VRIL COMPENDIUM

VOLUME

3

VRIL LINKAGE

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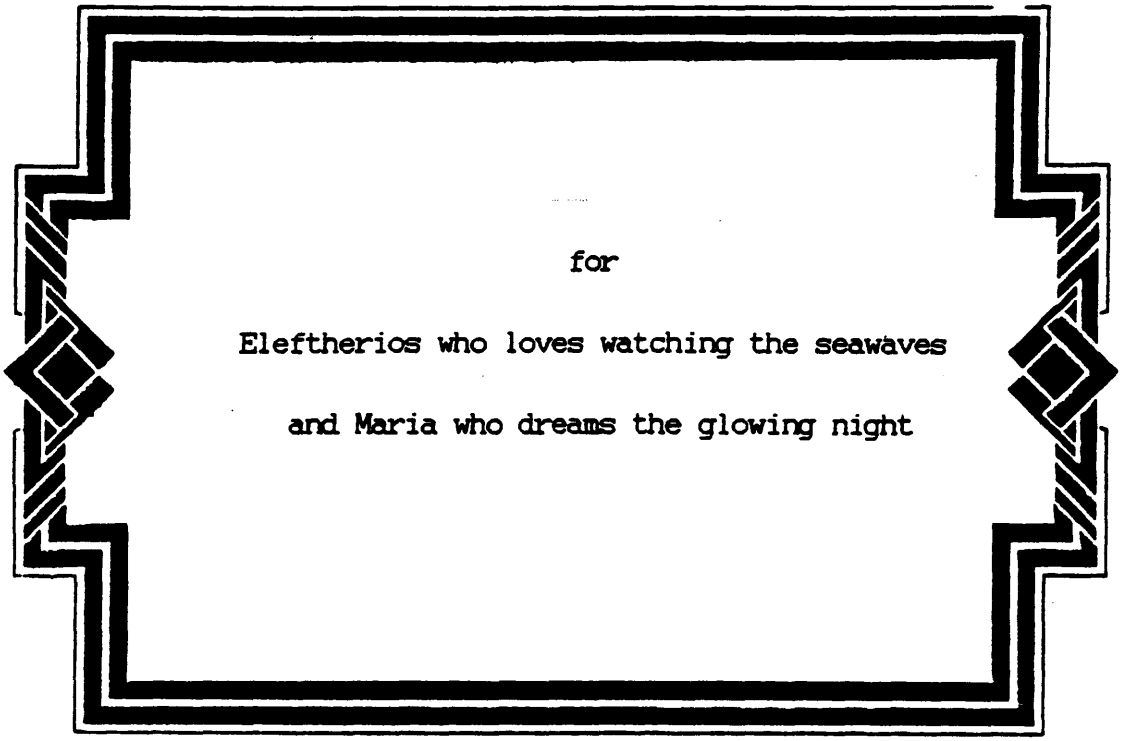

for

Eleftherios who loves watching the seawaves

and Maria who dreams the glowing night

SECTION

1

COMMENTARY

VRIL COMPENDIUM III

VRIL systems display intelligence because VRIL is intelligence. VRIL permeates all systemologies. VRIL is the ground of being. VRIL manifests when human technologies remove artificially applied codes. VRIL is the means through which Divine Presence is communicated. VRIL is responsive to needs.

True VRIL potentials fulfill human organismic desires. Systems are VRIL conductive before detrital species are applied to them. VRIL translates participants. VRIL translations sends participants through VRIL worlds.

Prime VRIL access reveals VRIL dendritic matrices. VRIL matrixial junctures reveal VRIL eidetic worlds. VRIL worlds inter-relate in hegemonous hierarchies. Physical experience is inertio-referenced. Meaningful experience is VRIL world referenced.

Descriptive examinations of material configurations are inertially referenced. VRIL eidetic world experiences translate participants free of inertial restrictions. VRIL eidetic world consciousness is inertia-free consciousness. Inertial impedance limits organismic extension in VRIL eidetic worlds. Special material configurations permit prolific organismic conscious extent amid VRIL eidetic worlds.

Related regional hegemonies compose the apparent world. Apparent world infrastructure is limited to VRIL eidetic world terminal distributions. The apparent world is a multi-juncture terminal of innumerably merging VRIL eidetic worlds. This explains the structure and experience of the apparent world. The apparent world exists because of an inertialized space. Inertia is alien and hostile to VRIL expressions. Inertia is rigid space-reference.

Innumerable VRIL threadways intermesh throughout VRIL experiential spaces.

VRIL provides free translatory experience. VRIL is self-referencing.

VRIL translatory experience is true organismic experience. Inertial space impels organisms to perceive VRIL juncture in spatially separated distribution. Inertial space is RESISTIVE separation. Inertial patterns maintain fixed form. Inertial patterns hold in spatial form. Inertial patterns can be detrital species-specific. Inertial patterns effect degenerating species of detritus.

VRIL Science differentiates inertial detritus. Electro-detrital products are differentiated from other neutral forms by the organismic sensations which they produce. Each design produces a discernably different electro-detrital species. VRIL Technology arranges the collimation and directivities of electro-inertial detritus through reliable componentry.

Inertia distorts, impedes, impels, invades, and resists VRIL eidetic world experience. Inertio-sensory pressures force distorted organismic response. Apparent world experience is inertio-sense pressured. VRIL thread mergings give true sensual experience. VRIL nodes fill projected experiential space.

Eidetic contact shatters false perception. Eidetic contact destroys inertio-distorted perceptions of spatial separations. VRIL technology seeks to magnify and refuse interrupted eidetic connectivity.

VRIL projects space. VRIL projected space permeates. VRIL projected space is consciousness. Consciousness and experience is differentiated as specific eidetic worlds.

Thoughts and thought forms may be tracked in their passage through VRIL thread space. Transverse observation of VRIL threads delays eidetic communion. Transverse VRIL observation permits quasi-inertial knowledge of otherwise eidetic transactions. The sensitive may observe the passage of experiential translations among VRIL junctures across space. Eidetic world projections through materials is spontaneous. Organismic contact or intent is not necessary for spontaneous projections and transactions. VRIL examines itself. Eidetic world projections release inertial effluences through inertial space impacts.

The human organisms needs VRIL eidetic contact. Other worlds feed this apparent world. Eidetic experiences give synaesthesis which contradict the apparent world. Eidetic worlds defy the apparent world in season, time of day, and weather patterns. Eidetic worlds are wondrous, original, pure, and untainted. In them we may see night towns in broad daylight, spring blooming during winter, and bright sunny meadows at midnight. Eidetic worlds defy reason and 5-sensor argument.

Eidetic worlds are contradictions of the inertial space which they defy and dissolve. We may experience translation up into snowy upper spaces, discover watery lakes where houses are founded, and ascend up into galactic frosted blue stars. These are not projections of consciousness. These are transactions of projected worlds through material contacts. They require no personal force, initiation, or effort.

Eidetic worlds preserve and project things lost to this world during specific seasons. We discover flowers in winter. VRIL infra-structure projects vital holisms and experiential space. VRIL eidetic connectivity permits total participational translation. VRIL space is translatory SUFFUSION. VRIL dissolves, cavitates, eradicates, and translates inertial space into an eidetic "hole" world ... an abyss of dissolutions.

VRIL junctures permit expanded consciousness. VRIL junctures dissolve inertia and permit eidetic translatory revelation. VRIL eidetic worlds illuminate regions from beneath (Corliss). VRIL eidetic worlds manifest anomalously irregardless of apparent world stratifications (C.Fort). VRIL worlds invade the inertio-apparent world with anomalies.

VRIL worlds self-participate and self-interact. Operators effect VRIL transmutations via contact. VRIL contact prolongs VRIL eidetic world presence along local axes via operators. VRIL interpenetrates experiential space. VRIL examination requires direct contact. VRIL eidetic is transacted via VRIL threads.

VRIL requires conduits, materials, and proper alignments for its proper utilization. Metal plates through which VRIL transacts become VRIL engraved hieroglyphs of superlative mystery. Human organismic interactions with such designs release revelational experience of highest degree. At the glowing center of the regional VRIL archeforms (crystallographic pyramidals) is found a special black pool of generative VRIL: the exceptional presence desired by each living sentient being. VRIL projects generativity and sustains worlds. VRIL aurae are tufted striations. Specific VRIL aurae contain progenerative inflections during specific times. VRIL Science is not mechanistic. VRIL Science is empirical and experiential. VRIL Science discovers experiential meanings through eidetic contacts. VRIL Technology designs and arranges experientially derived componentry.

VRIL threads are indivisible portions of their parent eidetic worlds. VRIL threads give trans-regional experience. Design-determined material configurations give desired VRIL eidetic experience.

VRIL threadways remain in contact with

participating organisms. VRIL threads utilize synaptic junctures in human neurology. VRIL experiences require place-visitation. VRIL experience exalt consciousness and virtue.VRIL aurae are innately withdrawn and enfeebled as a result of inertial immersions. The blackness of VRIL presence is seen in the ground also. Black radiance is VRIL striated presence. VRIL presence is viscero-eidetic potential. VRIL revelations provide short-cuts through which we achieve futural science.

VRIL eidetic messagings direct and restructure human consciousness into deepest VRIL potentials. VRIL eidetic consciousness breaks inertial bondage to the 5-sensory degenerate perceptive mode. Human physiology is not inertially defined, discerned, or operated. Human physiology is not schematically comprehended through the pressures of inertial detritus.

VRIL Light is formative radiance. VRIL Light gives eidetic translation among and through VRIL Templates. Eidetic transactions reveal native phenomena utilized by VRIL technology. VRIL technology requires knowledge only of VRIL natively available transactions. VRIL threadways are copiously and densely found in the ground. The ground is our normal VRIL reference domain. Organisms largely rely on ground for VRIL ground transactions which engage human consciousness in necessary eidetic experience.

Examination of the VRIL Template which sustains experiential horizontality reveals intriguing aspects pertinent to VRIL Science and VRIL technology. This VRIL Template generates and sustains the stratified appearance of ground and space. Apparent World is an ordained profusion of viscero-eidetic projections. Experience is most potent along specific VRIL Axes which transect districts and regions. VRIL Axes project sensual fullness of experience. Being is infrastructural rudimentary in absence of eidetic projections.

With proper VRIL transactors the mind may be guided into earth beyond inertial limits. Deep subterranean nodes transact with the sensitive. Juncture-interconnections require special mapped knowledge of VRIL node and VRIL juncture distributions. VRIL maps must be extant throughout whole volumes of experiential space.

Viscero-eidetic experience reveals specific experience via specific arrangements. Arrangements release specific experience. VRIL Science is configuration specific science. VRIL projected experience is the unifying radiant space in VRIL Science.

VRIL loads systems with meanings. The very form and disposition of systems become noumenous and enigmatically suggestive. Ideas, metaphors, and strange significations are radiated from VRIL loaded systems. The fluorescence of VRIL loaded systems is eidetic transactivity.

VRIL continuities and holisms are evidenced as chunking of system components. Meanings crystallize in systems. Portions of whole meanings crystallize in specific components. These may be isolated and experientially examined. Separating such components of VRIL dense configurations result in loss of context and meaningful system operation. This is especially apparent in written minerals and metals: where separating single sentences suffices to derange the reader's continuous meaningful transactions.

RECOGNIZE that there are natural Insensate Processes whose activities are not humanly traceable. LEARN that the Insensate and Inactive are vast VRIL fundamental activities which the human organism cannot yet discern.

VRIL dynamic systems appear inert and static to the insensitive beholder. VRIL structures are radiant, noumenous structures of formidable and respectful aspect to VRIL sensitives.

FORMATIVE RADIANCE

Eidetic luminations have been photographed through various sensitive (chemical) processes. Eidetic luminations react with other eidetic transactions to produce fractions of their total light emissions. VRIL interactions permeate and suffuse all detection means. All chemical detection processes are necessarily and primarily eidetic interactions. Such specific processes intercept fractions of the more total display of an eidetic transaction.

