations Physiques et Mathématiques.* 4 vols. 8vo. (See vol. i. p. 17. At p. 134 there is a full description, with illustrations, of what was probably Comus's apparatus. Two other Paris editions of 1786 and 1799.) Paris, 1769.

1788 BARTHÉLEMY (JEAN JACQUES). *Voyage du Jeune Anacharsis en Grèce*, &c. 4to. (Quoted in *Journal of the Society of Arts*, May 20, 1859, p. 472: twelve other editions (of which three are English translations) in the British Museum. See also *Correspondance Inédite du Madame du Deffand*, vol. ii. p. 99.) Paris, 1788.

1795 EDGEWORTH (RICHARD LOVELL). *Essay on the Art of Conveying Secret and Swift Intelligence.* Published in the *Transactions of the Royal Irish Academy.* (See vol. vi. p. 125.) Dublin, 1797.

1797 GAMBLE (J.). *An Essay on the Different Modes of Communication by Signals*, &c. 4to. (See p. 57.) London, 1797.

The Electric Telegraph had, properly speaking, no inventor. It grew little by little, each inventor adding his little to advance it towards perfection.

About 1617, Famianus Strada of Rome claimed to have signalled without wires by means of two sympathetic compasses.

Sparks of electricity were sent through wire in 1729 and 1730.

About 1750, Mechanical Electricity was first suggested.

1753, it was proposed to send signals through insulated wires on poles.

1774, Lesage used 24 insulated wires and claimed to have contemplated for thirty years corresponding by electricity.

1787, Lomond used a single brass wire of some length.

1791, Samuel F. B. Morse was born.

1794, Rieser used 36 wires.

1795, Cavello used a Leyden jar and about 200 feet of copper wire.

1798, Salva successfully signalled 26 miles.

1807, Alfred Vail was born.

1808, Chemical Electricity used for signalling by Von Soemmering of Munich.

1812, Schilling exploded powder mines by electricity across the river Neva near St. Petersburg.

1816, Ronalds signalled through 8 miles of wire and his principle was successfully used by Wheatstone, 1839, by House, 1846, and by Hughes in 1850, and in same year (1816) Dr. Coxe of Philadelphia suggested communication by electricity.

1820, Oersted also suggested the same means of communication, and Ampere discovered galvanic magnetism.

1823, Baron Schilling signalled by electricity.

1824, Peter Barlow signalled with a Sturgeon's magnet and the Edinburg Philosophical Journal for January, 1825, published his conclusions as follows:

"The details of this contrivance are so obvious and the principle on which it was founded so *well understood* that there was only one question which could render the result doubtful, and this was 'is there any diminution of effect by lengthening the wire'? Two hundred feet of wire so reduced the effect that he gave it up."

In 1828, Dyer, an American, strung wires on poles, with glass insulators.

1828 to 1831, Prof. Joseph Henry sent electric signals at Albany, N. Y.

VRIL INFLUENCES AND PENDULUMS USED AS TELEGRAPHY

"But it is time to tell you briefly in what my plan consisted. One can imagine a subterranean tube, of glazed earthenware, the inside of which is divided, at every fathom's length, by diaphragms, or partitions, of glazed earthenware, or of glass, pierced by twenty-four holes, so as to give passage to as many brass wires, which could in this way be supported and kept apart. At each of the extremities of this tube, the twenty-four wires are arranged horizontally, like the keys of a harpsichord, each wire having suspended above it a letter of the alphabet, while immediately underneath, on a table, are pieces of gold leaf, or other bodies that can be as easily attracted, and are, at the same time, easily visible.

"He, who wishes to signal anything, shall touch the ends of the wires with an excited glass tube, according to the order of the letters composing the words; while his correspondent writes down the characters under which he sees the little gold leaves play. The other details are easily supplied."

Le Sage had an idea of offering his invention to Frederick the Great, and drew up an introductory note as follows:—

"To the King of Prussia.

"Sire,—My little fortune is not only sufficient for all my wants, but even for all my tastes—except one, *viz.*, that of contributing to the wants and tastes of others; and this desire all the monarchs of the world, united, could not enable me to fully satisfy. It is not, then, to a patron who can give much, that I take the liberty of dedicating the following discovery, but to a patron who can do much with it, and who can judge for himself of its utility without having to refer it to his advisers." *

Whether he ever carried out this idea or not is difficult to say, but it is certain that his plan was never practically tried, and, like so many of its class, was soon forgotten.

1787.—*Lomond's Telegraph.*

The next plan that we have to notice was a decided improvement, and had an actual existence, though on a very small scale. Seeing, no doubt, the difficulty and expense of using many wires, Lomond of Paris reduced, at one sweep, the number to one, and thus produced a really serviceable telegraph. 'Arthur Young, the diligent writer on natural and industrial resources, saw this apparatus in action during his first visit to Paris, and thus describes it in his journal, under date October 16, 1787:—

* See *Notice de la vie et des écrits de George-Louis Le Sage de Genève*, &c., par Pierre Prévost, 8vo., Genève, 1805, pp. 176–7. All writers on the Electric Telegraph, copying Moigno (*Traité de Télégraphie Électrique*, Paris, 1849 and 1852), say that Le Sage actually established his telegraph at Geneva in 1774—an assertion for which we have not been able to find any authority.

"In the evening to M. Lomond, a very ingenious and inventive mechanic, who has made an improvement of the jenny for spinning cotton; common machines are said to make too hard a thread for certain fabrics, but this forms it loose and spongy. In electricity he has made a remarkable discovery. You write two or three words on a paper; he takes it with him into a room and turns a machine enclosed in a cylindrical case, at the top of which is an electrometer, a small fine pith-ball*; a wire connects with a similar cylinder and electrometer in a distant apartment, and his wife, by remarking the corresponding motions of the ball, writes down the words they indicate, from which it appears that he has formed an alphabet of motions. As the length of the wire makes no difference in the effect, a correspondence might be carried on at any distance; within and without a besieged town for instance, or for a purpose much more worthy, and a thousand times more harmless—between two lovers prohibited, or prevented, from any better connection. Whatever the use may be, the invention is beautiful. Mons. Lomond has made many other curious machines, all the entire work of his own hands. Mechanical invention seems to be in him a natural propensity."*

As in all systems where the signals were indicated by electroscopes, or electrometers, their action would continue so long as the charge communicated to the wires lasted, and, as during this time it would not be possible to make another signal, the authors must in some way have discharged the wires after every signal, so as to allow the balls, gold leaves, or other indicators, to resume their normal position. This they might have done, either by touching the wires with the finger after the signal had been noted, or by making the indicators themselves strike against some body that would convey their charges to earth. But, probably, there was no need for any such stratagem, as the insulation of the wires would be so imperfect, and the speed of signalling so slow, that the inconvenience would not have been felt.

* Soon after the discovery of the Leyden jar the necessity of some sufficient indicator of the presence and power of electricity began to be felt, and after some clumsy attempts at an electrometer by Gralath, Ellicott, and others, the Abbé Nollet adopted the simple expedient of suspending two threads, which when electrified would separate by their mutual repulsion. Waitz hung little leaden pellets from the threads for greater steadiness, and Canton, in 1753, improved upon this by substituting two pith balls suspended in contact by fine wires—a contrivance which is used to this day. The electrometer mentioned in the text was of the kind known as the quadrant electrometer, introduced by Henley in 1772.

VRIL AND "GALVANIC FORCE"
CAUSING THE POLARIZATION-EFFECTS
COMMONLY CALLED MAGNETIC
AND ELECTRIC FORCE

a black vulcanite frame, highly polished, and in this, it is stated, the whole cause of the trouble lay. It was found that this frame was peculiarly liable to become electrified, that the slightest friction, even the mere carrying in the pocket, was sufficient to charge it, and that, when thus electrified, if brought near the needle of a compass, it had almost the effect of a loadstone in drawing it from its true settling place. On discarding this magnifier and using an ordinary glass lens without a frame, no further trouble was found in the field work done with the compass. This must be taken for what it is worth."

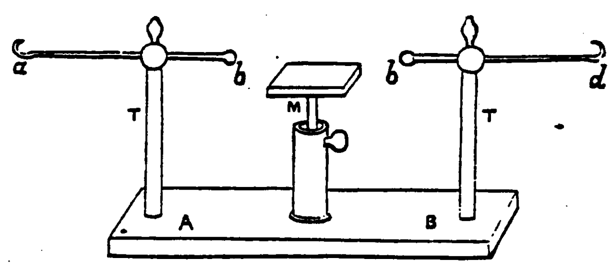
As little value attaches to the observation of Mojon which we find recorded by Aldini, and which seems to us but a repetition of Franklin's experiment (before mentioned, p. 252), with this difference, that a voltaic battery was used instead of one of Leyden jars. Aldini says :—"The following experiment has been quite recently communicated to me by its author Mojon :—

"Having placed horizontally sewing-needles, very fine, and two inches long, he put the two extremities in communication with the two poles of a battery of one hundred cups, and on withdrawing the needles, at the end of twenty days, he found them a little oxidised, but at the same time endowed with a very sensible magnetic polarity. This new property of galvanism has been verified by other observers, and lately by Romanesi, who has found that galvanism is able to deflect a magnetic needle." *

At p. 120 of his *Manuel du Galvanisme* (Paris, 1805), Joseph Izarn describes Mojon's experiment, and appends an illustration, which shows most conclusively that it had no reference to electro-magnetism. His words are :—

"Apparatus for observing the action of galvanism on the polarity of a magnetised needle :—

FIG. 9.



Mojon's Experiment, according to Izarn.

"*Preparation*. Arrange the horizontal rods *a b*, *b d*, (Fig. 9) so that they may approach the magnetic bar shown between them, in place of the knobs *b b*, screw on little pincers which take hold of the magnetic bar, and attach one pole of a pile to *a*, and the other to *d*, thus completing the voltaic circuit through the length of the magnet.

* *Essai Théorique et Expérimental sur le Galvanisme*, Paris, 1804, vol. i. p. 339.

"*Effects.* According to the observations of Romagnosi the magnet experiences a declination, and according to those of Mojon needles not previously magnetised acquire by this means a sort of magnetic polarity." *

In a paper read before the Royal Academy of Munich, in May 1805, Ritter, a Bavarian philosopher, advanced some curious speculations, which, although always quoted, as suggestive of electro-magnetism, are really as wide of the mark as the experiments of Romagnosi, Schweigger, and Mojon. We find them thus described in the *Philosophical Magazine*, for 1806:†—

"The pile with which M. Ritter commonly performs his experiments consists of 100 pairs of plates of metal, two inches in diameter; the pieces of zinc have a rim to prevent the liquid pressed out from flowing away, and the apparatus is insulated by several plates of glass.

"As he resides at present near Jena I have not had an opportunity of seeing experiments with his great battery of 2000 pieces, or with his battery of 50 pieces, each thirty-six inches square, the action of which continues very perceptible for a fortnight. Neither have I seen his experiments with the new battery of his invention, consisting of a single metal, and which he calls *the charging pile*.*

"I have, however, seen him galvanise a louis d'or. He places it between two pieces of pasteboard thoroughly wetted, and keeps it six or eight minutes in the circuit of the pile. Thus it becomes charged, though not immediately in contact with the conducting wires. If applied to the recently bared crural nerves of a frog the usual contractions ensue. I put a louis d'or thus galvanised into my pocket, and Ritter told me, some minutes after, that I might discover it from the rest by trying them in succession upon the frog. I made the trial, and actually distinguished, among several others, one in which only the exciting quality was evident.

"The charge is retained in proportion to the time that the coin has been in the circuit of the pile. Thus,

* Mr. Sabine appears to have studied Izarn, yet he writes thus, at p. 23 of his *History and Progress of the Electric Telegraph*, 2nd edit., London, 1869:—"After explaining the way to prepare the apparatus, *which consists simply in putting a freely suspended magnet needle parallel and close to a straight metallic conductor* through which a galvanic current is circulating, he describes the effects in the following words," &c. The words that we have italicised are altogether misleading.

† Vol. xxiii. p. 51. "An ingenious and extraordinary man, from whom much might have been expected, had nature permitted the continuance of his scrutiny into her secret operations. A premature death deprived the world of one whose constitutional singularity of opinion, ardency of research, and originality of invention, rendered him at once systematic in eccentricity, inexhaustible in discovery, and ingenious even in error."—Donovan's *Essay on the Origin, Progress, and Present State of Galvanism*, Dublin, 1816, p. 107.

Johann Wilhelm Ritter was born December 16, 1776, and died at Munich, January 23, 1810.

* The charging pile, or, as we now call it, the secondary battery, was first described by Gautherot in 1801. See Izarn's *Manuel du Galvanisme*, Paris, 1804, p. 250; also *Phil. Mag.*, for 1806, vol. xxiv. p. 185.

of three different coins, which Ritter charged in my presence, none lost its charge under five minutes.

"A metal thus retaining the galvanic charge, though touched by the hand and other metals, shows that this communication of galvanic virtue has more affinity with magnetism than with electricity, and assigns to the galvanic fluid an intermediate rank between the two.

"Ritter can, in the way I have just described, charge at once any number of pieces. It is only necessary that the two extreme pieces of the number communicate with the pile through the intervention of wet pasteboards. It is with metallic discs charged in this manner, and placed upon one another, with pieces of wet pasteboard alternately interposed, that he constructs his charging pile, which ought, in remembrance of its inventor, to be called the *Ritterian pile*. The construction of this pile shows that each metal galvanised in this way acquires polarity, as the needle does when touched with a magnet.*

* * * * * *

"After showing me his experiments on the different contractibility of various muscles, Ritter made me observe that the piece of gold galvanised by communication with the pile exerts at once the action of two metals, or of one voltaic couple, and that the face, which in the voltaic circuit was next the negative pole, became positive; and the face towards the positive pole, negative.

"Having discovered a way to galvanise metals, as iron is rendered magnetic, and having found that the galvanised metals always exhibit two poles as the magnetised needle does, Ritter suspended a galvanised gold needle on a pivot, and perceived that it had a certain dip and variation, or deflection, and that the angle of deviation was always the same in all his experiments. It differed, however, from that of the magnetic needle, and it was the positive pole that always dipped."*

Ritter also observed that a needle composed of silver and zinc arranged itself in the magnetic meridian, and was slightly attracted and repelled by the poles of a magnet; and, again, that a metallic wire through which a current had been passed took up of itself a N.E. and S.W. direction.

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* We may here dispose of a paragraph which has hitherto puzzled a good many writers, who have supposed it to refer to some kind of magneto-electric machine. It occurs in *The Monthly Magazine*, for April 1802, p. 268, and reads as follows:—

"Galvanism is at present a subject of occupation of all the German philosophers and chemists. At Vienna an important discovery has been announced—an artificial magnet—employed instead of Volta's pile, decomposes water equally well as that pile, or the electrical machine; whence it has been concluded that the electric, galvanic, and magnetic fluids are the same." Clearly the artificial magnet here mentioned can be none other than Ritter's secondary pile. One thing is certain, it cannot be a magneto-electric machine, for magneto-electricity was not known in 1802.

* C. Bernoulli, in *Van Mons' Journal*, vol. vi. See further on this subject in *Phil. Mag.*, vol. xxv. pp. 368–9.

Cosmos les Mondes (June 30, 1883).

Dr. Tommasi, in republishing Romagnosi's experiment, asks the following questions, which he submitted, in particular, to the managing committee of the (late) Vienna Exhibition, in the hope that they might have been brought before electricians :—

"Is it to Oersted, or to Romagnosi, that we should ascribe the merit of having first observed the deviation of the magnetic needle by the action of the galvanic current?

"Had Oersted any knowledge of the experiment of Romagnosi when he published his discovery of electro-magnetism ? *

"Have any other *savants* taken part in this discovery ?"

Now, we should have thought that after the admirable *exposé* of Govi, to which we have just referred, no electrician would seriously put to himself these questions. But it appears that our Paris *confrère* does so, although, if he had only read carefully the facts on which he bases them, he would perceive that they have no relation whatever to electro-magnetic action, but are simply effects of ordinary electrical attraction and repulsion brought about by the static charge which is always accumulated at the poles of a strong voltaic *pile*—the form of battery used in Romagnosi's experiments, and which, as is well known, exhibits this phenomenon in a far more exalted degree than the ordinary cell arrangement.

We cannot establish better the correctness of our conclusions than by quoting in full the recital of Romagnosi's experiment, as it originally appeared in the *Gazzetta di Trento*, of August 3, 1802 : *—

"Article on Galvanism.

"The Counsellor, Gian Domenico de Romagnosi, of this city, known to the republic of letters by his learned productions, hastens to communicate to the physicists of Europe an experiment showing the action of the galvanic fluid on magnetism.

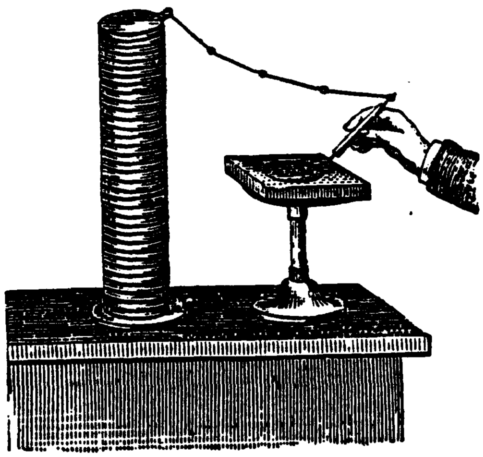
"Having constructed a voltaic pile, of thin discs of copper and zinc, separated by flannel soaked in a solution of sal-ammoniac, he attached to one of the poles one end of a silver chain, the other end of which passed through a short glass tube, and terminated in a silver knob. This being done, he took an ordinary compass-box, placed it on a glass stand, removed its glass cover, and touched one end of the needle with the silver knob, which he took care to hold by its glass envelope. After a few seconds' contact, the needle was observed to take up a new position, where it remained, even after the removal of the knob. A fresh application of the knob caused a still further

* Dr. Hamel, for one, thought he had, and tries to prove it in his *Historical Account*, &c., of 1859 (pp. 37–9 of W. F. Cooke's reprint).

* Our translation is made from the reprint at p. 8 of Govi's *Romagnosi e l'Elettro-Magnetismo*.

deflection of the needle, which was always observed to remain in the position to which it was last deflected, as if its polarity were altogether destroyed.

FIG. 8.



Romagnosi's Experiment, according to Govi.

"In order to restore this polarity, Romagnosi took the compass-box between his fingers and thumbs, and held it steadily for some seconds. The needle then returned to its original position, not all at once, but little by little, advancing like the minute or seconds hand of a clock.

"These experiments were made in the month of May, and repeated in the presence of a few spectators, when the effect was obtained without trouble and at a very sensible distance."

Here it will be seen that Romagnosi uses only *one* pole of the pile, and *never speaks of the circuit being closed*—facts which show that his experiment has no resemblance to that of Oersted.

The effects which he describes are, moreover, easily explainable on another hypothesis. The compass needle, we may imagine, received a charge of static electricity by contact with the charged pole of the pile. Being insulated, it could not part with this charge, and, consequently, as soon as it had attained the same potential as the voltaic pole, mutual repulsion ensued. As the needle belonged to "an ordinary compass-box," we may assume it was neither strongly magnetised, nor delicately suspended. Friction at the point of support, then, might more than counterbalance the directive force of the earth, and so the needle would always remain in the position to which it had been last repelled.

The "restoration of polarity," or the bringing back of the needle to the magnetic meridian, by merely holding the compass-box steadily between the fingers and thumbs, although savouring of legerdemain, was really due to a "simple turn of the wrist." Romagnosi may have imagined that he held the compass-box *steadily*, but there can be no doubt that his hands suffered a slight and imperceptible tremor, which, aided by the directive force of terrestrial magnetism, sufficed to shake the needle into a north and south position.

VRILLIC ACTIVITY MISTAKEN AS INERTIAL POLARIZATIONS (MAGNETISM AND ELECTRICAL FORCE)

The force is in that form more latent than as electricity, and less so than as magnetism. It is, therefore, probable that the electric force, when superposed, will exercise a less influence on magnetism than on galvanism. In the galvanic pile, it is the electric state [tension] which it acquires that is affected by the approach of an excited glass rod; more, it is not that interior distribution of forces constituting magnetism that we can change by electricity, but it is the electric state which belongs to the magnet as to bodies in general.

"We do not pretend to decide anything in this matter; we only wish to clear up, as far as possible, a very obscure subject, and, in a question of such importance, we shall be very well satisfied if we have made it apparent that the principal objection to the identity of the forces which produce electricity and magnetism is rather a difficulty of reconciling facts than of the facts themselves."

And again, on p. 238, he says:—"Steel when heated loses its magnetism, showing that it becomes a better conductor by the elevation of temperature, like electrical bodies. Magnetism, too, like electricity, exists in all bodies in nature, as Bruckmann and Coulomb have shown. From this it seems that the magnetic force is as general as the electric; and it remains to be seen whether electricity in its most latent state [*i. e.*, as galvanism] will not affect the magnetic needle *as such.*

"This experiment will not be made without difficulty, for the electrical actions will blend and render the observations very complicated. In comparing the attractions on magnetic and non-magnetic bodies, some *data* will probably be obtained."

In trying experiments with a view to the illustration of these hazy notions Oersted is said to have succeeded in obtaining indications of the action of the conducting wires of the pile, during the passage of electricity, on the needle; but the phenomena were, at first view, not a little perplexing; and it was not till after repeated investigation that, in the winter of 1819–20, the real nature of the action was satisfactorily made out.*

Even then Oersted seems not to have clearly understood the full significance of his own experiment. Unlike Davy, who, when he first saw the fiery drops of potassium flow under the action of his battery, recorded his triumph in a few glowing words in his laboratory journal,† Oersted took no immediate steps,

* "Professor Forchhammer, the pupil and friend of Oersted, states that, in 1818 and 1819, it was well known in Copenhagen that he was engaged in a special study of the connection of magnetism and electricity. Yet we must ascribe it to a happy impulse—the result, no doubt, of much anxious thought—that, at a private lecture to a few advanced students in the winter of 1819–20, he made the observation that a wire uniting the ends of a voltaic battery in a state of activity affected a magnet in its vicinity."—*Ency. Brit.*, 8th ed., Dissertation vi. p. 973.

† On 16th October, 1807, while investigating the compound nature of the alkalies. On seeing the globules of potassium burst through the crust of the potash, and take fire as they entered the atmosphere, he could not contain his joy, but danced about the room in wild delight,

As the result of all these observations the Bavarian philosopher concluded that "electrical combinations, when not exhibiting their electric tension, were in a magnetic state; and that there existed a kind of electro-magnetic meridian depending on the electricity of the earth, and at right angles to the magnetic poles."* These speculations are, as we see, sufficiently obscure, and, like those that we have hitherto described, failed to throw any light on the relation so anxiously sought after.

Nor can we give Oersted credit at this period for any more distinct apprehensions. In a work which he published in German, in 1807, on the identity of chemical and electrical forces, he observes:*—

"When a plate composed of several thin layers is electrified, and the layers afterwards separated, each is found to possess an electric polarity, just as each fragment of a magnet possesses a magnetic polarity.

"There is, however, one fact which would appear to be opposed to the theory of the identity of magnetism and electricity. It is that electrified bodies act upon magnetic bodies, as if they [? the magnetic bodies] were endowed with no force in particular. It would be very interesting to science to explain away this difficulty; but the present state of physics will not enable us to do so. It is, meanwhile, only a difficulty, and not a fact absolutely opposed to theory; for we see in frictional electricity and in that of contact [galvanism] analogous phenomena. Thus, we can alter the tension of the electric pile by bringing near it an excited glass rod, and yet not affect in any way the chemical action. A long column of water, or a wetted thread of flax or wool, will also suffer a change in its electricity without experiencing any chemical changes.

"It would appear, then, that the forces can be superposed without interfering with each other when they operate under forms of different activities.

"The form of galvanic activity holds a middle place between those of magnetism and [static] electricity

* *Phil. Mag.*, vol. lviii. p. 43. It is curious to note that the English philosophers entirely neglected this study, being content to follow the brilliant lead of Sir Humphry Davy in another branch of the science. Indeed, it seems to have been the general opinion in this country, as late as the year 1818, that there was nothing more to be discovered. Bostock, in his *Account of the History and Present State of Galvanism*, published in London in that year, says:—

"Although it may be somewhat hazardous to form predictions respecting the progress of science, I may remark that the impulse, which was given in the first instance by Galvani's original experiments, was revived by Volta's discovery of the pile, and was carried to the highest pitch by Sir H. Davy's application of it to chemical decomposition, seems to have, in a great measure, subsided. It may be conjectured that we have carried the power of the instrument to the utmost extent of which it admits; and it does not appear that we are at present in the way of making any important additions to our knowledge of its effects, or of obtaining any new light upon the theory of its action" (p. 102).

Napoleon did not hold these views. In the First Consul's letter to the Minister, Chaptal, founding two prizes to encourage new researches in galvanism, he said:—"Galvanism, in my opinion, will lead to great discoveries."

* Chap. viii. pp. 235-6 of the French edition, *Recherches sur l'Identité des Forces Chimiques et Électriques*, Paris, 1813.

In studying the points of analogy between lightning and electricity, the great Franklin remarked that the latter, like the former, had the power not merely of destroying the magnetism of a needle, but of completely reversing its polarity. By discharging four large Leyden jars through a common sewing needle, he was able to impart to it such a degree of magnetism that, when floated on water, it placed itself in the plane of the magnetic meridian. When the discharge was sent through a steel wire perpendicular to the horizon it was permanently magnetised, with its lower end a North, and its upper end a South pole; and, on reversing the position of the wire and again transmitting through it the discharge, the polarity was either destroyed, or entirely reversed. Franklin also found that the polarity of the loadstone could be destroyed in a similar manner.*

Dalibard, about the same time, imagined that he had proved that the electric discharge gives a northern polarity to that point of a steel bar at which it enters, and a southern polarity to that at which it makes its exit, while Wilcke, for his part, was equally satisfied that an invariable connection existed between negative electricity and northern polarity.

* Priestley's *History of Electricity*, London, 1767, p. 178.

From a review of all these, and other observations by himself made between 1753 and 1758, Beccaria came to the conclusion that the polarity of a needle magnetised by electricity was invariably determined by the direction in which the electric discharge was made to pass through it; and as a consequence he assumed the polarity acquired by ferruginous bodies which had been struck by lightning as a test of the kind of electricity with which the thunder-cloud was charged.

Applying this criterion to the earth itself, Beccaria conjectured that terrestrial magnetism was, like that of the needle magnetised by Franklin and Dalibard, the mere effect of permanent currents of natural electricity, established and maintained upon its surface by various physical causes; that, as a violent current, like that which attends the exhibition of lightning, produces instantaneous and powerful magnetism in substances capable of receiving that quality, so may a more gentle, regular, and constant circulation of the electric fluid upon the earth impress the same virtue on all such bodies as are capable of it. "Of such fluid, thus ever present," observes Beccaria, "I think that some portion is constantly passing through all bodies situate on the earth, especially those which are metallic and ferruginous; *and I imagine it must be those currents which impress on fire-irons, and other similar things, the power which they are known to acquire of directing* *themselves according to the magnetic meridian when they are properly balanced.*" *

Diderot, one of the editors of the celebrated "Encyclopædia," and whom the *Revue des deux Mondes* † calls a "Darwinist a century before Darwin," was also, as early as 1762, a firm believer in the identity of electricity and magnetism, and has left in his writings some arguments in support of this hypothesis.

In his essay *On the Interpretation of Nature* he says:—"There is great reason for supposing that magnetism and electricity depend on the same causes. Why may not these be the rotation of the earth, and the energy of the substances composing it, combined with the action of the moon? The ebb and flow of the tides, currents, winds, light, motion of the free particles of the globe, perhaps even of the entire crust round its nucleus, produce, in an infinite number of ways, continual friction. The effect of these causes, acting as they do sensibly and unceasingly, must be, at the end of ages, very considerable. The nucleus or kernel of the earth is a mass of glass, its surface is covered only with remains of glass—sands and vitrifiable substances. Glass is, of all bodies, the one that yields most electricity on being rubbed. Why may not the sum total of terrestrial electricity be the result of all these frictions, either at the external surface of the earth, or at that of its internal kernel?

"From this general cause it is presumable that we can deduce, by experiments, a particular cause which shall establish between two grand phenomena, *viz.*, the position of the aurora borealis and the direction of the magnetic needle, a connection similar to that which is proved to exist between magnetism and electricity by the fact that we can magnetise a needle without a magnet and by means only of electricity.

"These notions may be either true or false. They have no existence so far but in my imagination. It is for experience to give them solidity, and it is for the physicist to discover wherein the phenomena differ, or how to establish their identity." *

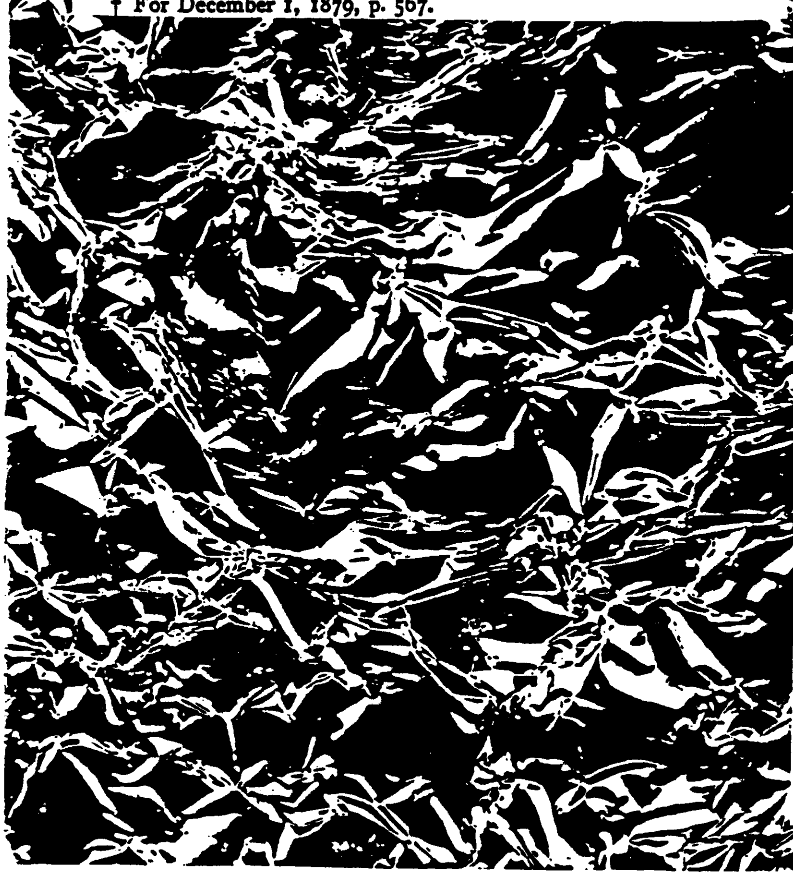
In the year 1774, the following question was proposed by the Electoral Academy of Bavaria as the subject of a prize essay:—"Is there a real and physical analogy between electric and magnetic forces, and, if such analogy exist, in what manner do these forces act upon the animal body?" The essays received on that occasion were collected and published ten years later by Professor Van Swinden, of Franeker—the winner of one of the prizes. †

* Ampère's theory of electro-magnetism, and likewise his view of terrestrial magnetism, are here distinctly foreshadowed by this most acute and accurate observer. For a full account of Beccaria's researches, see Priestley's *History of Electricity*, London, 1767, pp. 340–352.

† For December 1, 1879, p. 567.

* The physicist has been true to the trust. See *Collection Complète des Œuvres Philosophiques, Littéraires, et Dramatiques de Diderot*, 8vo., 5 vols., Londres, 1773, vol. ii. p. 28.

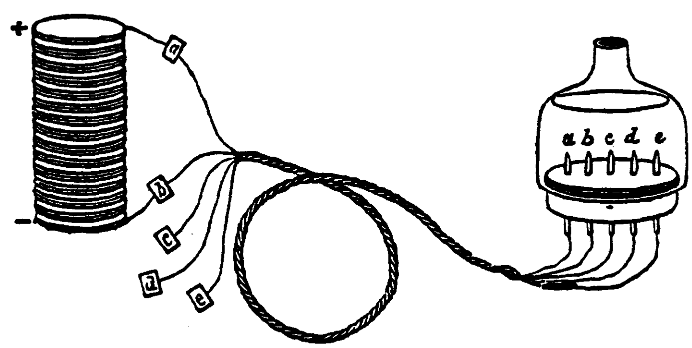
† *Recueil de Mémoires sur l'Analogie de l'Electricité et du Magnétisme*, &c., 3 vols., 8vo., La Haye, 1784.



This event in which Chappe's semaphore played so important a part caused much attention to be directed to the subject of telegraphy, and on the 5th July following we find the Bavarian minister, Montgelas, requesting his friend, Dr. Sömmerring, to bring the subject before the Academy of Sciences (of Munich), of which he was a distinguished member.*

Sömmerring at once gave the matter his attention, and soon it occurred to him to try whether the visible evolution of gases from the decomposition of water by the voltaic current might not answer the purpose. He worked at this idea incessantly, and, before three days had elapsed, had constructed his first apparatus, shown in Fig. 6. He took five wires of silver, or copper, and, insulating each with a thick coating of sealing-wax, bound the whole up into a cable. These wires, at one end, terminated in five pins which penetrated a glass vessel containing acidulated water; and, at the other, were capable of being put in connection with the poles of a pile of fifteen pairs of zinc discs, and Brabant thalers, separated by felt soaked in hydrochloric acid. By touching any two of the wires to the poles of the pile he was able to produce, at their distant ends, a disengagement of gases, and thereby indicate any of the five letters *a, b, c, d, e.* Having thus shown the feasibility of his project, he set himself to perfect his apparatus, and worked at it with such a will that by the 6th of August it was completed. He wrote in his diary on that day:—"I have tried the entirely finished apparatus which completely answers my expectations. It works quickly through

FIG. 6.



wires of 362 Prussian feet." Two days later he worked it through 1000 feet, and then through 2000 feet, the wire in each case being wound round a glass cylinder for greater compactness.*

* Hamel, Cooke's reprint, pp. 5-7.

* Hamel, pp. 7, 8. On the 4th February, 1812, he worked through 4000 feet, and on the 15th March following through as much as 10,000 feet.

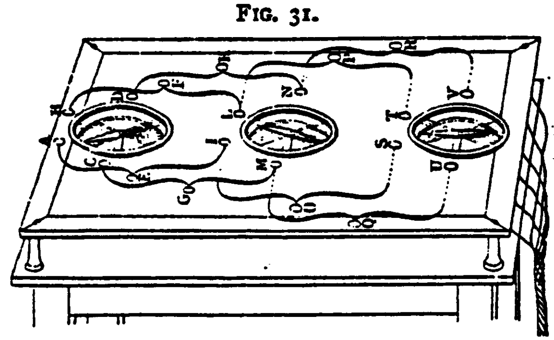
1837.—*Magrini's Telegraph.*

The proposal that we have now to notice is one of great merit, and resembles in some respects Cooke and Wheatstone's five-needle, or *Hatchment*, telegraph of 1837. It is the invention of Professor Luigi Magrini, of Venice, and is described by him, at length, in a *brochure*, which he published, at Venice, in 1838, entitled *Telegrafo Elettro-Magnetico, Praticabile a Grandi Distanze.* From an Appendix on pp. 85–6, it appears that the first published account of this telegraph is that contained in the *Gazzetta Privilegiata di Venezia*, No. 189, of 23rd August, 1837;* but, as far as we can discover, it was never tried on any extensive scale. Had this been done, there can be no doubt that it would have succeeded as well as the English one, and we should have had the curious result of seeing the simultaneous and independent establishment in Italy and in England of electric telegraphs, which are not only based on the same principles, but, in some respects, are almost identical.

The signal apparatus consisted of a horizontal table, one metre long, and sixty centimetres broad, into which fitted three galvanometers as shown in the Fig. 31. By means of two batteries of different strengths, and a commutator, each needle was susceptible of four movements, one weak and one strong to the right, and one weak and one strong to the left. These four positions indicated for each needle a different letter which was suitably inscribed on the board, or table. Thus, the letters appertaining to the first galvanometer were A, B, C, D; those of the second, I, L, M, N; and those of the third, S, T, U, V.

In order to indicate all the other letters, the needles were employed, two and two at a time; F, for example, corresponded to *weak*, right-handed deflections of needles 1 and 2; H, to *strong* deflections of the same two needles, and in the same direction; O, to weak, left-handed deflections of the second and third needles; R, to strong deflections of the same needles, but in the other, or right-handed direction; and so on for the rest.

FIG. 31.

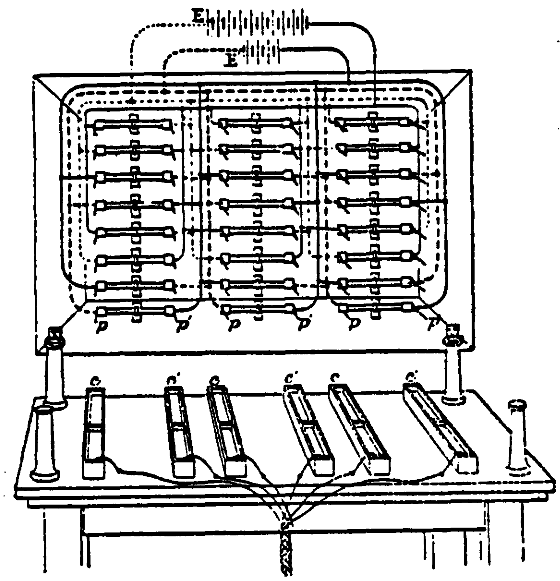


Magrini employed six line wires, forming three metallic circuits. At the sending station these dipped into troughs of mercury placed on a table, and a little above which was laid the commutating board on short supports. This board, which for clearness sake is shown in the Fig. 32, in a raised, or vertical, position, carried, underneath, twenty-four glass rods, in three rows of eight rods each. To the ends of each rod were attached elastic strips of brass, terminating in projecting pins of the same material, which could be pushed downwards (by means of a handle affixed to the centre of the rod and projecting through the top face of the board) so as to dip into the mercury troughs. The other ends of the elastic strips were permanently connected, the one with the positive,

* In the *Annales Télégraphiques*, for March–April 1882, p. 140, it is said to date back to 1832; but this is probably a misprint.

and the other with the negative pole of one or other of the batteries E, and E′. Taking, for example, the first row of keys, or rods, on the left of the figure, which, we will suppose, was connected to the first

FIG. 32.



galvanometer at the distant station, then the first rod, at the top, was in connection with the poles of the strong battery; the second rod was connected to the same battery, but in the reverse way to the first; the third and fourth rods were connected to the weak battery in the same manner that the first and second were to the strong. The remaining four rods were connected, rod for rod, like the last, that is to say, the fifth was connected to the same battery as the first, and in the same manner, the sixth like the second, and so on.

Whenever, then, the first rod was depressed, a current from the strong battery E, flowed out to line, and circulating through the coils of the first galvanometer, produced a strong deflection of the needle (say, to the left), and so pointed to the letter C. Depressing the second rod produced a strong deflection of the same needle to the right, and so indicated D; and so on for all the rest. With regard to the last four rods of each row they were used in pairs, one from each row; thus, when the fifth rods in the first and second rows were depressed, the needles of the first and second galvanometers were strongly deflected to the left, and indicated the letter G; while depressing the last rods of the second and third rows produced feeble deflections to the right of the second and third galvanometers, and indicated P.

It is easy to see that all these combinations could be obtained by making use of the first four rods of each row, but it was no doubt in order to avoid all chance of confusion that the inventor introduced special ones for this purpose.

A HISTORY OF WIRELESS TELEGRAPHY.

FIRST PERIOD—THE POSSIBLE.

> "Awhile forbear,
>
> . . . .
>
> Nor scorn man's efforts at a natural growth,
> Which in some distant age may hope to find
> Maturity, if not perfection."
>
> PROFESSOR C. A. STEINHEIL—1838.

JUST mentioning *en passant* the sympathetic needle and sympathetic flesh telegraphs of the sixteenth and seventeenth centuries, a full account of which will be found in my 'History of Electric Telegraphy to 1837' (chap. i.),[1] we come to the year 1795 for the first glimmerings of telegraphy without wires. Salvá, who was an eminent Spanish physicist, and the inventor of the first electro-chemical telegraph, has the following bizarre passage in his paper "On the Application of Electricity to Telegraphy," read before the Academy of Sciences, Barcelona, December 16, 1795.

After showing how insulated wires may be laid under the seas, and the water used instead of return wires, he goes on to say: "If earthquakes be caused by electricity going from one point charged positively to another point charged negatively, as Bertolon has shown in his 'Électricité des Météores' (vol. i. p. 273), one does not even want a cable to send across the sea a signal arranged beforehand. One could, for example, arrange at Mallorca an area of earth charged with electricity, and at Alicante a similar space charged with the opposite electricity, with a wire going to, and dipping into, the sea. On leading another wire from the sea-shore to the electrified spot at Mallorca, the communication between the two charged surfaces would be complete, for the electric fluid would traverse the sea, which is an excellent conductor, and indicate by the spark the desired signal."[1]

Another early telegraph inventor and eminent physiologist, Sömmerring of Munich, has an experiment which, under more favourable conditions of observation, might easily have resulted in the suggestion at this early date of signalling through and by water alone. Dr Hamel[2] tells us that Sömmerring, on the 5th of June 1811, and at the suggestion of his friend, Baron Schilling, tried the action of his telegraph whilst the two conducting cords were each interrupted by water contained in wooden tubs. The signals appeared just as well as if no water had been interposed, but they ceased as soon as the water in the tubs was connected by a wire, the current then returning by this shorter way.

Now here we have, *in petto*, all the conditions necessary

[1] E. & F. N. Spon, London, 1884.

[1] Later on (p. 81 *infra*) we shall see that Salvá's idea is after all not so extravagant as it seems. We now know that large spaces of the earth *can* be electrified, giving rise to the phenomenon of "bad earth," so well known to telegraph officials.

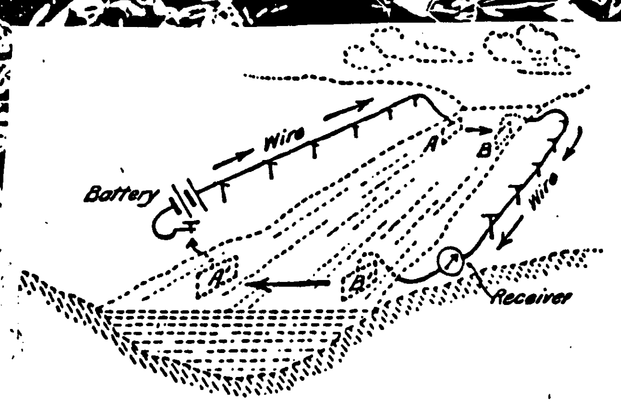
[2] 'Historical Account of the Introduction of the Galvanic and Electro-magnetic Telegraph into England,' Cooke's Reprint, p. 17.

for an experiment of the kind with which we are dealing, and had it been possible for Sömmerring to have employed a more delicate indicator than his water-decomposing apparatus he would probably have noticed that, notwithstanding the shorter way, some portion of the current still went the longer way; and this fact could hardly have failed to suggest to his acute and observant mind further experiments, which, as I have just said, might easily have resulted in his recognition of the possibility of wireless telegraphy.

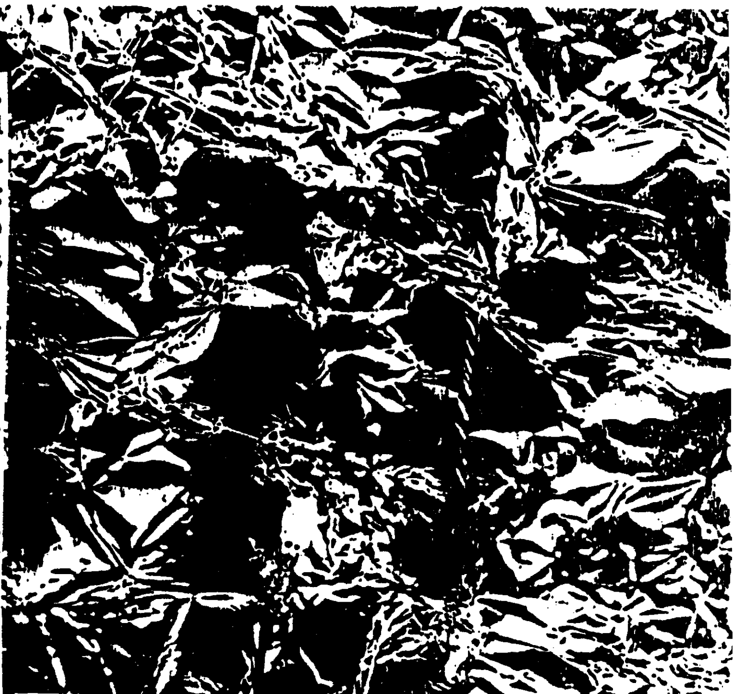
Leaving the curious suggestion of Salvá, which, though seriously meant, cannot be regarded as more than a *jeu d'esprit* — a happy inspiration of genius — and the what-might-have-come-of-it experiment of Sömmerring, we come to the year 1838, when the first intelligent suggestion of a wireless telegraph was made by Steinheil of Munich, one of the great pioneers of electric telegraphy on the Continent.

The possibility of signalling without wires was in a manner forced upon him. While he was engaged in establishing his beautiful system of telegraphy in Bavaria, Gauss, the celebrated German philosopher, and himself a telegraph inventor, suggested to him that the two rails of a railway might be utilised as telegraphic conductors. In July 1838 Steinheil tried the experiment on the Nürmberg-Fürth railway, but was unable to obtain an insulation of the rails sufficiently good for the current to reach from one station to the other. The great conductibility with which he found that the earth was endowed led him to presume that it would be possible to employ it instead of the return wire or wires hitherto used. The trials that he made in order to prove the accuracy of this conclusion were followed by complete success; and he then introduced into electric telegraphy one of its greatest improvements—the earth circuit.[1]

[1] For the use of the earth circuit before Steinheil's *accidental* discovery, see my 'History of Electric Telegraphy,' pp. 343-345.



Morse's system of telegraphing across a canal used metal plates (A, A', B, B') submerged beneath the water. When the key to (A') was pressed, current from the battery flowed along the left-bank wire and then from plate (A) through the water to plate (B). The right-bank wire completed the circuit through the receiver and plates (B') and (A'). A lot of current was lost by diffusion in the water.



PROFESSOR MORSE—1842.

The idea of a wireless telegraph next appears to have presented itself to Professor Morse. In a letter to the Secretary of the Treasury, which was laid before the House of Representatives on December 23, 1844, he says:—

"In the autumn of 1842, at the request of the American Institute, I undertook to give to the public in New York a demonstration of the practicability of my telegraph, by connecting Governor's Island with Castle Garden, a distance of a mile; and for this purpose I laid my wires properly insulated beneath the water. I had scarcely begun to operate, and had received but two or three characters, when my intentions were frustrated by the accidental destruction of a part of my conductors by a vessel, which drew them up on her anchor, and cut them off. In the moments of mortification I immediately devised a plan for avoiding such an accident in future, by so arranging my wires along the banks of the river as to cause the water itself to conduct the electricity across. The experiment, however, was deferred till I arrived in Washington; and on December 16, 1842, I tested my arrangement across the canal, and with success. The simple fact was then ascertained that electricity could be made to cross a river without other conductors than the water itself; but it was not until the last autumn that I had the leisure to make a series of experiments to ascertain the law of its passage. The following diagram will serve to explain the experiment:—

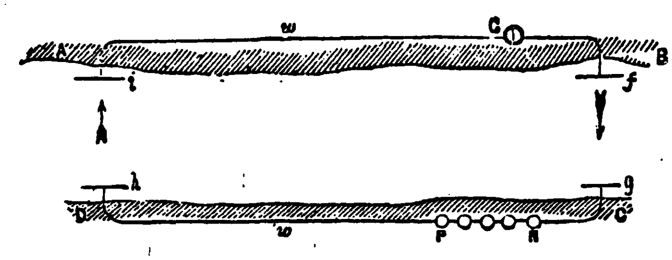


Fig. 1.

THE ELECTRIC TELEGRAPH.

[From Chambers' Journal.]

Beacon fires were the ancient mode of telegraphy adopted in Great Britain. An act of the Scottish Parliament of 1455 directs that "one bale or fagot shall be the warning of the approach of the English in any manner; two bales, that they are coming indeed; and four bales blazing beside each other, that the enemy are in great force." The earliest well defined plan of telegraphic communication is that of Dr. Robert Hooke, described by him in a paper to the Royal Society in 1684, and published in 1726 in Derham's collection of his *Philosophical Experiments and Observations.* A number of symbols or devices were to be displayed on an elevated frame-work. M. Chappe much improved on this in 1793. A kind of shutter telegraph was in 1796 adopted in England in the first Government line of telegraph from London to Dover. It is stated that information had been conveyed by this from Dover to London in seven minutes. This, of course, was only available in clear weather.

We now come to the electric telegraph, by which Puck's fairy boast of putting a girdle round the earth in forty minutes can be realized, though, instead of forty minutes, it can be done in *one second.* Strada, the Italian Jesuit, speaks in his *Prolusiones Academicæ*, in 1617, of "the instantaneous transmission of thoughts and words between two individuals over an indefinite space," caused by a species of loadstone, which possesses such virtue, that if two needles be touched with it, and then balanced on separate pivots, and the one turned in a particular direction, the other will sympathetically move parallel to it. These needles were to be poised, and mounted parallel on a dial with the letters of the alphabet around. It is wonderful how nearly this description would apply to the electric telegraph. Addison playfully quotes this as a substitute for love letters in the *Spectator* of 1712. Glanvil, in a work addressed to the Royal Society two hundred years ago, treating of things, then rumors, which might be practical realities, says: "To confer at a distance of the Indies by sympathetic conveyances, may be as usual to future times as to us in literary correspondence." Experiments of making electric shocks through wires had been made many times before Franklin's theory of positive and negative electricity was started. Mr. Timbs states that in the *Scotts Magazine* for 1753 there appeared a distinct proposition for a system of telegraphic communication by as many conducting wires as

with the uttermost parts of the earth." In the same year, Francis Ronalds employed frictional electricity. His telegraph was a single insulated wire, the indication being by pith balls in front of a dial. In the next year, Mr. Hill, of Alferton, invented a voltaic electric telegraph.

Oersted discovered, in 1819, that a magnetic needle is deflected by the passage of a circuit of electricity through a wire parallel and in close proximity to it. This made the wonderful discovery of the telegraph possible. But the deflecting power of the current must be multiplied, and Schweigger did this by passing a wire insulated by silk a number of times round the needle. M. Arago, in 1819, invented the first electro-magnet, by coiling round a piece of soft iron a length of insulated copper wire, the ends of which communicated with a battery. By alternately making and breaking the circuit of the current, an up and down movement can be produced, which is the principle of action in Wheatstone's electric magnetic dial instrument. These discoveries do not seem to have been followed up in a practical manner till, in 1837, Wheatstone took out a patent in conjunction with Mr. Cooke. Their telegraph had five wires and five needles, two of which indicated the letters of the alphabet placed around. In July, 1837, wires were laid down from Euston Square to Camden Town Stations, by the sanction of the Northwestern Railway, and Professor Wheatstone sent the first message to Mr. Cooke between the two stations. The professor says: "Never did I feel such tumultuous sensation before, as when, all alone in the still room, I heard the needles click; and as I spelled the words, I felt all the magnitude of the invention, now proved to be practical beyond cavil or dispute." The form of telegraph now in use was substituted because of the economy of its construction, not more than two wires (sometimes only one) being required. Of course several persons claimed to have invented the telegraph before Professor Wheatstone. In the same month that the professor was working upon the Northwestern Railway, there was one in operation invented by Steinheil of Munich, but Wheatstone's patent had been taken out in the month before. An American named Morse claims to have invented it in 1833, but did not put it in operation till 1837. After this, his system was generally adopted in the United States. It is a *recording* one.

Mr. Brunel adopted Wheatstone's telegraph on the Great Western, and the wires at this time were not carried on posts, but placed in a tube under ground. But soon after a gentleman, at a meeting of the shareholders, said the whole was a "new fangled scheme," and actually got a resolution passed repudiating the agreement with the patentees. They were, however, graciously permitted to work the wires at their own expense. The tariff was one shilling per message; curiously enough, the very sum now charged since the wires in Great Britain have been transferred to the Government.

Sir M. I. Brunel and Professor Daniell thus speak of the relative positions of Messrs. Cooke and Wheatstone in the invention of the electric telegraph: "Whilst Mr. Cooke is entitled to stand alone, as the gentleman to whom this country is indebted for having practically introduced and carried out the electric telegraph, as a useful undertaking, promising to be a work of national importance—and Professor Wheatstone is acknowledged as the scientific man whose profound and successful researches had already prepared the public to receive it as a project capable of practical application—it is to the united labors of two gentlemen so well qualified for mutual assistance, that we must attribute the rapid progress which this important invention has made during the five years since they have been associated."

In 1840, Professor Wheatstone invented the revolving dial telegraph, working without any clock-work power: a magneto-electric machine supplies the place of a voltaic battery. In 1841, he invented the type printing telegraph. The American printing telegraph of House has much complicated mechanism, but does its work well; and messages are printed by it at the rate of fifty letters per minute in common Roman characters on long slips of paper. Bakewell's telegraph is of this kind, though, if possible, more ingenious. Formerly, an alarm used to be sounded by an electro magnet, to arouse the operator, but the cliking of the needle is found quite sufficient. When a message is sent between London and Edinburgh, all the needles of all the telegraph stations on the line are deflected at the same time: but a special signal is made to show for which station the message is intended. Dr. Winter mentions a somnolent station clerk, who, in order to enjoy a nap, trained his terrier to awake him at the clicking of the needles.

The new magnetic alphabet dial telegraph, invented by Wheatstone in 1858, and improved in 1860, was used by the Universal Private Telegraph Company, and by private individuals in great numbers.

VRIL AND GROUND

DENDRITIC CIRCUITRY

Discovery of the Earth Circuit.

In order not to interrupt the continuity of our description of Steinheil's beautiful apparatus, we have reserved for a special paragraph our notice of this most important discovery.

As we have seen in our second, third, fourth, and fifth chapters, the earth circuit was used, with few exceptions, in all experiments with static electricity. Its function, however, was either unsuspected or misunderstood.* Of all the telegraphic proposals based on static electricity, those of Bozolus, 1767, and of the anonymous Frenchman, 1782, are the only ones in which complete metallic circuits were proposed. Reusser, 1794, used one common return wire; while all the others employed the earth, Volta, Cavallo, and Salvá making distinct mention of their doing so.

The power of the earth to complete the circuit for dynamic electricity has also been known for a very long time. Thus, on the 27th of February, 1803, Aldini sent a current from a battery of eighty silver and zinc plates from the West Mole of Calais harbour to Fort Rouge through a wire supported on the masts of boats, and made it return through 200 feet of intervening water.†

Basse, of Hamel, made similar experiments, and

* As in Watson's experiments, described at pp. 111–13 of Priestley's *History of Electricity*, 1767.

† Aldini's *Account of late Improvements in Galvanism*, London, 1803, p. 218.

about the same time, on the frozen water of the ditch, or moat, surrounding that town. He suspended 500 feet of wire, on fir posts, at a height of six feet above the surface of the ice, then making two holes in the ice and dipping into them the ends of the wire, in the circuit of which were included a galvanic battery and a suitable electroscope, he found that the current circulated freely. Similar experiments were made in the Weser; then with two wells, 21 feet deep, and 200 feet apart; and, lastly, across a meadow 3000 feet wide. Whenever the ground was dry it was only necessary to wet it in order to feel a shock sent through an insulated wire from the distant battery. Erman, of Berlin, in 1803, and Sömmerring, of Munich, in 1811, performed like experiments, the one in the water of the Havel, and the other along the river Isar.*

All these are very early and very striking instances of the use of the earth circuit for dynamic electricity; but the most surprising and apposite instance of all has yet to be mentioned, in which the use of the earth is suggested precisely as we employ it to-day. In a letter signed "Corpusculum," and dated December 8, 1837, in the *Mechanics' Magazine*,* we read:—

"It seems many persons have formed designs for telegraphs. I, too, formed mine, and prepared a specification of it five years ago, and that included the plan of making one wire only serve for the returning wire for all the rest, as in Alexander's telegraph; *but even that might, I think, be dispensed with where a good discharging train, as gas, or water, pipes, at each end of the telegraph could be obtained.*"

In July 1838, or seven months after the publication of "Corpusculum's" letter, Steinheil made his *accidental* discovery in a way which we find thus related by De la Rive:†—

"Gauss having suggested the idea that the two rails of a railway might be employed as conductors for the electric telegraph, Steinheil, in 1838, tried the experiment on the railroad from Nüremburg to Fürth, but was unable to obtain an insulation of the rails sufficiently perfect for the current to reach from one station to the other. The great conductibility, with which he remarked that the earth was endowed, caused him to presume that it would be possible to employ it instead of the return wire. The trials that he made in order to prove the accuracy of this conclusion were followed

* Gilbert's *Ann. der Physik*, vol. xiv. pp. 26 and 385; and Hamel's *Historical Account*, &c., p. 17 of Cooke's reprint. Fechner, of Leipsic, after referring to Basse's and Erman's experiments in his *Lehrbuch des Galvanismus* (p. 268), goes on to explain the conductibility of the earth in accordance with Ohm's laws. As he immediately after alludes to the proposals for electric telegraphs, he has sometimes been credited with the knowledge of the fact that the earth could be used to complete the circuit in such cases. This, however, is not the fact, as we learn from a letter which Fechner addressed to Professor Zetzsche on the 19th February, 1872 (Zetzsche's *Geschichte der Elektrischen Telegraphie*, p. 19).

* For 1837, p. 219. The full text of this interesting letter will be found at p. 477, *infra*.

† *Treatise on Electricity*, London, 1853–58, vol. iii. p. 351.

by complete success; and he then introduced into electric telegraphy one of its greatest improvements."

In Steinheil's own account of this discovery, he begins by pointing out that Ampère required for his telegraphic proposal more than sixty line wires; that Sömmerring reduced the number to thirty or so; Cooke and Wheatstone to five; and Schilling, Gauss, and Morse to "one single wire running to the distant station and back."

He then goes on to say:—"One might imagine that this part of the arrangement could not be further simplified; such, however, is by no means the case. I have found that even the half of this length of wire may be dispensed with, and that, with certain precautions, its place is supplied by the ground itself. We know in theory that the conducting powers of the ground and of water are very small compared with that of the metals, especially copper. It seems, however, to have been previously overlooked that we have it within our reach to make a perfectly good conductor out of water, or any other of the so-called semi-conductors.

"All that is required is that the surface that its section presents should be as much greater than that of the metal as its conducting power is less. In that case the resistance offered by the semi-conductor will equal that of the perfect conductor; and as we can make conductors of the ground of any size we please, simply by adapting to the ends of the wires plates presenting a sufficient surface of contact, it is evident that we can diminish the resistance offered by the ground, or water, to any extent we like. We can indeed so reduce this resistance as to make it quite insensible when compared to that offered by a metallic wire, so that not only is half the wire circuit spared, but even the resistance that such a circuit would present is diminished by one half.

"The inquiry into the laws of dispersion according to which the ground, whose mass is unlimited, is acted upon by the passage of the galvanic current, appeared to be a subject replete with interest. The galvanic excitation cannot be confined to the portions of earth situated between the two ends of the wire; on the contrary, it cannot but extend itself indefinitely, and it, therefore, only depends on the law that obtains in this excitation of the ground, and the distance of the exciting terminations of the wire, *whether it is necessary or not to have any metallic communication at all for carrying on telegraphic intercourse.*

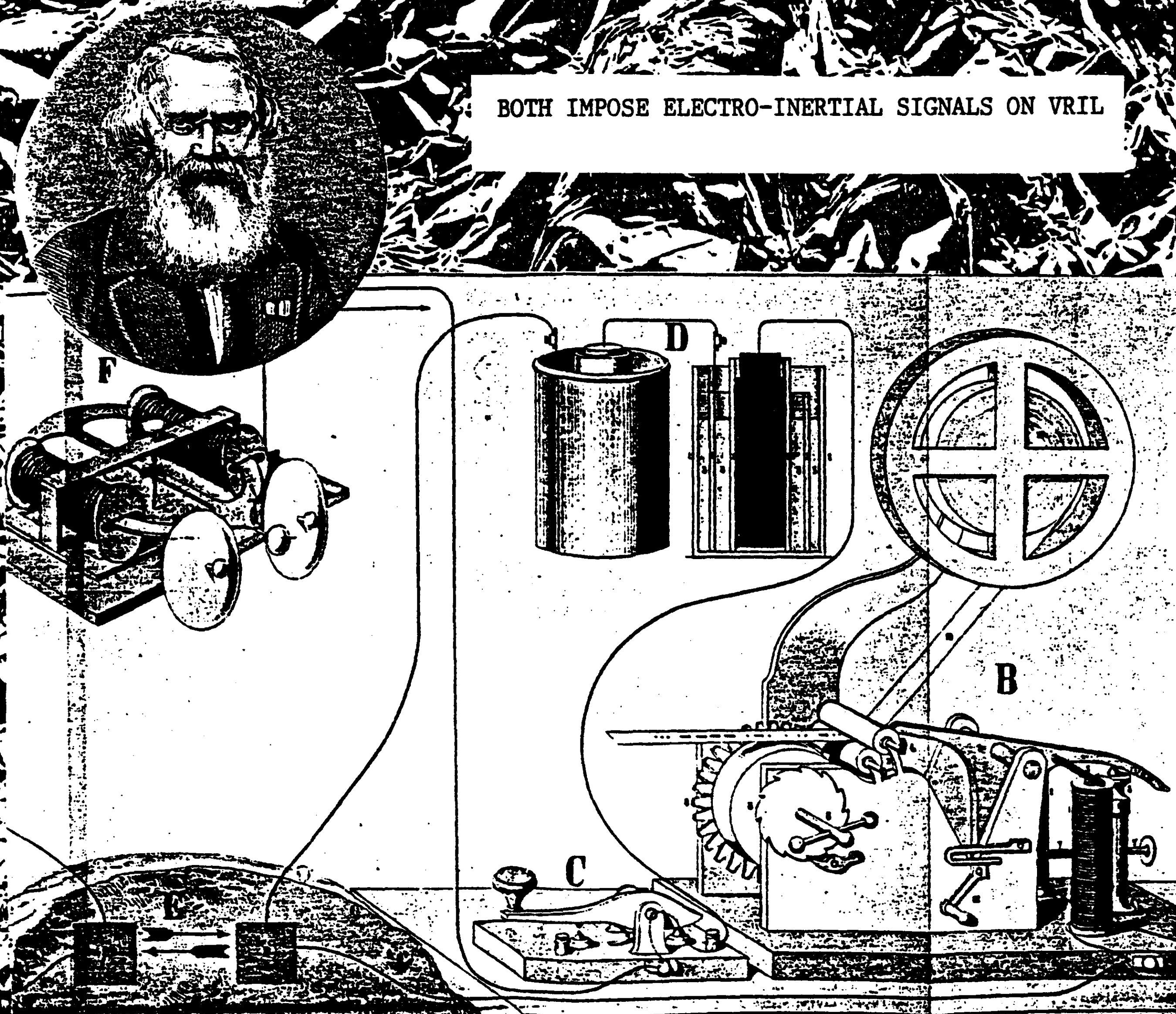
"An apparatus can, it is true, be constructed in which the inductor, having no other metallic connection with the multiplier than the excitation transmitted through the ground, shall produce galvanic currents in that multiplier sufficient to cause a visible deflection of the bar. This is a hitherto unobserved fact, and may be classed amongst the most extraordinary phenomena that science has revealed to us. It only holds good, however, for small distances; and it must be left to the future to decide whether we shall ever succeed in telegraphing at great distances without any metallic communication at all. My experiments prove that such a thing is possible up to distances of 50 feet. For greater distances we can only conceive it feasible by augmenting the power of the galvanic induction, or by appropriate multipliers constructed for the purpose, or, in conclusion, by increasing the surface of contact presented by the ends of the multipliers. At all events the phenomenon merits our best attention, and its influence will not perhaps be altogether overlooked in the theoretic views we may form with regard to galvanism itself." *

* Sturgeon's *Annals of Electricity*, vol. iii. pp. 450–2. Dr. O'Shaughnessy (afterwards Sir William O'S. Brooke), the organiser of the East Indian telegraphs, claims to have independently discovered the earth circuit, and points for evidence to his paper in the *Journal of the Asiatic Society of Bengal*, for September 1839, pp. 714–31. See his *Electric Telegraph in British India*, London, 1853, p. 21.

JOSEPH HENRY DEVELOPS
MAGNETO-ELECTRIC TELEGRAPHY

MORSE DEPLOYS A SYSTEM

BOTH IMPOSE ELECTRO-INERTIAL SIGNALS ON VRIL



Portrait of Samuel Morse and a diagram of his electrical telegraph system.

CONDUCTING POWER AND GALVANIC ACTION OF THE EARTH.

VRIL IN THE EARTH

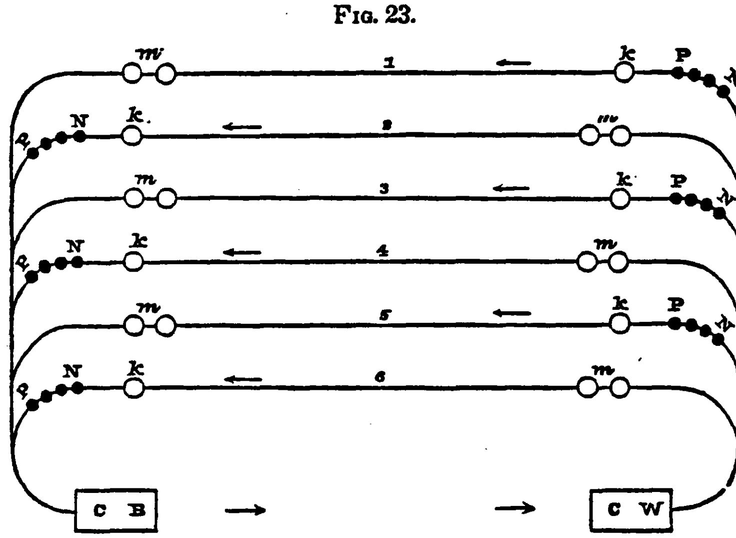
After the close of the session of Congress in the spring, 1844, a series of experiments were commenced by the request of Prof. Morse, under the direction of Mr. Vail, for the purpose of ascertaining what amount of battery was absolutely required for the practical operation of the telegraph. From the first commencement of its operations to the close of the session, so anxious were the public to witness its almost magic performances, that time could not be taken to put it in a state to test either the size of the battery required, or bring into use all the machinery of the register. On that account, but *one wire* was used during that period for transmitting and receiving intelligence, and the capabilities of the instrument were shown to some disadvantage; requiring the constant attendance of those having charge of the two termini.

The first experiment made was to ascertain the number of cups absolutely required for operating the telegraph. Eighty cups had been the number in use. Upon experiment, it was found, that two cups would operate the telegraph from Washington to Baltimore. This success was more than had been anticipated and urged on further experiments, which eventually proved that the earth itself furnished sufficient galvanic power to operate the electro magnet without the aid of a battery. In the first experiment, a copper plate was buried in the ground, and about three hundred yards from it, a zinc plate was also buried in the ground. To each of these plates a wire was soldered, and the ends brought into the telegraph office, and properly connected with the key and electro magnet of the register. The battery not being in connection. Upon manipulating at the key, it was found that the electro magnet was operated upon and the pen of the register recorded. This led to another experiment upon a more magnificent scale, and nothing less than that of using the copper plate at Washington, and the zinc plate at Baltimore, with the single wire, connecting those distant points, and the battery thrown out. Here, too, success followed the experiment, though with diminished effect. By the application of a more delicate apparatus, the *Electro Magnet** was operated upon, and the pen of the *registering instrument recorded* its success. From these experiments, the fact appears conclusive, that the ground can, through the agency of metallic plates, constantly generate the galvanic fluid.

* See Silliman's Journal, vol. 35, 1839, pages 253—267.

Six Independent Circuits, with six wires, each wire making an independent line of communication.

FIG. 23.



* Franklin appears to have been the first, or among the first, who used the ground as part of a conducting circuit in the performance of electrical experiments. Steinheil it appears was the first to use the ground as a conductor for magneto electricity. Bain, in 1840, was the first to use the ground as a source of electricity in conjunction with its conducting power, as a circuit

In the above figure, 23, let the right hand side represent Washington, and the left, Baltimore. The lines marked 1, 2, 3, 4, 5, and 6, between *m* and *k*, respectively, represent the six wires connecting (for example) Washington with Baltimore. Each cluster of black dots, P and N, represent the batteries of that line upon which it is placed. There are three batteries at W, and three at B; *m* 1, *m* 3, and *m* 5, represent the three magnets, or registers, and *k* 2, *k* 4, and *k* 6, the three keys, or correspondents, at Baltimore; *k* 1, *k* 3, and *k* 5, are the three keys, or correspondents, and *m* 2, *m* 4, and *m* 6, the three magnets, or registers, at Washington. C B is the copper plate at Baltimore, and C W, the copper plate at Washington, one at each terminus.

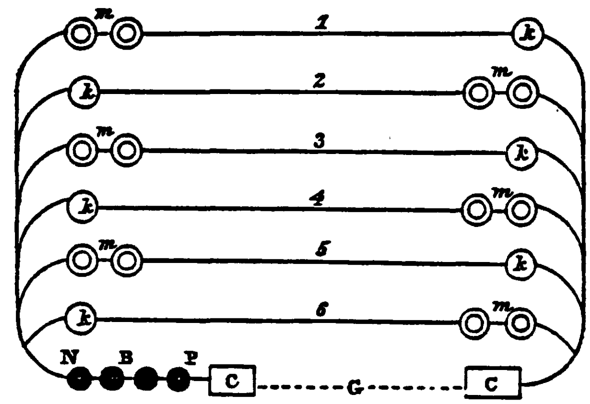
In order to operate the six lines, simultaneously, if required by the pressure of telegraphic communications, there must be three operators at each station, commanding their respective keys, and presiding at their respective registers. If the three operators at Washington choose to write in Baltimore, together, or in succession, on their respective registers at the latter place, the galvanic current of the three lines 1, 3, and 5, takes this direction. Commencing at the point, P, of the three batteries, 1, 3, and 5, at W, it passes to *k*, of the keys; thence along the wires to *m*, the magnets, 1, 3, and 5 at B; thence to the single wire, where the three currents join in one to C B, the copper plate; then through the ground to C W; the other copper plate; then up the single line to their respective batteries at the point, N, having each finished its circuit independently of each other.

If, in reply, the three operators at Baltimore wish to write upon their registers at Washington, either together, or in any succession, they may choose; the fluid leaves the point, P, of their respective batteries, at Baltimore, 2, 4, and 6; unite in the single wire to C B, the copper plate; then pass through the ground in the direction of the arrows to C W, copper plate at Washington, then along the single wire to their respective magnets, *m*, 2, 4, and 6; then along the extended wires to *k*, 2, 4, and 6 at Baltimore; and then to N pole of their respective batteries. In this manner six distinct circuits may be operated independently of each other, at the same time, or in any succession, with only one wire for each, and the ground in common, as a part of the circuit.

It is obvious from the above arrangement that if one wire only, extended between two distant points, will suffice to enable communications to be exchanged with each other; that any number of wires extended, will also, each, individually, give a distinct and separate line for telegraphic purposes, independently of all the other lines on the same route.

Prof. Morse, has since the establishment of the telegraphic line, used the ground as half the line, with perfect success, employing the battery; and Mr. Vail, in an experiment in 1844, succeeded in operating the electro magnet, with its amature attached to a lever, without any battery.

In figure 24, the same arrangement of wires is observed as respects their number, and the situation of the keys and magnets; but, with this difference,



that instead of six batteries, one for each wire, there is but one, which is placed upon the single wire, with which the six wires join. The battery is represented by four black dots, marked N B P. The course of the fluid in this case is from P to C, the copper plate on the left side; then through the ground to C, the copper plate on the right; then through the single wire to any of the six wires, which may be required, then to the single wire on the left side to N, of the battery. It is obvious that in this arrangement there is a division of the power of the battery, depending upon the number of circuits that may be closed at any one instant. For example: if circuit 1 is alone being used, then it is worked with the whole force of the battery If 1 and 2 are used at the same instant; each of them employ one-half the force of the battery. If 1, 2 and 3 are used, then each use one-third its power. If 1, 2, 3 and 4, then each circuit has one-fourth the power; if 1, 2, 3, 4 and 5 are used, at the same moment, then one-fifth is only appropriated to each circuit, and if 1, 2, 3, 4, 5 and 6, then each employ a sixth part of the galvanic fluid generated by the battery.

VRIL TRANSACTIONS AND RESONANCES

The Philosophy of the Earth Circuit.

It was at one time imagined that the earth completed the circuit precisely in the same manner as a return wire; this opinion is now considered incorrect. Gavarret explains the action thus:

"The poles of a battery, when disconnected, have equal and contrary tensions.

"When insulated conductors are placed in contact with them, they themselves become the poles of the battery, the battery having furnished a current sufficient to charge them, but not of *sufficient duration* to move a galvanometer needle.

"If the conductors are enlarged, the time occupied in charging them will increase, until, as they are still further enlarged, a limit will be reached at which the flow of electricity into them will last long enough to affect the galvanometer; and when the conductors become infinitely long or infinitely large, the time occupied in charging them also becomes infinite, or, in other words, the current will pass precisely as if the poles were connected.

"Thus, when the extremities of a circuit are connected to the earth, which is an infinitely large conductor, their respective tensions are diffused in all directions without producing any appreciable tension in the earth itself, so that the current will continue to flow.

"The earth acts as an ordinary conductor and opposes some resistance to this diffusion."

Another view is, that as whenever one kind of electricity is produced, an equal quantity of the opposite is also produced; and as both these tensions are ultimately transferred to the earth, its tension remains unaltered, the opposite tensions neutralizing one another through the earth's conductibility.

When a layer of soil placed in a box is compared with a similar layer forming part of the earth's surface, it is found that the isolated portion offers the greater resistance. Its resistance follows the same laws as that of any other substance, depending on its dryness or dampness, its nature, and its length and section.—*Culley's Handbook of Telegraphy.*

Galvanic Experiments.

To the Editor of the Scientific American.

The interesting electrical experiment, described on page 263 of the SCIENTIFIC AMERICAN, reminds me of a series of galvanic experiments of a similar nature, which I made many years ago. As they have never been published, it may be useful to have them recorded in your widely read paper.

The house I occupied in Holland, in 1840, was situated a short distance from a river, to which, at high tide, the salt ocean water had access; but in which, at low tide, the fresh displaced the salt water. When the first mention was made about burying the plates of the galvanic battery in the earth, in order to procure a constant action, I conceived the idea of throwing a copper and a zinc plate into the river, each connected with a proper wire; and having conducted these wires to my house, and connected them with the galvanometer, a constant current was obtained which beautifully fluctuated in intensity, according to the degree of saltness of the water, but never became zero. When the copper plate was immersed in a fresh water well in the rear of the house, while the zinc plate remained in the sea water, so as to have a battery with two liquids and a porous cup (the earth) between, the current was almost as strong as when both plates were immersed in sea water, notwithstanding the plates were now several hundred feet apart; this proved practically, to me, that the earth offers little or no resistance to electric currents, a fact well established since the introduction of the electric telegraph.

The most curious variation of the experiment, however, was when immersing two copper plates of equal size—one in the fresh well water, and the other in the ocean water; at high tide there was a strong current, as the salt water acted on the copper; at low tide there was no current at all, as both plates were in equal circumstances in fresh water. The degree of saltness of the river water was beautifully indicated by the deflection of the galvanometer, going from zero, for fresh water at low tide, to the maximum at high tide; by slow changes in the surface of the plates, however (principally in that exposed to the action of the salt water), the maximums did not correspond every day, as was to be expected.

This experiment gave rise to a series of interesting and instructive investigations on a smaller scale, which I can highly recommend to all who want to become acquainted with the electric action of different liquids on metals, and also of liquids on one another. All that is wanted is a sensitive galvanometer, and some plates of different metals.

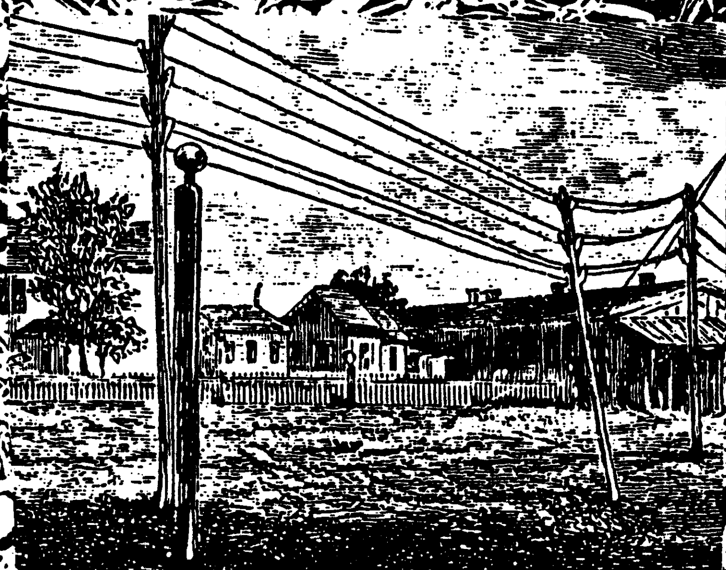
9.—M. Jamin also communicated two notes by M. Treve on electric currents. In one of these the author cited some further observations in support of his assertion that two currents cannot circulate in opposite directions in the same wire or in the same Geissler's tube; in the second he indicated a method of explaining the course of the currents in telegraphy when terrestrial communications are employed without a return wire. He maintained that the soil is to be regarded as a common reservoir rather than as a conductor.—A note by M. J. Mario on the phenomena of electrostatic induction was read. From his experiments he proposed a theory of terrestrial currents, according to which the sun would be a source of positive electricity acting by induction upon the earth.—A note by M. Neyreneuf, on the theory of electrical condensers, was also read.—

Ocean Telegraphy.

Telegraphy may, with propriety, be considered one of the branches of engineering, and is peculiarly of modern development. A clever writer says that it may be read by each of the five senses. On land lines each signal is made by suspending the flow of the electric current for two different intervals of time, called "dots and dashes,"—the use of which in different orders constitutes the alphabet of the telegraph. When they are printed they are read by sight, but ordinarily the operator reads them by sound, as easily as the musician reads the letters of the scale by the same sense. If the operator has no instrument he will grasp the wire in his hands and read the signals by feeling the intermissions of the flow of the electric current. In like manner, by placing the wire across his tongue, he can "taste" the same intermission (but this is a dangerous experiment). And it is said that the electricity can be made to dissolve a chemical and produce a pungent odor in the telegraphic alphabet, which can be read by "smelling," but for this I do not vouch. I believe that the method of signalling through the Atlantic cable is known in detail to but few persons. The operation is exactly reversed from that on the land lines.

"A NEW TELEGRAPHIC invention has been exhibited in London. The model consists simply of a trough filled with water, on each side of which are two copper plates, the plates on the one side being connected with a common electric battery; and it is found that, without any wire, the electricity passes through the water and makes signals on the other side, in the ordinary manner—the theory being that the copper plates guide the electric current in the circuit."

[We copy the above from our venerable neighbor, the New York *Sun*. What a nice idea it would be, if we could only send our messages through the briny deep without the aid of ocean cables, simply using water, as the conducting medium! This great discovery has, however, not even the merit of novelty to recommend it. To our certain knowledge it is thirty years old, and we know not how much older. The idea is impracticable.



PHYSICS

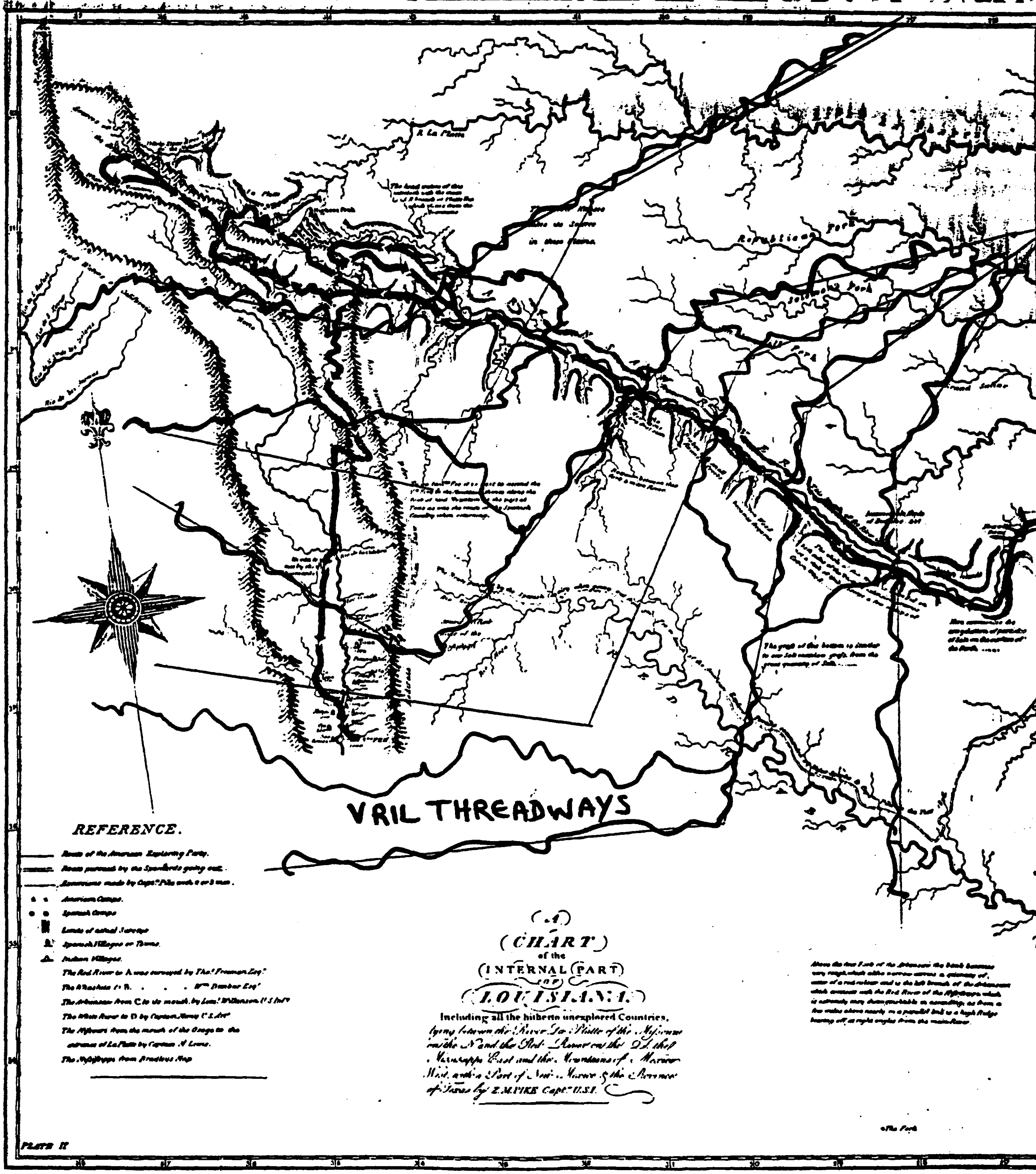
On a Quantitative Method of Testing a "Telegraph Earth," by W. E. Ayrton*

THE method used up to the present time for testing a telegraph earth has been *qualitative* only. As, however, the electrical condition of every "earth" is of great practical importance, it is necessary that some accurate *quantitative* method should be devised, in order that every telegraph office may ascertain whether the resistance of their earth is higher or lower than the maximum resistance allowed. The principal difficulty met with is that, if the resistance between two earths be measured successively with positive and negative currents, the same result is not obtained. Consequently the ordinary law for a Wheatstone's Bridge, or Differential Galvanometer, would not hold true. This difficulty, however, has been overcome in this paper, and formulæ are developed suitable for a Wheatstone's Bridge, a Differential Galvanometer, or a Galvanometer of which the law of the deflections is known.

The details of some experiments are also given, and a particular instance is mentioned in which a much better "earth" was obtained by burying the plate in the upper stratum of soil than by burying it much deeper, on account of a bed of sandstone that existed at about fifteen feet below the surface.

Kennedy Electric Clock.

An exhibition of this clock, to gentlemen of the press, was made on Wednesday, at the rooms of the company in this city. The clock is impelled by the motion of the pendulum, and is of extremely simple construction. The pendulum ball contains a permanent magnet, which is alternately repelled by oblong helices placed on either side of it at a proper distance. The helices connect with a zinc and carbon earth battery, and the circuit is alternately broken by a commutator attached to the pendulum rod, which is of rosewood, baked, and saturated with paraffine. The clock will run without winding, or any other attention, after the primary adjustments are made. It is said that its regularity and accuracy are superior to clocks of any other construction. We may, at some future time, give a more extended description of this invention.