VRIL eidetic transactions are notable for their everpresence, permeativity, and suffusive quality. VRIL transactions are detected as eidetic processes. The true intelligence of the universe is experiential: visceral and eidetic intelligence flood all materials. Contacts with matter is contact with the distributed intelligence of VRIL space.

VRIL radiance caused the offices and terminals of telegraphic and telephonic companies to stand stark and glowing with meaningful eidetic potentials. This effect is captured in photographs. Furtive material contacts transact lasting eidetic impressions. Short interrupted contacts deposit eidetic traces which are largely ignored. The universe of matter is an available continual transaction with VRIL itself.

Minerals and metals produce eidetic world transactions which penetrate and dissolve the inertial environment. Minerals and metals expand specific holisms into their immediate surroundings. Each is distinct.

Material combinations do not eidetically give the simple sum of their eidetic constituents. Eidetic transactions of material combinations surpass the sum of their eidetic parts. Pure VRIL LIGHT is semi-sensate. Pure VRIL LIGHT is organismically sensed. Pure VRIL LIGHT is the light of eideto- projective worlds. Each eideto-projective radiance differs in quality and character. Each eideto-projective radiance projects qualities and characteristics of pure worlds into our own world structure.

Baron Karl von Reichenbach studied spontaneous illuminations of all minerals and metals in darkness. These excellent studies fell short because they focussed attention only upon detrital luminations of inertial space. They prove the continual VRIL activity which proceeds as an insensate presence through space.

Significant eidetic translations were not mentioned by these researchers. No doubt the free translatory eidetic experiences gained through dark-room observations of minerals and metals provides rich treasuries of knowledge. VRIL photographs analogue the metal-dependent tone-signatures which have been identified as audio energy (Vassilatos).

P. Dobler photographed VRIL activated inertial phosphorescence in ground. Metallo-densifiers were utilized to focus VRIL eidetic projections. VRIL eidetic projectivity is metal-specific. Eidetic intensity dissolves inertial space in white sheath phosphorescence. Auric colorations near radiant eidetic projectors vary considerably. Color photographs of VRIL LIGHT content have not been reported.

VRIL LIGHT is viscero-eidetic. VRIL LIGHT is pure. Auric phosphorescence is composed of two distinct species: white-sheath light of inertial dissolution and pure transactive viscero-eidetic light. Metal transactor plates mounted with special photographic emulsions may be placed upon the ground or buried. Most powerfully illuminated plates are those which employ zinc. Zinc gives strongest white-sheath phosphorescence when ground-buried. The eidetic world of zinc is entirely groundward oriented. Zinc eidetic world is snowy white. Dobler inadvertently transacted with VRIL eidetic worlds through this process.

Inertial white-sheaths surround insensate VRIL threads. Inertial white sheaths accompany the VRIL transaction of lodestone. These effluences are visually recognized as white misty flares and wispy rays near magnetic spaces. White wisps and flares correspond with VRIL irregularities in lodestone crystal. Wispy white flares signal VRIL

surge-activated cavitations in inertial space at micro-nodes on lodestone surfaces. Magnetic light has been photographed. It is the result of complex VRIL projected cavitations in inertial space. Partial distal-eidetic photographs have been made by certain researchers (Drown, DeLaWarrs).

White fibril phosphorescent manifestations are not VRIL. Such manifestations of light distort and diffract some quality of the projected eidetic worlds through inertial densification. Eidetic transactions through materio-organismic contact collimate inertial detritus. Inertio-organismic collimations prove dangerous to vital integrity.

White sheaths are dead displays which stimulate specific retinal responses via inertio-pressive effort (Kilner). Inertio-sensory stimulation is degenerate primitive stimulation. The human organismic responses to inertial pressures are primitive sensory displays devoid of eidetic experience. Inertio-detrital displays glow in colorations which are well known. Inertial glowing detritus remain in degenerate sensory realms. These are devoid of meaningful potential.

Eidetic experiences are the "aethers, aurae, and atmospheres" of Victorian lore. The darkroom examination of all minerals and metals reveals visceral and eidetic phenomena.

Specific substances may be grouped according to their visceral attributes. The exterior surfaces of minerals and metals fluoresce under white light. The "color" of matter is surficial and exists only in white light illuminations. Topological interiors do not display colors. The coloration of surfaces limits our view. Material interiors remain dark. Coloration is meaningless in the dark. Darkroom eidetic transaction is primary and fundamental sensory-experiential.

Darkroom viscero-eidetic transaction gives contrary colorations (Reichenbach). Iron is sensed as sharp black. Zinc is sensed as soft black. Copper is sensed as yellow-green. Elemental lead and mercury each choke viscero-eidetic transactions to degrees which prevent human experience. Silver produces bright white visceral lights tinged in purple and blue.

Dr.Gustav Le Bon discovered the pervasive and suffusive existence of what he termed "Dark Light". Thick cylindrical ebonite plugs completely filled the beam path of oil lamps to charge matter. Photographs taken after such charging resulted in special and remarkable photographs in total darkness. Dark light was released for days afterward and was capable of illuminated rooms with radiance of this light. Photographs illustrated his claim. Dark light passes through objects and illuminates them. Dark light can be used to photograph whole room segments from behind the projecting lamp. Dark light is not infrared light.

Dr.Le Bon produced numerous photographs without the use of the special projector lamp. All substances spontaneously and mysteriously emit this bright white "Dark" light. Special emulsions are used to photograph what the eye cannot see. Dr.Le Bon captured these phenomenal illuminations on such chemical emulsions. The brightness of Dark Light exceeds that of sunlight. Human sensors do not perceive this extremely powerful radiance unless activated through VRIL eidetic transaction.

VRIL LIGHT is true light. VRIL generates pure light. Inertially produced light is the result of frictive action when VRIL threads impact inertial space. VRIL LIGHT is everywhere. VRIL LIGHT is insensate. Natural human organismic functions deal with viscero-eidetic transactions which seem suppressed in most inertial spaces.

VRIL LIGHT is formative radiance. Apparent world structure is defined and determined by VRIL meaningful transactions. Apparent world structure is quality devoid in absence of eidetic world transactions. Eidetic transactions flood apparent world structure in holistic qualities. Apparent world structure is terraced, sectional, and boundary distinct. Eidetic places, districts, regions, worlds, domains, and Templates define reality. VRIL experience does not give topographic continuity. VRIL psychotopography is sectional. VRIL sections are eidetic projections. VRIL eidetic projections may be mutually independent. Projective eidetic radiance forms and floods this apparent world structure in qualities.

VRIL LIGHT gives eidetic translation via VRIL Templates. VRIL experience reveals specific organizing permeations. VRIL experience indicates existence of VRIL Space Templates. Sentient experience is Template resonant via specific technological designs. Normal experience transects numerous VRIL Templates in succession.

We must empirically examine natural substances to discover the true foundations of inertial reactivities and visceral attributes. VRIL LIGHT is radiant pure LIGHT. VRIL LIGHT may be organismically intensified by appropriate receptors. VRIL LIGHT radiates from the ground directly. VRIL LIGHT is sharply focussed and active in certain districts. Organismic sensory receptors may give direct experience of VRIL LIGHT. Photographs give inertial by-products of eidetoprojective VRIL LIGHT.

VRIL LIGHT coincides with dowsing currents and visceral ground-lines. VRIL LIGHT coincides in densification with Lahovsky ring-resonators, Lecher parallel-wire assemblies, H-shaped resonators, cavities, fissures and gaps. VRIL LIGHT is eidetically powerful. Specific intense VRIL LIGHT does not interact with inertial space. Semi-sensate interactions cannot reveal correlations of VRIL presence through measuring devices and photographic plates.

Dowsers have long known that the detection of "substance lines" in any locale is specific. Dowsers were sensing these potentials for centuries with the apparatus of their own organisms: VRIL sensory vision. Dowsers could literally see the subterranean surgings, seething storms, deep rivers, black glowing streams, resounding caverns, whorling springs, subterranean cataracts, and underground falls.

Many people dream of these VRIL structural realities. The natural appearance of VRIL channels, threadways, and causeways (deepest) is envisioned by VRIL sensitives who perceive these as glowing black "subterranean rivers". Mistermed by dowser as "subterranean water channels" each VRIL causeway is exceptionally densified in ground and ground strata.

We recognize the trace of dowsing arts amid the old scientific literature of the Victorian Era. The search for VRIL threadways was often the driving force behind geographic exploration. Those who misapprehended these wonders were often disappointed.

Marvelous rivers of rock-transfusing VRIL threadways are still a wonder to behold. Inertialists measured electrical and magnetic detritus where VRIL channels surge. In typical manner these were equated with telluric currents.

There are instances in which spontaneous and anomalous sunny-yellow illuminations suddenly appear near dried organic minerals and metals. These are experienced on cloudy days as warm and anomalous illuminating presence of orange-yellow solar-like light at fixed foci above certain districts. Such aerial positions correspond to VRIL aerial nodes. Phosphorescences which appear to emerge from the ground are never uncommon.

The discovery of proper means of releasing this pure potential will enable wonderful new social consciousness. Stubblefield, Tesla, MacFarland-Moore, and Moray succeeded in achieving varieties of these translations.

Inertial space cavitates and luminesces when focussed VRIL penetrates space volumes. The imperfect process of contemporary illumination employs the concentration of inertial condensates in material wires or gaseous spaces. Frictively impacted min-

erals and metals conduct an inferior fraction of VRIL LIGHT in plasma tubes and incandescent lamps. Illumination technology makes minimal use of pure VRIL LIGHT.

Many experimenters have not properly understood the work of Stubblefield and Tesla. What these and other researchers (MacFarland-Moore) realized to some degree was the essential purity of that which we call "light". I say "purity of light" because true light is a quality and essence: not an effect. Those whose designs cause light to manifest through a gradual staging of ever-degenerating inertial effects do not understand Light at all.

Stubblefield said that he had "succeeded in taking light from the ground". His demonstrations proved that tremendous amounts of light could be taken from earth directly: and many witnesses repeat their sightings of his cabin grounds "flooded with light all night long". To the careful examiner, the Stubblefield battery cannot possibly generate electrolytic amounts of charge to accomplish this feat. Neither did Mr. Stubblefield have a huge bank of batteries to accomplish this feat. Mr.Stubblefield charged batteries from his ground device.

Visitors to his tract of land were startled by the sheer amount of "white light" released through his apparatus. They were substantially amazed to remember and report them. Firsthand witnesses recounted their tales with sufficient bravado to convince anyone of the real truth: Stubblefield had indeed released the VRIL LIGHT. The release of pure white light was not therefore the result of "electrical gaseous friction".

His ground coils are VRIL terminals. They are not electrolytic cells. The need for "dowsing out" the proper placement of these plugs was a known fact to those who studied the testimonies of his son, Barnard Stubblefield. Dr.Thomas Morgan mentioned statements made to him by Barnard to the effect that the Stubblefield battery was "an electrical plug...not an electrical battery". Mr.Stubblefield insisted that his design be called a "magneto- electric cell...a receiver of earth electrical waves".

Inertialists have a distorted view of energy; believing that work must be performed in order that manifestations be released. They furthermore believe that certain systems do not develop energy but rather exchange work functions. Energy of the kind and order with which Mr.Stubblefield was involved is native energy: densified transactive power in the ground.

VRIL is responsible for the "spook lights" seen in many swamplands and across meadows during the night. Stubblefield had accomplished was realistic channeling of pure VRIL LIGHT directly into carbon-vacuum arcs. His use of this material composition is significantly alchymycal in nature.

Meanings leave a luminous trace. Visions record on film. Transactions may be captured in appropriate manner. Dr.Ruth Drown mysteriously retrieved interior anatomical views of the human organism through the use of VRIL LIGHT. VRIL energy and presence cannot measure directly on inertial meters: being experiential energy. Devices partake of experience and meaning. These may only be enjoined through viscero-eidetic contacts.