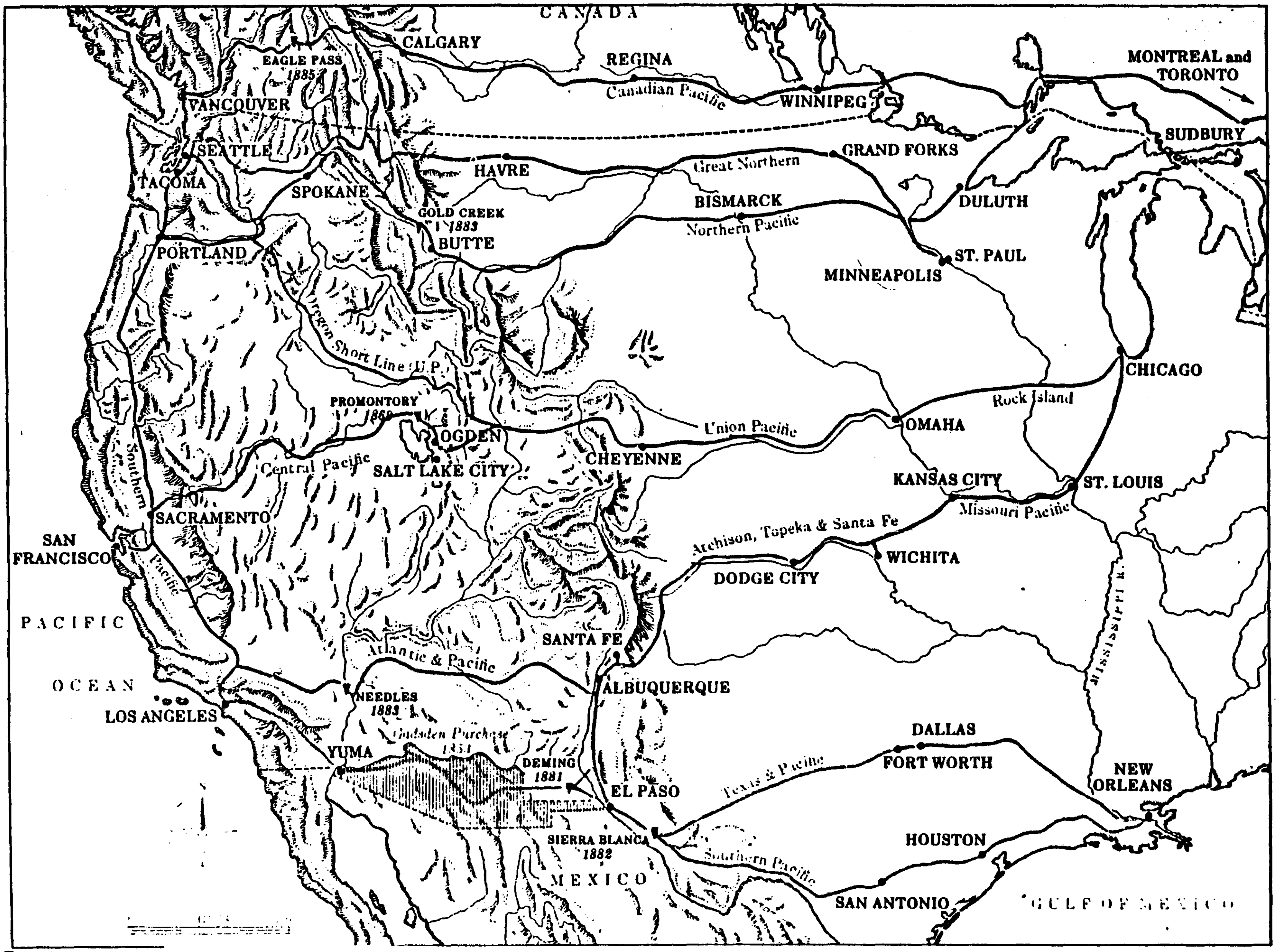


NATURAL DISTRIBUTIONS OF VRIL THREADWAYS ARE ILLUSTRATED

NUMEROUS KINDS OF DEPICTIONS

GRANT SENSITIVE VRIL DEFINITIONS AND DISCERNIBLE ROUTINGS

OF DEEP AERIAL, SURFACE, AND DEEP GROUND VRIL DISTRIBUTIONS



RAILS AND LINES FOLLOWED RIVERS, RIDGES, INDIAN TRAILS, AND FOREST RILLES

PASSAGE WAS BLASTED IN MOUNTAIN ROCK

VRIL VIOLATIONS OF EVERY KIND WAS PERMITTED

VRIL WIRELESS WAS REVEALED BEFORE THE PROJECT WAS ARROGANTLY COMPLETED

THE ROAD OF IRON FOLLOWED NATURAL VRIL CAUSEWAYS...
EIDETIC ENERGIES WERE GUIDED ALONG BOTH RAILS AND LINES

TELEGRAPHIC DISPATCH CENTERS WERE NOUMENOUS SITES FLOODED WITH CONSTANT SOCIAL

SOCIAL TRANSACTIONS OF THE VERY HIGHEST TENSION

DESIRES POURING FORTH MANAGED TO TRANSACT WITH DISTANT RELATIVES AND FRIENDS

ALL IN HOPES, DREAMS, AND EARNEST WELL-EXPECTATIONS

THE TELEGRAPHIC STATION WAS A NEW SOCIAL CENTRE OF SPECIAL AND SINGULAR TRANSCENDENCE

JOSEPH HENRY PRE-DATES SAMUEL MORSE

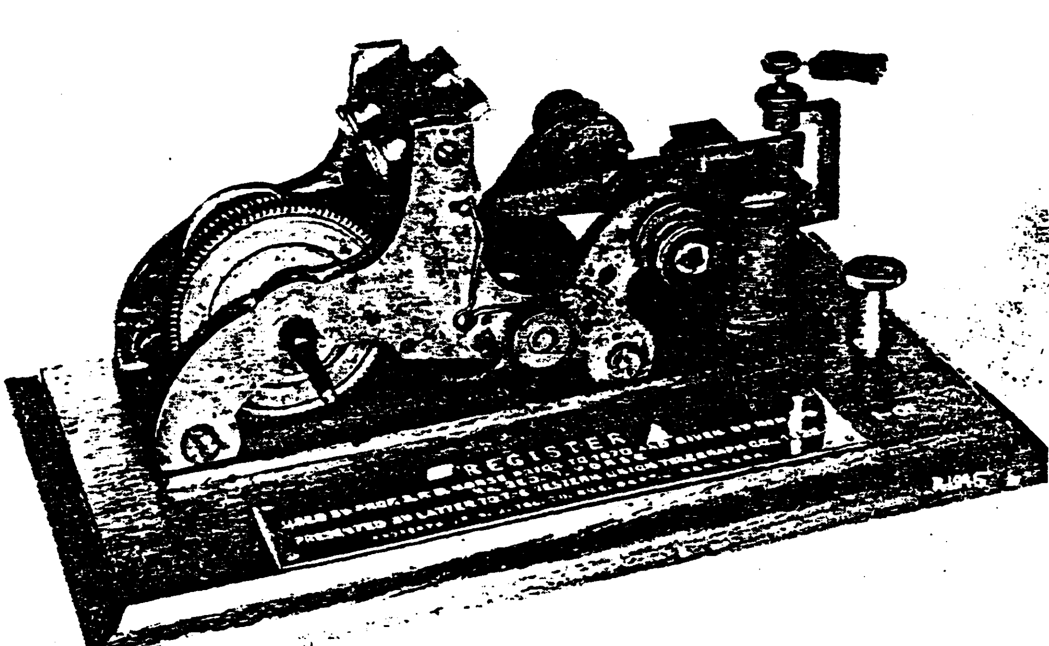
BOTH NEEDLESSLY EMPLOYED ARTIFICIAL MEANS FOR THE EXCHANGE OF MESSAGE

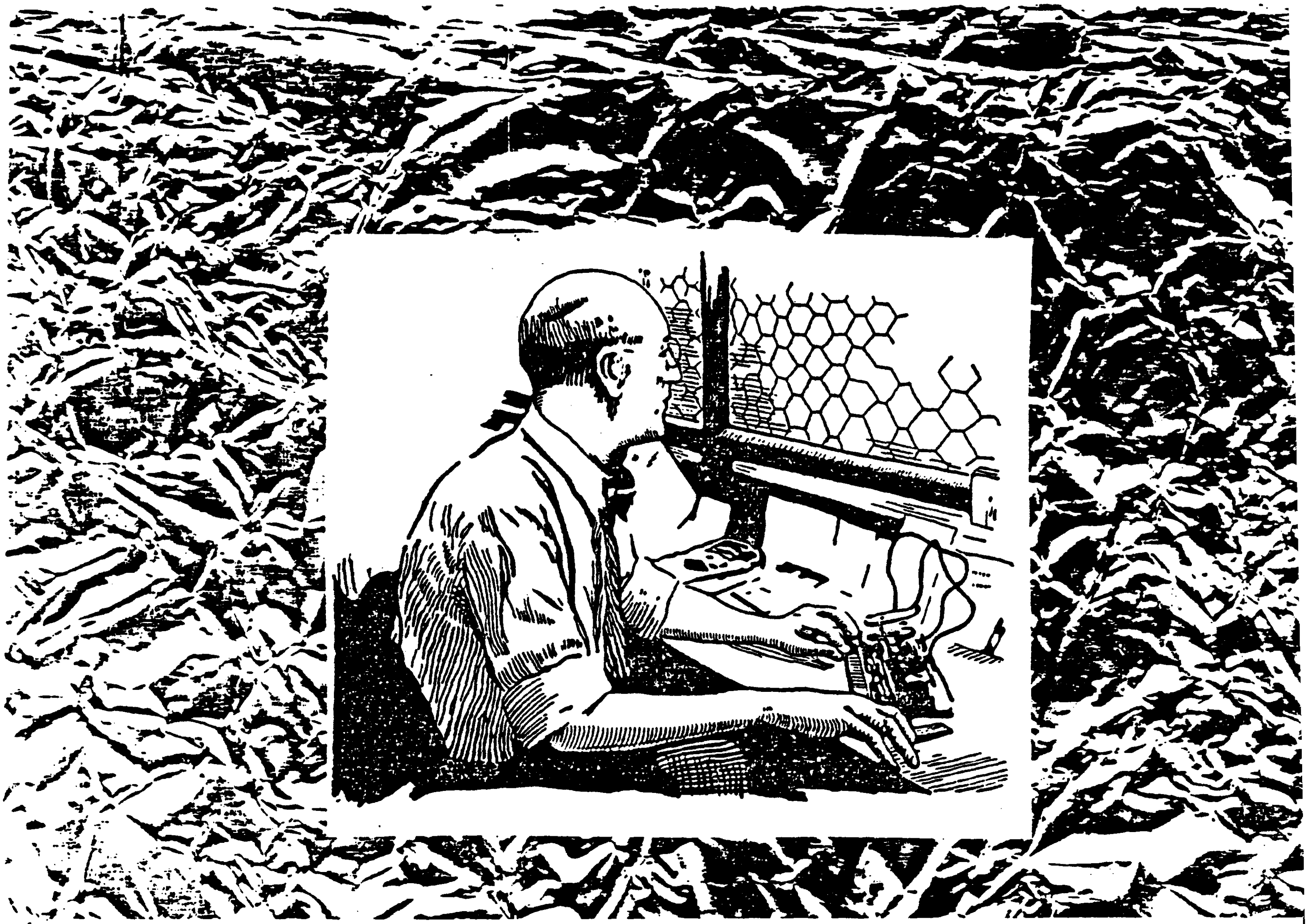
NATIVE EIDETIC PHENOMENA REMAIN THE UNRECOGNIZED COMMUNAL POTENTIAL

Courtesy Western Union Tel. Co.

SENDING THE FIRST PUBLIC TELEGRAPH MESSAGE

Telegraph instrument used by Samuel F.B. Morse prior to 1870



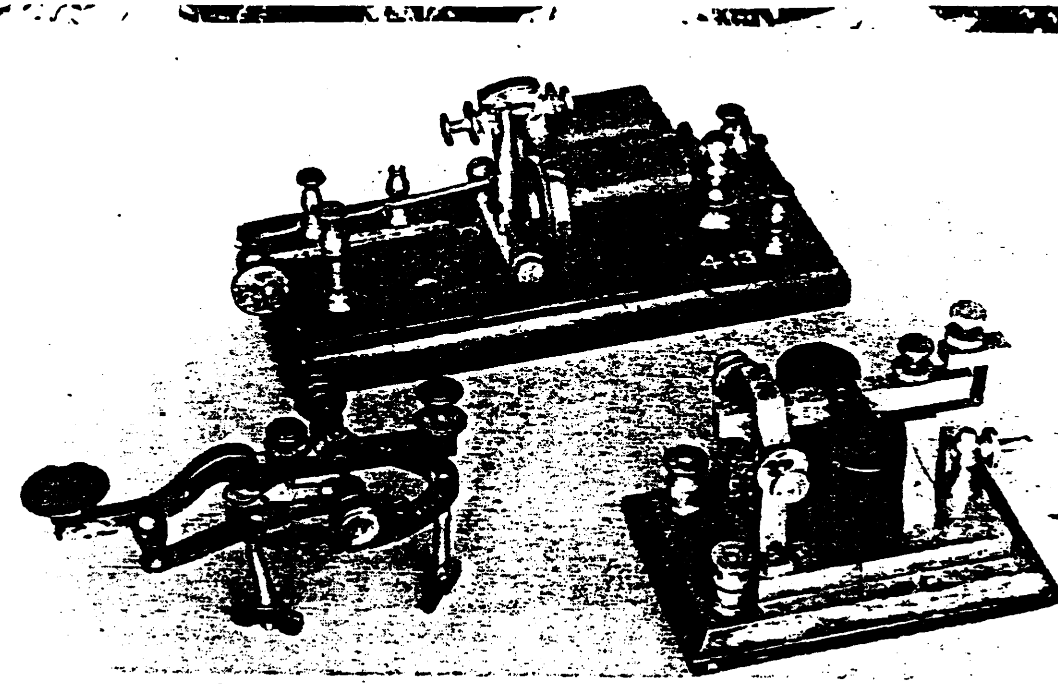


THE EIDETIC TRANSACTION WITH INCOMING SIGNALS IS A TRANSCENDENT PROCESS
TELEGRAPH OPERATORS EXPERIENCED THE EIDETIC POTENTIALS PROJECTED INTO THEM
FROM DISTANT STATIONS...
EXPERIENTIAL TRANSACTION WITH DISTAL SURROUNDINGS GAVE EXCEPTIONAL CLARITY
WHEN VRIL REQUIREMENTS WERE BEST MET ALONG THE LINE

THE REVERIE OF THE RECIPIENT WAS TOTALLY ENMESHED IN THE EIDETIC AURA
TRANSACTED THROUGH IRON LINES AND MAGNETIC RECEIVING BLOCKS
CODE MERGED WITH MESSAGE IN A SYNAESTHESIAL EXPERIENCE OF UNEQUALLED STRENGTH

THE TELEGRAPH OPERATOR TENDED THE ARTIFICIAL FIRES OF BATTERIES NOT REALIZING THE SOURCE OF MEANINGS TRANSACTED THROUGH THE LINES... THE TELEGRAPHIC RECEIVING BLOCK IN THIS DEPICTION REVEALS A COLLIMATED VRIL ORIENTATION WHICH WOULD NECESSARILY BE HORIZONTAL AND RIGHTWARD BEAMING

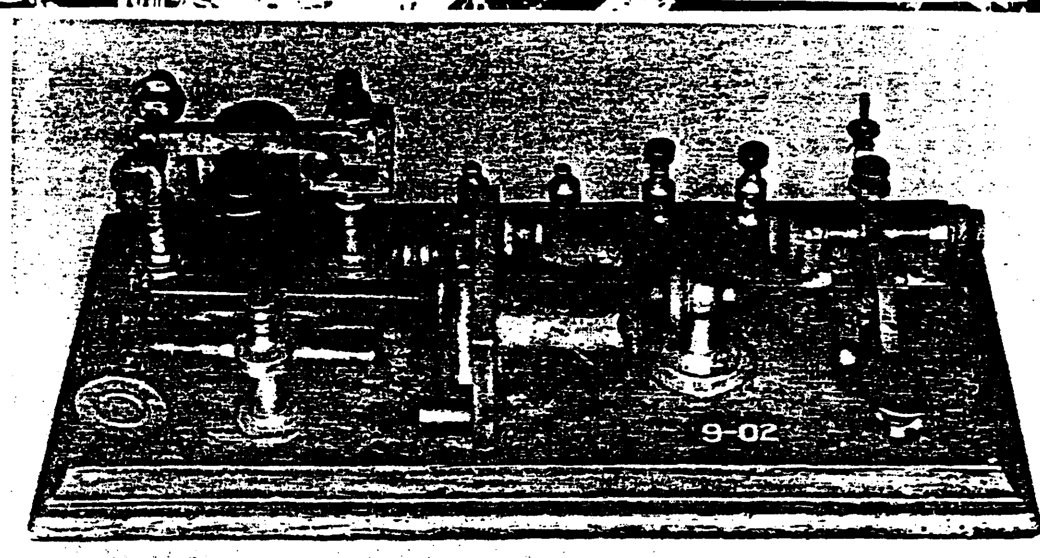
TELEGRAPHIC RECEIVING BLOCKS ARE INTENSIFIERS AND PROJECTORS OF VRIL THREADS



Morse telegraph sending and receiving instruments of 1870

VRIL COLLIMATED BEAMS EMERGE FROM COIL TOPS

HUMAN CONTACT WITH THE TELEGRAPHIC KEY
GAVE INSTANT EIDETIC EXPERIENCE



Morse key and sounder used around 1880

EXPERIMENTAL REPLICATIONS HAVE REVEALED SUCH EIDETIC TRANSACTIONS
AS POWERFUL AND SINGULAR

SENSITIVE OPERATORS INCLUDED MANY WOMEN AMONG THE TELEGRAPHIC RANKS

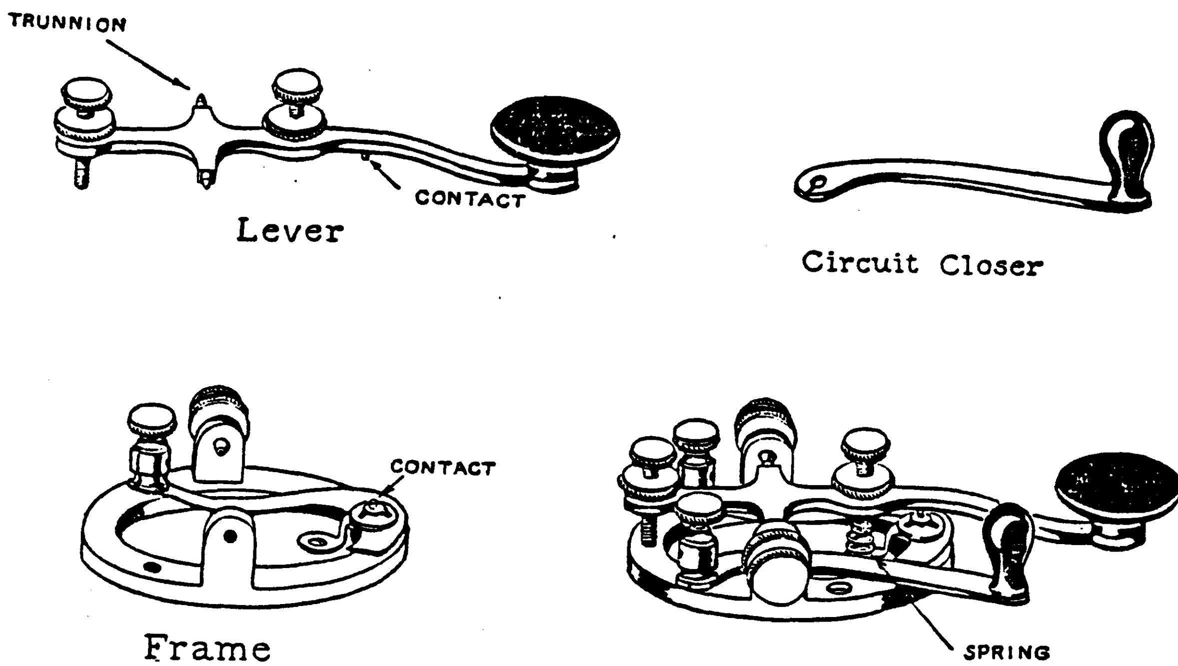
IT WAS SAID THAT TELEGRAPHERS WERE POSSESSED OF SUCH RARE AND DELICATE SENSITIVITY THAT THE PERSONALITY, GENDER, AND MOOD OF A COMMUNICANT COULD COULD EASILY BE COMPREHENDED.

EXAMINATION OF TELEGRAPHIC SIGNALLING DEVICES REVEALS THESE EMPATHIC SENSITIVITIES TO BE ENTIRELY ANOMALOUS FROM THE ELECTRICAL VIEWPOINT: TELEGRAPHIC SIGNALLING APPARATUS IS NOT TOUCH-SENSITIVE AT ALL. TOUCH SENSITIVITY DUE TO RESISTIVE EFFECTS ARE ELIMINATED BY PERIODIC CLEANSING OF CONTACT TERMINALS AND PLATES...THE SENSE BY WHICH GENDER, MOOD, AND IDENTITY IS MADE KNOWN IS A VISCERO-EIDETIC ONE SUPPLIED VIA VRIL.

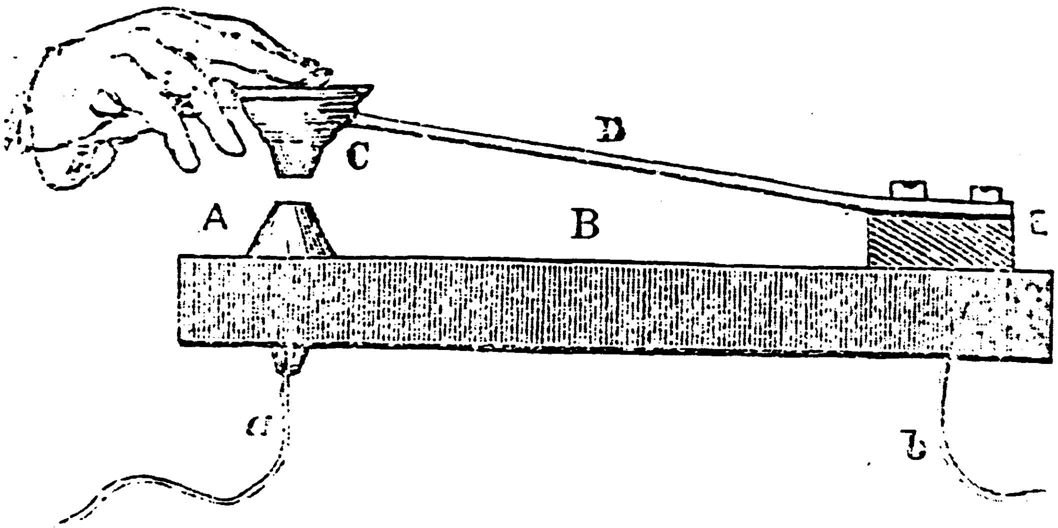
TELEGRAPHIC TRANSACTION OCCURS AT TELEGRAPHIC KEYS...

TELEGRAPHIC KEYS ARE AURIC TRANSACTORS...

THE ELECTRIC TELEGRAPH



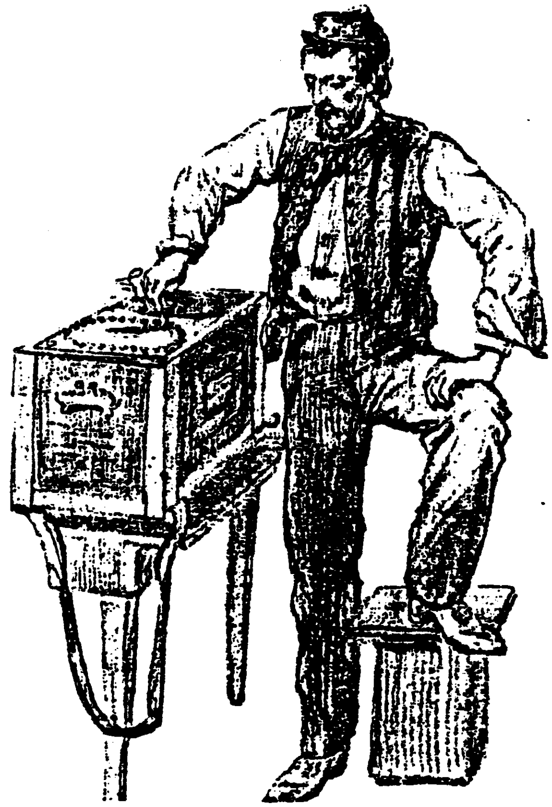
THE STANDARD MORSE TELEGRAPH KEY



THE STRIATIONS OF THE HUMAN AURA ARE THE VRIL TERMINII WHICH PROJECT THROUGH THE BODY INTO OBJECTS OF CONTACT.

IT IS BY SUCH TRANSACTION THAT WE SENSE AND EXPERIENCE...

TELEGRAPHIC KEYS PRODUCE EIDETIC EXPERIENTIAL TRANSACTION THROUGH THEIR MATERIAL COMPOSITION AND SYMMETRIC DISPOSITION



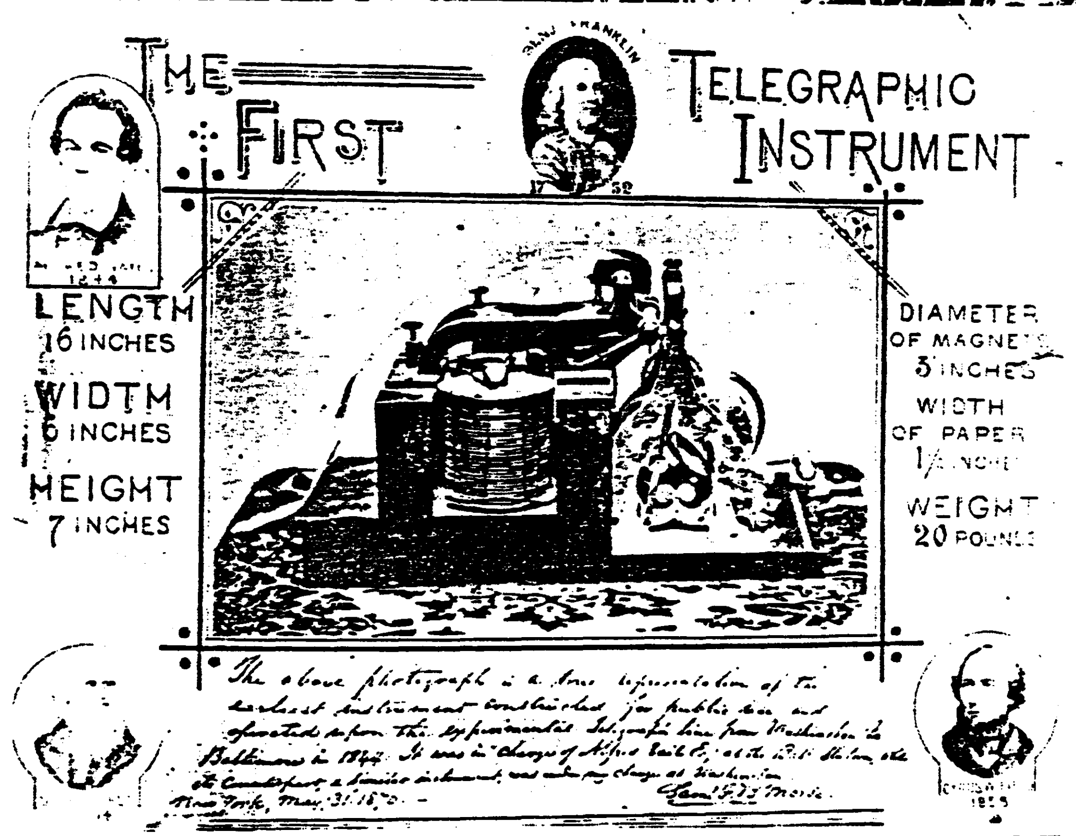
A Union telegrapher sends a message on a machine used by operators who did not know code. When they dialed a letter, a machine at the other end registered the same selection. A rising businessman named Andrew Carnegie helped organize the army telegraphers. Some 40 years later, millionaire Carnegie pensioned more than 100 Civil War telegraphers or their widows.

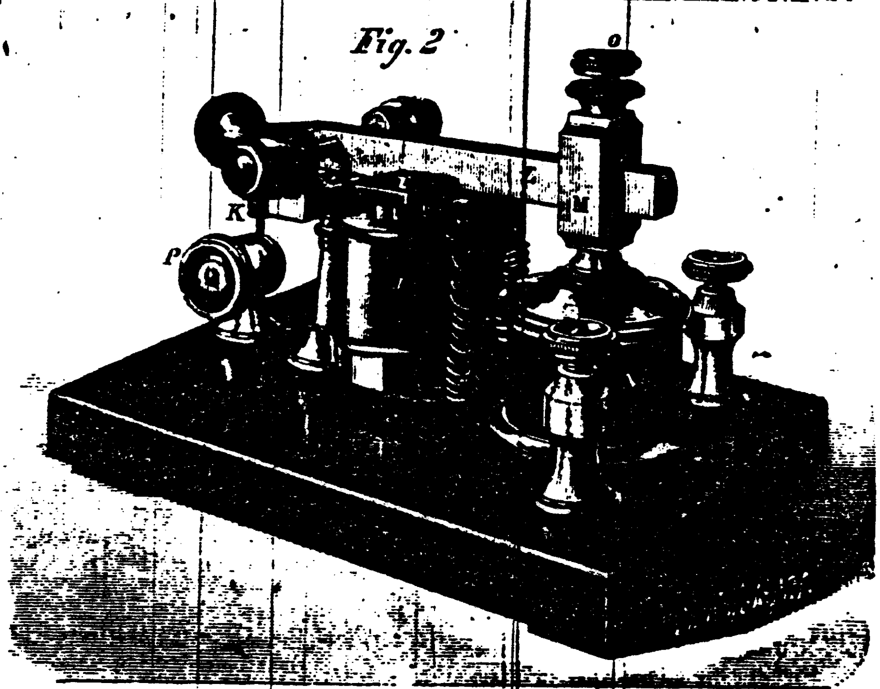
PROJECTED BEAMS OF VRIL THREADS ARE VISCERAL
IN PRIMARY INFLUENCE...
OPERATORS ARE DRAWN INTO THE TRANSACTION VIA PHYSICAL CONTACT.
CONTACT WITH THE HARD RUBBER KEY IS HIGHLY TRANSACTIVE
AURIC STRIATIONS (ORGANISMIC VRIL THREADS)
TRANSMERGE WITH SYSTEM-CONDUCTED VRIL TO RELEASE
EIDETIC IMAGERY AND EXPERIENTIAL BILOCATIONS

TELEGRAPHIC SOUNDERS ARE VRIL PROJECTORS

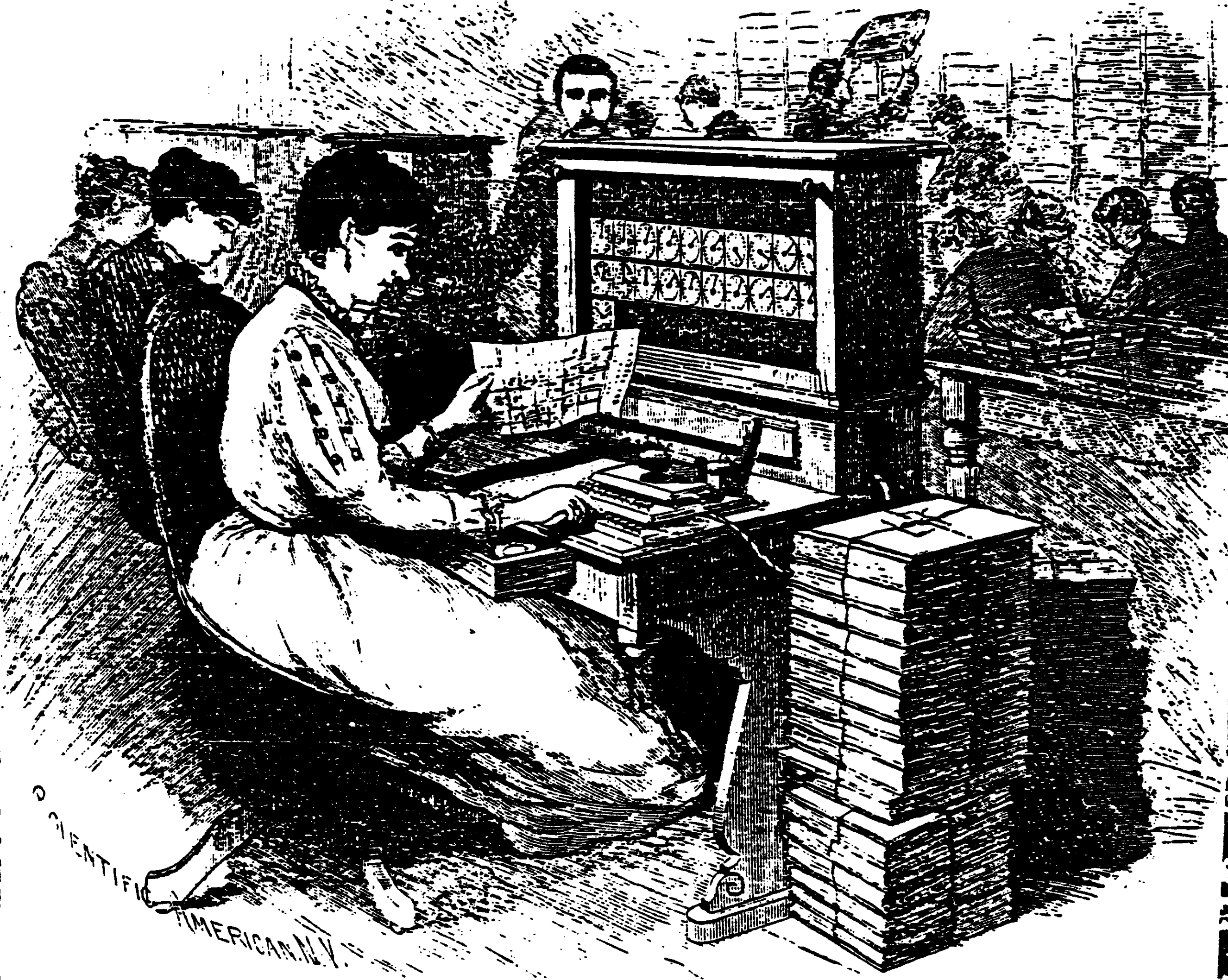
IRON CORE AND FINE COPPER COILS ARE INTENSE VRIL TRANSACTORS:

COLLIMATED VRIL THREAD BEAMS EMERGE FROM IRON CORES

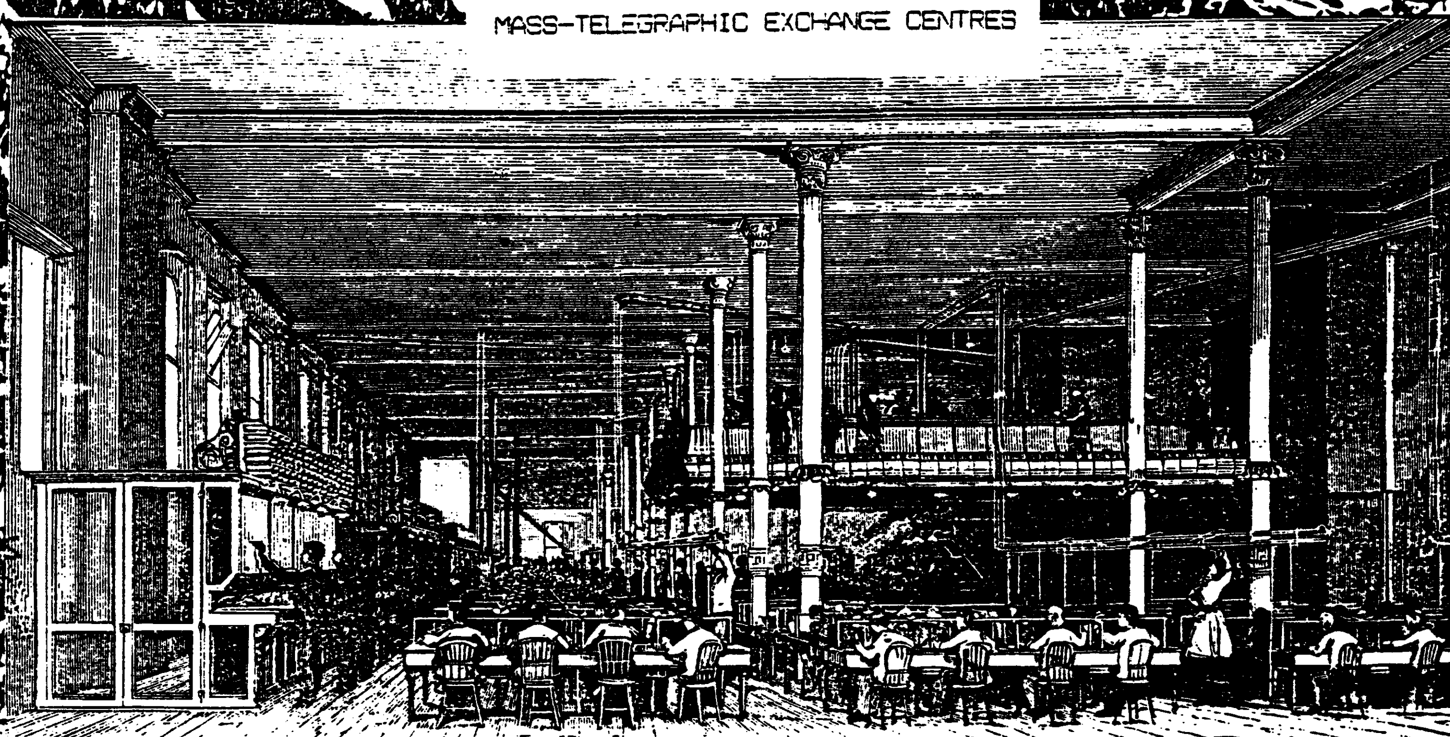


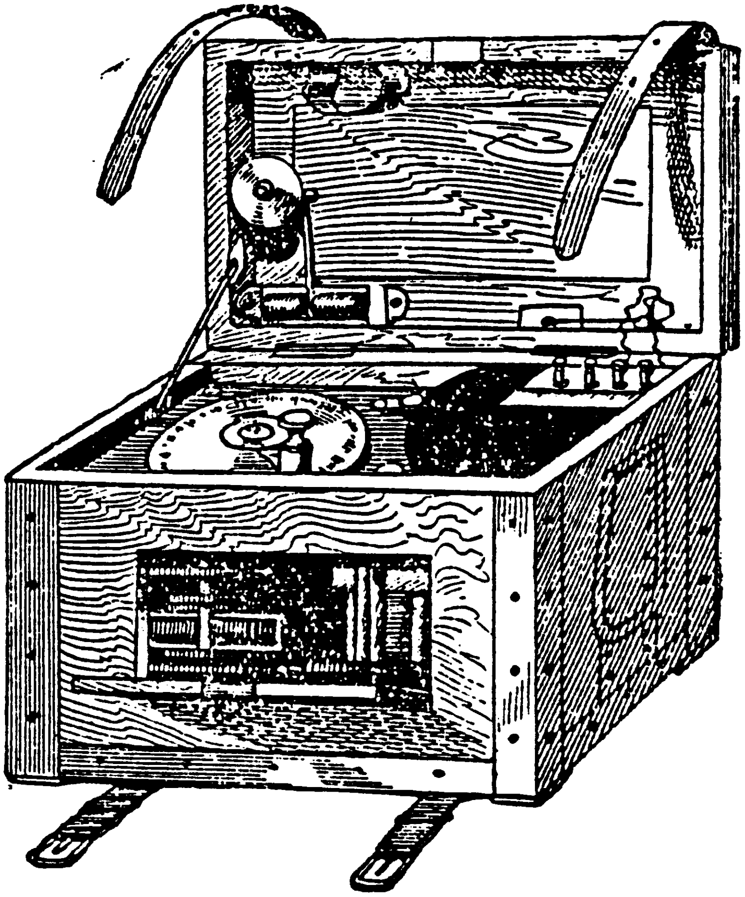


DAVIS' SOUNDING INSTRUMENT.



MASS-TELEGRAPHIC EXCHANGE CENTRES





Civil War U.S. Magneto Electric Signal Telegraph

PORTABLE UNITS WERE OFTEN PLACED ON THE GROUND DIRECTLY

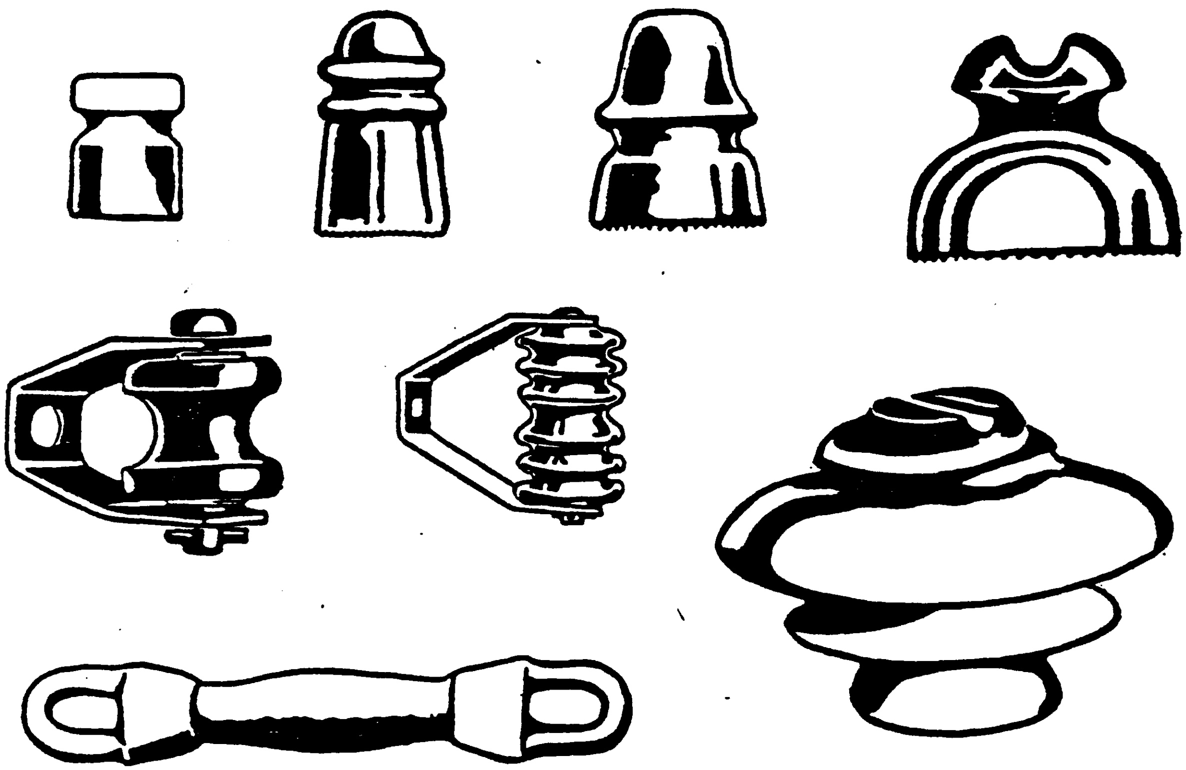
LINE CONNECTIONS GAVE VRIL IN DEGREE OF GROUND CONNECTION AND LINE ORIENTATION

OPERATORS ALIGNMENT IS RARELY MENTIONED

WHILE OPERATORS OF DISTANT STATIONS ASSUMED FAVORITE OPERATIONAL POISE

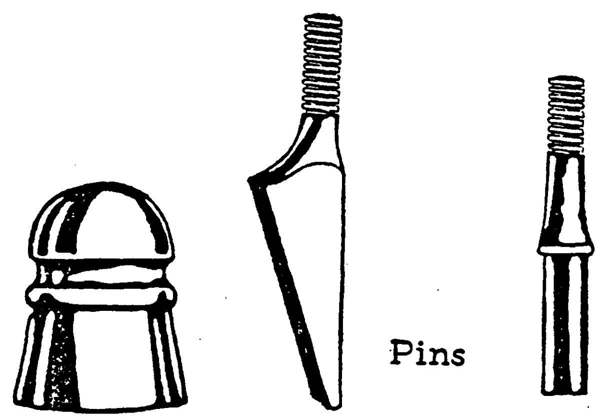
DISTANT VIEWS AND MEANINGS ARE BEST RECEIVED WHEN FACING SPECIFIC DIRECTION

IRON AND FERRUGINOUS MATTER DISSOLVES INERTIAL SPACE SPONTANEOUSLY
IRON-RICH GLAZES AND OTHER METALLIC DEPOSITS
PERMIT EXCEPTIONAL EIDETIC COLLIMATIONS WHICH
SURMOUNT VRIL-DENSIFIED POLES AND TOWERS.



INSULATORS

Here are some of the many forms of insulators used to support wires so the current will not leak.



INSULATOR AND PINS

Telegraph and telephone wires are insulated from the poles by glass insulators which screw on wooden pins.

FERRUGINOUS AND CARBONACEOUS CHARGED CERAMICS

SURMOUNT TELEGRAPHIC AND TELEPHONIC POLES

EIDETIC TRANSACTIVITIES IN METALLIC GLAZES IS STRONG AND METAL-SPECIFIC

GLASS INSULATORS BRING A SPECIAL EIDETIC POWER TO A SYSTEM

INSULATORS FUNCTION AS VRIL THREAD-BEAM TERMINALS

TERMINALS EITHER ENDRAW OR PROJECT VRIL THREAD-BEAMS THROUGH SPACE

When the apprentice was judged to be able to fend for himself, barely, he might be sent to "solo" as a night operator in a small station that had little traffic. Much as he tried to hide his inexperience, often he had to signal "bk . . . bk"—break, break—and ask the sender to repeat words he had missed. Embarrassing as this was, it was better than trying to guess at the missing words and filling in wrong ones.

In the early days of the telegraph, before commercial distribution of electricity was common, tending the batteries that generated power for the line was one of the telegrapher's duties. The Western Union handbook of rules for operators issued in 1860 gave instructions on how to take care of the battery:

> Clean jar, set copper in jar, spreading it as wide as jar will admit. Fill the pocket with pulverized vitriol and hang on the edge of the jar where the copper is open. Having filled porous cup with soft or rain water, sufficiently full as not to overflow when the zincs are inserted, put the zinc into the porous cup, having first placed the cup inside the copper. Pour soft water slowly through the vitriol in the pocket, filling up with the pulverized vitriol as it is reduced by the flow of water. No vitriol should be allowed to be dropped into either the jar or the porous cup.

Once he mastered the mysteries of the battery, the operator would start work on the wire.

TELEGRAPHIC LORE FLOODED THE TRADE JOURNALS OF THE DAY
EMPIRICALLY RECEIVED EXPERIENCES IN AND ABOUT THE TELEGRAPHIC STATION
WAS ALWAYS ACCEPTABLE EVIDENCE OF MYSTERIOUS NATIVE ACTIVITIES
REGULAR ANECDOTES ARE EXTANT OF BOTH VISCERAL, EIDETIC,
AND INERTIO-DETRITAL ANOMALIES

During heavy lightning storms operators were instructed to cut off the main telegraph wires from their instruments as a safety precaution. Many placed insulators under the legs of their tables for the same reason.

The noise seemed like a jungle of sound. It did not to the telegrapher, however. His ears were trained so delicately that he could pick out the tone of his particular instrument. Some operators placed an empty tobacco tin behind the sounder on the table, to give the incoming dots and dashes a distinctive pitch. For many years the telegraphed messages that kept the business of America running bounced off the stout frock-coated figure of Prince Albert on the front of a thousand bright red tobacco cans.

Although operators at opposite ends of a telegraph circuit could converse only through dots and dashes, they became well acquainted in this manner. Each operator had his own sign, usually one or two initials, with which he ended his messages to show who transmitted them. Q might never meet CG, with whom he worked a wire, or even know his full name, but they felt that they knew each other. A skilled operator had a personal touch on the sending key with delicate variations in his dot and dash strokes. His work could be recognized by other veterans along the wire even before he sent his signature sign. The flow of the telegrapher's code had nuances similar to those of the human voice. During gaps between commercial messages the operators chatted—told jokes in Morse code, exchanged personal opinions and gossip. Despite company rules requiring use of gentlemanly language at all times, operators sometimes dropped in a few swear words.

Not all operators were men. In the days when few women held jobs anywhere else, feminine telegraphers were seen frequently. Having proved their skill at sending and receiving, women often took their places at the telegraphers' tables, even on the railroads. Usually an experienced operator could tell when a woman was sending, by her light touch.

ANOMALOUS REPORTS EXIST OF "TOUCH SENSITIVITY"

DIFFERENTIATIONS AMONG SIGNALS ARE NOT UNITARY

COMMUNICATIONS SYSTEMS DEPEND ON THE COMPOSITION OF CODE...

AND MEANINGFUL TRANSACTION

COMMUNICATIONS IS A COMPOSED EXPERIENTIAL PROJECTION

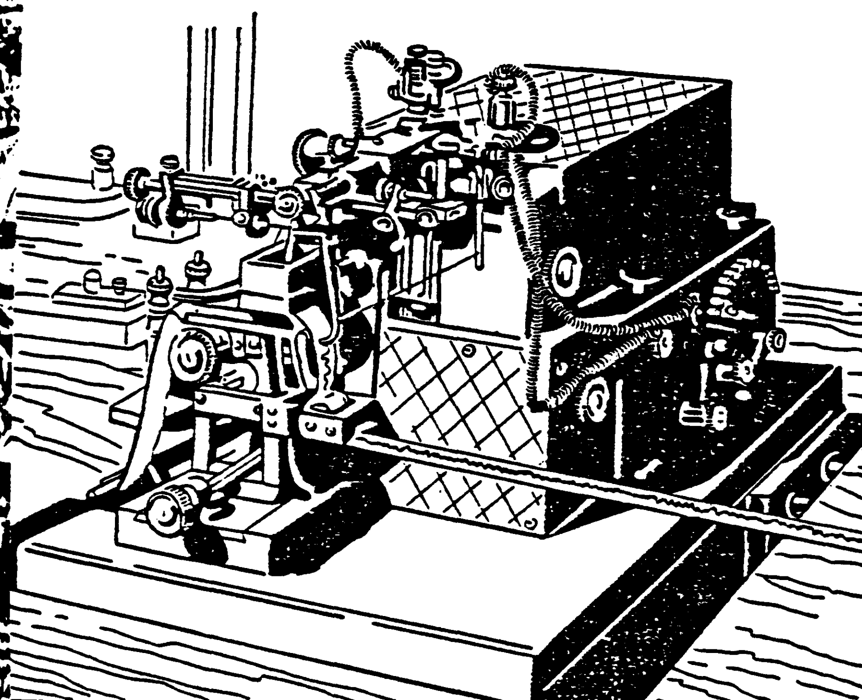
IN SEVERAL INSTANCES OF DISTORTION CODE AND MEANINGFUL MESSAGE SPLIT APART

CERTAIN TELEGRAPHIC RECEIVING BLOCKS PROVIDED LOUD BUT "UNCLEAR" SIGNALS

ORGANISMIC TRANSACTIVITY WITH MEANINGFUL COMPONENTS REQUIRE SPECIFIC POSITION

SIPHON-RECORDER

This machine prints the messages sent over ocean cables upon a paper tape. The message appears as a wavy line.



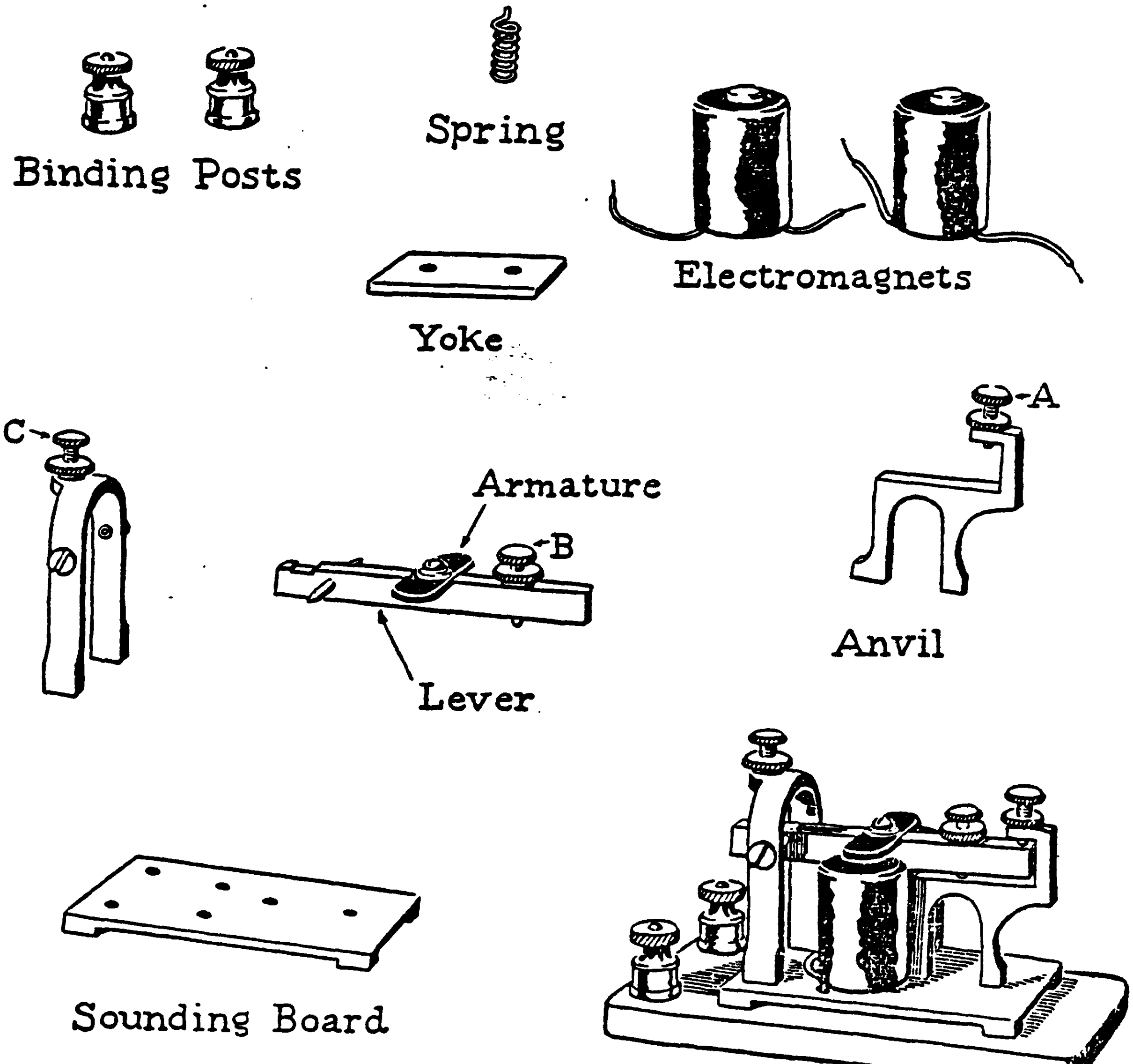
SPONTANEOUS AND UNEXPECTED TELEGRAPHIC REGISTRATIONS

WERE RECEIVED WITH REGULARITY IN LINES

THE MYSTERIOUS LANGUAGE OF THE GROUND CAUSED MUCH SURPRISE AMONG TELEGRAPHERS

WHO OFTEN ATTEMPTED DECIPHERING THE UNKNOWN TONGUE

A MORSE TELEGRAPH SOUNDER AND ITS PARTS



VRIL FUNCTIONS OF COMPONENTRY MAY BE DISTINCTLY EXPERIENCED IN ABSENCE OF ARTIFICIALLY APPLIED IMPULSES...

SIDE-TO-SIDE SOUNDERS COULD HAVE BEEN THE PREFERRED SYMMETRY THROUGHOUT THE DEVELOPMENTAL HISTORY OF THESE DESIGNS.

THE INTUITIVE CONFORMABILITY WITH VRIL SYMMETRY REQUIREMENTS MADE EVERY TELEGRAPHIC COMPONENT A VRIL-ACTIVE ONE

SECTION

3

VRIL LINKAGE

FRANKLIN'S RESULTS.—**Benjamin Franklin**, a citizen of America, connected two wires, one to either coating of a Leyden Jar, their free ends being separated only by the space of about one inch. Between these wires he suspended by a silk thread a pith ball which oscillated from one wire to the other until the jar had lost all its electricity. In 1752, during a thunderstorm, he flew a silk kite on a wet string, insulated at its lower end by a short length of silk ribbon, and by drawing sparks from the string to a metal key which he held in his hand, established the identity between lightning and electricity, and as a result suggested the erection of lightning conductors. Many books have been written on the work of **Cavendish, Joule, Coulomb, Galvani, Volta, Ampère, Ohm, Faraday**, and a host of others, whose brilliant researches have made Electricity the servant of man, and have paved the way to Radio-telegraphy.

THE EARTH RETURN.—In 1838 Professor **C. A. Steinheil**, of Munich (4 to 4d and 5), carried out a test in line telegraphy between Nuremberg and Fürth, endeavouring to use the railway lines in the place of properly insulated telegraph wires. This proved a failure, but it led to a most important discovery. Rightly attributing his non-success to leakage of electricity through the earth between the rails, the idea occurred to him that as the earth appeared to be so good a conductor of electricity it might possibly be employed in place of the return wire, which had been used up to that time. This experiment was tried and proved entirely successful, and it is undoubtedly one of the most important contributions towards successful telegraphy. He also invented a telegraph alphabet, which, like that of **Morse**, was made up of two elementary signals in different combinations.

The first diagram in Fig. 3 represents the old double line telegraph, as employed before 1838. B is the battery, K the key at the sending end to make and break contact, G a galvanometer, or other needle instrument, used to record the signals at the receiving end of the lines. The second diagram in Fig. 3 represents **Steinheil's** discovery of the earth return, and the third diagram is a water analogy, in which the water represents the free electrons in the earth. The pump represents the battery, a length of pipe represents the telegraph line, and a water wheel the receiving instrument. When the pump is turned on water is drawn from the ocean at the pump end of the pipe, and after passing along the tube falls over the

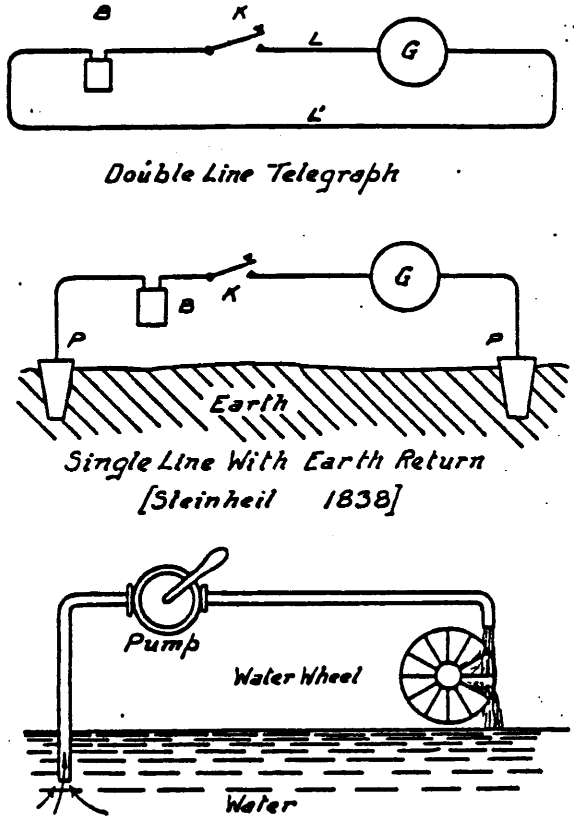


FIG. 3. Illustrating the evolution of the earth return, with a water-wheel analogy.

After the discovery of the earth return **Steinheil** continued his experiments and endeavoured to trace out the area covered by the current as it returned through the earth. He succeeded in detecting weak currents, which he picked up in another circuit having no metallic connection with the transmitting circuit. The following are a couple of quotations from his own account of these experiments. (5) "For distances up to 50ft. I have found the possibility of such electric communication by experiment. For greater distances we can only conceive it possible by augmenting the power," etc., etc. (then follow a number of technical details); "it only holds good, however, for small distances, and we must leave it to the future to decide whether it will ever be possible to telegraph to great distances entirely without metallic connections."

MORSE, 1842.—**S. F. B. Morse** (4a, 4b, and 9), Superintendent of Telegraphs to U.S.A. Government, when giving a demonstration of line-telegraphy at the request of the American Institute of New York, between Governor's Island and Castle Garden, a distance of one mile, had the demonstration entirely spoiled owing to a vessel weighing its anchor and in so doing cutting his submerged cables. Owing to this accident the idea occurred to him that possibly water itself might be employed to carry the electricity across the river without any metallic conductors.

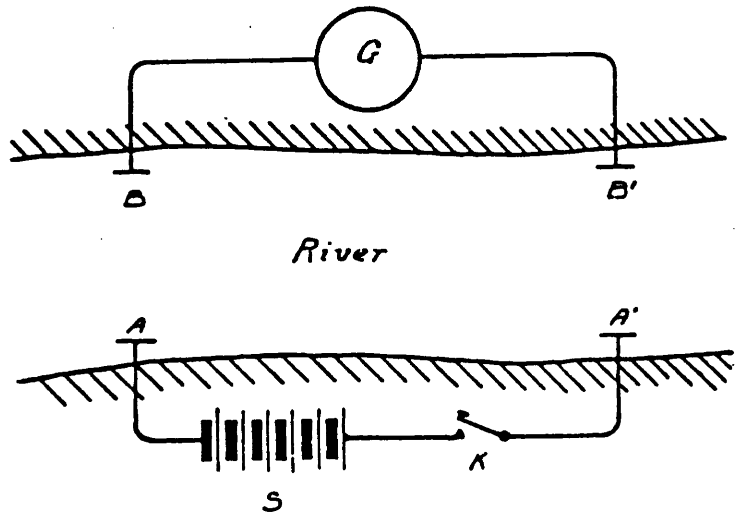


FIG. 4. Illustrating Morse's original system of telegraphing across a river.

During the same year, on December 16th, 1842, he successfully transmitted current across a canal at Washington, the distance bridged being 80ft. Fig. 4 shows the method he adopted. On each side of the canal he had insulated line wires, to the ends of which were connected large copper plates A, A^1, B, B^1, submerged in the canal. On the transmitting side he had a battery S, and Morse key K (of his own invention), and on the receiving side he placed a galvanometer in series with the insulated line. He conducted a series of tests, placing the plates on each bank of the canal at different distances apart up and down stream, and found that, provided the plates were separated by a distance greater than the width of the canal, a reading could be obtained on the galvanometer. In 1845, working in conjunction with **Vail** and **Rogers** (his assistants), he succeeded by the same method in signalling across the Susquehanna River at Havre-de-Grace, a distance of almost one mile. (6)

A very full and interesting account of the life and work of Morse is given in a two-volume book written by his son, **E. L. Morse**, 1914, entitled "Samuel F. B. Morse, his letters and journals," in which it is claimed that he was the original inventor of the Electro-Magnetic Telegraph (7, 93, 4). It is interesting to note that during the first 30 years of his life Morse devoted himself to art. In 1813 he exhibited a picture in the Royal Academy. He devoted himself to the study of electricity after attending a course of lectures on Electricity and Magnetism by **Professor Dana**, at the New York Athenæum, in 1826. Having heard that **Benjamin Franklin** had experimented and shown that "electricity passes instantaneously over any known length of wire," Morse foresaw that it might be used for signalling to great distances, and before he had invented his telegraph he devised, almost by inspiration, his "Morse alphabet," which, with slight variations, is in universal use at the present day for telegraphy and radio-telegraphy. Another interesting fact, and one not very well known, is that whilst in Paris in 1838 he met **Daguerre**, who explained to him how far he had succeeded in perfecting the daguerrotype process, and in America he shares with **Professor Draper** the honour of being the first to photograph living persons.

In Great Britain, in 1845, **Wm. F. Cook** and **Chas. Wheatstone** carried out similar experiments to those shown in Fig. 4, using an instrument designed by **Wilkins**, which was a forerunner of **Lord Kelvin's** Siphon Recorder. Wheatstone, it will be remembered, was responsible for laying the first Channel cable to France in 1850 (the same year in which the first trans-Atlantic cable was laid). He also patented a needle telegraph, and there is some doubt as to whether this was not prior to that of Morse.

LINDSAY'S EXPERIMENTS.—In 1843 **James Bowman Lindsay** carried out a series of experiments very similar to those of

Morse, across the river Tay where it was three-quarters of a mile wide, and his greatest achievement was a distance of two miles—from Dundee to Woodhaven. A few facts concerning this remarkable man and his other achievements may be of interest. He was born in 1799 at Carmylie, where he learned weaving. Being exceedingly poor, he educated himself as best he could, attending St. Andrews University as a student and working at his trade during the college recesses. He worked hard and he worked alone, often almost on the border of starvation, and could only afford to rent one room. He predicted the universal adoption of electricity for lighting, heating, and power. In 1829 he was lecturer on mathematics at the Watt Institution. His poverty can be better realised when we know that he gladly accepted the appointment of teacher in Dundee prison in 1841, at a salary of £50. In 1858, on the recommendation of the Queen, he was granted a pension of £100 per annum. His death was very sad. His rooms (for now that he was in receipt of a pension he had two), in a flat near the harbour, contained piles of books from floor to ceiling. On the table, when the hand of death arrested him, lay his great work, "A Dictionary of 50 Languages," in neatly written manuscript, but unfinished. It was already a volume of ponderous bulk, the pages of which he had ruled most carefully, and methodically spaced to allow of the equivalent of each word being written in many languages. "Very pathetic was the testimony borne by that book to the old man's ambition to leave something monumental behind him, and the manner in which his hand had been stopped in the midst of his labours" (Kerr's Book, *loc. cit.* 9).

It is very different with electricity; it must not only travel to Edinburgh, but it must come back to London—otherwise nothing can be recorded at Edinburgh; so that the communication must be as complete between Edinburgh and London, although the latter only is to send messages, as between London and Edinburgh.

The explanation of this peculiarity, if we avoid the niceties of electrical theory, may be said to be found in the fact, that no electricity leaves the battery till its terminal zinc and copper plates are *connected* by a wire or other electrical conductor. It is not as if one wire were sufficient at least to carry the electricity from London to Edinburgh. Our electrical messenger is like a government courier—who does not start till he is satisfied that there are relays of horses to make certain his homeward, as well as his outward journey. If there be not a return-wire, or equivalent arrangement, the electricity never sets off from London! or, rather, there is in truth no electricity to set off in any direction, till the zinc and copper at that starting place are connected. Till a communication is effected between them, the battery is equivalent only to a loaded gun. The completion of the connection is like the fall of the trigger which fires the charge. In a moment the battery discharges its electricity, which, with inconceivable rapidity, passes, by the shortest route it can find, from the copper plate, at the one end of the battery, to the zinc plate at the other. No shorter route, however, is provided for it than the insulated wires, so that in the case supposed, although the plates to be connected are only a few inches apart, the electricity which leaves one of them must travel from London to Edinburgh and back again before it can arrive at the other! Our newest telegraph in this respect is like Noah's most ancient one.

Lindsay's connection with electric telegraphy forms a very interesting episode. We have seen that from about the year 1830 he was familiar with telegraphic projects, and that he made them the subject of illustration in his classes. At this date electric telegraphs were distinctly in the air, but, like electric lighting, they had hardly advanced beyond the laboratory stage.[1] Lindsay does not appear to have carried them much further for several years, for it was not until 1843 that he conceived the bold idea of a submarine telegraph to America by means of a naked wire and earth-batteries, "after having proved the possibility by a series of experiments."

It is true that at this time the earth-battery was known. It was first proposed by Kemp, of Edinburgh, in 1828; Prof. Gauss in 1838 suggested its employment for telegraphic purposes, and Steinheil, acting on the suggestion, actually used it with some success on the Munich-Nanhofen Railway, twenty-two miles long; and Bain in October 1842 employed it for working clocks. Similarly, the idea of signalling with uninsulated wire and without any wire at all was not new, for, as we have seen, the possibility of doing so was in a manner forced on the notice of Steinheil in 1838 and on Morse in 1842, but Lindsay was certainly the first to combine the two principles in his daring proposal of an Atlantic telegraph; and this, be it remembered, at a time when electric telegraphy was still a young and struggling industry, and when submarine telegraphy was yet a dream.

[1] See also the 'Mechanics' Magazine,' vol. xiii., First Series, p. 182.

MYSTERY OF THE VRIL GROUND ACTIVITY

DENDRITIC RETURN CIRCUITRY AND THE MODULATION OF INTENDED MEANINGS

(631) *Electro-Magnetic Telegraphs.*—The idea of employing Electricity as an agent to effect communication between distant places, is of no recent date; for almost as soon as it became known that conducting wires had the power of transmitting Electricity instantaneously to the distances of several miles, the idea occurred to several Electricians, that correspondence between distant parties might be accomplished by electric action. In 1748,* Dr. Watson, Bishop of Llandaff, with several other philosophers, made experiments at Shooter's Hill, which showed that Electrical discharges from a Leyden jar could be propagated through a distance of upwards of four miles, without any appreciable loss of time, although a considerable portion of the circuit was formed of land and water. The success of these experiments appears to have given rise to the first ideas of forming electric telegraphs, by means of which, distant parties might hold correspondence. From the time that Dr. Watson made his experiments at Shooter's Hill, there have been many contrivances for applying electric agency to telegraphic communication. Before 1750, *Winkler*, at *Leipsic*, discharged Leyden jars through very long circuits, in some of which a river formed a part, *Le Monnier*, at *Paris*, produced shocks through 12,789 feet of wire:—and it is said that *Betancourt*, at *Madrid*, discharged electric jars through a distance of 26 miles.

(632) In 1816, Mr. Ronalds, of Hammersmith, invented and constructed an electric telegraph, which he worked by a single circuit, through eight miles of wire, in the presence of several scientific men; and in 1823 he published a work,† in which he very fully described his telegraph, in both letter press and plates, together with several other Electrical instruments of his invention. Mr. Ronalds employed *clocks* to work his telegraph; a revolving disc was fixed upon the seconds' *arbor*, the signals being engraved upon it in divisions, from its centre to the circumference, each division being in size and shape similar to an opening in a *fixed* plate, behind which it revolved, so that only one division or signal could be seen at one time. An ingenious application of the voltaic battery to telegraphic purposes was made by M. Sommering:—a series of gold pins were arranged for the decomposition of water, and by touching a key, any of them could be brought into play, and thus signals could be communicated.

(633) In the year 1819, the famous discovery of electro-magnetism was made by Oersted, and since that time, nearly all the telegraphs

* See Sturgeon's Annals of Electricity, vol. v. p. 299.

† See a reference to it in the last Edition of the Encyclopædia Britannica, p. 582.

that have been brought before the public are based on the deflection of the magnetic needle by the voltaic current. It was Ampère who first suggested this application, and Mr. Alexander, of Edinburgh, who first took advantage of the suggestion. His telegraph* consisted of thirty-one wires, for the purpose of showing the alphabet in full, with stops, &c., in all thirty signals, which were shown upon a distant dial. A voltaic battery was provided, and a series of troughs of mercury to which were attached keys, to be pressed down by the finger of the operator, by which the voltaic circuit was completed; thirty magnetic needles, each carrying a screen which concealed a letter, were fixed on the dial, and each needle had its corresponding key. When no Electricity was passing, these screens remained stationary over the several letters, and consequently concealed them from view; but when the current was made to flow, by the depression of a key, the corresponding needle in the distant instrument was deflected, carrying the screen with it, and uncovering the letter, which became exposed to view. For this telegraph, a caveat for Great Britain and Ireland was lodged by Mr. Alexander, in April, 1837.

(634) In the same year, a public exhibition of an electric recording register Telegraph, in which deflected needles and pencils recorded signals, was made in America, by Mr. Morse; it is described in Silliman's Journal of Science, for October, 1837, and also in Franklin's Journal. In November of the same year, Mr. Davy exhibited a telegraph at Exeter Hall, which attracted considerable attention. In this apparatus, the signals appeared as luminous characters within a dark aperture: and in July of the following year, the same individual took out a patent for improvements in apparatus for making telegraphic communications or signals, by means of electric currents.†

(635) The first patent of Messrs. Wheatstone and Cooke, "for improvements in giving signals and sounding alarms at distant places, by means of electric currents, transmitted through metallic circuits," was sealed on the 12th of June, 1837. The telegraph here patented they call their *needle telegraph;* it is thus described by Mr. Wheatstone, in his examination before the Parliamentary Committee on Railways.—"Upon a dial are arranged five magnetic needles in a vertical position; twenty letters of the alphabet are marked upon the face of the dial, and the various letters are indicated by the mutual conveyance of two needles, when they are caused to move. These magnetic needles are acted upon by Electrical currents passing through coils of wire placed immediately behind them.

It is stated in Young's Travels in France, (1787, 4th ed. vol. 1, p. 79,) that a Mr. Lomond had invented a mode by which, from his own room, he held communication with a person in a neighbouring chamber, by means of electricity. He employed the common electrical machine placed at one station, and at the other an electrometer constructed with pith balls. These instruments were connected by means of two wires stretched from one apartment to the other; so that, at each discharge of the Leyden phial, the pith balls would recede from each other, until they came in contact with the return wire. His system of telegraphic correspondence is not related. We must suppose from the character of his invention, having but one movement, that of the divergence of the balls, and using an apparatus extremely delicate, that his means of communication could not have been otherwise than limited, and required a great amount of time.

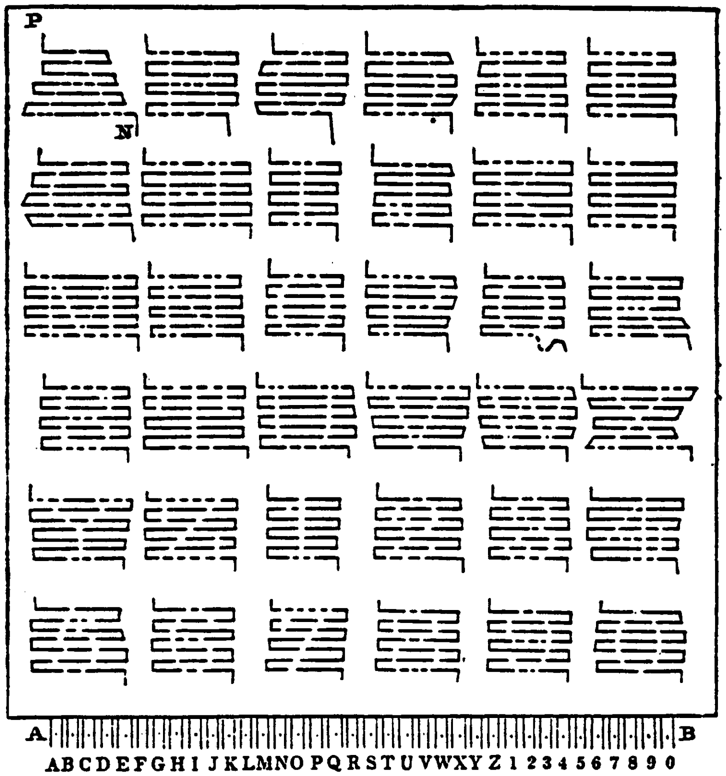
The only mode in which it appears possible for him to have transmitted intelligence, seems to be this: a single divergence of the pith balls, succeeded by an interval of two or three seconds, may have represented A. Two divergencies in quick succession, with an interval following, may have represented B; three divergencies, in like manner, indicated the letter C; and so on for the remainder of the alphabet. Instead of these movements of the pith balls representing letters, they may have indicated the numerals 1, 2, 3, &c. so that with a vocabulary of words, numbered, conducted his correspondence. This appears to be the first electrical telegraph of which we have any account; but does not appear to have been used upon extended lines.

Reizen's Electric Spark Telegraph.

In 1794, according to Voigt's Magazine, vol. 9, p. 1, Reizen made use of the electric spark for telegraphic purposes. His plan was based upon the phenomenon which is observed when the electric fluid of a common machine is interrupted in its circuit by breaks in the wire, exhibiting at the interrupted portions of the circuit a *bright spark*. The spark thus rendered visible in its passage he appears to have employed in this manner.

Figure 34 is a representation of the table upon which were arranged the letters of the alphabet, twenty-six in number. Each letter is represented by strips of tin foil, passing from left to right, and right to left, alternately, over a space of an inch square upon a glass table. Such parts of the tin foil are cut out, as will represent a particular letter. Thus, it will be seen

FIG. 34.



that the letter A is represented by those portions of the tin foil which have been taken out, and the remaining portions answer as the conductor. P and N represent the positive and negative ends of the strips, as they pass through the table and reappear, one on each side of the small dot at A. Those two lines which have a dot between, are the ends of the negative and positive wire belonging to one of the letters. Now if a spark from a charged receiver is sent through the wires belonging to letter A, that letter will present a bright and luminous appearance of the form of the letter A. "As the passage of the electric fluid through a perfect conductor is unattended with light, and as the light or spark appears only where imperfect conductors are thrown in its way, hence the appearance of the light at those interrupted points of the tin foil; the glass upon which the conductors are pasted, being an imperfect conductor. The instant the discharge is made through the wire, the spark is seen simultaneously at each of the interruptions, or breaks, of the tin foil, constituting the letter, and the whole letter is rendered visible at once." This table is placed at one station, and the electrical machine at the other, with 72 wires inclosed in a glass tube connecting the two stations. He could have operated with equal efficiency by using 37 wires having one wire for a common communicating wire, or with 36 wires by substituting the ground for his common wire. It does not appear that it was ever tested to any extent.

Dr. Salva's Electric Spark Telegraph.

In 1798, Dr. Salva, in Madrid, constructed a similar telegraph, as that suggested by Reizen, (see Voigt's Magazine, vol. 11, p. 4.) The Prince of Peace witnessed his experiments with much satisfaction, and the Infant Don Antonio engaged with Dr. Salva in improving his instruments. It is stated that his experiments were conducted through many miles. No description of his plans appear to have been given to the public.

Origin of Galvanism.

Galvanism takes its name from Galvani, Professor of Anatomy at Bologna, who discovered it in the year 1790. As the account of the circumstances attending the discovery of this useful and wonderful agent, may not be uninteresting to the reader, we insert it here as related in the "*Library of Useful Knowledge.*"

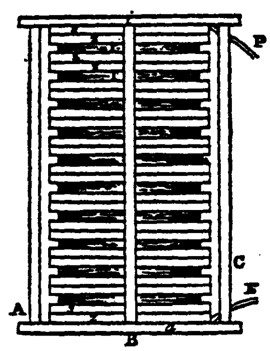
"It happened in the year 1790, that his wife, being consumptive, was advised to take, as a nutritive article of diet, some soup made of the flesh of frogs. Several of these animals, recently skinned for that purpose, were lying on a table in the laboratory, close to an electrical machine, with which a pupil of the Professor was amusing himself in trying experiments. While the machine was in action, he chanced to touch the bare nerve of the leg of one of the frogs with the blade of the knife that he held in his hand; when suddenly the whole limb was thrown into violent convulsions. Galvani was not present when this occurred, but received the account from his lady who had witnessed, and had been struck with the singularity of the appearance. He lost no time in repeating the experiment: in examining minutely all the circumstances connected with it, and in determining those on which its success depended. He ascertained that the convulsions took place only at the moment when the spark was drawn from the prime conductor, and the knife was at the same time in contact with the nerve of the frog. He next found that other metallic bodies might be substituted for the knife, and very justly inferred that they owed this property of exciting muscular contractions to their being good conductors of electricity. Far from being satisfied with having arrived at this conclusion, it only served to stimulate him to the farther investigation of this curious subject; and his perseverance was at length rewarded by the discovery, that similar convulsions might be produced in a frog, independently of the electrical machine, by forming a chain of conducting substances between the outside of the muscles of the leg, and the crural nerve. Galvani had previously entertained the idea, that the contractions of the muscles of animals were in some way dependent on electricity; and as these new experiments appeared strongly to favour this hypothesis, he with great ingenuity applied it to explain them. He compared the muscles of a living animal to a Leyden phial, charged by the accumulation of electricity on its surface, while he conceived that the nerve belonging to it, performed the function of the wire communicating with the interior of the phial, which would, of course, be charged negatively In this state, whenever a communication was made by means of a substance of high conducting power between the surface of the muscle and the nerve, the equilibrium would be instantly restored, and a sudden contraction of the fibres would be the consequence.

"Galvani was thus the first to discover the reason of that peculiar convulsive effect which we now obtain from the Galvanic battery, and he attributed it to a modification of electricity. It was left to another to construct an instrument which would give a constant and increased effect, and develope this extraordinary fluid. Whatever share accident may have had in the original discovery of Galvani, it is certain that the invention of the Pile, an instrument which has most materially contributed to the extension of our knowledge in this branch of physical science, was purely the result of reasoning.

"Professor Volta, of Pavia, in 1800, was led to the discovery of its properties by deep meditation on the developements of electricity at the surface of contact of different metals. We may justly regard this discovery as forming an epoch in the history of galvanism; and since that period, the terms, Voltaism, or Voltaic electricity, have been often, in honour of this illustrious philosopher, used to designate that particular form of electrical agency.

"He had been led by theory to conceive that the effect of a single pair of metallic plates might be increased, indefinitely, by multiplying their number, and disposing them in pairs, with a less perfect conducting substance between each pair. For this purpose he provided an equal number of silver coins, and of pieces of zinc, of the same form and dimensions, and also circular discs of card, soaked in salt water, and of somewhat less diameter than the metallic plates. Of these he formed a pile or column as shown in figure 35, in which three substances, silver, zinc, and wet card, denoted by the letters S, Z, I, were made to succeed one another in the same regu-

Fig. 35.



lar order throughout the series. The efficacy of this comoination realized the most sanguine anticipations of the discoverer. If the uppermost disc of metal in the column be touched with the finger of one hand, previously wetted, while a finger of the other hand is applied to the lowermost disc, a distinct shock is felt in the arms, similar to that from a Leyden phial, or still more nearly resembling that from an electrical battery, weakly charged. These discs are supported by two large discs, *a* and *i*, of wood, one at the bottom and the other at the top of the pile, with three glass rods, A, B, C, at equal distances around the pile, but not touching it, and are cemented into the wooden base and cover. P represents the wire connecting the silver disc, and N that connecting the zinc."

LUIGI GALVANI

HOW ONE WIRE CAN BE USED

A bald statement that an electric current must always have a complete circuit does not appeal very forcibly to many minds. I have seen people quite at sea in trying to arrange a simple electric circuit, such as connecting up a bell, push, and battery. There need not be the very slightest confusion if one clearly keeps in mind what is taking place when a battery sends a current of electricity along a wire. All that the battery does is to cause an electric current to pass from its carbon plate to its companion zinc. We fix a short wire across from the one plate to the other, and an electric current passes along the wire on its way from the carbon to the zinc. We may make the wire a mile long, or as long as we please, and the current must pass by this route on its way from the one plate to the other. If we carry the wire to Land's End and back, then before the current can get from the carbon to its close neighbour the zinc plate, it is forced to travel *viâ* Land's End. If the wire circuit is broken at any place the current immediately ceases, as it has no path left from the carbon to the zinc; if the wires are touched together again, the current once more passes. The ordinary electric bell push is merely a means of making and breaking the circuit.

If the wire of our imaginary Land's End circuit be cut at that distant place and the two free ends be joined to the two ends of the coil in a needle-telegraph instrument, then the current in going from the carbon to the zinc in the battery has to pass through this distant telegraph instrument, as its coil has become part of the circuit. The necessity for a complete circuit is therefore quite apparent (see Fig. 5).

While fitting up a telegraph installation on a railway in 1838, Steinheil, of Munich, noticed that his return wire was broken, and the two ends were put into the earth; the current passed just as though the wires were joined together. It was soon found that it did not matter how far distant these earth connections were, so that if a telegraph is to be fitted up between London and John O'Groat's a wire is led from the carbon in the battery at London all the way to that northern limit of the Scottish mainland and there connected to one end of the telegraph coil. Instead of now bringing a return wire from the other end of the coil right back to the zinc of the London battery, a short wire is simply connected to the earth at the Scottish end, while at the London end another short wire is led from the earth to the zinc in the battery there. At the London end it would be quite sufficient to fasten the short wire from the zinc to any water-pipe in the building and thereby get into contact with the earth, but not finding a similar convenience at

HOW ONE WIRE CAN BE USED

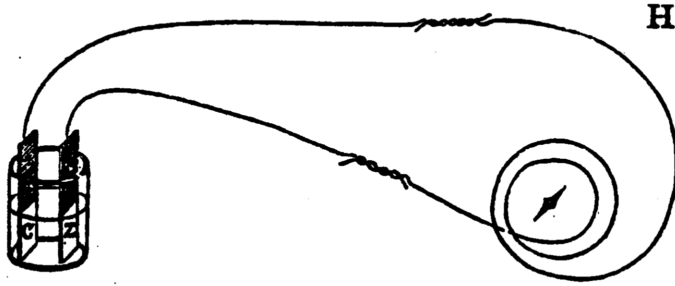


FIG. 5

SHOWING A CELL CONNECTED TO A TELEGRAPH INSTRUMENT

the northern house it would be found necessary to attach the wire to a copper plate and then bury it in the moist subsoil. In Fig. 6 an earth circuit is shown in which both ends are attached to buried plates.

It was originally supposed that the current of electricity passed through the earth from the one plate to the other, but it seemed afterwards more reasonable to picture the current as being dissipated in the earth at the one end and fed on at the other end. An analogy portrays the earth as a great ocean, the wire like a pipe with its two free ends dipping into the ocean at far separated points, and the battery as a pump propelling the current along. Whatever mental picture we form, we must remember that the electric current is not a material fluid.

There is no difficulty in sending a current over this single wire with its earth circuit, but one is not surprised to learn that when any great natural disturbance takes place in this ether-ocean into which the wires are dipping,

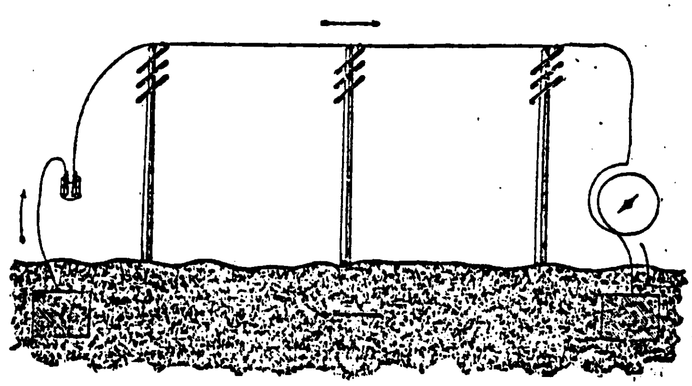


FIG. 6

HOW A TELEGRAPH IS WORKED WITH A SINGLE WIRE

the current in these earth-connected wires is very appreciably affected, our whole telegraph system being sometimes quite upset during a magnetic storm.

EXPLORING THE EARTH THROUGH VRIL

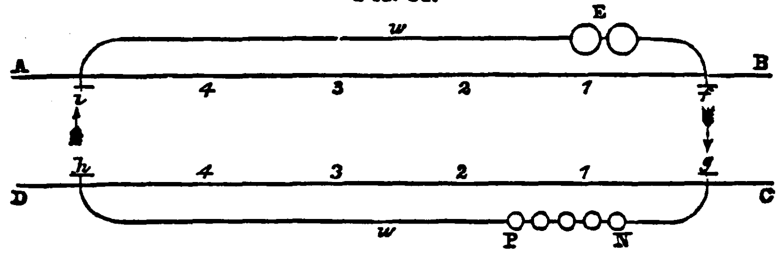
VRIL AND WATER: SUBAQUEOUS MESSAGINGS

MODE OF CROSSING BROAD RIVERS, OR OTHER BODIES OF WATER, WITHOUT WIRES.