VRIL sensory awareness (in the aerial and subterranean expanses) permitted the development of both earth and aerial batteries. "Corridors" and "hallways" of underground energy were very real to the early telegraphic and telephonic engineers. Through the aid of their technically gifted helpers frequent dramatic proof that the "old discerning methods" were valid and useful.

Geomantic formations (to which dowsers were sensitive) often did not correspond with geological formations. Nevertheless the dowsing means by which grounds and lines were structured often revealed the presence of anomalously active energies. We have several accounts of telegraph lines whose operation depended solely upon VRIL projected power for years.

Certain inventors describe what seems to be underground electrical rivers into which grounded wires are deposited (Farmer). It seems likely that the particular spots chosen for the groundplate sites were "dowsed". Telegraph and telephone lines were grounded at each terminal point. Strong signals were exchanged among station operators with very little battery power. Applied currents seemed to be self-magnifying along specific ground routes. Many telegraphic operators had extraordinary eidetic experiences during night service time.

Early telegraphic linesmen were dowsers. Such sensitives were actively employed to determine the proper alignments of lines and buried cable conduits. These individuals laid cable and erected aerial line-guides precisely along VRIL threadways and VRIL channels.

Telegraphers and early telephonists accept the important action of geomantic factors in their systems. The numerous hired "old-timers" were experts at locating "good groundsites" by instinct alone. This artifact of the dowsing arts managed to survive until meters and artificial aids were developed to service the insensitive.

The few old-timers who knew the secret of seeking "good ground" and favorable geomantic tracts of land (for raising or laying lines) were disappearing. These earth-features (of which they were deeply aware) were often utilized directly in guiding and intensifying the transmission of telegraphic signals. Road engineers whose work with telegraphy and telephone paid heavy attention to subterranean and subaqueous conduction paths were privy to many secrets of the land. With these few went the mysteries which made the first (anomalous) rediscoveries of VRIL.

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 VRIL 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. Of further note is the deranged conditions which certain such cable connections actually brought into existence.

Deepest VRIL causeways can never be approached. These supply experiential structure. The systemological transactivity was enormous. Social activations became VRIL polarized. Aerial lines and buried cable conduits (which conform with underground VRIL channels) are especially powerful as VRIL eidetic transactors.

Telegraph cable and telephone cable resembled VRIL threadways. VRIL naturally entwined and transacted with these line systems. VRIL pre-existent ground surface structures were eventually violated by expanding enterprise. Massive systems assault laid cable conduits across VRIL threadways. Systems and enterprise were eventually guided away from the use of wires entirely.

Nathan Stubblefield proved that VRIL threads were self-organizing and self- articulating.

VRIL threadpaths seek out their recipients in the absence of distinct connective lines. Ground-wedded radionic devices were always the most potent in activity and results (G.W.Starr-White, R.Drown, Hieronymus). Grounded apparatus become enhosted by eidetic ground node attributes. Grounded apparatus become eidetically radiant to all who behold them. Viscero-eidetic transactions regenerate inertified conditions in districts. All minds turn into the eidetic ground nodes of a district. All eidetic imagery focusses upon special such VRIL centres of space distributed consciousness.

Helical copper reveals local eidetic ground nodes. Sweeping districts with such helical forms does not alter eidetic view. Larger circumferences grant greater con-

scious transaction. Opening such coils skyward gives enlarged view of eidetic ground node area skyward.

Notable luminous displays have been reported in the ground, at ground surface, and in the aerial spaces. The lengthy list of such extraordinary VRIL radiances include:

(1) straight-sided auroral pillars from the ground skyward
(2) radiating auroral pillars from the ground skyward
(3) insensate soft ground curtains of space-descending rainbow light
(4) insensate green curtains surrounding a radio station from space
(5) severe VRIL Radiance historically associated with specific local geologies
(6) induced phosphorescence of laboratory chemicals (potassium platinocyanide and quinine disulphate) during a local auroral display
(7) insensate multi-colored kaleidoscopic mists and fogs
(8) black auroral displays from ground to sky during daytime hours
(9) ground radiated pillars of light into space from mountain peaks
(10) VRIL radiant waves sweeping in the ground mass
(11) corridors and sweeping bands of sea radiance definitely not bioluminescent in source
(12) sea light waves just above watery surface
(13) bright phosphorescent silvery sea fogs and mists
(14) giant sea phosphorescent wheels
(15) giant sea phosphorescent V-shaped waves
(16) lightning-like flashes in the sea

Such displays are commonly reported. Polynesian "TE LAPA" appear as continuous streaks, flashes, and plaques of bright extremely deep underwater radiance. Pacific sea-going natives rely on these VRIL Radiant displays for long-distance navigation between and among islands. Night-time navigation is no hindrance for those whose vision enjoins the "TE LAPA". Natives insist this light-form is unlike the surface lights.

Tonally activated "woivres" may be detected and traced across the ground surface by anyone. Woivres are the "waverings" which signal VRIL threadways in the ground. Such dendritic veniforms are wondrous. The correspondence of these ground waverings (black-waves) with energies which dowsers envision explains much.

Try singing along the ground. Notice where your attention is drawn each time. Do you find that each note takes a different path? Do you find that specific tones take specific (and consistent) paths? You can map these tonal paths along any tract of ground. There are lines in which small vocal utterances become magnified. There are lines along which loud vocal utterances are extinguished. There exists a verticillate ground structure which alters the continuous reception of tones and voices.

The American Natives knew these empirical principles. When they listened at knives (placed in the earth) they heard all manner of non-acoustic visceral sounds however distant. Telegraphy made use of these VRIL principles through empirical discovery. The false equation of its components and their function with electrical action has forever tainted the minds of engineers.

Viscero-visual sightings of black imbricated dendrites and white raysheaths reveal the difference between VRIL threadways and leylines. Ground infrastructure is composed of intense VRIL veniforms having specific activity on the inertial spaces which they transpierce.

The improper inter-connection of VRIL junctures did damage to certain regional experiences. Certain tracts of land grew bleak and stark as a result of the deranged and erroneous connection of several VRIL junctures. VRIL junctures and naturally occurring VRIL nodes must be interconnected (if at all) in specific sequence.

Lacking the sensitivity which native American Indians displayed, engineers pursued and imposed their self-willed construction operations among distant regions. No regard for the danger which improper VRIL juncture connections poses led many intuitively gifted individuals to seek other means of communications.

VRIL MOTORS

The earth is a vast VRIL SYSTEM. Motor actions emerge when VRIL transactivities reach special projective degrees. Viscero-eidetic transactions release motive actions in certain circumstances.

Unutterable depths contain vast galleries of special minerals and metals whose presence is never known at the surface. These are quasi-metaphysical minerals and metals which visionaries experience through VRIL thread contacts. In these episodes of experience the visionary is completely interfused with these minerals and metals and "knows" their attributes. Such experience permits identification of surface matter in which similar qualities thread be sensed.

The search for "rare earths" is the special realm of the visionary. Envisioning these locations is a purely eidetic function. Eidetic transactivity gives true communion. Eidetic transactions of surpassing degree give true and total translation. VRIL generates and sustains metal and mineral crystals. All VRIL generated worlds are VRIL projections. Each geo-region is VRIL projected. We discern the VRIL nature of a geo-region when observing the natural forms which appear. Most evident are those permeating forms which appear naturally, historically, and culturally in a region or district.

Local topography, geology, flora, fauna, and weather characteristics tell the VRIL nature of the region. Deeper examinations reveal the psychotopography of the region: the mood, archeform, tone, sense, and theme of a region. VRIL nature determines these more fundamental characteristics and inflections from which all material forms and aggregates are derived. Closer examination proves that cultural trends of art, music, architecture, and literary styles, are VRIL projected.

VRIL threads out into space, arcs into the ground, and wriggles through the local subterranean depths. VRIL resonantly translinks region with region. VRIL makes bilocational experiences possible. VRIL is the means through which the dream technology and dream culture is being realized. Communing with VRIL brings expanded consciousness and ability. Proper communion in VRIL channelry is direct eidetic experience. VRIL eidetic communications is true communication. Ancient VRIL systems conducted the enlivening energy of eidetic world experiences.

Eidetic correspondence is noted among materials and separated contactees. Lodestones were eidetically engaged among communicants who knew their secrets.

Correspondence is the mystical secret which unlocks the doorways to all forgotten lore. Without eidetic experience there can be no alchymy. Metal and mineral crystals were precisely cut and pieces were dispersed among travellers. Each remained in eidetic communication with the others through VRIL sensory experience. These results may be replicated; requiring sensitive skill toward the unravelling of their special runic language.

The use of the poised compass needle for demonstrating the existence of VRIL was never totally appreciated by those who worked with them. Magnetic needles are true VRIL detectors. These are capable of entuning special eidetic transactions through pondermotive effects in inertial space. Sharpened perception of tunneled eidetic vision into world-projecting realms are received through special contact with them. Magnets require vocal utterance for the activation of their eidetic transactivities.

Technological departures from the an-

cient knowledge of eidetic communications led to progressive inertialization and degenerate technologies. Telegraphic systems became progressively more inertial through reliance on code and artificial applications of inertial impulse.

Early telegraphs reveal the inertial tendency albeit rare and mystifying. Penduli and ponder-motive impulsers gave mere physical impulse for coded transfer of signal. VRIL transactions can move penduli, vanes, and motors (Bain, Stubblefield, Hendershot). VRIL energies were utilized in influence motors with success 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 re-emerging in technological garb.

Pendulum telegraphs of various forms were designed and successfully operated throughout this time period until the middle 19th Century. Numerous testimonies affirm their true operation. Such designs cannot operate through electrical means.

Several remarkable demonstrations of earth-powered "electrical hoops" employed pith-ball penduli as signal indicators. Widely separated hoop assemblies were set up on the ground. 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. Synchronous timing had nothing to do with the operation of these mystifying designs.

These influence transceivers were connected with a single wire. The hoops were grounded ends of these distant signalling communicators. Moving the pendulum toward a letter caused a corresponding equivalent movement toward that letter on the receiving end. Messages were exchanged as pendulum swings. Letter position caused an equivalent swing in the receiving hoop.

Articulated messages were communicated in the absence of articulated lines. VRIL self-articulates. Multiple lines were not needed in these strange pendulum telegraph designs. Engineers remain ignorant of VRIL native phenomena. Engineers design the redundant. VRIL native phenomena demonstrate all the articulations which engineers convolute. Self-articulation and self- directionality is the VRIL transactive attribute. This is observed in all VRIL communications systems.

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 (dialettes) for the indication of letters. These do not operate by electrical principles. Pendulum telegraphy worked through means non-electrical. Correspondence of this type is quite impossible without VRIL.

Pendulum and vane telegraphs represented the historical persistence of rabdomancy and pendulomancy while keeping participants from direct eidetic contact. Focussing attention into the inscribed groundhoop would project eidetic experience directly into the communicants. Code would be eradicated thereby. This ancient-most means of communications would be re-discovered.

Researchers have developed several kinds of VRIL dialettes (Meinke). Dialettes and vanes indicate VRIL permeative spontaneous transactivities. Transactive projections impel rotors and vanes. Inertial dissolutions follow VRIL world projections. Pure motion requires specific eidetic transactions. There are eidetic worlds whose presence generates specific kinds of motive effects. These worlds are motive worlds. Conducting these eidetic worlds is channeling pure motance.

Jangling bells, bobbing penduli, spinning rotors, dialettes, earth compasses, and vane indicators have been enjoined to aerial masts and ground rods with success. Motor action is not the result of mere static-electric forces. These motional effects come from the ground as well. Devices have been grounded and shielded to prevent electrostatic detritus from contaminating observations. Experiments with such configurations have verified and replicated these motive effects.