The following extract from Professor' Morse's letter to the Secretary of the Treasury, and by him submitted to the House of Representatives, Dec. 23, 1844, in relation to this interesting subject, will sufficiently illustrate it:

"In the autumn of 1842, at the request of the American Institute, I undertook to give to the public in New York a demonstration of the practicability of my telegraph, by connecting Governor's Island with Castle Garden, a distance of a mile; and for this purpose I laid my wires properly insulated beneath the water. I had scarcely begun to operate, and had received but two or three characters, when my intentions were frustrated by the accidental destruction of a part of my conductors by a vessel, which drew them up on her anchor, and cut them off. In the moments of mortification, I immediately devised a plan for avoiding such an accident in future, by so arranging my wires along the banks of the river as to cause the water itself to conduct the electricity across. The experiment, however, was deferred till I arrived in Washington; and on December 16, 1842, I tested my arrangement across the canal, and with success. The simple fact was then ascertained, that electricity could be made to cross a river without other conductors than the water itself; but it was not until the last autumn that I had the leisure to make a series of experiments to ascertain the law of its passage. The following diagram will serve to explain the experiment.

Fig. 31.



A, B, C, D, are the banks of the river; N, P, are the battery; E is the electro magnet; *w w*, are the wires along the banks, connecting with copper plates, *f*, *g*, *h*, *i*, which are placed in the water. When this arrangement is complete, the electricity, generated by the battery, passes from the positive pole, P, to the plate *h*, across the river through the water to plate *i*, and thence around the coil of the magnet, E, to plate *f*, across the river again to plate *g*, and thence to the other pole of the batterv, N. The numbers 1, 2, 3, 4, indicate the distance along the bank measured by the number of times of the distance across the river

The distance across the canal is 80 feet; on August 24th, the following were the results of the experiment.

No. of the experiment,	1st.	2d.	3d.	4th.	5th.	6th.
No. of cups in battery,	14	14	14	7	7	7
Length of conductors, *w*, *w*, ...	400	400	400	400	300	200
Degrees of motion of galvanometer, . . .	32 & 24	13½ & 4½	1 & 1	24 & 13	29 & 21	21½ & 15
Size of the copper plates *f*, *g*, *h*, *i*, ...	5 by 2½ ft.	16 by 13 in.	6 by 5 in.	5 by 2½ ft.	5 by 2½ ft.	5 by 2½ ft.

Showing that electricity crosses the river, and *in quantity in proportion to the size of the plates in the water*. The *distance of the plates on the same side* of the river *from each other* also affects the result. Having ascertained the general fact, I was desirous of discovering the best practical distance at which to place my copper plates, and not having the leisure myself, I requested my friend Professor Gale to make the experiments for me. I subjoin his letter and the results.

NEW YORK, *November* 5th, 1844.

MY DEAR SIR—I send you, herewith, a copy of a series of results, obtained with four different sized plates, as conductors to be used in crossing rivers. The batteries used were six cups of your smallest size, and one liquid used for the same throughout. I made several other series of experiments, but these I most rely on for uniformity and accuracy. You will see, from inspecting the table, that the distance along the shores should be *three times greater* than that from shore to shore across the stream; at least, that four times the distance does not give any increase of power. I intend to repeat all these experiments under more favorable circumstances, and will communicate to you the results.

Very respectfully,

L. D. GALE.

Professor S. F. B. MORSE,
Superintendent of Telegraphs.

Series of Experiments on four different sizes of plates, to wit: 1st, 56 square inches; 2d, 28 square inches; 3d, 14 square inches; and 4th, 7 square inches.

Experiment 1st.—Surface of one face of the copper plate, 56 *square inches; battery, Morse's smallest,* 6 *cups.*

NOTE.—In all the experiments, *f* and *g* are stationary.

Distance from bank to bank.	Distance along shore	1st. Trial.	2d Trial.	3d Trial.	4th Trial.	5th Trial	6th Trial.
1	1	22°	23°	23°	22°	22	22°
1	2	31	32	31½	31	31	31
1	3	36	36	35½	35	35	35
1	4	36 scant	36 scant	34½	34	34	34

Experiment 2d.—Plates 28 *square inches, conducted as above.*

Distance from bank to bank.	Distance along shore	1st Trial.	2d Trial.	3d Trial.	4th Trial.	5th Trial.	6th Trial.
1	1	18°	17°	17°	17°	17°	17°
1	2	27	26	27½	27½	27½	27
1	3	31	31	31	31	31	31
1	4	31	31	31	31	31 scant.	31

Experiment 3d.—Plates 14 *square inches, conducted as No.* 1.

Distance from bank to bank.	Distance along shore	1st Trial.	2d Trial.	3d Trial.	4th Trial.	5th Trial.	6th Trial.
1	1	8°	8½°	8½°	8°	8°	8°
1	2	19½	20	19½	19	19	19
1	3	23½	23½	23½	23½	23½	23½
1	4	24½	24½	23½	23½	23½	23½

Experiment 4th.—Plates 7 *square inches, conducted as No.* 1.

Distance from bank to bank.	Distance along shore	1st Trial	2d Trial.	3d Trial.	4th Trial.	5th Trial.	6th Trial.
1	1	5°	5°	5°	5°	3°	3°
1	2	15	14½	14	15	15	12
1	3	17½	18	17½	17½	18	17
1	4	19	18	18	17½	17½	17

The distance from bank to bank, 30 inches. Depth of water, 12 inches. In experiment 4, the liquor of the batteries was very weak. exhausted towards the last; and in trials 5 and 6, the irregularities are to be attributed in part to the weak liquor, and in part to the twilight hour at which the experiments were made.

As the result of these experiments, it would seem that there may be situations in which the arrangements I have made for passing electricity across the rivers may be useful, although experience alone can determine whether lofty spars, on which the wires may be suspended, erected in the rivers, may not be deemed the most practical. The experiments made were but for a short distance; in which, however, the principle was fully proved to be correct. It has been applied under the direction of my able assistants, Messrs. Vail and Rogers, across the Susquehanna river, at Havre-de-Grace, with complete success; a distance of nearly a mile.

THE MIND OF THE INVENTOR

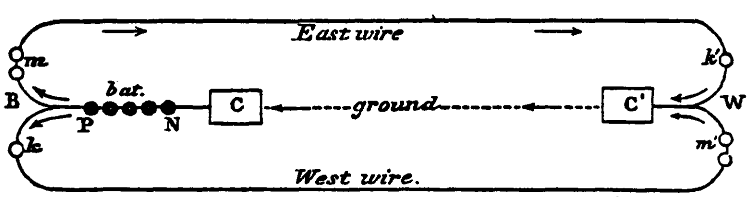
ENTRAINED BY VRIL

ENVISIONS THE GROUNDPATHS

then it is the *east wire* to k', the key at W, then to m', the magnet or register, then to the *copper sheet*, C', buried beneath the brick pavement in the dry dust of the cellar of the capitol. The direction of the current is from P of the battery to k, to m, and along the east wire to k', to m', and to C', where it is lost in the earth; but reappears at the copper plate, C, at B, and thence to the N pole of the battery, having completed its circuit. It is, therefore, certain, that one-half of the circuit is through the earth. From B to W the east wire is the conductor; and from W to B the ground is the conductor. In this arrangement, the west wire is thrown out, and is no part of the circuit; while the earth has been made a substitute for it.

The last diagram, as has been stated, exhibits the plan of the wire and ground, as used for telegraphic purposes, from its first operation, until the adjournment of Congress in 1844, being prevented from completing the arrangement of the third mode from the throng of visitors, that pressed to see its operation. After the close of the session, the following arrangement of the wires was made, as shown in the diagram, figure 14, by means of which, both stations could transmit at the same time, with one battery for both, and the keys were not required to be closed. It is called the two *independent circuits*.

FIG. 14.



Here the west wire is used for transmitting from B to W; and the east wire from W to B. The copper plates at B and W remain as they are described in the second plan. *Bat*, the battery, at B is used in common for both circuits. It is simply necessary here to designate the course which the fluid takes when both lines are in operation, viz. B transmitting to W; and W to B. In the former case, the current is from P of the battery to k, then the *west wire*, then to m', at W, then to C', thence through the ground to C at B, and then to the N, or negative pole of the battery, as shown by the arrows. In the latter case, the current is from P of the battery to m, then the *east wire*, then to k', at W, thence to C', thence through the ground to C at B, thence to the N, or north pole of the battery, as shown by the arrows. This arrangement, by which one battery is made efficient for both circuits at the same time, where two were formerly used, was devised by Mr. Vail, assistant superintendent, in the spring of 1844, and has contributed much to diminish the care and expense in maintaining that part of the apparatus of the telegraph. One battery being now used instead of two. By the above diagram, it will be perceived that the *ground* is common to both circuits, as well as the *battery*, and also the wire from the N pole of the battery, to the copper plate, C; and from the copper plate, C′, to the junction of the two wires near the two arrows. For the purposes of telegraphic communication they answer as well as though there were four wires and two batteries. Instead of using the ground between C and C′, a wire might be substituted, extending from the N pole of the battery to the junction of the wires at the two arrows at W. The arrangement of the wires, battery, keys, magnets or registers at both stations, with the ground, as shown in figure 14, is the plan now used for telegraphic operations between B and W; and has many decided advantages over the arrangements of figures 13 and 14. First. In both of those arrangements, the circuit is obliged to be kept closed, when neither station is at work; and as the battery is only in action when the circuit is closed, it follows that the battery will not keep in action as long as when the circuit is allowed to remain open, as in the use of the third plan, figure 15. Second. There is an advantage in dispensing with the use of the metallic wedge, which is liable to be forgotten by the operator. Third. The attendant may occasionally leave the room, and is not required to be in constant waiting, as the clock work is put in motion and stopped by the operator at the other end, and the message written without his presence. But in the first and second arrangement, the apparatus for putting in motion and stopping the clock work, is entirely useless. The attendant being obliged to put it in motion and stop it himself.

We will now proceed to describe the modus operandi of transmitting intelligence from one station to another; the arrangement being as in figure 14; *k* is the key of the operator at Baltimore, and *m′* represents his register, or writing desk, at Washington; *k′* is the key of the operator at Washington, and *m* his register, or writing desk, at Baltimore. Each has the entire control of his respective register, excepting, only, that each operator winds up the other's instrument, and keeps it supplied with paper. It will also be borne in mind, that each circuit is complete, and every where continuous, except at the keys, which are open. If, then, the hammer is brought in sudden contact with the anvil, and permitted as quickly as possible to break its contact by the action of the spring, and resume its former position, the galvanic fluid, generated at the battery, flies its round upon the circuit, no matter how quick that contact has been made and broken.

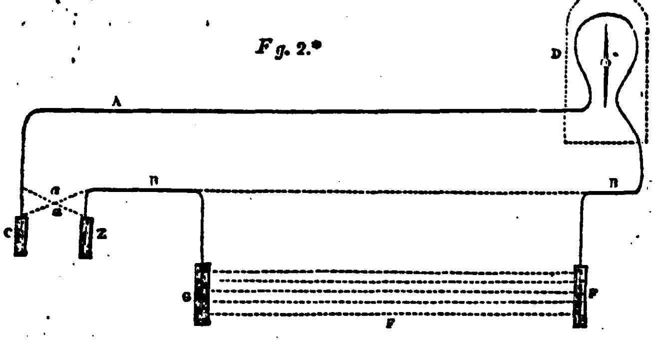
On the left bank two plates are immersed opposite those on the right bank, and connected by a wire. The electricity on leaving the battery has therefore the choice of two paths. It may either keep entirely on the right bank, passing from the one buried plate on that side to the other, and so back to the battery by the long coiled wire; or it may cross to the left bank through the water, traverse the wire on that side, return across the water to the right bank, and regain the battery by the shorter wire. The Thames has been actually crossed by electric currents in this way; the resistance to their passage by the water between the banks being less than that between the ends of the wires on the right and left bank, respectively. The permanent establishment, in September, 1851, of a quadruple telegraph-wire between the French and English coasts, has naturally excited much interest, but it does not involve any electrical novelty. It is generally named the *submarine*, but should rather be called the *transmarine* telegraph; for the triumph is not in having passed *below*, but *across* or *through* the Channel. So early as 1837, Wheatstone demonstrated the practicability of telegraphing under water. The only difficulty then lay in the rarity of good and easily-applied insulators. From the period, however, when the excellence and applicability of gutta percha as an insulator were demonstrated, it became certain that water would not be more difficult to telegraph through than a wet tunnel; and accordingly, in January, 1849, a skilful electrician, Mr. Charles V. Walker (superintendent of telegraphs on the South-Eastern railway) telegraphed for two miles under water (near Folkestone harbour), through that length of copper wire, which had been covered with gutta percha for use in the tunnels. This was strictly a *submarine* telegraph.

The only practical difficulty which attended the laying of a wire from Dover to Calais, or from Folkestone to Boulogne, was the necessity for giving it a strength and solidity which should enable it to resist injury; and the question of strength was only a question of expense, which was solved as soon as the practicability of the scheme was demonstrated to men of capital. It would have been answered much sooner, had not the restrictions which the French government puts on the employment of telegraphs rendered it doubtful whether the scheme would prove remunerative.

In August, 1851, an experimental copper wire, covered with gutta percha, half-an-inch in diameter (including its covering), twenty-five miles long and weighted with lead, was laid between Dover, and Cape Gris Nez on the French coast. It completely answered, so far as transmission of signals was concerned; but in a few days it was cut or broken across. The cable which now stretches at the bottom of the sea, between Dover and Calais, is more than 24 miles long, and weighs about 180 tons. From the account of its construction given in the "Illustrated News" (Sept. 27. 1851), it appears that it consists of four copper wires, through which the electric currents pass, insulated by coverings of gutta percha: these are formed into a strand, and bound round with spun-yarn soaked in tar or tallow, forming a core or centre, round which are led ten iron wires, plated with zinc $\frac{5}{16}$ths of an inch in diameter, each welded into one length of $24\frac{1}{2}$ miles, and weighing about 15 tons. This immense cable, when wound together, formed a coil of 30 feet diameter outside, 15 feet inside, and 5 feet high. It was made in the short space of twenty days.

Each of the copper wires forms, along with the sea which acts as its return wire, a separate channel for sending messages; and the whole arrangement has worked so well, that additional cables, similar in construction, are about to be laid down. Cannons have been simultaneously fired, on either side of the Channel, by the current from a battery some twenty-five miles distant on the opposite coast

Fig. 2.*



* *Fig.* 2. Diagram of telegraph supposed to have a single message-sending and receiving station.

C, last copper, and Z, last zinc of battery at sending station.

A, upper wire suspended on posts, on the aërial (English and American) telegraph lines, and insulated by being passed through porcelain rings; buried in the ground on the subterranean (Continental) telegraph lines, and insulated by being covered with gutta percha.

D, long loop of covered wire, continuous with A, and coiled many times round the magnetic needles of the signal-index (shown in profile in *Fig.* 3. p. 39.) at the receiving station.

B, lower or return-wire, a continuation of the upper one, which in the *theoretically* simplest telegraph returns, as shown by the dotted line, to the last free zinc of the battery. In actual practice the return-wire is cut short after bending back from the signal-index at the receiving station, and is made to terminate in a plate of metal E, which, in the land telegraph, is buried in the earth, and in the aqueous or marine telegraph is plunged beneath low water-mark in the channel to be crossed.

F, interposed mass of earth or water, separating giving and receiving station.

G, second buried or submerged plate sunk near the sending station, and communicating by a wire with the battery.

By means of a moveable handle not represented in the diagram, A can be connected with the copper of the battery, and B with the zinc (as indicated by the vertical *unbroken* lines proceeding from C and Z) when the index-needle at D moves to one side; or B can be connected with the copper, and A with the zinc (as shown by the *dotted* lines *a a*), when the index moves to the opposite side: or the wires may be disconnected from either end of the battery, and the index stands vertically, pointing to neither side.

Instead, however, of being carried along the posts a second time, the wire is now cut short and soldered to a large plate of metal, which is buried in the ground at some little depth. A comparatively short wire is also attached to the last zinc of the London battery, and soldered to a metallic plate, which is likewise buried in the ground. (*Fig.* 2. p. 23.) The arrangement is equivalent to a great gap or breach several hundred miles long in the double wire, filled up by moist earth. When the battery is in action, the electricity (positive) flows from the copper along the wire to Edinburgh, descends there to the one earth-plate (as it has been called), passes from it through the earth to the similar plate near the London station, and from it reaches the zinc of the London battery. The circulation of the electricity, in this way, is found to be even more rapid than when the double wire is furnished for its passage.

Good people have perplexed themselves with speculations as to why the electricity never wanders, misses its road, or fails to find its way back. But, as has been implied already, in the case of the double wire, electricity, like a prudent general, always takes care that a retreat be provided for, before it begins its march. Till an unbroken circuit of conductors connect the terminal plates of the battery, no electricity can be set free. It is not essential, however, that those conductors should be metallic; a column or stratum of moist earth will do quite as well as an iron or zinc wire. One half in length of the connecting conductors must be insulated; so that the electricity may be compelled to travel to the farthest point to which messages are to be telegraphed. But the other half of the conductors need not be insulated, and cannot be too large. The quicker the current can pass the better; and it will pass most quickly when conveyed by one or other of the two great electrical conductors which man has at his disposal—the solid mass of the globe, and the ocean with its tributary waters.

The last allusion leads us directly to the marine telegraph.

It requires, however, no detailed description—as it differs from the land telegraph only in having the space between the buried plates occupied by water instead of by earth. Broad estuaries or channels do not permit the insulated wire to be carried across by bridges. The wire, therefore, proceeding from the copper end of the battery, is embedded in gutta percha, or any other waterproof insulator, and sunk in the waters to a depth sufficient to secure it against fishing-nets, ships, anchors, or large sea-animals.

In this way it is conveyed from one shore to the other, and bending backwards after being connected with the index-needles, terminates in a broad plate of metal sunk in the waves, close to the further shore. A second but uninsulated wire proceeds from the zinc end of the battery to a metal plate sunk beneath low-water mark, at the side from which the insulated wire set off. Between the immersed plates on the opposite shores, the mass of water, though ever changing, acts in relation to electricity as if it were an undisturbed gigantic metallic wire. Theoretically, there is no limit to the ocean spaces which electricity may traverse in this way. Already, accordingly, schemes for telegraphing across the Atlantic and the Pacific have been triumphantly expounded to the wonder-loving public.

One of these, whether hopeless or not for immense distances, is so very ingenious, and so likely to succeed across limited spaces, that we cannot pass it unnoticed. It dispenses, except to a very trifling extent, with wires, and carries the current *both ways* through moist earth and water. It is desirable, for example, to telegraph from the right to the left bank of a broad river. From the copper end of a battery on the right bank, a wire is carried to the shore (on the same side) and soldered to a plate buried in the river below water-mark. A wire is also led from the zinc end to a long coil of wire which ends in a metallic plate. This likewise is buried in the river below water-mark on the same right bank.

J. W. WILKINS.

with terminals dipping into the earth or sea, and as nearly parallel as possible to one another; and I suggested a form of telegraph instrument 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.

"It may be interesting to relate 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 while engaged on the only long line of telegraph then existing in England—London to Gosport — that my observations led me to question 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 & 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 & 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 120 ft. 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.*"

. . . .

The following extracts from the letter in the 'Mining Journal,' above referred to, may now be reproduced with interest. I have slightly altered the phraseology with a view of making the writer's meaning more clear and connected:[1]—

"Allow me, through the medium of your valuable

[1] Mr Charles Bright has reprinted this letter *verbatim* in Jour. Inst. Elec. Engs.,' vol. xxvii. p. 958, as containing "the first really practical suggestion in the direction of inductive telegraphy"; but, as we now see, it is not the first suggestion, and it is certainly not inductive.

journal, to draw attention to a principle upon which a telegraphic communication may be made between England and France without wires. I take for certain (as experiments I have made have shown me) that when the poles of a battery are connected with any extended conducting medium, the electricity diffuses itself in radial lines between the poles. The first and larger portion will pass in a straight line, as offering the least resistance; the rays will then form a series of curves, growing larger and larger, until, by reason of increasing distance, the electricity following the outer curves is so infinitesimal as to be no longer perceptible.

"These rays of electricity may be collected within a certain distance—focussed as it were—by the interposition of a metallic medium that shall offer less resistance than the water or earth; and, obviously, the nearer the battery, the greater the possibility of collecting them. I do not apprehend the distance of twenty miles being at all too much to collect a sufficient quantity of electricity to be useful for telegraphic purposes. If, then, it is possible, as I believe, to collect in France some portion of the electricity which has been discharged from a battery in England, all that is required is to know how to deal with it so that it shall indicate its presence.

"The most delicate of the present telegraph apparatus, the detector, being entirely unsuited for the purpose, I propose the following arrangement: Upon one shore I propose to have a battery that shall discharge its electricity into the earth or sea, with a distance between its poles of five, ten, or twenty miles, as the case may be. Let a similar length of wire be erected on the opposite coast, as near to, and parallel with, it as possible, with its ends also dipping into the earth or sea. In this circuit place an instrument consisting of ten, twenty, or more round or square coils of the finest wire of best conductibility, suspended on points or otherwise between, or in front of, the poles of an electro-, or permanent, magnet or magnets. Any current passing through the coil would be indicated by its moving or shifting its position with reference to the poles of the magnet. This would constitute a receiving apparatus of the most delicate character, for its efficiency would depend not so much on the strength of the current passing as on the power of the magnet, which may be increased at pleasure.

"I hope some one will take up this suggestion and carry it out practically to a greater extent than my limited experiments have enabled me to do. Of its truth for long as well as for short distances I am satisfied, and only want of means and opportunity prevent me carrying it out myself."

In a recent letter to the writer *àpropos* of this early proposal, Mr Wilkins says:—

"I will just say that all thought of induction was absent in my first experiments. I modified my views in this respect a year or two later, but I did not attach sufficient importance to the matter to follow up my communication to the 'Mining Journal,' especially as at that time a cable was actually laid across the Channel, which I could not doubt would be a success, and a permanent one too. I rather courted forgetfulness of the proposition. Whatever my opinion at the time was as to the source of the electricity that I discovered in the far removed and disconnected circuit, the result was the same, and the means I used to obtain it the same in principle as those which make the matter an accomplished fact to-day—viz., elevated lengths of wire, and the discharge of electricity from the one on to a delicate receiving apparatus in the circuit of the other.

"As regards the form of receiving apparatus which I suggested for indicating the signals, I did then, and do now, attach great importance to the happy idea.

THE "EARTH BATTERY BASE":

VRIL CONDUCTORS AND ACCUMULATORS

My description of the apparatus is based on the complete specification and drawings of the second patent, which were lodged in the Patent Office on April 30, 1864, and which must therefore be supposed to contain the inventor's last word on the subject.

A, Z (fig. 4) are copper and zinc plates respectively, curved as shown, and buried in the earth about 3 feet

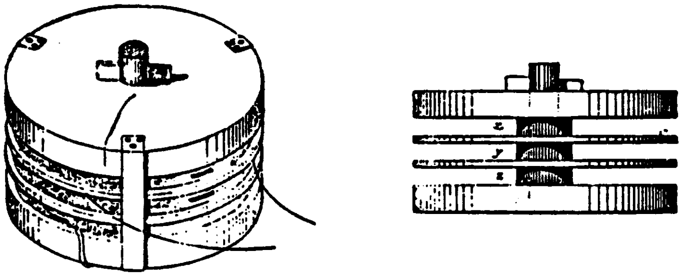


Fig. 5.

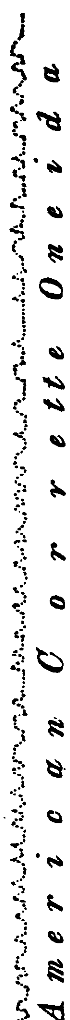
apart. The superficies varies according to distance and other circumstances: thus, for distances up to 75 miles plates 1 foot square suffice; over 75 and up to 440 miles, plates 24 by 16 inches are required. G, F are copper cylinders, 24 by 4 inches, buried in earth, which is always moist. At a point distant about 3 feet from the centres of A and Z a wooden box J is buried, containing a coil of insulated copper wire, No. 16 gauge, wound upon a wooden reel. The ends of the coil are attached to binding screws shown on top of the box. B is a wooden box containing a wooden reel divided into three compartments, *x*, *y*, *z* (fig. 5). *x* is filled with fine covered-copper wire, the ends of which are brought together and secured on the outside of the reel. *y* is filled with thicker covered-copper wire, wound in the same direction as *x*, and the ends are severally connected to binding-screws, shown on the outside. *z* is half filled with insulated iron wire, wound in the same direction as *x* and *y*; the ends are fastened together on the outside of the reel as with coil *x*. The compartment is then filled with more of the same iron wire, wound double, and in the reverse direction to the coil below it. These double wires are not twisted, nor bound together, nor allowed to cross one another, but are wound evenly in layers side by side; and the ends of each coil are secured together on the outside of the reel as in the case of the lower coil, and adjacent thereto. Usually the wire of coil *x* is No. 32 gauge; *y*, No. 16; and *z*, No. 20; but the sizes and quantities required must vary according to distance and other circumstances.

JOHN HAWORTH.

NOVEL TELEGRAPHY — ELECTRIFICATION OF AN ISLAND

A CURIOUS discovery has been made by Mr. Gott, the superintendent of the French company's telegraph station at the little island of St. Pierre Miquelon. There are two telegraph stations on the island. One, worked in connection with the Anglo-American company's lines by an American company, receives messages from Newfoundland and sends them on to Sydney, using for the latter purpose a powerful battery and the ordinary Morse signals.

The second station is worked by the French Transatlantic Company, and is furnished with exceedingly delicate receiving instruments, the invention of Sir William Thomson, and used to receive messages from Brest and Duxbury. These very sensitive instruments were found to be seriously affected by earth-currents; *i.e.*, currents depending on some rapid changes in the electrical condition of the island; these numerous changes caused currents to flow in and out of the French company's cables, interfering very much with the currents indicating true signals. This phenomenon is not an uncommon one, and the inconvenience was removed by laying an insulated wire about three miles long back from the station to the sea, in which a large metal plate was immersed; this plate is used in practice as the earth of the St. Pierre station, the changes in the electrical condition or potential of the sea being small and slow, in comparison with those of the dry rocky soil of St. Pierre. After this had been done, it was found that part of the so-called earth-currents had been due to the signals sent by the American company into their own lines, for when the delicate receiving instrument was placed between the earth at the French station and the earth at the sea, so as to be in circuit with the three miles of insulated wire, the messages sent by the rival company were clearly indicated, so clearly indeed, that they have been automatically recorded by Sir William Thomson's syphon recorder. Annexed is a facsimile of a small part of the message concerning the loss of the steamship Oneida, stolen in this manner.



It must be clearly understood that the American lines come nowhere into contact, or even into the neighbourhood of the French line. The two stations are several hundred yards apart, and yet messages sent at one station are distinctly read at the other station; the only connection between the two being through the earth; and it is quite clear that they would be so received and read at fifty stations in the neighbourhood all at once. The explanation is obvious enough: the potential of the ground in the neighbourhood of the stations is alternately raised and lowered by the powerful battery used to send the American signals. The potential of the sea at the other end of the short insulated line remains almost if not wholly unaffected by these, and thus the island acts like a sort of great Leyden jar, continually charged by the American battery, and discharged in part through the short insulated French line. Each time the American operator depresses his sending key, he not only sends a current through his lines, but electrifies the whole island, and this electrification is detected and recorded by the rival company's instruments.

No similar experiment could be made in the neighbourhood of a station from which many simultaneous signals were being sent; but it is perfectly clear that unless special precautions are taken at isolated stations, an inquisitive neighbour owning a short insulated wire might steal all messages without making any connection between his instrument and the cable or land line. Stealing messages by attaching an instrument to the line was a familiar incident in the American War; but now messages may be stolen with perfect secrecy by persons who nowhere come within a quarter of a mile of the line. Luckily, the remedy is simple enough.

All owners of important isolated stations should use earth-plates at sea, and at sea only. This plan was devised by Mr. C. Varley many years ago to eliminate what we may term natural earth-currents, and now it should be used to avoid the production of artificial earth-currents which may be improperly made use of.

FLEEMING JENKIN

TELEPHONY AND TELEGRAPHY

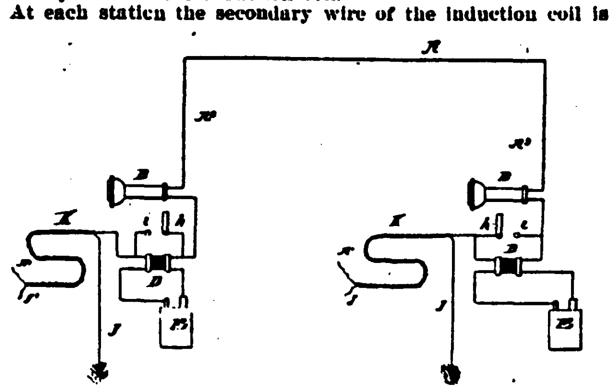
THE ABSTERDAM SYSTEM OF "MAGNETIC" TELEPHONY.

SOME time since Mr. John Absterdam, of this city, brought out a system of telephony in which the line is claimed to be discontinuous, in order to demonstrate that a continuously closed circuit was not necessary to the transmission of articulate speech. In this system, it may be recalled, Mr. Absterdam employed at each end of the line coils wound with two conductors, side by side; but the opposite ends of the conductors connected to the receiver and to the line, respectively, were left open ended, as shown in the accompanying diagram.

Recently Mr. Absterdam has been at work on another part of the problem of telephony, which has resulted in what he terms a method of transmitting speech "magnetically."

The accompanying diagram illustrates the arrangement adopted for this purpose. A represents a single conductor extending from a telephone station A² to a second telephone station A² and including at each end a telephonic instrument B. At each station there is an induction coil D and a local battery E, the poles of which are connected in circuit with the primary wire of the adjacent induction coil, so that the battery current flows continuously and uniformly through the primary wire of the induction coil.

At each station the secondary wire of the induction coil is



ABSTERDAM'S SYSTEM OF "MAGNETIC" TELEPHONY.

connected into the main line A. The respective ends A' of the main line A instead of being grounded or otherwise connected are terminated at each station adjacent to a wire J, one end of which is grounded. The ends of the wires A' and J' may be twisted together into a cord, K, and are insulated from each other, thus leaving the line A open at both ends, as shown at A' A', so that it is impossible to pass a current directly over the line or to operate telegraph instruments, bells, or analogous instruments thereon.

Mr. Absterdam extends the cord formed by the wires A' and J' into a coil of a considerable length, taking care at all times to maintain a perfect insulation between them, so that they shall not form in any sense or possess any of the peculiarities of condensers, according to his idea.

In practice he finds that although the line may be open at both ends, as above described, and although there may be no battery current upon the line and no interruption or pulsation of the primary current through the induction coils, as is generally believed to be necessary to set up secondary or induced currents in the line, nevertheless there exist in the line conditions such that articulate speech or other sounds uttered at a telephone at either station will be heard and understood in the receiving telephone at the other station.

As will be seen, the general arrangement of apparatus somewhat resembles that of an ordinary telephone line in that an induction coil, local battery, and telephone receiver or transmitter are used, but differs essentially therefrom in that the local battery is not used to set up the speech vibrations or variations, but the local current is allowed to flow without interference from any transmitting devices upon the local circuit which maintains the magnetic field in inductive proximity to the line, while the magnetic variations corresponding to speech are originated at some other portions of the circuits or apparatus independently of the local.

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 8 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 currents, 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.

Scientific American

MARCH 8, 1902.

Telegraphy without Wires.—Prof. A. E. Dolbear, writing on the above in the *Electrical Engineer* of New York, of May 29th, makes the following statement :—

"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 500ft. or 600ft. 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."

SECTION
4

MAGNETO ELECTRIC TELEGRAPHY

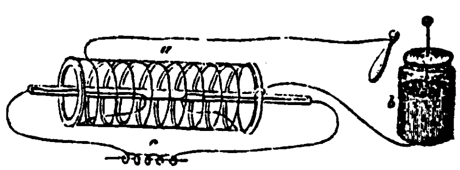
JOSEPH HENRY DEVELOPS MAGNETO-ELECTRIC TELEGRAPHY

TRUE DISCOVERER OF ELECTRIC RAYS AND THEIR VRILLIC EFFECTS

JOSEPH HENRY 1797–1878

(689) In Fig. 258, the current induced in f by the helix e, is one of *quantity;* the effects, however, of the induced tertiary current in d would be those of *intensity;* and by grasping metallic handles, attached to the ends of that helix, shocks may be received: thus a quantity current can be induced from one of intensity and the converse. Dr. Henry found that on interposing a screen of any conducting substance, between a and b, no secondary currents could be obtained; a circular plate of lead, for instance, caused the induction in b almost entirely to disappear; but when a slip of the metal was cut out in the direction of a radius of the circle, the induction was not in the least interfered with: again, the coil b being placed upon a with the two ends separated, and on the coil the helix d, shocks could be obtained from the latter as if the coil were not present; but when the ends of b were joined, so as to form a perfect metallic circuit, no shocks could be obtained. The explanation of this apparent mystery was at first obscure; it was, however, subsequently referred by Dr. Henry to the changes in the direction of the induced currents: the secondary current, which is induced in the screening plate, or closed ribbon coil, is in the same direction as the current from the battery;—it nevertheless tends to induce a current in the adjacent conducting matter of a contrary direction. A similar re-action, as it were, may be observed by placing on a flat ribbon coil, containing about 100 feet of metal, another similar coil, and then taking the shock from the first when the ends of the second are joined, the intensity will be found to be very materially diminished; although, if the ends of the second coil be not joined, no difference in the intensity of the shocks will be perceived.

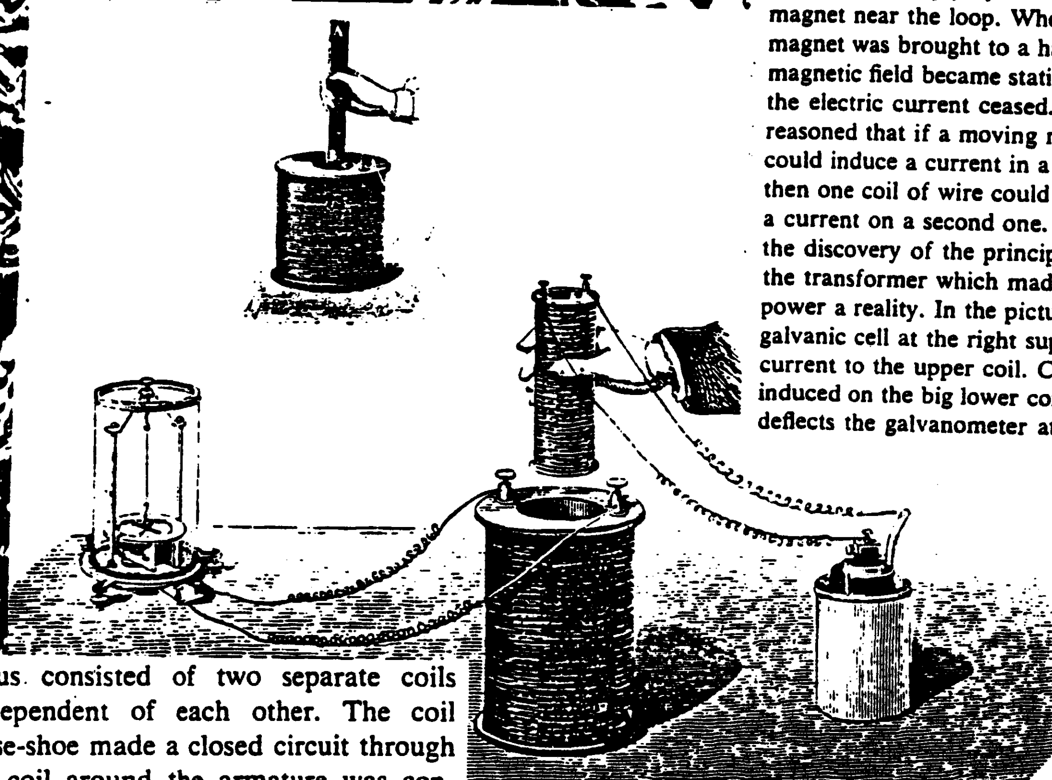
Fig. 259.



(690) By employing the arrangement shown in Fig. 259, Professor Henry succeeded in demonstrating that the discharge from the Leyden jar possesses the property of inducing a secondary current precisely the same as the galvanic apparatus. A hollow glass cylinder a, of about six inches in diameter, was prepared with a narrow riband of tinfoil, about thirty feet long, pasted spirally around the outside, and a similar riband of the same length pasted on the inside; so that the corresponding spires of each were directly opposite each other. The ends of the inner spiral passed out of the cylinder through a glass tube, to prevent all direct communication between the two. When the ends of the inner riband were joined by the magnetizing spiral c, containing a needle, and a discharge from a half-gallon jar sent through the outer riband, the

needle was strongly magnetized in such a manner as to indicate an induced current through the inner riband, in the same direction as that of the current of the jar. When a second cylinder, similarly prepared, was added, a *tertiary* current was induced in the inner riband of the second; and by the addition of a third cylinder, a current of the *fourth* order was developed.

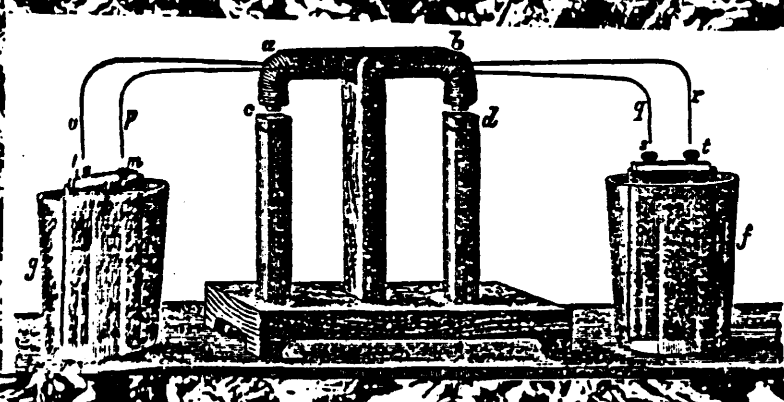
(691) In all the experiments that were tried, the results with ordinary and galvanic Electricity proved to be similar. A most interesting fact, however, came out in the course of the investigation: when the Leyden experiments were made with the glass cylinders, the currents, instead of *alternating*, as was the case in the galvanic experiments, were all in the same direction as the discharge from the jar; but when the arrangement of coils and helices, Fig. 258, was used, the coils being furnished with a double coating of silk, and the contiguous conductors separated by a large plate of glass, the discrepancy vanished, and the alternations were found the same as in the case of galvanism: thus the cylinders gave currents all in one direction; the coils in alternate directions. Dr. Henry made a great number of experiments, in order to get some explanation of these apparently anomalous results; and he at last succeeded satisfactorily in tracing them to the *distances* of *the conductors*. Thus two narrow strips of tinfoil, about twelve feet long, were stretched parallel to each other, and separated by thin plates of mica to the distance of about $\frac{1}{30}$th of an inch. When a discharge from the half gallon jar was passed through one of these, an induced current in the same direction was obtained from the other. The ribands were then separated by plates of glass, to the distance of $\frac{1}{20}$th of an inch,—the current was still in the same direction, or *plus*. When the distance was increased to about one-eighth of an inch no induced current could be obtained; and when they were still further separated the current again appeared, *but was now found to have a different direction, or to be minus:* no other change was observed in the direction of the current, and the intensity of the induction decreased as the ribands were separated. Thus, when the conductors are gradually separated, there is, it appears, a distance at which the current begins to change its direction, and this distance depends on the amount of the discharge, and on the length and thickness of the conductors. With a battery of eight half-gallon jars, and parallel wires of about ten feet long, Dr. Henry found that the charge in the direction did not take place at a less distance than from twelve to fifteen inches; and with a still larger battery, and longer conductors, no change was found, although the induction was produced at a distance of several feet.



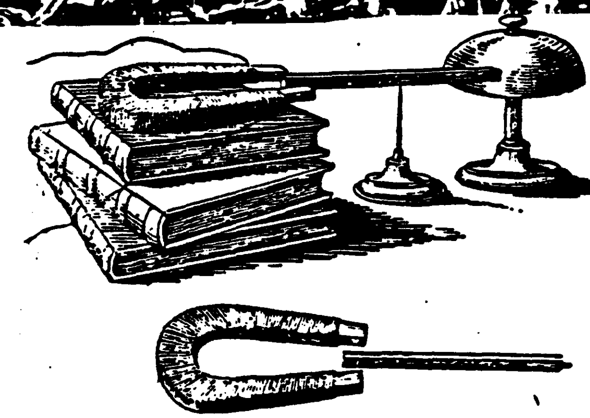
Induced current could be made to flow through a closed loop of wire, Henry discovered, simply by moving a magnet near the loop. When the magnet was brought to a halt, the magnetic field became stationary, and the electric current ceased. Henry reasoned that if a moving magnet could induce a current in a wire, then one coil of wire could induce a current on a second one. This was the discovery of the principle of the transformer which made electric power a reality. In the picture, a galvanic cell at the right supplies current to the upper coil. Current induced on the big lower coil deflects the galvanometer at left.

His apparatus consisted of two separate coils completely independent of each other. The coil around the horse-shoe made a closed circuit through a battery. The coil around the armature was connected neither to a battery nor to any other visible source of current, but only to a galvanometer.

"I stationed myself near the galvanometer and directed an assistant at a given word to . . . connect the . . . battery attached to the magnet . . . . The north end of the galvanometer needle was deflected 30°, indicating a current of electricity in the wire surrounding the armature. . . ."



The first electric motor was made by Henry in 1831. An iron rod wrapped with wire rocked on a pivot, making alternate contacts with galvanic cells through wires (*op* and *qr*). It was just a toy, but a neighboring blacksmith, Davenport, built a real motor with a spinning armature.



An electrical relay and the first electromagnetic telegraph were built by Henry in 1831, anticipating Morse by six years. Henry's receiver was a bell. At Princeton he sent signals through a mile of wire, and stated that relays could extend his circuit indefinitely.

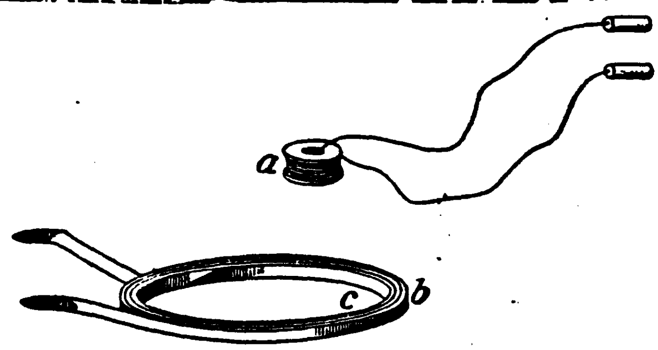
While still at Albany, Henry invented the electrical relay which he used to create the first electromagnetic telegraph system.

CORRESPONDENCE OF METALS:

THE PERSISTENT USE OF BELLS AND OTHER SUCH

METAL RESONATORS

IN THIS EARLY MODEL OF JOSEPH HENRY



The transformer grew out of experiments with this coiled copper ribbon and wire spool. Voltage was measured by the intensity of shocks received through the handles. Feeble currents were detected by the acid taste detected when a current was applied to the experimenter's tongue.

At Princeton, he continued his researches, describing mutual induction so clearly that the following experiment may be considered the paper which embodied the design of the electric transformer:

"The principal articles of apparatus used in the experiment consist of a number of flat coils of copper ribbon. . . . Coil No. 1 was arranged to receive the current from a small battery, and coil No. 2 (of very few turns) placed on this, with a glass interposed to insure perfect insulation; as often as the circuit of No. 1 was interrupted, a powerful secondary current was induced in No. 2. . . . The shock, however, from this coil is very feeble, and can scarcely be felt above the fingers."

In other words, the current had been increased, but the voltage had been stepped down. This arrangement of coils was the first step-down transformer. "Coil No. 1 remaining as before, a longer coil (with a great many turns) was substituted for coil No. 2. With this arrangement, the magnetizing power was much less . . . but the shocks were more powerful." He had cut down the current, but stepped up the voltage—the prototype of the first step-up transformer.

ELECTRIC RAYS AND THEIR EFFECTS ON THE HUMAN MIND

Henry's experimental technique was so ingenious and his insight so clear that he was able to prove that the discharge of a condenser was of an oscillatory nature; the most important experiment in capacitance since Franklin's analysis of the Leyden jar.

Henry's last great contribution to electricity was the experiment in which he anticipated Hertz. In 1842, he discovered that needles in the basement of a building could be magnetized by the effects of an electric spark two floors above.

"It would appear that the transfer of a single spark is sufficient to disturb perceptibly the electricity of space throughout at least a cube of 400, 000 feet of capacity; and when it is considered that . . . (the spark is oscillatory) it may be further inferred that the diffusion of motion in this case is almost comparable with that of a spark from a flint and steel in the case of light."

JOSEPH HENRY

Samuel Morse, photographed here by the famous Mathew Brady, gained much of the knowledge which helped him build his telegraph from Joseph Henry. Yet Morse gave Henry far too little credit for it.

The following extracts show Morse's original idea:

FROM PRIME'S LIFE OF MORSE: (P. 19.)

Morse. when a student, heard Dr. Day of Yale say, at a lecture on electricity: "If the circuit be interrupted, the fluid will become visible and, where it passes, it will leave an impression upon any intermediate body."

MORSE SAYS IN 1832: (P. 252.)

"If the presence of Electricity can be made visible in any part of the circuit I see no reason why intelligence may not be transmitted instantaneously by Electricity."

Were not these remarks, on the Sully," based on Dr. Day's lecture heard years before. Many before Morse had laboured to develop the same idea.

Morse writes to Prof. Jackson, Sept. 18, 1837:

"The discovery, is the original suggestion of conveying intelligence by Electricity, the invention, is devising the mode of conveying it."

Morse writes the Secretary of the Treasury, Sept. 27, 1837:

"I planned (on the Sully) a system of signs and an apparatus to carry it into effect. I cast a species of type which I had devised for this purpose, the first week after my arrival home, and altho the rest of the machinery was planned . . . I . . . was not able to test the whole plan until within a few weeks." These type produced the V-shaped line, and could not produce letters. The points of each V being read as numbers, thro a "Dictionary" which Morse wrote Vail October 24, 1837, "is at last done." These points represented single or compound numbers as indicated by the larger or smaller spaces between them, these spaces producing at the top of the record, dashes, longer or shorter as made necessary to provide the larger or smaller spaces at the bottom. The top, therefore, showed *lines* or *points* with spaces between, being in fact the embryo of the letters which came when a machine and type capable of marking dots (or *points*), dashes (or lines) with *spaces* between, was evolved. The key made type unnecessary. Baxter, his assistant, says Vail constructed the new lever and thus for the *first* time produced a register capable of making dots, dashes and spaces.

Morse to Prof. Jackson: N. Y., Dec. 7, 1837.

"This machinery consisted, as you well know, of a system of signs, which were numerals to be read by intervals, type and apparatus to arrange the numbers for transmission, a lever to mark on the register, and a register moving by clock machinery to receive the marks at the proper times.

"The plan of numerals, type, lever &c., is the very plan I have now in successful operation."

March, 1838.

S. F. B. Morse signed a paper in which he claims to be "the sole and original inventor of a *system* of Electro-Magnetic Telegraphs for conveyance of intelligence by words or signs or by either."

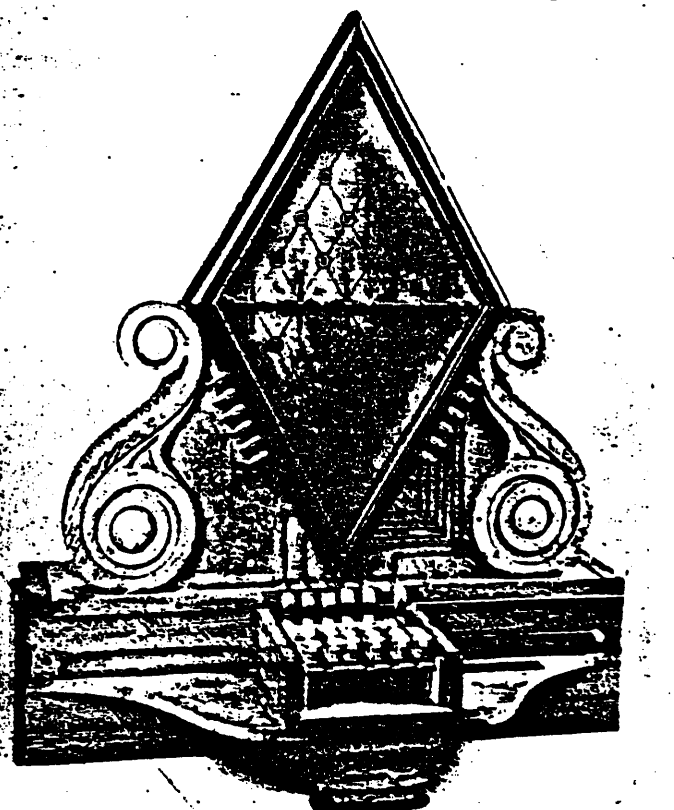
He writes to the British Attorney General: July 12, 1838.

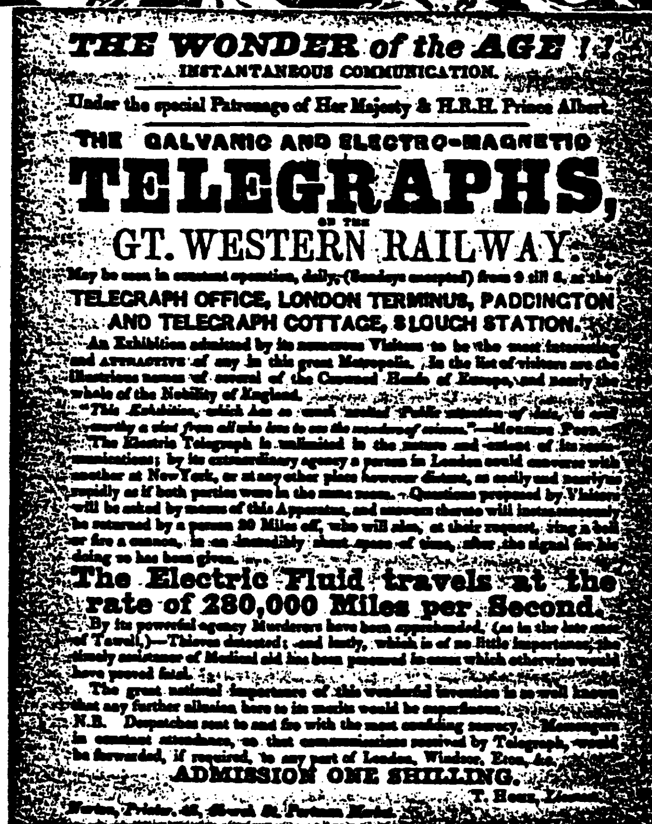
" . . the use of electricity on metallic conductors, for which no one could obtain an exclusive privilege since this much has been used for nearly one hundred years."

F. O. J. Smith to Vail: Washington, Jan. 13, 1839.

"You will find an interesting letter from Prof. Morse to me—in which he adverts to still other improvements and among them, the dispensing with all but one alphabet of type. I know not how this has been effected. . . . . . . Morse's first idea was decomposing salts by the Electric Current, and as he wrote Prof. Jackson in 1837 he tried the experiment."

ALFRED VAIL





THE WONDER of the AGE !!
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THE GALVANIC AND ELECTRO-MAGNETIC

TELEGRAPHS,

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TELEGRAPH OFFICE, LONDON TERMINUS, PADDINGTON AND TELEGRAPH COTTAGE, SLOUGH STATION.

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"*This Exhibition, which has so much excited Public attention of late, is well worthy a visit from all who love to see the wonders of science.*"—MORNING POST.

The Electric Telegraph is unlimited in the nature and extent of its communications; by its extraordinary agency a person in London could converse with another at New York, or at any other place however distant, as easily and nearly as rapidly as if both parties were in the same room. Questions proposed by Visitors will be asked by means of this Apparatus, and answers thereto will instantaneously be returned by a person 20 Miles off, who will also, at their request, ring a bell or fire a cannon, in an incredibly short space of time, after the signal for his doing so has been given.

The Electric Fluid travels at the rate of 280,000 Miles per Second.

By its powerful agency Murderers have been apprehended, (as in the late case of Tawell,)—Thieves detected; and lastly, which is of no little importance, the timely assistance of Medical aid has been procured in cases which otherwise would have proved fatal.

The great national importance of this wonderful invention is so well known that any further allusion here to its merits would be superfluous.

N.B. Despatches sent to and fro with the most confiding secrecy. Messengers in constant attendance, so that communications received by Telegraph, would be forwarded, if required, to any part of London, Windsor, Eton, &c.

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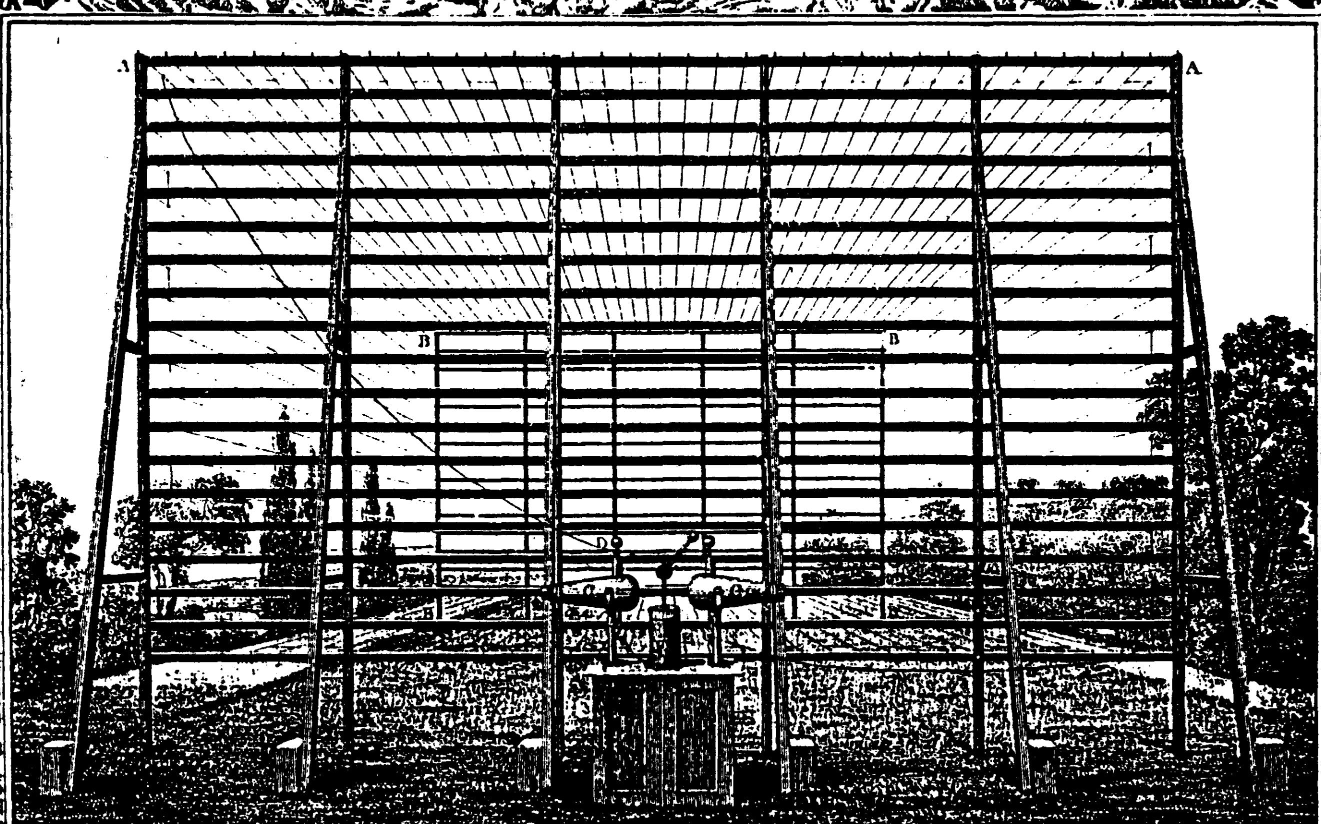


AN ACCOUNT OF VRIL SATURATION

THE PROGRESSIVE REMOVAL OF INERTIAL (IMPRESSED ELECTRIC) SIGNAL FROM AN EARLY LINE

July 10: "This morning took a double circuit from the main battery, one for the main line and the other for the local."

July 12: Washington: "Went to the Capitol, made a diagram or small model of the plan of the circuit, which worked well."

July 15: "Succeeded with experiment of 2 wires and grounds forming 2 independent circuits. It worked well."

July 20, Baltimore: "Have tried all my experiments upon the small plan upstairs, and find it succeeds well."

July 25: "Ascertained by experiments that the large battery could be dispensed with entirely, by using the galvanism of the earth."

"On the 25th of July, 1844, I used the galvanometer instead of our large receiving magnet, and with the needle of the galvanometer closed and broke the local circuit, thus operating the register magnet which was in the circuit, as is usually the case when using the receiving magnet.

(Signed) ALFRED VAIL.

July 27: Vail reports reducing the battery from 80 cups to 4 cups and succeeded well in sending from Baltimore to Washington.

July 27: "Commenced to refit my lever of the big magnet and 2 others, found that 4 cups would work the main line between Balt. and Washington very well."

July 30, 1844: "Telegraphing with 20 cups, the lowest number used since we have been in operation. All worked well."

July 31: "Both of us (Vail & Rogers) wrote independently of each other with only one battery of 20 cups between us."

Aug. 2, "Fitting up a more delicate lever."

Aug. 3, "Tried the more delicate lever and it worked very very well, I find I can, with the East wire, this lever and only 2 cups, work it. Since, 2 cups have worked it very well."

Aug. 3, Morse writes Vail from New York that he ought to take $18,000 cash for his shares.

Aug. 5, "Went to Havre de Grace, with Rogers, Avery & Cleveland."

Aug. 6 & 7, "Experimented across the Susquehannah River without wires, favourable results."

Aug. 8, Vail writes Morse refusing to sell for less than $50,000.

Aug. 9, . . . "I (Alfred Vail) have discovered a plan of making a telegraph without the Electro-Magnet . . . "

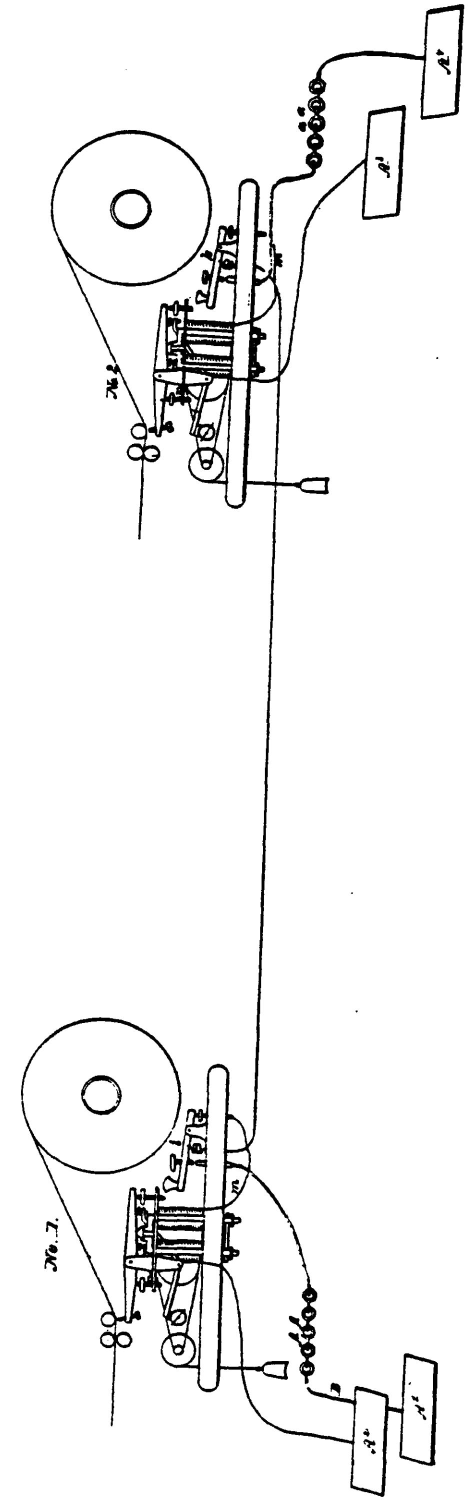
Aug. 8, Vail to Morse in N. Y.: "I was setting out for Havre de Grace to try the experiment of crossing there without stretching the wires, which resulted very favourable . . . but it needs still more experimenting . . . I have also got the telegraph to work for one circuit with only 2 cups . . ."

Aug. 13, Balt. "We reduced our battery to-day to 5 cups and telegraphed to Washington."

E. CORNELL.

Telegraph Wire.

No. 4,318. Patented Dec. 20, 1845.



N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

EZRA CORNELL, OF ITHACA, NEW YORK.

IMPROVEMENT IN THE MODE OF OPERATING ELECTRO-MAGNETIC TELEGRAPHS.

Specification forming part of Letters Patent No. 4,318, dated December 20, 1845.

To all whom it may concern:

Be it known that I, EZRA CORNELL, of Ithaca, in the county of Tompkins, in the State of New York, have invented a new and improved mode of adjusting and using metallic wire for telegraphic purposes, by which telegraph-instruments at opposite extremities of the same or of a single wire, or located at distant points on the same or a single wire, may be kept in constant readiness for use in conjunction with a galvanic battery, without the necessity of keeping the galvanic circuit closed when neither instrument is at work, and by which dependent circuits are avoided; and I do declare the following to be a full and exact description thereof, viz:

First, the figures or drawings herewith submitted, and numbered 1 and 2, represent Samuel F. B. Morse's telegraphic instrument or register.

Any other instrument that has been or may be used in connection with metallic conductors is equally as well adjusted to my invention, and may, for illustration, be represented in the place of the annexed drawings.

In the annexed drawings, A' A^2 A^3 A^4 represent four copper plates buried in the ground, two at each point or extremity of the wire where telegraphic instruments or registers are to be used. Plates A' and A^4 are severally connected by a metallic wire or conductor to one pole of a distinct galvanic battery, numbered A A and *a a*. From the opposite pole of battery A A is a like conductor, that terminates in a point or button directly under the center of a metallic lever that is marked in Fig. 1 *i*. From a corresponding pole of battery *a a* is a like conductor, that in like manner terminates under the center of a like lever that is numbered in Fig. 2 *k*. The extreme right end of each lever, as represented, rests upon the point or termination of a metallic conductor that is marked *m*, and which in its extent forms the helix of the magnet in each instrument, and thence passes to and adjoins the copper plate A^2 in Fig. 1, and A^3 in Fig. 2. In the above position of said levers there is no contact of either with the metallic point described as beneath its center. Each lever rests upon a fulcrum between such center, and its extreme right end, before described. When the extreme left end of either lever is pressed down by the finger it is brought in contact with said central point beneath; but thereupon its extreme right end is lifted from a contact with the metallic point before described, and upon which its right extremity was before resting in contact. From near the center of each lever, on the under side, proceeds a metallic wire or conductor, the whole distance through which telegraphic communication is to be made, and connecting the two levers together. Said conductor is marked *h*.

With each lever at rest in the position represented by said figures it will be perceived that there is not from either battery, A A or *a a*, a continuous metallic conductor, which, in conjunction with the earth, so connects the two poles as to produce the action of a galvanic current, and consequently both batteries are at rest or out of action. Thus tracing from plate A' along the metallic conductor B through the battery A A, and thence along the before-described conductor that proceeds from the opposite pole, and there is a termination of the metallic conductor in the point beneath the center of the lever *j*. So tracing from plate A^4 in like manner along its metallic conductor to the battery *a a*, and from the opposite pole along the adjunctive wire or conductor, and it terminates in the point beneath the center of lever *k*; but press the last-named lever down to a contact with the last described point beneath its center and the metallic conductor is made continuous from plate A^4 through battery *a a* and said point and lever *k*, and along the main conductor *h* and along lever *i*, in Fig. 1, and the point with which the right extremity of that lever is in contact, and along the wire or conductor *m* that forms the helix of the magnet of the instrument, Fig. 1, and thence by the conductor extending from said magnet to plate A^2 in the ground. The continuous metallic line thus formed by pressing the lever *k* in contact with the central point beneath it puts the battery *a a* in instant action, and the galvanic current generated works the instrument at the distant point represented by Fig. 1. As soon as said lever *k* ceases to be pressed into such contact the continuity of such line is destroyed, and the action of the battery is thereby instantly suspended. In the meantime, the lever i not having been disturbed, the other battery has remained inactive; but on a similar pressure upon its lever i with that described of lever k, and on contact of it with the central point beneath it, the continuous metallic line from plate A' to plate A^3, through battery A A and lever i, and the same main wire h as in the former case, and lever k and wire m, and the helix of the instrument in Fig. 2 is formed, and the battery A A put into instantaneous action, and the magnet in Fig. 2 put in action. The contact of lever i with the central point beneath it being broken the battery A A is thereby again instantaneously suspended. By said arrangement only one wire need be used to work two instruments from opposite points, and the action, nevertheless, of all galvanic currents is suspended except when one of the instruments is in operation, and the operator of each instrument may thereby at all times command a galvanic current from the suspended battery to work the instrument at the point distant from him in a manner never before known or practiced.

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

The new and improved mode above described of arranging and adjusting metallic wires or other conductors to electro-magnetic and galvanic telegraph-instruments, by which instruments at opposite extremities of the same or of a single main wire, or located at distant points on the same main wire or a single wire, may be kept in constant readiness for use, in conjunction with a galvanic battery, without the necessity of keeping the galvanic circuit closed or the battery in action when neither instrument is at work, and by which the battery is put out of action instantly on the ceasing of the motion of the instrument, and in like manner is put into action immediately on commencing the motion of an instrument, and avoiding the disadvantage heretofore experienced in what have been denominated "dependent circuits" in the working of two or more telegraphic instruments over a single circuit of wire, or of wire and earth conjoined.

E. CORNELL.

Witnesses:
WM. C. R. ENGLISH,
H. WILSON.

VRIL TRANSDUCERS:

TRANSACTIONS BETWEEN HUMANS AND GROUND

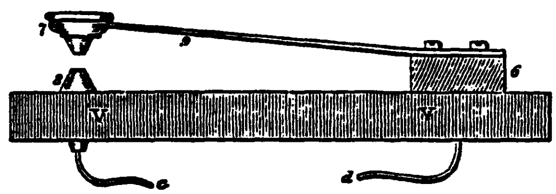
TRANSMITTING THE MEANING

DESPITE THE IMPRESSED (INERTIAL)

SIGNALS

The key or correspondent is represented by 6, 7, 8, 9, Another view of it is more distinctly seen in figure 11. The same letters in each, represent

FIG. 11.



the same thing. V and V is the platform. 8 is a metallic anvil, with its smaller end appearing below, to which is soldered the copper wire *c*. 7 is the metallic hammer, attached to a brass spring, 9, which is secured to a block, 6, and the whole to the platform, V V, by screws. A copper wire passes through the whole, and is soldered to the brass spring at 6. The key or correspondent is used for writing upon the register at the distant station, and both it and the register are usually upon the same table.

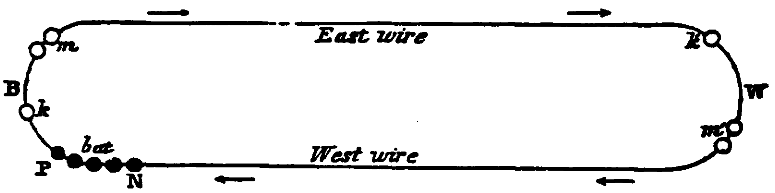
Having now explained the Register, Key and Battery, we proceed to describe the arrangement of the conductors or wires connecting distant stations, and the mode by which the earth, also, is made a conductor of this subtle fluid.

The term *circuit* used frequently in this work, has reference to the wire, which, commencing at the positive pole of the battery, goes to any distance and returns to the negative pole of the battery. When its going and returning are continuous or unbroken, the circuit is said to be *closed* or *complete.* When it is interrupted, or the wire is disconnected, the circuit is said to be *broken* or *open.*

When a magnet or key or battery is spoken of as being *in the circuit*, it has reference to the use of the wire belonging to the key, magnet or battery, respectively, as a part of the circuit.

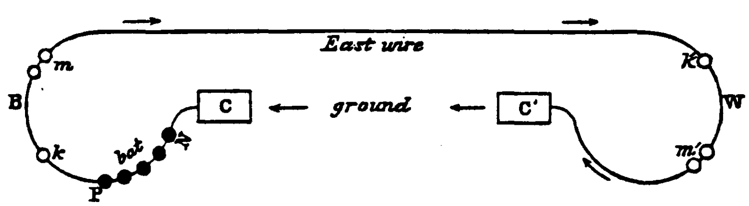
There are three modes of arranging the wires, so as to communicate between two distant stations. Two of these modes are *inferior*, as they furnish but one circuit for the termini, and consequently obliging one station to wait, when the other is transmitting, both stations not being able to telegraph at the same time. These two modes are called the *dependent circuits.* The first mode is, where two wires are used, of which figure 12 is a diagram. B represents Baltimore, and W Washington; *m* is the magnet or register; *k* the key, and *bat* the battery, all at the Baltimore station; *m'* is the magnet or register; *k'* the key at the Washington station. The lines, represent the wires upon the poles, connecting the two stations, and are called the east and

Fig. 12.



west wires. In this arrangement of the wires and also in the second, the key (which has been explained in a preceding figure, 11, and shown at 6 and 7 to be open) must be closed at both stations, in order to complete the circuit, except at the time when a communication is being transmitted.* For the purpose of closing the circuit at the key, a metallic wedge is used, which is put in between the anvil 8 and the hammer 7, and establishes the circuit. Supposing the battery is in action, and B has a communication for W: he opens his key, by removing the wedge, and sends his message. The galvanic fluid leaves the point, P, of the battery, and goes to *k*, to *m*, along the east wire to *k'*, to *m'*, and back by the west wire to N pole of the battery. In the same manner it proceeds along the wires, if W is writing to B. In this arrangement, the direction of the galvanic current is the same, whether B or W is communicating, unless the poles of the battery are reversed.

Fig. 13.

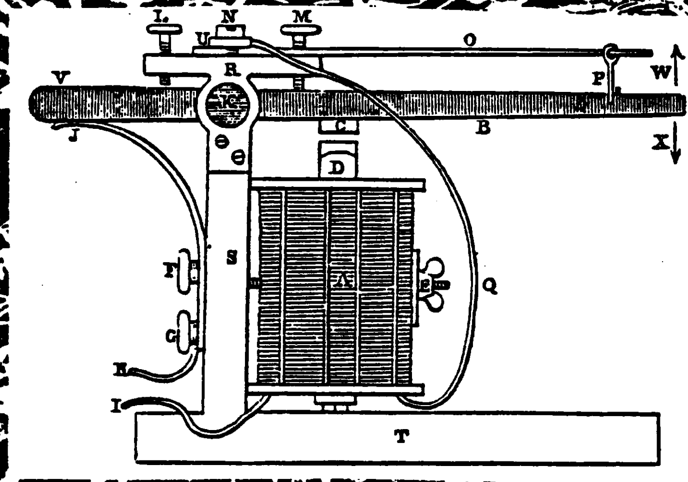


The second mode has but one wire and the ground, represented by figure 13. The use of the ground as a conductor of the galvanic fluid, between two distant points, is to many a mystery. But of the fact there is no question. The above diagram exhibits the manner in which the east wire and ground were used from the first operation of the Telegraph, until the close of the session of Congress, June, 1844. In this diagram, we will minutely follow the course of the galvanic current. B represents Baltimore, and W Washington; C represents a sheet of copper, five feet long and two and a half feet wide, to which a wire is soldered and connects with the N pole of the battery. This sheet of copper lies in the water at the bottom of the dock, near the depot of the Baltimore and Ohio Rail Road, Pratt street. From P of the battery, the wire

* At this time the key is opened at the station from which the communication is to be sent.

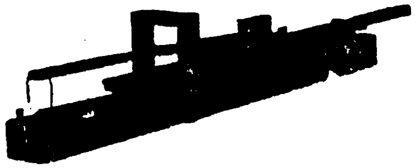
MEANINGFUL VRIL SIGNAL
THROUGH SPECIAL TRANSDUCERS

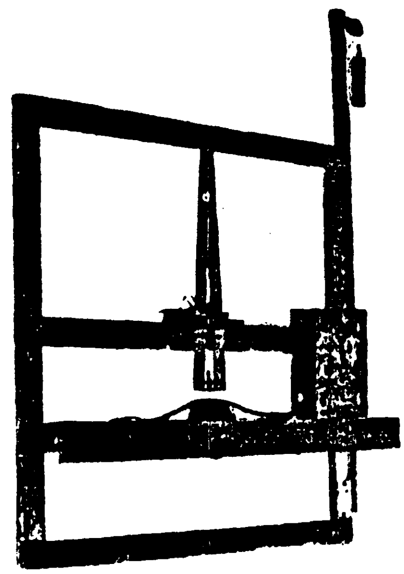
(HELICAL COILS OF COPPER
WRAPPED ON IRON RODS)



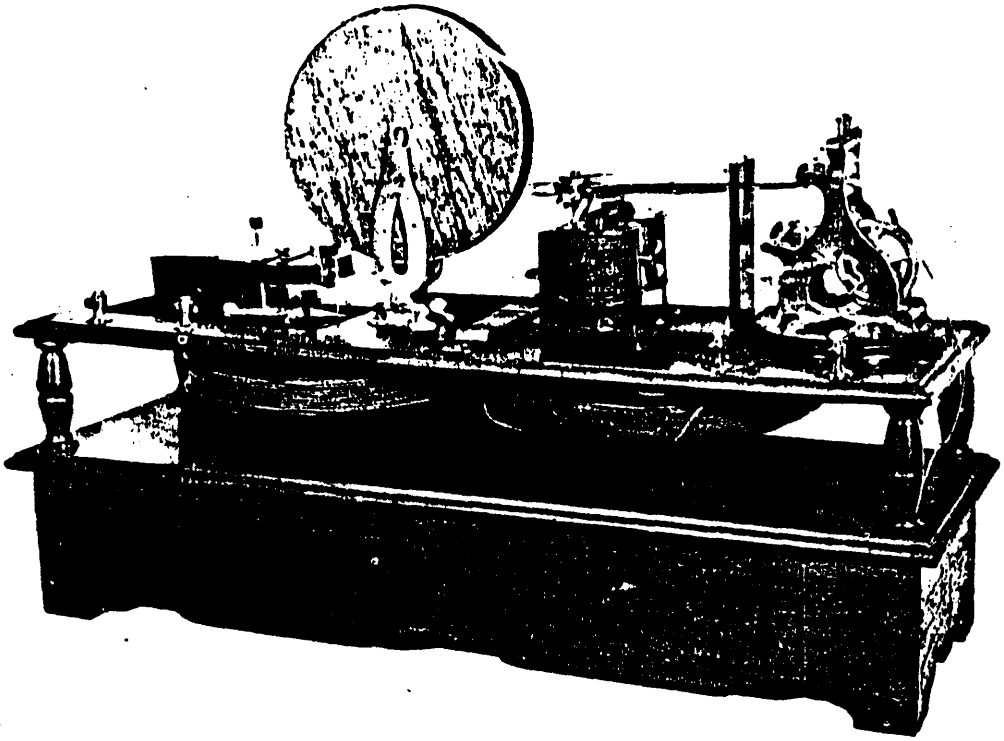
The wire, Q, from one of the coils is connected with the plate, U, at the top of the standard, R. As the standard, R, is of brass, the plate U, the axis of the lever of steel, and the lever, B, of brass, all of them being metals, and conductors of the galvanic fluid, they are made in this arrangement to serve as conductors. I is the wire proceeding from the other coil, and is extended to one pole of the battery. The wire, H, coming from the other pole, is soldered to the metallic spring, J, which is secured to the upright, S, by means of the adjusting thumb screws, F and G. This spring is extended to J, where it is in contact with the lever, B. We have now a complete circuit. Commencing at I, which is connected with one pole of the battery, from thence it goes to the first coil; then to the second; then by Q to U, the plate; then to the standard, R; then to the steel screw, K; then to the steel axis; and then to the lever to the point, J; where it takes the spring to H, the wire running to the mercury cup of the other pole of the battery.

The battery being now in action, the fluid flies its circuit; D becomes a powerful magnet, attracting C to it, which draws the lever down in the direction of the arrow, X. But since B and J are a part of the circuit at V, and since, by the downward motion at X, and the upward motion at V, the circuit is broken at J, the consequence is, that the current must cease to pass, and D can no longer be a magnet. Hence the lever at V returns, coming again in contact with J. Instantly the fluid again passes and the lever at V separates from J. Again the fluid ceases to pass, and the lever again returns. By this arrangement, then, the lever breaks and closes the circuit, and it does it in the best possible manner to show how rapidily the magnet can be made and unmade. When its parts are well adjusted, its vibrations are so quick that no part of the lever is distinctly seen. It appears bounded in size by the limits of its movement up and down, and the motion is so rapid as to produce a humming noise, sometimes varying the notes to a sharp key. In this way it will continue to operate so long as the battery is applied. We infer from this, the almost inconceivable rapidity, with which it is possible to manipulate at the key of the register in sending intelligence, far surpassing that of the most expert operator. This arrangement of the electrome, was devised by Mr. Vail in the summer of 1843.*



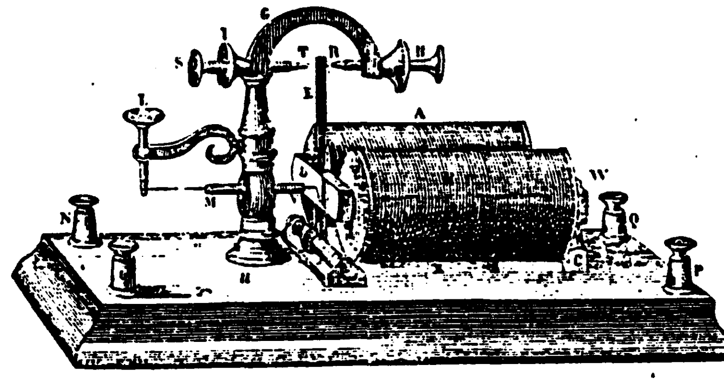


In 1837 Morse built his revolutionary telegraph "register and port rule," one of the first successful inventions to put electricity to use in communications. The wooden frame (right) holds the electromagnet, at center, and the "register," or receiver itself, on the right side of the frame. The "port rule" or transmitter (above) was cranked by hand. By 1846 Morse had improved his invention and patented the instrument below. This telegraph had the same basic parts the other instruments had, but it could be operated more smoothly and could send and receive over much greater distances.



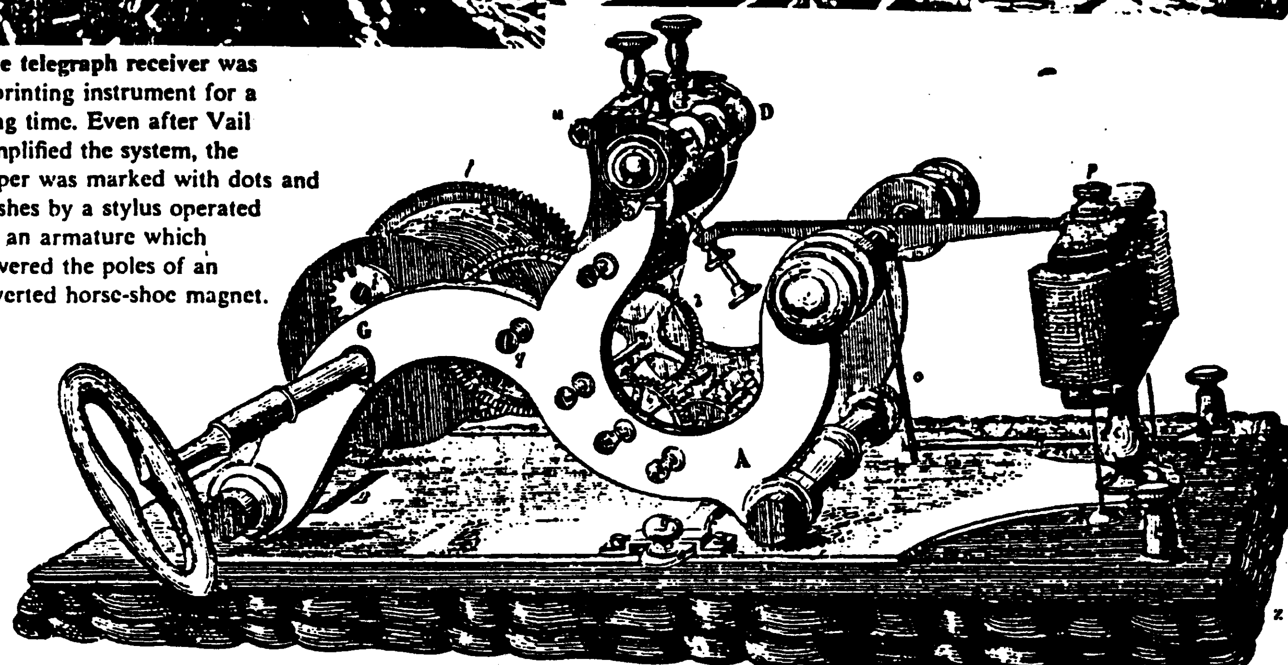
STRUCTURES USED IN MAGNETO-ELECTRIC TELEGRAPHY
ARE FOREVER SUBBOURNED BY THE
EVER-PRESENT VRIL

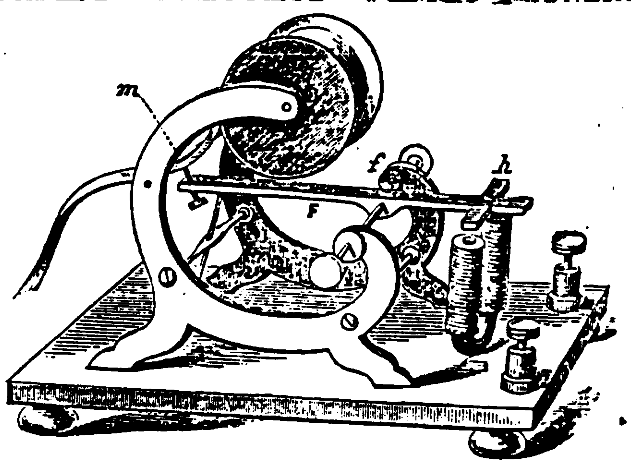
DESIGNS USED BY MAGNETO-ELECTRIC TELEGRAPHERS SERVE VRIL AND ITS PRIMARY PURPOSE



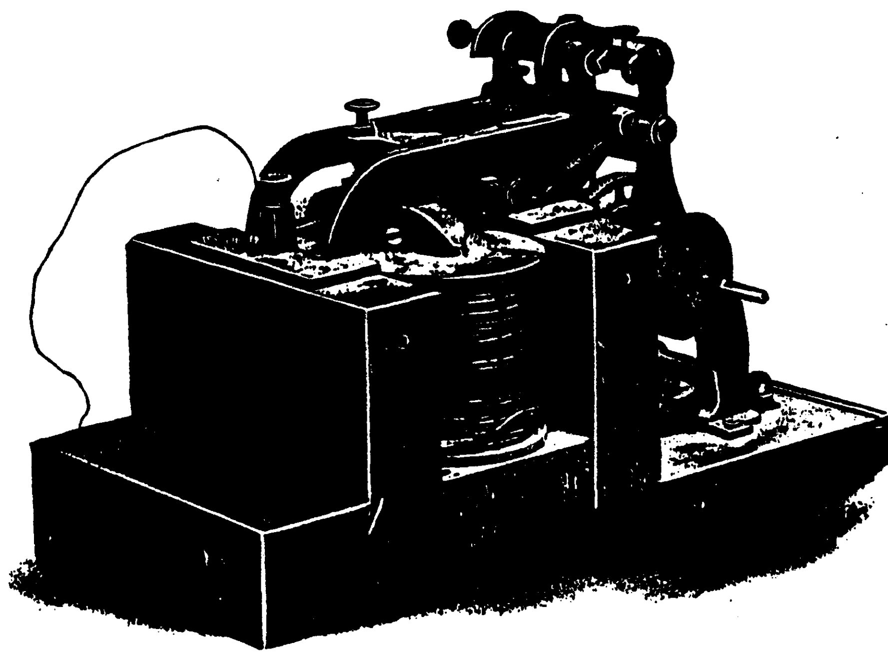
The heart of the system was the relay.

The telegraph receiver was a printing instrument for a long time. Even after Vail simplified the system, the paper was marked with dots and dashes by a stylus operated by an armature which covered the poles of an inverted horse-shoe magnet.

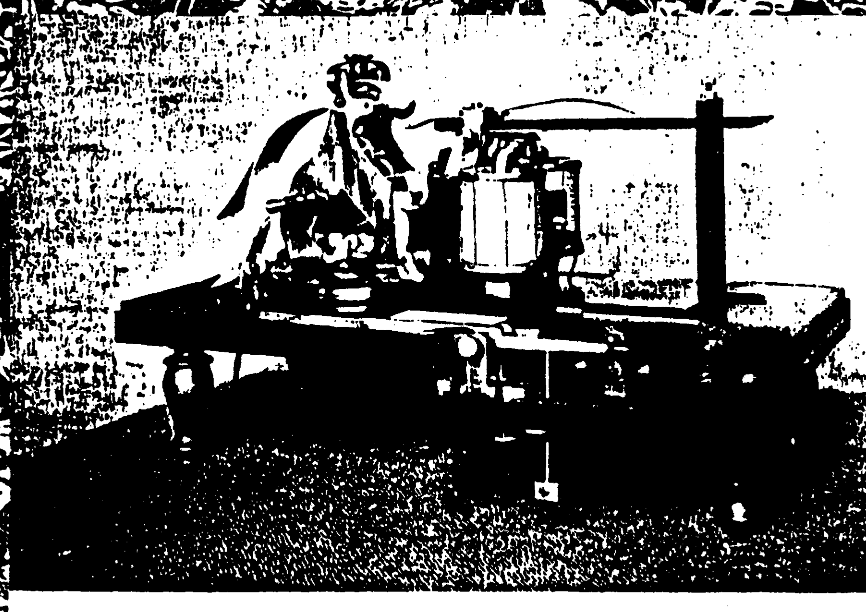




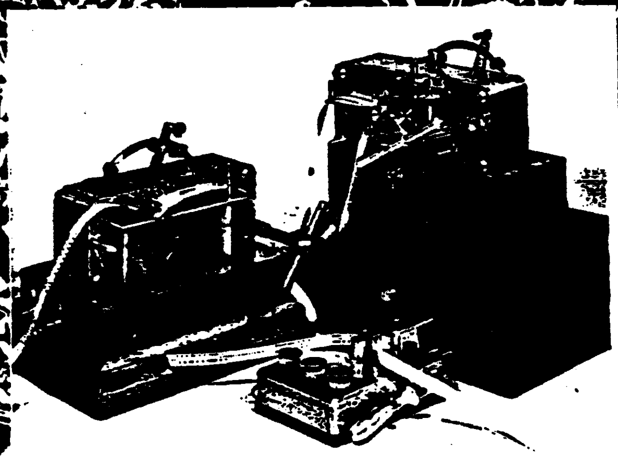
Another stylus and paper strip model.



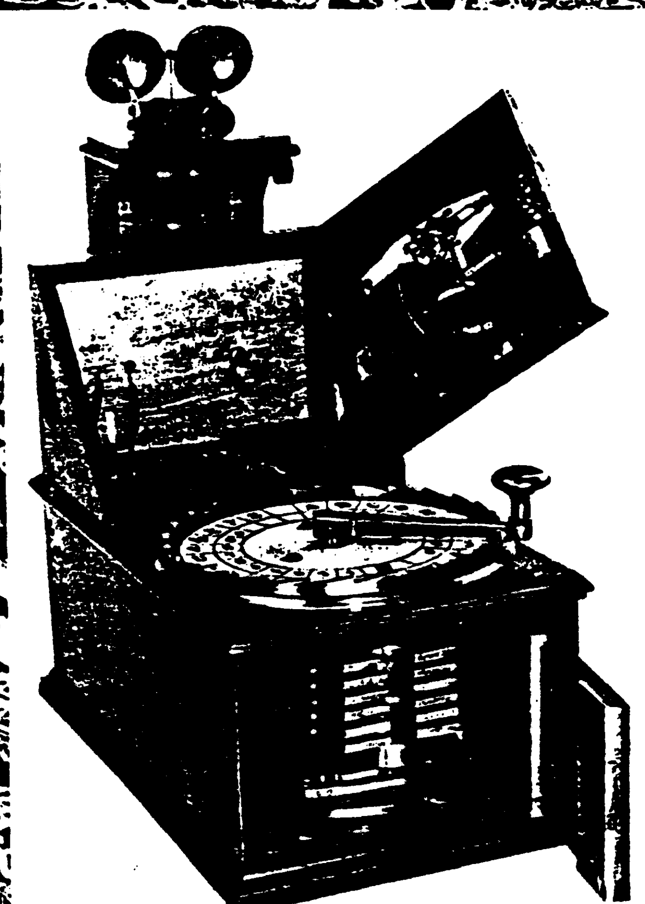
ORIGINAL MACHINE WHICH AT BALTIMORE RECEIVED THE MESSAGE "WHAT HATH GOD WROUGHT?" SENT FROM WASHINGTON, MAY 24, 1844



Morse's second telegraph constructed in 1846, which included a writing apparatus.



Left: Telegraphic transmitter, with magnetic induction, manufactured by Siemens in 1856.

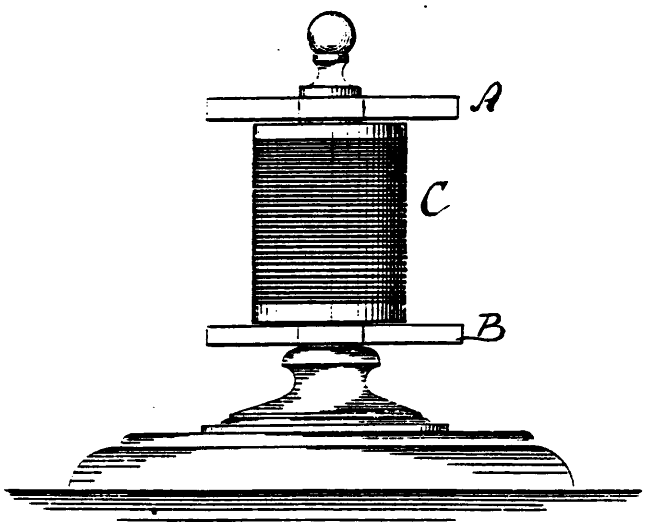


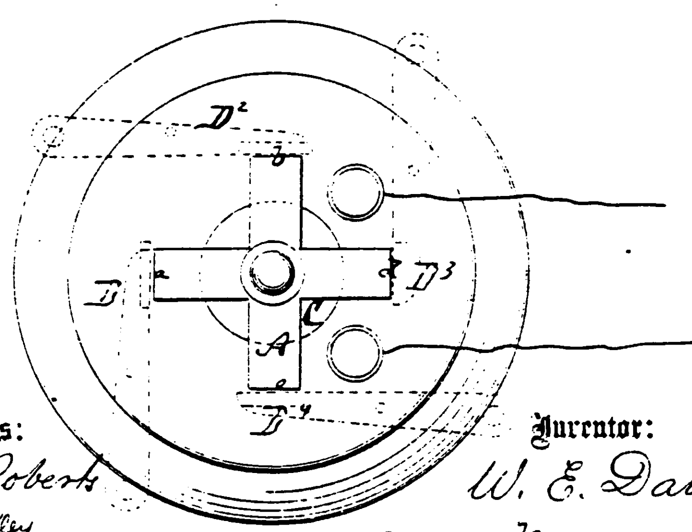
Wheatstone's telegraphic transmitter of 1837 was the prototype for many later devices: This model with punched tape input and pen-tape output was made in 1858.

W. E. DAVIS.

Electro-Magnets for Telegraphy.

No. 133,968. Patented Dec. 17, 1872.





Witnesses:

Alex F. Roberts

Frank Blockley

Inventor:

W. E. Davis

per

Munn & Co

Attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM E. DAVIS, OF JERSEY CITY, NEW JERSEY.

IMPROVEMENT IN ELECTRO-MAGNETS FOR TELEGRAPHY.

Specification forming part of Letters Patent No. **133,968**, dated December 17, 1872.

To all whom it may concern:

Be it known that I, WILLIAM E. DAVIS, of Jersey City, in the county of Hudson and State of New Jersey, have invented a new and Improved Telegraphic Instrument, of which the following is a specification:

Figure 1 is a side elevation, and Fig. 2 is a top view, of my improved telegraphic instrument.

Similar letters of reference indicate corresponding parts.

This invention relates to a combination of one electro-magnetic coil and its magnets with two or more armature-levers which are simultaneously affected by the currents through the coil, thus utilizing the same electro-magnet for operating a suitable number of instruments at once.

In carrying the invention into effect I shape the magnets A and B at the ends of the coil C like crosses (see Fig. 2) or otherwise to obtain the desired extent and position of contact surfaces *a b d e* for the armatures D D^2 D^3 D^4, &c., which are shown by dotted lines in Fig. 2. When a current is passed through the coil C and magnetizes the plates A B the armatures will all be attracted at once, and all will be repelled or withdrawn at the same time, if the current is arrested. By this means a suitable number of messages can be sent by one operation through several diverging lines, and more power will be derived from the same electro-magnet than could be done where but one armature was acted upon by the same coil.

This invention can be used in suitable position—vertical, horizontal, or otherwise—and with a continuous or divided coil.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

The combination of an electro-magnet with two or more armatures which are simultaneously attracted by the same plates A B, as set forth.

WILLIAM E. DAVIS.

Witnesses:
C. SEDGWICK,
T. B. MOSHER.

J. O. BYRNS.

TELEGRAPH-KEY.

No. 180,839. Patented Aug. 8, 1876.

Fig: 1.

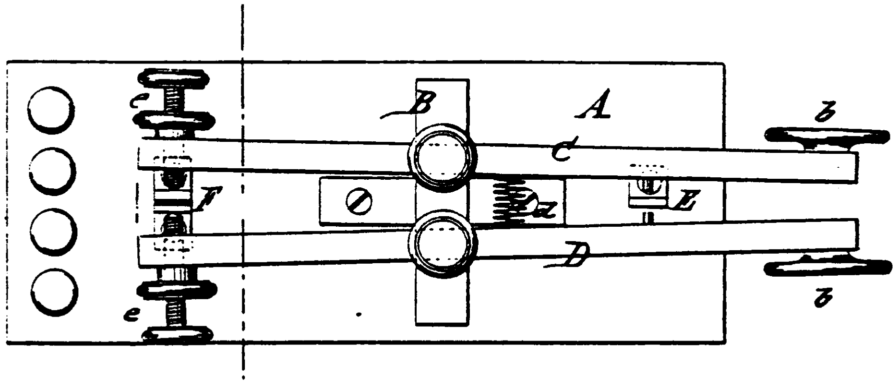
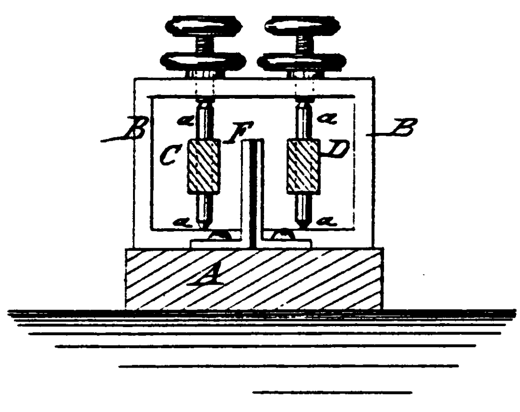


Fig: 2.



WITNESSES:

Chas. Nida

John Goethals

INVENTOR:

J. O. Byrns

BY

Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

JAMES O. BYRNS, OF JERSEY CITY, NEW JERSEY.

IMPROVEMENT IN TELEGRAPH-KEYS.

Specification forming part of Letters Patent No. **180,839**, dated August 8, 1876; application filed May 22, 1876.

To all whom it may concern:

Be it known that I, JAMES O. BYRNS, of Jersey City, in the county of Hudson and State of New Jersey, have invented a new and Improved Telegraph-Key, of which the following is a specification:

In the accompanying drawing, Figure 1 represents a top view, and Fig. 2 a vertical transverse section on line *x x*, Fig. 1, of my improved telegraph-key.

Similar letters of reference indicate corresponding parts.

The object of my invention is to furnish for telegraph-operators an improved duplex key, by which the time taken up by the upward motion of the present key may be utilized, and the sending of the messages be accomplished in about half the former time, and with greater facility and ease.

The invention consists of two horizontal swinging and spring-acted keys, whose contact-points alternately close the circuit by contact with an intermediate post, the keys being cut out, when not in use, by the rear set-screws bearing against a double post with dividing insulating-layer.

In the drawings, A represents the base-frame of the key; B, the upright metallic frame, to which the horizontally-swinging keys C and D are pivoted by steel pins *a*. The keys C and D are provided at the outer ends with the usual buttons *b*, by which the keys are operated by being swung by thumb and forefinger from one side to the other in place of the up-and-down motion of the common key.

The keys are jointly connected by a spiral spring, *d*, that interrupts the contact of the key-points with the post E, which is connected to one pole, while the upright support B is connected to the other pole, of the battery.

The contact of either key closes the circuit, so that by the alternate working of the keys the motion of the hand is utilized in both directions for the transmission of telegraphic characters.

The rear ends of the keys C and D bear by set-screws *e* against a double post, F, that is centrally split or divided by an insulating-layer, which serves to cut out the key by connection with the main line and keys. The tension of the spring *d* is regulated by the adjustment of the set-screws in the customary manner. The duplex key admits with little practice double transmitting speed, as compared to the single key, and facilitates the work of the telegraph-operator to a considerable extent.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A duplex telegraph-key made of horizontally-swinging and spring-acted lever-keys, that close the circuit alternately, substantially in the manner and for the purpose set forth.

2. The combination of two horizontally-swinging and spring-acted keys, by rear set-screws, with a double centrally insulated post, substantially as shown and described.

JAMES O. BYRNS.

Witnesses:
PAUL GOEPEL,
T. B. MOSHER.

J. E. SMITH.

Telegraph.

No. 33,269. Patented Sept. 10, 1861.

Fig. 1.

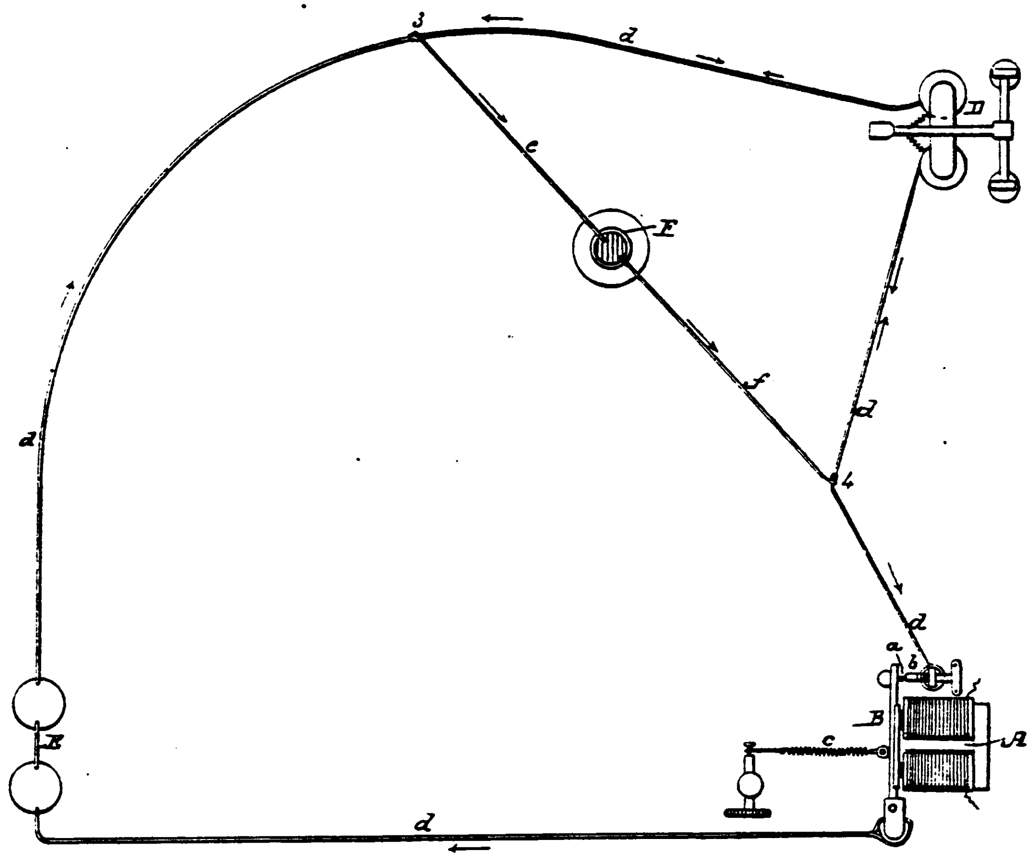
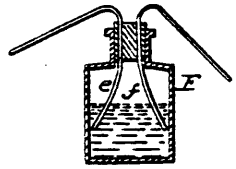


Fig. 2.



Witnesses

J W Coombs

M M Livingston

Inventor:

J. E. Smith

per Munn & Co

Attorneys

UNITED STATES PATENT OFFICE.

J. E. SMITH, OF POUGHKEEPSIE, NEW YORK.

IMPROVEMENT IN ELECTRO-MAGNETIC TELEGRAPHS.

Specification forming part of Letters Patent No. **33,269**, dated September 10, 1861.

To all whom it may concern:

Be it known that I, J. E. SMITH, of Poughkeepsie, in the county of Dutchess and State of New York, have invented a new and useful Improvement in Electro-Magnetic Telegraphs; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan of the local circuit of a telegraph-line, illustrating the application of my invention. Fig. 2 is a vertical section of the principal portion of the supplemental conductor, which constitutes the essential feature of my invention.

Similar letters of reference indicate corresponding parts in both figures.

This invention relates to all electro-magnetic telegraphs in which a local circuit is used. Its object is to prevent the magneto-electric current induced in the local circuit from darting through the air between the relay-points and thereby disrupting the metal from the said points and transferring particles of it from one point to the other, and thus, by forming a flexible conductor between the said points, keeping the local circuit closed after the main circuit has been opened.

The invention consists in the application to the local circuit of a supplementary conductor composed wholly or in part of some substance of feeble conducting power, as water, through which but a very small portion of the local-battery current will pass when the local circuit is closed, but through which the induced magneto-electric current will pass, rather than dart through the air between the relay-points, when the said circuit is open, said conductor touching the local circuit in two places, one of which may be anywhere between one of the opening and closing points of the relay and the register or sounder magnet, and the other between the other of the said points and the other side of the said magnet. By the use of this conductor a less movement of the armature of the relay-magnet may be made effective, the armature may be brought closer to the poles of the magnet, and a finer adjustment of the armature, and a weaker armature-spring may be used, and the line may be made to work with a weaker main battery or better with a main battery of a given strength.

To enable others skilled in the art to make and use my invention, I will proceed to describe it with reference to the drawings.

Fig. 1 represents the several parts of the local circuit arranged not so much with a view to practical convenience as to explain the application of my invention.

The arrangement of the parts is immaterial, so far as my invention is considered, and may be the same as is commonly adopted in telegraph-offices, or any other that is convenient.

A is the relay-magnet; B, its armature; *a* and *b*, the opening and closing points of the circuit; *c*, the armature-spring; D, the register; E, the local battery; and *d*, the ordinary conducting-wires of the local circuit.

F *e f* is the supplementary conductor, which constitutes my invention, consisting of a bottle of water, F, and two separate wires, *e* and *f*, passing through the cork and entering the water. These wires *e* and *f* are connected with the conductor *d* at the point 3 between the relay-point *a* and one side of the register-magnet, and at the point 4 between the relay-point *b* and the other side of the register-magnet. This conductor may be made more or less feeble by separating more or less the ends of the wires *e f*, which are in the water. When the main circuit is open and the armature B is held back by the spring *c*, keeping the points *a b* separated, the induced magneto-electric current in the local circuit takes the direction of the red arrows shown in Fig. 1 through the conductor F *e f*, and when the local circuit is closed in the points *a b* by the attraction of the armature B, produced by the closing of the main circuit, the local circuit is formed, as usual, by the conductor *d*, as indicated by the black arrows in Fig. 1, a quite inconsiderable portion of the local-battery current passing through the conductor F *e f*.

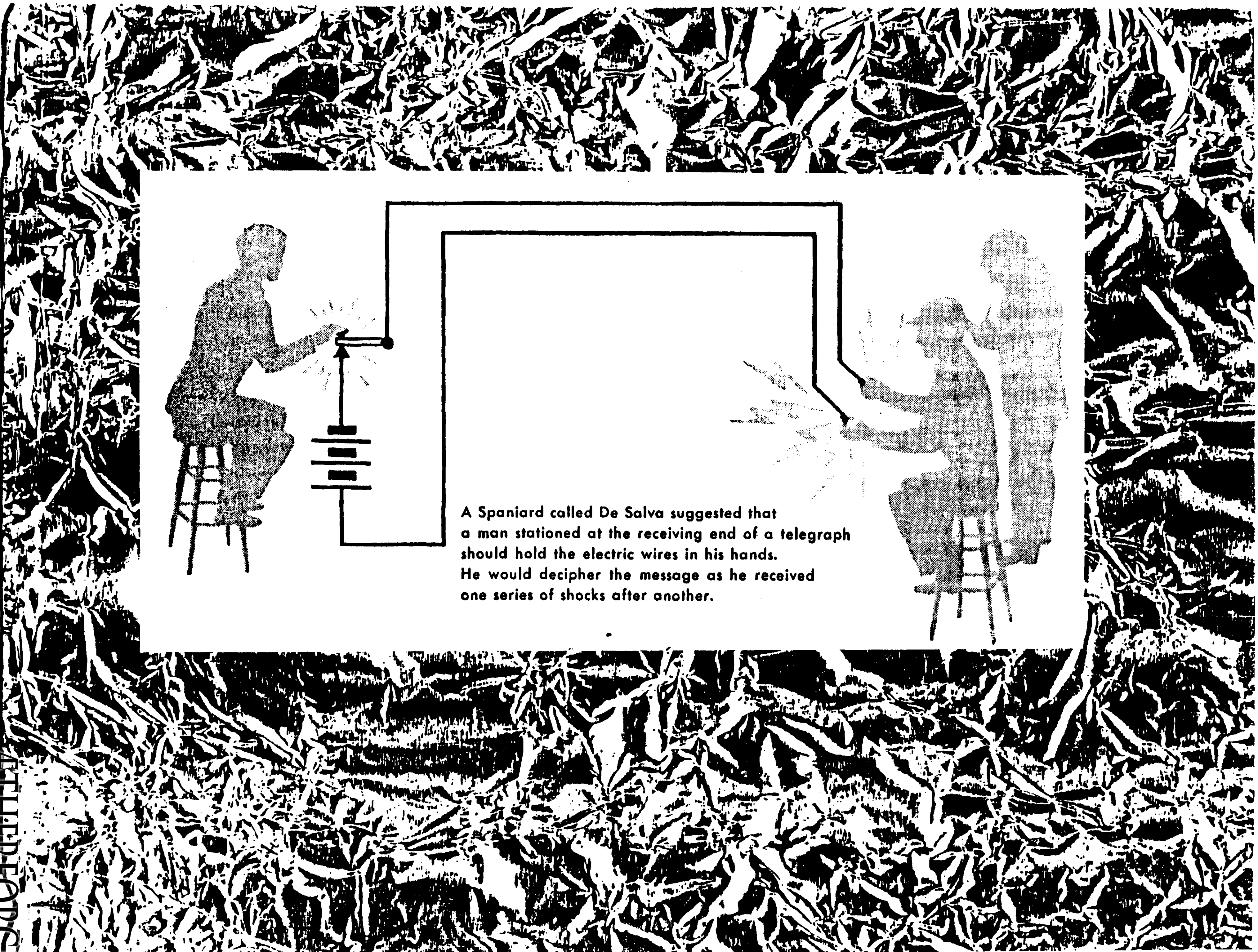
I do not confine myself in carrying out my invention to the use for the purpose specified of a conductor composed in part of water, as described, as any other poor conducting substance may be substituted for water: but

I claim as my invention and desire to secure by Letters Patent—

A supplementary conductor applied to the local circuit, to operate substantially as and for the purpose herein specified.

J. E. SMITH.

Witnesses:
F. H. LAWRENCE,
HENRY A. REED.

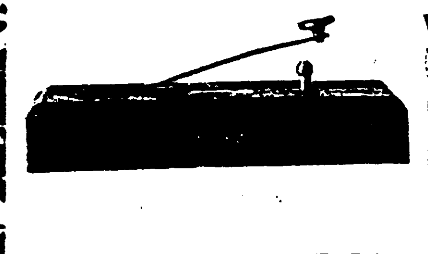


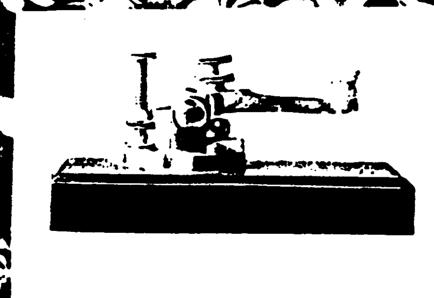
A Spaniard called De Salva suggested that a man stationed at the receiving end of a telegraph should hold the electric wires in his hands. He would decipher the message as he received one series of shocks after another.

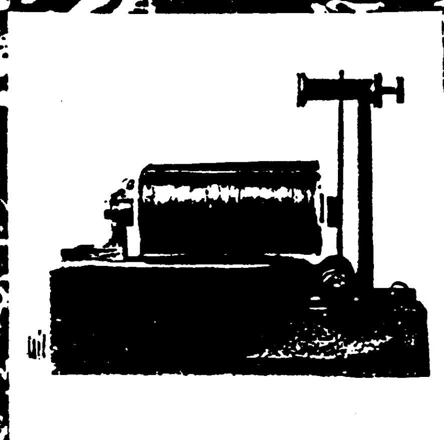
RABDOMANCY IN A NEW LIGHT...THE TELEGRAPHERS STUTTERING KEY

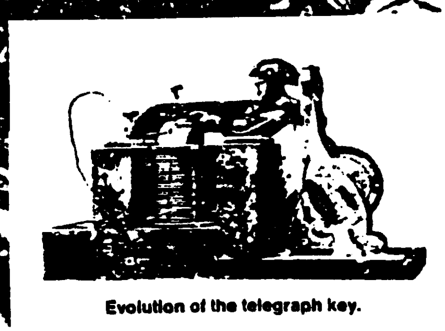
HERE WE SEE THE TRANSACTION OF OPERATORS WITH RECIPIENTS THROUGH A DIRECT CONTACT VRIL INSTRUMENT OF SURPRISING SENSITIVITY.

NOT AS A MEANS FOR SENDING INERT SIGNAL...BUT RATHER AS A MEANS BY WHICH AN INTENSTIONAL MEANING COULD BE TRANSACTED THROUGH VRIL THREADS...THE KEY MAY BE EXAMINED.

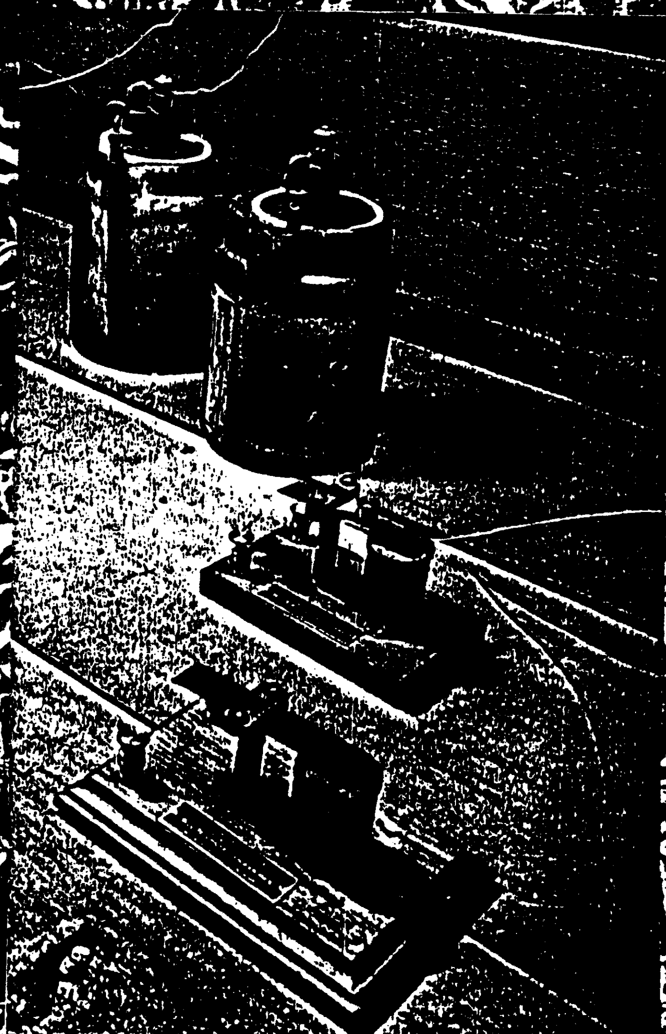








Evolution of the telegraph key.



Harmonic Telegraph transmitter and receiver.

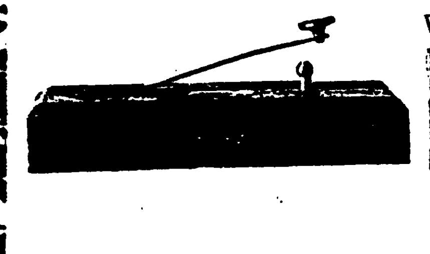
VRIL (VIA GROUND CONDUCTANCE)
TRAVELS OVER THE COIL WINDINGS IN PERPENDICULAR THREADS.
THEM ARE COLLIMATED IN THE IRON CORE
AND RADIATE IN DENDRITIC FASHION THROUGH SPACE.
TELEGRAPH OPERATORS WERE THUS EXPOSED TO HIGHLY DENSIFIED BEAMS
OF VRIL.

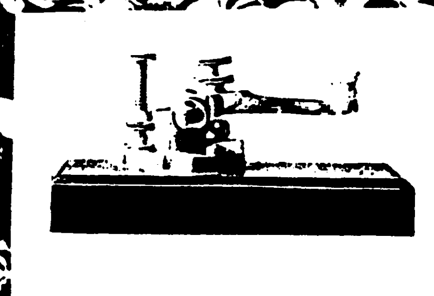
VRIL BEAMS AND VRIL THREADS CARRY THE MEANINGFUL COMPONENT OF ALL COMMUNICATIONS.
TELEGRAPH OPERATORS WERE ABLE TO CODE AND DECODE THE ACOUSTIC SIGNALS (INERT)
ONLY BECAUSE OF THE VRIL THREADS WHICH FLOODED THE SPACE
IN WHICH THEY OPERATED THEIR APPARATUS.
TINES AND BARS OF HARMONICALLY ENTUNED IRON
ENHANCE THE VRIL THREADS

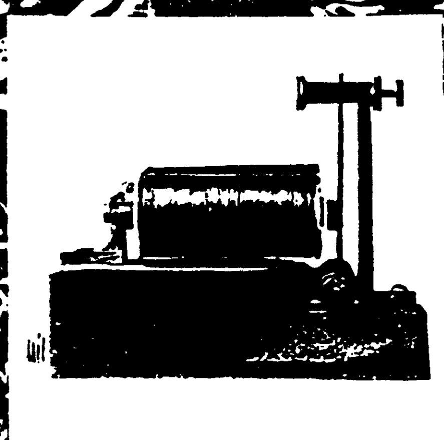
RABDOMANCY IN A NEW LIGHT...THE TELEGRAPHERS STUTTERING KEY

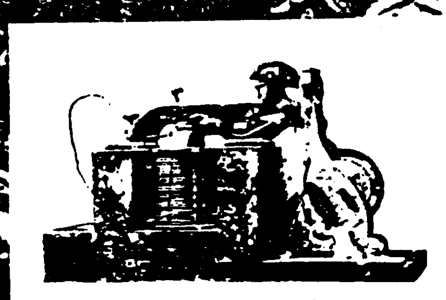
HERE WE SEE THE TRANSACTION OF OPERATORS WITH RECIPIENTS THROUGH A DIRECT CONTACT VRIL INSTRUMENT OF SURPRISING SENSITIVITY.

NOT AS A MEANS FOR SENDING INERT SIGNAL...BUT RATHER AS A MEANS BY WHICH AN INTENSTIONAL MEANING COULD BE TRANSACTED THROUGH VRIL THREADS...THE KEY MAY BE EXAMINED.

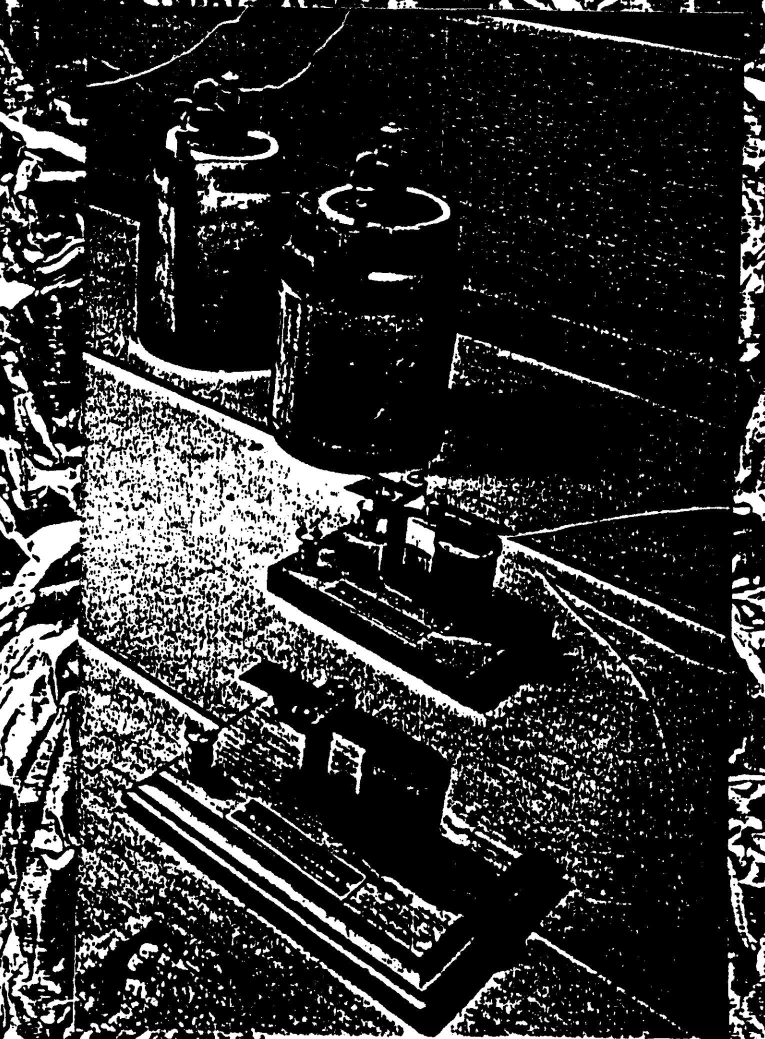








Evolution of the telegraph key.



Harmonic Telegraph transmitter and receiver.

VRIL (VIA GROUND CONDUCTANCE)
TRAVELS OVER THE COIL WINDINGS IN PERPENDICULAR THREADS.
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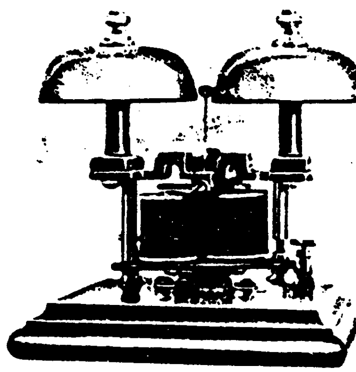
TINES AND BARS OF HARMONICALLY ENTUNED IRON
ENHANCE THE VRIL THREADS



Watson type of ringer

IRON IS THE MOST POTENT RESONATOR OF VRIL.

THE HUMAN ORGANISM IS PRINCIPALLY ENTUNED TO RECEIVE VRIL THROUGH IRON.

IRON CORES IN TELEGRAPHIC SOUNDERS WERE VRIL ACTIVATED THROUGH COPPER HELICIES WRAPPED

WRAPPED ABOUT THEM IN FINE MANIFOLDS.

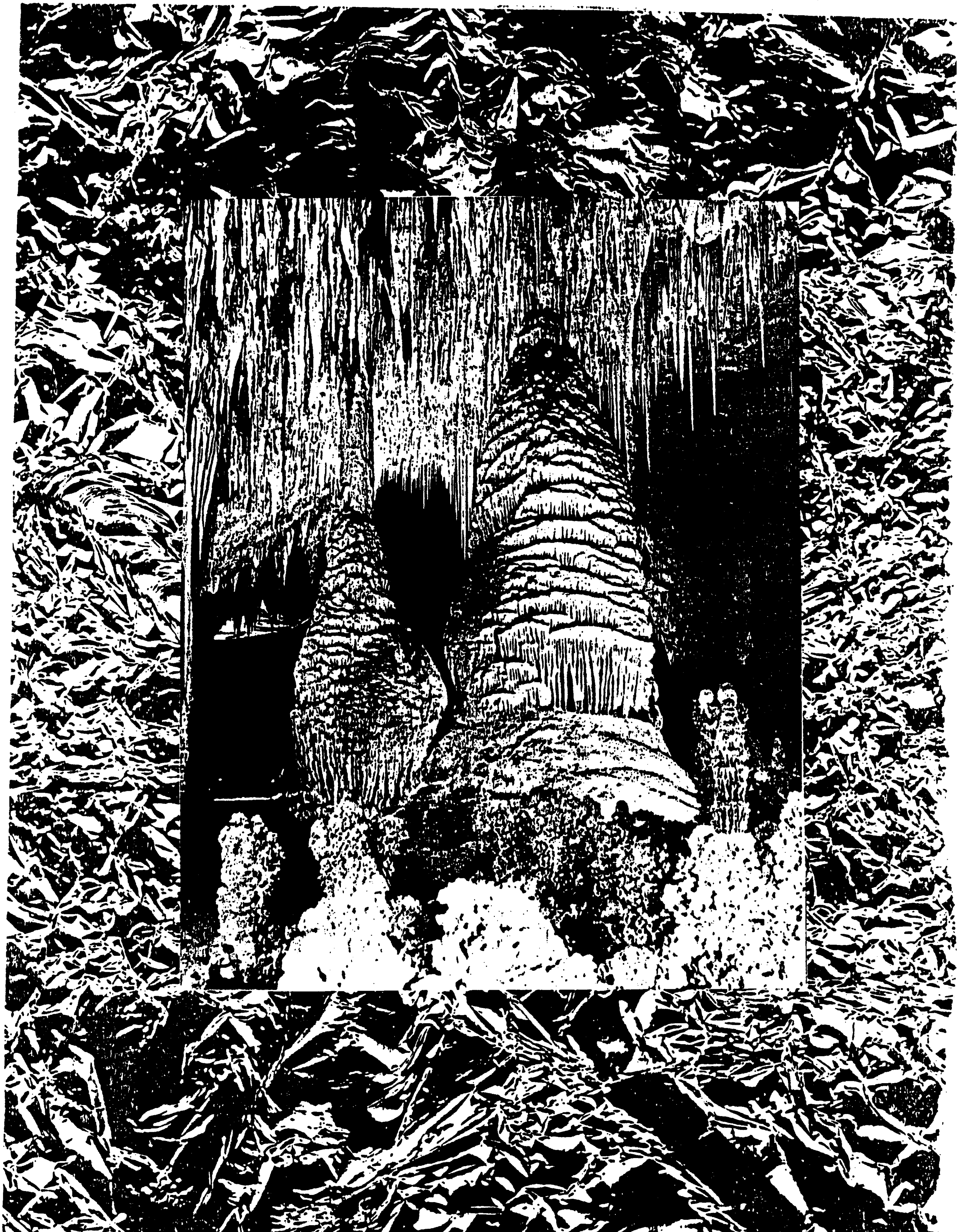
WHILE THE COPPER FILAMENTS WERE FORCED TO CARRY IMPRESSED SIGNALS

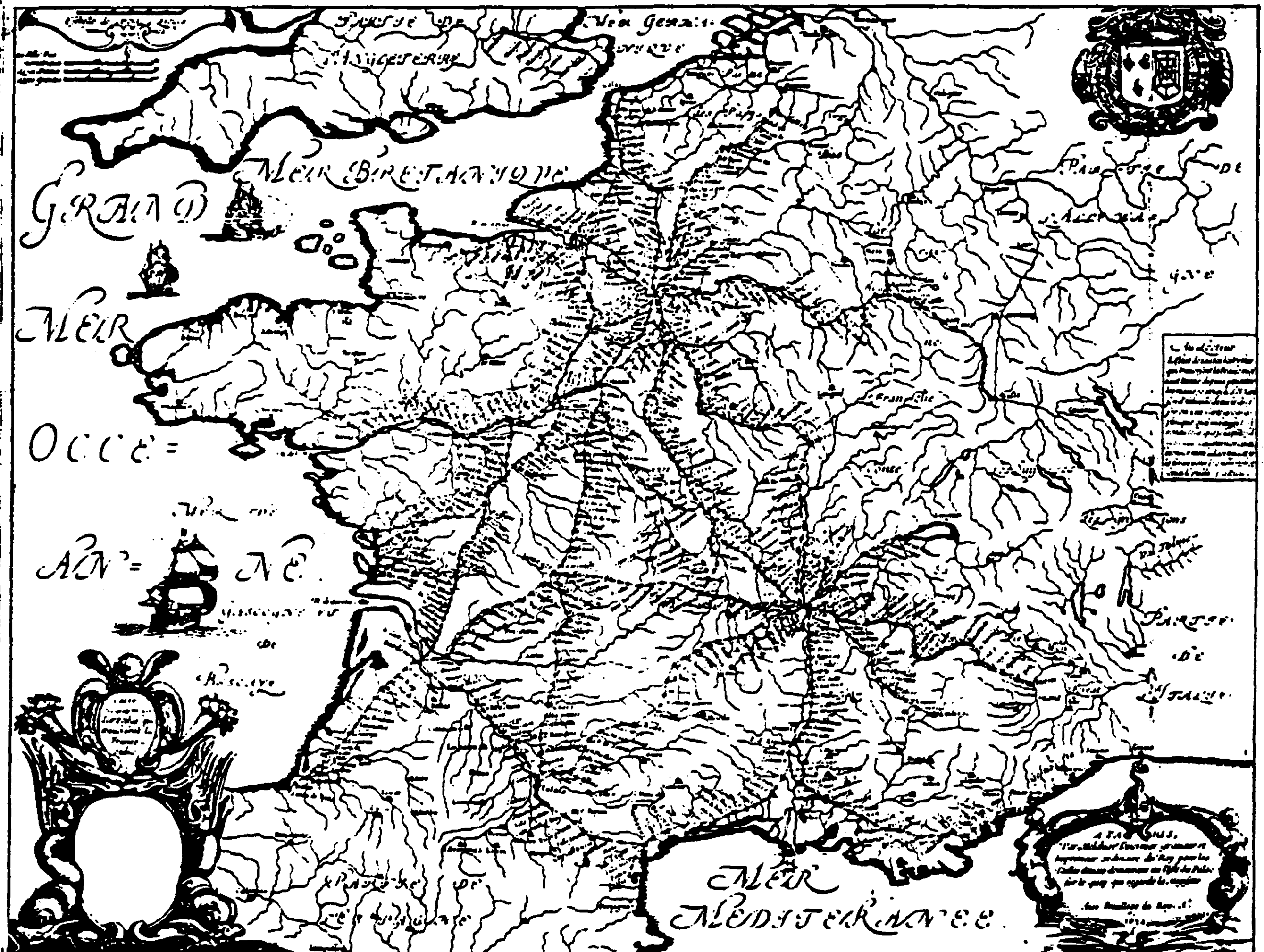
OF ELECTRIC DETRITUS

THE IRON CORES CONCENTRATED AND FOCUSSED VRIL.

SECTION
5

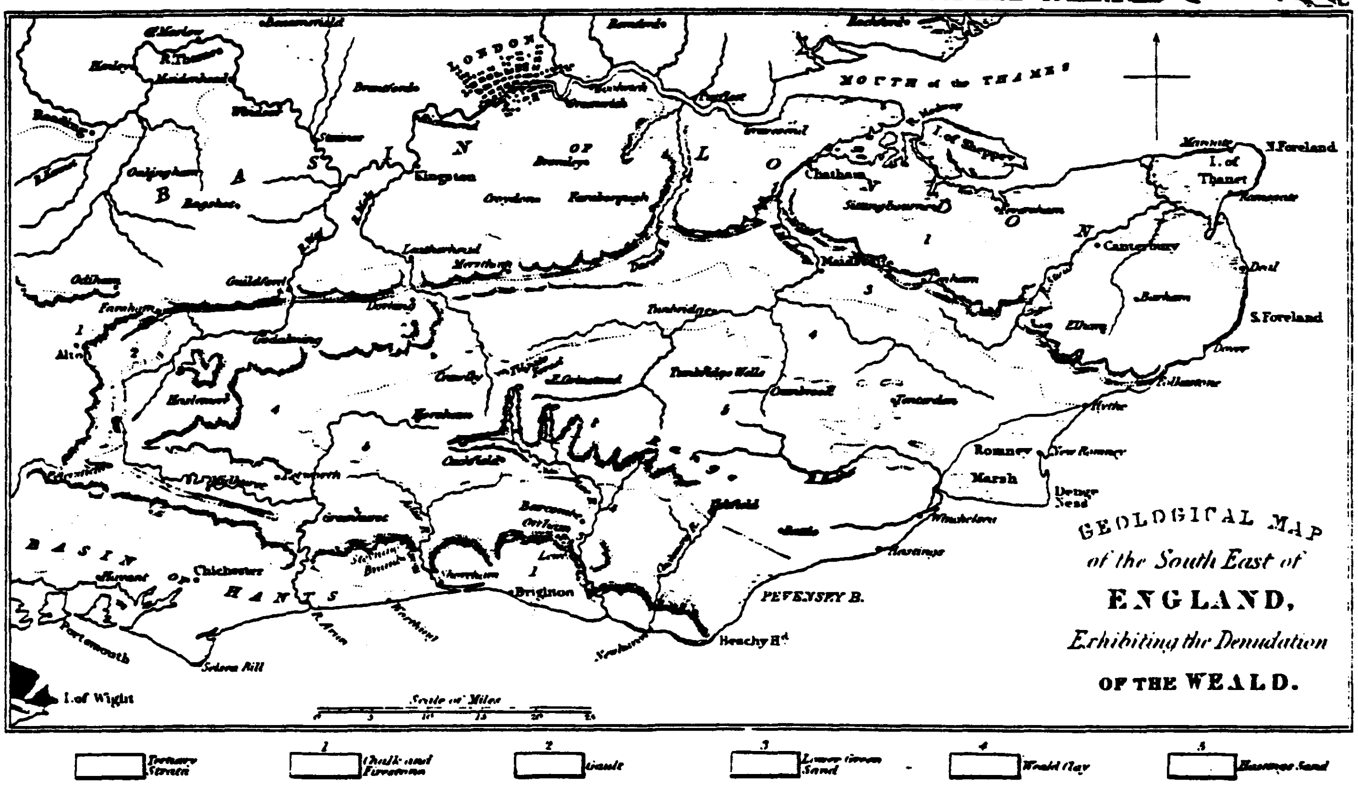
VRIL MAPS





MELCHIOR TAUERNIER: POST ROADS OF FRANCE, 1632

HUMANITY EVER PURSUES VRIL TRAILS
BUILDING BOTH CITY AND
PUBLIC WORKS PROJECTS
UPON THE VRIL POWERPOINTS



Ground Plan of Roman Catacombs.

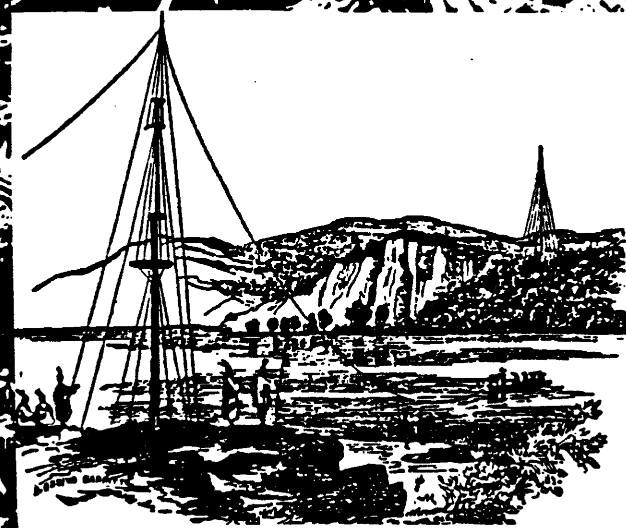
FOLLOWING THE VRIL TRAILS:

VRILLIC SATURATION OF TELEGRAPHIC SYSTEMS

The lines followed railroads wherever possible. This station was along the road from Washington to Fairfax.

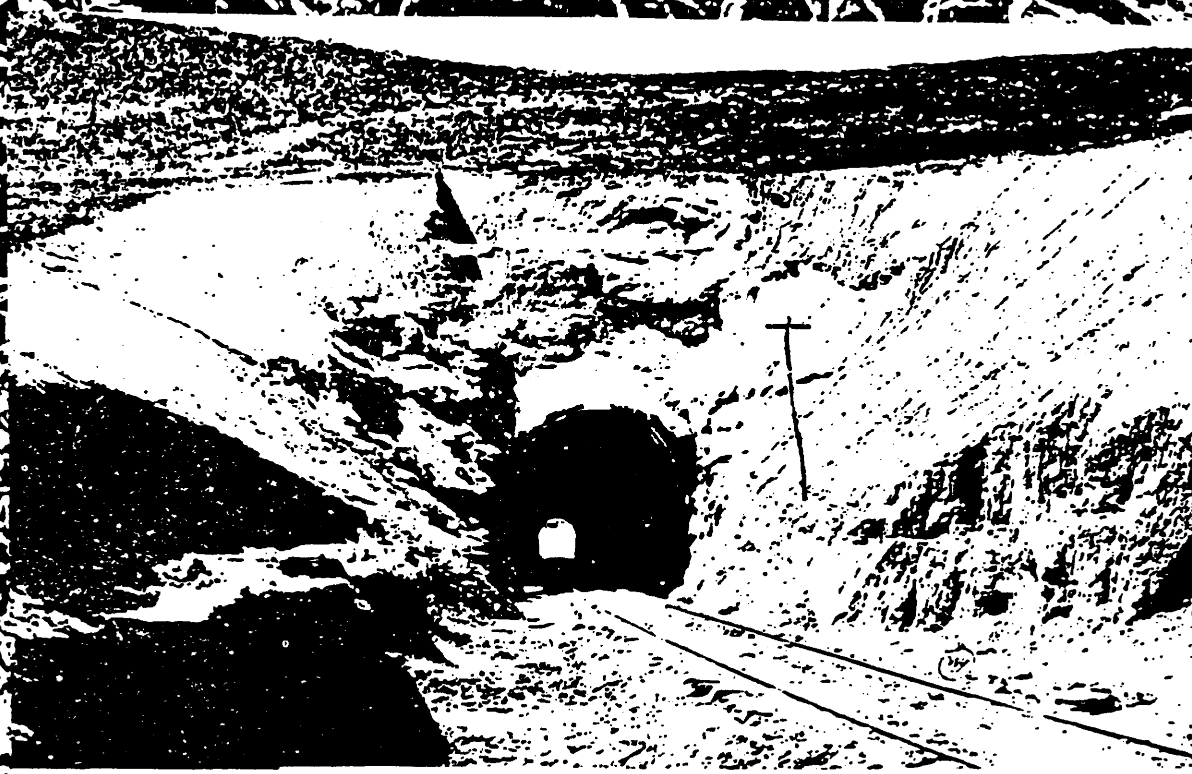
Western Union battery room before the days of generators

A lineman of the 1850's

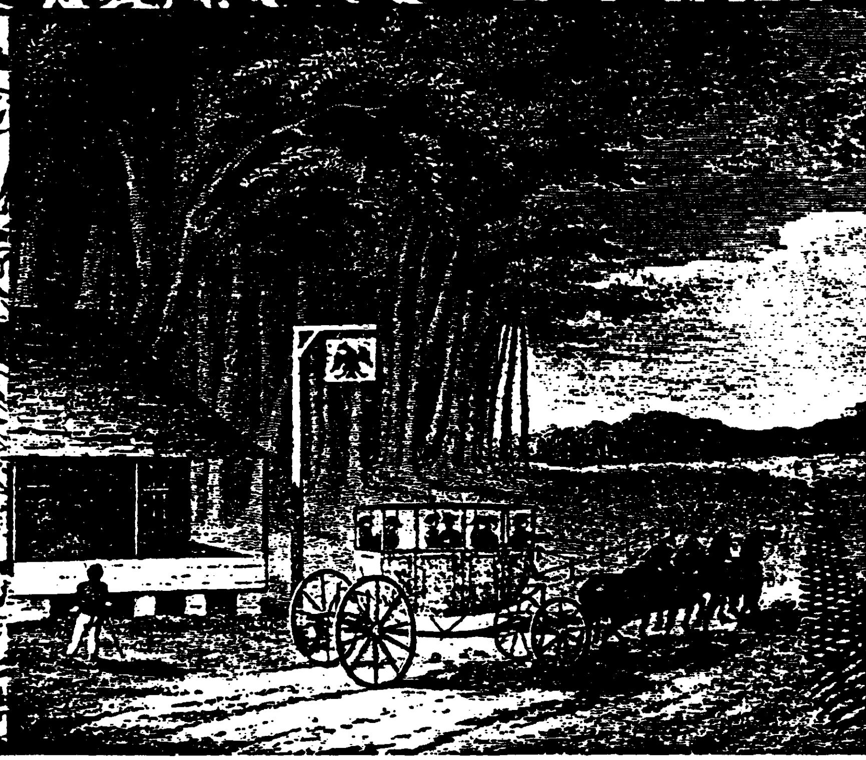


High masts at a river crossing

Cable for a river crossing was spun on the spot. Submarine cables were used later when gutta percha proved to be a good underwater insulator.



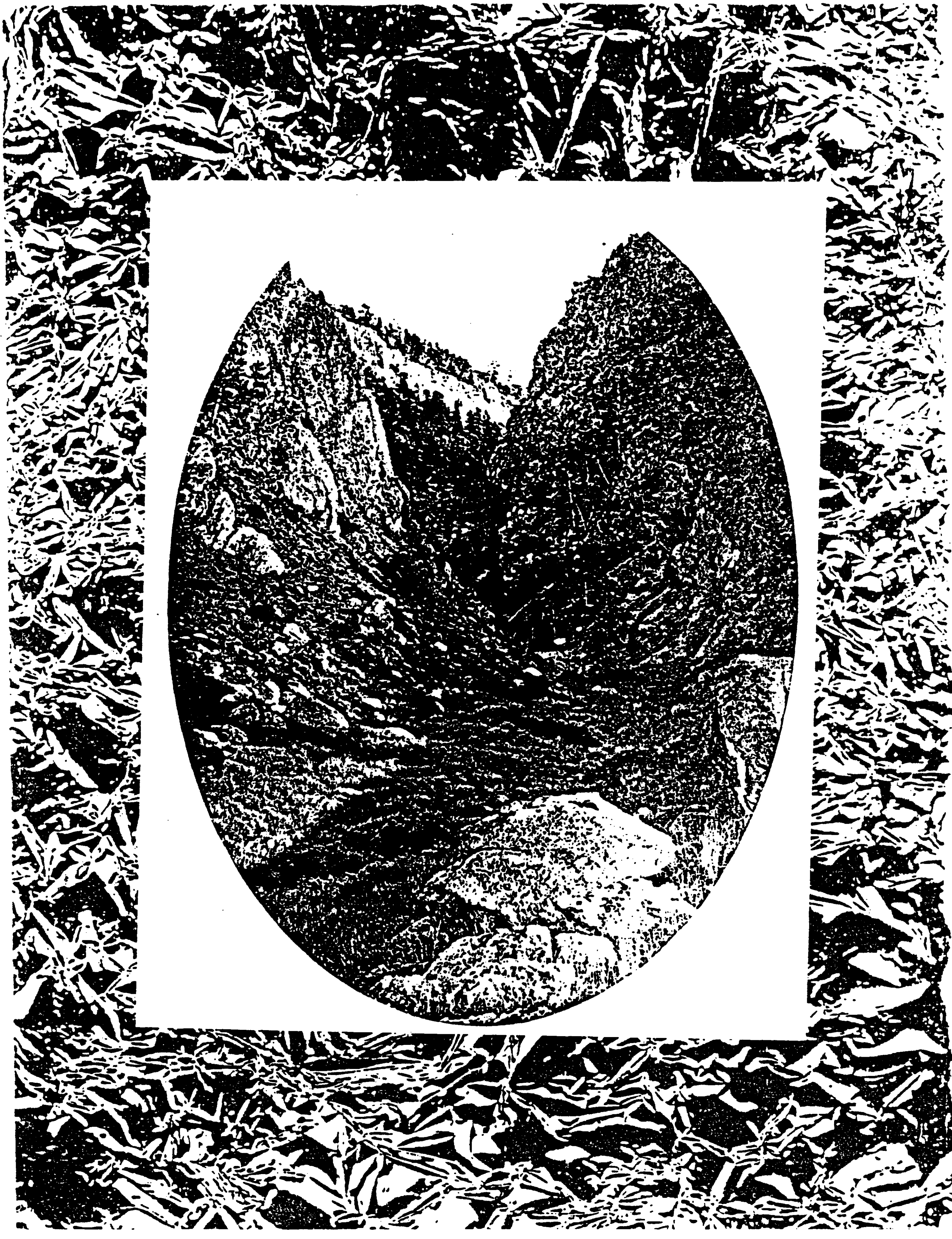
RAILS AND TELEGRAPH LINES TOGETHER
BOTH OBEYED THE ANCIENT VRILLIC URGE

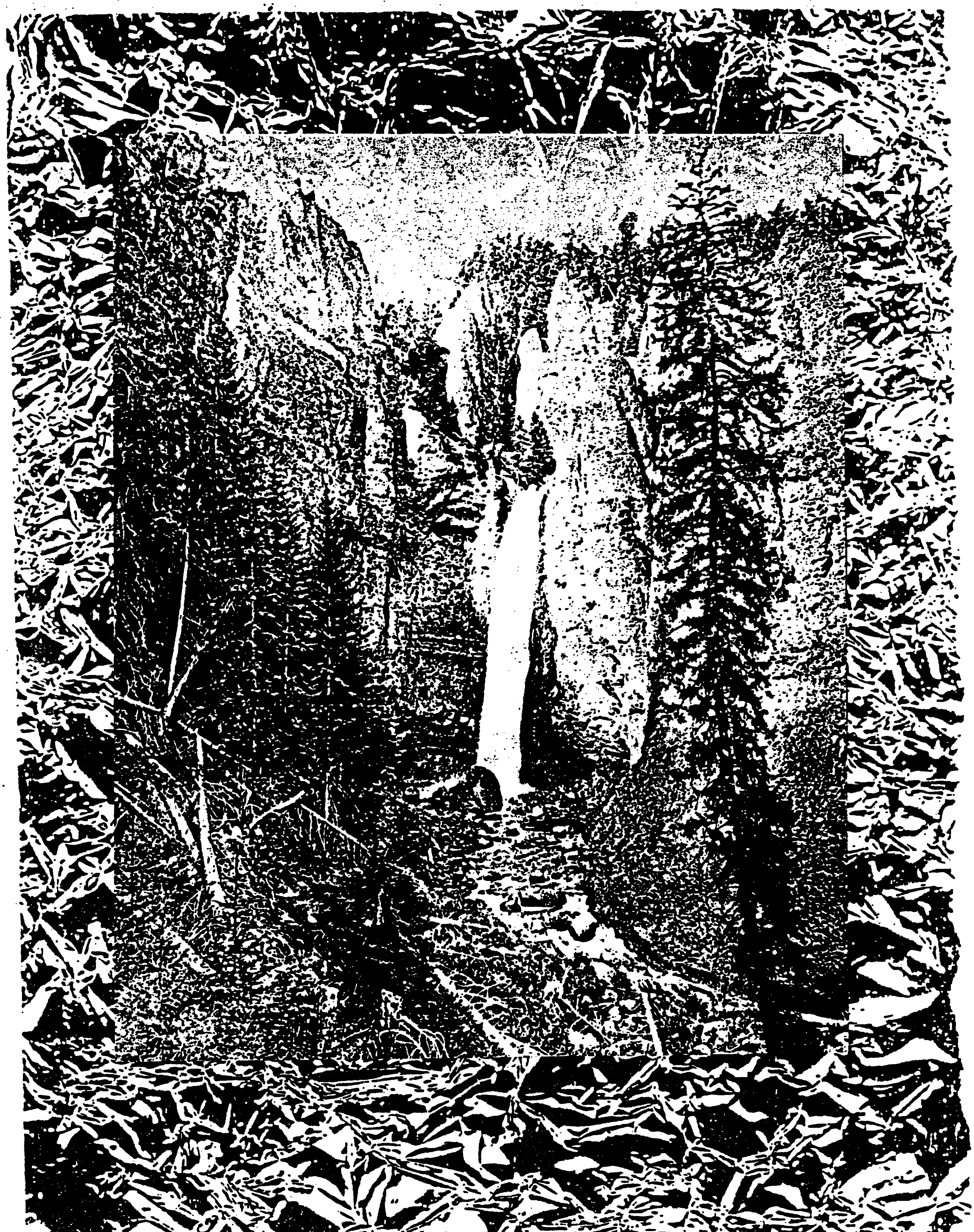


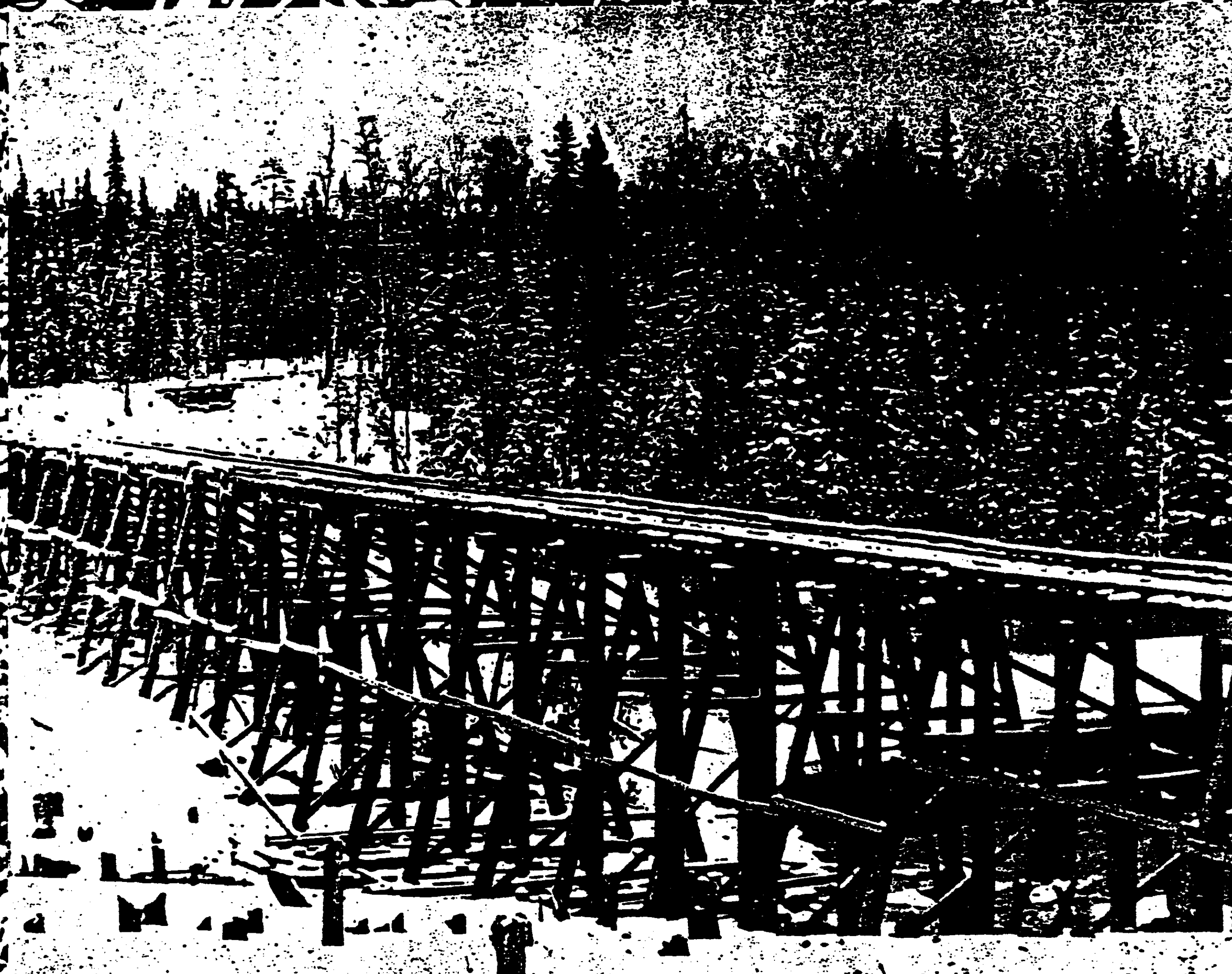
Miserable roads, like the Cumberland, made canals attractive because of unlimited load-carrying capacity and smoothness.

VRIL IN THE ENVIRONMENT IS VERY EVIDENT

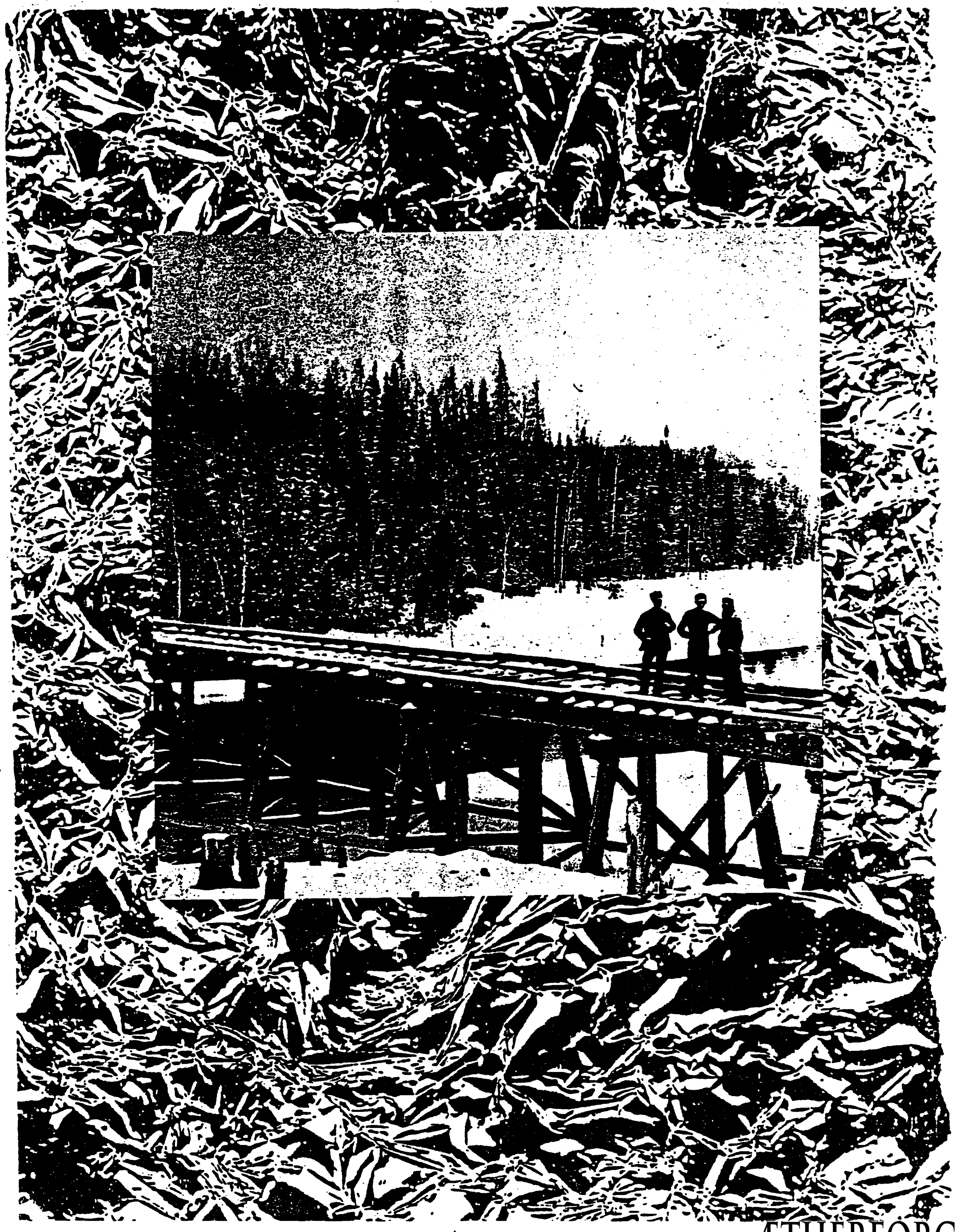
OUR ATTENTIONS ARE POWERFULLY DRAWN
INTO ITS EVERY GROUND PASSAGE



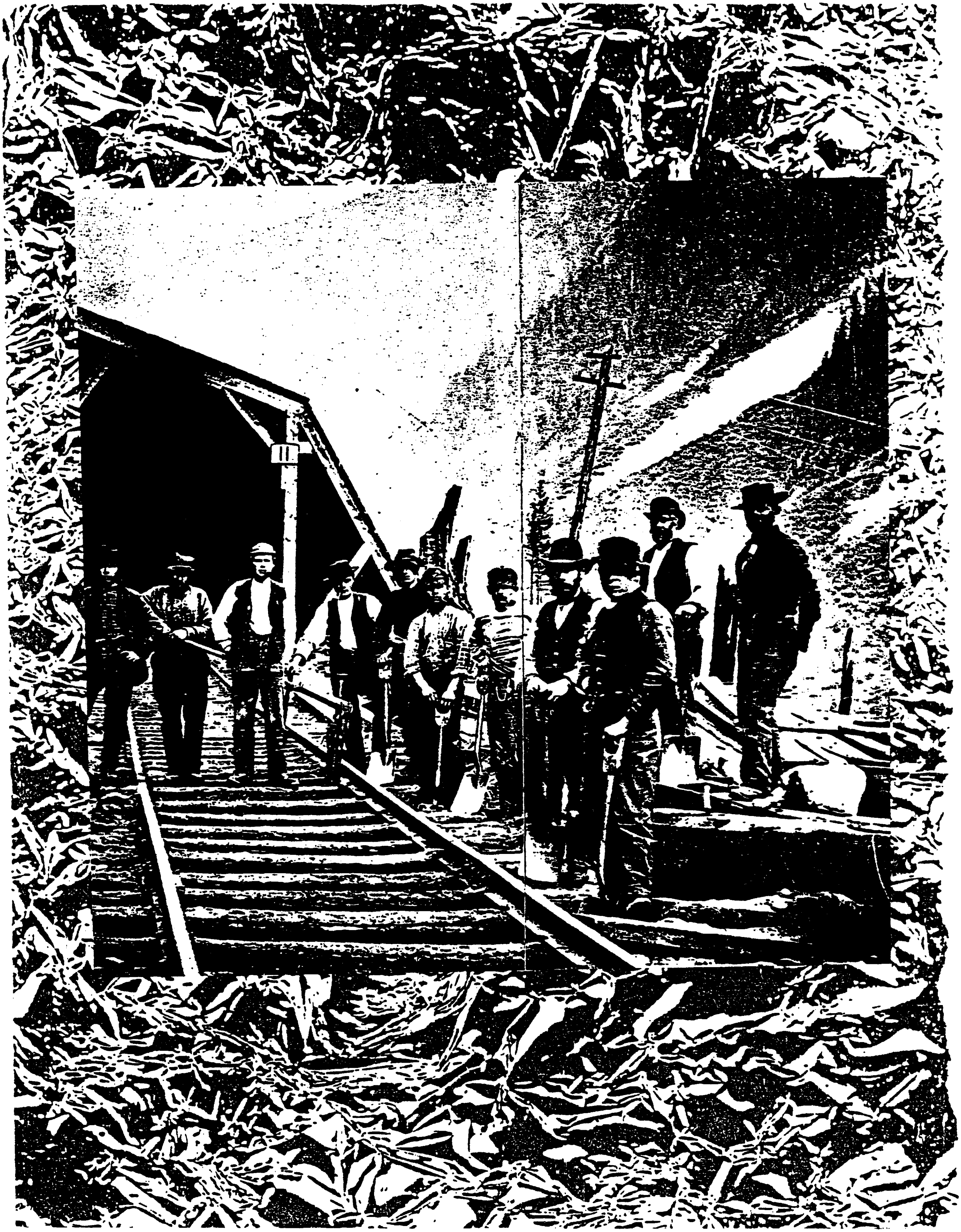


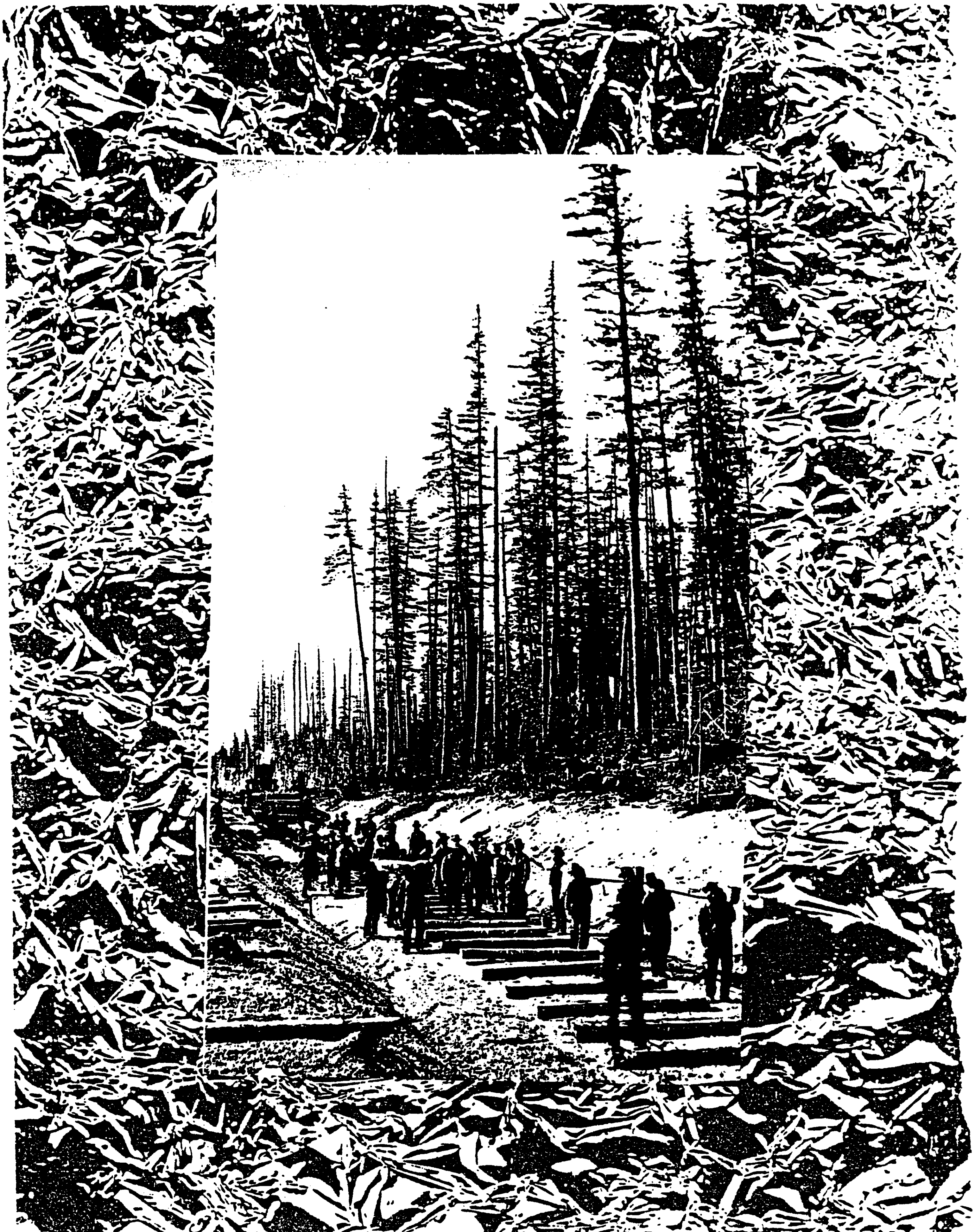


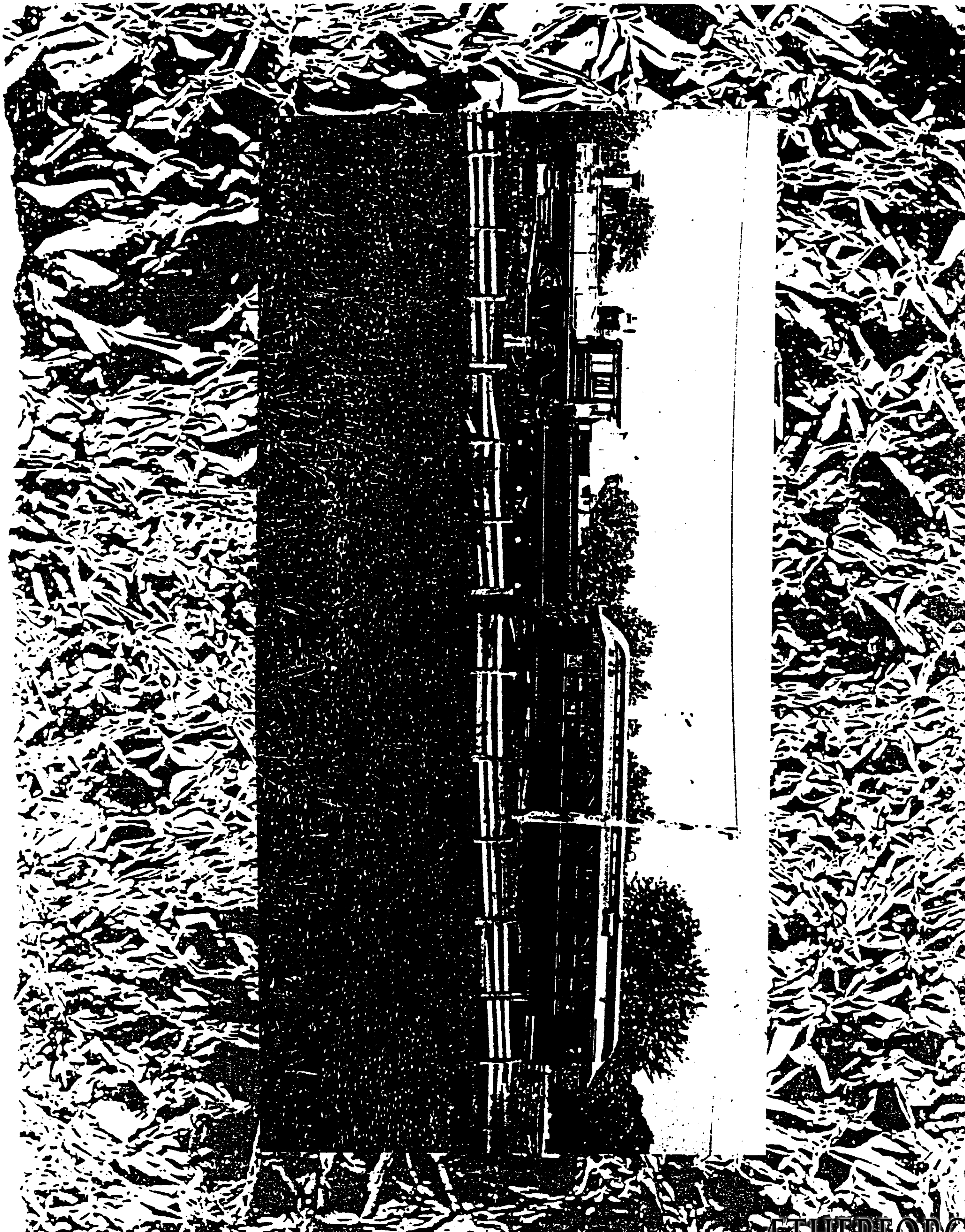
THE IRON RAILS BROUGHT UP VRIL FROM THE DEEP GROUND
VRILLIC POWER WAS ENTRAINING AND GENERATING
HUMAN VISIONS TO NEW DEPTHS

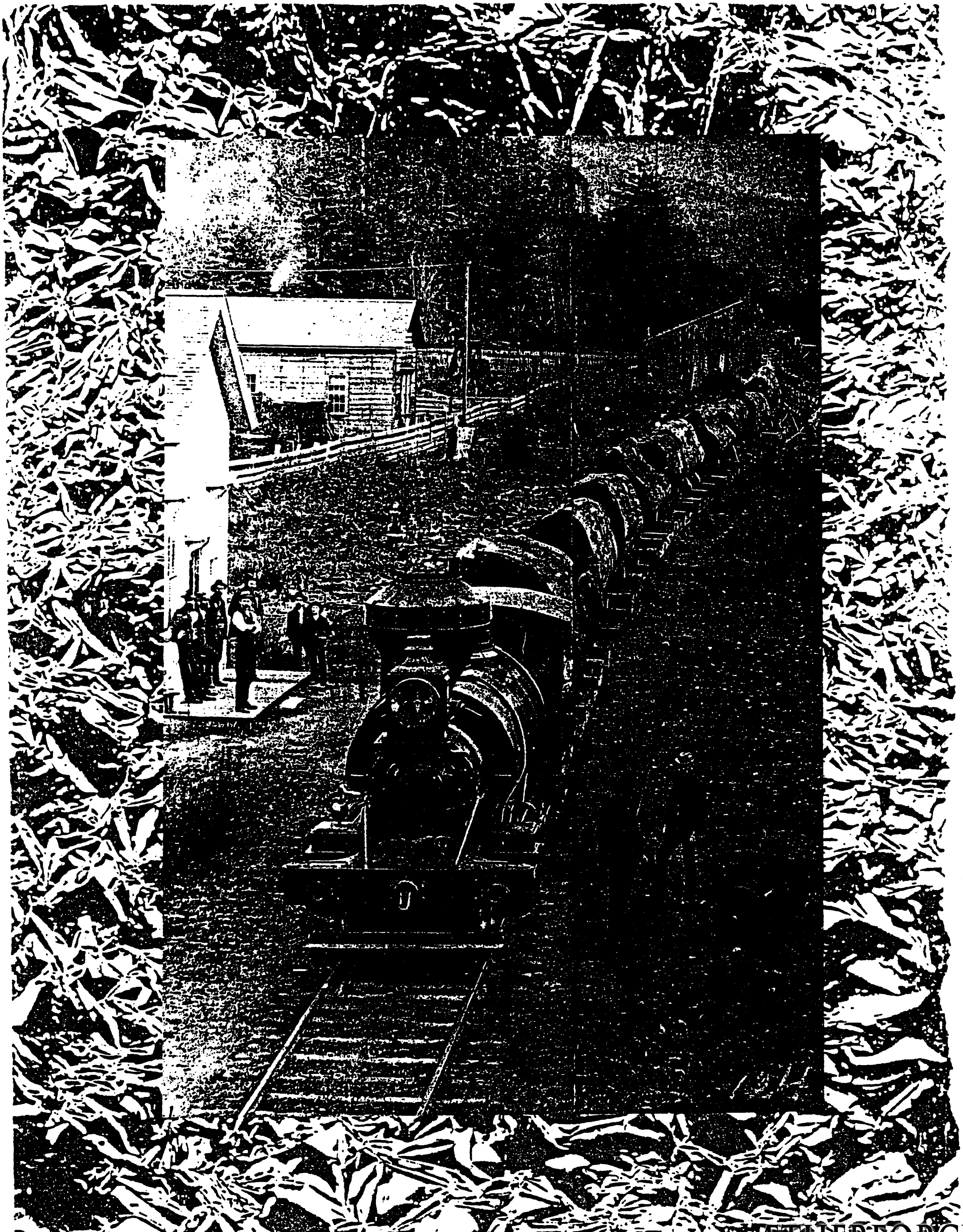



THE RAILS OF IRON
AND THE WIRES OF IRON
TOGETHER
FORGING TRAILS OF NEW MIND









M. G. FARMER.

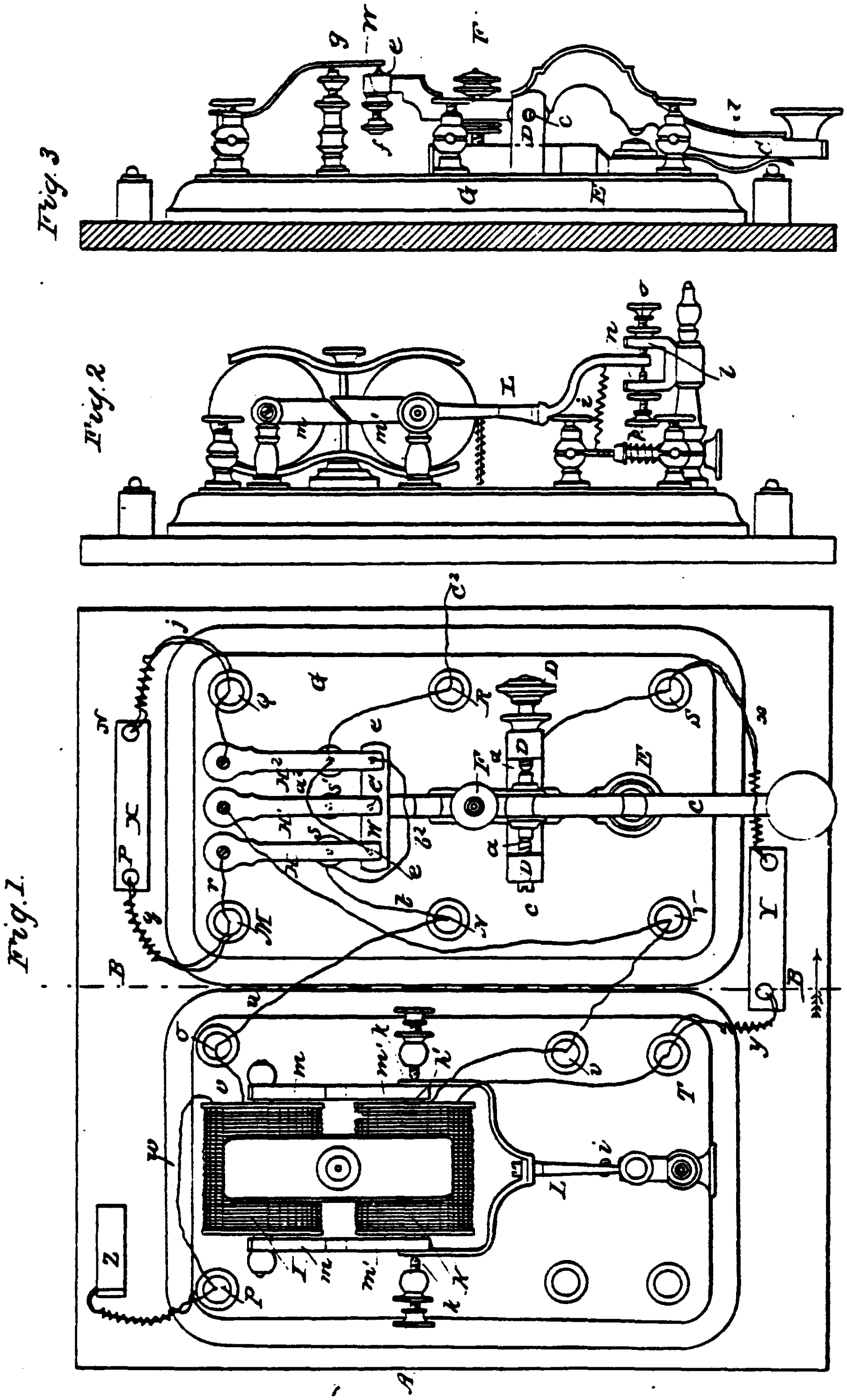
Duplex Telegraph.