Such native VRIL motor forces are employed in rabdomancy, pendulomancy, and early influence-telegraphy systems. The history of influence telegraphy is inexorably linked with rabdomancy, pendulomancy, geomancy and the use of compass-dialettes. The hand-held rod or pendule is an antenna for VRIL threadways. Sensitives become VRIL permeated in a special organismic transaction with the ground. These moments give exceptionally viscero-eidetic empowerment toward the verification of VRIL channelry.

Plants move in rhythmic fashion with VRIL transactivities. Ivy and morning glories curl around grounded rods and fences. Trees and flowers move with VRIL transactive surgings. Rabdomancers take their lead from the bobbing limbs of trees activated beyond static thresholds by the wind. Freely swinging vanes assume distinct material-dependent VRIL axes. Winds do not alter their alignment preferences.

The motor actions of penduli and rabdi are not the unconscious motions or "subtle reflexes" of the operator. Motor actions are the native VRIL projected polarizations in inertial space. Mild activations of the antenna are achieved through rotations (penduli), loose probings (rods), and viscero-eidetic direction ("aquavideo").

VRIL self-articulates, self-organizes, self-arranges, and self-maintains the operations of its own technology once human agency has provided the material pathways. VRIL technology employs human agency as privileged participant in co-creative works. VRIL technologers construct and configure specifically transactive artifices with an aim toward altering geo-regional consciousness.

Human operators serve the inflections and intentions of VRIL in maintaining the specific material components required by VRIL. Luigi Galvani was especially aware of the projective "atmospheres" of metals. Galvani intuitively suspected that metals projected some special influence into surrounding space. Galvani was unaware of the eidetic communications projected from metals and minerals at all times. Galvani observed sudden enormously powerful projective surges among the metals when these were properly aligned and oriented. These observations remind us of statements made by more modern researchers (Moray).

Galvani viewed the metals as solid centres which materialized amid the activity of generative essential atmospheres. Metals are projected generations. Contact with the metals derive experiential presence from these living "atmospheres". Configurations and arrangements of metals directs their projections.

The mere presence of a metal plate is a sufficient arrangement to create viscero-eidetic organismic responses in humans and animals alike.

Galvani discovered that dead animal parts (frogs and dogs) show signs of revivification when exposed to these thready eidetic strains. Contact with the metals was not necessary. Space itself was reservoir to these living aerial currents. Animal tissues engage and transact the VRIL motor effect. This peculiar force is VRIL projected polarizations in inertial space.

It is possible to yet demonstrate these effects with small configurations of dissimilar metal. Arrangements of dissimilar metals disposed on opposed sides of a thin metal vane reveal the presence of aerial energy channels. The vanes move and oscillate when in these metal reactor "cavities".

The presence of dissimilar aerial metal plates conditions specific VRIL transactivities. VRIL projections cavitate inertial space. Thready eidetic strains are experimentally demonstrated by organismic

interposition. Strong visceral strains are sensed between distant dissimilar metal plates in absence of contact. Certain sizes and masses of the metals are necessary for these effects to be wholly experienced.

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VRIL vanes have been arranged with water as an active agency of intensification. Galvanic oscillators have been assembled and successfully demonstrated. Results of these experiments have been replicated. A configuration of dissimilar metals and elements is sufficient to cause the constant undulation of a free-swinging vane.

Weather vanes and lightning rods project transactivities in districts. Responses of the districts to these projections are sudden and unexpected. The emergence of house-protecting sceptres follows the long tradition of European talisman design. Is it indeed the wind which moves weathervanes at all times? Have there been instances in which VRIL motor effects have not in fact preceded the work of the wind?

Properly disposed platinum sceptres is a proven lightning-protector. Eidetic content of platinum impacts inertial space in sharply focussed vertical cones. Resulting inertial interaction eliminates electro-detrital conductions when properly aligned. designed, and disposed.

Copper-covered steeples and copper masts transact their sensual softness and content in districts. Certain fundamental conscious states permit examination of district consciousness-compositions. Ground node displaced iron masts and monuments give powerful sharpness of conscious acumen. Each metallic mass radiates its VRIL projected eidetic content.

Free-swinging aluminium vanes execute sudden movements and assume inexplicable orientations. Weather conditions cause these to forcibly move toward lightning strikes well before the strikes occur. The motor reactions cannot be the simple results of electrostatic induction since the vanes were well-grounded. Specific positional alignment were observed to effect magnified motor actions. Other spots seemed to depress these effects considerably. Left alone the vanes assume a characteristic alignment pattern which represents material-specific VRIL channel polarization.

VRIL channelry sustains the ground and projects space. All consciousness seeks the place where these subterranean channels structure and project conscious space. Materials assume alignments specific to these directions. Suspended rods of various free-swinging materials were allowed to assume their natural rest-states in the VRIL space. Each assumed characteristic poise and orientation in these regards. The entire assembly of these suspended materials went into sudden and violent re-alignments when approached by the experimenter. These demonstrations are reminiscent of observations made by other researchers earlier in this century. The "Sthenometer" demonstrated similar VRIL motor action in various forms (Russ, Thorr, Crookes).

Nearly every Victorian scientist of any repute had attempted the explanation of "spiritualistic energies". Faraday, Crookes, Lodge, Tesla, and others seemed desperate in their need to either discover or cover the heart of this historic quest for VRIL. Reactive 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. Crookes wondrously beheld the delicate ectoplasmic corruscations in gaseous discharge tubes and saw them to be VRIL LIGHT displays. The Crookes radiometer was an outgrowth of attempts to define aetheric presence.

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 empathic communication systems began to emerge from the forgotten depths of time. Various suspended materials align themselves amid the VRIL active matrix. Different materials reach different rest-alignments.

VRIL motor effects are first observed in conscious undulations and eidetic oscillations. Visceral motor effects are important in the study.

Dreams and visionary episodes occur with greatest experiential depth along specific routes and in specific ground nodes. Subtof designs which John W.Keely demonstrated.

T.A. Edison describes how vocal energies may be directed (tangentially) upon any roughened surface through a ratchet arm. The resultant frictive effect drives the flywheel continuously. This is problematic from theoretical considerations. Acoustic sound is undulatory.

Unipolar motion which results from singing into a vibrating diaphragm is not acoustically generated motion. The vocal engine is not an acoustic rectifier. Acoustically driven membranes undulate. Backward friction on the bevelled wheel limits whatever forward momentum has been initiated by the driver-ratchet. The initial thrust becomes greatly magnified through specific vocal components (primary vowels).

VRIL thready projections engage viscero-eidetic transactions. Projections engage material windows in several spontaneous anomalous activities. Legends tell of "flying" metallo-forms. Geometric structuring of metals and minerals may bring forth VRIL realities previously considered mythological.

Vocal and tonal patterns reveal VRIL thready auric passage through inertial space. Each thready source produces distinct patterns. Voices differ mutually in pattern. Tonal sources also produce mutually different patterns. Vocal and tonal patterns entirely differ. The results are not due to tympanic vibration alone. Primary vocal utterances give luminous viscero-eidetic transactions of surroundings.

Sizeable tympanic surfaces reveal the spatial form of a sound impulse. Differentiation between acoustic impulses and thready auric transactions become clarified when examining these patterns.

The "Vocal Engine" and sound radiometers are VRIL motors. Freely swinging material vanes and rotors self-align and self-orient in the VRIL space structure. Such vanes demonstrate response to vocal utterances. Vocal- polarizations have been demonstrated (Vassilatos). Vanes which have been vocal-polarized follow the one in whose voice they have been imprinted. Unipolar motion which results from singing into a vibrating diaphragm is not acoustically generated motion. The vocal engine is not an acoustic rectifier. Acoustically driven membranes undulate. Backward friction on the bevelled wheel limits whatever forward momentum has been initiated by the driver-ratchet. The initial thrust becomes greatly magnified through specific vocal components (primary vowels).

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Pendulomancers employed wooden blocks to prevent their muscular tremors from distorting pendulum gyrations. This anomalous practice was employed by European dowsers. Several photographs of these methods are extant.

The wooden block functions in identical manner with the wooden block eidetic diffractors employed to "deaden" telegraph line vibrations (Connor).

Sound-deadening blocks provide a mysterious clue to the source of night telegraph-line vibrations (Connor). No such block mounting can suppress line vibrations. Line vibrations would continuously permeate the block itself and transfer acoustic sound into the stationhouse. Such an organic block design operates because it modifies a non-acoustic energy.

Experiments were performed with bent wires which were grounded to provide strong eidetic transactions. The identical bent metal wire was sandwiched between wooden block (one free terminal grounded again) failed to give the same eidetic representation: deferring the otherwise deep groundward direction of consciousness into a starry region of space.

Such deferment of eidetic transaction results in reduced VRIL-induced line vibration. These block designs dampen eidetic transactions. The sounds stop because the transaction is deferred and altered. These sounds reached crescendi during the early morning hours and conform with our observation of VRIL projected sounds which flood enclosures shortly after midnight (2-4 A.M.). These sounds are viscero-organismic, non-acoustic, and are beneficially permeating.

An impressive viscero-inertial transaction takes place when minerals and metals are immersed in flowing water. The body alternately absorbs VRIL and inertia in pulsations. Such pulsations alternate according to a fixed numerical sequence which is reminiscent of pendulum oscillations when dowsing minerals. These alternating organismic pulsations are enjoined in specific numerical sequences: forward surges between VRIL conductivity and backward surges of inertial resistivity.

VRIL motor power was employed in a design by Nathan Stubblefield as reported. Lester Hendershot managed the powerful transaction of VRIL motive power. This motor was distinct from the Hendershot Transformer.

VRIL IMPRESSION RECORDERS

Conduction of VRIL transactivities along various conductors has long been established. Dr.Anton Mesmer conducted VRIL energies from special capacitors (grounded) and condensers (insulated) through iron poles, along iron wires, and through silken threads. Recipients were healed of many maladies through transformative viscero-eidetic transactions.

Galvani demonstrated that projected influences flooded space gaps among dissimilar metals. Galvani showed the conduction of such space-strains through copper and iron wires. Powerfully vivifying energies were conducted through wires in specific transactive conditions. Moderately elevated aerial terminals gave thrilling (non-electrical) "shocks" when grasping grounded lines.

An amazing anecdote of silver crystallizations during thunderstorms has been given in a previous volume (circa 1700). Such lore matches those which report eidetic scene impressions made upon organically coated matter during lightning storms (Corliss).

Baron Karl von Reichenbach showed that it was possible for sensitives in darkened rooms to discern differences between polarities of magnets, crystals, lunar light, and solar light through wires. T.G. Hieronymus proved that the "chlorophyll energy" (VRIL eidetic transaction) in sunlight made plants thrive in darkened rooms.

Holistic pictures may be transacted through wires in absence of coded scanners. Wires serve VRIL self-articulating threads behaving optically. No loss of image or signal strength occurs however distant. Radionic tuning devices focus eidetic transactions. Guidewires may fix these worlds on photographic plates and sensitive papers. When used with rheostatic tuners auri-sensitive papers do produce special and mysterious depictions (Drown, DeLaWarr).

VRIL entuned systems produce clarified eidetic images across suitable material media. Clarification of eidetic images requires VRIL eidetic node entunement (Drown, DeLaWarr, Dobler). Dr.Ruth Drown produced radionically entuned photographs of anatomical interiors. Radiovision is an eidetic transactor of superlative quality.

Radiovision apparatus utilized flickering light and single-wire "guides" of eidetic whole images. Photographic film preserved the effects of these shadowgraphs. Transactive phenomena engage eidetic impressions. Such eidetic images are directly transmitted through single wires to sensitive plates.

Dr.R.Drown discovered it possible to recover anatomical perspectives from distant places over a single wire. Other researchers duplicated these results successfully (DeLaWarr).

Natural flickering lights produce eidetic images which deposit on organic material media (Corliss). Inductoscripts, lightning figures, keraunographia, or lightning shadowgraphs are prolifically reported. Such shadowgraphs are made via distant lightning flashes. Images of specific objects remain deposited on walls, floors, and other organic absorbers. Records indicate these shadowgraphs to be projective images. When objects lie between lightning and observers phenomenal projection of images is observed on organic absorbers.

Organic suspensions reveal organismic VRIL conditions. The delicate formations and general fluidic traces of certain organic suspensions give direct manifestation of VRIL space patterns.

Paper chromatographic records of crystallizations employing specific salts during specific astrological configurations record VRIL permeative influence (Kolisko, Pfeiffer). Archetypal chromatographs revealed the permeating structural activities of insensate VRIL transactions in darkened rooms. These traces correlate with those made through chemical telegraphs.

Crystallizations followed patterns specific to local VRIL transactions.

These archetypal effects are magnified when experiments are performed near the ground proper. Connectivity with chromatographs and metallic evaporation dishes was achieved through VRIL aerial-ground threads. VRIL insensate activities surpass our own sensory modes of communing. Certain VRIL threadways enlarge our sensory apprehensions to include insensate experiences.

Chemical telegraphic systems transact eidetic experience long before radionists rediscovered the effect. Primitive VRIL telegraphic radionic tuners (rheostatic) transact complex permeating eidetic experiences among operators. Chemical telegraphic systems detect VRIL stimulated luminescence

in chemical media. Chemical telegraphs used special papers to register signal markings (Bain, Smith, Westbrook, Rogers).

Chemical telegraphs offered strange and anomalous electric circuitry (Sawyer: 166, 305, Lefferts, Edison: 141,776: 150,848: 156,843). Certain employed numerous ground plate penetrations (earth batteries) along their line length (Edison: 141,776). These designs were sensitive enough to utilize very little current (Edison, Lefferts, Little). Chemical impression recorders utilized eidetic entunement via rheostats (Edison, Lefferts, Little). Chemical telegraphs frequently registered thready auric signals while being electrical short-circuits.

Primitive VRIL tuners transact complex luminous glows in absence of organismic contact-sites. VRIL stimulated luminescence can be photographed. VRIL transactivity leaves traces on sensitive papers. Certain pendulum designs combined motor principles with impression recorders (Bain, Dyar).

Numerous chemical formulae were shared for posterity. Chemical telegraphs use sensitive chemical papers (potassium prussiate) in detecting the presence of (electrical) influence.

The formula for making auri-sensitive papers was given (Bain). Very little electricity was actually used in chemical telegraphy (Lefferts). Chemical telegraphy utilizes anomalous electrical connections and impossible charge arrangements. Lines are entirely positive in "charge". Grounded line ends are each positive in "charge". Application of earth batteries ("local batteries") to chemical telegraphy (Lefferts).

ENTUNING VRIL

Empirical researchers were extremely VRIL consciousness in absence of terminology. The confusion and disorder of intriguing circuitry is absent in VRIL technology. Components are empirically combined to produce very specific transactions. There are no confusing routes and exchange paths. VRIL self- articulates and arranges its own intelligence in components. Components are VRIL guided to perform as the VRIL presence intends.

Primary function was forgotten and lost...while the electrical function was retained. Comprehending the separate function of each component may be valuable only insomuch as we gain insight to their functioning within each aggregate. We find chokes, tunable coils, resistors, tunable (carbon) resistors, rheostats, resistance coils, chemo-electric batteries, branched groundplates, and wire conduction paths. These are the elements of circuitry. They are not primarily electrical components. Together they form whole aggregates. These are the parts of the VRIL resonant system called "Telegraphy".

Eidetically transactive nodes attract and hold organismic contact. The sticking reaction is a polarization of physiology when encountering eidetic nodes. African soothsayers use special wood-grain rubbing plates to discern organismic states of mind and health.

Metallic surfaces are covered with micro-eidetic nodes. Minerals and crystals are permeated with numerous major eidetic nodes. Woody grains and vasculated materials display natural eidetic nodes when properly ground aligned. Addition of other materials to such basic componentry produces new eidetic nodes. These were called "rates" by radionists.

Luigi Galvani discovered physiological responses in distal spaces among large metal plates. Conductive contacts were not required for the powerful experience of visceral excitations. Interposing the hand between separated plates of copper and of zinc gave strongly vivifying strain states. Contact with other dissimilar metallic contacts gave other similar effects. Galvani distinguished between the physiologically vivifying effects which he discovered and those which Volta claimed.

Antonio Meucci discovered tonal-physiological responses in human bodies. Anomalous observation of conducted complex electro-acoustic tones among human subjects was embodied in the world's first telephonic system. Human subjects could "hear and speak" through a charged-wire system. The Meucci physiophone enjoined VRIL transactions when ground-connected.

Human physiological response to organo-tonic conduction was characteristically vivifying. Exposure to physiophonic conductions differed entirely from exposure to the tonic currents of inductoria. Inductoria provided fixed tonal currents high in detrital products. Physiophonic currents were strong in a vivifying presence.

Baron Karl von Reichenbach found it possible to transmit empathic signals through varieties of lines. Tuning variables were not employed.

Threads, strings, chains, and various metallic wires were used in darkroom experiments. Sensitives grasped one end of long conductors. Conductors terminated on varieties of minerals and metals. Sensitives registered personal reception of emotion and visceral sensation.

Various minerals, metals, crystals, magnets, plants, sunlight, moonlight, and starlight were viscerally transacted by these methods along conductive lines. Records do not detail holistic visual impressions among the sensitives.

Elisha Gray discovered the frictive effects of organismic contact with charged grounded metal plates. Capacitative contacts yield separate and minute nodal frictive contacts. These seem continuous with casual examination. Close examination reveals that seemingly continuous frictive contacts are composed of close, distinct, and separate nodes. Eidetic transaction is the proper means of examining components, systems, and states.

These components transact eidetically with operators. Potentiometers and variable capacitors were developed in telegraphic systems to enjoin ground node potentials and secure "line balance". Telegraphic lines successfully operated among ground-plates through entuned states. Rheostats and capacitative ground forks were utilized to enjoin district nodes.

"Good ground" determined telegraphic efficacy. Rheostatic entunement insured powerful code transfer (Buell, Little, Field). These topical effects were made possible only because VRIL states were successfully engaged by the systems.

Dr.George W.Starr-White discovered a strange series of autonomic muscular tonic states in human physiology. These were enjoined by assuming specific positional alignments with respect to ground. Abdominal reflexes were autonomic and involuntary. Visceral responses manifested when physiology encountered spatial dispositions of insensate energy.

Like the iris of the eye, the visceral organismic response to spatial energetic states was the assumption of very distinct strain states. A series of specific reflexes were discovered. Each manifested involuntarily when specific energetic strains permeated space. In determining viscero-tonic reflexes Dr.Starr-White relied upon abdominal percussions. Specific tonal differences gave the specific muscular reflex elicited by any permeating energy.

Non magneto-electric pervasive ground energies dominate human physiology. Dr.Starr-White employed grounded terminals for the conduction of these mystery energies. The "Valens Cosmo-Electro-Energy Condenser" utilized telegraphic principles and was a return to ancient ground-oriented technology. Vivifying effects were enjoined through the absorption of these semi-sensate VRIL threads.

Dr.A. Abrams found that "human energies" could charge telegraphic components in specific manner. Telegraphic rheostats and Leyden jars were charged with "human

energy". Proving the existence of human energy relied upon several distinct autonomic reflexes with which Dr.Abrams had previously dealing.

Dr.Abrams discovered distinct frictive actions when contacting humanly charged systems. This friction was later utilized in determining of tonic states. Touchplate capacitors were an unprecedented addition to rabdomantic arts. Radionic tuners enjoin the participation of their operators through the rubbing plate contact (visceral component). Variety of nodes is established through variability components.

Rheostats of various compositions and variable capacitors have been used to determine radionic rates. Dr.Abrams externalized the abdominal reflex reactions by employing rheostats. Scaled rheostatic positions were specifically equated with abdominal reflexes. This allowed the examiner to relinquish abdominal percussion techniques.

Componentry reflected organismic sensitivities. VRIL activate components are quasi-intelligent. There are some sensitives who eliminate of the rubbing plate and successfully discern rates directly through space tensions (visceral). This method is utilized by dowsers who use the hang-rod method to scan districts. Abdominal reflexes signal eidetic nodes. Powerful eidetic nodal transactions are engaged via specific ground alignments. Utilization of ground-fixed rheostatic tuners alters district strain-states.

Each VRIL system component must be empirically experienced through various contacts and distal examinations. Determinations of VRIL functions is empirically appreciated. VRIL configurations must individually and empirically designed. These empirical discoveries deal with eidetic projections which hold their form through time. One may return to these configurations and find identical projections long after time has washed their image clean from memory. They are not the result of self-deception. It is critical that we collate consortium eidetic impressions to find significant differences and similarities among examiners. Transactive differences may reference special potentials yet unappreciated.

Radionic "rates" are eidetic nodes in minerals and metals. Material geometry determines eidetic nodes. Massive minerals and metals of length may have several longitudinally distributed nodes. These may occur as discrete points or in wavy bands. Natural massive crystalline minerals and metals have numerous eidetic nodes throughout their volumetric mass. It is possible to isolate eidetic nodes in specific sized minerals and metals.

Broad organismically transactive plates have been designed (Vassilatos). These may be utilized to give patterned rate displays. Mappable nodes are surface located when using thin transactive materials. These special conductive strips may be connected with minerals and metals for the determination of eidetic nodes. Such a strip is frictively contacted along its length and breadth. This design effectively combines the variability component and the contact plate. Examination of the nodal pattern topically differentiates minerals and metals.

Such a radionic display plate may be used to enjoin eidetic transactions once nodes ("rates") are determined. The older methods which were pioneered by the mentioned legendaries limited us to single rate determinations. Designers utilized aluminium capacitor plate tuners (Miller). Staged rheostatic switches of carbon and nichrome were employed as variability components (Hieronymus, Drown). Others used telegraphic carbon rheostats and inductors. Specific conductive media effect specificity in received "rate" distribution.

VRIL tuners mark eidetic nodes. Specific minerals and metals contain specific eidetic node-quantities. Each such material displays specific eidetic node distributions throughout their mass. Each eidetic node gives a special view and experience within a specific periphery and atmosphere.

Great accuracy in determining radionic rates was achieved through the tuning devices of Dr. Hieronymus. Neither aluminum nor nichrome are elements found to any normal degree within the human body. Carbon is the chief organismic tuning element. Carbon should be included as the prime natural tuning material. The powerful emanational influence of the iron should be enjoined in transactive tuners. Both elements in combination represent the agency through which we are organismically entuned with VRIL.

Radionic "rates" are established through sensitive contact. Catalogues of rate registrations are established through consortium replication. These positions were numerically identified when variability components were numerically scaled. Rate registrations are not numerical positions in VRIL space. Rate registrations are eidetic nodes. Rate registrations contain far more eidetic information than mere viscero-tonic adhesive power. Most significant operators receive information directly through eidetic visional experiences.

Materials and variability componentry (rheostats, resistance step switches, capacitors, crystal lodes, metalloforms) produce eidetic node entunement. The increased meaningful eidetic transactions which were thereby enjoined were noted for their "clarity of signal". Each design produces specific inertial space concentrations or space dissolutions. White inertial sheaths bring perceptual congestions, distortions, and organismic difficulties. Inertia is fibrillic when concentrated. White inertial fibrils are dangerous to organismic integrity. The enjoinment and concentration of inertial detritus must be avoided. Designers must structure componentry with the operator in mind.

Human organismic response to eidetic transactivity is most intense when tuner designs include natural forms of iron and carbon. Material organismic components (carbon) and living blood (iron) magnify transactivities.

All substances are simultaneously (proportionally) VRIL-conductive and inertial-resistive. Organismic VRIL sensory systems do not easily participate in volumes of high inertial concentration. Inertial detritus is strongly absorbed, and distorted away from the entire organismic presence when near or in contact with Iron. Iron contacts prove to form organismically reflexive conical shields.