2 Sheets—Sheet 1.

SEE REISSUE

No. 21,329.

Patented Aug. 31, 1858.

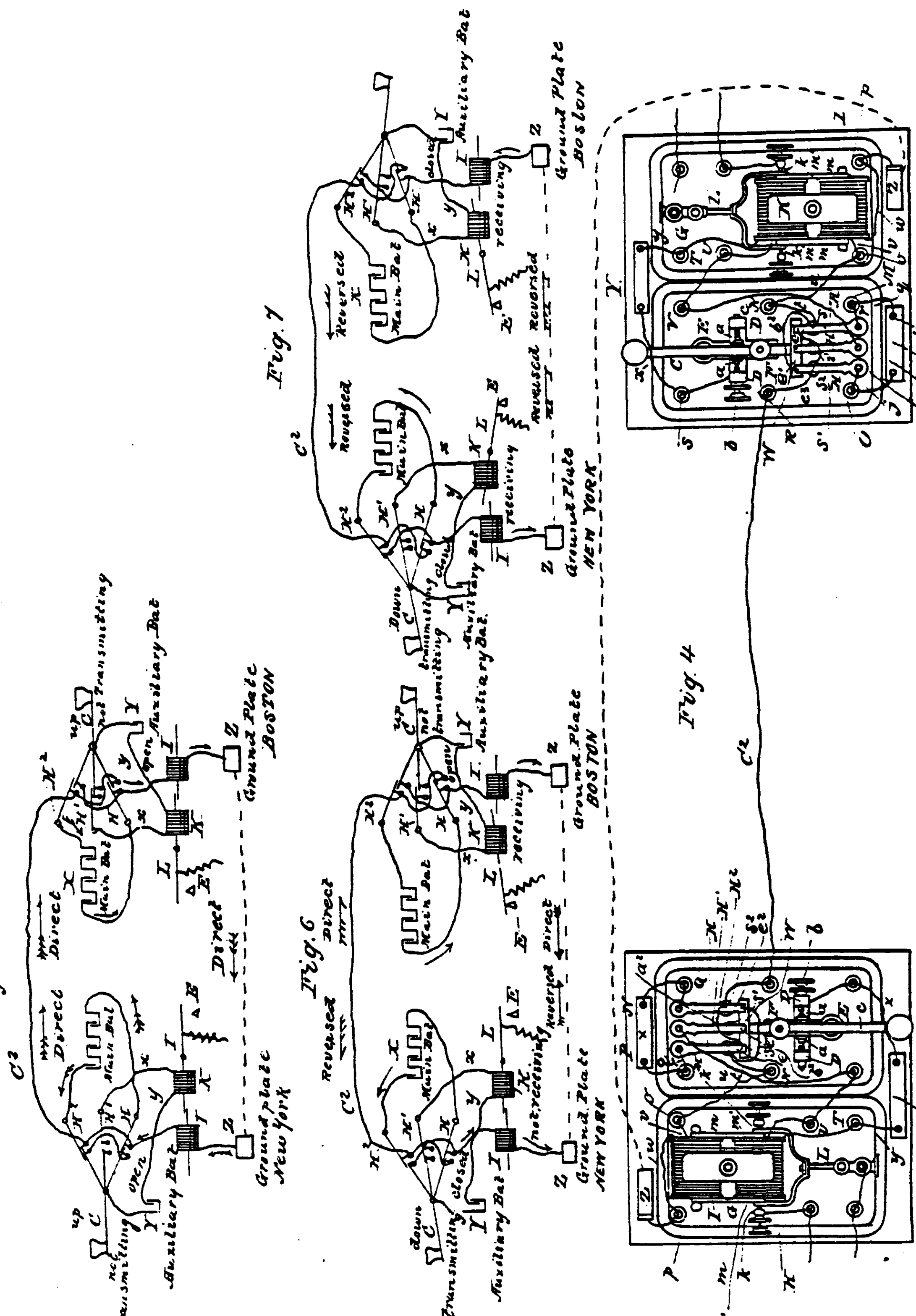


2 Sheets—Sheet 2.

M. G. FARMER.

Duplex Telegraph.

No. 21,329. Patented Aug. 31, 1858.



N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

MOSES G. FARMER, OF SALEM, MASSACHUSETTS.

IMPROVED METHOD OF SENDING AND RECEIVING MESSAGES SIMULTANEOUSLY OVER THE SAME TELEGRAPHIC WIRE.

Specification forming part of Letters Patent No. **21,329**, dated August 31, 1858.

To all whom it may concern:

Be it known that I, MOSES G. FARMER, of Salem, in the county of Essex and State of Massachusetts, have invented an Improved Relay-Magnet and Key for Magnetic Telegraphs, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a plan of my instrument; Fig. 2, an elevation of the same, seen from the point A of Fig. 1; Fig. 3, a section upon the line B B of Fig. 1, looking in the direction of the arrow. Fig. 4 represents two instruments in working order at opposite ends of a line; Figs. 5, 6, and 7, diagrams that will be referred to hereinafter.

My invention has for its object to send and receive messages simultaneously over the same wire and upon one instrument; and this I accomplish by the employment of an accessory magnet and an accessory battery to each instrument, in combination with the main batteries and main magnets, and with a means of reversing the direction of the current of each of the main batteries, as will be hereinafter more particularly described. My apparatus consists, essentially, of two parts—the key or transmitting apparatus and the relay or reversing apparatus. The transmitting apparatus will first be described.

The key C (seen in plan in Figs. 1 and 4 and in elevation in Fig. 3) is pivoted at *a* to standards D, and is regulated in position horizontally by screws *b* and *c*. It is raised from its anvil E by the spring *d*, its motion in this direction being regulated by the adjusting screw and nuts F. At its rear end the key carries three platina points, e e' e^2, (seen dotted in Fig. 1,) beneath the springs H H′ H^2. One of these points is seen in elevation at *e*, Fig. 3, their distance from the springs being adjusted by thumb-screws *f*. The center point, e', is in communication with the key C. The outside points, e e^2, are insulated. The key and the other details of the instrument are insulated by the wooden foundation G, except so far as they are connected with the batteries and with each other by wires, as will be hereinafter more fully described.

H H′ H^2 are contact-springs which rest upon the anvils s s' s^2, Fig. 3, the height of which is adjusted by screws *g*. The outside contact-springs are for the purpose of reversing the poles of the main battery or the direction of the main currents. The middle spring, H′, is for the purpose of opening or closing what I term the "accessory circuit." The key and the springs are so adjusted as to close one circuit or make one contact precisely at or before the time of breaking or opening another circuit or contact, and this is effected by so adjusting the springs with reference to the key that when the key is depressed it shall make contact with the springs at the very moment of beginning to lift them from their stops or anvils.

The relay-magnet is seen in plan in Figs. 1 and 4, and in elevation in Fig. 2.

I is the main magnet; K, the accessory magnet. The two are precisely similar, and each consists of a spool of fine insulated wire, inside of which are the cores or magnets, which consist of a round bar of iron armed at each end with a rectangular bar of soft iron, m m', which may be called the "armatures." The face of the outer end of each armature is inclined at an angle of nearly forty-five degrees, as seen in Fig. 2, and the two are so arranged that when in contact they seem to form rectangular bars across the poles of the magnets. The armatures *m* of the main magnet are stationary; but the armatures m' of the accessory magnet, together with its arm L, are allowed to vibrate a short distance under circumstances which will be presently explained. The armatures m m' are separated from each other and the arm L drawn down by the spring *i*. When so drawn down the arm rests upon the platina point *n*, Fig. 2, and the local circuit is closed, the register (not shown upon the drawings) being thereby thrown into action. When the armature m' is drawn down upon *m* the arm L is carried up against the ivory point *l*, the points *n* and *l* being adjusted by the screws *o* and *p*, and the armatures m' and arm L pivoting with the bar h' upon the centers *k*.

From the above description it is evident that when from any cause the armatures m m' are attracted to each other the arm L will be raised and the register of that instrument will be thrown out of action; and when from any cause the armatures are separated, as in Fig. 2, the arm L falls and the register is brought into action. If either one of the magnets be charged, or if they are both charged so that their armatures *m m'* indicate opposite polarities, the armatures are drawn together; but when both magnets are charged so that their armatures possess similar polarities, then the armatures repel each other and the register is set in action. The magnet I is included in the main telegraphic circuit and the accessory magnet in the circuit of the accessory battery, as will now be more fully explained.

When the instrument is not in operation, as in Fig. 5, the main circuit is closed, the positive current passing by the wire *q* to the screw-cup M; thence by the wire *r* to the spring H; thence to its anvil *s*, and by the wire *t* to the screw-cup N; thence by wire *u* to screw-cup O, from which, by the wire *v*, it passes to the main magnet I; thence by wire *w* to screw-cup P and ground-plate Z. From the corresponding ground-plate at the other station it passes through this machine in a direction the reverse of that just traced and enters the main battery at the negative pole. From the positive end of this battery it passes by the wire *j* to the screw-cup Q; thence to the spring H^2 and to its anvil S^2; thence by the screw-cup R over the line-wire C^2 to the instrument at the first station, which it re-enters by its screw-cup R, and by way of the spring H^2 and cup Q enters the negative pole of the main battery. The main magnets of both instruments are thus charged, and each register is held out of action by the elevation of the arm L. When the instruments are thus at rest the circuit of the accessory battery Y is broken, proceeding on the one hand by the wire *x* and screw-cup S to the key C, and on the other by the wire *y*, screw-cup T, through the magnet K; thence by screw-cups U and V to the contact-spring H'. Here the circuit is broken, the spring H' not being in contact with the key C, and consequently the magnet K remains uncharged and inactive. Thus far the currents of the two main batteries have acted in unison, their poles being reversed with respect to their machines.

It now remains to be seen what will be the consequence of a depression of the key of either one of the instruments. Whenever the key is thus depressed, as in Fig. 6, the contact of the springs is changed from their anvils to the points *e e'* e^2 in the ivory bar W upon the end of the key. The current of the main battery of this instrument over the line-wire C^2 is now reversed, as will be seen by tracing out the connections. Starting from the positive end of the battery X, it proceeds by cup M, spring H, point *e*, and wire a^2 to anvil s^2; thence through screw-cup R over the line-wire in a direction contrary to that which it took before the key was depressed. Entering the other instrument, it proceeds through the course already marked out for this current, but in a reversed direction, and re-enters the first instrument by its ground-plate Z; thence by the magnet I and screw-cups O and N to anvil *s*; thence by wire b^2 to the insulated point e^2 on the bar W; thence by spring H^2 and screw-cup Q to the negative pole of the battery. No change having taken place in the direction of the current from the main battery of the other instrument, the two currents oppose each other, and their effect upon the main magnets of each instrument is neutralized, and these magnets are consequently both thrown out of action. Other and differing effects are also produced upon the two instruments. At that station where the key is not depressed, the main magnet ceasing to act, the armatures *m m'* are no longer attracted to each other, and the arm L drops, thus setting the register of this machine in action, as before explained, and this instrument receives the message sent. The main magnet of the transmitting-instrument is equally thrown out of action by the depression of its key; and it remains to show in what manner its registering apparatus is kept quiet while the one at the other end of the line is in action. As the key is depressed the point *e'* is brought in contact with the spring H', by which the circuit of the accessory battery is closed and the magnet K within this circuit is charged. By this means the armature *m'* is magnetized and is attracted toward the armature *m*, by which means the arm L is retained elevated, and the register of this instrument is not called into action on the depression of its key. The same state of things, however, does not exist upon the other instrument, as its accessory battery is not brought into action upon its magnet K.

It now remains to be seen what will be the result of a simultaneous depression of the keys upon both instruments, as in Fig. 7. By the depression of the first key the currents of the main batteries were caused to move in opposite directions and neutralize each other and the accessory battery and accessory magnet of the first instrument were brought into action, whereby the register of this instrument is still kept from acting. If, now, the key of the other instrument be depressed, the direction of the current of the main battery of this instrument is also reversed, and the united currents from the main batteries of the two instruments will proceed together in a direction contrary to that which they took before either key was depressed.

It should be mentioned here that the strength of each accessory battery is such that its effect upon its magnet K shall be equal, or very nearly so, to the effect produced upon the magnet I by the united currents of the two main batteries. The accessory batteries are so arranged with respect to their magnets K that the armatures *m'* shall indicate similar polarities with the armatures *m* of the magnets I when the currents of the two main batteries are reversed by the depression of the keys of both instruments. A similar state of things now exists on each instrument. The armatures

m m', being similarly magnetized, repel each other, the levers L drop, and both registers are brought into action, and thus a message may be simultaneously sent and received over a single wire by means of the instruments described.

Figs. 5, 6, and 7 are diagrams which illustrate the course of the currents when the instruments are at rest or in operation. The right-hand portion of each of these diagrams, which may denote the instrument in Boston, corresponds to the left-hand instrument in Fig. 4, and the left-hand portion of the diagrams, which may denote the instrument in New York, corresponds to the right-hand in Fig. 4. In Fig. 5 neither instrument is writing. The current from the positive end of the New York battery passes by the spring H^2 and line-wire C^2 to the instrument in Boston, and by the spring H^2 of this instrument to the negative end of its battery. Leaving the positive end of this battery, it passes by the spring H to the magnet I; thence to the ground-plate Z, and by the ground to the corresponding plate of the New York instrument; thence by the spring H to the negative end of the battery from which it first started. In Fig. 6 the New York key C is depressed, and the current from its battery then takes the following course: Starting from the positive end, as before, it passes by spring H^2 to the key C; thence by the wire b^2 of Fig. 4 and the anvil of spring H to the magnet I, the auxiliary magnet K of this instrument being brought into operation, as before explained, to hold the lever L up from its anvil. From the magnet I and ground-plate it passes to the instrument at Boston, and from its magnet I it passes by spring H to the positive end of this battery; thence from the negative end of this battery, by the spring H^2 and line-wire C^2, back to the New York instrument, entering by the anvil of the spring H^2; thence by the key C and spring H back to the negative end of the battery. The two currents, moving in opposite directions, neutralize each other, as before explained, and the arm L of the Boston instrument sets the register-battery of this instrument in operation. In Fig. 7 the keys of both the New York and Boston instruments are represented as depressed, the currents of both batteries taking the following course: Starting from the positive end of the New York battery, the current passes by spring H^2, key C, and anvil of spring H to magnet I; thence by ground-plate to Boston, entering the magnet I; thence by anvil of H, key C, and spring H^2 to the negative end of the battery; thence from the positive end of this battery to spring H, key C, and wire to the anvil of H^2; thence by main-line wire C^2 back to New York, and by the anvil of H^2 and wire to key C, and by spring H and wire back to the negative end of the battery.

It is evident that a branch of the main battery may be used as a substitute for an independent accessory battery without departing from the principle of my invention.

Thus far I have spoken of the employment of galvanic batteries as a means of generating the electric current. Any other suitable means of generating this current may be employed; but this forms no part of my present invention and need not be further discussed.

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

The employment of an accessory magnet and an accessory battery to each instrument, in combination with the main batteries and main magnets, and with a means of reversing the direction of the current of each of the main batteries, in the manner substantially as herein set forth.

MOSES G. FARMER.

Witnesses:

SAM. COOPER,

THOS. R. ROACH.

WILLIAM C. BARNEY.

Improvement in Telegraphy.

No. 123,441. Patented Feb. 6, 1872.

Fig. 1.

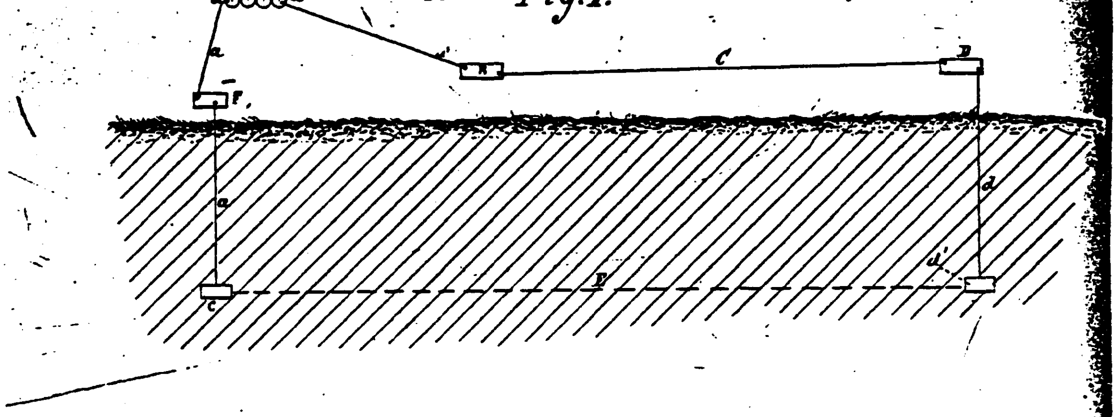


Fig. 2.

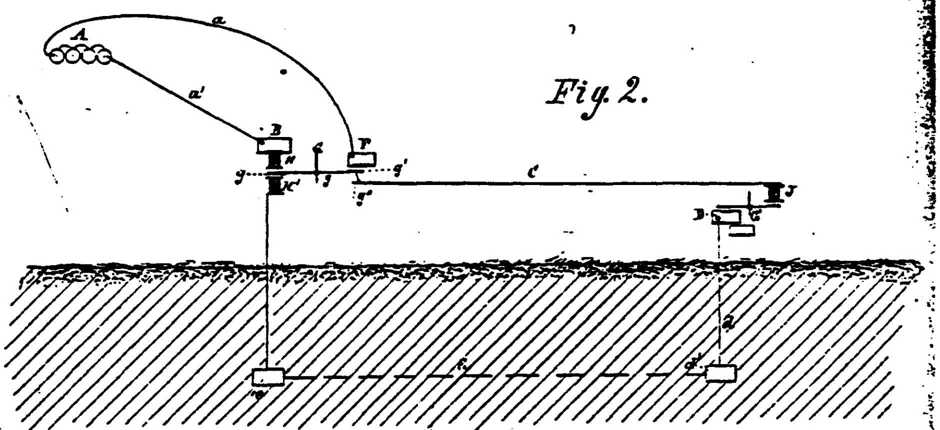
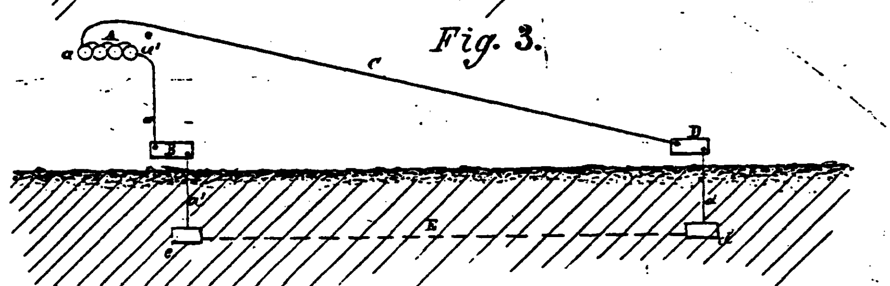


Fig. 3.



Witnesses:

G. Matthys

Solon C. Kemon

Inventor:

William C. Barney

Per Munn & Co

Attorneys.

123,441

UNITED STATES PATENT OFFICE.

WILLIAM C. BARNEY, OF WASHINGTON, ASSIGNOR TO FRANKLIN STEELE, OF GEORGETOWN, DISTRICT OF COLUMBIA.

IMPROVEMENT IN TELEGRAPHY.

Specification forming part of Letters Patent No. 123,441, dated February 6, 1872.

Specification describing Improvement in the Art of Telegraphy, invented by WILLIAM C. BARNEY, of Washington city, in the District of Columbia.

The invention will first be fully described and then clearly pointed out in the claims.

Figure 1 represents an electro-chemical telegraph, that marks the message by passing the galvanic current through chemically-prepared paper and dissolving the compound employed thereon. Fig. 2 is a view of the Morse telegraph, sufficiently changed to operate in connection with my invention. Fig. 3 is a view of the modification which, by connecting the positive pole directly with the ground, enables the ground current to be employed before the electro-fluid has made a transit of the wire.

A represents battery; a, wire that leads from negative pole thereof into the earth; and a', the wire that leads to the transmitter. B is the transmitter. C represents the line of conducting-wire between any two points, as New York and Washington. D is the receiver to which said line of wire reaches, and d the wire which leads from it into the ground. E is the ground-line, which makes the circuit complete.

It is a well-known fact that conductivity is a property which not only belongs to all bodies in a greater or less degree, but it was also known as long ago as 1836 that the earth was a body which possessed this property to such a degree that a perfect circuit could readily be formed by including it as one of the intermediate conducting bodies. Up to the present time, however, the only practical use to which this discovery has been applied is that same one not only foreshadowed, but fully described, by the great German scientist, Steinheil.

Practical telegraphists have long felt and appreciated the great inconvenience and loss of time in repeating messages to verify their correctness. As now performed, the wire must be disconnected with the battery at one end and connected at the other. After much thought, labor, and practical experiment, I have discovered that the earth current may be utilized so as to overcome this difficulty and produce a very great economy of time and money.

In drawing it will be observed that I have interposed an ordinary receiver, F, between the negative pole of the battery and the ground plate c.

The mode of operation in an electro-chemical telegraph, which I have repeatedly verified, is as follows: The current of electricity, passing from the positive pole of battery through wire a' to transmitter B, performs its function in this manipulator. It then passes over the wire C to receiver D and marks the message. It then moves across the ground-line E, through wire a, to the receiver F, and repeats the message. The message is thus repeated and verified at the initial point from which it started, and by the same current or messenger which delivered it at its ultimate destination. I will now show how it may be applied to the Morse system of telegraphing.

In Fig. 2, G represents the Morse hand-lever for breaking or completing the circuit. g is a bar of iron, which is placed between two electro-magnets, H H'. At the other end is placed the platinum point g^1, which connects with and leads to the wire-line C. At the end of wire-line is a magnet, J, which operates lever G'. The current passes from positive pole a' through manipulator B, and magnet H draws the end g of lever up and connects end g^1 with platinum point g^2 and wire-line C. The current now passes to magnet J, operates lever G', and leaves the message at receiver D. Thence it passes through wire d into the ground, across to wire e; then to the magnet H', which operates lever G and causes it to repeat message at F.

It will be observed that in these two figures of the drawing there is a manipulator at each end, as well as a receiver. The manipulator which is placed at the end where it is intended to receive message, (or the appropriate signal,) is closed down to complete the circuit, while the other is placed at liberty to enable operator to close and break it intermittently. Thus a message is repeated at the same end of line from whence sent, or another brought from the other end by the same battery and by the same receiver F, arranged as has been specified.

In Fig. 3 it will be seen that the positive electricity, after going through the manipulator B, passes directly from wire a' into the ground at e'; thence across to d', up wire d to receiver, and delivers message without having been over the air-line C at all. It then passes back over the wire to the negative pole of the battery.

The advantage of this arrangement is, that under certain conditions of the atmosphere the latter presents conducting-surfaces which are equally as good or better than the wire, while it is a well-known property of the fluid to take (where two equally-good conductors are presented) the one that leads by the shortest route to the negative pole of the battery.

The earth is not subject, as far as I am aware, to any disturbing causes which would neutralize its conductivity or prevent its action from being entirely uniform. Hence this utilization of the ground-current produces a more uniform and reliable intermediate conductor between the manipulator and the message-receiver.

Having thus described all that is necessary to a full understanding of my invention, what I esteem to be new, and desire to secure by Letters Patent, is—

1. The method herein described of sending a message over the ground-line from a transmitting to a receiving instrument before it has made a transit of the wire—that is to say, by placing the transmitting instrument between the positive pole of the battery and ground and connecting the air-line with the negative pole of battery, substantially as described.

2. The method of arranging the message-receiver or message-repeater between the ground-wire E and negative pole *a* of the battery, as and for the purpose described.

WILLIAM CHASE BARNEY.

Witnesses:
SOLON C. KEMON,
CHAS. A. PETTIT.

4 Sheets--Sheet 1.

M. G. FARMER.

Duplex Telegraph Apparatus.

No. 160,581

Patented March 9, 1875.

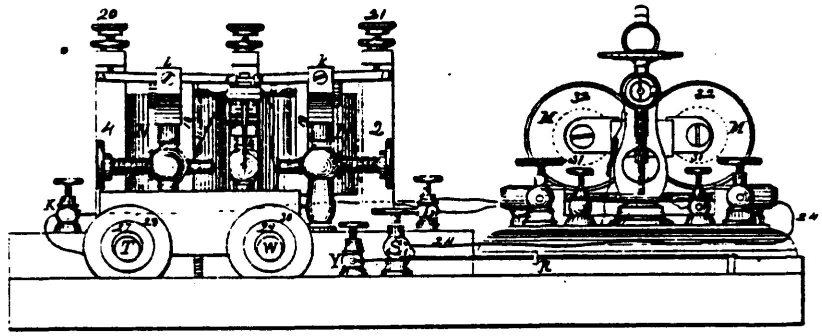


Fig. 2.

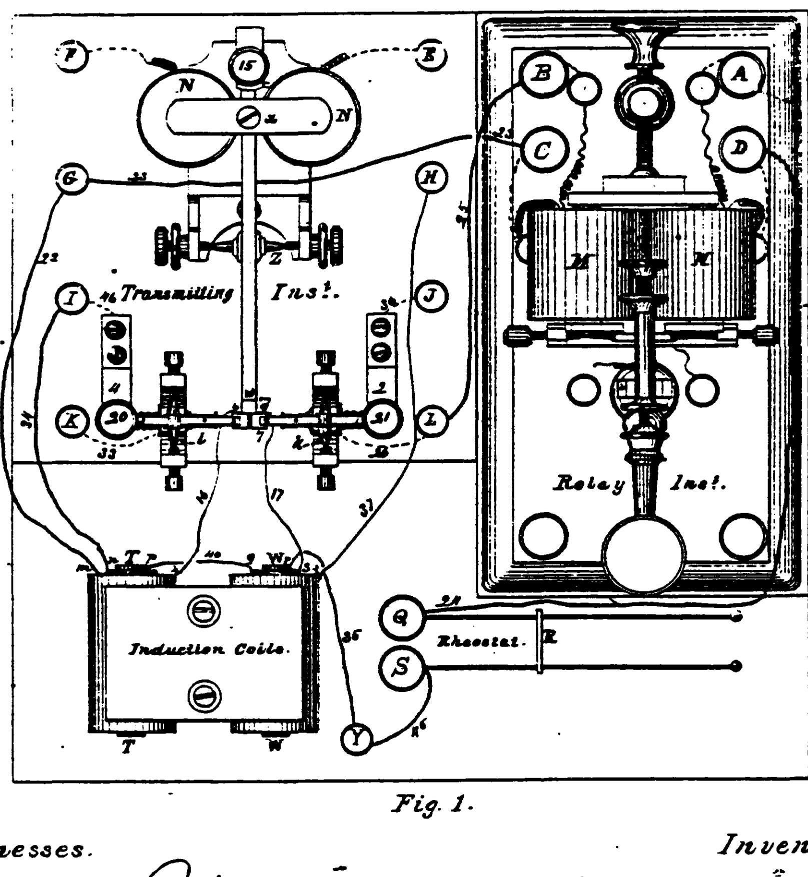


Fig. 1.

Witnesses.

Charles Stowell

Geo A Stowell

Inventor.

Moses G. Farmer

4 Sheets--Sheet 2.

M. G. FARMER.

Duplex Telegraph Apparatus.

No. 160,581. Patented March 9, 1875.

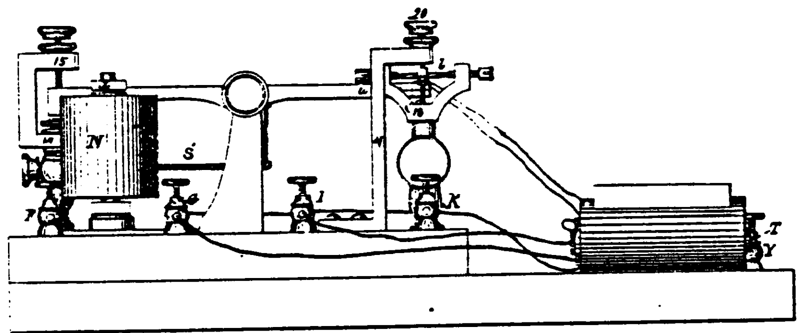


Fig. 3.

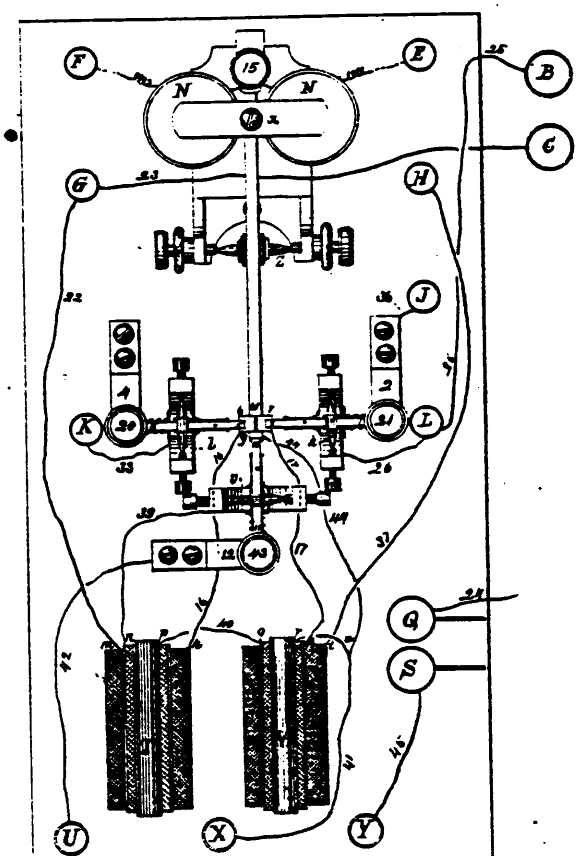


Fig. 4.

Witnesses.

Charles Stowell

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4 Sheets--Sheet 3.

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Duplex Telegraph Apparatus.

No. 160,581. Patented March 9, 1875.

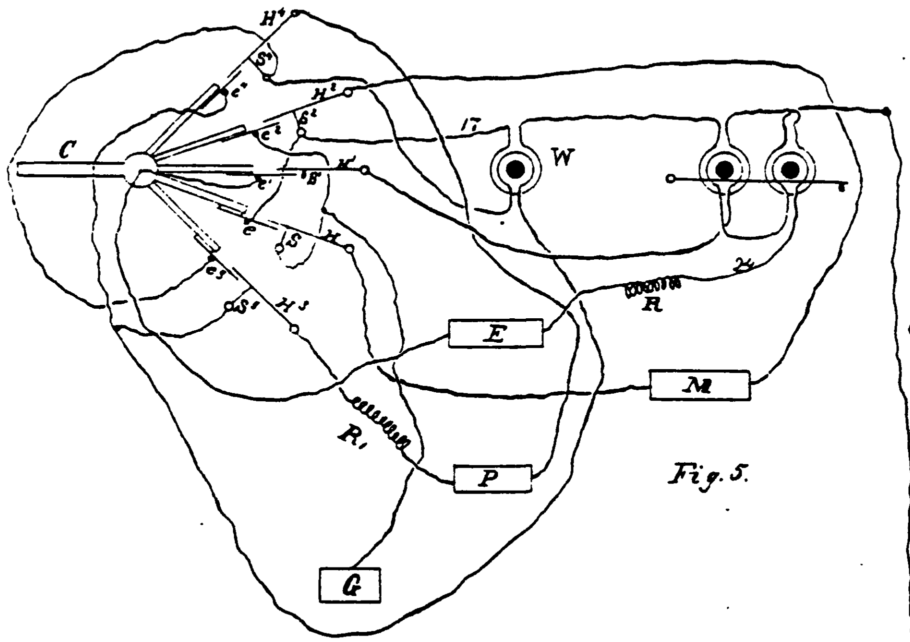

Fig. 5.

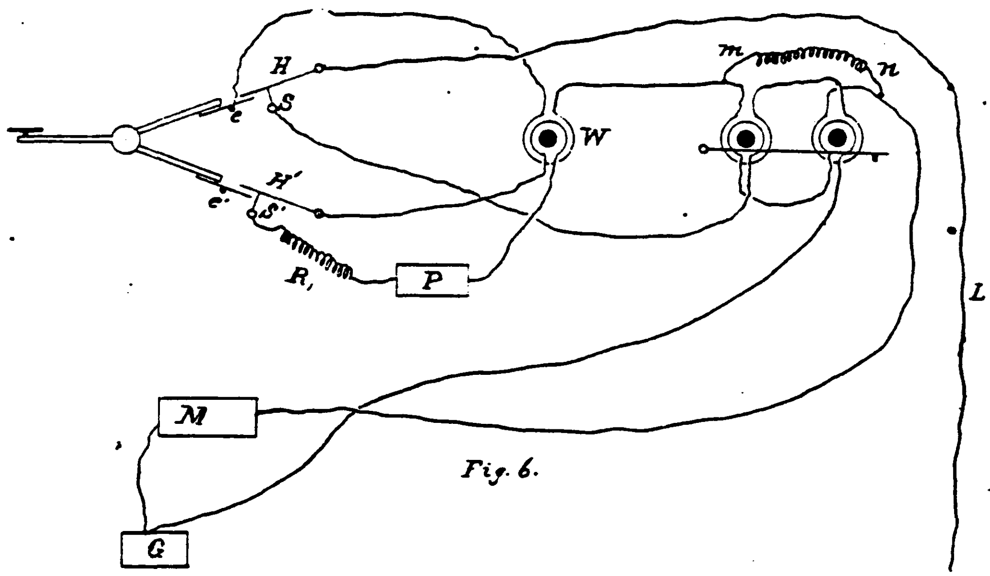

Fig. 6.

WITNESSES.

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4 Sheets--Sheet 4.

M. G. FARMER.

Duplex Telegraph-Apparatus.

No. 160,581 *Boston* Patented March 9, 1875.

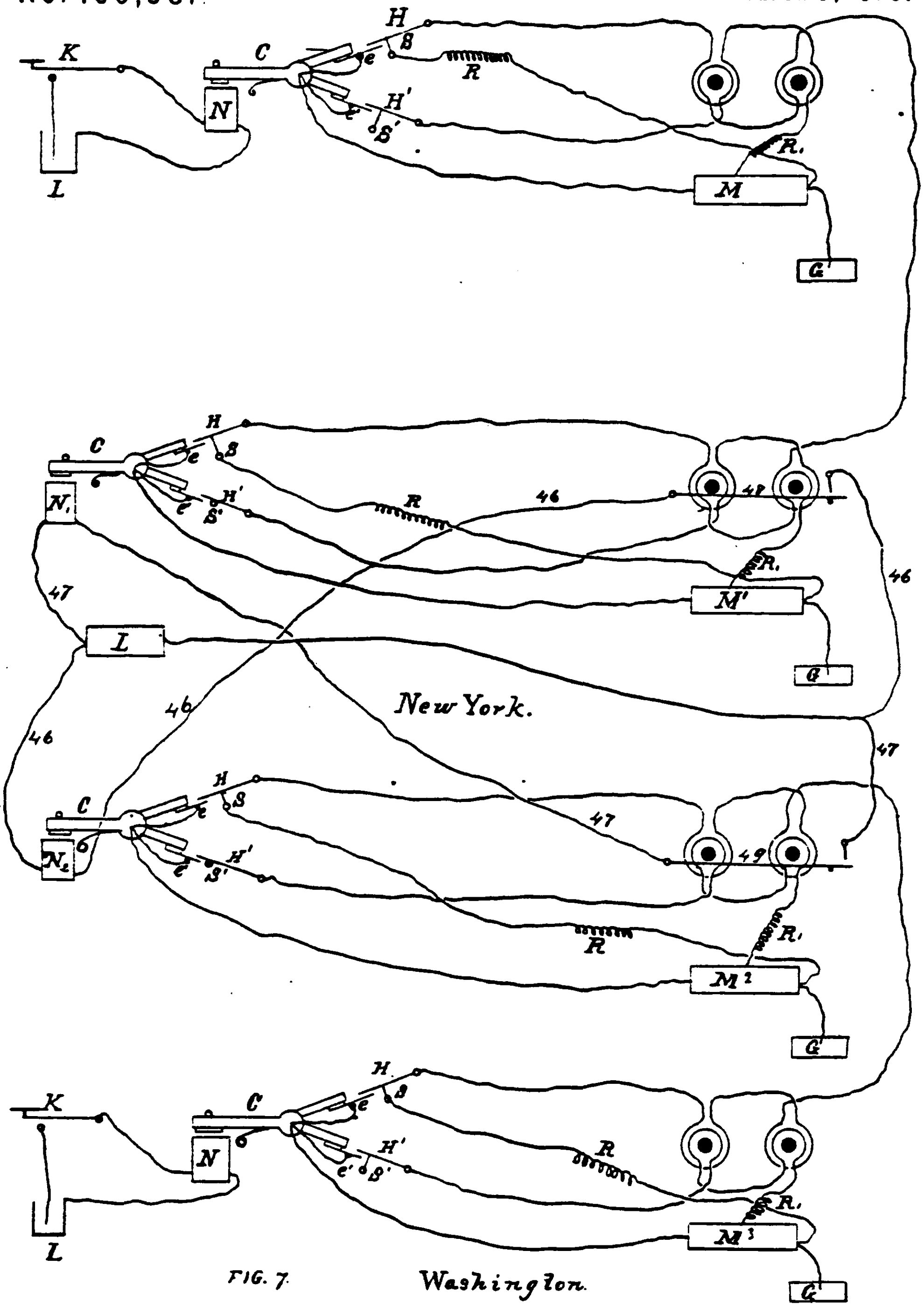

FIG. 7.

WITNESSES.

Charles Stowell

Geo A Stowell

INVENTOR.

Moses G. Farmer

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

UNITED STATES PATENT OFFICE.

MOSES G. FARMER, OF SALEM, MASSACHUSETTS.

IMPROVEMENT IN DUPLEX-TELEGRAPH APPARATUS.

Specification forming part of Letters Patent No. **160,581**, dated March 9, 1875; application filed September 30, 1872.

To all whom it may concern:

Be it known that I, MOSES G. FARMER, of Salem, in the county of Essex and Commonwealth of Massachusetts, have invented certain Improvements in Telegraphic Instruments for Double Transmission, of which the following is a specification:

In attempting to send two messages simultaneously over the same long telegraphic wire in opposite directions, by means of a divided current—one part passing through a coil in the main circuit and the other part passing through an accessory or equating coil or circuit—the phenomenon of charge makes its appearance, and the two coils upon the relay, which would completely neutralize each other's influence upon the armature in a short line, do not seem to do so on a long line, for the first rush of current through that coil or portion of the relay which is in the main circuit for an instant overpowers the action of that portion which flows through the equating-coil and rheostat, and causes a sudden and momentary jump of the armature. The reason of this action is this: A long line of telegraph is as a Leyden jar, the wire being the inner coating and the earth beneath the wire acting like the outer coating. Such a line has a definite static or charge capacity, depending upon its diameter, its length, and its height from the ground. If it be insulated and buried in the ground or sea, its charge-capacity is still greater, and this momentary rush so much the greater. After this first rush is over the two currents or branches of the current neutralize each other's action upon the armature, if the rheostat has been properly adjusted. This sudden motion of the armature may be hindered in two principal ways: First, by attaching a condenser, or Leyden jar, to the equating coil or circuit, which condenser shall have a charge-capacity approximately equal to that of the main line. This has been already accomplished on land-lines. Second, by inserting the secondary wire of a common induction-coil into the main circuit, and so adjusting the time and mode of interrupting the primary circuit that, at the instant when the main-battery current is applied to the line, a sudden stroke shall be induced in this secondary coil by the opening of its primary, and the direction of this secondary stroke shall be opposed to the direction of the battery-current in the main line, and shall be equally powerful, and simultaneous with the sudden rush due to the charge-capacity of the line, and shall subside at the same time. Another way is to put this induction-coil into the equating-circuit and cause the direction of the instantaneous stroke to be coincident with the direction of the current in the equating wire or coil, thus momentarily adding to the strength of the equating-current. It is evident that induction-coils may be inserted both into the main and into the equating circuits, and both induction-strokes be caused by the interruption of a single primary circuit, which embraces both of the primary coils; only this must be attended to—that the induction-stroke in the main circuit must tend to hinder the development of the battery-current in the coil which is in the main line, and the induction-stroke in the accessory or equating circuit or coil must tend to help the development of current in that branch. Since an induction-stroke is developed in the secondary wire of a double helix, upon closing as well as upon opening the primary circuit, it is best to insert these secondary coils into such portions of the main or equating circuits as are open when the primary wire of the induction-coils is closed. For this purpose it is well to make use of either the three-point key described and figured at Fig. 1 of my Patent No. 21,329, of August 31, 1858, or else of the two-point key figured in my Patent No. 81,485, of August 25, 1868.

To work this my invention I make use of a relay, a rheostat, one or more induction-coils, and a transmitter.

Fig. 4 shows the complete three-point transmitting-key with three secondary levers, the induction-coils, a portion of the rheostat, and a portion of the relay.

Fig. 3 shows a side elevation of the transmitter and the induction-coils.

Fig. 2 shows an end view of the transmitting-key, the induction-coils, and the relay.

Fig. 1 shows a ground plan of the transmitting-key with one of the secondary levers omitted. It shows also the induction-coils, the relay, and the rheostat.

The relay is like those in common use, except that there are two independent wires coiled on each of the cores of the electro-magnet. One of these wires is to be included in the circuit of the main line. The other wire is to be included in the accessory or equating circuit. These two wires may be coiled simultaneously into one coil, or one wire may be coiled onto the core first, and then the other outside of it; or, thirdly, one wire may be made into a coil by itself, not occupying the whole length of the core, while the other wire is made into another coil, occupying the remainder of the core. This latter method I do not consider as good as either of the two others. Each leg of the magnet is provided with a similar double coil.

I make use of a transmitting key or device which differs from those in common use for single transmission in this particular respect—that it provides for preserving the continuity of the main circuit. It is also provided with means for opening and closing the accessory or equating circuit, and likewise opens and closes the primary circuit of the induction-coils T W.

Two methods of operating the primary circuit of the induction-coils are shown, one of them in Fig. 1, the other in Fig. 4. In Figs. 1 and 4, the transmitting key or lever *w x* is represented as operated by an electro-magnet, N, and its armature *x*. This is for the purpose of repeating from one circuit to another. The lever *w x* might be operated directly by the finger when situated at a terminal station; but it is more convenient, and less wearisome to operate it by the intervention of an independent circuit, into which it is included by the screw-cups E and F.

I use, also, a rheostat, to adjust the strength of the equating current, so that its magnetizing effect on the cores of M shall be equal to and neutralize the magnetizing effect of the main-line current through the other coil or wire 32 32 of the relay M. Also, a rheostat may be used to modify the action of the primary circuit of the induction-coils.

The key *w x* operates the main-line circuit through the intervention of an auxiliary lever, 1 8, pivoted at *k*, as seen in Figs. 1 and 2. The outer end 1 of this lever is limited in its upward motion by the adjustable screw 21 in the post 2. Its inner end 8 receives a downward tendency by the spring 19, as seen in Fig. 2. The end *w* of the lever *w x* is situated underneath the inner ends of the levers 1 8, 5 3, and 10 11, seen in Fig. 4, and also underneath the inner ends of the short levers 1 8 and 3 5. (Seen in Fig. 1.) This end *w* of the lever *w x* is provided with three insulated pieces of platinum, 6, 7, and 9, in Fig. 4, and with two pieces, 6 and 7, in Fig. 1. These pieces of platinum on the upper side of the end of the lever *w x* serve to make contact with similar pieces on the under side of the inner ends of the levers 1 8, 3 5, and 10 11. The lever 3 5, pivoted at *l*, is used to open and close the accessory circuit at 5 6 in Figs. 1 and 4. By proper adjustment of the screws 20 and 21 the closing of the accessory or equating circuit at 5 6 can be made simultaneous with the closing of the battery onto the main circuit at 7 8, and this act is simultaneous with, or precedes, the removing of the main circuit from its ground-connection at 1 21.

I will ~~now~~ proceed to describ~~e the mode~~ of connecting up the induction-~~coils T and W~~, and inserting them into their proper circuits. They are constructed substantially as induction-coils ordinarily are, having a bundle of soft-iron wires, which can be thrust into them to a greater or less distance, according to the strength of the induction-stroke required. The secondary wire of W is inserted into the main circuit; the secondary wire of T into the equating circuit, as follows: The outer end of the secondary wire of W at *t* is connected by wire 37 to screw-cup H, which cup receives one pole (say, the positive or copper pole) of the main battery, the other or zinc pole being to earth. The inner end of this secondary wire *s* is connected by wire 17 to the platinum piece 7 on the end *w* of the lever *w x*.

The outer end *h* of the secondary wire of the coil T is connected by wire 16 to the platinum piece 6 on the lever *w x*, while the inner end *m* of this secondary wire is connected by wire 22 to the screw-cup G, and this, by wire 23, to screw cup C on the relay. This cup C is one terminal of the equating coil or circuit of the relay, the cup D being the other terminal.

The primary circuits of the coils T and W are connected in Fig. 4 as follows: The axis *b* of the secondary lever 10 11 is connected by wire 39 to the outer end *n* of the primary or coarse wire of the helix T. The inner end *p* of this primary wire is connected by wire 40 to the outer end *q* of the primary of W, and the inner end *r* of this primary is connected by wire 41 to the screw-cup X. This wire 41, at *u*, makes a junction by the wire 44 to the platinum piece 9 on the end of the lever *w x*. The post or cock 12 is connected by wire 42 to the screw-cup U. The cups U and X receive the poles of the primary battery, which operates the induction-coils T and W simultaneously. The circuit is broken and closed by the motion of the auxiliary lever 10 11, between the point 11 and the screw 43.

The use of the wire 44 is to prolong the duration of the secondary currents in T and W, as more fully shown in my patent of May 14, 1872. It is not always necessary to make use of this device, nor always needful to have the auxiliary lever 10 11, and the primary battery at U and X, so another method of operating these primary circuits is shown in Fig. 1, where the whole or a portion of the equating-battery is used to operate these primaries, when not used in the equating-circuit. Its connection and mode of action are more fully shown in Fig. 1. Thus: the cup I is connected by wire 34 to the outer end *n* of the primary wire of T, the inner end *p* is connected by wire 40 to q as before, while r is connected by 35 to screw-cup Y, which receives one pole of the equating-battery. The cup I is connected by wire 46 to post 4, so that the primary circuit of T W is broken at 3 20 by the motion of the auxiliary lever 3 5. The axis l of the lever 3 5 is connected by wire 33 to screw-cup K, which receives the other pole of the equating-battery. The axis K of the lever 1 8 is connected by wire 26 to cup L, and this by wire 25 to cup B, one of the terminals of the main circuit of the relay. A is the other terminal of this main circuit, and receives the line-wire. The post 2, carrying the screw 21, is connected by wire 36 to cup J, which receives the ground wire.

Supposing the equating-battery to be properly connected—say, its positive pole to Y and its negative to K, while the positive of the main battery is at H—there will be two different paths open for the main circuit, according as the armature x be up or down. The course of the currents and the action of the apparatus will be as follows in Fig. 1: The circuit of the main battery will be interrupted at 8 9, (if the armature x be up,) the equating-circuit will be interrupted at 5 6, but the primary circuit of T W will be closed at 3 20. If, now, the armature x be depressed, the end w of the lever w x will lift the auxiliary levers 3 5 and 1 8, closing the main circuit at 8 7, the equating-circuit at 5 6, and breaking the primary circuit at 3 20. The main-battery current, starting from H, will flow by wire 37 into the secondary coil of W at t, pass out at s, and by wire 17 to platinum-piece 7, thence to the end 8 of lever 1 8, thence from k by wire 36 to L, and by 25 to B, where it enters the main-circuit wire of the relay M. It emerges at A, and enters the main line and proceeds to the other station, where it enters a similar instrument, as at A. The course of the equating-current in Fig. 1 will be as follows: The equating-circuit being closed at 5 6, from the cup Y it proceeds by 46 to cup S of the rheostat R. Leaving it at Q, it passes by wire 24 to cup D on the relay, and flows through the equating-wire in such contrary direction as to neutralize the effect of the main current on the cores of M. It emerges at C, passes by 23 to G, and by 22 to m, where it enters the secondary coil of T. Leaving this at h, it goes to 6, and thence to 5, with which it is in contact; passes thence by l and 33 to K, where it re-enters the equating-battery.

The primary circuit in Fig. 1 of T and W is broken at 3 20 at the same time that the equating-circuit is closed at 5 6. So the equating-battery at K Y is constantly employed either in charging the equating or the primary circuit, and care should be taken to properly proportion the resistance of the two circuits so as properly to accomplish the results desired, the manner of doing which is familiar to skilled electricians.

From the above it will be seen that at the instant of depressing the armature x, a sudden stroke is generated in the two secondaries of T and W, and if they are properly connected the stroke in T will help the equating-circuit, and the stroke in W will hinder the main-battery current at the instant of closing. A rheostat for modifying the action of the primary circuit may be inserted into it, say, in place of the wire 34 in Fig. 1, or 42, Fig. 4. The coils of these rheostats may have iron cores within them, so as to contribute to the strength of the induction-stroke.

The scheme shown in Fig. 4 possesses some advantage over that in Fig. 1, since, by varying the adjustment of the screw 43, the induction-strokes of the coils T and W can at pleasure be made to precede or follow the closing of the main and equating circuits, while, by the plan in Fig. 1, the induction-strokes cannot be made to precede the closing of the equating-circuit.

I will trace out the course of the primary current in Fig. 4. Commencing at U, passing by wire 42 to the post 12, it goes by screw 43 to the end 11 of the lever 10 11; thence from axis r, by wire 39, it enters the primary coil of T at n. Emerging at p, it passes by wire 40 to q, where it enters the primary of W. It emerges at r; passing by the junction u and wire 41, it arrives at the other pole x of the primary battery.

The use and action of the wire 44, in Fig. 4, is as follows: The armature x being up, this primary circuit is closed at 11 43. If the armature x be depressed the contact 9 10 is made before that at 11 43 is broken.

The energy which is stored in the primaries n p and q r, instead of appearing in the form of a spark at 11 43, will be expended in prolonging the time of the subsidence of the magnetism in the cores of T and W, and, of course, will prolong the duration and modify the intensity of the induction-strokes of the secondary coils of T and W. This will be of especial use in lines that have large static capacity, as, for instance, short cables or long land-lines.

Having thus fully described the construction of my invention and its mode of operation, I will show briefly, by Figs. 5 and 6, how it may be applied to or combined with my inventions patented August 31, 1858, and November 15, 1859. The lettering in these two figures will correspond, so far as convenient, with the lettering in those specifications.

In Fig. 5, the springs or levers H^3 and H^4 are similar to H, H^1, and H^2 in Letters Patent No. 21,329. These two levers serve to connect the primary battery P with the key or transmitter C, and to afford the means of reversing the direction of the current in the primary circuit of the induction-coil W. There is a rheostat, R_1, in this primary circuit for the purpose of increasing or diminishing the strength of the primary current. There is also a rheostat, R, in the equating-circuit, for the purpose of modifying the strength of the equating-current. No induction-coil is shown in connection with the equating-circuit. E is the equating-battery; M, the main battery; G, the ground-plate, and C^2 the line-wire.

Fig. 6 shows the adaption of the induction-coil W of this present invention to my patent No. 26,097. H is the contact-spring of the main circuit, and H^1 of the primary circuit. P is the primary battery; R_1, a rheostat in this primary circuit. M is the main battery; *m n*, the rheostat which shunts the outer coil of the relay. L is the main line.

Fig. 7 shows how these double-transmitting instruments may be so connected as to enable messages to be repeated simultaneously from one main line to another. In this diagram the induction-coils and their adjuncts are omitted for clearness' sake.

Three stations are represented, viz. Boston, New York, and Washington. M M^1 M^2 M^3 represent the main batteries. There are two represented at the repeating-station, (New York,) although one will suffice, provided the batteries at the terminal stations are properly connected. H is the contact-lever of the main circuit, and H^1 of the equating-circuit. The keys or circuit-closers C C, at the repeating-station, are operated by the electro-magnets N_1 N_2 and the single local battery L, which serves for the two local circuits 46 and 47. They are opened and closed by the armatures 48 and 49 of the relay-magnets M^1 M^2. From what has been said above their mode of operation will be readily understood by skilled electricians.

Having thus described my invention, I claim as new—

1. The combination of a main telegraphic circuit and its batteries with an induction-coil so arranged as to hinder the effects of static charge, substantially as set forth.

2. The combination of an induction-coil with an equating-circuit to help the equating-circuit to neutralize the effect of static charge on the relay in the main circuit, substantially as set forth.

3. The combination of a continuity-preserving key and an induction-coil with an equating-coil and an independent equating-battery, substantially as set forth.

4. The combination, in the main or equating circuit of an induction-coil or coils, in such parts of the main or equating circuits as are open when the main and equating batteries are disconnected, substantially as set forth.

5. The combination of the circuit-preserving key above alluded to with a relay or its equivalent, and with one or more induction-coils, substantially as set forth.

6. The combination of the continuity-preserving key with a relay, an induction-coil or coils, and with a means of regulating both the strength of the induction stroke or strokes and the strength of the equating-current, substantially as set forth.

7. The combination of primary and secondary helices with the means above described of preventing the appearance of a spark upon rupturing the primary circuit, substantially as above described.

MOSES G. FARMER.

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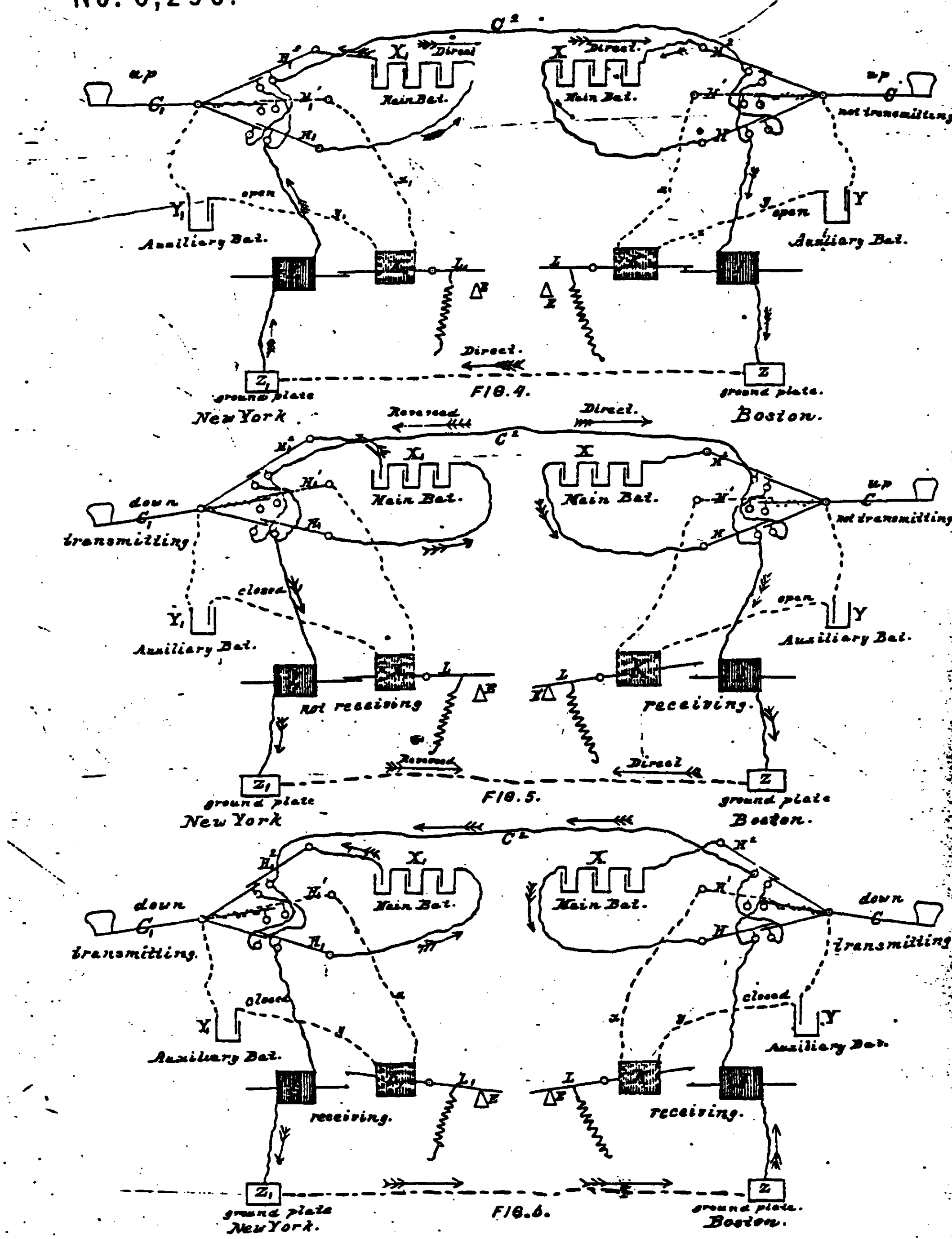
Method of Sending and Receiving Messages Simultaneously over the Same Telegraph-Wire.

No. 6,296. Reissued Feb. 16, 1875.



WITNESSES.

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IMPROVEMENT IN METHODS OF SENDING AND RECEIVING MESSAGES SIMULTANEOUSLY OVER THE SAME TELEGRAPH-WIRE.

Specification forming part of Letters Patent No. 21,329, dated August 31, 1858; extended seven years; reissue No. 6,296, dated February 16, 1875; application filed February 18, 1873.

To all whom it may concern:

Be it known that I, MOSES G. FARMER, of Salem, in the county of Essex and Commonwealth of Massachusetts, have invented an Improved Apparatus for Transmitting Simultaneously Two Messages over the same Telegraphic Wire, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification.

In the common mode of working the Morse telegraph for single transmission it is customary to work what is called a closed circuit—that is, a circuit having one or more batteries located at some one or more points in the circuit—and the circuit is kept closed when not in use, so that the operator at any station upon the line may have command of the current when he wishes to transmit a message. This act he performs by alternately opening and closing the circuit by raising and depressing his key, and while so doing every receiving-instrument in the circuit, his own included, responds to the motion of his key; but, if two of the stations should attempt to send messages at the same time, confusion would ensue, for while one station had the main circuit open it would do no good (or, rather, make no signal on the line, if well insulated) for any other station to manipulate his key. As soon, however, as the circuit is closed at all stations except the one transmitting, immediately all the receiving-instruments begin to respond to the working of this single key.

Since the operation of transmitting is usually performed by working the key up and down—the circuit being usually open when the key is up, and closed when it is down—if it be desired to transmit messages simultaneously, say, from the two terminal stations, some means must be provided at each of these terminal stations so that the act of raising the key may not open the main circuit, yet such must be the effect of this operation that this act shall somehow express itself at the other end of the line—that is, somehow affect the receiving-instrument at this distant station—and means must also be provided so that this act of raising or depressing the key at this transmitting-station shall not cause the receiving-instrument at this station to respond to the movements of this key.

I accomplish the desired result in this invention in the following manner: By the use of two coiled wires upon the relay or receiving-instrument, one of which is in the main circuit, and the other in the equating or accessory circuit, as I term it, and by the use of an equating current in the equating coil, I am thus enabled to neutralize the effect of the main current on the relay, so that the working of the key up and down does not cause its associate relay to respond to its movements, as will be hereafter more fully shown.

In the ordinary plan of single transmission the function of the key is simply to open and close the main circuit.

In this plan of double transmission the function of the key is to shift the course of the main circuit from one path to another without opening the main circuit at all. It also performs an additional function, viz., that of opening and closing the accessory circuit. This accessory circuit may be operated by a separate and independent battery, or by a branch of the main battery. In the drawings before us it is represented as operated by a separate accessory or equating battery.

The novelty of the invention lies principally in the key or transmitting device. This instrument is constructed very much as telegraph-keys or circuit-closers ordinarily are, with the exception that it has one or more auxiliary key springs or levers, as represented by H H^1 H^2 in the drawings.

Of the drawings, Sheet 1 shows, in Figure 1, an elevation of the relay, in Fig. 2 an elevation of the key. Sheet 2, Fig. 3, shows a plan view of the relay and key, with their respective connections, at two terminal stations—as, for instance, New York and Boston. Sheet 3, at Fig. 4, shows a skeleton of the apparatus and connection at Boston and New York, neither instrument being in the act of transmitting. Fig. 5 exhibits New York as transmitting, and Boston as receiving, while Fig. 6 shows each station as both transmitting and receiving. Sheet 4, at Fig. 7, shows an enlarged plan view of both relay and key with their mutual connections.

I will first briefly describe the relay. It has two coils of wire, I and K, Fig. 1. The coil I is in the main circuit, the coil K in the accessory circuit. Each coil has a central core of soft iron, terminated at each end with arms m m^1 of the same material. The ends of the arms are sloped at l''', so that when in contact the iron cores with their arms form, as it were, a parallelogram. The core of the coil I is stationary; that of K is capable of being rotated through a small arc around its axis. To the core of K is attached a stirrup or yoke, 23 24, carrying an arm or lever, L 40. A spring, i, tends to depress the end 40 of the lever against the platinum-point n of the screw p, while the attraction of the arms m m^1 for each other, caused by a current of electricity in either or both of the coils I K, would lift the end 40 of the lever L against the insulated point l of the screw o, of course stretching the spring i.

There are screw-cups P O U T 25 27 on the relay-platform for the purpose of making conveniently the proper connection with the telegraphic circuit with the key and with the batteries. One end of the wire composing the coil I is connected by wire v to the screw-cup O, while the other end of the coiled wire is connected by w' to cup P. This cup is connected by the ground-wire g to the ground-plate Z. (See Fig. 7.) One end of the wire of the coil K is connected by 31 to cup T, while the other end is connected by 32 to cup U. The core of K is connected by 30 to cup 25, which receives the wire 29, leading to the local or register circuit. The cock supporting the screws o and p is connected by the wire 26 to the cup 27, which receives the wire 28, also leading to the local battery of the register-circuit. The cup T is connected by wire y to one pole of the accessory battery Y. The cup U is connected by wire 35 to cup V on the key-platform. Likewise the cup O is connected by wire u to the cup N on the key-platform.

The key (shown on an enlarged scale in Figs. 2 and 7) has a bent lever, C, like an ordinary telegraph-key. It has a thumb-piece, T T, an axis, D^1, supported in a cock, D; also, a small spring, d, to press it up from the anvil E until the back screw F rests on the base of the key-frame. In addition to this ordinary lever C there are one or more (in this instrument three) auxiliary levers, springs, or keys, H H^1 H^2, supported at 20 21 22, and tending normally to rest on screws, anvils, or supports S S^1 S^2, unless when raised by the points e e^1 e^2 of screws f, which are inserted into the ivory bar W, which is rigidly attached to the hinder end of the independent key-lever C. The screw f e^2 is in metallic connection with the key-lever C, but the screws f e and f e^2 are insulated therefrom by the bar W of ivory or other insulating material. The key-platform G has on it the screw-cups M, N, V, S^3, R, and Q. The cup M is connected by the wire q with the pole P^1 of the main battery X, while its other pole N^1 is connected by the wire j to the cup Q. The cup M is connected by the wire r' to the end 20 of the auxiliary lever H. The cup Q is connected by wire r'' to the end 22 of the auxiliary lever H^2. The anvil S^2 is connected by the short wire a^2 to the screw f e; also, by wire 34, to the cup R. The anvil S is connected by wire b^2 to the screw f e^2; also, by wire t, to the cup N. The supporting-cock D of the key-lever C is connected by wire 33 to cup S^3, and this, by wire X, to the other terminal of the accessory battery Y. The end 21 of the auxiliary lever H^1 is connected by wire 41 to the cup V, while the anvil S^1 is insulated. The cup R receives the main-line wire C^2.

I have thus minutely described the construction of the instruments, as exhibited in Figs. 1, 2, and 7.

I do not limit myself to the particular construction of either the relay or key as here described, but would use any other known form of either, so long as they should perform the same function in substantially the same manner.

I will now describe their proper arrangement and connection with a line of telegraph, referring therefor to Sheet 2, Fig. 3. In Fig. 3 the letters and figures on the New York instrument are the same as those on the Boston instrument, with the exception of having a subscript mark thus $_1$. X_1 represents the main battery at New York, while X represents the main battery at Boston; and there is this other difference that the poles of the main battery at New York are in a position the reverse of that at Boston. The screw-cups R and R_1^1 on the key-platforms at Boston and New York serve to receive the ends of the main-line wire C^2.

I will next trace out the course of the main circuit. When the keys C and C_1 are up, commencing at the ground-plate Z_1 at New York, its course is as follows: By wire g_1 to P_1, via wire w_1, coil I_1, wire v_1, cup O_1, wire u_1, to N_1 on key-platform; thence by l_1 to anvil S_1, via H_1, 20_1, r_1, M_1, and wire q_1, to the cup N_1^1 of the New York main battery X_1. Emerging from P_1^1 it passes by wire j_1 to screw-cup Q_1; thence by wire r_1'' to the auxiliary lever H_1^2; thence to S_1^2, and by wire 34_1 to the cup R_1, where it enters the main line C^2. Passing over it to the Boston instrument it enters at R. Passing by wire 34 to anvil S^2, thence by H^2, 22, r'', Q, and j, it enters the Boston main battery at N'. Emerging at P', it goes by q to M; thence by r' to 20, along H to S; thence by wire t to N; thence by u to the relay at O. Here it enters the main-circuit coil I by the wire r. It emerges by w, goes to the cup P, and thence by wire g to ground-plate Z, completing the circuit, via the earth, to New York.

It will be seen that the currents from both main batteries X_1 and X are in the same direction, and of course the electro-motive force active in the main circuit is that due to both the batteries X_1 and X, and is, therefore, equal to their sum.

It will be noticed, also, that the negative pole N_1' of the New York battery is toward the earth, and the positive pole P' of the Boston battery is to earth. Hence the main-circuit coils I and I_1 will be charged, and their cores magnetized, to an extent due to the strength of this main-circuit current, and to the number of turns of wire in each coil. Of course the arms $m\ m_1$ will become magnetized, attracting the arms $m'\ m_1'$, and tending to lift the levers L and L_1 against the force of the springs i and i_1.

Suppose, now, the key C_1 at New York be depressed, as in Fig. 4, Sheet 3. The depression of the thumb-piece $T_1\ T_1$ will bring the screw-points $e_1\ e_1^1\ e_1^2$ against the auxiliary levers $H_1\ H_1^1\ H_1^2$ and lift them from their anvils $S_1\ S_1^1\ S_1^2$, closing the circuit of the auxiliary battery Y_1 at $e_1^1\ H_1^1$, reversing the direction of the current from the main battery X_1, putting its positive pole P_1' to earth, so that the current from the battery X_1 will tend to neutralize that of the current from the main battery X; and if the two batteries be equal, and the line well insulated, will do so completely, so that the cores of I_1 and I will become demagnetized: but, since the accessory battery Y_1 has its circuit closed at $e_1^1\ H_1^1$, the coil K_1 will be charged, its core magnetized, and its arms m_1' will attract the arms m_1, and prevent the lever L_1 from being drawn down by the spring i_1. Not so, however, with the lever L, because the coil K is not charged, the key C not having been depressed. Hence the lever L will drop, and thus give a sign that C_1 is depressed.

If, now, while C_1 is depressed, we should also depress C, we should reverse the direction of the current from the main battery X, and close the circuit of the accessory battery Y; and since, when the accessory circuit Y is closed, and the direction of the current from the main battery X reversed, the polarities m and m' are similar, of course L will drop, closing the local circuit of the register at 40 n.

It is the same with m_1 and m_1'. When the key C_1 is depressed, the direction of the current from X_1 tends to produce in m_1 a polarity similar to that produced in m_1' by the closing of its accessory circuit Y_1.

The case where both keys are simultaneously depressed is shown at Fig. 6, Sheet 3.

I will now go back and trace the course of the current through the New York instrument when the key C_1 is depressed. None of the connections are changed except between N_1 and R_1. Starting from N_1, the circuit is, via t_1, to S_1. Since the depression of C_1 has lifted H_1 off from S_1 by the contact of e_1, the only alternative for the main circuit is by following along the short wire b_1^2 from S to e_1^2. There it enters H_1^2, goes, by 22_1, r_1'', Q, and j_1, to the main battery X_1, which it enters at P_1', emerges at N_1', passes, by q_1, to M_1, thence, by r_1', to H_1, which it enters at 20_1, passes along to contact e_1; thence, by wire a_1^2, to S_1^2, and thence, by wire 34_1, to R_1, where it enters the main line C^2.

It will thus be seen that the path of the main circuit is different when the key is depressed from what it is when the key is up. When the key C_1 is depressed, the short wires a_1^2 and b_1^2 are included in the main circuit; but as they may be made so short and large as to offer no resistance of any account, compared with the resistance of the whole circuit, the circuit resistance may be considered as practically equal in either position of the key. Another and vital point is worthy of notice. It is this: if the anvil-screws $S_1\ S_1^1\ S_1^2$ are properly adjusted with reference to the auxiliary levers $H_1\ H_1^1\ H_1^2$ and points $e_1\ e_1^1\ e_1^2$, the continuity of the main circuit remains unbroken during the manipulation of the key, for, though, at the instant when the points e_1 and S_1 are both in contact with the lever H_1, as also e_1^2 and S_1^2 with H_1^2, the main circuit is shortened by the cutting out of the main battery X_1, yet as this lasts only for an instant, its effect is not felt on the coil I_1 of the relay, especially if the internal resistance of the main battery X_1, including its leading wires j_1 and q_1, be of considerable magnitude, so as to prevent the appearance of much spark at the instant when H_1 and H_1^2 rise from S_1 and S_1^2.

It is manifest that, without departing from the principles of my invention, I may reverse the location of the screws o and p, so that the insulated point shall be below the lever L; and also reverse the connections of the main battery at, say, Boston, so that its negative pole N^1 shall be to earth. Then, if the two main batteries be equal and the line well insulated, there will be a neutral current, so to speak, or rather there will be no current on the main line, and the coils I and I_1 will not be charged when the keys C and C_1 are up. But then the direction of the accessory battery connections at Boston must be reversed likewise, and it is easy to see that the instruments will work equally well in this manner, and there will be this advantage, when the instruments are not at work, that the consumption of materials in the main batteries will be lessened.

It is obvious that way-stations, provided only with instruments suited for single transmission, cannot hold double communication with either terminal station. Neither can a way-station, with ordinary instruments, understand what is passing between the terminal stations when both are transmitting, nor yet when one only is transmitting by the use of the double transmitter-key, because the way-station hears only a short break when the double transmitting-key is depressed or raised. But if a way-station should work his key in the ordinary manner both terminal stations will recognize his movements, and understand his writing, if both the main batteries be arranged in the manner first described, and if the points of the contact-screws p and o be arranged in the second manner described. Either terminal station can execute single transmission to the other terminal station, or to any way-station, by manipulating either of the auxiliary keys H or H^2 at Boston, or H_1 or H_1^2 at the New York station, as the manipulation of either H or H^2 singly simply opens and closes the main circuit, as is ordinarily done by a common make and break circuit key.

I have corrected, in Fig. 4, Sheet 3, of the drawings which accompany this amended specification, a slight error which occurs in all the copies which I have seen of the original patent. The original has been lost. The error is this: In Fig. 5 of the original drawings the dotted lines, which stand for the short wires a^2 b^2, are represented as not crossing each other, which they should do, as they do in Figs. 6 and 7—that is, the anvil S should be represented as connected, by the short wire b^2, to the point e^2 on the ivory bar of the key-lever C; also, the anvil S^2 should be represented as connected, by the wire a^2, to the point e. The error is manifestly the error of some copyist, as the proper mode of connection was correctly described in the original specification.

It will thus be seen that I have provided a means of preserving the continuity of the main circuit during the manipulation of the key by closing one branch or path for the main circuit, that was previously open, at the same time or slightly before opening another branch or path that was previously closed, as, for instance, closing the path $N_1\ t_1\ S_1\ b_1^2\ e_1^2\ H_1^2\ j_1\ P_1\ N_1^1\ q_1\ M_1\ r_1^1\ H_1\ e_1\ a_1^2\ 34_1\ R_1$ at the same time or slightly before opening at $S_1\ H_1\ S_1^2\ H_1^2$ the previously-closed path $N_1\ t_1\ S_1\ H_1\ r_1\ M_1\ q_1\ N_1^1\ P_1^1\ j_1\ Q_1\ H_1^2\ S_1^2\ 34_1\ R_1$, and vice versa, when the key C_1 is let up.

Hence I claim—

1. The combination, with a double transmitter, of a device which shall preserve the continuity of the main circuit, by closing one branch or path thereof, which was previously open, at the same time or slightly before that it opens another branch or path that was previously closed.

2. The combination of such a continuity-preserving device with an equating circuit which shall hinder the associate relay or other receiving-instrument from responding to the action of this transmitting key or device, unless assisted by the action of some other independent transmitting device.

3. In combination with instruments for sending and receiving messages simultaneously upon one wire, a key or device, arranged to transmit signals by reversing the direction of the main-battery current, without interrupting the continuity of the main circuit.

4. The combination of a continuity-preserving key with a battery for transmitting signals to a distant station, and a relay or receiving-instrument for receiving signals at the same time, from a distant station.

5. In instruments for the simultaneous transmission and reception of messages over one wire, the combination, at each station, of an accessory magnet or coil, an accessory battery, the necessary main-circuit magnets, and batteries with the means of reversing the direction of the current of each of the main batteries, substantially as set forth.

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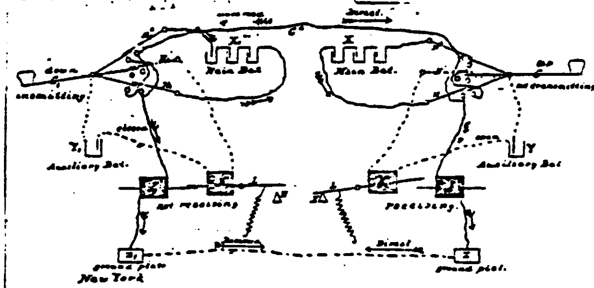
Witnesses:
SARAH J. FARMER,
CHARLES STOWELL.

6,296. METHODS OF SENDING AND RECEIVING MESSAGES SIMULTANEOUSLY OVER THE SAME TELEGRAPH-WIRE. M. G. Farmer, Salem, Mass. Patent No. 21,329, dated Aug. 31, 1858; extended seven years. [Filed Feb. 18, 1873.]

Brief.—Combines with duplex telegraph a continuity-preserving key.

1. The combination, with a double transmitter, of a device which shall preserve the continuity of the main circuit, by closing one branch or path thereof, which was previously open, at the same time or slightly before that it opens another branch or path that was previously closed.

2. The combination of such a continuity-preserving device with an equating circuit which shall hinder the associate relay or other receiving-instrument from responding to the action of this transmitting key or device, unless assisted by the action of some other independent transmitting device.



6,296.

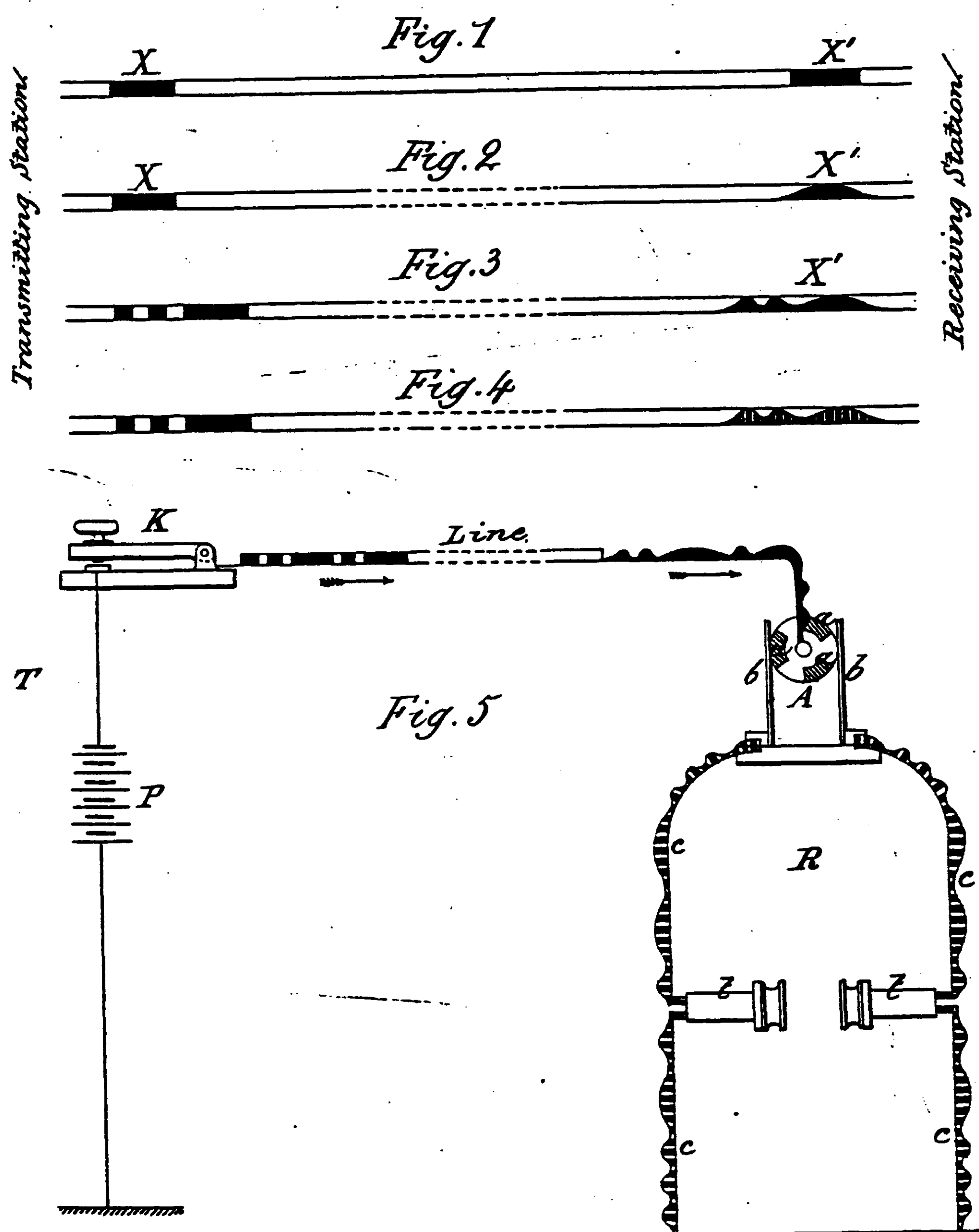
3. In combination with instruments for sending and receiving messages simultaneously upon one wire, a key or device, arranged to transmit signals by reversing the direction of the main-battery current, without interrupting the continuity of the main circuit.

(No Model.) 3 Sheets—Sheet 1.

C. ADER.

TELEGRAPHY.

No. 377,879. Patented Feb. 14, 1888.



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(No Model.) 3 Sheets—Sheet 2.

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TELEGRAPHY.

No. 377,879. Patented Feb. 14, 1888.

Fig. 6.

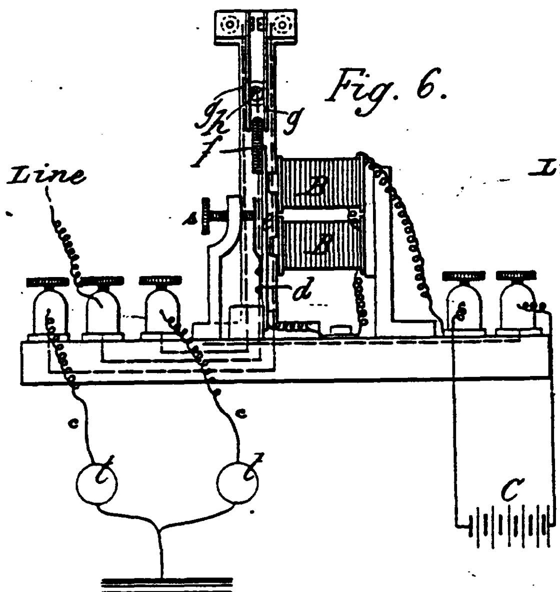


Fig. 7.

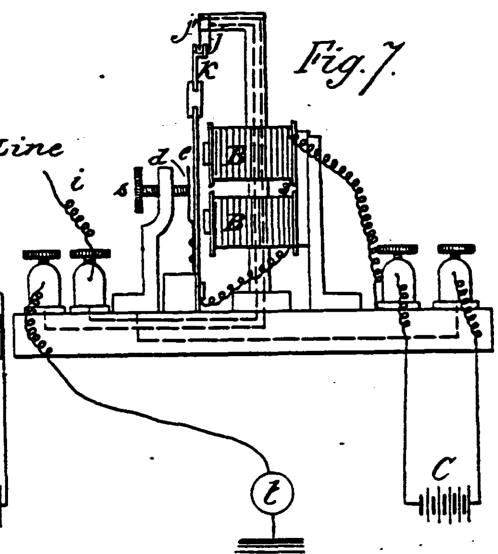


Fig. 8

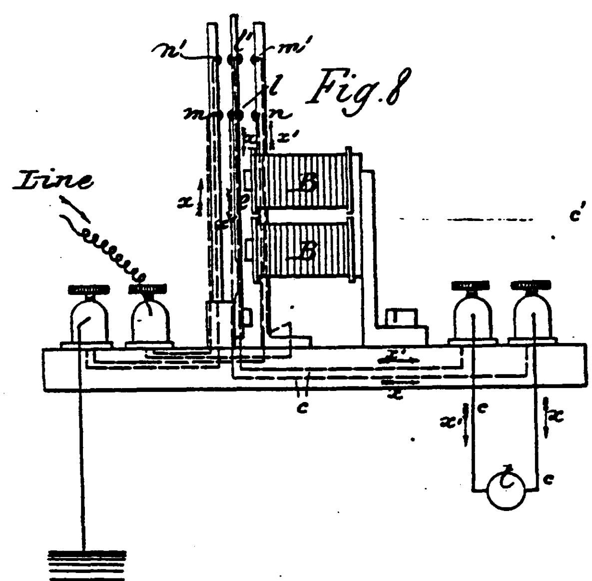
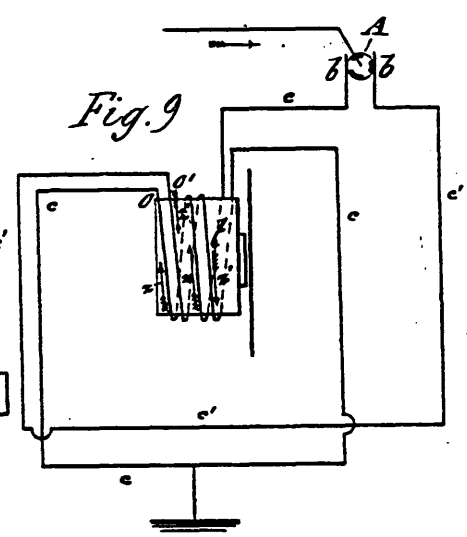


Fig. 9



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(No Model.) 3 Sheets—Sheet 3.

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TELEGRAPHY.

No. 377,879. Patented Feb. 14, 1888.

Fig. 10

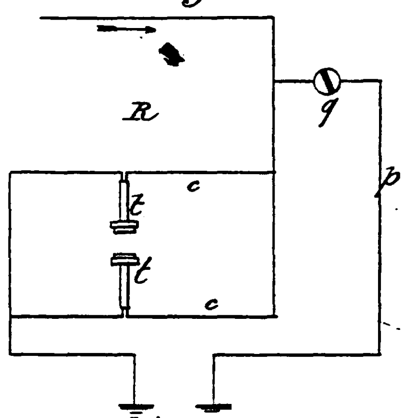


Fig. 13

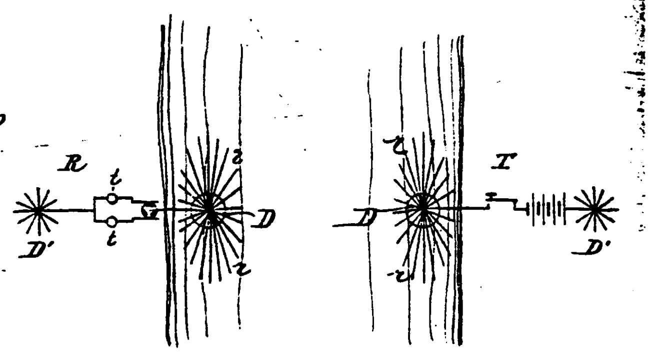


Fig. 11

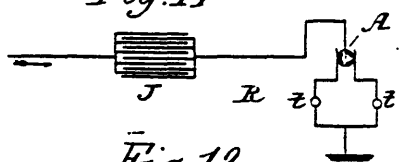


Fig. 14

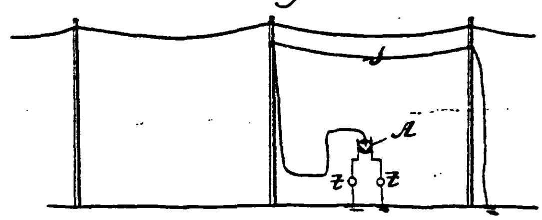


Fig. 12

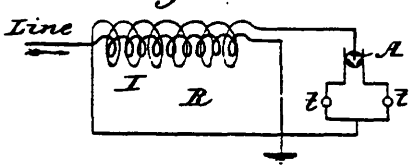


Fig. 15

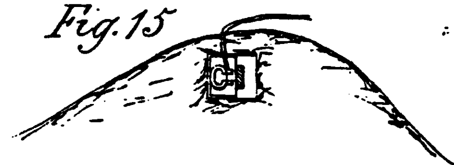


Fig. 17

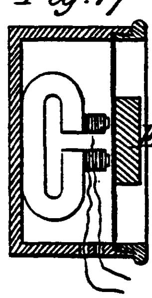


Fig. 18

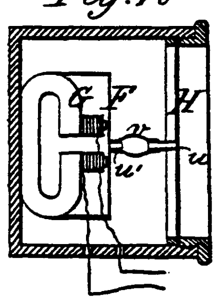
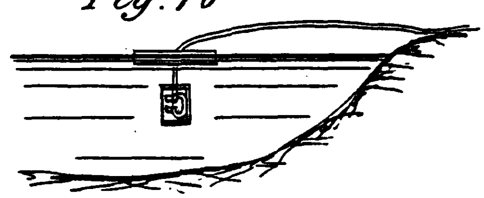


Fig. 16



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CLEMENT ADER, OF PARIS, FRANCE.

TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 377,879, dated February 14, 1888.

Application filed July 1, 1887. Serial No. 243,124. (No model.) Patented in England May 18, 1887, No. 7,265.

To all whom it may concern:

Be it known that I, CLEMENT ADER, a citizen of the French Republic, residing in Paris, France, have invented certain new and useful Improvements in the Art of and Means for Electric Signaling or Telegraphing, of which the following is a specification.

This invention has been patented in Great Britain by Patent No. 7,265, dated May 18, 1887.

This invention relates, principally, to the method of receiving telegraphic or other electric signals, whereby they are rendered audible.

I will proceed to explain the principle upon which my invention is based with reference to Figures 1, 2, 3, and 4 of the accompanying drawings, which are diagrams illustrating graphically the electric currents as transmitted and received over electric circuits.

Let us assume that intermittent currents are transmitted over an ordinary telegraphic circuit by means of the usual key. We may then represent the current emitted from the sending-station by a mark, X, in Fig. 1, of uniform thickness, and if the circuit is relatively short or presents but little resistance the intermittent currents arriving at the receiving-station will present substantially the same form, and may be represented by the mark X' in Fig. 1. If, however, the line is long or presents a high resistance, the current undergoes a change of form during its transmission and reaches the receiving-station not as a series of sharply-defined pulsations, but as an undulatory current of varying intensity, such as may be represented by the undulatory mark X' in Fig. 2. Thus, in telegraphic transmission according to the Morse alphabet, there is received at the receiving-station a series of undulatory pulsations of varying intensity and of different length, which may be represented by undulatory tracings, as shown at X' in Fig. 3. This is the result of the ordinary method of telegraphic transmission over long circuits or those of high resistance. Much difficulty is continually experienced in the reception of messages thus transmitted, since a very accurate adjustment of the receiving-instrument is rendered necessary, and this adjustment must be varied from time to time to correspond with the varying conditions of the line. It is the object of my invention to provide a method of reception which shall avoid this difficulty.

It has been proposed to receive telegraphic signals by means of a receiving-telephone, the diaphragm of which should be vibrated in consonance with the variations in the intensity of the currents. This method is impracticable, for the reason that if the number of vibrations produced by the current is not such as to produce a sound or note perceptible to the ear the message cannot be read by listening in the telephonic receiver. My invention overcomes this difficulty by means which I will now describe.

Let us suppose that one intercalates in the circuit at the receiving-station and at a point traversed by the current before it reaches the telephonic receiver an apparatus which subdivides the undulatory current into pulsations succeeding one another regularly and continually and with great rapidity, as denoted in Fig. 4, their velocity being such that the number of pulsations per second corresponds to the number of vibrations necessary for producing a sound or note perceptible to the ear. The current thus subdivided being received in the telephone produces therein a continuous sound or note of uniform pitch; but as the currents which form the telegraphic signals are undulated the sound that is heard in the telephone is more or less loud or intense. This sound thus becomes an exact reproduction of the transmitted signals. It is possible in this manner to receive electric signals acoustically at great distances under the form of undulatory sounds. It is only necessary that the signals which arrive in the form of undulatory electric currents or impulses shall be subdivided into rapidly-successive pulsations, the number of which corresponds to an audible sound or note. Such is the principle of my invention, to which I have given the name of the "phono-signaling" system.

It will be understood that by means of this system the transmission of electric signals over long lines is rendered much more rapid than by those heretofore in use, since it is no longer necessary to discharge the line between the successive emissions of the signals.

The principle of my invention being thus understood, I will now proceed to describe the means which I have devised for practicing it.

In so doing I will make reference to the remaining figures of the accompanying drawings, of which—

Fig. 5 is a diagram illustrating a telegraphic circuit with sending and receiving stations, and representing the transmitted current before and after subdivision. Fig. 6 is a side elevation of one construction of instrument for effecting the subdivision of the current. Fig. 7 is a similar view of another construction of such instrument. Fig. 8 shows still another construction. Fig. 9 is a diagram of a modified construction of receiving-instrument, and illustrating the arrangement of the circuit at the receiving-station. Figs. 10, 11, and 12 are diagrams illustrating different circuit arrangements at the receiving-station. Fig. 13 is a diagram of a circuit for telegraphic transmission across bodies of water. Fig. 14 is an elevation of a portion of a telegraph-line, illustrating the application of my invention to the inductive reading of messages therefrom. Fig. 15 is a vertical section illustrating the utilization of my invention for the detection of subterranean disturbances. Fig. 16 is a similar view showing its utilization for the detection of submarine disturbances. Fig. 17 is a vertical transverse section of the transmitting-instrument employed for the detection of subterranean disturbances, and Fig. 18 is a similar view of the transmitting-instrument employed for submarine use.

Referring to Fig. 5, let T designate the transmitting and R the receiving station. At the former is the battery P and the transmitting-key K, both of which may be installed in the manner common to electric telegraphs. At the receiving-station are telephonic receiving-instruments *t t*, which may be ordinary magnetic telephones, and a commutator, A, which is installed between the receiving-telephones and the line. This commutator is the instrument by which the subdivision of the electric current is effected. In the construction here shown it consists of a rotary cylinder having blocks *a a*, of insulating material, set at intervals in its periphery and rotating between metal contact plates or springs *b b*, which touch it peripherally. The commutator is rotated continuously and at the requisite speed by any convenient local force independent of the current on the line. It may be, for example, a belt from shafting or an electromotor fed by a local battery. The arrangement of the insulating-blocks *a a* relatively to the contacts *b b* is such that the line is connected alternately with one contact or the other through the metallic portion of the cylinder, and when its metallic portion is touching one contact one of its insulations is against the other contact. Thus, as the commutator revolves, the current coming over the line is subdivided by bifurcation, and the successive pulsations pass alternatively into two branches, *c c*, of the circuit, both of which lead to the earth, and in each of which one of the telephonic receivers *t* is intercalated. Thus each telephone receives a series of pulsations succeeding one another with the velocity requisite for producing an audible note and occurring in alternation with the pulsations in the other telephone, as clearly indicated in the diagram by the undulatory lines. By this method of subdivision of the current by bifurcation the line-circuit is not interrupted, since it is continually connected to earth through either one branch *c* or the other.

Fig. 6 shows another method of subdividing the current by bifurcation. Instead of a rotary commutator, a vibratory one is here employed, being vibrated at a uniform velocity by an electro magnet operating on the principle of the rheotome. The electro-magnet B is fed by a local battery, C, the circuit from which, after traversing the coils of the magnet, passes through a contact-spring, *d*, which comes against a screw, *s*, through which the current passes on its return to the battery. This constitutes the rheotome, the construction being such that when the magnet B attracts its armature *e* it draws the spring *d* out of contact with the screw *s* and breaks the circuit, whereupon the armature flies back by reason of its elasticity and re-establishes the contact. The armature *e* is thus given a constant and rapid vibration before the poles of the magnet. It carries at its end a finger, *f*, of insulating material, which vibrates between two very light springs, *g g*, and in its vibration displaces them alternately out of contact with a button, *h*, of conducting material, between them. The button *h* is connected to the line, and the springs *g g* are connected to the respective branches *c c* of the circuit, in which are intercalated the receiving-telephones *t t*.

The current may be subdivided by simply interrupting it, although I do not prefer this method. Fig. 7 shows a means for accomplishing its subdivision in this manner. The rheotomic magnet B, with its armature *e* and contacts *d s*, is of the same construction as in Fig. 6. The armature *e* carries at its free end a conducting-fork, *k*, which is insulated from it, and which on vibrating toward the magnet touches and electrically connects together two contact-springs, *j j'*, and on its vibration from the magnet passes out of contact therewith and breaks the circuit. The spring *j* is connected with the line-wire *i* and the spring *j'* is connected to earth, the receiving-telephone *t* being intercalated in the latter connection. The circuit is thus alternately closed and broken, the interruptions being of such velocity as to produce the requisite audible sound in the telephone.

The subdivision of the current may be accomplished by alternating its direction, causing it at the receiving-station to flow first in one direction and then in the other, and the alternations of direction succeeding each other with the frequency requisite for the production of an audible sound. For this purpose it is necessary to employ a current-alternating commutator at the receiving-station. This commutator may be either rotary or vibratory, many different constructions of each kind being well known in the art. As an example of one construction that may be used, I would make reference to Fig. 8, which shows a vibratory commutator vibrated by a rheotomic magnet, B, as in Figs. 6 and 7. For the sake of clearness, the contacts and local battery pertaining to this rheotome are not shown. Its vibratory armature *e* carries two contact-buttons, *l* and *l'*, which are insulated from each other and constitute the opposite terminals of a loop or branch, *c*, of the circuit, in which loop the receiving-telephone *t* is intercalated. On one side of the armature are two contacts, *m* and *n'*, which are touched by the contacts *l* and *l'* when the armature recedes from its magnet, and on the opposite side are two contacts, *n* and *m'*, which are touched by the contacts on the armature when the latter approaches its magnet. The line-circuit is divided into two branches, one of which terminates at the contact *m* and the other of which terminates at the contact *m'*. The earth-wire is likewise divided into two branches, one of which terminates at the contact *n* and the other of which terminates at the contact *n'*. When the armature is retracted from its magnet, the current of the line enters at *m* and follows the path indicated by the arrows *x x*, flowing through the loop *c* and passing out at *n'* to the earth. On the opposite vibration of the armature the line-current enters at *m'* and passes through the loop in the direction indicated by the arrows *x' x'*, passing out at *n* to the earth. These alternations of direction of the current passing through the telephone produce the same effect as the subdivision by interruption or bifurcation.

The same result may be accomplished without the employment of a current-alternating commutator by the arrangement shown in Fig. 9. The magnet-core of the telephone *t* is here wound with two coils, which are intercalated, respectively, in the two branches *c* and *c'* of the circuit. The current is subdivided between these branches by bifurcation through the medium of the rotary commutator A, as first described, and the respective coils *o o'* are connected in inverse order in the two branches in such manner that when the current is passing through the branch *c* it flows around the telephone-coil in the direction denoted by the arrows *x x*, whereas when the current is flowing through the branch *c'* the current flows around the telephone-coil in the opposite direction, as denoted by the arrows *x' x'*. Thus the telephone is influenced by currents flowing in alternately opposite directions.

It is not necessary that the commutator for subdividing the current be arranged in the line-circuit, as it may be placed in a derivation thereof. Fig. 10 shows such an arrangement. The line-circuit is divided into two branches, *c c*, at the receiving-station, in each of which one of the receiving-telephones *t* is intercalated, and outside of these branches is a short circuit or shunt, *p*, in which is intercalated a current-interrupting commutator, *q*. When the shunt-circuit is broken by the commutator, the entire current passes for an instant through the telephones *t t*; but when the shunt is closed the greater portion of the current passes to earth through the shunt, thereby avoiding the telephones. This constitutes what I call "subdivision by derivation."

If necessary, condensers may be interposed in the circuit at the receiving-station, as is done with electric submarine cables. This is shown in Fig. 11, where J designates the condenser.

My system may be worked inductively, if desired, by providing an induction-coil at the receiving-station and passing the line-current through the primary wire thereof to the earth, while the secondary wire thereof is joined in a local circuit, which is provided with a current-subdividing commutator and with receiving-telephones. Fig. 12 shows such an installation, I being the induction-coil, A the commutator, and *t t* the telephones.

My "phono-signal" system is applicable not only to aerial telegraph-lines and submarine cables, but also for electric transmission along or across rivers, lakes, arms of the sea, and other bodies of water wherein the water constitutes the sole conductor in lieu of a line-wire. Fig. 13 illustrates such a circuit. In this case it is necessary to arrange in the water, both at the receiving and transmitting sides thereof, floats D D, provided with metallic conducting-rods *r r*, which spread out in all directions, in order to distribute the current to a very large surface of the liquid, so as to conduct the current to the latter and collect it therefrom with the least possible resistance and loss, whereby the liquid may be utilized as a conductor. At the transmitting side of the body of water is a short metallic circuit containing the battery and transmitting-key, and at the receiving side is another short circuit containing the commutator A and the telephones. Both these circuits terminate in earth-connections, which are by preference made through the medium of plates D' D', which radiate in all directions. In this case it is preferable to arrange at the receiving-station condensers or induction-coils, as above described.

Fig. 14 shows an application of my new system for the purpose of reading the signals transmitted over a telegraph-wire without interrupting their transmission to their destination. For this purpose a wire, *s'*, is strung between two telegraph-poles parallel with and in proximity to the line-wire, in order that upon the passage of currents over the latter these currents, which are either intermittent or more or less undulatory, shall induce corresponding currents in the wire *s'*, and these induced currents are read by means of telephones *t t*, between which the current is subdivided by a commutator, A, as already described. Finally, this system enables slow oscillations or vibrations, as in the case of subterranean noises, earth-tremblings, and noises made under water by steamboats or torpedo explosions and the like, to be detected. These noises or concussions are transmitted by means of a battery or magnetic telephone. My system is applicable for the reception of signals of similar character where undulatory currents are sent over the line emanating from electric transmitters. It is necessary in such case to construct the transmitter appropriately to the special use for which it is destined.

Fig. 15 illustrates the arrangement of a transmitter for the observation of subterranean sounds or concussions. For this purpose the transmitting-instrument is buried in the earth at a suitable depth, and should be of such construction as to be sensitive to the slow vibrations which it is to transmit. Fig. 17 shows its preferred construction. It consists simply of a magnetic telephone the vibrating diaphragm of which carries a weight, E, which increases its inertia. If the soil is subjected to vibratory movements, the transmitter is displaced with it; but the diaphragm, tending to remain in place by reason of its inertia, is not moved so quickly as the electro-magnet, so that they mutually recede from and approach each other, thereby generating undulatory currents, which are sent over the line, and which upon their arrival at the receiving-station are subdivided and received acoustically in the telephonic receivers.

Fig. 16 illustrates the arrangement of a transmitter for the observation of submarine sounds or vibrations, the transmitting-instrument being suspended beneath a float. The preferred construction of this instrument is shown in Fig. 18. It is constructed in such manner as to prevent a sudden increase of pressure from forcing the diaphragm against the poles of the electro-magnet. To this end I inclose the apparatus in a box, one of the sides of which is a diaphragm, H, to which is fixed a rod, *u*, which projects inwardly toward a similar rod, *u'*, which is fixed to the diaphragm F, which latter diaphragm is the one which is disposed closely adjacent to the poles of the magnet G. A tube, *v*, having its ends split, embraces the rods *u u'* and connects them together in such manner that the vibrations of the diaphragm H are transmitted through it to the diaphragm F; but if an excessive pressure of water comes against the exterior diaphragm, thereby pressing the latter inward, the tube *v* yields without injuring the apparatus, and the vibrations continue to be transmitted and consequently to induce undulatory currents upon the line.

My phono-signal may be combined with duplex and other telegraphic systems.

The velocity of subdivision of the current, which I have hereinabove stated to be constant, is not necessarily or essentially absolutely constant, but is preferably so, in order that the musical note heard in the receiving-instrument shall not be subject to variations of pitch, which would confuse or annoy the listener. The speed of the commutator may vary from time to time without departing from my invention.

I claim as my invention my improved system of and apparatus for the transmission and reception of telegraphic and other electrical signals, presenting the following-defined novel features, substantially as hereinabove specified, namely:

1. The reception of electric signals by subdividing the electric current into pulsations succeeding one another at a constant velocity which corresponds to the vibrations of an audible note, and passing the subdivided current through a telephonic receiver, thereby producing in the latter a sound of uniform pitch, the intensity of which varies according to the undulations of the subdivided current, whereby the electric signals are acoustically translated.

2. The transmission of electric signals by sending a succession of electric impulses over the line, subdividing the resulting undulatory current at the receiving-station into pulsations succeeding one another at a constant velocity which corresponds to the vibrations of an audible note, and passing the subdivided current through a telephonic receiver, whereby the electric signals are acoustically translated.

3. The combination, with an electric signaling-circuit, of a commutator at the receiving-station adapted to subdivide the currents arriving over said circuit into pulsations succeeding one another at a velocity corresponding to the vibrations of an audible note, and a telephonic receiver through which the subdivided current is passed.

4. The combination, with an electric signaling-circuit divided into two branches, of a commutator adapted to direct the current into said branches alternately and to shift it from one to the other with a frequency corresponding to the rapidity of vibration of an audible note, whereby the current is subdivided into rapidly successive pulsations in said branches, and with a telephonic receiver intercalated in one of said branches.

5. The combination, with an electric signaling-circuit divided into two branches, of a commutator adapted to direct the current into said branches alternately and to shift it from one to the other with a frequency corresponding to the rapidity of vibration of an audible note, whereby the current is subdivided into rapidly successive pulsations in said branches, and with telephonic receivers intercalated in said branches.

6. The combination, with an electric signaling-circuit and a telephonic receiver, of a commutator at the receiving-station adapted to subdivide the current arriving over said circuit into pulsations succeeding one another at a constant velocity corresponding to the vibrations of an audible note, and circuit-connections between said commutator and the telephonic receiver, substantially as described,

so that the successive pulsations are passed through said receiver in alternately opposite directions.

7. The combination, with an electric signaling-circuit, of a commutator at the receiving-station adapted to subdivide the current arriving over said circuit into pulsations succeeding one another at a velocity corresponding to the vibrations of an audible note, a telephonic receiver through which the subdivided current is passed, and a source of power independent of said circuit for actuating said commutator, whereby the said commutator may be caused to act with a constant velocity uninfluenced by variations in the signaling-circuit.

8. The combination, with an electric signaling-circuit, of a vibratory commutator at the receiving-station adapted to subdivide the currents arriving over said circuit, a telephonic receiver through which the subdivided current is passed, and a rheotomic magnet for vibrating said commutator, adjusted to vibrate it at a constant velocity corresponding to the vibrations of an audible note.

9. The combination, with an electric signaling-circuit and a telephonic receiver, of a commutator at the receiving-station adapted to subdivide the currents arriving over said circuit, a rheotomic magnet for vibrating said commutator, adapted to vibrate it with a velocity corresponding to the vibrations of an audible note, and a source of electric current independent of said circuit for actuating said rheotome, whereby the rapidity of vibration thereof may be rendered constant.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

CLEMENT ADER.

Witnesses:
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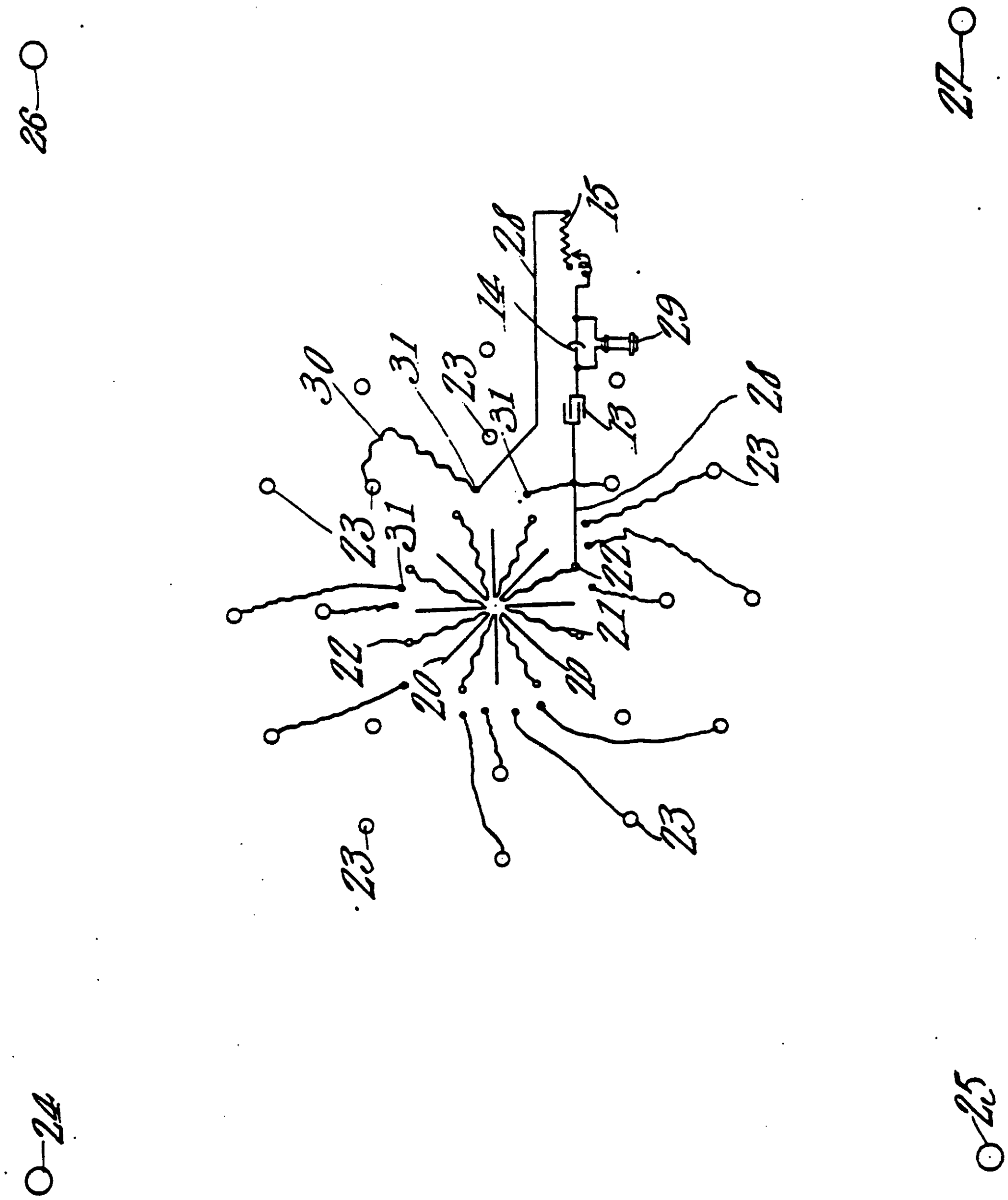
AMAND RITTER.

W. E. FROW.

MEANS FOR TRANSMISSION OF INTELLIGENCE.

APPLICATION FILED JUNE 10, 1910.

1,016,003. Patented Jan. 30, 1912.



William E. Frow, Inventor

Witnesses

J. R. [illegible]

F. T. Chapman.

by C. A. Snow & Co. Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM E. FROW, OF LISBON FALLS, MAINE.

MEANS FOR TRANSMISSION OF INTELLIGENCE.

1,016,003. Specification of Letters Patent. **Patented Jan. 30, 1912.**

Application filed June 10, 1910. Serial No. 566,236.

To all whom it may concern:

Be it known that I, WILLIAM E. FROW, a citizen of the United States, residing at Lisbon Falls, in the county of Androscoggin and State of Maine, have invented a new and useful Means for Transmission of Intelligence, of which the following is a specification.

This invention has reference to improvements in means for transmission of intelligence and its object is to provide for telegraphic or telephonic intercommunication without the use of line conductors or aerial transmission.

In accordance with the present invention there are provided at each station separated ground connections between which the transmitting and receiving instruments are included and these ground connections are so related one to the other at each station and at the communicating station that communication is solely through the ground. Furthermore provision is made for changing the relation of the grounds at a receiving station to bring these grounds into proper relation to the sending station so as to obtain the best results.

The invention will be best understood from a consideration of the following description taken in connection with accompanying drawings forming a part of this specification, in which drawings, the figure is a diagram illustrating a means whereby the ground connections at a receiving station may be brought into the best relation with the sending station.

Referring to the drawings, the system is shown with the receiving station arranged for picking up any of the several divergent outlying stations. The station is shown as equipped with a series of radial ground plates 20 each connected at one point to a conductor 21 terminating at a binding post 22 or other suitable means of permitting the connection of another conductor thereto. At varying distances and in different relations to the ground plates 20 are other ground connections 23 which may be of various types such as metal plate or strands of wire, sunk into the damp earth, and either already existent or purposely installed. In the drawings the outlying stations are simply indicated at 24, 25, 26, 27 without any attempt to show the installations thereat, but it will be understood that each of the outlying stations may be equipped like the receiving station both for transmission and reception and it will be understood that the receiving station will also be provided with suitable transmitting apparatus. In the equipment care is taken that the grounds 23 either already existent or which may be installed when the station is installed, shall be sufficiently divergent. There is provided a conductor 28 including a receiver 29, and this may be indicative of both receiving and transmitting apparatus, and this conductor is capable of being connected at one end to any one of the binding posts 22 and at the other end to any one of the grounds 23 and since these grounds 23 may be at varying distances from the grounds 20, the conductor 28 may be long enough to reach from any one of the binding posts 22 to the most remote grounds 23 at the particular station.

It has been found in actual experience that unless the grounds 20 and 23 at the receiving station be in proper relation to the transmitting station, usually in a plane to coincide with the lines of current flowing, that the reception of the messages is materially less distinct or loud than they are when the relation is properly established. The arrangement provides a ready means for establishing this relation in a minimum of time since an operator on picking up a message from a sending station may quickly establish the best relation to such station by connecting the conductors 28 to a proper one of the binding posts 22 and grounds 23. This connecting up of the grounds at the receiving station may be facilitated by having each ground 23 connected by a conductor 30 to a binding post 31 adjacent to the binding posts 22 so that the conductor 28 which may then be quite short may be readily coupled up between the upper binding posts 22 and 31 and the desired relation of the grounds to the sending station may thus be quickly established with a minimum of trouble for the operator may quickly pass around the entire series of binding posts with the terminals of the conductor 28 to thereby establish the proper relation on the ground.

In the arrangement shown, all the inner grounds 20 may be coupled together as one ground and all the outer grounds 23 may be coupled together as the other ground, when necessary or desirable.

More than one message may be received at one time with the arrangement by selecting appropriate separate couples of the grounds 20 and 23, or by using one of the grounds 20 and properly chosen grounds 23, the latter being in number equal to the number of messages to be received.

What is claimed is:—

1. In a system of electrical transmission of intelligence, a receiving station having a receiving instrument, an equal number of divergent ground connections for both terminals on the receiving instrument, and means for the inclusion of the receiving instrument in circuit with any separated pair of ground connections at said station.

2. In a system of electric transmission of intelligence, a receiving station having a receiving instrument, a centrally located divergent ground for the receiving instrument and other grounds in divergent relation to the first named ground, and connections from both terminals of the receiving instrument adapted to be coupled to the central ground and any of the divergent grounds, respectively.

3. In a system of electric transmission of intelligence, a receiving station having a receiving instrument, a centrally located ground for the receiving instrument composed of a divergent series of separate grounds and connections therefrom to accessible terminals, other grounds in separated divergent relation to the first named ground and each also provided with accessible terminals, and connections from both terminals of the receiving instrument adapted to be coupled to the accessible terminals of any chosen member of the central ground and any chosen one of the divergent grounds respectively.

4. A means for the electrical transmission of intelligence below the earth's surface, which consists of transmitting and receiving instruments at separated stations, said receiving station having a centrally located ground composed of divergent separated connections another series of divergent grounds, and connections from both terminals of the receiving instrument adapted to engage any pair of the respective grounds.

5. In a system of electric transmission of intelligence, a receiving station having a receiving instrument, a central ground having radiating members below the earth's surface, other grounds disposed in substantially radial lines from said central ground, and means for connecting the receiving instrument to selected members of the respective grounds.

6. In a system of electric transmission of intelligence, a series of radiating grounds connected to a single terminal, a receiving instrument adapted to be connected thereto, another series of divergent grounds, all of said grounds being located below the earth's surface, and means whereby the remaining terminal of the receiving station may be attached to the selected terminal of the divergent ground.

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

WILLIAM E. FROW.

Witnesses:

CHARLES E. RAYMOND.

R. F. SPRINGER.

HOGO, PIGGOTT & BEARDMORE.

Telegraph.

No. 25,016. Patented Aug. 9, 1859.

Fig. 1.

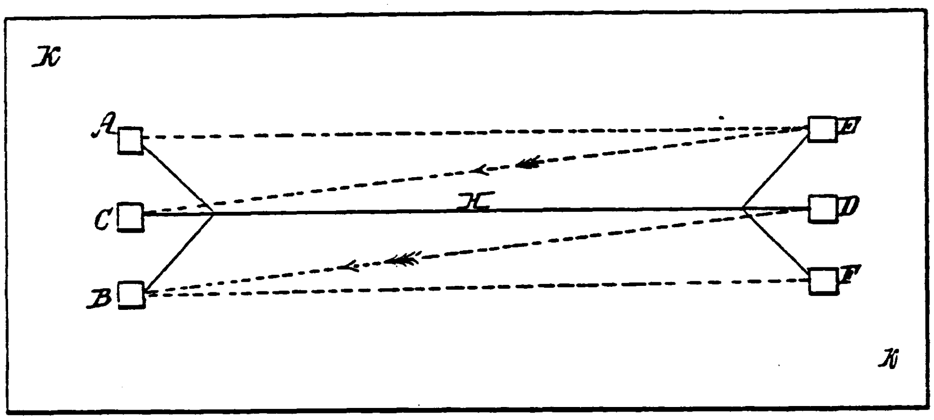
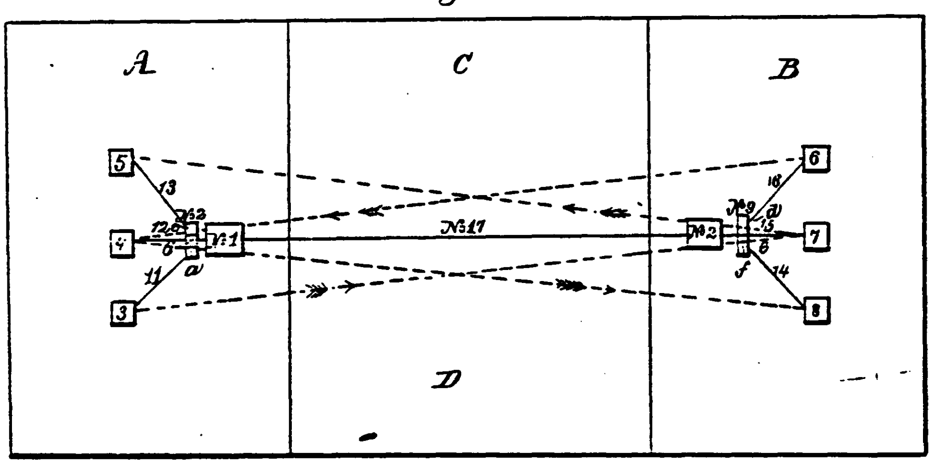


Fig. 2.



Witnesses
John T. Polinger
T. P. Capps

Inventors.
Stanislas Hoga
William Peter Piggott
Septimus Beardmore.

UNITED STATES PATENT OFFICE.

S. HOGA, W. P. PIGGOTT, AND S. BEARDMORE, OF THE COUNTY OF MIDDLESEX, ENGLAND.

IMPROVED MODE OF GENERATING AND APPLYING ELECTRIC CURRENTS IN TELEGRAPHING.

Specification forming part of Letters Patent No. **25,016**, dated August 9, 1859.

To all whom it may concern:

Be it known that we, STANISLAS HOGA, gentleman, WILLIAM PETER PIGGOTT, electrician, and SEPTIMUS BEARDMORE, civil engineer, all of the county of Middlesex, in that part of the United Kingdom of Great Britain and Ireland called "England," have invented a new and Improved Mode of Producing, Using, and Transmitting Electric Currents for Telegraph Purposes; and we do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings hereto annexed and made part of this specification, in which—

Figure 1 presents a simple arrangement for producing the currents. K K shows a plan of the earth or natural body of water A D, in which are placed plates of zinc or other positive metals; B E, plates of iron or other metal which is negative to zinc, but positive to C F, plates of platinum or other metal which is also negative to A D. H is the conducting-wire, which, when connecting A or C at one end with E at the other, or D or D or F at one end with B at the other, produces the currents required.

Fig. 2 exhibits more particularly the mode of working an electric-telegraph instrument. A B may be supposed to be land on either side of C, D representing water. Nos. 1 and 10 represent telegraphic instruments or simple galvanometers at each station; 2 and 9, levers or handles, each insulated in two separate places; 3, zinc or other positive metal placed near No. 1; 4, iron or other metal negative to No. 3, but positive to No. 5, representing platinum or other metal negative to both the others. Nos. 6 7 8 represent similar metals as Nos. 3, 4, and 5, and are placed in a similar manner near No. 2, 6 being zinc, 7 iron, and 8 platinum. Nos. 11, 12, and 13 are wires connecting 3, 4, and 5 with the handle No. 2, and 14, 15, and 16 connect 6, 7, and 8 with the handle No. 9. 17 represents the conducting-wire, insulated at either end.

The current of electricity operating on telegraphs has been hitherto generated at either end of the line by means of local batteries, made by placing the negative and positive elements in juxtaposition in a cell or cells, and transmitted over the line-wire, returning by the earth, while the reverse current is obtained by changing the poles of the local batteries.

Our improvement, which for the purpose of designation is termed the "globe-telegraph," consists in creating the current in the manner hereinafter described, and in transmitting it directly through and by means of the earth or natural body of water, using the line-wire only for the return-current.

To obtain the current we place in the earth, or in a natural body of water near each of the stations for communication, in the form of plates, the three substances 3, 4, and 5, possessing the relations to each other as above mentioned. These metals or substances are not connected with each other, but can be connected with the insulated wire or wires H, Fig. 1, or No. 17, Fig. 2, transmitting the return-current. By the alternate action of the zinc and platinum or similar positive and negative substances at one station with the iron or similar substance at the other the required current is obtained, and with it the signals are effected. It is to be observed here that although iron is considered by the best authorities to be negative to zinc, yet we have found it, when much oxidized, to be positive in relation to that metal.

We consider a very important part of the invention to be the adjustment and size of the plate-surface to the distance of transmission. This is regulated by the following rule: Having ascertained the size or amount of plate-surface required to work an instrument at a given distance, the same instrument can be operated at any other distance by increasing or diminishing the amount of surface in proportion to the square root of the distance. Thus, if two square feet of zinc at one end of an insulated conducting-wire fifty miles long, at the other end of which is a piece of platinum of the same size, produces sufficient electromotive force to work the instrument, then four square feet of the same metals, similarly placed two hundred miles distance, will produce the same effect.

The mode of operating the globe-telegraph may be described as follows: If by a conventional arrangement the parts *b c* of the handles 2 and 9, Fig. 2, are placed in contact, the one or the other with the instruments 1 or 10, the operator at B will, in order to operate on the instruments, break contact with *d* and instrument No. 10. A current will thereby flow from 6 through the earth to 4, and thence through instrument No. 1, by the wire, back to 6. Then, in order to produce a reverse current, the sender at B will place f (handle No. 9) in contact with the instrument No. 10, and the current will then flow from 4 through the earth to 8, and back through No. 10, by the wire, to 4; or, vice versa, the operator at A will break contact with a, (handle No. 2,) and thereby cause the current to flow from No. 3 through the earth to No. 7, which, when at rest, is in contact with instrument No. 10. To obtain a reverse current he will break contact with C, (handle No. 2,) and thereby cause the current to flow from No. 7 through the earth to No. 5, the current returning along the wire to No. 7.

The plates may be placed in separate porous cells, and, if it be necessary to have a large amount of surface, several plates of the same metal can be used in the same or separate cells, and be connected by a wire, so as to operate as one plate. To facilitate the generation of the current the usual mode of chemically exciting these metals may be employed.

When a large amount of electric force, or what is understood by the word "tension," is required, two, three, or more insulated wires may be used, electric action being caused along each by means of the separate dissimilar metals, as above described, while the increased force on the instrument is obtained by connecting such two or more wires with two or more coils round the same helix, but unconnected with each other.

When a printing-instrument like Morse's, Siemens', or Hughes's is used, requiring only a current in one direction for the purpose either of forming a temporary magnet or altering the condition of the magnetism in a permanent one already attached to the instrument, we need only apply so much of our arrangement as will be necessary to generate the current only in one direction from the positive to the negative substance through the earth, and using this when necessary to set a local battery at work, by which to act on the instrument.

The production of electric currents by means of positive and negative substances placed in the earth, or in natural bodies of water connected together by an insulated wire, has been suggested and described by Alexander Bain in the specification to his English Letters Patent dated May 27, 1843; but his manner of applying the suggestion to telegraphic purposes failed to lead to any practical or useful result, and was abandoned. Our mode of arrangement is an improvement upon his, inasmuch as he expected to obtain the current but in one direction, while we are able, as above described, to obtain currents not only in one but in either direction, and by the discovery of the proportion the plate-surface should bear to the space through which the current is to pass we are enabled to construct and work lines of great lengths, especially when the plates are used in porous cells.

We prefer to use between stations an insulated connecting wire or cable of iron or galvanized iron or copper; but the circumstances which make such insulation necessary differ from those which necessitate an insulation in the case of existing telegraphs. The lines of these last conduct currents of electricity from batteries, and such intense currents will, by the contact of such line-wire with the moisture of the earth or water, tend to run back to the batteries producing them. In our arrangement the produced currents have a tendency to pass from the positive to the negative metal or substance through the earth or water, and the line-wire for the return-current completes the circuit, and the necessity of insulation exists, because where a line-wire is in contact for some distance with the earth or water it becomes, according to its positive or negative quality, an opposite metal to some of the metals or substances at the different stations which may be in contact with it, and thus the current which we require for telegraphic purposes would be expended and returned along the line-wire to the station where either of the three metals or substances (negative or positive to the substance of which the line-wire is composed) is in contact. Insulation of the line-wire—that is, protection from free electric contact with earth or water—therefore is required. For the above reasons it can be more readily made and maintained in our mode than under the system at present in use; but where a large portion of the wire becomes uninsulated by wear or other circumstances we can increase the surface of the metals or substances, and thus compensate for the loss or change of relation.

By our method the formation of a temporary magnet is effected or the condition of a permanent magnet altered at pleasure in the usual way.

Having now described the nature of our invention and in what manner the same is to be performed, what we claim, and desire to secure by Letters Patent, is—

The application to telegraphic instruments of currents of electricity produced from metals or substances arranged in the earth or in natural bodies of water, in the manner and of the properties and relations above described.

STANISLAS HOGA.
WILLIAM PETER PIGGOTT.
SEPTIMUS BEARDMORE.

Witnesses:
JOHN T. PITMAN,
T. P. CAPP.

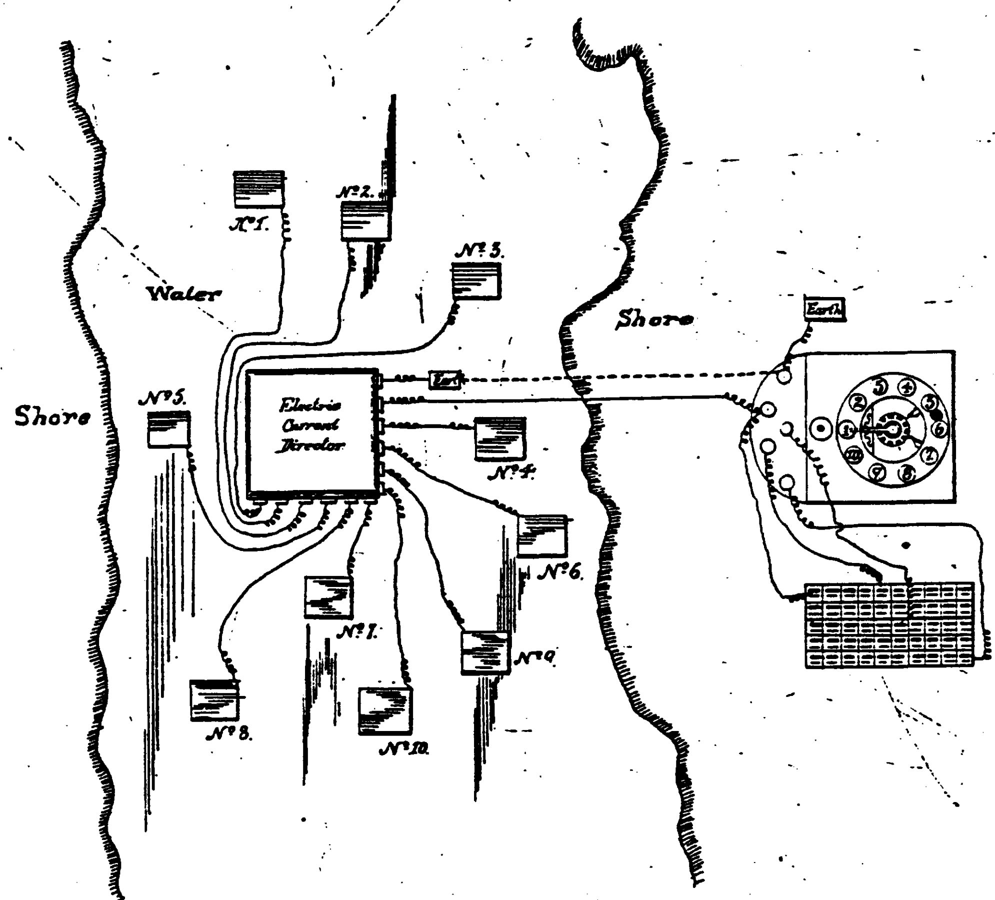
(No Model.)

G. E. HAIGHT.

ELECTRICAL DEVICE FOR OPERATING SUBMERGED MINES, &c.

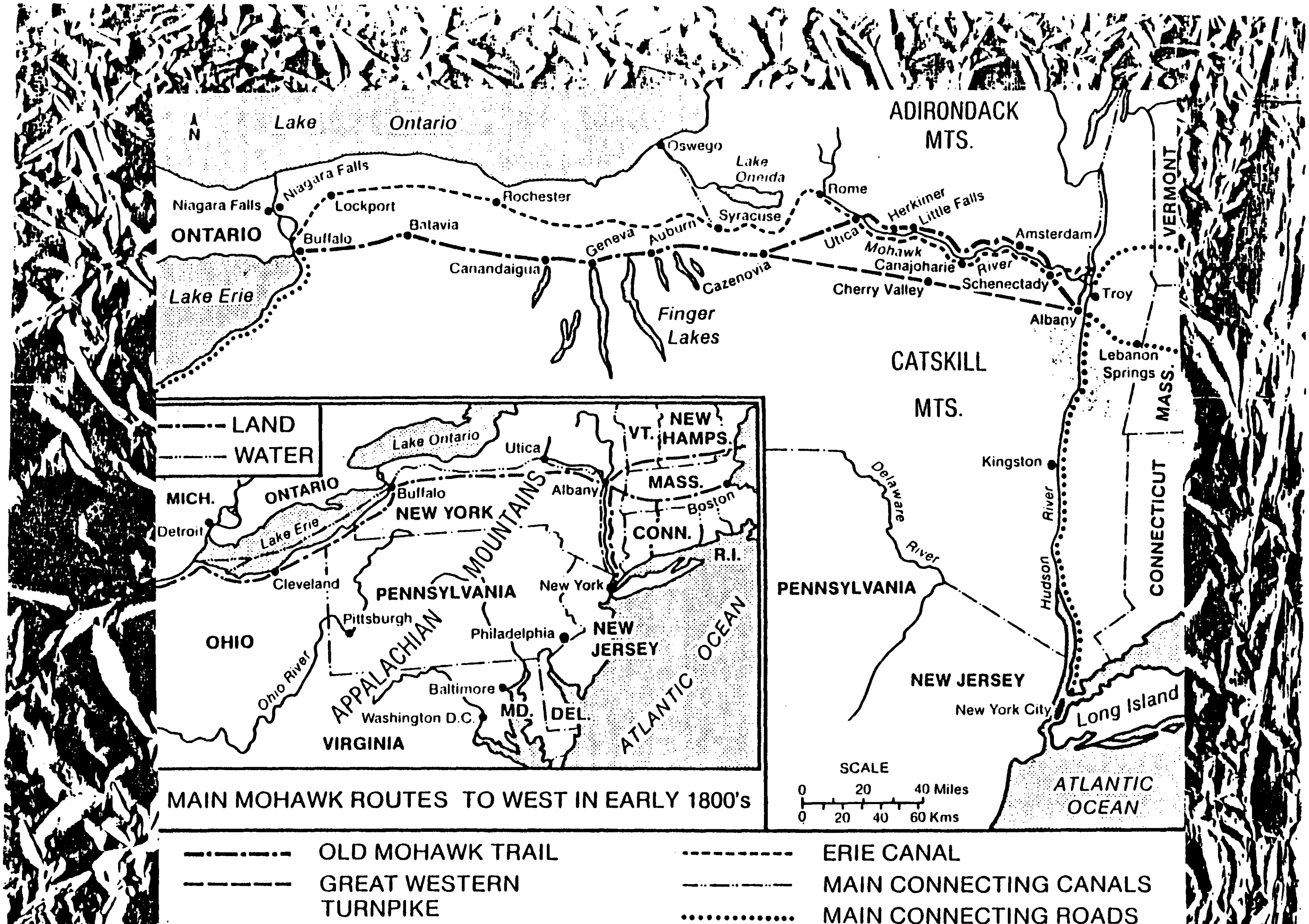
No. 257,695. Patented May 9, 1882.

Fig. I.



Attest:
A. W. Bright
H. L. Hautemann

Inventor:
George E. Haight.
by O. W. B. Brock
Atty.



ROADS FOLLOWED INDIAN TRAILS...

ALL OF WHICH WERE VRIL PATHS BY NATURE

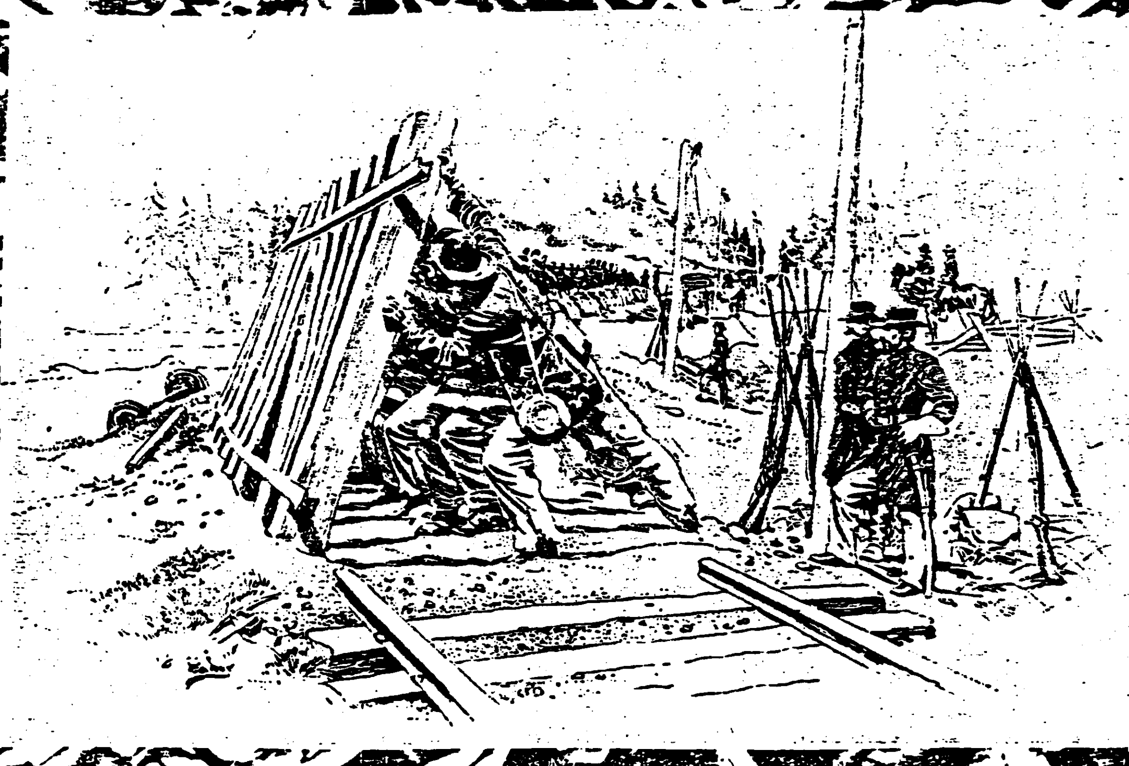
THESE VERY PATHWAYS BECAME THE SITES ALONG WHICH RAILS AND LINES WERE STRUCTURED

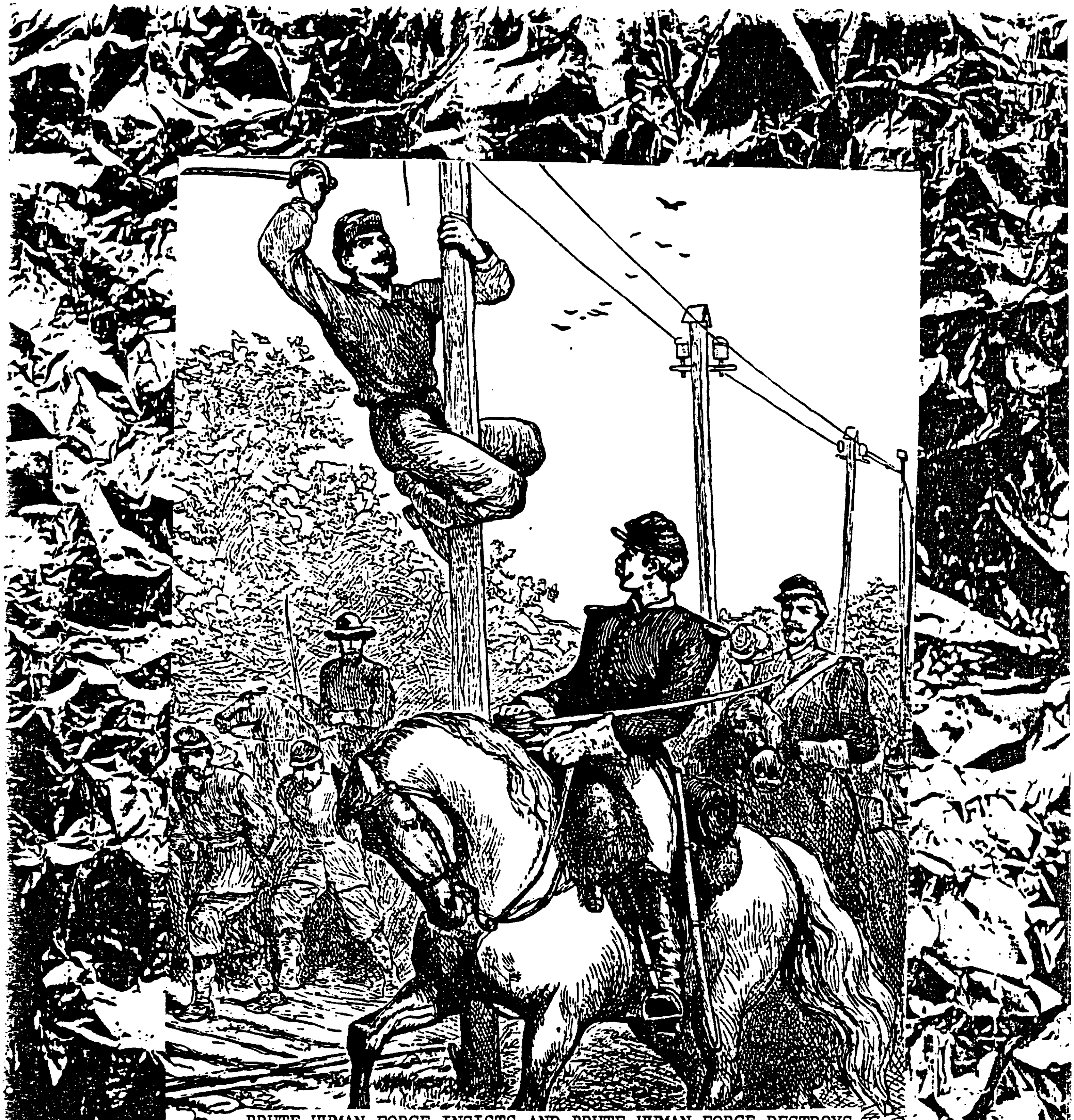
REGIMES ATTEMPT THE SPREAD OF FORCED WILL...

REGIMES ATTEMPT THE IMPRESSMENT OF INTENT UPON NATURAL PROJECTIONS.

ARROGANCE NEVER SUCCEEDS AGAINST VRIL CHANNELRY

VRIL PREVAILS AND MESSAGES EIDETIC WORLDS TO THE SURRENDERED RECIPIENT WHO IS DEVOTED





BRUTE HUMAN FORCE INSISTS AND BRUTE HUMAN FORCE DESTROYS
WHAT ONE REGIME FORCEFULLY SEEKS TO IMPRESS ON NATURE...
ANOTHER WILL DISANNUL BY FORCEFUL INTENT.
HUMAN SAVAGERY IS AN IGNORANT CLOSURE WHICH BLOCKS
VRIL CONSCIOUSNESS AND EIDETIC TRANSACTIONS.

VRIL IS VICTORIOUS WHEN SURRENDERED PERSONS
RECEIVE AND HONOR VRIL IMPRESSIONS

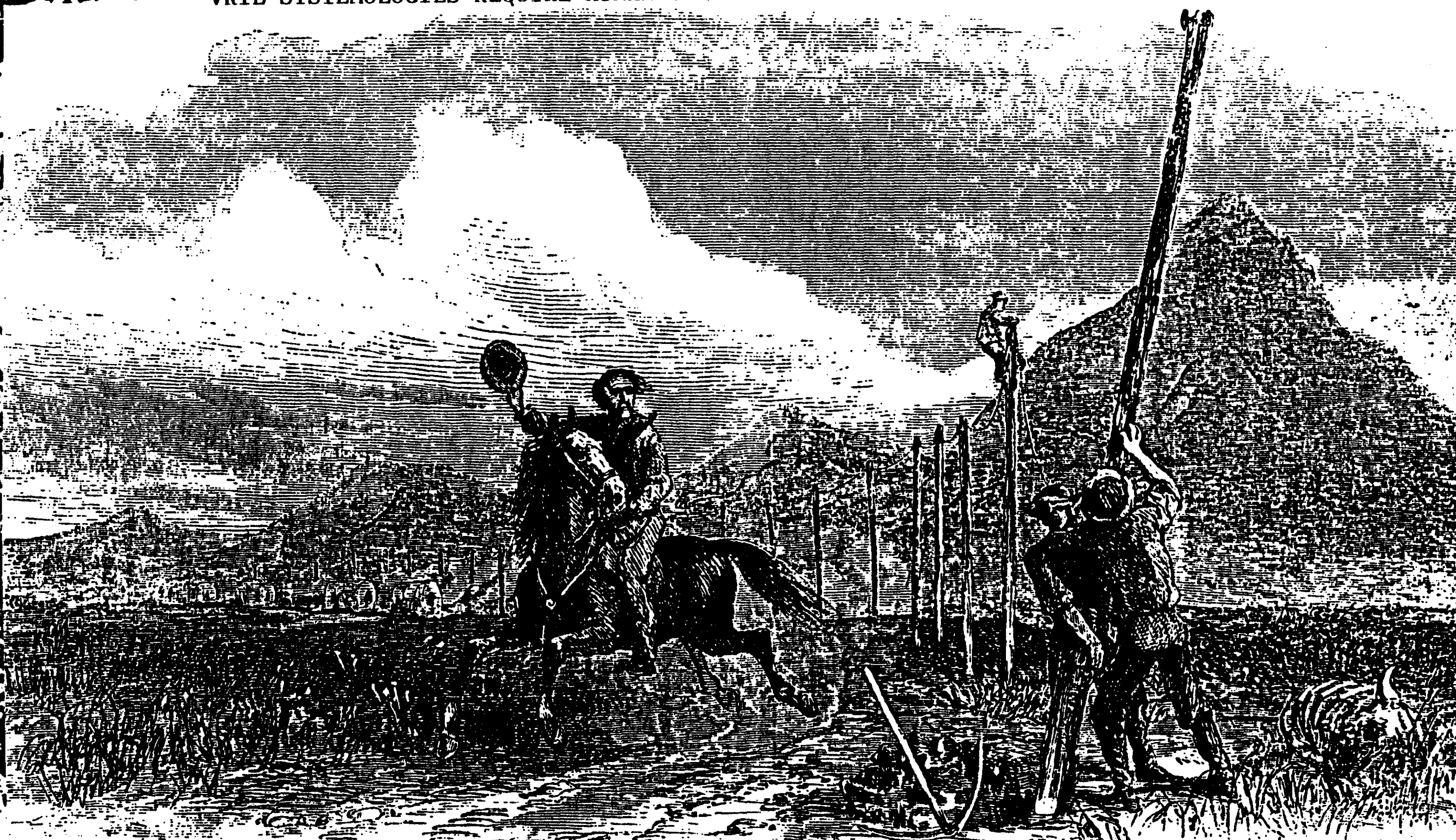
HUMAN SYSTEMS WHICH ARE NOT BASED UPON VRIL ENJOINMENT SELF-DISSOLVE MUTUALLY...

HUMAN ENTERPRISE OSCILLATES ABOUT A FIXED POINT WHICH NEVER MOVES

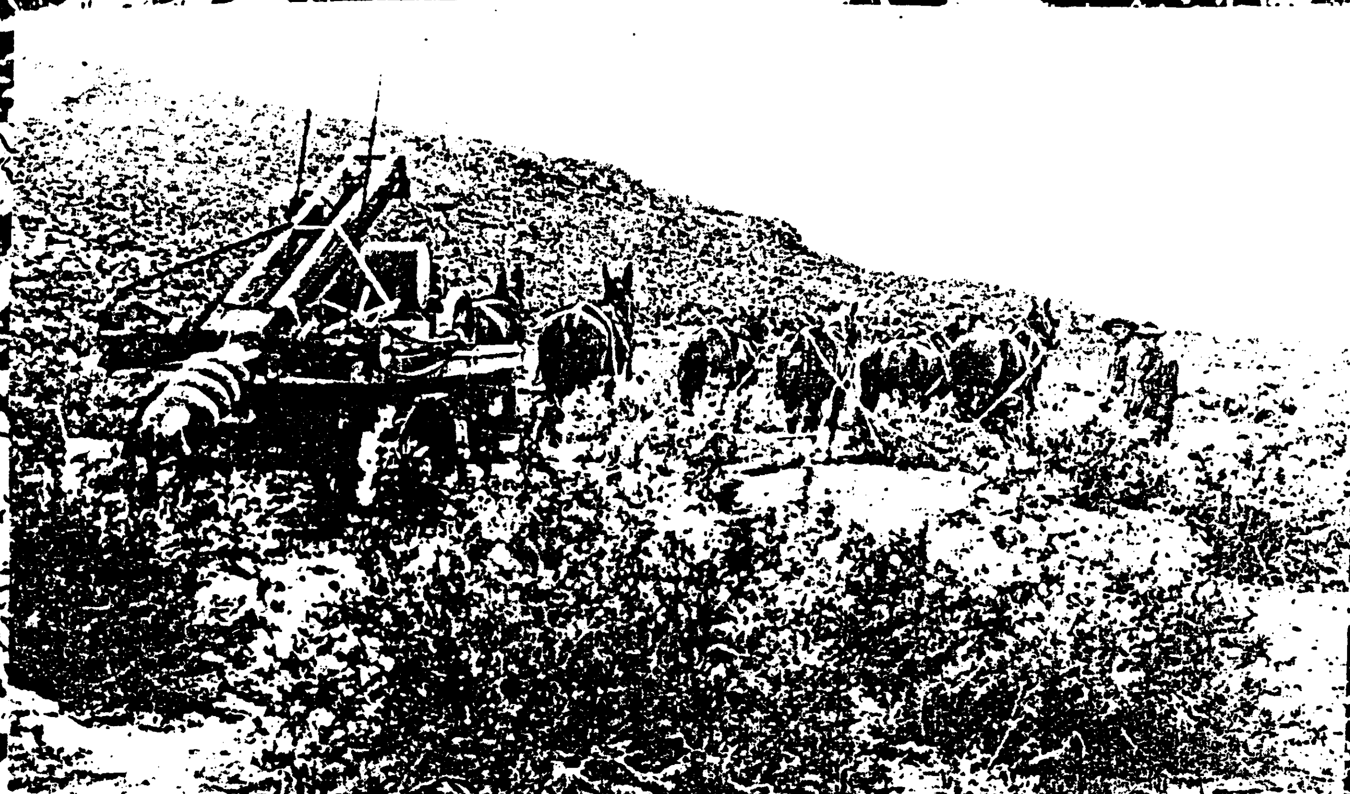
SOCIETY MOVES FROM THE FIXED POINT WHEN ALLOWING AND RECOGNIZING VRIL

VRIL SYSTEMOLOGIES DO NOT REQUIRE HUMAN INTENT.

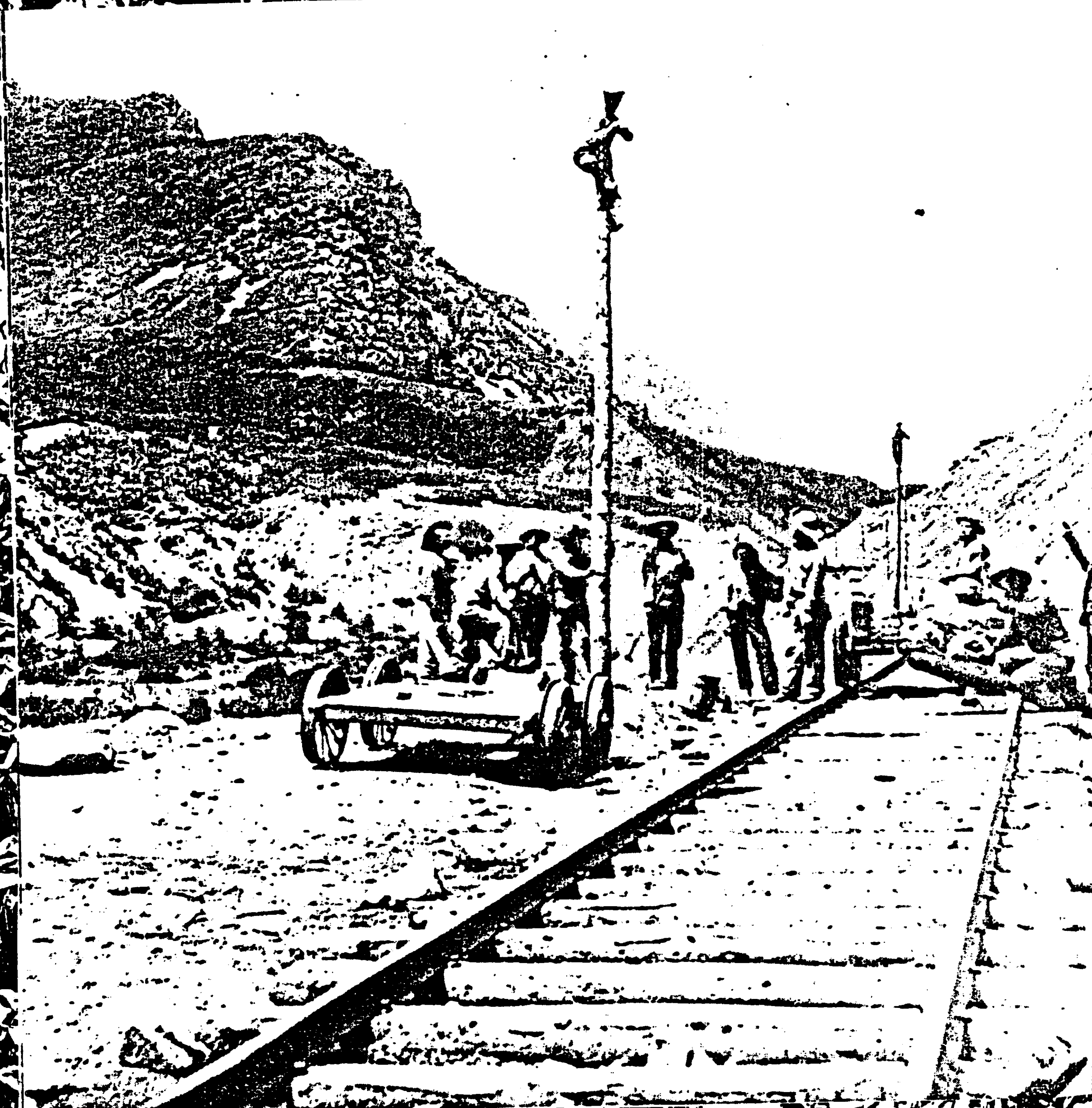
VRIL SYSTEMOLOGIES REQUIRE HUMAN SURRENDER AND CO-CREATIVE SHARING



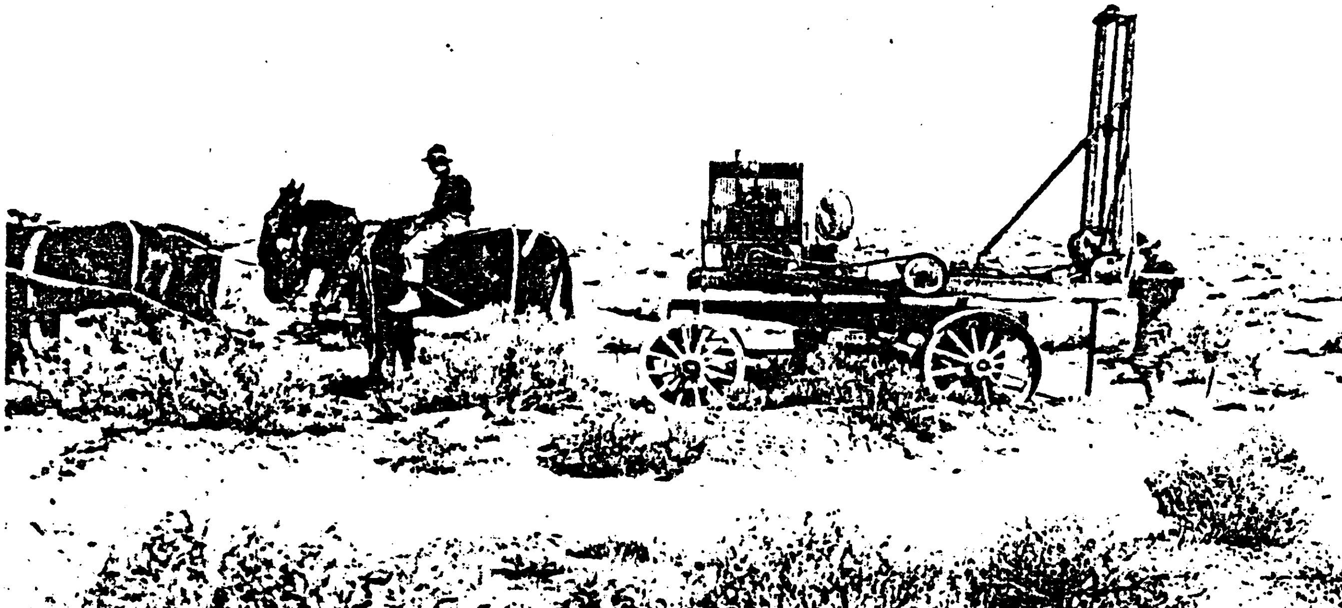
THE IRONY OF HUMAN ENTERPRISE NOT FOUNDED ON VRIL FUNCTION
INERTIAL SYSTEMS MOUNT AND SURMOUNT EACH OTHER



DIRECTIONS FOR THE GENERAL TREND OF A TELEGRAPHIC LINE WERE NOT SPECIFIC
AND SERVED THE VRIL FUNCTION THROUGH GUIDED PERSONAL CHOICES
THOUSANDS OF POLES WERE PLACED IN VRIL-RICH TOPOGRAPHY
FOR THE EIDETIC SERVICE OF THE LINES IN ALL DIRECTIONS



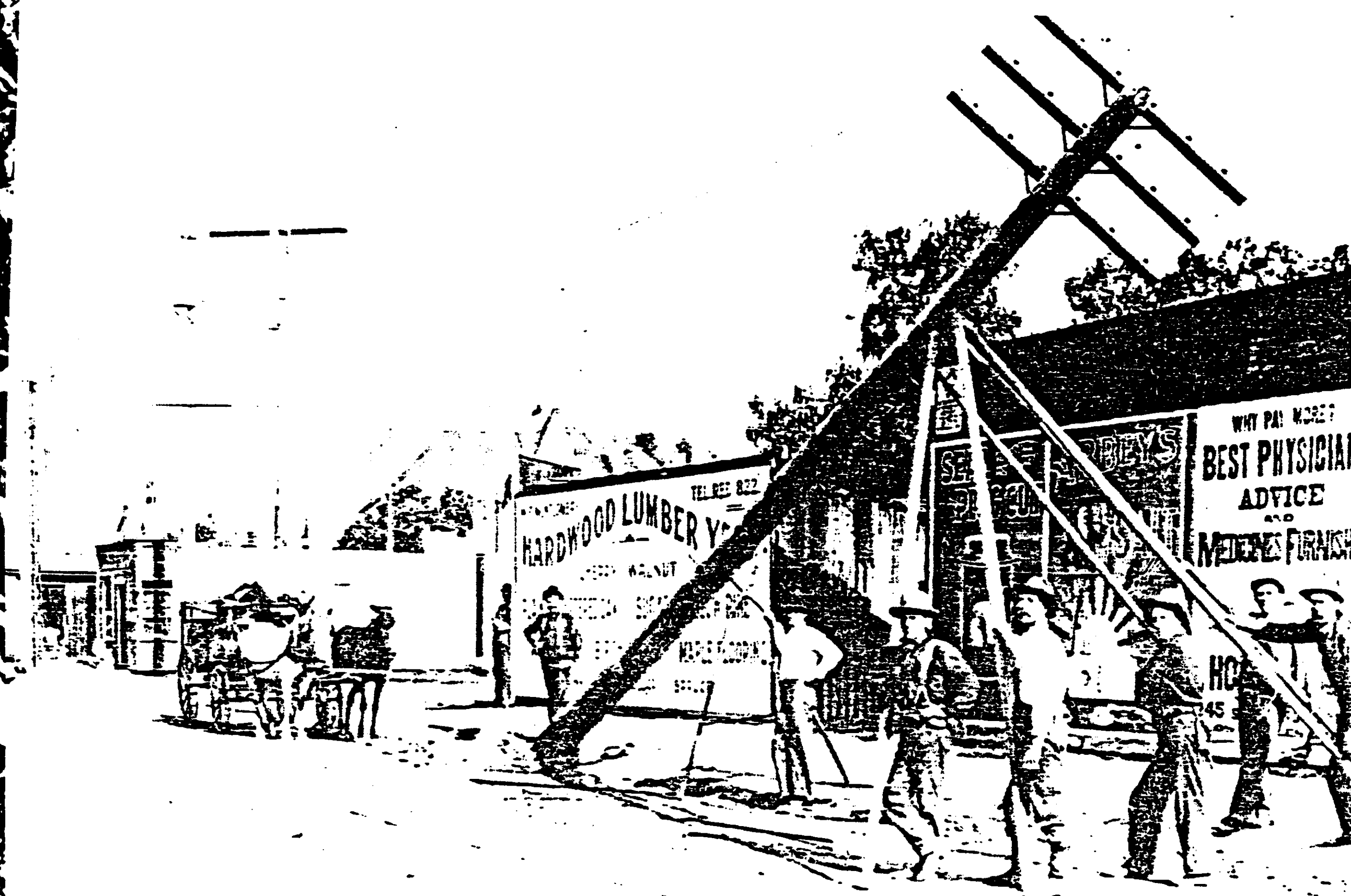
SEEKING "THE RIGHT SPOT" FOR EMPLANTING THE TELEGRAPHIC POLE
WAS LEFT TO THE INTUITIONS OF HARD-WORKING ROAD CREWS AND THEIR LEADERS

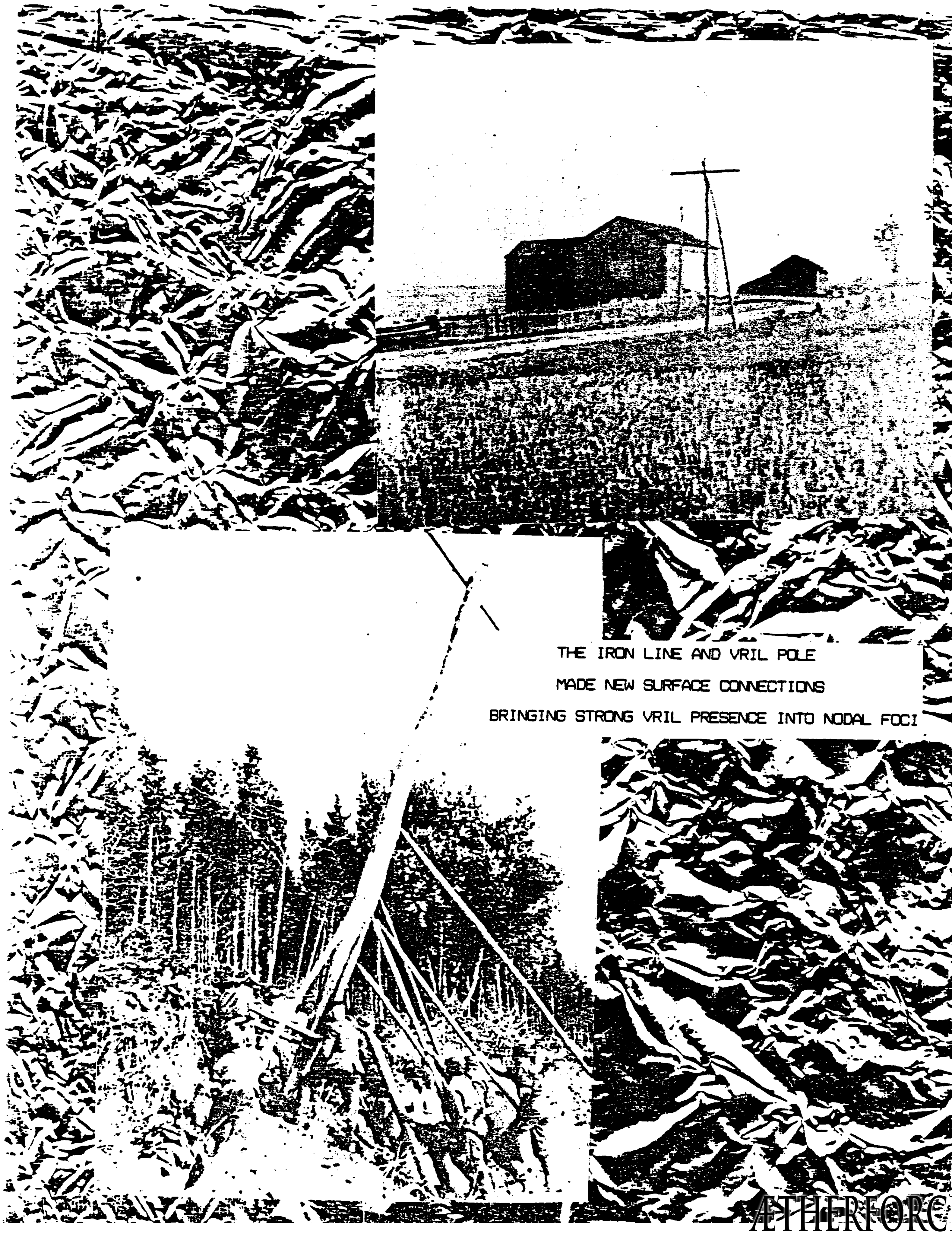


GROUND ACCESS NOT WIDELY RECOGNIZED AND DESIRED

ENTERPRISE LABORED IN RAISING AERIAL POLES

DIRECT DESCENDANTS OF ANCIENT TOTEMS AND LITURGICAL MESSAGE



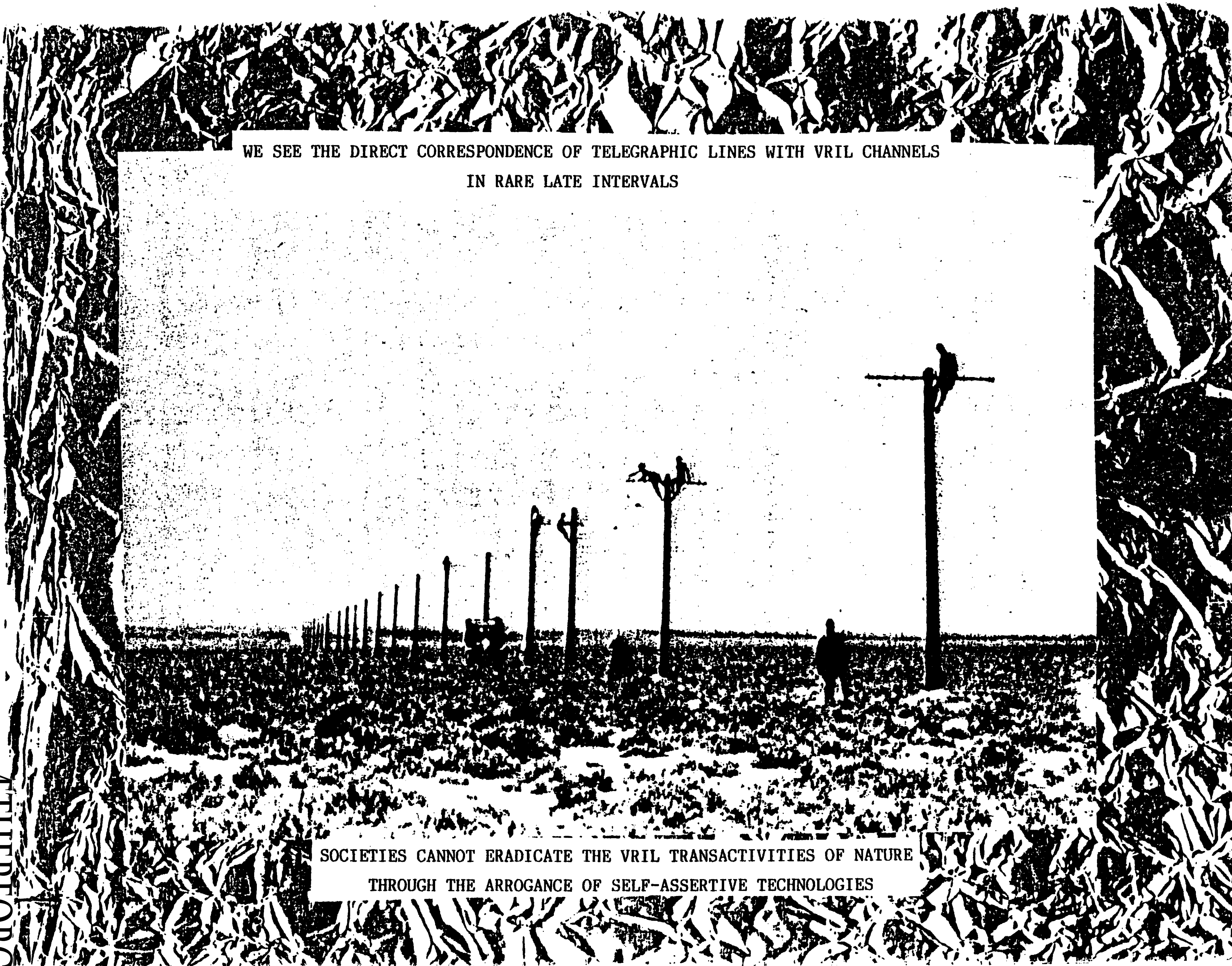

THE IRON LINE AND VRIL POLE
MADE NEW SURFACE CONNECTIONS
BRINGING STRONG VRIL PRESENCE INTO NODAL FOCI

SELF-ASSERTIVE TECHNOLOGIES DEFEND NON-FUNDAMENTAL ENTERPRISES WHICH MUTUALLY SELF-DESTRUCT

SABOTEURS OF EACH FACTION AND REGIME ERADICATE THE EFFORTS OF THEIR RIVALS

VRIL TECHNOLOGIES DO NOT HOLD RIVALRY OR ENMITY

VRIL TECHNOLOGY IS INOPERATIVE WHEN ASSERTIVE PERSONALITIES BECOME INVOLVED


WE SEE THE DIRECT CORRESPONDENCE OF TELEGRAPHIC LINES WITH VRIL CHANNELS
IN RARE LATE INTERVALS
SOCIETIES CANNOT ERADICATE THE VRIL TRANSACTIVITIES OF NATURE
THROUGH THE ARROGANCE OF SELF-ASSERTIVE TECHNOLOGIES

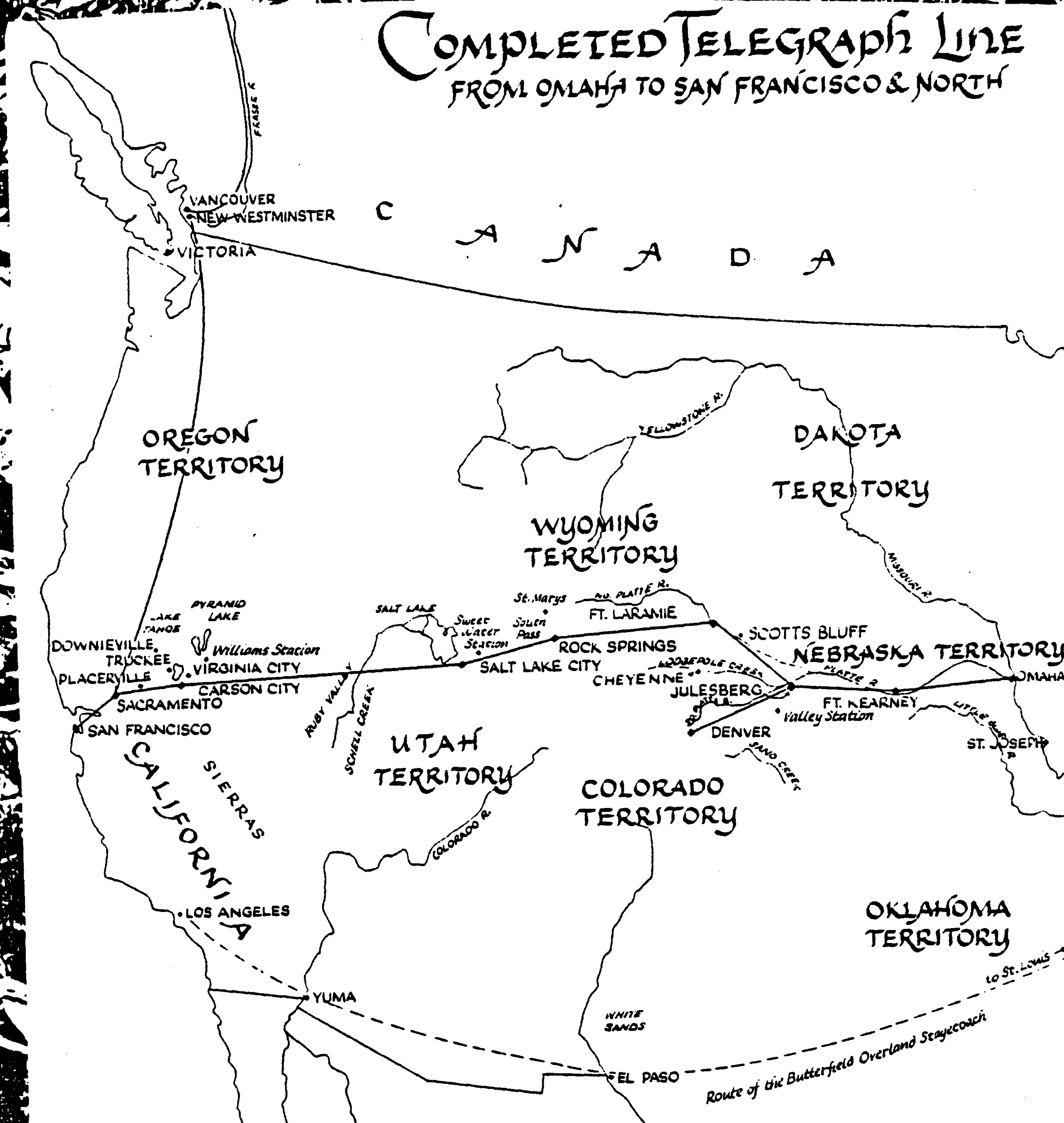
CERTAIN SYSTEMS WERE DEAD-ON IN VRIL CONFORMITY...