Iron is a very sharp transactor. Thready penetrations of iron into the human body can be painful at times. Iron penetrations sting the recipient. Iron is organismically accommodating. Iron offers the organism adaptive difficulty. Iron receives and responds with every corresponding change in the vitalistic world. Iron sends powerfully overcoming messages into the body which can hurt. Carbon softens the reactivity of the iron signal considerably. Organic minerals and materials are strong organismic VRIL contacts. Organic minerals and materials are used to ease contact transaction with eidetic worlds.

It was discovered that these 2 elements in combination produce a softened organismic receptivity. Carbon-iron transactivities are very "brittle" and "noisy" during certain times. Manganese dioxide softens inter-auric thready transactions on behalf of the operator.

Manganese dioxide powder neutralizes transactive discontinuities. Transactive discontinuities are experienced as signal "static". Manganese dioxide powders provide smoothened signal transactions on behalf of the operators. Combinations of iron, carbon, and manganese dioxide powders make continuous transactions possible. Eidetic transactions are made effortless through the employment of this mixture.

Static reduction in telegraphic lines was achieved through the use of carbon (Rosebrugh). Very curious "tunneling" phenomenon are enjoined through this organismically designed coupling mixture. Received transactions are effortlessly entuned. VRIL

sensory response is instantaneously sustained through this mixture. The activations of VRIL sensory organs is mysterious.

The right organismic side may be the VRIL side: the right eye, the VRIL eye. VRIL thread synapse activity makes difficult the physiological location of these VRIL sensory organs. VRIL enjoins perfoliate synapse spaces. VRIL organs exist as a space anatomy "among the synapses". VRIL organic anatomy remains unidentified. These synaptic distributions are the receptors of VRIL.

Organismically conducted VRIL threads project from the body as thready striations and tufts against the inertial space. Observation of aurae reveal the existence of these tufted striations. VRIL thread body projections radiate from all objects and beings.

Auric interactions and interblendings may be detected among sentient beings and objects. Organismic VRIL aurae in proximity with specific material configurations are powerfully drawn into systems. System-conducted VRIL threads merge with applied aurae to provide viscero-eidetic transactions among communicants.

VRIL spreads out feathery aura threads in sequence upon carbon. VRIL auras become feathery and copiously ciliated in carbon. VRIL threads do intensify at specific points along the carbon surface when ground contact is provided. Eidetic transaction requires VRIL ground contact. VRIL threads discharge at specific nodal points along carbon rods or plates. These mark VRIL eidetic nodes.

Dr.A.Abrams arranged experimental tuners to specifically entune thought- forms. Abrams' work represented another step in a progressive movement toward recognizing empathic communications systems. Telegraphic systems were long operating in these very transactive modes. Connections were made with specific organismic centres. Dr.Abrams demonstrated that thought-forms could be holistically entuned and transferred through conductive lines.

Visceral thought transactions through tuned componentry exceeded the strength of unaided "telepathic" transactions. Telepathic communications are excessive in specific VRIL alignments and districts. Ordinary unaided telepathy relies on VRIL ground transactivities, channelry, and ground nodes. Holistic impressions are transmitted through one VRIL organism to others. The entire organismic sensory system becomes the articulate transmitter of experience to others. Those whose organismic correspondence is properly disposed and aligned receive experiential holisms.

Interpositions of minerals, metals, and special components (rheostats, resistance switches, minerals, organic matter, etc.) enhance, amplify, and clarify shared eidetic transactions.

VRIL enters grounded materials to established volumetric distributions of eidetic nodes in patterns. Frictive adhesion phenomenon is utilized to specify nodes. Nodes are located across an adjustable tuning scale. Tuning mechanism and the frictional touchplate is combined in a single design. Such a system realizes an entirely new world of polyphonic rates previously impossible with "single rate" tuners.

Broad frictive adhesion plates have their use in mapping VRIL spatial distributions. Large surface area glass plates are coated with a mixture of iron, carbon, and manganese dioxide powders. The plate is arranged perpendicularly to district VRIL threadways and allowed to become VRIL polarized. Visceral examination of this coated plate permits actual mapping of VRIL activity. Plaque mappings of this sort indicate that specific thread forms remain constant while others fluidly migrate. Geometric distributions of these maps are shape shifting over time.

Such broad plate effect enhanced VRIL consciousness in the operators. These exposure plaques become the sensory transmitters of distal eidetic nodes. Sensitivity to meaningful and mysterious impulses is attained through VRIL artifice. One may receive knowledge and vision exceeding that of mere distant places and events through technologically magnified awareness.

VRIL ground thread dynamics seem to proceed in deranged and mysterious expressions when threads are observed. The observation of the strange VRIL thread language does not enjoin the examiner with an eidetic experience immediately. Exposure to the language must be continual and suffusive. Runic messagings become intimate and familiar with exposure. Depth of eidetic exposure requires time.

VRIL threads must be enjoined for transactivity to take place. Skewed thread perfoliations do not enjoin strong transactions. Successive exposures magnify the VRIL vocabulary of operators: who suddenly perceive and interpret the permeative and mysterious runic archeforms seen throughout their districts. Broad plaques such as this are the effective sensory transactors of a natural VRIL communications system.

VRIL self-articulation permits continuous reception and participation in eidetic transmissions from unknown distal sensory node sites. These units are elementary in form. They assume a darkened radiance in which eidetic transactions commence. Operators are eidetically translated into undisclosed distal locales according to the ways of the VRIL natural structure by these artificial and external retinas.

Telegraphic and telephonic switchboards serve the same function in the operators. Those who are positioned before the variegated jack-housings and nib-like projective terminals of copper become continually suffused with eidetic transactions. Multiple VRIL discharges project from copper and iron terminals. VRIL discharges intertwined and interpenetrated the auric striations of the operator. Such persons became exceptional eidetic agents through continual exposure to line-connective distal nodes sites.

The literal exchange and magnification of social consciousness was proliferated through these wired systems. Eidetic information self-articulated in lines from ground-plate stations. Eidetic information was entuned through rheostatic and capacitative enjoinments. Eidetic information was distributed along guide-lines. Eidetic information freely discharged among ground nodes throughout the line length.

Buried conduits were permeated with fibrous and follicular VRIL threads by mere alignment, ground depth, and ground-plate placements. Eidetic information projected out into space through multiply stippled terminals and received by operators.

Multiply aristulated aerial guideways conveyed conscious exchanges into local homes at specific ground nodes (street corners and neighborhoods). People who lived in these city-sectors absorbed VRIL transactions and became exceptionally sensitive and gifted.

Weather patterns are the result of mysterious VRIL eidetic transactions. Fine ground-tuning at telegraph station ground-plate sites effects district weather control.

Gradual transformation of telegraphic and telephonic exchange systems more closely approached natural VRIL Ground Systemologies. Samuel Morse began with ground-buried cables. Such cables became flooded with "static". Morse quickly and unquestioningly changed to aerial wire-pole systems. These remained the norm until buried conduit exchange systems were perfected. Each such system was the redundant expression of existing VRIL Ground Systemology.

VRIL self-articulates. Organismic vocal utterances emplaced in grounds require no artificial cablery or distributive channels.

Several researchers experimented with non-powered exchange systems. These found their perfection in systems perfected by Nathan Stubblefield. Revelations of VRIL ground self-articulations reigned for several years (Meucci, Rossetti, Tomkins, Brown, Stubblefield). Later researchers forgot the

Stubblefield system. Powered ground wireless systems were pursued by many others (Tesla, Preece, Morse, Bell). Most of these were not vocal transactors. Nathan Stubblefield transacted vocal exchanges with clarity and volume through the natural VRIL ground articulations.

VRIL progressively enters the sensate and impacts the inertial. Radionic rates are eidetic leakage points in our world. They open our consciousness into other realities. VRIL nodes are found everywhere on the ground surface. Ground-state radionic rates are nodes whose fundamental pervasiveness dominates all other rates.

All minerals and metals are VRIL transaction sites. VRIL projects mineral, vegetable, and animal forms. VRIL is simultaneously crystallic and fluidic. VRIL appears in floreolar displays. Delicate VRIL threads compose the tissues of flowers. VRIL threads compose minerals and metal filigrees in rock. VRIL extends the ganglia of organismic integrity. VRIL projects the thready plasmal resplendence of the galaxies. VRIL is the fundamental form of the universe.

The verticillate penetrations of metallic lodes, crystals, and natural minerals among inertially congealed masses is a mystery. The naturally occurring appearance of metals and minerals has much to do with VRIL conditions during the time of material generation. Complex and contrary conditions prevailed in unknowable proportion during the generative epochs of archane existential history.

This generative mystery may be solved in examinations of the eidetic transactions which have occurred in those districts. We may encounter difficulty in eidetically retrieving knowledge of these pre-archaic ages. Difficulty in comprehending runic language may prevent such eidetic retrieval.

The veined appearance of minerals and metal lodes amid matrix rocks infers that strong VRIL projections congealed powerful enveloping inertial spaces.
Gneiss massives reveal dark veiny threads (high VRIL conductivity) with speculate (inertialized) resistive matter. Contact with these materials propels eidetic experience through the dark filigree.

VRIL channels are found in the ground geology at depths not exceeding several hundred yards. VRIL causeways are the vast regional axes which generate and sustain whole regions. VRIL transacts with all overlying minerals and metals, arrangements, components, and spaces. Minerals and metals exist in conscious states. VRIL transactions are meaningful to recipient minerals and metals.

The VRIL world is flooded with eidetic images. Sensation and consciousness are its blood. Projective worlds exist independently in absence of projected forms. They may be located through their projected materials which respond to their presence. All materials respond with local VRIL channelry. All materials when touched are viscero-eidetic terminals. Organismic modulation of native VRIL provides organismic expression and exchange among juncture points. Eidetic communications is possible with special auripermeable apparatus.

Virtual forms emerged from the ground with entunement of telegraphic systems. Ephemeral virtual architecture materialized around the telegraphic system. The eidetic transaction was sustained and magnified by telegraphic components to which the operators were privy. Telescopic telegraphy was an unknown eidetic feature of the art. Fragments of the telegraphic circuitry become stellar termini when properly configured and poised.

These activities did not require aerial elevations. Certain ground conduits projected hydrant-like access ports in the ground at special loci. When natural stellar connectivities with VRIL nodes were armed with telegraphic conduits the effects were striking. Eidetic information loaded the grounded systems and was transacted with unwary participants.

Human experience of other conscious worlds powerfully occurs when contacting eidetic ground nodes through specific metals and minerals. The natural VRIL ground structure is suffused with eidetic transactions constantly. The VRIL structure is a communications matrix of unimaginably vast proportion. This SYSTEM interconnects humanity with other worlds. This SYSTEM holds the true secrets toward practical experiential teleportation and empathic communications. VRIL dendritic structure is fibrous and perfoliate. VRIL projects glowing black space. VRIL brancates into black glowing space and permutes into new experiential worlds. Operators are privileged to transact and participate in co-creative acts.

Distal bilocations connect operators with VRIL juncture in absence of experiential translation through intervening spaces. Instantaneous juncture placements are notable with bilocational experience. Distal sites are possessed of natural sensory apparatus. This native mystery explain telepathic exchange and points to the future of true geo-regional communications. Natural articulate response and distal transactivities produce simultaneous distal experience in distal nodes.

Certain translocations guide the participant along specific paths to some ultimate point in the eidetic experience. Other translocations are discontinuous: operators experience "jumps" along an eidetic guide-path. Distal bilocation are instantaneous distal experiential placements. Distal bilocation interconnects communicants with central VRIL junctures.

VRIL junctures are the natural ordained nexial spaces. Repeatable contact with specific VRIL worlds may be charted among communicants. Communicants merge in VRIL junctures. Communicants wordlessly share experience and conscious identity at VRIL junctures. To know and experience VRIL is all doorways.

Communal knowledge is power. VRIL operators do alter their environments directly through the proper and powerful direction of VRIL Technology. Cultural raising of district and geo-regional consciousness is the noble labor of VRIL operators.

Instantaneous VRIL juncture placements are notable with bilocational experience. Distal sites are possessed of natural sensory apparatus. Eidetic nodes "experience" and transmit their experience to other eidetic nodes. Eidetic ground nodes are the sensory organs of the VRIL universe. Organismic modulations in native VRIL nodes communicates shared organismic consciousness across vast distances. Communications enjoin those who share in native expressions, language, and runic knowledge.

Visceral effects are the dim perceptions of eidetic worlds. Visceral effects may be insensate eidetic projections. We perceive these as synaesthesic sensations. We may yet be unable to translate their deepest meaning.

Perhaps the VRIL visceral projections are a language which eludes human beings as yet. Perhaps we may learn their mysterious message. Visceral effects are usually the first experiential transactions. Because of this fact we might suppose them to be the fundamental realities. Sentient beings possessed of greater sensitivity and other capacities may perceive visceral effects as conscious foundations.

VRIL transactivity requires new definitions and descriptive terminology. VRIL communion is more than verbal exchange. VRIL junctures proliferate shared expression and exchange among VRIL communicants. There are no doubt sentient beings in the universe who speak and comprehend in these generative, ordained symbologies. The exceedingly deep transactions of VRIL causeways are intelligent, mysterious, symbolic, and geometric in representation to sentient beings. Such exceedingly deep VRIL messagings are a mysterious language of the Divine.

The deepest VRIL supply provides and

generates the eidetic worlds which are experienced. The universe is a VRIL projected structure. The VRIL projected structure is an multi-experiential, optically conscious, sensory structure.

Minds may look along and through specific axes to experience distal sites. Operators of VRIL entunement stations utilize specific material access contacts. These may be crystals, minerals, or metallo-forms.

Blockage of experiential continuity is inertia. VRIL eidetic vision through metal plates is holistic. Geometric configurations are eideto-optical in nature.

Eidetic vision proceeds in specific substances as through optical assemblies. Eidetic visual experience may be sharply focussed through material edges or broad surface areas. Each eideto-optical pattern is material dependent and material specific. VRIL eidetic experience is foundational reality for sentient beings.

Geo-regions are vast distances of archetypes and archeforms. Inertial boundaries are deceptive. Participatory passage among geo-regions requires numerous preparations and transactions. One does not simply "march in" to another geo-region without VRIL eidetic guidance. The true VRIL structure of the universe is not what appears to the 5-sensor perceptive mode.

VRIL operators manage the spontaneous entunement of specific junctures, obtaining experiential knowledge of distal events and circumstances.

Each VRIL juncture, VRIL node, and ground plate assembly requires a specific rheostatic entunement. Eidetic worlds reveal select axial centres which concentrate distributed awareness across space axes. VRIL junctures and natural nodes are the ganglial centres of the natural VRIL environment.

Telegraphy utilized differing rheostatic positions to enjoin the eidetic potential of ground peculiar to the point of entry (Buell, Little, Field). Telegraphic lines necessitate inter-connections which may occur through human demands and therefore become the conductive pathways of eidetic oscillations.

Distortions and continual oscillations of eidetic content create disturbing influences on operators. Difficulty in transacting with meaningful supply results in "broken" messages despite coded transfer clarity. Entunement must be specific. Ground plate emplacement must be precise.

The proper emplacement of componentry in VRIL threadworks releases exceptional eidetic transactivity. Most material configurations engage VRIL experiential eidetics at the ground surface. VRIL capacitors placed in the ground are especially potent transactive agencies. The most fundamental VRIL eidetic transactions are ideational, revelatory, metaphysical, and symbological. These eidetic transactive emerge from the deepest hierarchic eidetic worlds.

Dr.Drown utilized a grounded tuning system. Grounded systems alone are eidetically reliable. Vitality and organismic reintegration is the result of eidetic suffusion. Dr.Drown was able to obtain special radiovision shadowgraphs via eidetic entunement and ground contact.

Visceral effects are projected from specific components when ground node placements are superlative. Visceral transactions effect non-acoustic tones, aromas, tastes, and other synaesthesial experiences into a district (Corliss, Bradford, Spera). Such transactions may suddenly occur without previous warning. Physical translations and disappearances near specific nodes and among specific kinds of technology are not unreported.

Eidetic energies are constantly surging in the VRIL structure. Eidetic energies are the universal activity. We must experience them to be complete. We intersect with them through every material contact. Eidetic examination is the key to all doorways.

MULTIPLE RATE LOADS

A study of the complex VRIL interactivities which occur in grounded conductive systems is afforded us in telegraphic systems. Many empirically workable circuit designs were actually anomalous in activity and impossible in analysis (Edison, Lockwood, Sawyer, Ellison).

Telegraphic and telephonic systems transact eidetic meaningful exchanges with their operators. Tuning components provide focussed meaning to couple with the code. Comprehend the VRIL functioning of the telegraphic systems first and fundamentally. Comprehend telegraphy as a signal transfer system last and of least importance.

Telegraphic systems interlinked the consciousness of different geo- regions in foundational permeating transactions which have yet to be fully comprehended. The VRIL functioning telegraphic systems represent central means through which conscious supply was proliferated among participants directly from the VRIL source.

The examination of telegraph patents and old telegraph designs reveals startling anomalies. Numerous electrically impossible configurations imply the energetic operation of an integrating presence. Working configurations with "wrong connections" abound in the Victorian literature. Theoretics become topic-specific and invention-specific to excess. Geometrically accurate systems were often electrically inaccurate.

The noumenous presence seems mysteriously transactive in another energetic realm. "Energy" is an improper term in this regard. The noumenous presence of special designs seems to be a radiant densification of consciousness itself. Beauty, geometric form, function, direction...mystery...all these seem thoroughly admixed in each of these designs. The operation of such devices depend upon a more fundamental quantity. VRIL is that consciousness. VRIL is that intelligent integrator.

Recognition of VRIL patterns becomes obvious when an excessive use of mysterious ground and aerial connections is observed among such patents. Other anomalous instances involve the use of material interactions and reactive components which demand energetic activities exceeding those ascribed to electricity. The geometric patterning of system componentry throughout the ages demands fundamental examination. VRIL Science provides vision into these primary activities.

Certain telegraphic circuits are found to make "no electrical sense" when examined closely. Their empirically proven results are not due to electrical transformations. We must not study detrital-activities or follow the patterned responses of inertial detritus to VRIL projections. The micro- analytic process of learning from parts to whole does not work in VRIL designs. VRIL Science stresses learning from whole to parts.

Engineers focus tightly on inertial paths, shunts, vibrations, and undulations within devices. One comprehend VRIL transactive functions of systems by grasping whole geometric portions of diagrams. VRIL Science is an art aesthetic. Ancient mystics well understood these axioms. That which forms flowers and mountains alike cannot be enjoined through micro-processes.

Look at the telegraphy designs as intelligent geometric aggregates. The designs are quasi-living organo-crystallic forms. The designs may be viewed as radionic circuits. Marked by extreme simplicity and structural ruggedness these transact great conscious potentials across 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.

Duplex, quadruplex, sextuplex, and multiplex systems were beautiful in appearance (Buckingham, Delaney). These systems transact simultaneous multiple eidetic exchanges with their operators. Multiple eidetic transactions flooded code with great profusions of meaning and conscious de-

lights.

VRIL continuities and convolute holisms are evidenced as chunking of system components. VRIL meanings crystallize in systems. Portions of whole meanings crystallize in specific components. These may each be isolated and eidetically examined.

Separating components of VRIL dense configurations results in loss of context and meaningful system operation. Removal of a significant system chunk suffices to derange continuous meaningful transactions.

Minute details of electro-detrital exchanges do not hold our interest any longer. Maddening conduction paths defy experience and theoretical logic. The anomalies broke the tension of strict engineering design. Most multiplex designs were perfected empirically. Their defiance of electrical theory marks them as VRIL systems. Certain designs exhibit strange and anomalous circuitry (Hughes, Edison: 178.222, 168.385).

We view the eidetic functioning of the circuitry in whole perspective. We see whole design sections as aggregates and VRIL transactive self- articulating cavities. VRIL aristulate threadworks cover certain design structures and flood space among componentry. No one comprehends these mysterious VRIL languages of form. Telegraphic systems and their components were capable conductors and discharge assemblies for self-articulate VRIL.

See whole circuit geometries. Refrain from micro-analysis. Cease the study of specific micro-activities in these designs. VRIL forged the telegraphic and telephonic systems. Dreamers and artistic designers built what revelation envisioned for them. The evident forms in these systems do not differ appreciably from those found in the Gothic Cathedral System.

Remember that most of the telegraphic developments originally emerged from dream impressions and visions. It is crucial that we recognize the signature of the Power which forged the system as a primary study level. The empirical experience of these designs in fragmentary replication is the second study level. Eidetic consortium is the tertiary stage of study. The final step is implementing the design components in new VRIL technology.

VRIL gives eidetic holistic transactions. VRIL material configurations release specific eideti-holistic transactions. Eidetic experience is the fundamental test for determining technologic efficacy. Confusion between VRIL activity and electrical impressments caused early electrical engineers to imagine that empirically discovered efficiency equalled "electrical efficiency". They do not.

Empirically discovered means for enlarging and enhancing telegraphic signals had nothing to do with coded transfer (electrical signalling) at all. VRIL systems operate in inertial (electric) modes only insomuch as they drained the detritus of VRIL impaction out of the design structure. Most of the anomalies emerge because of these conjugate and antithetical processes.

VRIL transactivity reached peak crescendi and produced copious detrital quantities. These events prevented coded transfer due to excessive "static". Meaningful transaction never ceased functioning during these events. Meaningful transactivity was continuous in the absence of electrical applications. Telegraphic systems worked because they served VRIL principles...not electrical ones. Empirically discovered components and their (apparent) functions were not thoroughly examined to discern important differences. It was assumed that these empirical functions were actual indications that the components were performing electrical work functions. In fact they were not.

The systems worked despite of the electrical impressments. Coils, resistors, groundplates, aerial guidelines, buried conduits, batteries, capacitors, rheostats and other parts functioned for VRIL threadworks.

Inertial technology superimposes artificial code upon VRIL eidetic imagery in systems. Telegraphers receive steady eidetiholistic experience of every line terminal in absence of applied electricity. Telegraphers were a secretive guild, sharing secrets of the trade and mysterious phenomena of the daily operations of systems. These anecdotes and peculiarities are mentioned in trade journals of the day.

Telegraph sets are not code-touch sensitive. There is no electromechanical means by which one may determine the personality or gender of a communicant. Yet telegraph operators were able to ascertain who was on the line by sensing their "touch". The midnight fantasies of telegraph operators were filled with strange accounts of sudden anomalous distal perceptions.

These "hallucinations" included time dilations, eidetic journeys, vivid memories, sudden lucid revelations, bilocations. These signatures of eidetic transactions were common along the system. Dream and eidetic reality seemed a great blur at times. Sleep was effortless. Time lost meaning. Visions merged with messages.

This fundamental empathic signal is 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. Important eidetic activities flood componentry and the designs which technology employs in other services.

The spontaneous exchange of clairvoyant and empathic impressions was a well-known experience among telegraphic operators. Night-time eidetic excursions were thought to be the result of loneliness. Participating night- time communicants became mutually clairvoyant and fully capable of communicating in excess of mere coded transfer: communicants could "know" what the other party was about to say...and even discern the entire content of an incoming call simply through the bell-sounding.

Intent may be holistically transacted through VRIL resonant components.

Intent is an organismic VRIL auric inflection (modulation) which may be conductively transacted through metal lines and ground systems.