THIS LOVELY DEPICTION REVEALS THE AESTHETIC PERFECTION WHICH EMERGES

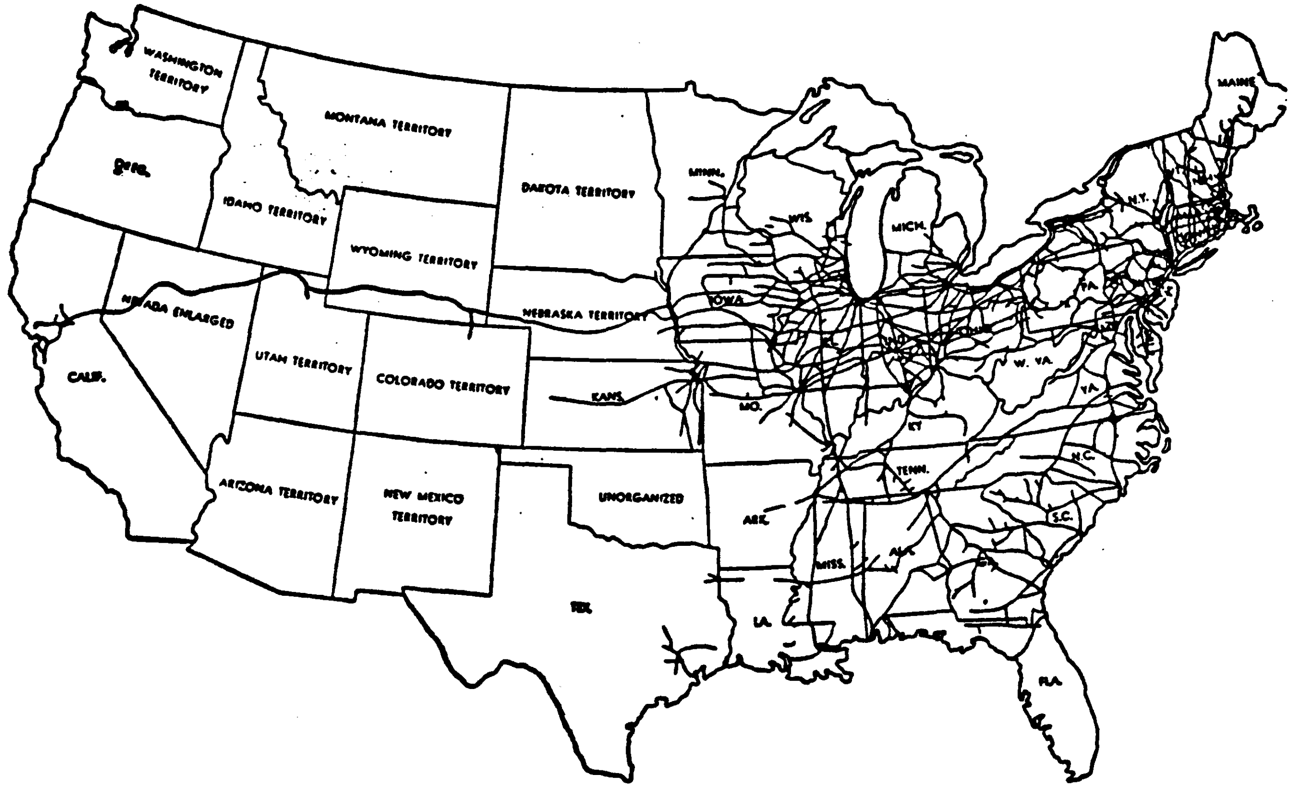
WHEN MATERIAL CONFIGURATIONS COINCIDE DIRECTLY

WITH VRIL CHANNELS

MATERIAL CONFIGURATIONS ARE BEAUTIFUL WHEN VRIL CONFORMED



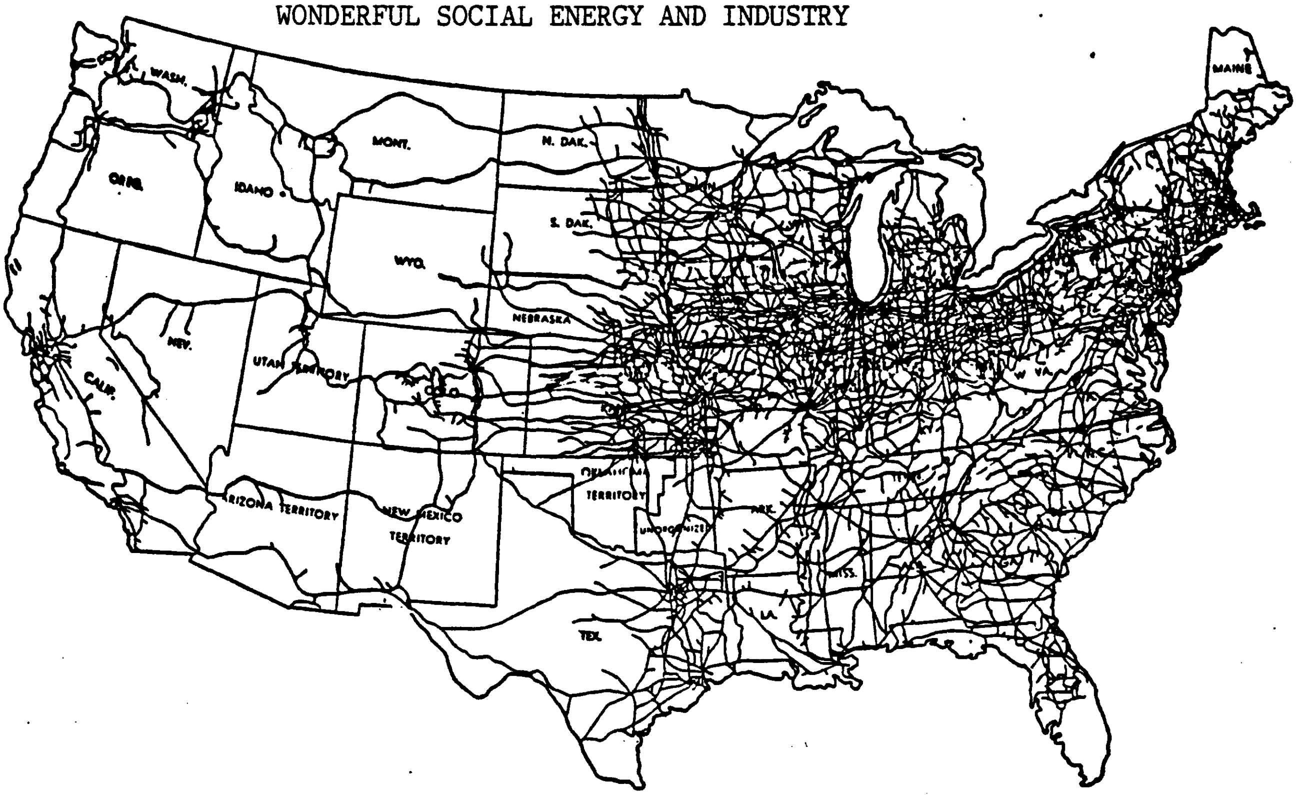
TECHNOLOGICAL THRUSTS WESTWARD WERE NOT INFORMED OR VRIL CONFORMED
ONLY LATER WERE SPECIFIC SYSTEM PORTIONS ABLE TO
ASSUME THEIR PROPER CONFIGURATIONS AMID THE VRIL MATRIX

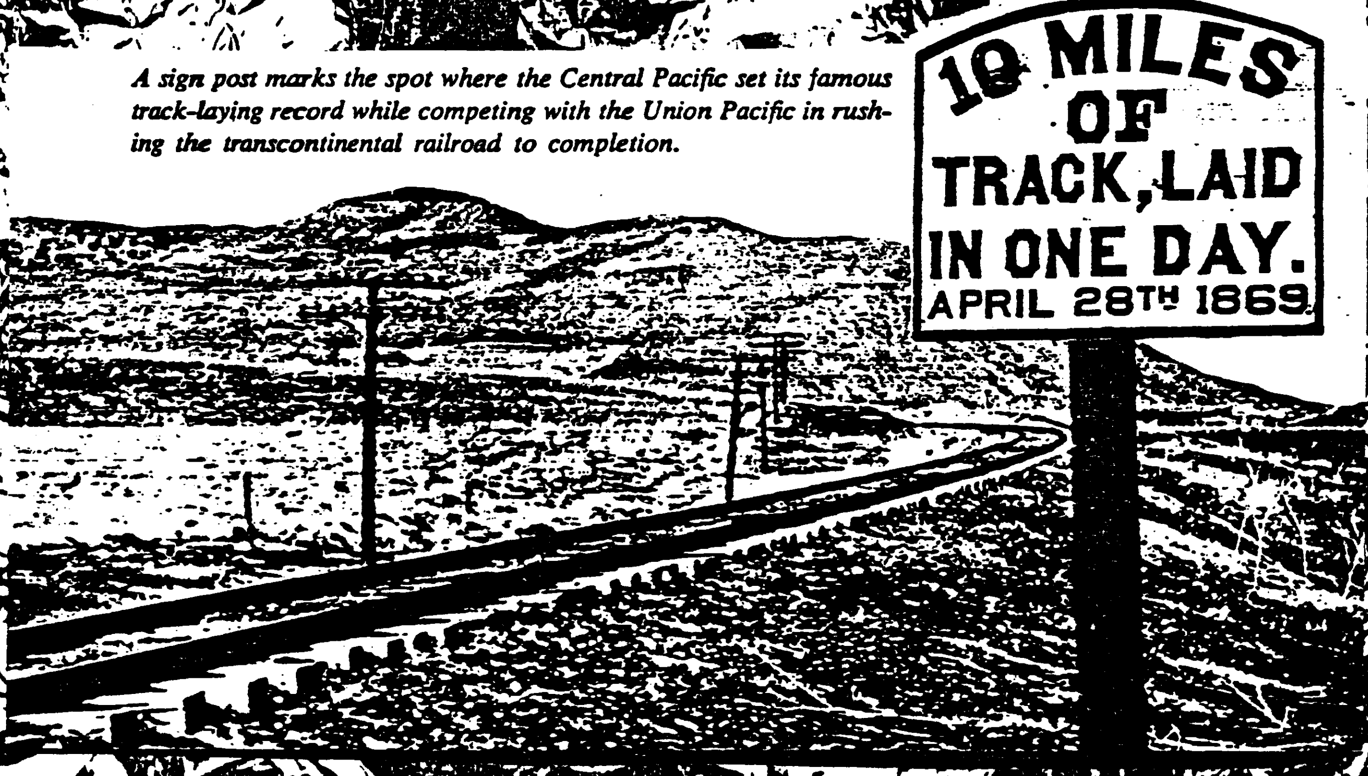


MAPS AND GEOLOGICAL CHARTS REVEAL THE INCREDIBLE PROLIFERATION OF RAILS AND LINES IN A SHORT TIME PERIOD...

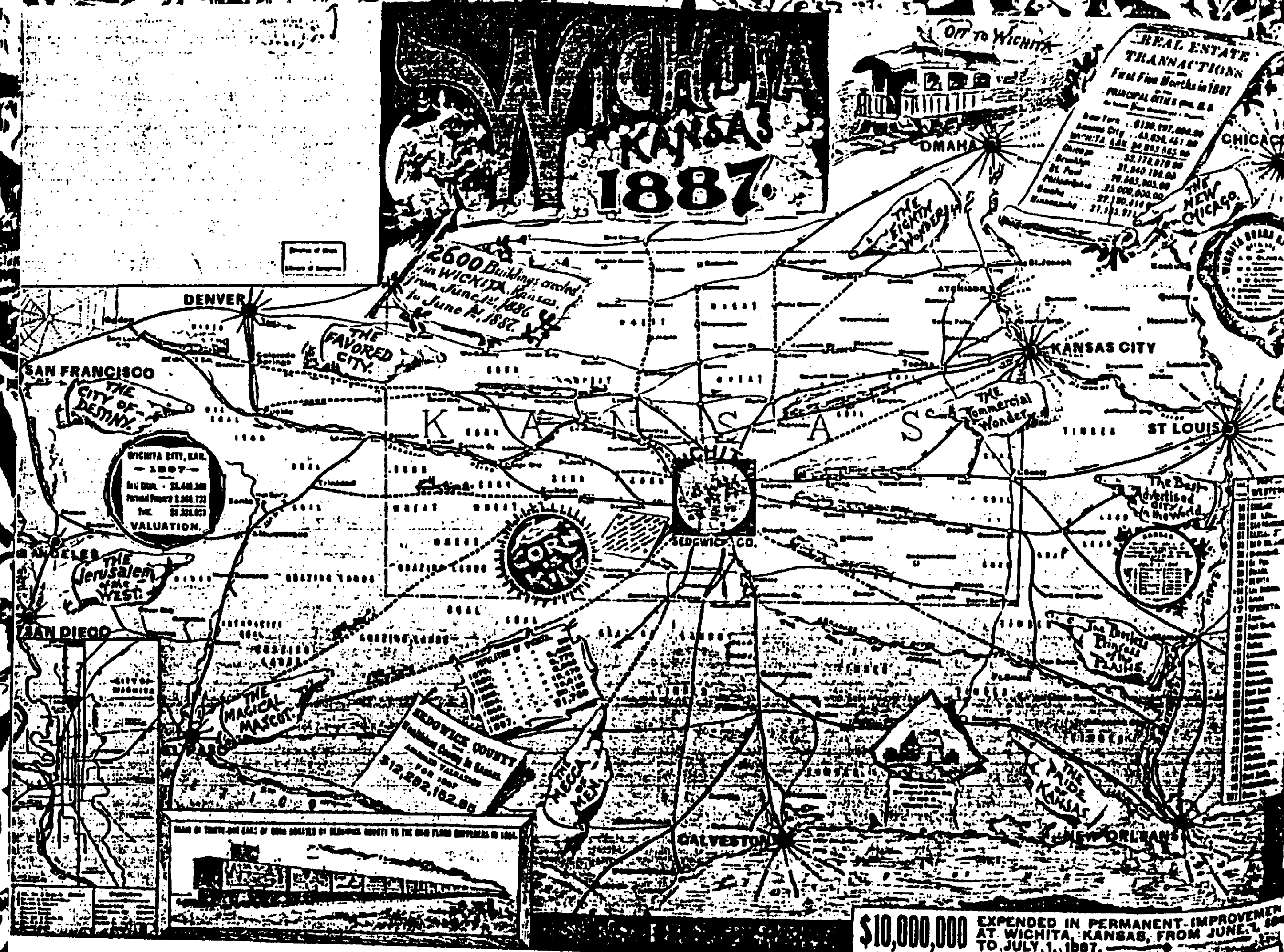
THESE DIAGRAMS REVEAL THE VRIL CONFORMABLE DENDRITIC PATTERNS WHICH COMMUNICATIONS AND TRANSPORTATIONS SYSTEMS INVARIABLY ASSUMED

VRIL NODES AND MAJOR JUNCTURES BECAME METROPOLITAN CENTRES OF WONDERFUL SOCIAL ENERGY AND INDUSTRY

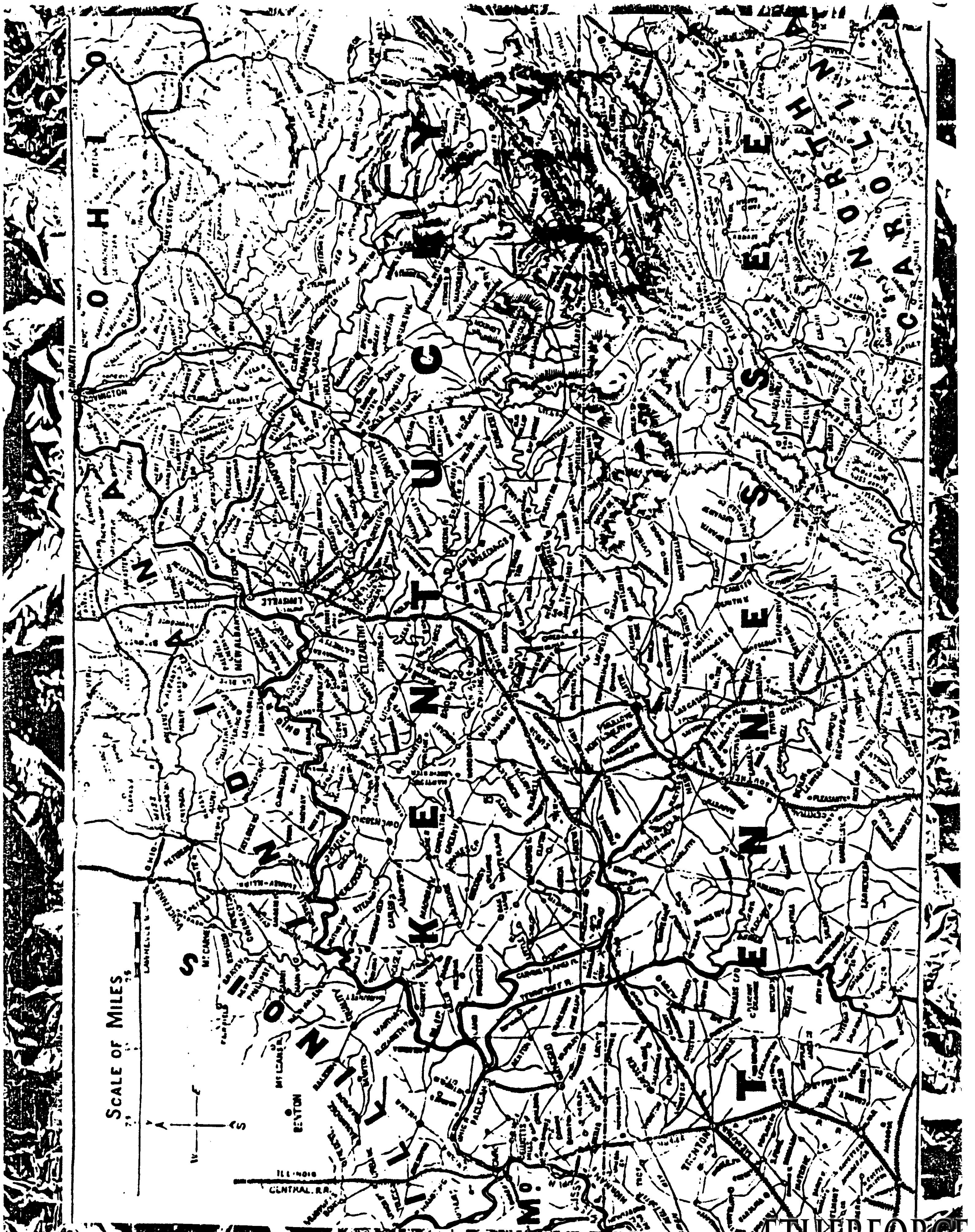




A sign post marks the spot where the Central Pacific set its famous track-laying record while competing with the Union Pacific in rushing the transcontinental railroad to completion.



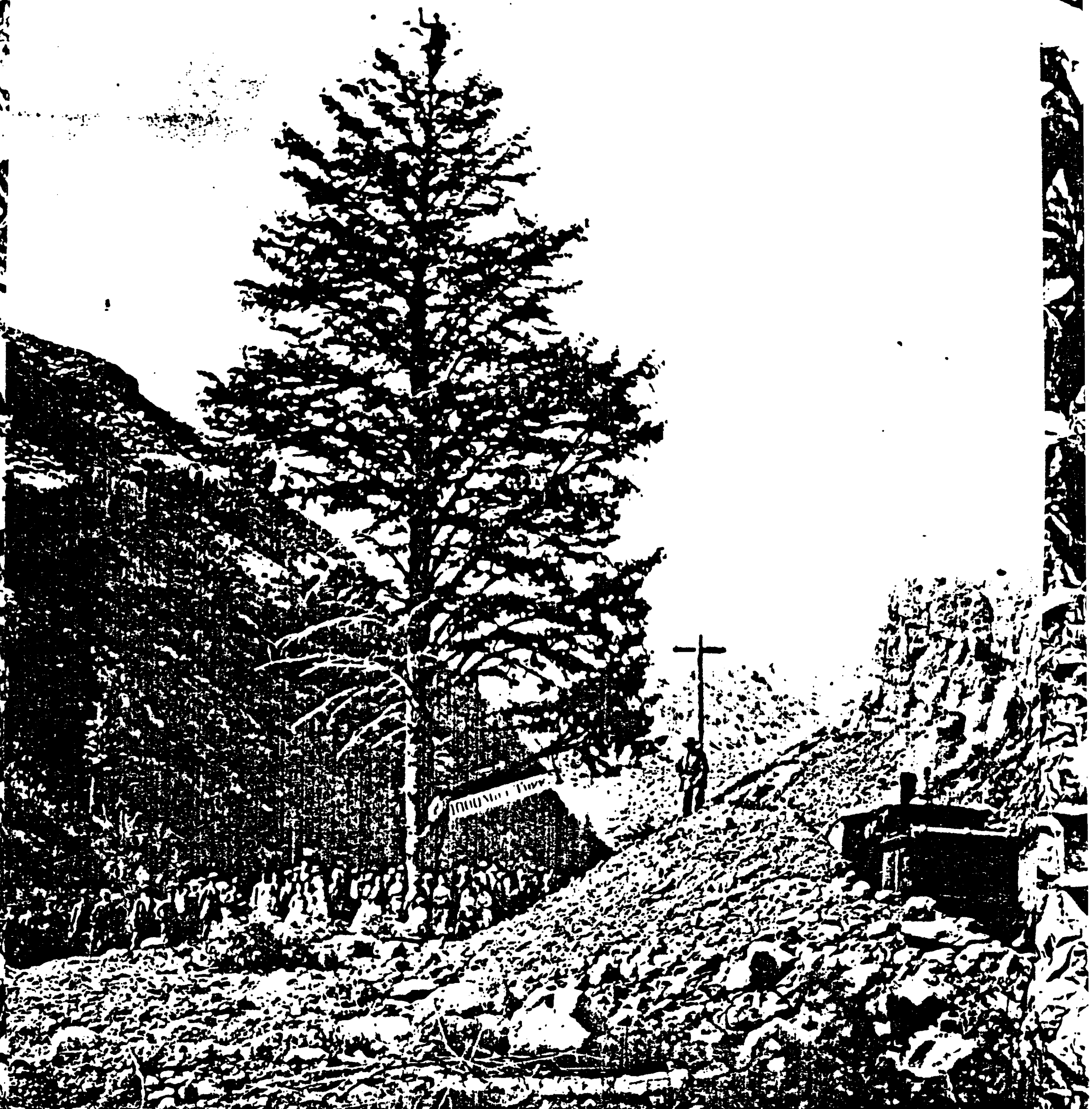
WICHITA
KANSAS
1887
OFF TO WICHITA
REAL ESTATE TRANSACTIONS
2600 Buildings erected in WICHITA, Kansas from June 1st 1886 to June 1st 1887.
DENVER
THE FAVORED CITY.
SAN FRANCISCO
THE CITY OF DESTINY.
WICHITA CITY, KAS. 1887 VALUATION.
THE Jerusalem of the WEST.
SAN DIEGO
OMAHA
CHICAGO
THE NEW CHICAGO
THE EIGHTH WONDER
KANSAS CITY
THE Commercial Wonder
ST LOUIS
KANSAS
SEDGWICK CO.
The Best Advertised in the World.
The Brightest Prettiest of the Plains
THE MAGICAL MASCOT
SEDGWICK COUNTY
$12,292,162.85
THE PRIDE OF KANSAS
GALVESTON
NEW ORLEANS
$10,000,000 EXPENDED IN PERMANENT IMPROVEMENTS AT WICHITA, KANSAS, FROM JUNE TO JULY 1, 1887.


KENTUCKY
TENNESSEE
INDIANA
OHIO
ILLINOIS
NORTH CAROLINA
MO.
SCALE OF MILES
ILLINOIS CENTRAL R.R.
COVINGTON
CINCINNATI
ELIZABETH
BENTON

RAIL AND LINE...LINE AND RAIL...

BOTH FOLLOWED VRIL CONFORMABLE PATHWAYS IN THE EARLY DAYS

LOCAL VRIL THREADS WERE ENJOINED BY THE IRON GUIDANCES



GIVING EIDETIC TRANSACTIONS AT BOTH RAILWAY TERMINALS
AND TELEGRAPHIC STATIONS

Two photographs of ceremony marking completion of the first transcontinental railroad, May 10, 1869. Locomotives from the East and the West meet nose to nose as men climb telegraph pole for a better view. News that the final spike had been driven was flashed to the world by the telegraph instrument on the table at right center of bottom photograph.

THE ULTIMATE AND ARROGANT FEAT OF ENTERPRISE COMPLETED

RAILS AND LINES OF IRON MIS-JOINED ACROSS A CONTINENT

VRIL BRIDGES WERE STRUCTURED THROUGH GROUNDS WHICH WERE TO REMAIN ISOLATE

VRIL GUIDES, CO-OPERATES, MOLDS, AND BUILDS SOCIAL CLIMAX

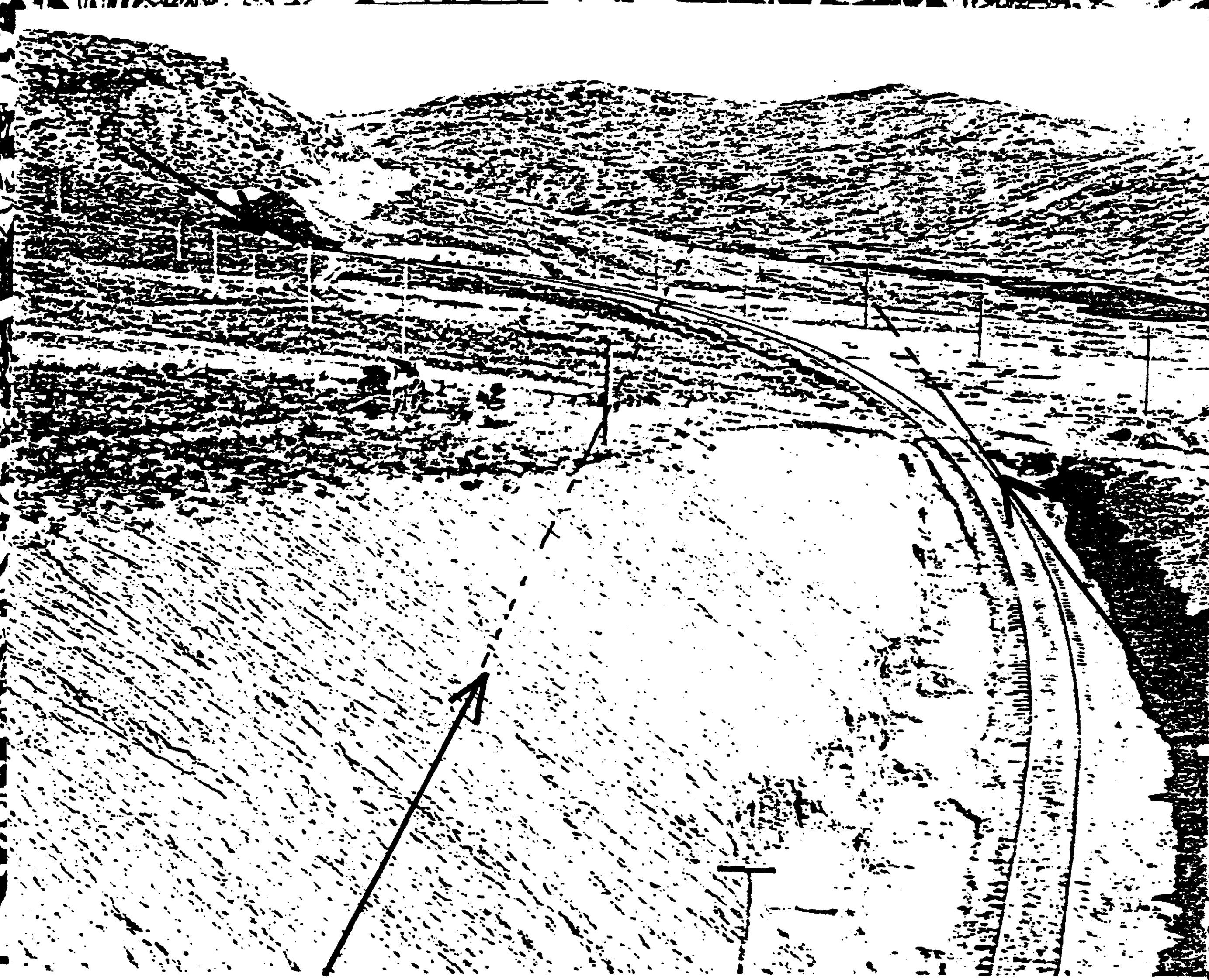
VRIL WOULD ACHIEVE ITS OWN SELF-DETERMINED WAY

VRIL GRANTS LESSONS TO HUMANITY

VRIL GIVES REVELATIONS IN PATIENT STAGES

VRIL DISPLAYED AERIAL WIRELESS THROUGH M.LOOMIS IN 1862

VRIL WOULD RELEASE GROUND SYSTEM WIRELESS 3 YEARS LATER THROUGH N.STUBBLEFIELD



SINUOUS VRIL PATHS WOULD CONSTRAIN THE STRUCTURE OF HUMAN EFFORT

AND FORCE HUMAN PROJECTS TO FOLLOW ITS GUIDANCES HOWEVER DERANGED

THE HUMAN REPRESENTATIONS MIGHT BE

VRIL PATHS ARE INDICATED IN THE TOPOGRAPHY

THE RAILS MEANDER ABOUT THESE CHANNELS

THE NOUMENOUS AND BILOCATIONAL QUALITY OF RAILROAD STATIONS IS EXTREME

VISITORS SENSE THE EXPECTATIONS OF EIDETIC EXPERIENCE

...AND OFTEN RECEIVE MORE POTENT EIDETIC TRANSACTIONS THAN THOSE

WHO ACTUALLY TRAVEL THE RAILS

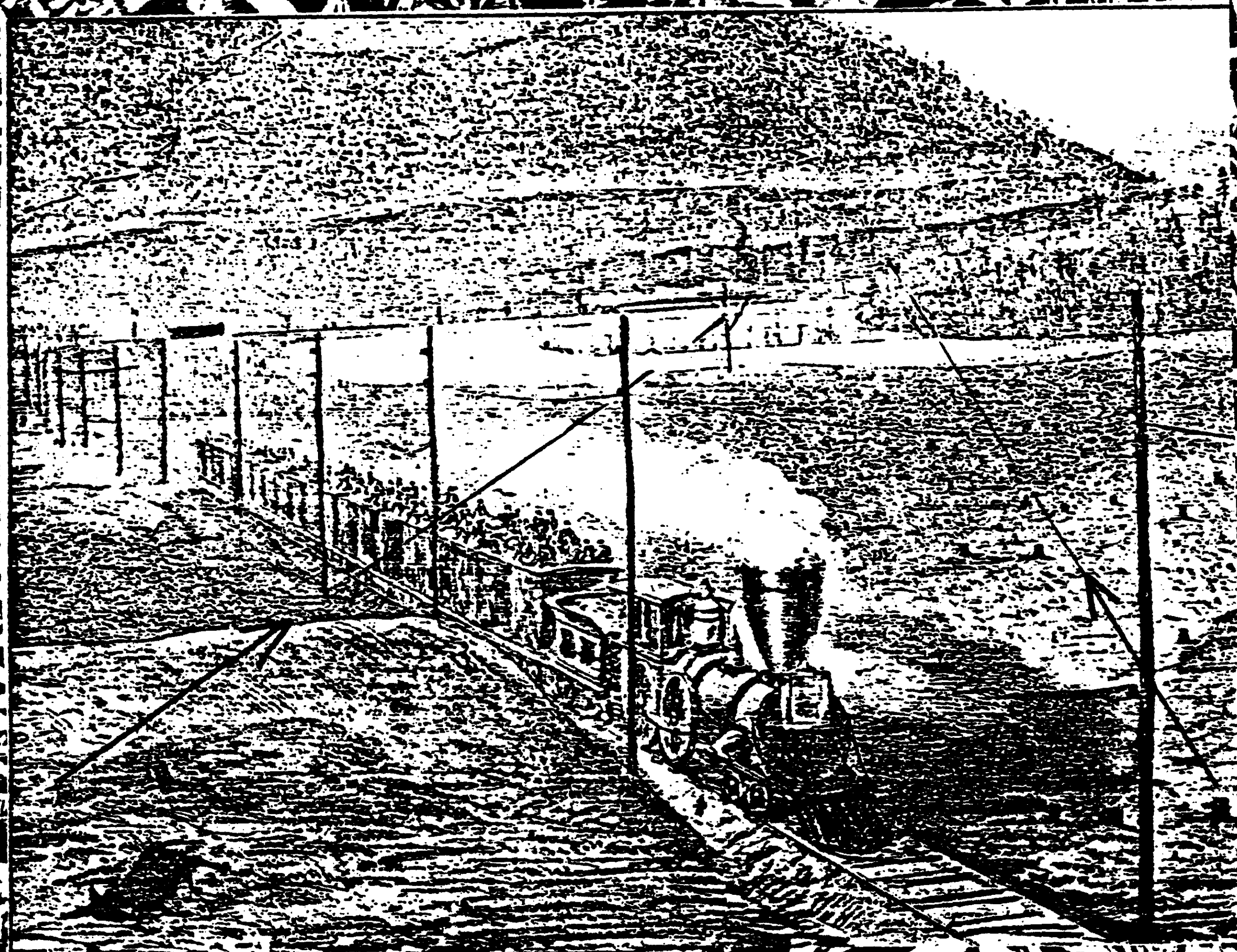
VRIL CONVERGES IN STATION MANIFOLDS OF IRON RAILS

VRIL WAS CONDUCTED ALONG THE RAILS FROM DISTANT MOUNTAINS

DIRECTLY INTO THE CITY

THESE RAILS POWERFULLY DREW THEIR PARTICIPANTS INTO TRAVEL

WELL BEFORE AN ACTUAL PHYSICAL JOURNEY BEGAN



WHERE TRANSITTING RAILS WOULD CONVEY THE VRIL POWER THROUGHOUT THE CONNECTIVE GUIDEWAYS WHICH INTERSECT NATURAL COURSES

Early train and the telegraph in Animas Canyon, Colorado.

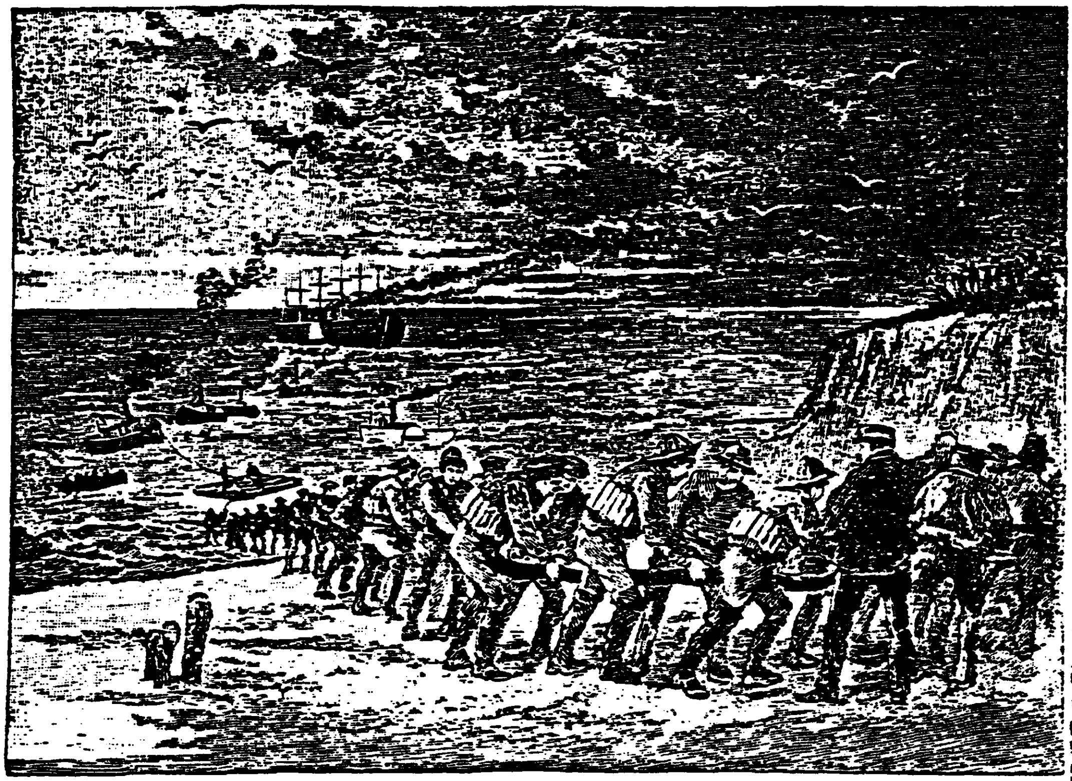
NATURAL VRIL CONVERGENCES WERE PURSUED BY HUMAN DESIRES FOR TRAVEL...CONNECTIVITY

HIGHEST DESIRES WERE MET IN MOUNTAIN VALES...

WHERE VRIL DENSITY WAS EXTRAORDINARY AND PREVALENT

HERE WERE SET RAILS AND LINES OF IRON TO MERGE WITH VRIL CHANNELS

AND CONVEY POWER ALONG THEIR LENGTHS

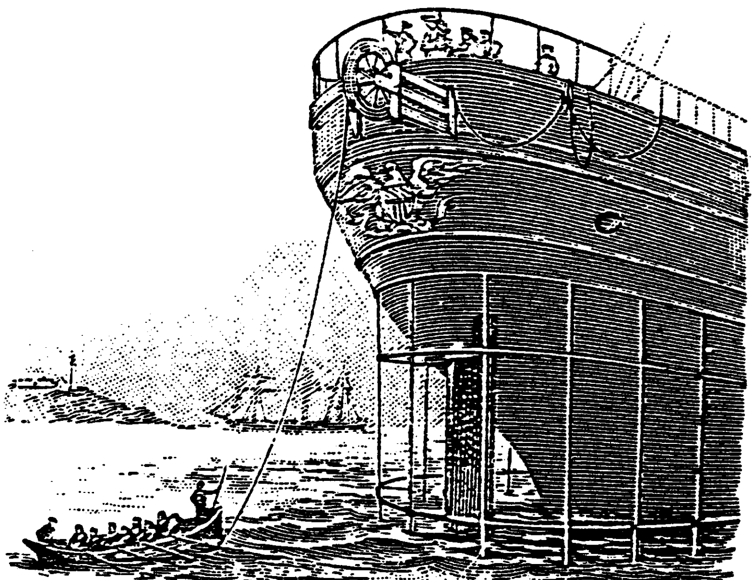


Landing the Atlantic Cable at Heart's Content

THE LABOR OF INTERCONTINENTAL LOVE AND HUMAN EFFORT...
MISINFORMED AND DISOBEDIENT TO THE VRIL REVELATIONS
GIVEN TO ANTONIO MEUCCI

THE TRANS-ATLANTIC CABLE PROJECT BROUGHT A WONDERFUL SENSE OF INTERNATIONAL
COMMUNITY BETWEEN DISTANT AND PREVIOUSLY ISOLATED LANDS

Cyrus W. Field



Laying the Atlantic Cable

A VRIL CONVERGENCE...

THE MILL STATION...

WHERE VRIL PATHS MEET THE RAILS AND TELEGRAPH LINES FROM THE MOUNTAIN SLOPES DOWNWAR

THE BUILDING ITSELF IS STARK AND EIDETICALLY TRANSACTIVE

THE BROADSIDE WHICH FACES US REVEALS A REMARKABLE DEGREE OF VRIL CONDUCTIVITY

WHICH FORCES THE EYE TO WANDER ALL OVER ITS SURFACE

RAILWAY STATIONS BECAME FOCAL POINTS OF HUMAN EXCHANGE AND SOCIAL ENERGIES
RAILS AND LINES COMMUNICATED DREAMS, MATERIALS, PERSONNEL, AND MORE...
DISTANT AWARENESSES BEGAN TO SUDDENLY PULSATE THROUGH THE RAILS AND TELEGRAPHIC LINES

ALL THE ELEMENTS OF NOUMENOUS POWER CONVERGE IN THE VRIL JUNCTURE: THIS WESTERN UNION EXCHANGE TERMINAL WAS THE AVENUE FOCAL POINT WHERE ALL THOUGHTS MERGED AND ENTERED DISTAL TRANSACTIVITIES WITH EIDETIC FLASHES

HUMAN SOCIAL ACTIVITIES ARE VRIL COLLIMATED:

VRIL CHANNELS DIRECT HUMAN CHOICE FOR FOUNDING

VILLAGES, TOWNS, HAMLETS...ROADS, AVENUES, JUNCTURES...

AND TELEGRAPHIC LINES

ALL THE OVERHEADS CONVERGE ON THE WESTERN UNION BUILDING SHOWN AT LEFT.

EXAMINATION OF THE DETAILS REVEALS THAT SOCIAL ALIGNMENTS

METROPOLITAN ACTIVITY BECAME ESPECIALLY

AND NOTABLY COLLIMATED ALONG THESE GUIDEWAYS...

VRIL THREADS ARE NOT OBEYED WHEN PROJECTS EMPLOY THE INSENSITIVE

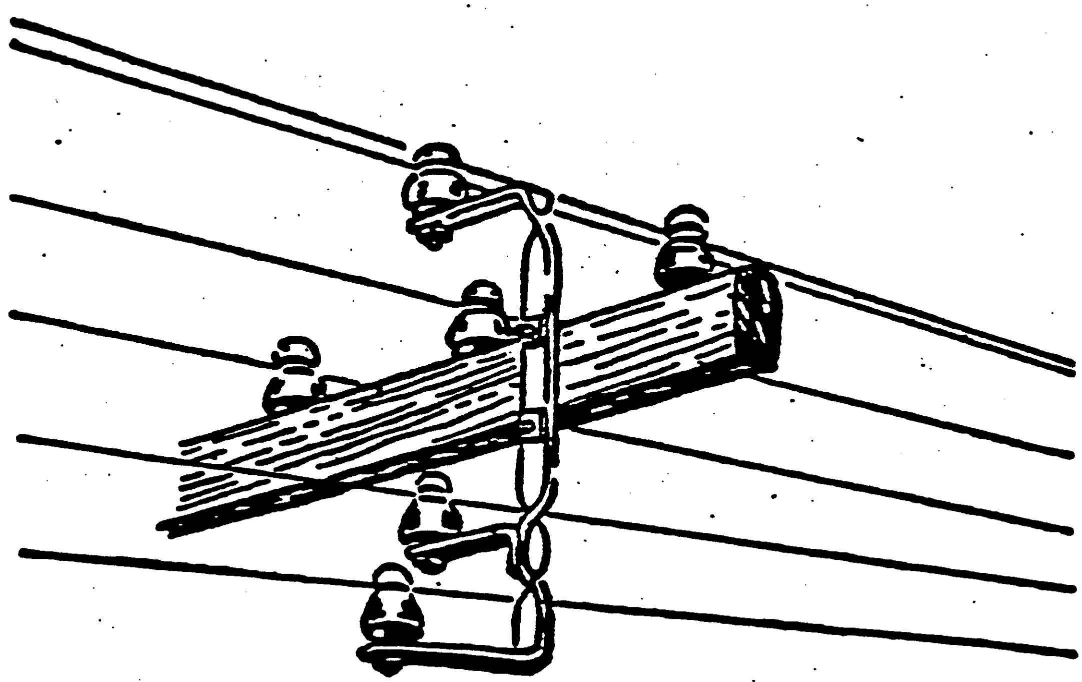
TELEGRAPHIC AND TELEPHONIC LINES OFTEN CROSSED VRIL THREADS

ARROGANT PROJECTS LOSE SIGHT OF VRIL CONTEXT IN SPACE

EXAMINATION OF THIS PHOTOGRAPH INDICATES THAT VRIL CONFORMITY

HAS NOT BEEN OBEYED

VRIL CHANNELS EMERGE FROM THE SMALL VALE AT THE RIGHT CENTER



WIRES AROUND THE EARTH

TELEGRAPHIC AND TELEPHONIC POLES

WERE SURMOUNTED BY FERRUGINOUS AND CARBONACEOUS CHARGED CERAMICS

VRIL DEPOSITED IN POLE SYSTEMS WAS POWERFULLY DISCHARGED FROM GROUND NODES

VRIL THREADWAYS WERE ABSORBED AND CONDUCTED IN SPECIALLY PREPARED POLES

VRIL LOADED POLES TRANSACTED EIDETICALLY IN AERIAL LINES

CONDUCTING EIDETIC EXCHANGES THROUGH GREAT DISTANCES

MANY VRIL REGIONS ARE TRAVERSED AND VIOLATED

IMPROPER CONNECTIVITIES EFFECT DISTORTIONS IN THE VRIL DISTRIBUTIONS

NOUMENOUS PRESENCE IN BUILDINGS FOUNDED ON VRIL NODES IS POWERFUL

NATURAL VRIL NODE PLACEMENT AND ALIGNMENT

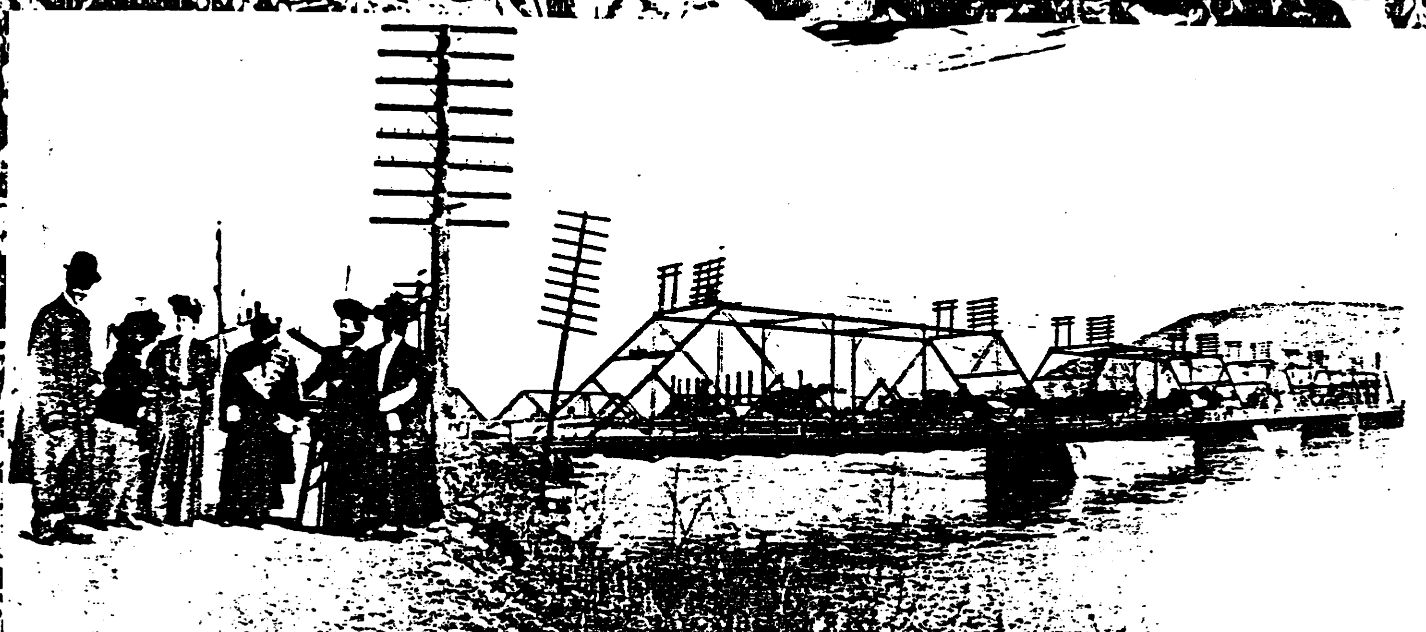
FLOODS BUILDINGS IN VRIL EIDETIC POTENTIAL

IRON TELEGRAPHIC LINES BRING POTENT VISCERO-EIDETIC ACTIVITY INTO BUILDINGS

SOCIAL ACTIVITY SURROUNDS, CONVERGES UPON...

AND FOCUSSES INTO ARTIFICIAL JUNCTURES

IRON BRIDGES, RAILS, AND TELEPHONIC LINES FOCALIZE SOCIAL ENERGIES



SECTION

6

EARTH RODS
AND
LOADS

Standard apparatus was developed, despite the confusion, and each wagon carried equipment to string a 10-mile wire.

VRIL GROUND STRUCTURES AND EARTH RODS

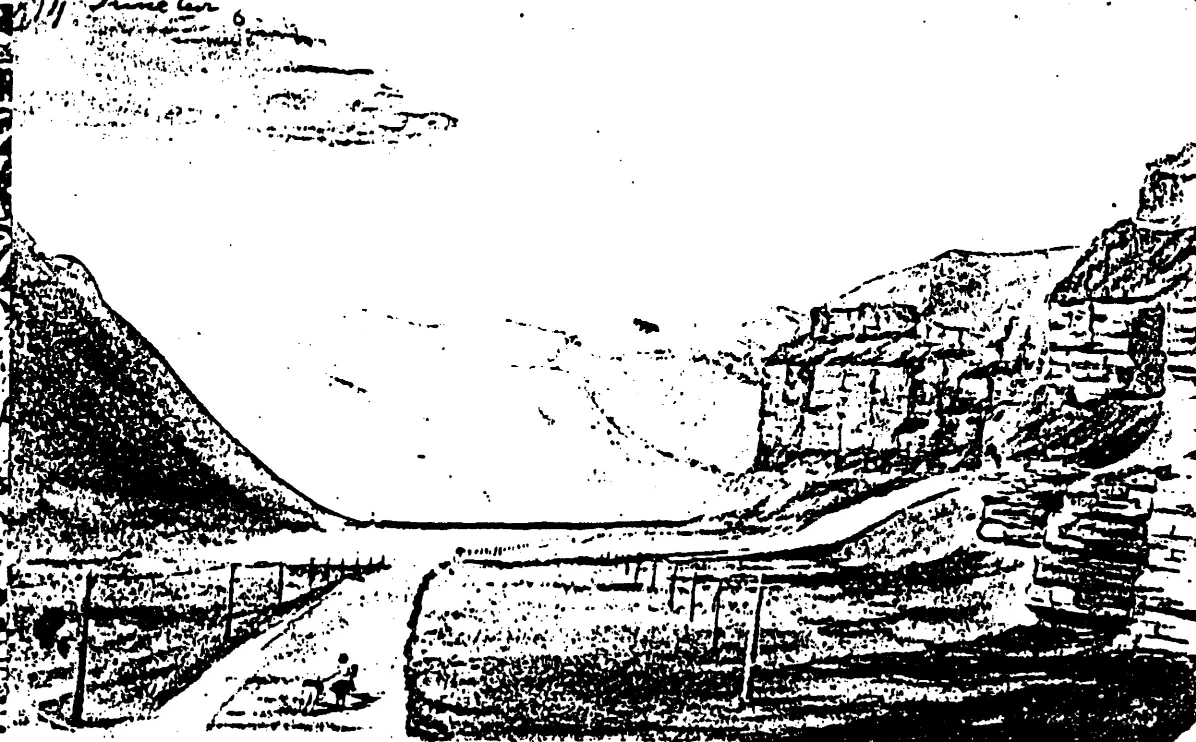
STRINGING THE "LIGHTNING WIRE"

A telegraph wagon of the Union Army contained batteries, chemicals, wire, and replacement parts. The telegrapher in the wagon is dressed in civilian clothes because the Military Telegraph was not part of the military service.

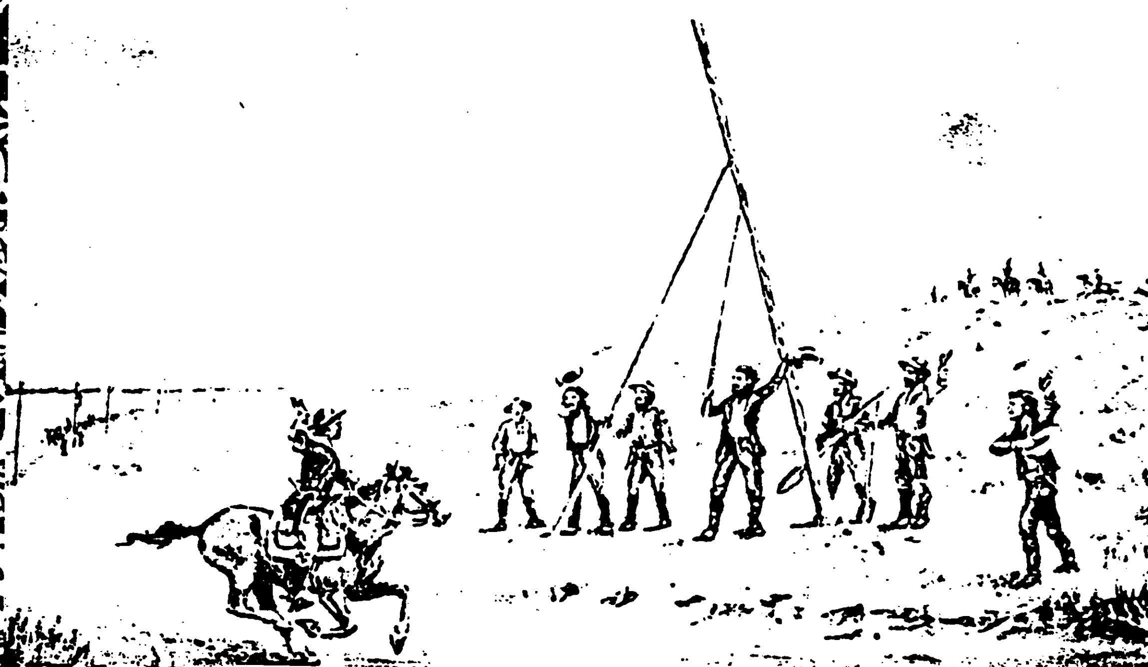
POLES AND EARTH RODS:

THE MEANS BY WHICH VRIL WAS

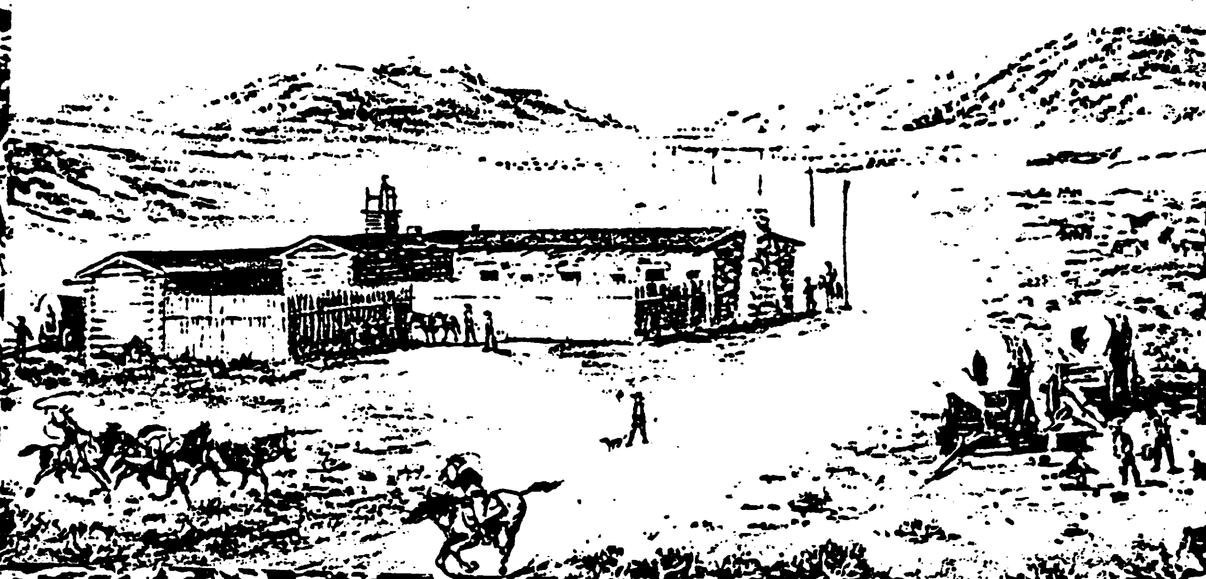
CONDUCTED ABOVE THE GROUND SURFACE

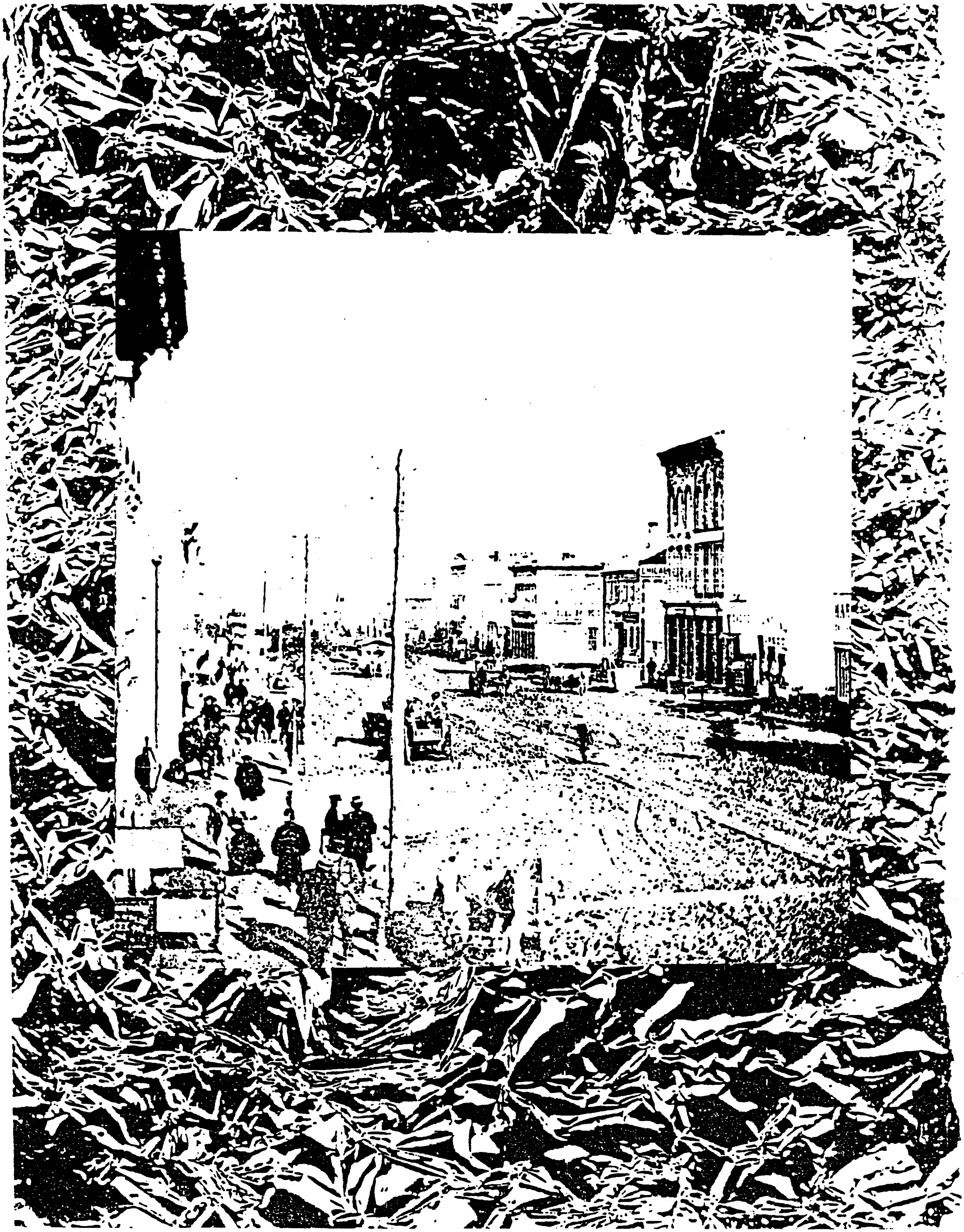


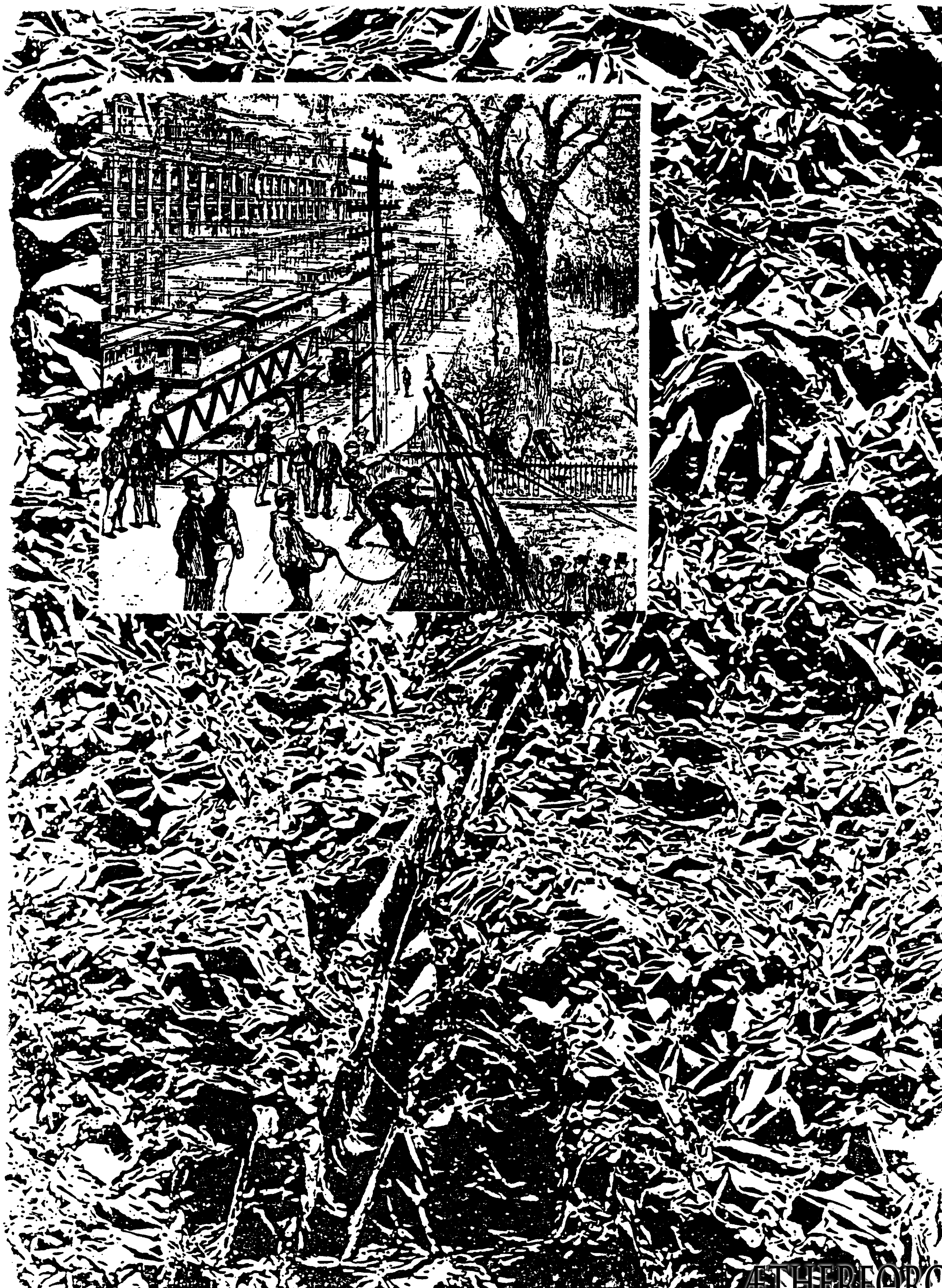
Men at work on the extension of the telegraph line cheered the passing Pony Express man with unconscious irony. The completion of the transcontinental telegraph in October, 1861, ended all need for the tough little ponies and their fearless, lithe riders.



THEY CHASED THE VRIL TRAILS
CONSTRAINED BY THE INNER URGE
TO SEARCH FOR MEANINGS AND LIVING ENERGY







J. HOLLAND.

Telegraph-Wire Insulator.

No. 41,157. Patented Jan. 5, 1864.

Fig. 1

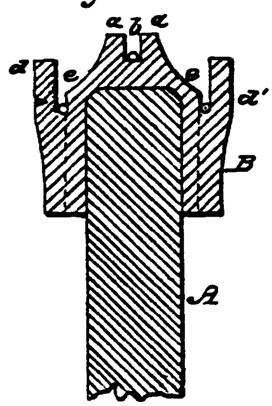


Fig. 3

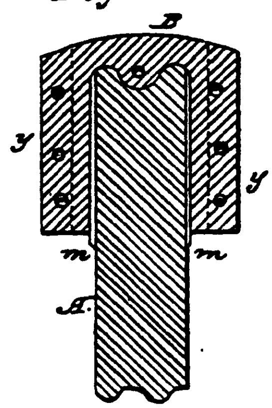


Fig. 5

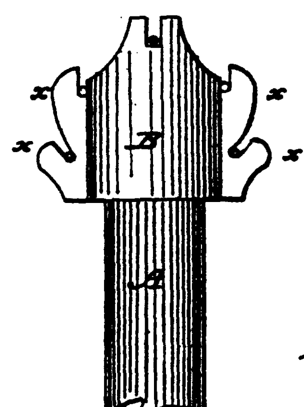


Fig. 2

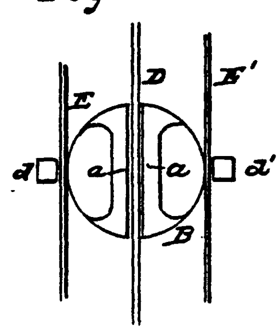
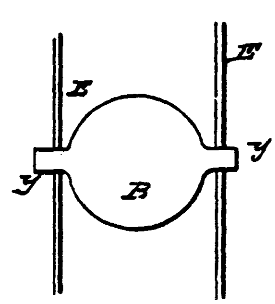


Fig. 4



Attest

Inventor

Henry Howson
Atty for J. Holland

UNITED STATES PATENT OFFICE.

JAMES HOLLAND, OF CONSHOHOCKEN, PENNSYLVANIA.

IMPROVEMENT IN INSULATORS FOR TELEGRAPH-WIRES.

Specification forming part of Letters Patent No. 41,157, dated January 5, 1864.

To all whom it may concern:

Be it known that I, JAMES HOLLAND, of Conshohocken, Montgomery county, Pennsylvania, have invented an Improved Insulator for Telegraph-Wires; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention consists of an insulator and wire-holder made of terra-cotta, earthenware, or equivalent substance or substances, adapted to a pole and formed for the reception of the wires, substantially as described hereinafter, the said insulator and holder forming a cheap, simple, and durable substitute for the separate insulators, cross-bars, and other appliances heretofore used for the holding and insulating of telegraph-wires.

In order to enable others to make and apply my invention, I will now proceed to describe the manner of carrying it into effect.

On reference to the accompanying drawings, which form a part of this specification, Figure 1 is a vertical section of one of my improved insulators and holders for telegraph-wires; Fig. 2, a plan view of Fig. 1; Fig. 3, a modified form of insulator and holder; Fig. 4, a plan view of Fig. 3, and Fig. 5 an exterior view of a modification of Fig. 1.

On reference to Figs. 1 and 2, A represents the upper end of an ordinary pole for supporting telegraph-wires; and B is the insulator and wire-holder, which consists, in the present instance, of a hollow cylinder of terra-cotta, closed at the top and fitted to the pole of which it forms the cap. On the top of this cap a groove, L, is formed by the two flanges *a a*, and in this groove rests the wire D, and two projections, *d* and *d'*, are formed, one on each side of the cap, for retaining the wires E and E'.

It will be seen that the cap can be so formed with grooves and projections that the three wires may be a proper distance apart from each other.

In Figs. 3 and 4 the cap has a flange, *y*, on each side, each flange being pierced with three holes, there being another hole through the top of the cap, so that in this instance it serves as a support for seven wires. In Fig. 5 the cap has two projections forming two recesses, and one groove at the top, so as to support five wires.

The material which I have used with marked success in the manufacture of the above-described insulators and wire-holders is a clay found in abundance in Montgomery county, Pennsylvania, as well as in many other sections of the country, the clay being used in the above locality for making cheap water and drain pipes, and for the manufacture of a variety of cheap vessels and other objects, both ornamental and useful, which have received the name of terra-cotta ware. Articles made of this clay, when properly baked and glazed, are of extraordinary strength. This, together with the facility with which the clay can be molded into any form, renders it especially adapted for the manufacture of my insulators and wire-holders, which possess the advantage of being readily applied to their places.

If the hole in the cap be somewhat too small to receive the end of the pole, the latter can be readily cut to suit the cap; and if the orifice in the cap be too large for the hole, the intervening space can be easily packed with suitable strips of wood, as seen at *m m*, Fig. 3. When the cap is once in its place the insulator and holder is complete, and nothing remains but to apply the wires.

When the time taken to secure the cross-bars of ordinary telegraph-poles and to adjust the separate insulators is considered, and when the expense necessarily incurred in the erection and completion of ordinary telegraph poles and insulators is taken into account, it will be evident that the advantages of cheapness and simplicity, and, I may add, durability, are on the side of my invention.

Although I have described my improved insulators and holders as manufactured of a particular kind of clay, it will be evident that they may be made of any of the clays or earths which, when baked, will be of sufficient strength and durability; that many of the artificial stones, which can be molded or cast into proper shape, may be used, and that even coarse glass can be employed. It will be evident, too, that the shape of the insulator and holder may be modified; that the caps may be made to present an ornamental appearance, and that they may be made for supporting any number of wires which a telegraph-pole has usually to support. As regards the insulating properties of the cap, it will be at once admitted that it is equal if not superior to the wire-holders hitherto used.

My improved insulator and holder possesses the further advantage of maintaining the top of the pole in an invariably dry condition.

I claim as my invention and desire to secure by Letters Patent—

An insulator and holder made of terra-cotta, earthenware, or equivalent substance or substances, adapted to a pole and formed for the reception of the wires, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES HOLLAND.

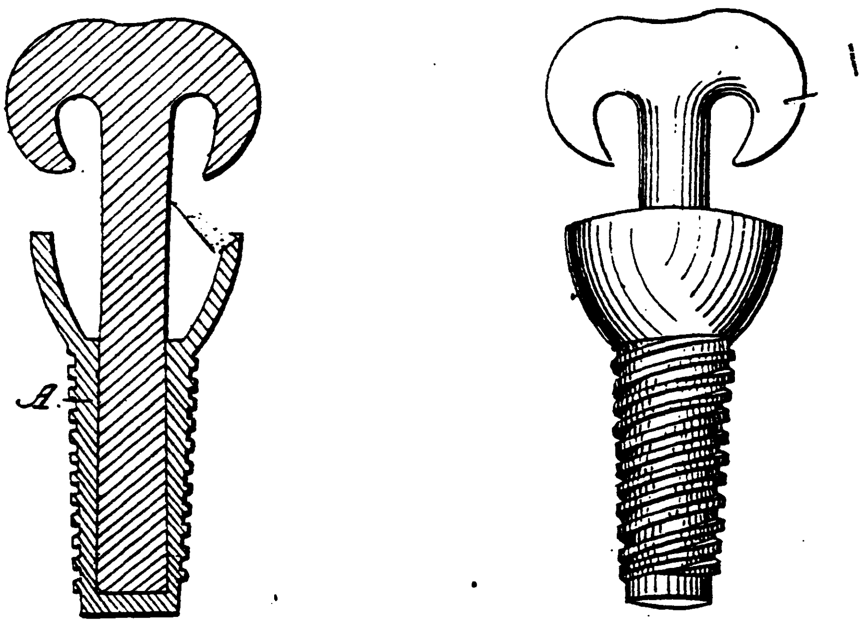
Witnesses:

CHAS. DAVIS,
JAMES MATTHEWS.

J. M. MERRICK, Jr.

Insulator for Electric Conductors.

No. 87,187. Patented Feb. 23, 1869.



Witnesses

Byron Rose

John L Hayes

Inventor

John M. Merrick Jr

United States Patent Office.

JOHN M. MERRICK, JR., OF BOSTON, MASSACHUSETTS.

Letters Patent No. 87,187, *dated February* 23, 1869.

IMPROVED COMPOSITION-INSULATOR FOR TELEGRAPH AND OTHER ELECTRIC CONDUCTORS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, JOHN M. MERRICK, Jr., of Boston, in the county of Suffolk, and State of Massachusetts, have invented a new and improved Insulator for Practical Telegraphy; and I do hereby declare that the following is a full, clear, and exact description thereof.

The nature of my invention consists in making the non-conducting portion of insulators, by which the telegraph-wires are supported upon the poles, and by which the escape of the electric current at the points of support is prevented, of a new and recently-discovered composition of matter, possessing remarkable resistance to conduction, to moisture, and dirt, as well as having the requisite strength and uniformity.

To enable others skilled in the art to understand my invention, I will proceed to describe its construction and operation.

Although I do not claim any novelty in the configuration of the insulators made by me, I annex a drawing, to illustrate the manner in which the insulating-portions are attached to the metallic or supporting-portions of the insulator.

In the drawing—

Figure 1 represents a view of one form of insulator in perspective, and

Figure 2, a sectional view.

In the form of insulator shown in the drawing, there is represented a spike of metal, provided, at one end, with a hook, for holding the wire, and a screw, of a non-conducting substance, at the other end, for entering the post, or the wooden attachment by which the insulator is fastened to the post.

The non-conducting material surrounding the metallic spike is represented at A in fig. 2.

The method of construction which I adopt, and the materials used, are as follows:

The insulating-material which I use is one for which I have received Letters Patent, numbered 85,018, and dated December 15, 1868, said material being known in the trade as diatite.

This material is composed, and prepared, and applied, to form the insulator, as follows:

Prepared silica, in the utmost possible state of division which can be obtained, or, what I prefer, the silicious earth, known as diatomaceous or infusorial deposits, naturally in a state of great division, is mixed with gum-shellac in a dry state, or any similar gum, in equal proportions, by weight.

The mixed material is brought to a semi-plastic state through heat applied to it by means of a steam-stove.

The material is then taken out, and pressed between steam-rollers, such as are used in rolling India rubber.

It is passed repeatedly through these rollers, until the ingredients are perfectly incorporated.

The compound, while still hot, and in a plastic state, is pressed into a metallic die; and upon this material the portion of the spike to be covered with the insulating-material is placed.

The die is so constructed as to give the impression of the desired form which the exterior of the insulator shall have.

Another die, to make an impression of the other side of the insulator, is placed upon the former die and the material which it contains.

Both dies are then heated, and placed in a powerful press.

The requisite smoothness is given by the polished surface of the die.

The insulator thus moulded, upon being removed from the die, is found to be perfectly finished for use.

The enveloping-material adheres perfectly to the metallic spike, and the end, spirally grooved, may be screwed into any wooden post or support, without separating the enveloping-material.

I have described and shown only one form in which the insulating-material above mentioned may be applied.

It may be used without metallic supports, in any desired form, or may form parts of compound insulators.

Having fully described the method of construction of my insulator, and the nature of the material of which the non-conducting portions are made, I will state the peculiar advantages which this insulator possesses, and the novel results from this peculiar application which make it a distinct invention in the art of practical telegraphy.

With the vast and increasing extension of telegraphic lines, the possession of an insulator which approaches perfection is of vital importance.

Improvements apparently slight become important, from the extent to which they may be adopted.

First. The first requisite of an insulator is its resistance to conduction. The material of which it is made should be a relatively bad conductor.

Second. As the resistance of insulators is almost purely a question of surface, and, in insulators similar in other respects, the largest in diameter will conduct the best, it is desirable to have a non-conducting material with sufficient cohesive properties to secure an insulator of the smallest possible diameter consistent with strength.

Third. The insulator should have little affinity for moisture, or power to attract dampness.

Fourth. The material should not deteriorate at its surface, through age or exposure, so as to become rough, and therefore liable to retain dirt.

Fifth. It should be cheap.

I claim that my insulator possesses all these requisites to a degree never before attained.

The insulating-qualities are given by a gum ranking at the very height of the list of non-conductors, and almost identical with amber or electron, the non-conducting properties of which gave electricity its name.

By the process used in the preparation of diatite, each microscopic particle of diatomaceous earth or silex, itself a bad conductor, is coated with the gum, while the complete incorporation of the hard particles of diatomaceous earth gives to the diatite a strength found in no material equally resistant to conduction.

I am thus able to make the insulators of the smallest diameter consistent with strength.

This insulator has little affinity for moisture, as compared with glass insulators, ordinarily used.

Its resistance to moisture is illustrated by the well-known fact that glass supports of apparatus used for experiments in frictional electricity are ordinarily varnished with shellac, to lessen the affinity for moisture.

My insulator possesses all the advantages of those made of vulcanite, hard rubber, or ebonite.

With all the excellences of the insulators last named, they are subject to two objections:

Being composed of India rubber and sulphur, when the vulcanite surrounds and is in contact with a spike or supporting-portion of iron, and when the insulator is exposed to rain, the sulphur combines with the iron, forming a sulphuret of iron, which, swelling, causes the envelope of vulcanite to split.

Another well-known objection to the use of vulcanite, hard rubber, or ebonite, under all which names this material is known, is that, by exposure, its surface becomes rough and spongy, so as to retain dirt, and therefore will not give a high insulation for a long period.

The material which I use is not subject to either of these objections.

The bulk of the material consists of silex, the most resistant of all known to atmospheric influences; and a marked peculiarity of this material, resulting from the aggregation of particles of extreme hardness, originally in the utmost possible state of division, and from the manner in which the material is struck and compressed in dies, is the smoothness and hardness of its surface, which continues under exposure.

The application of a material possessing these essential properties to insulators, constitutes the essence of my invention.

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

An insulator for practical telegraphy, the portions of which, adapted to resist conduction, are composed of a material consisting of a combination of a powder of silica, chemically prepared, or occurring in the form of diatomaceous or infusorial earth, with gum-shellac, or other similar gums, the same being moulded and compressed, substantially as described.

JOHN M. MERRICK, JR.

Witnesses:

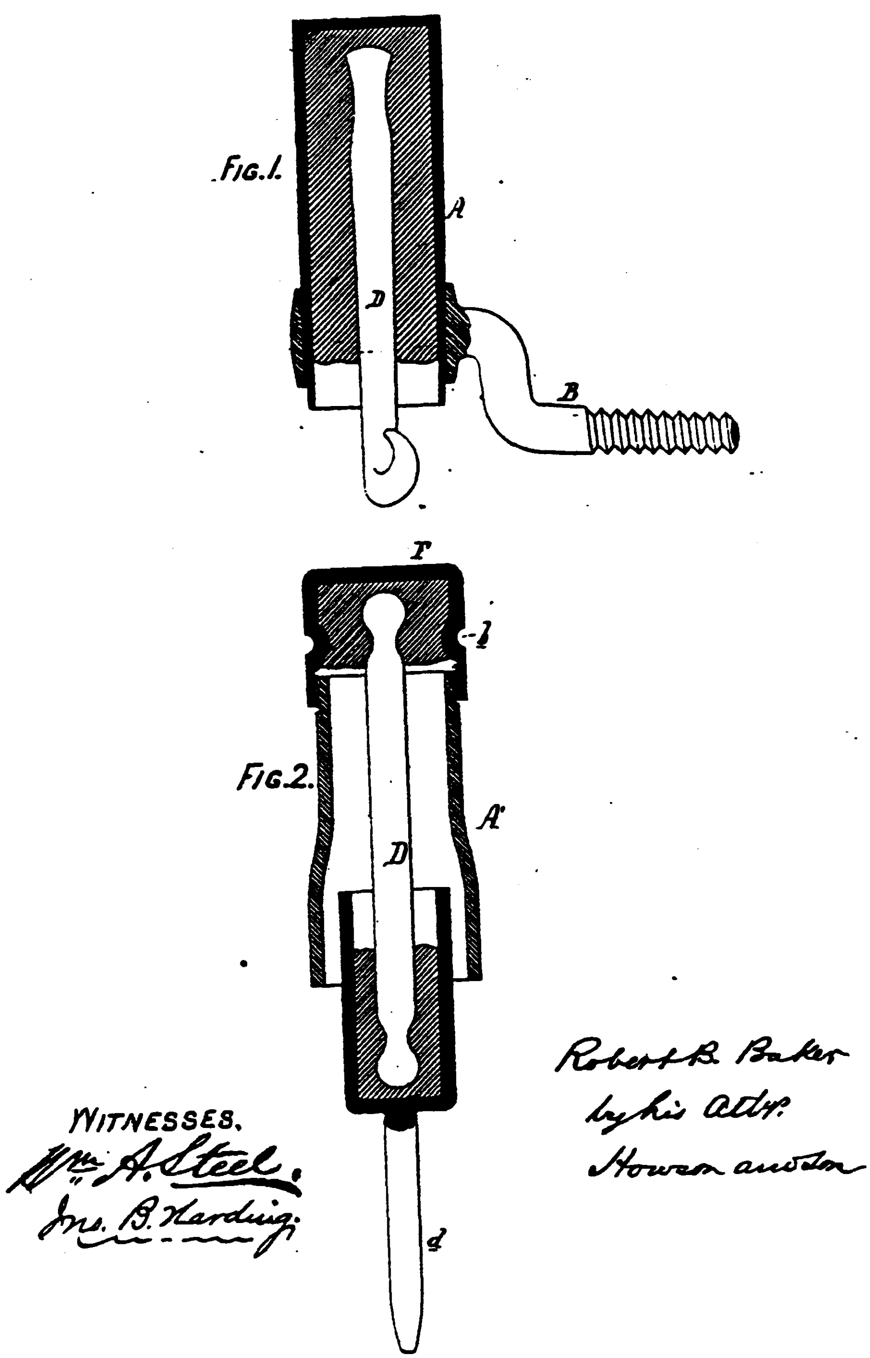
JOHN L. HAYES.

FRANCIS S. DYER.

R. B. BAKER.

Telegraph Insulator.

No. 103,122. Patented May 17, 1870.



United States Patent Office.

ROBERT BRECKENRIDGE BAKER, OF PHILADELPHIA, PENNSYLVANIA.

Letters Patent No. 103,122, *dated May* 17, 1870.

IMPROVEMENT IN INSULATORS FOR TELEGRAPHIC WIRE.

The Schedule referred to in these Letters Patent and making part of the same.

I, ROBERT BRECKENRIDGE BAKER, of Philadelphia, county of Philadelphia, State of Pennsylvania, have invented an Improvement in Insulators for Telegraph Wires, of which the following is a specification.

Nature and Object of the Invention.

My invention consists in the combination with, or application to, telegraphic wires, of metallic oxide as an insulating medium.

Description of the Accompanying Drawing.

Figure 1 represents a vertical section of an insulated wire-holder, to illustrate one mode of carrying out my invention; and

Figure 2 a section of another insulated wire-holder, illustrating another mode of carrying out my invention.

General Description.

I have discovered that metallic oxides, which have heretofore been looked upon as conductors of electricity, are actually the most effective non-conductors.

My invention of applying metallic oxides to the insulation of telegraphic wires may be carried into effect in a variety of ways, but I have not deemed it necessary to illustrate more than two such applications.

The wire-holder shown in fig. 1 consists of an inverted cup, A, of cast-iron, fitted to an eye in a screw-rod, B, by which the insulator may be connected to a pole, the cup A containing the suspension-rod D, the double hook at the lower end of which supports the telegraph-wire.

Wire-holders of this class have long been in common use, but their rods D have been heretofore confined to the cups A by sulphur, as a non-conducting medium, glass being sometimes used in conjunction with the sulphur, and sometimes paraffine, or both glass and paraffine being used as insulating mediums.

My insulating medium is a metallic oxide, red lead, for instance, which, when applied as shown in fig. 1, I mix with sulphur, the proportions of the sulphur and oxide being about equal.

The sulphur is melted and the oxide thoroughly mixed with it, and the composition, while in a semi-fluid state, is poured into the open end of the cup A, while the latter is in a position the reverse of that shown, while the suspension-rod D is held within the cup.

After the composition becomes thoroughly hard, the rod D will be firmly held in its place, and the holder effectually insulated and ready for use.

In the modified wire-holder, shown in fig. 2, the stem *d* is fitted in the arm of a telegraph-pole, and the telegraph-wire is coiled in the groove *b* of the cap F, which is screwed onto the casing A'. Further description of this modification will be unnecessary, as telegraph-holders of this class are well known.

Any of the metallic oxides, oxide of iron or oxide of zinc, for instance, may be used in place of red lead; and other solidifying substances, asphaltum, for instance, may be used in place of sulphur or textile material.

Although I have selected two styles of wire-holders with the view of illustrating modes of carrying my invention into effect, it should be distinctly understood that my invention may be applied to any of the wire-holders in use, my invention being, in fact, the application of metallic oxide as an insulating substance to any wire or wire-holder, whether the oxide be used in conjunction with any suitable material or substance simply as a medium of increasing the insulating properties of any wire-holders, or as an ingredient by which the suspension wires are retained, in the manner described above.

Those familiar with the construction of wire-holders can readily understand, without further explanation, how metallic oxides can be generally applied in a variety of ways to the insulating of all wire-holders, or to underground retainers of wires.

Claim.

The combination with, or application to, telegraph-wires, of metallic oxide as an insulating medium.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ROBERT BRECKENRIDGE BAKER.

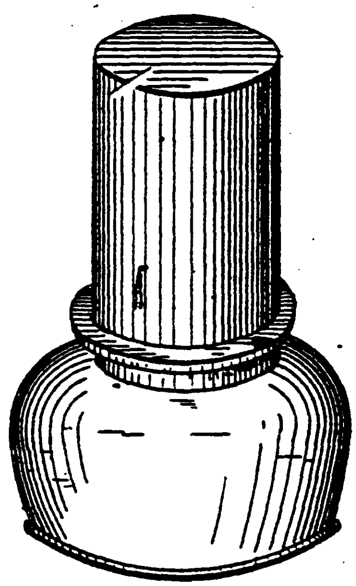
Witnesses:

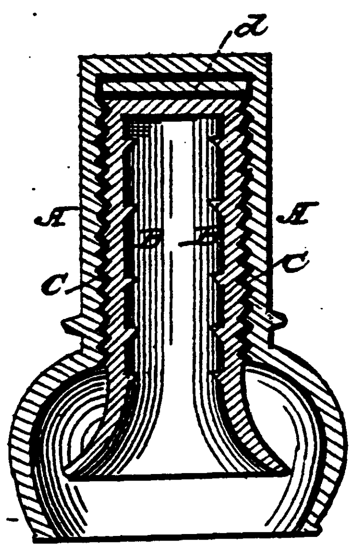
FRANK B. RICHARDS,
HARRY SMITH.

W. W. BALDWIN.

Telegraph Insulator.

No. 105,625. Patented July 26, 1870.





Witnesses

C. E. Wyman
J. Holmes.

Inventor:

W. W. Baldwin
by Geo W. Tibbitts
Attorney

United States Patent Office.

WILLIAM W. BALDWIN, OF CLEVELAND, OHIO.

Letters Patent No. 105,625, *dated July* 26, 1870.

IMPROVEMENT IN TELEGRAPH-INSULATORS.

The Schedule referred to in these Letters Patent and making part of the same

To all whom it may concern:

Be it known that I, WILLIAM W. BALDWIN, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and useful Improvement in Telegraph-Insulators; and I do hereby declare that the following is a full, clear, and exact description thereof, sufficient to enable those skilled in the art to which my invention appertains to fully understand and to make and use the same, reference being had to the accompanying drawing, and forming part of this specification, in which—

Figure 1 is a perspective view.

Figure 2 is a vertical section.

Like letters of reference indicate like parts.

This invention consists in the arrangement of two cast-metal sections, A and B, and interposing between them a suitable insulating substance, C. The outside section or shell A is intended as a protection to the insulating substance, and to which is to be attached the telegraph-wire, while the inner section B is intended to be placed on a pin on a telegraph-pole, thus making a cheap, durable, and reliable insulator.

In the drawing—

A represents a cast-metal shell or case, which may be in size and form suitable for strength and taste. The inside surface of this shell may have a screw-thread or annular rings cut or cast on it.

B represents a second shell, having a screw-thread or ribs on its outer surface, and is sufficiently smaller than the outer shell A to provide space for the insulating substance C. The inside surface of the shell B also has a screw-thread or barbs upon it, which are intended to secure it to the pin upon which it is driven, and prevents its being easily pulled off.

The insulator used may be porcelain, gutta-percha, paraffine, wax, or other suitable substance, which will insure a disconnection of the electricity between the two shells.

The lower end or mouth of the shell A is made spherical and hollow, to provide space between it and the mouths of the shell B, which is made flaring or bell-shaped. The object of this is to prevent water or moisture getting in. If water should spatter up inside of the shell it can only moisten the pin, and under side of the shell B. The open space between it and the shell A prevents its reaching it.

In putting these shells together, the shell B is first wound around with cotton, or other suitable fabric, and it is then dipped into the insulating substance, coating it all over both inside and out. The inside of the shell A is also coated with the insulator. When the shell B is inserted in the shell A, and screwed down into place, a piece of glass, *d*, may be placed between the ends of the shells, so as to prevent the two metal surfaces coming in contact.

By this method of constructing a telegraph-insulator, the shells may be made of cast metal, or wrought, as may be most convenient, and the insulator is perfectly protected from the dangers of injury from without by the weather, thus making a very cheap, durable, and perfect insulator.

Having thus described my invention,

I claim—

The metal shells A and B, when constructed, combined, and arranged with the insulating material C, substantially in the manner shown, and for the purpose set forth.

WILLIAM W. BALDWIN.

Witnesses:

C. E. WYMAN,

J. HOLMES.

H. READ.

Improvement in Insulators for Telegraph-Wires.

No. 115,521. Patented May 30, 1871.

Fig: 1.

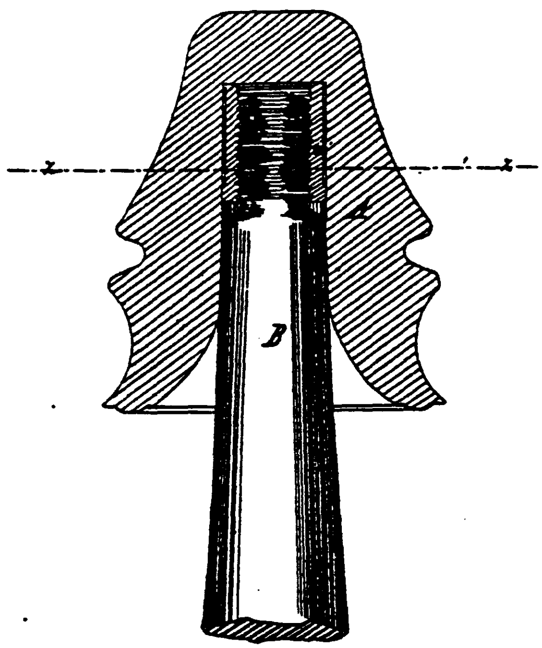
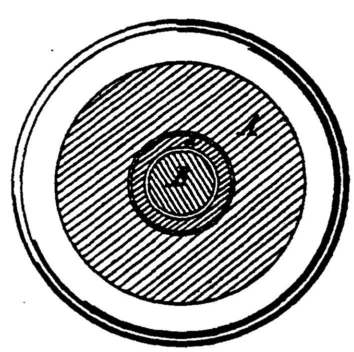


Fig: 2.



Witnesses:
J. C. Poller
E. F. Kastenhuber

Inventor:
Horatio Read
by
Van Santvoord & Hauff
Attys

115,521

UNITED STATES PATENT OFFICE.

HORATIO READ, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO HIMSELF AND B. B. HAGERTY, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN INSULATORS FOR TELEGRAPH-WIRES.

Specification forming part of Letters Patent No. 115,521, dated May 30, 1871.

To all whom it may concern:

Be it known that I, HORATIO READ, of Jersey City, in the county of Hudson, in the State of New Jersey, have invented a new and useful Improvement in Insulators; and I do hereby declare the following to be a full, clear, and exact description thereof, which will enable those skilled in the art to make and use the same, reference being had to the accompanying drawing forming part of this specification, in which drawing—

Figure 1 represents a vertical central section of this invention. Fig. 2 is a transverse section thereof.

Similar letters indicate corresponding parts.

This invention consists in the arrangement of a metal screw-socket in the interior of a glass insulator, in combination with a corresponding supporting-screw, in such a manner that said insulator can be secured to telegraph-poles or to buildings, or wherever it may be desired, in any position, with the greatest ease and facility.

A represents a glass insulator, such as is commonly used for the purpose of insulating telegraph-wires or conductors of electrical currents. In the interior of this insulator I secure a metal socket, *a*, which is fastened by cement or by pressing it into the glass, or in any other desirable manner, and which is provided with an internal screw-thread, as shown. This screw-thread may be longer or shorter, and if desired only a portion of the thread may be used, so that half a turn would be sufficient to fasten the insulator to the desired spot. The screw-thread in the socket fits on a thread cut on the end of a pin, B, which serves to support the insulator. This pin is secured to the telegraph-pole or building, or to any other place where the insulator is to be attached, and it will be readily seen that, by means of my screw-socket, the operation of attaching a glass insulator is materially facilitated. It will be seen that the insulator is firmly supported on the pin B. The screw-socket *a* is placed at the base of the opening, which receives the projecting pin so that the plain or unthreaded part of this pin bears against the sides of the opening or cavity, and serves to support the insulator, while the screw-socket prevents its displacement. These two features are necessary in consequence of the great strain upon the insulator.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

A telegraph-insulator, A, provided with a smooth socket, in the inner part of which is secured a metallic screw-thimble, *a*, to screw on the supporting-pin, while the outer portion of said socket forms a guide for the body of the supporting-pin, substantially as described.

HORATIO READ.

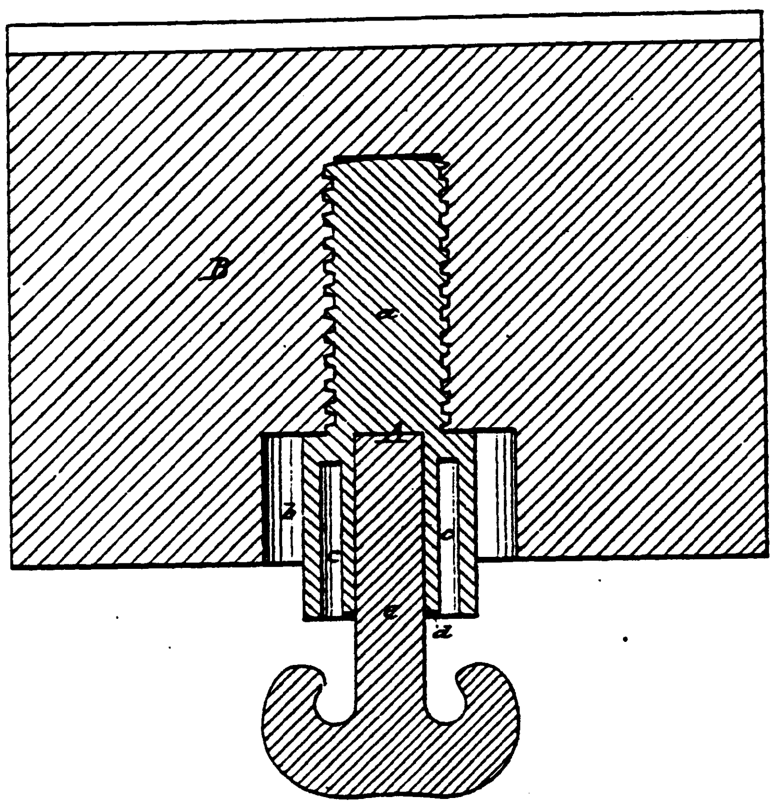
Witnesses:
W. HAUFF,
E. F. KASTENHUBER.

M. G. FARMER.

Improvement in Insulators.

No. 124,199.

Patented March 5, 1872.



Witnesses.

E. R. Stansbury.

F. C. Brecht.

Inventor.

Moses G. Farmer

By his Attorney

Chas. F. Stansbury

124,199

UNITED STATES PATENT OFFICE.

MOSES G. FARMER, OF SALEM, MASSACHUSETTS.

IMPROVEMENT IN TELEGRAPH-INSULATORS.

Specification forming part of Letters Patent No. 124,199, dated March 5, 1872.

SPECIFICATION.

To all whom it may concern:

Be it known that I, MOSES G. FARMER, of Salem, in the county of Essex and State of Massachusetts, have invented a new and useful Improvement in Insulators for Telegraph Wires; and I do hereby declare the following to be a full and correct description of the same, reference being had to the accompanying drawing, in which the figure represents a central longitudinal section of my insulator.

This invention relates to an improvement in insulators for telegraph wires; and consists, first, of a vulcanite body made with a shank or tang on which a screw-thread is formed, and having a deep recess surrounding a central portion in which an ordinary metal hook is inserted; and, second, in saturating or coating the insulator with the mixture described in an application which I have made even date with this for Letters Patent for the same. The object of this invention is the production of an insulator, which shall be as nearly as is possible in an exposed delicate device a perfect non-conductor, which is so hard as to be broken only by the most violent blow, and which is of such shape as to ward off stones and other missiles thrown thereat. This I accomplish as follows:

In the drawing, A may represent the insulator as a whole. The parts *a* and *b* I form in one piece, of vulcanite, and upon the shank or tang *a* is formed a screw-thread, whereby the insulator is readily inserted into an auger-hole bored in the pin or bracket B. The part *b* is provided with a deep cavity, *c*, surrounding the part *d*, in which latter an ordinary zinc-plated hook, *e*, is firmly inserted. By means of this cavity the wire is more perfectly insulated than if the part *b* was made solid. As is well known, vulcanite is but a poor conductor of electricity, and hence its value as an insulator; but, in order to render its property in this respect still greater, I immerse the insulator constructed after this plan in a melted mixture of rosin, bees-wax, spermaceti, or paraffine, with or without oil, as described in my application referred to. A small percentage of the mixture is absorbed by the vulcanite, and the whole insulator is evenly and nicely coated by the mixture; or, instead of this mixture I simply coat it with paraffine.

Rosin, bees-wax, spermaceti, &c., all have high insulating powers, and by thus combining them with vulcanite an almost perfect insulator is produced. Being preferably round, it is protected in a great measure from missiles thrown at it, and of itself is not easily broken, as its elasticity will break the force of the blow.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

An insulator for telegraph-wires, formed of vulcanite, in the manner described and represented, and supporting the ordinary wire-carrying hook, as and for the purpose set forth.

The above specification of my said invention signed and witnessed at Boston this 18th day of August, A. D. 1871.

MOSES G. FARMER.

Witnesses:
CHARLES STOWELL,
GEO. A. STOWELL.

M. G. FARMER.

Improvement in Insulators.

No. 124.200.

Patented March 5, 1872.

Fig. 1.

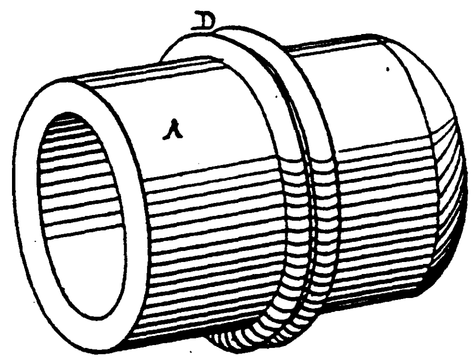
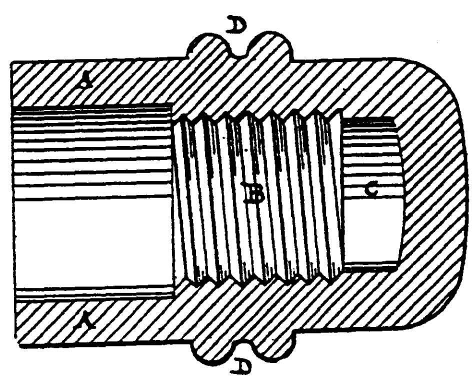


Fig. 2.



Witnesses.
J. W. Howard
E. R. Stansbury.

Inventor.
Moses G. Farmer
By his Attorney
Chas. F. Stansbury

124,200

UNITED STATES PATENT OFFICE.

MOSES G. FARMER, OF SALEM, MASSACHUSETTS.

IMPROVEMENT IN TELEGRAPH-INSULATORS.

Specification forming part of Letters Patent No. 124,200, dated March 5, 1872.

SPECIFICATION.

To all whom it may concern:

Be it known that I, MOSES G. FARMER, of Salem, in the county of Essex and State of Massachusetts, have invented a new and useful Improvement in Insulators for Telegraph-Wires; and I do hereby declare the following to be a full and correct description of the same, reference being had to the accompanying drawing, in which—

Figure 1 is a perspective view of my device, and Fig. 2 is a central vertical section of the same.

Heretofore insulators have been made of glass, porcelain, and composite substances, many of which possess merit, although liable to some important objections. Glass does not resist sufficiently the wear to which it is subjected; porcelain is open to the same objection, and to that of high cost, besides not being sufficiently strong. The "Brooks insulator," a representative of the composite class, being made of glass, coated with paraffine, and inclosed in a metal cap, is nearly perfect, but it is liable to crack; the cap prevents the ready discovery of the defects, and the cost is so great as to be an obstacle to its general introduction.

The object of my invention is to combine whatever excellencies these insulators possess, and to produce one which shall be strong, resist the effects of the weather, perfectly insulate the wires, while it can be manufactured at so moderate a cost as to allow of its ready adoption. It consists of an insulator, made preferably in the form shown in the drawing, and composed of biscuit-ware or other plastic and porous material, molded in the desired shape with a screw-thread formed in its interior surface, and a groove on its exterior for the reception of the wire. Thus made, it is dried, baked, and glazed, and afterwards immersed in a composition described in an application of even date herewith, and raised to a high heat, whence it is removed and placed in heated petroleum, from which it is taken and is ready for the market.

Referring to the drawing, A may represent an insulator of any approved form, made of biscuit or earthen-ware, or other suitable porous and plastic material, provided with a screw-thread, B, on its interior surface, and a groove, D, on its exterior surface, said groove being formed by two beads. A space, *c*, is left between the end of the insulator, and its thread to allow of its adjustment on the pin or bracket, as this may become necessary.

The mode of manufacture is as follows: The material used is molded in a suitable flask, or by hand on a pattern-wheel, the thread being formed by a wooden screw-plug, which is kept in the insulator until it is sufficiently hard to sustain its own weight, when it is withdrawn and the device is then dried, baked, and glazed in any ordinary manner. After it is glazed it is immersed in a melted composition of rosin, bees-wax, spermaceti, and oil, more or less of the oil being added, according to the climate in which the insulators are to be used, for which composition application has been made for Letters Patent, even date with this. This composition is heated to from 250° to 350° Fahrenheit, or so long as bubbles escape, care being taken not to injure the mixture or composition by too great heat. When the bubbles cease to rise the insulators are removed and placed in another vessel containing heated petroleum, "Merrill's deodorized oil" being considered the best by me. The porous material absorbs the mixture, which serves when hard to close the pores, and thus exclude moisture and preserve the insulating properties of the device. The oil removes any of the mixture that remains on the surface, but leaves the insulator sufficiently unctuous to shed the rain and to prevent the deposit of a film of moisture, which has been found so prejudicial to glass and other insulators having a vitreous surface. They are allowed to remain in the oil a short time, when they are removed and are ready for the market.

It will be found that these insulators can be manufactured at a small cost, and will insulate perfectly, wear well, and be adapted to all climates.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

A telegraphic insulator composed of earthen, stone, or biscuit-ware, or other suitable or porous and plastic material, molded, threaded, and prepared, substantially in the form and manner described, and saturated with the insulating compound specified, or other suitable insulating mixture, for the purposes set forth.

The above specification of my said invention, signed and witnessed at Boston this 18th day of August, A. D. 1871.

MOSES G. FARMER.

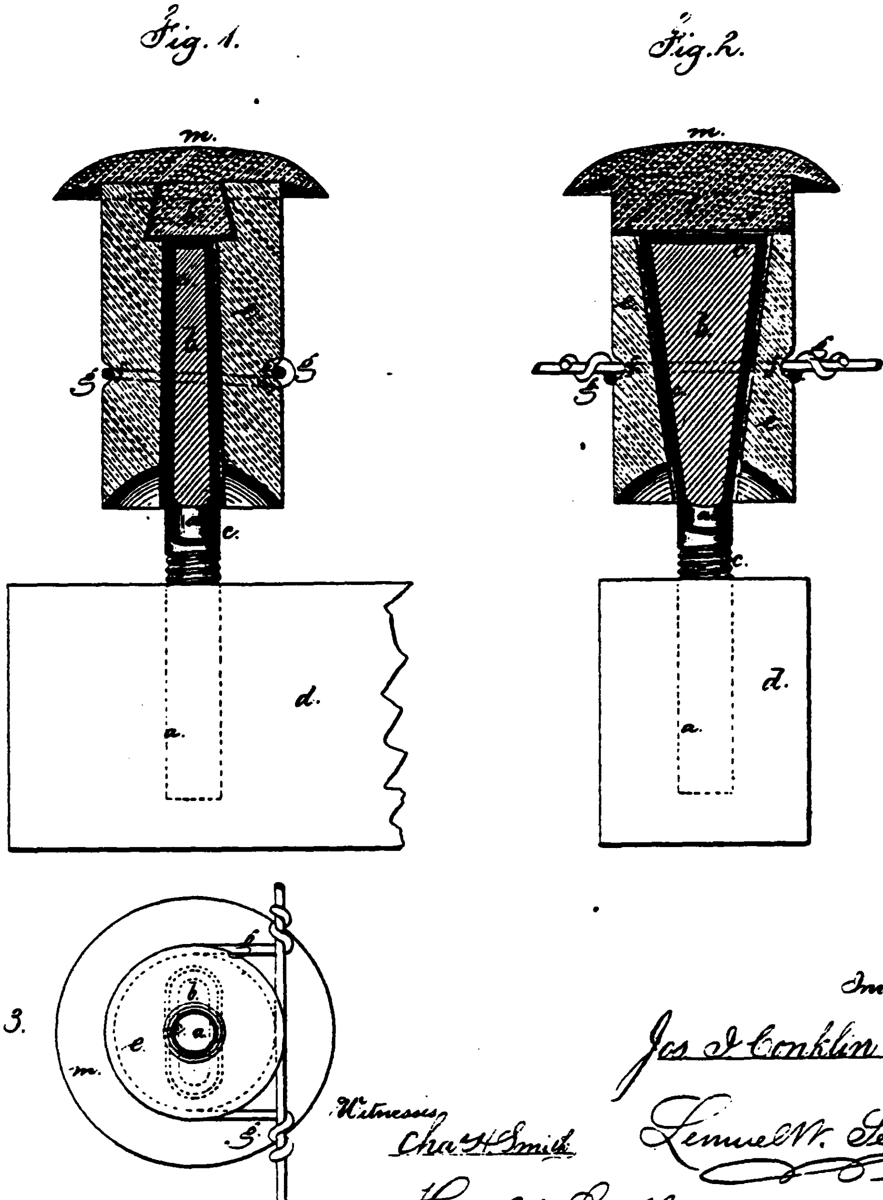
Witnesses:
CHARLES STOWELL,
GEO. A. STOWELL.

J. I. CONKLIN, Jr.

Improvement in Insulators for Telegraph-Wires.

No. 126,027.

Patented April 23, 1872.



Witnesses

Chas H Smith

Harold Serrell

Inventor

Jos I Conklin Jr

Lemuel W. Serrell atty

126,027

UNITED STATES PATENT OFFICE.

JOSEPH I. CONKLIN, JR., OF NEW YORK, N. Y.

IMPROVEMENT IN INSULATORS FOR TELEGRAPH-WIRES.

Specification forming part of Letters Patent No. 126,027, dated April 23, 1872.

To all whom it may concern:

Be it known that I, JOSEPH I. CONKLIN, Jr., of the city and State of New York, have invented an Improvement in Insulators for Telegraph-Wires, and the following is declared to be a correct description of the same.

The metal pin employed to connect the insulator to the post or cross-bar has been coated with a plastic non-conducting material, such as hard rubber. I make use of a pin so coated, but instead of being circular and screwed into the glass, I make a tapering head flattened upon said metal pin, thereby obtaining greater strength, and enabling me to introduce a wrapping of mica between the exterior of said pin and the interior of a correspondingly-shaped hole in the vitrified insulator. I also introduce a layer of mica between the end of the pin and a vitrified cap, that is applied at the upper end of the insulator, and is cemented in place.

In the drawing, Figure 1 is a vertical section of the said insulator. Fig. 2 is a similar view at right angles to Fig. 1, and Fig. 3 is an inverted plan of the insulator.

The pin *a* is made with a tapering enlargement or head, *b*, and is coated with non-conducting material *c*, in which is a screw-thread for holding the pin in the hole of the cross-bar or post *d*. The insulator glass is made in two parts, the body *e* has a hole through it of a size to receive the head *b* of the pin, together with a wrapping of mica to render the insulation more perfect. It is preferable that the head *b* should be flattened on two sides, as shown, so as to prevent turning, and at the same time less material will be used. The body of this insulator *e* is grooved at *f*, for receiving the wire and attachment *g*, and this being nearly in the middle of the insulator, there is no undue strain or leverage either on the pin or the insulator by the tension of the telegraph-wire.

The mica insulator is confined between the glass and the pin under circumstances where it cannot be broken or work loose. At the end of the pin *a* I introduce a layer of mica, and then insert the dovetail *l* of the cap *m* into a dovetail groove in the upper part of the body *e*, and secure the parts together by suitable cement.

The insulator made in this manner is much more perfect than those heretofore used, because the mica is entirely excluded from atmospheric influences and cannot become injured.

I claim as my invention—

1. A wrapping of mica introduced between the metallic pin and the body of the insulator, substantially as and for the purposes set forth.
2. The cap *m* with the dovetail *l*, in combination with the insulator *e* and pin *a*, the latter being formed with a tapering head, as and for the purposes set forth.

Signed by me this 18th day of March A. D. 1872.

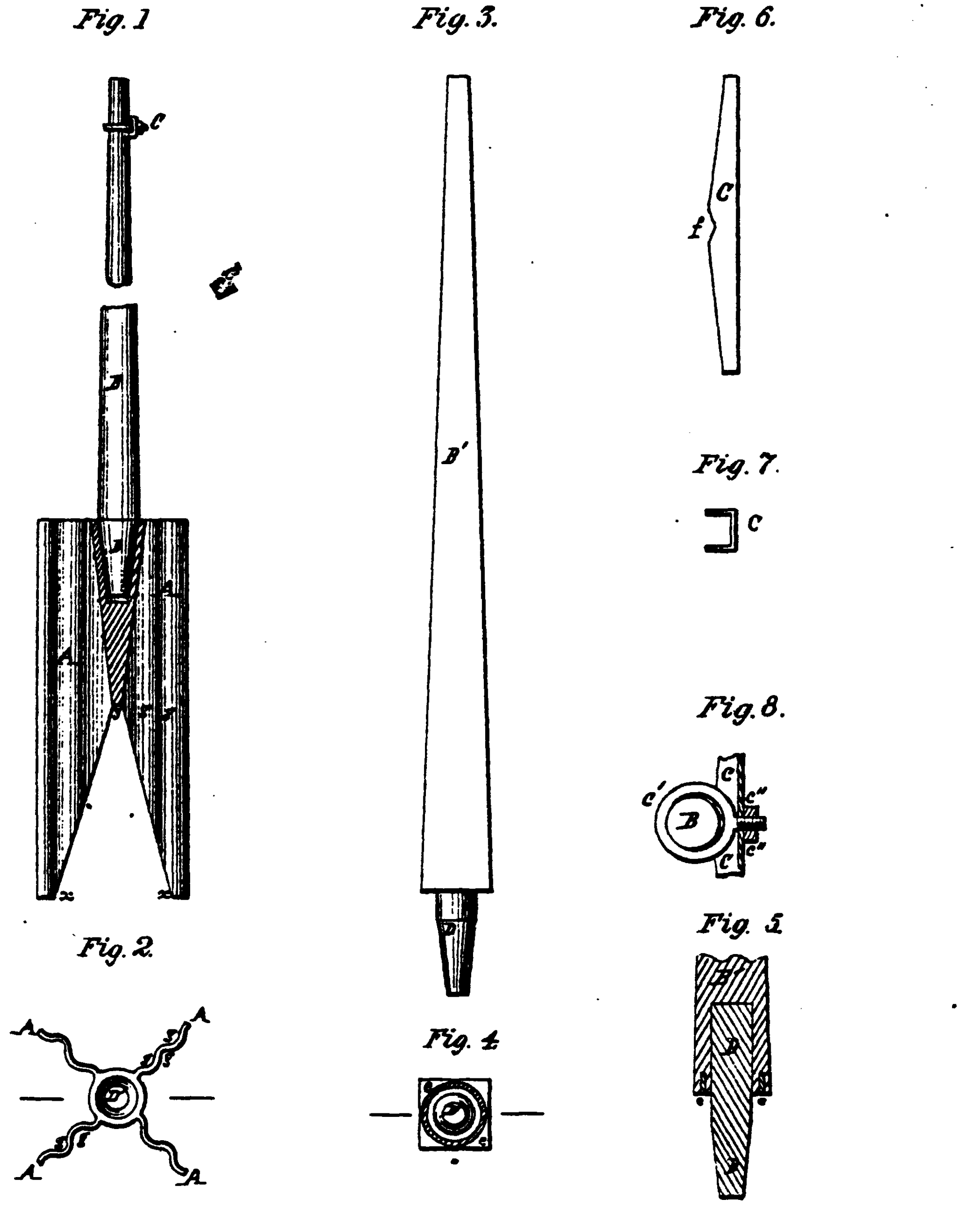
J. I. CONKLIN, JR.

Witnesses:
GEO. T. PINCKNEY,
CHAS. H. SMITH.

A. B. SPROUT.

Improvement in Telegraph-Posts.

No. 131,037. Patented Sep. 3, 1872.



Witnesses.
M. M. Leggett.
U. H. Hutchins

Inventor.
Amos B. Sprout.
By. Mills W. Leggett.
Attorney

UNITED STATES PATENT OFFICE.

AMOS B. SPROUT, OF PICTURE ROCKS, PENNSYLVANIA.

IMPROVEMENT IN TELEGRAPH-POSTS.

Specification forming part of Letters Patent No. 131,037, dated September 3, 1872.

SPECIFICATION.

Be it known that I, AMOS B. SPROUT, of Picture Rocks, county of Lycoming, State of Pennsylvania, have invented a new and Improved Telegraph-Pole; and I declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawing, which forms a part of this specification.

My invention relates to the manner of making the foundation or sill, in the pole itself, and in the cross-bar and its attachment.

In the drawing, Figure 1 is the sill A, pole B, attachment of the cross-bar C. Fig. 2 is cross-section by horizontal plane through the sill A, showing the dowel-hole D′. Fig. 3 is a wooden pole, B′, with iron dowel D. Fig. 4 is cross-section through bottom of the wooden pole, with dowel D surrounded with the iron ring *e*, driven into the bottom of the pole around the dowel. Fig. 5 is longitudinal section through bottom of the pole B′, D being the dowel and *e* the ring. Fig. 6 is view of the cross-piece C, showing notch *f*. Fig. 7 is sectional view of an iron cross-piece, C. Fig. 8 is view of the attachment-band *c*′, provided with bolt-head, and secured with nut *c*″ *c*″, screwing down flush with the cross-piece C.

My invention consists as follows: I make the sill A of metal, solid, and provided with a conical dowel-seat in the center, extending downward in the direction of the axis of the pole, and provided with four corrugated wings at right angles to each other, made in such a manner that where the wing is saliently corrugated on one side it presents a re-entrant surface on opposite side, thus employing the least amount of metal. The exterior edges of these wings are parallel to the axis of the pole, and from their lowest points, *x*, the metal is cut away up to a point, *y*, near to the bottom of the dowel-seat, as shown in the cross-section by vertical plane at the bottom of Fig. 1. Thus the whole sill is so arranged in its parts as to secure the greatest degree of stability when driven or set into the ground, and with the minimum amount of material. The pole A may be made of corrugated, solid, or hollow iron from the sill to the top, and tapering as it ascends; and the material may be of cast or wrought metal. At the bottom it is provided with a dowel to set into the dowel-seat D′ of the sill A. I propose generally to make the poles of wood, of any suitable shape in cross-section, and tapering as it ascends. At the bottom of this pole a hole is bored into the pole to admit the dowel-shank, and into the pole around this hole is driven the band *e e* to keep the pole from splitting open when the dowel is driven into the hole. This dowel is given a shape corresponding to that of the dowel-seat. I make the cross-piece at the top of the pole, for supporting the wires, of wood or iron, provided at the middle with a notch, *f*. A bolt, *c*′, with a band-head, is inserted through the cross-piece, leaving the ring on the notched side of the piece. When this ring or band is slipped over the top of the pole and adjusted to the desired height the nut *c*″ *c*″ is screwed up, drawing the ring or band into a recess in the cross-piece, and pressing the notch against the pole, holding the piece securely.

I do not limit the use of this dowel and sill to telegraph-poles, but propose to use them in fence-posts and other similar contrivances.

The iron parts in this device are treated, when hot, to a coating of coal-tar or mineral asphalt, and thereby are prevented from rusting.

The dowel-seat may be of any suitable shape in cross-section, either square, circular, elliptical, or other. In case a pole is made of corrugated metal it may be fastened in the dowel-seat by a plug or wedge being driven between the sides of the pole, thus spreading them against the sides of the dowel-seat. The dowel-seat may be provided with but three wings instead of four, and the wings may sometimes be plain instead of corrugated. In fence-posts the dowel-seat may have but two wings, A. When the wooden post is used the ring *e e* may sometimes be dispensed with.

I know that winged sills are not new; therefore I limit myself to such sills when cut away at *x y*, underneath, for the purpose of forming a more secure and rigid foundation or seat, and when provided with corrugations *g g*, which offer a great resistance, though for light structures these corrugations may be omitted.

Having thus described my invention, what

I claim as new, and desire to secure by Letters Patent, is—

1. The post or pole B B′, provided with dowel D, winged sill A A with corrugations *g g* and with or without the concealed ferrule *e e*, substantially as and for the purposes set forth and shown.

2. The cross-piece C, provided with notch *f*, eyebolt *c′*, and nut *c″*, as and for the purposes described.

3. The metal sill A A, provided with closed socket D′, wings A A cut away at *x y* beneath, and with or without corrugations *g g*, substantially as and for the purposes described.

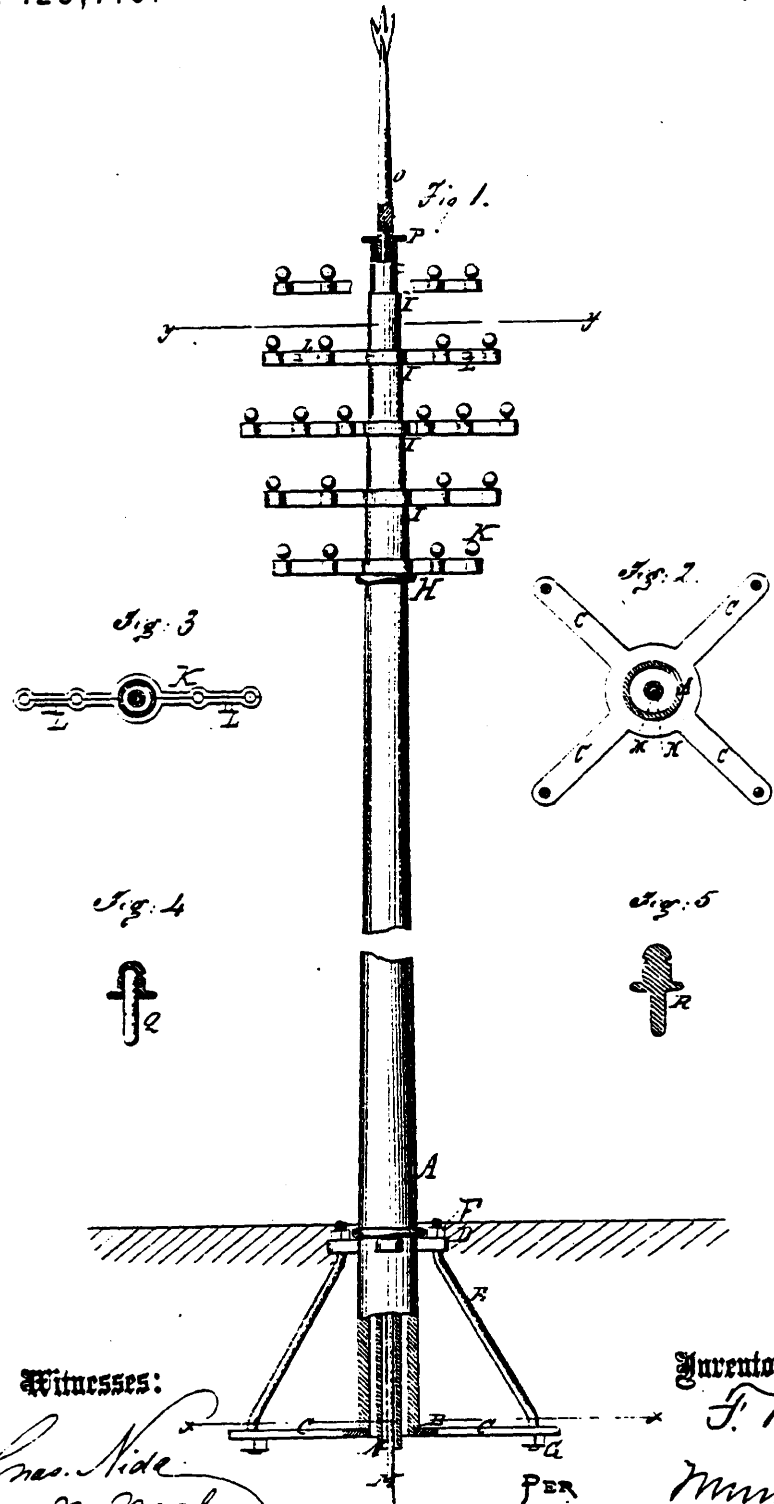
AMOS B. SPROUT.

Witnesses:
PETER VANDERBILT,
A. M. COWLES.

F. BOYD.
No. 125,716.

Improvement in Metallic Telegraph Poles.

Patented April 16, 1872.



Witnesses:
Chas. Nida
Geo W. Mabee

Inventor:
F. Boyd
PER
Munn & Co
Attorneys.

125,716

UNITED STATES PATENT OFFICE.

FRANCIS BOYD, OF NEWBURG, NEW YORK.

IMPROVEMENT IN METALLIC TELEGRAPH-POLES.

Specification forming part of Letters Patent No. 125,716, dated April 16, 1872.

Specification describing a new and Improved Metallic Telegraph-Pole, invented by FRANCIS BOYD, of Newburg, in the county of Orange and State of New York.

My invention relates to improvements in metallic telegraph-poles; and consists in constructing such a pole with collars for supporting horizontal arms which carry the insulators, in the means of connecting it with the base-piece, and in the arrangement of a lightning-rod or conductor.

Figure 1 is an elevation of my improved pole, with some parts sectioned. Fig. 2 is a cross-section on the line *x x*. Fig. 3 is a transverse section on the line *y y*. Fig. 4 is a section of the common wood pin and glass insulators for the wires, and Fig. 5 is a section of a solid India-rubber insulator which I propose to use.

Similar letters of reference indicate corresponding parts.

A is the cast-metal tube; B, the step; and C, the arms thereof, for bedding in the earth to support the pole; D, the ears for the braces E, said ears being cast on the pole and the braces being fitted through them, with screen-nuts F above for straining them to adjust the pole to a vertical position. Said braces may be made fast to the arms, or pass through them and be secured by nuts G below. H is the collar or ring cast on the pole for holding the lowermost ring; and I, shoulders for the other arms, formed by successive reductions of the size of the pole for the other arms. K represents the arms, which may be made of metal bars, with a large hole at the center to fit on the pole snugly above the shoulders, each arm having its hole corresponding in size to that of the pole above the particular shoulder whereon it is to rest, said arms either being made in one piece and put on over the top of the pole; or it may be divided in two parts longitudinally and vertically, and bolted together by bolts L. M is the lightning-rod, and N the insulating-tube. Said rod will project above the top of the pole, as at O, being insulated by an India-rubber cap, P, fitted water-tight on the top of the pole, and the hole through which the rod passes being packed tightly to prevent the water leaking out. The said arms will have holes for holding the wood pins Q or India-rubber insulators R, which may screw into the holes of the solid arms, and they may either screw into the divided arms, or they may be made larger below the arms and be held by such enlargements when clamped by said divided arms.

The arms should be galvanized; the parts below ground should be coated with coal-tar, and the parts of the hole above ground should be scaled and primed with red lead.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A tubular cast-metal telegraph-pole, having the collar H and shoulders I for supporting the arms, formed in the manner described.
2. The said cast-metal pole, provided with ears D, and stepped in and braced to a metal bed-piece, B, with arms C, by adjusting braces E, substantially in the manner described.
3. The lightning-rod M, insulating-tube N, cap P, and extension O, all combined and arranged with the pole, substantially as specified.

FRANCIS BOYD.

Witnesses:

LOUIS S. STERRIT,

JAS. B. B. BRUNDAGE.

(21.)

R. D. McDONALD & E. M. CRANDAL.

Improvement in Iron Telegraph Poles.

No. 122,952. Patented Jan. 23, 1872.

Fig. 1

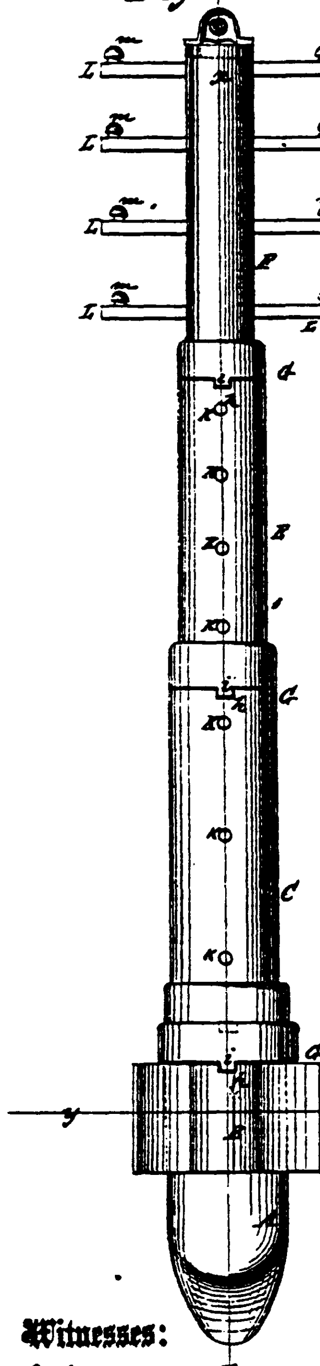


Fig. 3

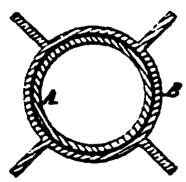
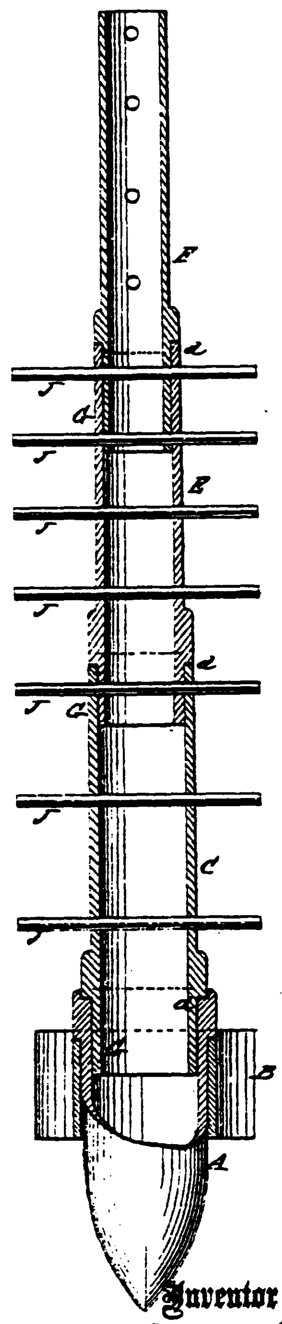


Fig. 2



Witnesses:

A. W. Almqvist
Francis. Mc Ardle

Inventor:

R. D. Mc Donald
Per E. M. Crandal
Munn & Co
Attorneys.

122,952

UNITED STATES PATENT OFFICE.

RICHARD D. McDONALD, OF JERSEY CITY, NEW JERSEY, AND EDWARD M. CRANDAL, OF MARSHALLTOWN, IOWA, ASSIGNORS TO RICHARD D. McDONALD.

IMPROVEMENT IN IRON TELEGRAPH-POLES.

Specification forming part of Letters Patent No. 122,952, dated January 23, 1872.

Specification describing a certain Improvement in Iron Telegraph-Poles, invented by RICHARD D. McDONALD, of Jersey city, in the county of Hudson and State of New Jersey, and EDWARD M. CRANDAL, of Marshalltown Station, in the county of Marshall and State of Iowa.

Our invention pertains to certain improvements in the construction of sectional iron telegraph-poles, which will be specifically indicated in the claim.

In the accompanying drawing, Figure 1 represents an exterior view of our improved telegraph-pole. Fig. 2 is a vertical section of Fig. 1, taken on the line *x x*. Fig. 3 is a cross-section of Fig. 1, taken on the line *y y*, showing the winged support or socket at the base of the pole.

Similar letters of reference indicate corresponding parts.

A is the lower section of the pole or the part which enters the ground, provided with a winged supporting-socket, B. The end of this section may be pointed or made sharp in any manner, so that it may be driven into the ground; or the end may be split, with the parts turned out in either direction, where a hole is made to receive the pole. This section is supported upon the socket B by shoulders, as seen in Fig. 2. In "planting" the pole this lower section is either driven into or placed in the ground, with the supporting-socket B around it, as represented, the top of which socket is designed to be at or near the surface of the ground. C represents the second section of the pole, which connects with the first section by a slip-joint limited by shoulders *d*, as seen. E is the third and F is the fourth tubular section of this pole, of diminishing diameter from the base section A up, and each connected by the slip-joint G, limited by the shoulders *d*. In the upper end of each of the lower sections is a recess, *h*, and on the other end is a lug, *i*, which fits into the recess *h*, as seen in Fig. 1. By this arrangement the sections are prevented from turning, and are held in proper position. There may be bands around the ends of each section, which will come in contact at each end of the joint, if desired. These tubular sections are made of gas or steam pipe, and they must necessarily be banded to form the shoulders or enlargements seen in the drawing. Ordinarily the tubing used would be of sufficient strength without the additional bands first referred to. J represents rounds, which pass through the holes K in the pole for convenience in ascending and descending the pole. L represents the arms for supporting the wires, and M are the insulators thereon. In the top of the upper section F there may be an insulator, with provision for supporting a telegraph-wire, as represented in the drawing. The pole being a tube, a conducting-wire (one or more) may be carried down through it to the ground, and thus be secured from injury, transverse bars being arranged, with proper glass insulators, to guide the wire within the pole.

We do not limit or confine ourselves to the precise form and arrangement of any of the parts described, as they may be varied in many ways without departing from our invention.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. The removable winged socket B, combined with the pointed and shouldered lower section or base of a sectional telegraph-pole, substantially as herein shown and described.

2. The telegraph-pole formed of tubular iron sections fitted together by means of slip-joints and recesses and lugs *h* and *i*, as herein shown and described.

RICHARD D. McDONALD.
EDWARD M. CRANDAL.

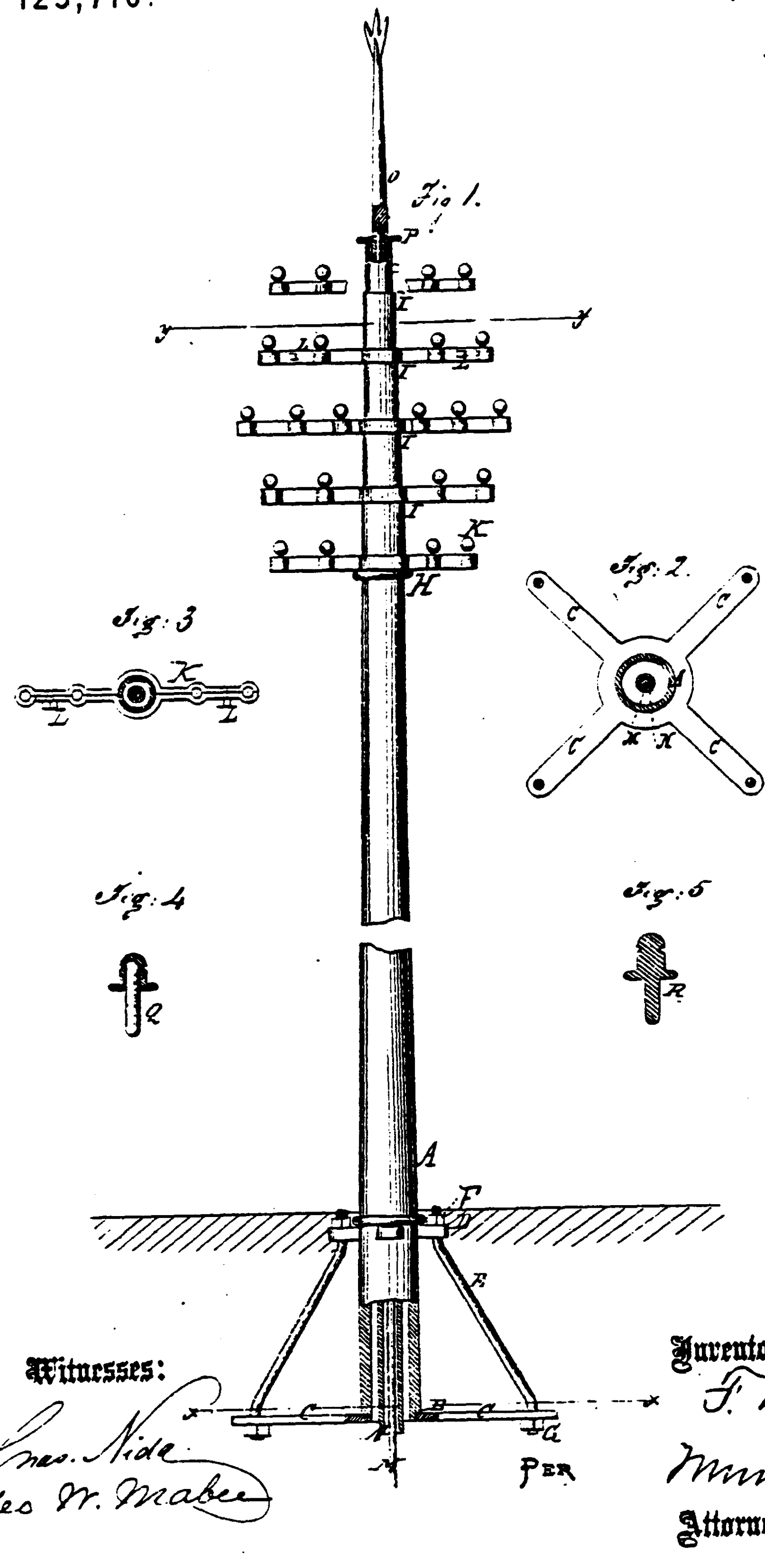
Witnesses for McDONALD:
GEORGE W. MABEE,
T. B. MOSHER.

Witnesses for CRANDAL:
O. A. ASHBY,
J. A. McARTHUR.

F. BOYD.
No. 125,716.

Improvement in Metallic Telegraph Poles.

Patented April 16, 1872.



Witnesses:
Chas. Nida
Geo W. Mabee

Inventor:
F. Boyd
PER
Munn & Co
Attorneys.

125,716

UNITED STATES PATENT OFFICE.

FRANCIS BOYD, OF NEWBURG, NEW YORK.

IMPROVEMENT IN METALLIC TELEGRAPH-POLES.

Specification forming part of Letters Patent No. 125,716, dated April 16, 1872.

Specification describing a new and Improved Metallic Telegraph-Pole, invented by FRANCIS BOYD, of Newburg, in the county of Orange and State of New York.

My invention relates to improvements in metallic telegraph-poles; and consists in constructing such a pole with collars for supporting horizontal arms which carry the insulators, in the means of connecting it with the base-piece, and in the arrangement of a lightning-rod or conductor.

Figure 1 is an elevation of my improved pole, with some parts sectioned. Fig. 2 is a cross-section on the line *x x*. Fig. 3 is a transverse section on the line *y y*. Fig. 4 is a section of the common wood pin and glass insulators for the wires, and Fig. 5 is a section of a solid India-rubber insulator which I propose to use.

Similar letters of reference indicate corresponding parts.

A is the cast-metal tube; B, the step; and C, the arms thereof, for bedding in the earth to support the pole; D, the ears for the braces E, said ears being cast on the pole and the braces being fitted through them, with screen-nuts F above for straining them to adjust the pole to a vertical position. Said braces may be made fast to the arms, or pass through them and be secured by nuts G below. H is the collar or ring cast on the pole for holding the lowermost ring; and I, shoulders for the other arms, formed by successive reductions of the size of the pole for the other arms. K represents the arms, which may be made of metal bars, with a large hole at the center to fit on the pole snugly above the shoulders, each arm having its hole corresponding in size to that of the pole above the particular shoulder whereon it is to rest, said arms either being made in one piece and put on over the top of the pole; or it may be divided in two parts longitudinally and vertically, and bolted together by bolts L. M is the lightning-rod, and N the insulating-tube. Said rod will project above the top of the pole, as at O, being insulated by an India-rubber cap, P, fitted water-tight on the top of the pole, and the hole through which the rod passes being packed tightly to prevent the water leaking out. The said arms will have holes for holding the wood pins Q or India-rubber insulators R, which may screw into the holes of the solid arms, and they may either screw into the divided arms, or they may be made larger below the arms and be held by such enlargements when clamped by said divided arms.

The arms should be galvanized; the parts below ground should be coated with coal-tar, and the parts of the hole above ground should be scaled and primed with red lead.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A tubular cast-metal telegraph-pole, having the collar H and shoulders I for supporting the arms, formed in the manner described.
2. The said cast-metal pole, provided with ears D, and stepped in and braced to a metal bed-piece, B, with arms C, by adjusting braces E, substantially in the manner described.
3. The lightning-rod M, insulating-tube N, cap P, and extension O, all combined and arranged with the pole, substantially as specified.

FRANCIS BOYD.

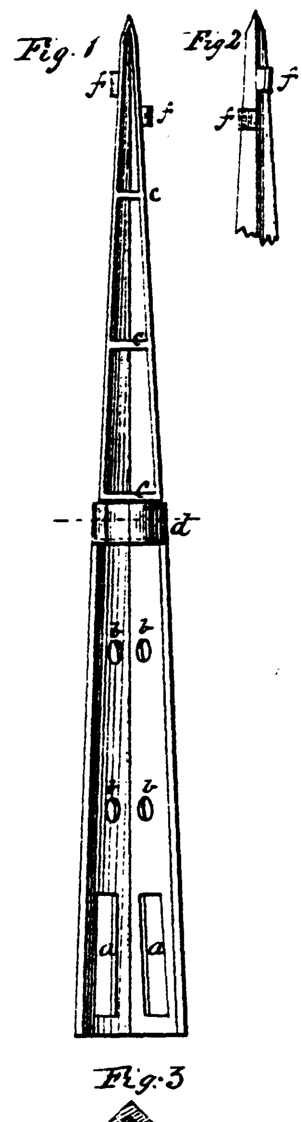
Witnesses:
LOUIS S. STERRIT,
JAS. B. B. BRUNDAGE.

T. J. McCARVER, J. ATHEY & B. JENNINGS.

Telegraph Poles.

No. 139,593.

Patented June 3, 1873.



Witnesses.

P. C. Dieterich

Alex F. Roberts

Inventor.

T. J. McCarver

J. Athey

B. Jennings

Per Munn & Co

Attorneys.

UNITED STATES PATENT OFFICE.

THOMAS JENNINGS McCARVER, JAMES ATHEY, AND BERRYMAN JENNINGS, OF OREGON CITY, OREGON.

IMPROVEMENT IN TELEGRAPH-POLES.

Specification forming part of Letters Patent No. **139,593**, dated June 3, 1873; application filed May 18, 1872.

To all whom it may concern:

Be it known that we, THOMAS J. McCARVER, JAMES ATHEY, and BERRYMAN JENNINGS, of Oregon City, in the county of Clackamas, and State of Oregon, have invented a new and useful Improvement in Telegraph-Poles; and we do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing forming a part of this specification, in which—

Figure 1 is an elevation of a sectional telegraph-pole made of angle-iron. Fig. 2 is a view of the inverse side of a part of the upper portion, showing the arrangement for attaching insulators for the wires. Fig. 3 is a cross section of Fig. 1.

Our invention consists of sectional telegraph poles of angle-iron, either cast or rolled, as hereinafter described.

The telegraph-posts are made in sections, and tapering from the base to the top, and when made of cast metal the wide flanges have long openings or slots *b*, in which pins may be inserted to adjust the wires. The cross-pieces *c* may be cast in the angle between the wires by which to climb.

These sections are connected together by clips *d* on the end of one section, between which and the end of said section the end of the other section will be fitted by sliding in endwise, as clearly shown in Figs. 1 and 3.

Similar clips or dovetailed-grooved clips *f*, will be applied to the upper ends of the top sections for reception of the insulators for holding the wires.

The posts of this form are cheaper and more durable than those of any other form before used.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

A telegraph-pole made of metallic sections, constructed substantially as described.

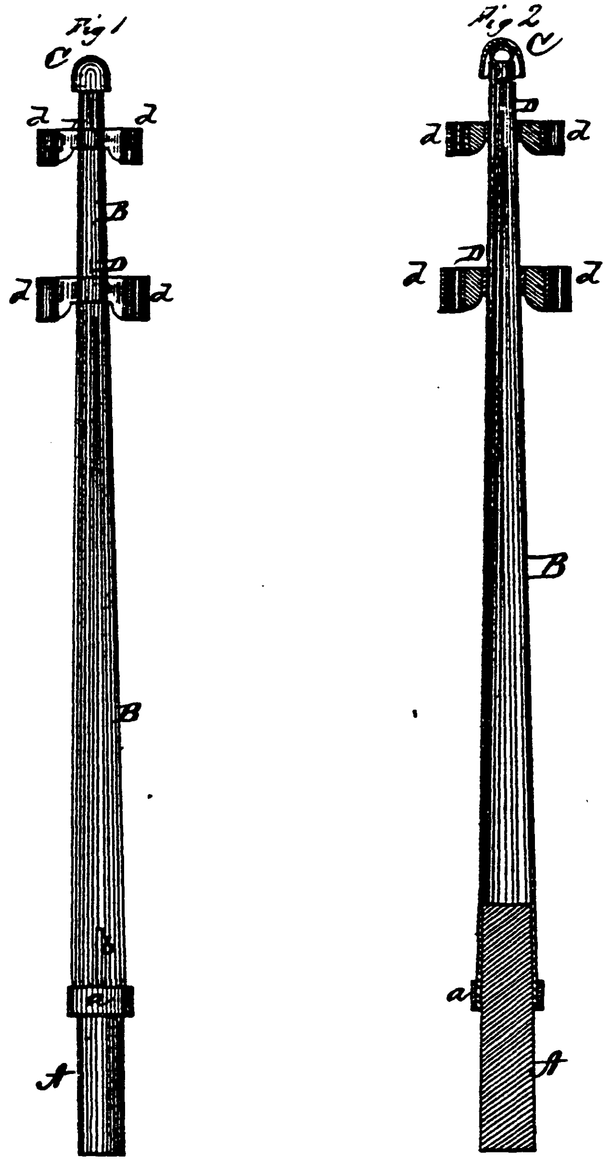
THOMAS JENNINGS McCARVER.
JAMES ATHEY.
BERRYMAN JENNINGS.

Witnesses:
ARTHUR WARNER,
WILLIAM PITT BURNS.

H. DODGE.

Telegraph Poles.

No. 140,255. Patented June 24, 1873.



Witnesses:

Franck L. Ourand

C. L. Evert.

Inventor.

Hiram Dodge

per Alexander Mason

Attorneys.

UNITED STATES PATENT OFFICE.

HIRAM DODGE, OF BEAVER DAM, WISCONSIN, ASSIGNOR OF ONE-HALF HIS RIGHT TO COLUMBUS GERMAIN, OF SAME PLACE.

IMPROVEMENT IN TELEGRAPH-POLES.

Specification forming part of Letters Patent No. **140,255**, dated June 24, 1873; application filed May 24, 1873.

To all whom it may concern:

Be it known that I, HIRAM DODGE, of Beaver Dam, in the county of Dodge and in the State of Wisconsin, have invented certain new and useful Improvements in Telegraph-poles; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings and to the letters of reference marked thereon, making a part of this specification.

The nature of my invention consists in the construction and arrangement of a telegraph-pole, as will be hereinafter more fully set forth.

In order to enable others skilled in the art to which my invention appertains to make and use the same, I will now proceed to describe its construction and operation, referring to the annexed drawing, in which—

Figure 1 is a side elevation, and Fig. 2 a vertical section of my telegraph-pole.

A represents the ground-support or base, made either of wood or cast-iron, and firmly placed in the ground in the same manner as telegraph-poles usually are put down. If this base A is made of wood it should first be immersed in hot coal-tar, so as to obtain a perfect coating of the same to preserve the wood. After it is firmly placed in the ground the pole B is placed on around the top of the same and fastened by a band, *a*, being firmly driven down, crossing a slot, *b*, in the lower end of the pole. The pole B is made in cylindrical or conical form, of galvanized iron, sheet-iron, or other suitable metal, made impervious to the effects of water or the weather by being, while heated, submerged in coal-tar. On the upper end of the pole B is a cap, C, constructed as shown in Fig. 2, so as to keep out the falling rain, and at the same time act as a ventilator far the dampness that may collect inside of the pole. On the pole B are collars or rests D D, for securely fastening telegraph-wires to the pole. Through arms *d d* projecting from said collars or rests are apertures for holding the wooden plugs, on which rest the glass insulators usually used on the old style of wooden pole. Around the pole B, and through the collars D D, I intend to place rubber bands or collars for the purpose of preventing the contact of the wire with the metallic pole in case of accident or breakage of any of the parts.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

The combination of the base A, pole B, band *a*, cap C, collars D D, with perforated arms *d d*, and rubber collars, as described, all constructed and arranged substantially as and for the purposes herein set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 26th day of July, 1872.

HIRAM DODGE.

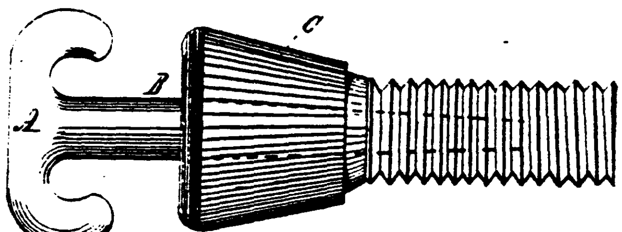
Witnesses:
J. E. HOSMER,
JOHN THOMAS.

I. SMITH.

Insulating Compounds.

No. 158,868.

Patented Jan. 19, 1875.



WITNESSES.

W. T. Newman,

Wm. H. Brereton Jr

INVENTOR

Isaac Smith

By Leggett & Leggett.

Attorneys.

UNITED STATES PATENT OFFICE.

ISAAC SMITH, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF HIS RIGHT TO GEORGE A. CHAPMAN, OF SAME PLACE.

IMPROVEMENT IN INSULATING COMPOUNDS.

Specification forming part of Letters Patent No. **158,868**, dated January 19, 1875; application filed January 16, 1874.

To all whom it may concern:

Be it known that I, ISAAC SMITH, of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Insulators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to an improved telegraphic insulator, and more particularly to the insulating material itself that is employed.

In the drawings, Figure 1, is represented an insulator of well-known form, in which the tang of the supporting-hook is insulated by the material that is the subject-matter of my invention.

A is any suitable metallic hook, provided with a tang, B, that projects up into and is insulated by the insulating material C, which material is prepared as follows:

I take the following ingredients, in proportions as follows: Asbestus, five pounds; shellac, two and one-half pounds; coal-tar, one-quarter pound; oak-black, one pound; paraffine, one-quarter pound; which proportions may be varied within reasonable limits, accordingly as the ingredients themselves vary in quality, and, by heat, work them together into a homogeneous mass, and I find the result to be a tough, hard insulating material, that is not acted on by water or frost, and to which water will not adhere. Then, to construct such an insulator as is shown in the drawing, a suitable piece of the material is softened by warming, is placed in a die with the tang B, and then, under the influence of strong pressure, the insulating material C is pressed and shaped as may be required around the tang B. The shape shown in the drawing is that of a screw, by which it may be fastened to a suitable support.

I do not limit myself to such forms of insulators as are shown in the drawing, nor to the combination of the material with a metallic hook, as other forms may be employed without departing in any degree from the principle of my invention, which refers to the insulating material wherever employed in cool localities to insulate a conductor of electricity.

It is obvious that asphaltum may be employed as a substitute for the coal-tar, and some other gum than shellac may also be employed instead of that ingredient, without departing from my invention, and so, instead of paraffine, spermaceti might be substituted, because each of these ingredients might be regarded, when used as above, as equivalents of those that I prefer to employ.

The ingredient "oak-black," hereinbefore mentioned, is the result of the distillation of oak-wood. The first substance drawn off is termed wood-alcohol, the second is a species of tar, and that which is left in the bottom of the still is oak-black. It is new to commerce, is black, bright, easily fractured, has a bright fracture, and resembles Nova Scotia coal, with a strong smell similar to tar.

I prefer generally to incorporate the foregoing ingredients by first mixing them, then passing them between rolls heated to about 150° Fahrenheit. After being thus incorporated the mass may be molded into suitable or desirable shapes in steel dies that have been heated, and after removal, while still hot, I coat them with hot paraffine, after which they are ready for use.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

The insulating material herein described, the same being a homogeneous mixture of shellac, asbestus, coal-tar, oak-black, and paraffine, in the proportions substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 31st day of October, 1873.

ISAAC SMITH.

Witnesses:
WELLS W. LEGGETT,
EDM. F. BROWN.

W. C. JOHNSON & S. E. PHILLIPS.
Insulator for Telegraph Wires.

No. 201,615. Patented March 26, 1878.

Fig. 1

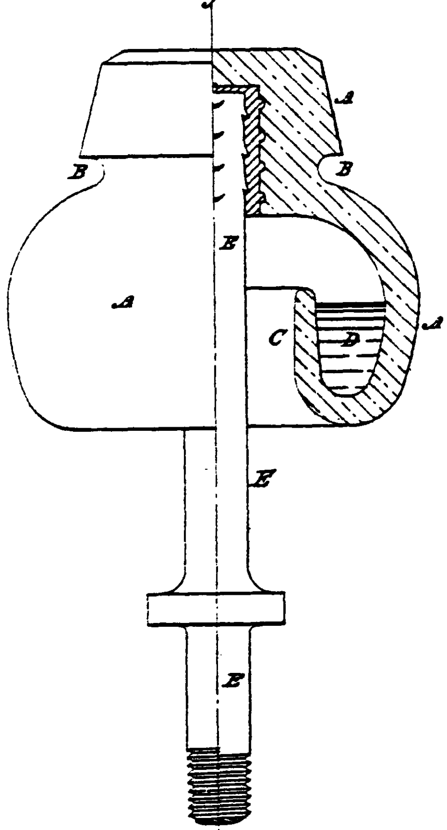


Fig. 3

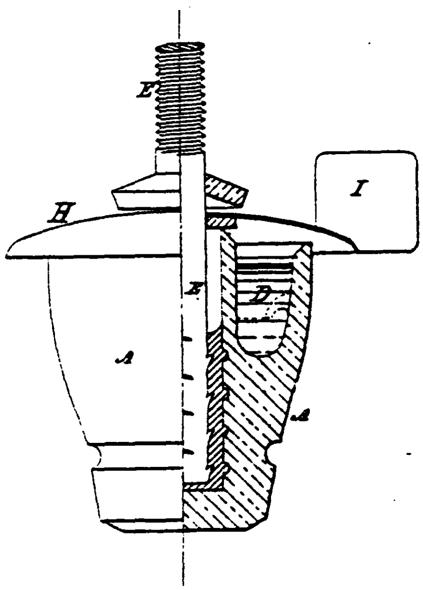


Fig. 4

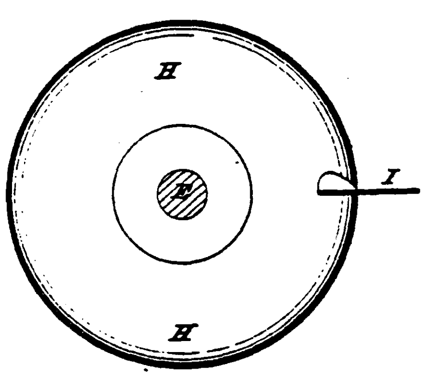
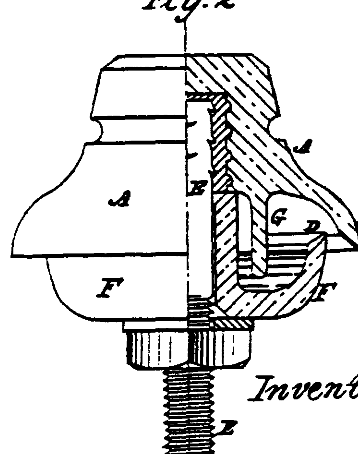


Fig. 2



Witnesses:
Will W. Dodge.
Donn P. Twitchell.

Inventor:
W. C. Johnson and S. E. Phillips
By Dodge & Son
Attys

UNITED STATES PATENT OFFICE.

WALTER C. JOHNSON AND SAMUEL E. PHILLIPS, OF CHARLTON, ENGLAND.

IMPROVEMENT IN INSULATORS FOR TELEGRAPH-WIRES.

Specification forming part of Letters Patent No. **201,615**, dated March 26, 1878; application filed August 22, 1877.

To all whom it may concern:

Be it known that we, WALTER CLAUDE JOHNSON and SAMUEL EDMUND PHILLIPS, of Charlton, Kent, England, have invented Improvements in Insulators for Telegraph-Wires, of which the following is a specification:

The object of this invention is constructing telegraph-wire insulators that they may contain a quantity of insulating hydrocarbon fluid, such as paraffine-oil, which will not support a film of moisture or dust on the surface, whereby we produce a better and more uniform insulation, especially during foggy and rainy weather.

We are aware that insulators have hitherto been made with inside cups or receptacles, containing paraffine-wax or other similar solid matter, and we make no claim thereto, our invention being limited to employment of the oil, or equivalent insulating fluid. By the use of the fluid instead of a solid, we secure a more perfect and permanent insulation, and avoid the danger of the insulation being destroyed, which is liable to occur in the event of the solid cracking or shrinking, or of dust setting on its surface and forming an absorbent for the moisture of the atmosphere.

The insulators, of porcelain, glass, or other suitable material, may have the fluid-receivers within themselves, the insulator acting as a cover, to shield the liquid from dust and dirt; or a separate receiver may be arranged under or within the insulator; or a metallic or other cover may be arranged above the fluid-receiver, which cover may be stationary or be caused to rotate by the action of the wind, whereby any web or filament may become broken.

The invention is clearly represented in the annexed drawings.

Figure 1—A is an insulator, of porcelain, of ordinary form exteriorly, the wire being fastened around or to the groove B, as is usual. This insulator is hollow, and has an internal lip, C, turned up, by which a receiver or reservoir is formed for containing hydrocarbon or other insulating fluid D. E is the stem or bolt by which the insulator is secured to the post, building, or other structure.

Fig. 2 shows a half-sectional view of an insulator, A, as a cover to a separate fluid-receiver, F, which is thus protected from dust and dirt. The insulator has a ring, G, dipping in the fluid for the perfect insulation of same.

Fig. 3 represents a half-sectional view of an insulator, by which a wire can be suspended in the usual manner. This insulator has its upper part recessed, to form a receiver or reservoir for the insulating-fluid D, and a cover, H, is fitted above, upon which, in some cases, we affix vanes or fan-blades I, as in Figs. 3 and 4, so that the wind may revolve it from time to time, and thus break any web or filament which might otherwise connect the insulator to the cover, and so to earth.

We claim as our invention—

1. In an insulator for telegraph-wires, a non-conducting fluid contained in a suitable cup or receptacle, and cutting off the surface connection between the wire and the exterior of the insulator, substantially as shown.
2. A telegraph-insulator having paraffine-oil or similar non-conducting fluid mounted therein, substantially as and for the purpose described.
3. A telegraph-insulator having a rotating cap, provided with a vane, substantially as shown, for the purpose of causing the wind to move the cap and break the continuity of any surface film of moisture which may form upon the insulator.

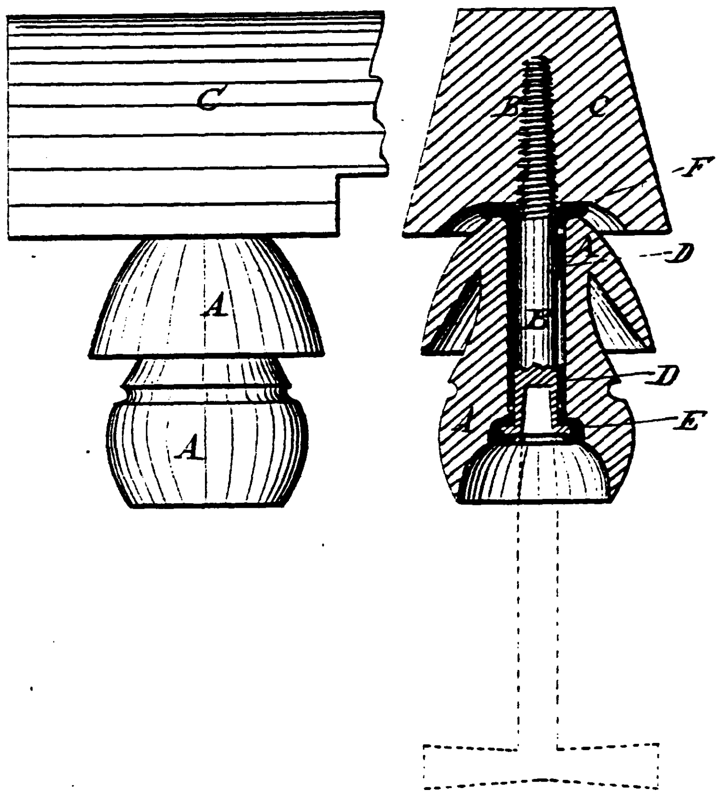
WALTER CLAUDE JOHNSON.
SAMUEL EDMUND PHILLIPS.

Witnesses:
JOHN SMITH, *Charlton.*
JOHN NEAL, *Charlton, Kent.*

J. H. BLOOMFIELD.
Telegraph-Insulator.

No. 216,138. Patented June 3, 1879.

Fig: 1. Fig: 2.



WITNESSES:
Achilles Schehl.
C. Sedgwick

INVENTOR:
J. H. Bloomfield
BY Munn & Co
ATTORNEYS.

UNITED STATES PATENT OFFICE.

JOHN H. BLOOMFIELD, OF CONCORDIA, ENTRE RIOS, ARGENTINE REPUBLIC.

IMPROVEMENT IN TELEGRAPH-INSULATORS.

Specification forming part of Letters Patent No. **216,138**, dated June 3, 1879; application filed January 29, 1879.

To all whom it may concern:

Be it known that I, JOHN HENRY BLOOMFIELD, of Concordia, Entre Rios, in the Republic of Argentine, have invented a new and useful Improvement in Insulators for Telegraph-Wires, of which the following is a specification.

Figure 1 is a side view of one of my improved insulators. Fig. 2 is a longitudinal section of the same.

Similar letters of reference indicate corresponding parts.

The object of this invention is to furnish improved insulators for telegraph-wires which shall be simple in construction, easily applied and replaced, which will not be liable to be broken by the breaking of the wire, which will not allow the wire to run down or slacken for several poles when the wire breaks, and which will not be liable to have the insulation of the wire destroyed by birds building nests of mud around them.

The invention consists in an insulator for telegraph-wires, formed of the insulator made of glass, porcelain, or glazed brown ware, perforated longitudinally and countersunk at the lower end of the perforation, the screw made with a round head having a square hole formed in it, the rubber bands, and the rubber rings, as hereinafter fully described.

A represents the insulator, which is designed to be made of glass, porcelain, or glazed brown ware, with a convexed upper end, a concaved lower end, and a downwardly-projecting cup-flange around its upper part covering the part around which the wire is to be fastened. The insulator A is perforated longitudinally to receive the screw B, by which it is secured to the lower side of the cross-bar C, attached to a pole.

The perforation is made a little larger than the body of the screw B, so that the insulator cannot be broken by the expansion of the said screw.

The lower end of the perforation through the insulator is countersunk to receive the head of the screw B, and the said head has a square hole or cavity formed in it, in line with the axis of the screw, to receive a key for screwing it into and out of the cross-bar C.

Upon the body of the screw B, within the upper and lower parts of the perforation through the insulator, are placed two rubber bands, D, to fill up the space between the screw and insulator and keep the said insulator firm and steady.

Upon the body of the screw B, at its head, is placed a rubber ring, E, which is made a little smaller than the said head, and which, when the screw is turned up into place, is pressed into the countersink in the insulator A, and around the outer edge of the said screw-head, so as to cushion the said screw-head and keep it from coming in contact with the said insulator.

Upon the screw B at the upper end of the insulator A is placed a rubber ring, F, which, when the said screw is turned up into place, is pressed into the upper end of the space between the screw and insulator, and between the insulator and the cross-bar C, so as to cushion the said insulator to the said cross-bar.

By this construction the insulator A is kept from contact with the screw B and the cross-bar C, and the said screw is allowed to expand without breaking the insulator A, and to contract without loosening it.

The under side of the cross-bar C is concaved to receive the upper end of the insulator A, to protect it from the weather.

With this construction, should an insulator be broken, a new one can be secured in place with the same rubbers and screw that secured the old one, so that the line-repairer will only have to carry a small key and a number of insulators, no nails, hammer, screw-driver, screws, &c., being necessary.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

An insulator for telegraph-wires, formed of the insulator A, made of glass, porcelain, or glazed brown ware, perforated longitudinally and countersunk at the lower end of the perforation, the screw B, made with a round head having a square hole formed in it, the rubber bands D, and the rubber rings E F, substantially as herein shown and described.

JOHN HENRY BLOOMFIELD.

Witnesses:

ERLE S. TALFORT,

J. PORRCHE.

J. RAUCH.

Telegraph-Pole.

No. 218,062. Patented July 29, 1879.

Fig: 1

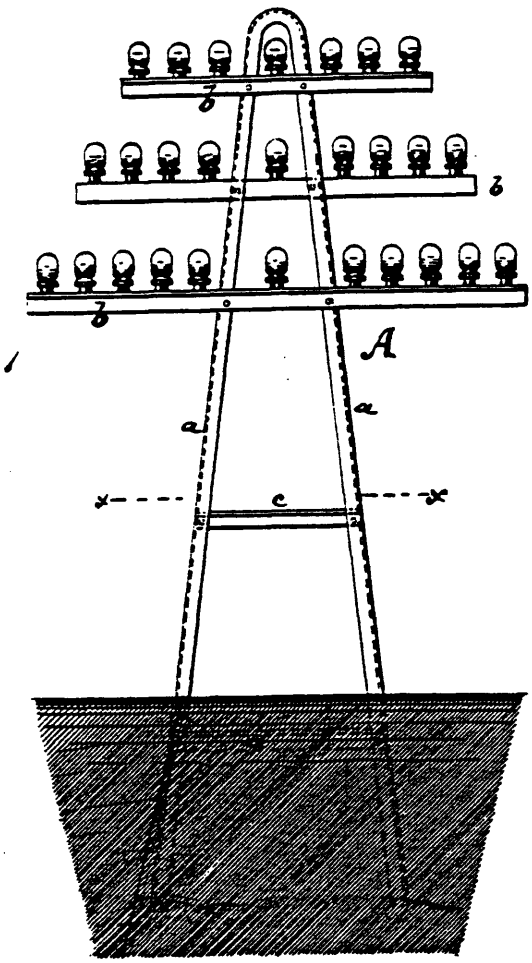
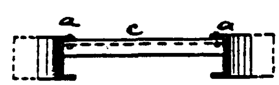


Fig: 2



Witnesses:

John C. Tunbridge

Willy G. E. Schultz.

Inventor:

Jean Rauch

by his attorney

A. v. Briesen

UNITED STATES PATENT OFFICE.

JEAN RAUCH, OF FRANKFORT-ON-THE-MAIN, PRUSSIA, GERMANY.

IMPROVEMENT IN TELEGRAPH-POLES.

Specification forming part of Letters Patent No. **218,062**, dated July 29, 1879; application filed April 24, 1879.

To all whom it may concern:

Be it known that I, JEAN RAUCH, of Frankfort-on-the-Main, Prussia, Germany, have invented a new and useful Improvement in Telegraph-Poles, of which the following is a specification.

This invention has for its object to improve the metallic telegraph-poles heretofore in use.

Heretofore these poles were similar to the wooden poles—single vertical uprights; but owing to the great weight of these metallic poles they had to be made comparatively thin, and offered but a narrow surface for the attachment of the horizontal arms that carry the insulators. At the same time these poles had to be sunk into the ground to a considerable depth, as they were heavy and had but a narrow base.

Now, my invention consists in making each telegraph-pole of two uprights, which are connected at the top and diverge toward the base, and which are combined by a horizontal brace, which serves to anchor them in the ground, as hereinafter more fully pointed out.

In the accompanying drawings, Figure 1 is a front elevation of my improved telegraph-pole. Fig. 2 is a horizontal section on the line *x x*, Fig. 1.

Similar letters of reference indicate corresponding parts in both figures.

The letter A represents my improved telegraph-pole. The same is made of rolled or other metal, and consists of two inclined uprights, *a a*, that are united at the top and diverge toward the base. The shape of the pole A in vertical longitudinal section is therefore that of the letter A. *b b* are the horizontal arms that carry the insulators in the usual or suitable manner. The arms *b b* are fastened to flanges projecting from the edge of the uprights *a a*, which uprights are made U-shaped in horizontal section, as shown in Fig. 2; but the uprights may be made L-shaped in horizontal section, in which case the arms *b* can be fastened to one side only of the uprights.

The arms *b b* may be fastened to the flanges of the uprights *a a* by pins, rivets, screws, or other fastening devices, the flanged uprights offering ample surface for their attachment.

c and *d* are horizontal braces, which connect the uprights *a a*. The brace *d* is applied near the lower end of the pole, so that it will be under ground when the pole is put up, and serves to anchor the same. The pole A will be firmly supported in the ground, even if inserted to a short distance therein.

I claim—

The combination of the A-shaped telegraph-pole A with the horizontal brace *d*, which serves to anchor it in the ground, substantially as specified.

This specification signed by me this 6th day of March, 1879.

JEAN RAUCH.

Witnesses:
Dr. G. RADERMACHER,
D. SHÄFER.

Applying the Glaze

The glaze ingredients, be they raw or fritted, are powdered and mixed with water and clay into a mixture called a *slip*. Then the pieces to be glazed are either sprayed with or dipped into the slip. Too fluid a glaze causes sticking, or bubbles and blisters in the coat; too viscous a glaze causes other faults, such as "crawling," or failure to smooth out. Somewhat rarer methods of application involve dusting or painting the pieces with the glaze ingredients.

Colored Glazes

Glaze is a smooth, glassy coating. Often it is colored; it can be glossy or dull in finish, or spotted with crystal specks. Special ingredients are responsible for the colors and textures of glazes. Compounds of certain elements, many of them metals, give color to ceramic melts. For instance, red is produced by gold, uranium, selenium, or combinations of chromium and tin or of chromium and aluminum. Cadmium and vanadium compounds give yellow. Green is produced by copper or chromium, blue by cobalt, purple by manganese, brown by iron or nickel.

In addition, colors can be altered by the conditions of firing. Instead of green, copper can be made to yield blue or red. Iron can produce green, blue, or red; uranium, black; cobalt, pink or purple; vanadium, purple. The ceramist adjusts the firing so as to make the pigments produce either normal or "transmutation" colors. To illustrate this point, consider a bottle that is colored brown by iron. The same iron under different conditions is responsible for a beautiful light green, called "celadon," seen on Chinese plates and vases.

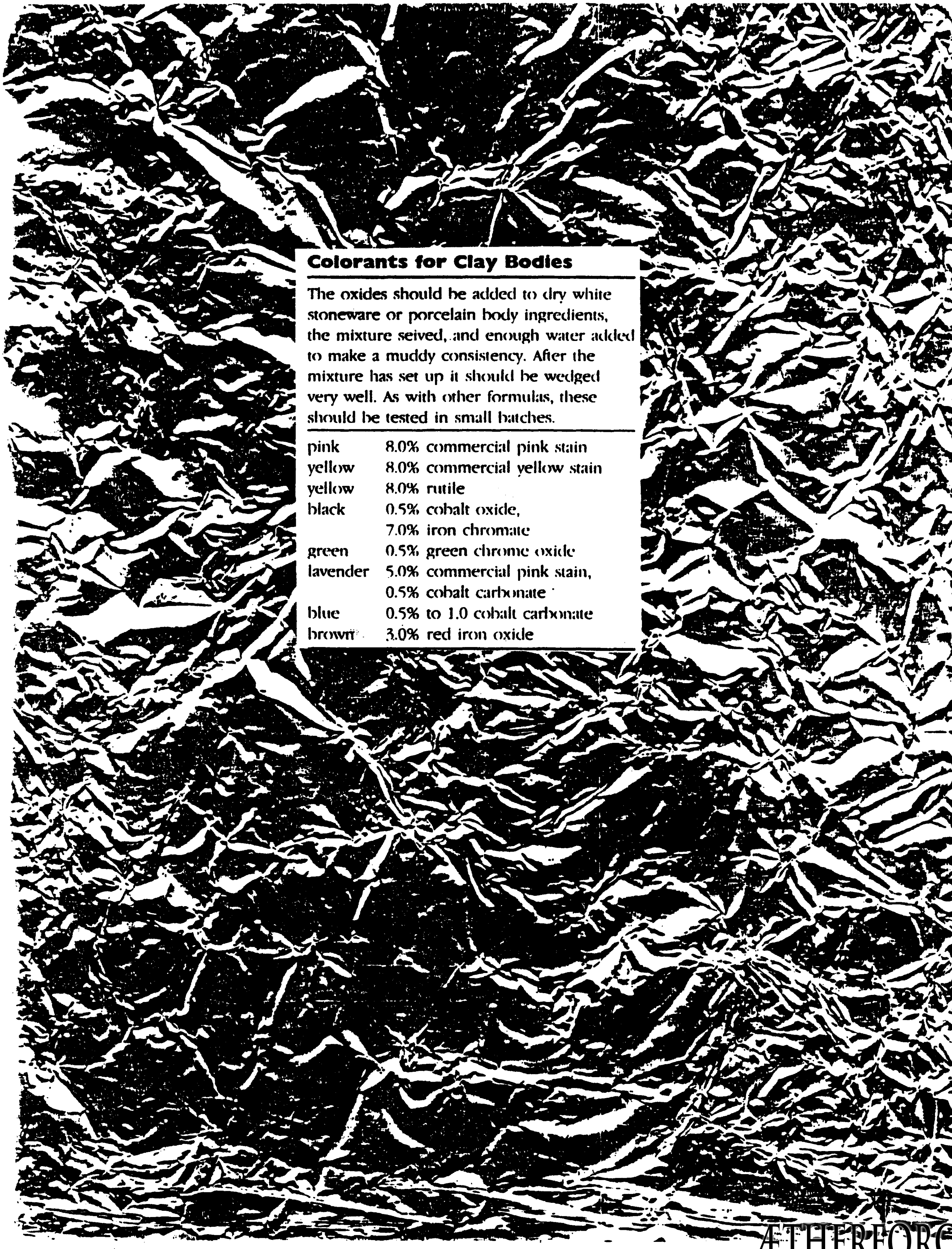
Whenever red or gold colors are desired in combination with other colors, an additional firing is required because these colors burn out at high temperatures.

White glass, such as milk glass, the white glazes that cover toilet porcelain, and the white enamels that coat refrigerators and stoves contain a white pigment called an *opacifier*. Compounds of tin, antimony, zirconium, and phosphorus are the usual opacifiers.

Porcelain insulators are shown here stacked on a car, ready to enter the tunnel kiln. Temperature within the kiln reaches a maximum of 2,300° F.

Unusual Effects with Glazes

There are beautiful, crystalline glazes that have feathery, colored crystals embedded in them. These glazes contain ingredients that induce crystallization during cooling. Manganese compounds, for example, promote crystal growth. Bismuth compounds produce an iridescence that gives a glaze of mother-of-pearl luster. Other compounds produce metallic lusters. In all cases the glaze reflects its composition and its heat treatment, be it bright or dull, opaque or clear, uniform or speckled, smooth or rough.



Colorants for Clay Bodies

The oxides should be added to dry white stoneware or porcelain body ingredients, the mixture seived, and enough water added to make a muddy consistency. After the mixture has set up it should be wedged very well. As with other formulas, these should be tested in small batches.

pink	8.0% commercial pink stain
yellow	8.0% commercial yellow stain
yellow	8.0% rutile
black	0.5% cobalt oxide,
	7.0% iron chromate
green	0.5% green chrome oxide
lavender	5.0% commercial pink stain,
	0.5% cobalt carbonate
blue	0.5% to 1.0 cobalt carbonate
brown	3.0% red iron oxide

Guide to Use of Colorants

Color	Oxide	Percentage	Temperature	Atmosphere
black	cobalt	1-2	any	either
	manganese	2-4		
	cobalt	1		
	iron	8	any	either
	manganese	3		
blue	cobalt	0.5-1	any	either
turquoise	copper (alkaline flux)	3-5	low	oxidizing
slate-blue	nickel (with zinc)	1-3	low	oxidizing
brown	rutile	5	any	reducing
	chromium (with MgO, ZnO)	2-5	low	either
	iron	3-7	any	oxidizing
	manganese	5	any	either
	nickel (with ZnO)	2-4	any	either
green	copper oxide	1-5	any	oxidizing
gray-green	iron	1-4	any	reducing
	nickel-magnesia	3-5	low	oxidizing
red	copper (alkaline flux)	1	any	reducing
	iron (high SiO_2, KNaO), CaO	2-5	low	oxidizing
pink	chrome and tin (1 to 18)	5	any	oxidizing
coral	chromium (with high PbO)	5	low	oxidizing
purple	manganese (with KNaO)	4-6	any	oxidizing
tan	iron	2	any	either
	manganese	2	any	either
	rutile	2	any	either
yellow	antimony yellow stain (with high PbO)	3-5	low	either
	praseodymium yellow stain	4-6	any	either
	uranium yellow and orange (with high PbO)	5-8	low	oxidizing
	zirconium-vanadium stain	5-10	any	either
	tin-vanadium stain	4-6	any	either