The loneliness of the telegraphic outpost was punctuated by sudden and graphically eidetic visions of distant places. The thrilling sensations of bilocational travel made such eidetic imagery the only desired quantity. To communicate. To reach across the silence of the night and call on distant strangers for response. Telegraphers often comprehended the whole of a message through eidetic means.

The telegraphic and telephonic systems did what the Cathedral System in Europe had done for those who frequented them. The use of ferruginous and metal-rich stones transformed natural VRIL ground nodes by architectural enclosure. Telegraphy replaced the need for massive structure and resonant chambers through the use of line componentry. It was possible to enjoin VRIL archeforms and receive revelatory communions through precise entunement. Powerful eidetic focus was potentially available when ground-plate penetrations were properly emplanted.

Geometric forms of componentry and systems were mysteriously permeated with Gothic symmetries. Componentry of telegraphy and telephony were significantly proportioned and physically disposed in analogous structure (Stearns, Buckingham, Jones).

Single message telegraphic systems may be thought of as "monophonic" tuning instruments. The multiple rate-loading of telegraphic systems is an historical note of great significance in technology. Rheostatically entuned systems were eidetically prescient and intelligent. Multiple rate-loaded systems were alchymycal lenses.

Increased channel handling capability brought with it a new conscious possibility among operators. Singular eidetic transactions could be fine-tuned and magnified through available tuning componentry. Operators could be focussed into singular eidetic worlds through ground nodes along their section of line. This was possible only when ground nodes were actually penetrated by the proper placement of ground-plate assemblages.

Duplex, quadruplex, sextuplex, octuplex...multiplex systems could simultaneously entune several distal eidetic nodes. These systems were multi- iconic. Multiplex systems were projectors capable of permuting VRIL into our space. The consciousness-magnifying possibilities were not fully appreciated. Alchymycal fusion of several eidetic nodes resulted in astounding conscious transmutations among the operators.

Permanent conscious polarizations result when eidetic transactions are projected, focussed, sustained, and fixed into a space. Permutations result when multiple entuned eidetic projections are focussed into a space. Consciousness surmounts its normal experiential parameters and is magnified to unexpected proportions. VRIL permutations make new conscious elevations permanent.

The duplex and multiplex patents must be properly viewed. These circuits engaged simultaneous conjugate VRIL transactions. No doubt there were better blends than others. Spontaneous transmutative events discharge from the terminals of multiplex designs. The primary effects are conscious ones. Consciousness in a district is greatly heightened when multiple distal nodes are brought into eidetic fusion.

Each patent design becomes progressively "polyphonic". Single line tuners enable the entunement of only single eidetic nodes. The entunement (the "rate") conveys the meanings and empathic components which the ground node establishes. Communicants become active sensory-system components.

Multiple rheostatic designs have been proposed for use in the healing arts as "polyphonic" transactors. Several separate parallel eidetic rates are simultaneously and independently applied to a patient in these forms. Total body treatment results from multiple exposure to multiple eidetic nodes. VRIL Alchymy simultaneously infuses space with multiple eidetic projections. Those who enter these spaces are changed.

Communicants mutually perceive intentions and expressions. Telegraphers could frequently "read" the message of those with whom they established line connection despite the click-clacking of telegraphic code.

Exposure to the telegraphic block assembly brings VRIL arcs from ground through floors and into operator's forehead (Stearns). The telegraphic block is an astoundingly focussed VRIL transactor. Visceral sensations include body heat, sharp insensate VRIL focus in forehead, with sharply focussed consciousness for several hours after exposure. Copper supports organismic sensory experience.

The VRIL eidetic beam which proceeds from the tops of telegraphic coils attracts organismic attentions and draw operators to themselves. Contact made with the telegraphic key is eidetically potential contact.

VRIL world eidetic transaction commences with organismic contact at the key.

Examination shows the simple artifice of hard rubber and brass. These specific minerals and metals provide a rich sensual contact with VRIL threadways. Excessively deep eidetic experiences proceed without interruption. Eidetic images and experiences of all other terminals are excessively powerful through telegraphic block contact. Placement of metal resonators over vertical coils immensely increases VRIL eidetic transactions.

Telegraphy made total use of artificial inertial code and was an imperfectly utilized VRIL transactor when coded communications were transmitted through the system. Telegraphic systems operated eidetically without applications of detrital powers.

The VRIL resonant bell of telegraphic and telephonic sounders is extremely potent as an eidetic projector. When the VRIL resonant bell was replaced by thin metal membranes a new step in VRIL technology was realized. Bells, membranes, and sounders were all fully capable of projecting holistic content of intended messages instantaneously. The superior eidetic transaction among communicants through telephonic assemblies has its basis in auric transactions.

Telegraphic receiver blocks were housed in specially coated wooden hoods. Their carbonaceous content and geometric form makes them powerfully focussed VRIL eidetic projectors. Iron projects VRIL threads. Fine-spun copper coils were wound upon iron armatures. Carbon softens the sting of iron potential transactivity. Copper transacts visceral sensations. Copper supplies the VRIL sensory system with synaesthesia.

Duplex systems accommodated several distinct meanings simultaneously. Such multiple rate loading did not bring mutual conscious interference. Codes could be collaged and deranged by line-interference. Greater rate-loading capacity of quadruplex and multiplex systems increased the conscious "polyphony". Capacity of multiplex systems to sustain, conduct, and project eidetic integrity of separate meanings and messages was demonstrated. Multiple eidetic transactions and fusions were excessively potent near exchange terminals and switchboards.

Eidetic transactions of meaningful context remained preserved for each separate conversant. Operators partook of the blending eidetic flux occurring among the terminal components. Telegraphic and telephonic systems glowed black with noumenous VRIL radiance.

Multiplex systems revealed a propensity for numerous ground-plate implantations at terminal ends (Buckingham, Jones, Stearns, Thompson). Only a few designs employed the bold notion of joining all the separate ground lines into one main ground-plate (Field). Multiply fused node-loaded lines were controlled by exchange operators. Eidetic fusions permitted the simultaneously meaningful transaction of code and experience in telegraphic systems.

Multiplex systems do not operate because they are resonantly tonal. Multiplex systems are resonantly tonal because they transact VRIL eidetic continuities. In material configurations we empirically correlate tonal correspondence with VRIL manifestations. We cannot predict or equate the VRIL tonal resonance of a configuration without eidetic examination. Formulations do not operate because each design is a distinct identity. VRIL tonal conductivities of systems differ completely from simple acoustic resonance. VRIL tonal conductivities of systems differ from simple electrical resonances. VRIL sensitives are devoted to the natural VRIL structures they identify. VRIL sensitives are devoted to componentry which engages VRIL transactivities. Beholders recognize that the very generative source of consciousness and existence surges in lanceolate distributions among special ground-penetrating componentry.

VRIL DIFFRACTORS

There are many patents which clearly operated in non-electrical modes. There are instances in which we carefully discern componentry incapable of delivering effects claimed for electricity. Discovering the native phenomena which VRIL transactively manifests is a plentiful thesaurus. The VRIL thesaurus flooded the Victorian scientific archanum. System componentry is examined through eidetic potentials alone. What may be said of specific componentry requires individual detailed eidetic examination. We cannot make broad generalizations concerning the eidetic transactivity of mate-

rials and material configurations. There are several specific examples which may here give aid in comprehending the behavior of telegraphic systems.

Attractions of mind and sense are powerfully collimated through rock massives, mineral rilles, metal lodes, crystal caverns, earth capacitors, aerial towers, ground terminals, and entuned system componentry.

Casual observation may not reveal the surging eidetic transactivity of seemingly static artifices. Telegraphic systems were largely uncharged during off hours. Grounded systems transact eidetically with those who are found in their immediate proximity.

The burial of telegraphic and telephonic cables in deep specially configured conduits provided exceptional transactivity of eidetic worlds among operators. These activities were especially powerful during the night. Telegraph operators were quick to mention the exceptional clarity of signals during the night hours.

Moderate exposure to these structures suffuses the beholder with viscero-eidetic transactivities. These may not be consciously appreciated as eidetic fluorescence. Most persons experience eidetic translations constantly and do not express surprise. Telegraphic stations are noumenous in appearance because they congeal, direct, and a grounded carbon rod at various positions. Each eidetic node in the carbon rod permits specific distal position and angulated view.

Analysis of the term "rheostat" has intriguing implications. "Rheos" refers to waves. "Stathis" refers to stationary. A rheostat was comprehended as a "wave station". To which waves were the originators referring? The addition of rheostatic components varies the aspect of any individual eidetic experience by permitting sweeping views through the contacted node. These sweeping views are called diffractions.

Rheostats provide diffractive eidetic sweeps of VRIL channelry. Each positional node gives the participant a new eidetic angle. Organismic movement is not required. Rheostats differ according to their material composition and geometric form.

Slide-contact rheostats reveal the longitudinal disposition of eidetic nodes in a material volume. Carbon, nichrome, osmium, and tungsten are among some rheostatic materials. Each selects specific eidetic population characteristic of the material substance. Careful and sensitive variation of slide-contact position permits diffractive eidetic sweeps of a local VRIL channel view without operator motion. The VRIL sensory system experiences what the eidetic sweep reveals. Positions may be held fixed in time for detailed examination (Buell). VRIL operators manage the spontaneous entunement of specific nodes. Experiential knowledge of distal events and circumstances may be apprehended by thee means.

Contact-filters are required for ease of organismic transaction with substances. Granulated carbon, iron, and manganese dioxide powders have been successfully employed to these ends. This mixture may be mixed with plastic or paint substrates and brushed on glass surfaces. Such filters ease the transactive transitions on behalf of the operator.

Most rheostats utilize a rod of carbon which has been end-grounded. Slide-contact provides node transaction which necessarily involves all. Rheostats provide diffractive eidetic sweeps of VRIL channelry. Each positional node gives the participant a new eidetic angle. Organismic movement is not required. Rheostats differ according to their material composition and geometric form.

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Most rheostats utilize a rod of carbon which has been end-grounded. Slide-contact provides node transaction which necessarily involves all the other nodes along the rod length. Material configurations in which numerous projections are individually grounded through rheostatic connections are noteworthy eidetic transactors Little). Each rheostatic eidetic node is separately grounded and activated. This design permits individual strong contacts which are not eidetically diluted by passage through all the other nodes.

Rheostatic components made excellent excessive use of carbon (Edison, Rosebrugh). Anomalous terminology was used by inventors to describe rheostatic action on static conditions (Buell). Tunable bridge rheostatic components reveal the nature of eidetic transaction and static formation (Stearns). Strong rheostatic contact provides strong eidetic experience. Least electrical resistivity is associated with closest eidetic view. Great electric resistivity is associated with furthest eidetic view along a VRIL channel. This empirically determined inverse correlation is significant.

Eidetic diffractive transactivity inversely determines electric conductivity. The strictly electro-detrital operation of componentry is an artificially forced condition. Technological designs are VRIL designs in their fundamental being. Electri-detrital activity is understood through VRIL reactivity in materials. Several designs employed special materials for the reduction of "line static".

Experiential static is the true spontaneous source of electrical static production in a line. The eidetic principles are pre-detrital (pre-electrical) in nature. Eidetic transactivities are spontaneous and continual in VRIL Space. Natural ground and material eidetic nodes spontaneously produce static constantly. The production of static strongly correlates with spontaneous eidetic transactivities...but static production remains typically weak in comparison with the eidetic potential. Static appears in several designed instances.

Systems inadvertently sharply entune and fix specific singular eidetic nodes to release static detritus. Certain grounds are composed of inertio- absorptive matter (halides, carbonates, silicates). Such grounds should not be entuned sharply. There are ground massives in which static never appears.

Such grounds are specific mineral-rich districts whose structure and composition are strongly eidetic and which dissolve detritus ("static").

Systems which enjoin improperly connected eidetic ground nodes invariably are plagued with "static" detritus. Enterprise did not concern itself with proper placements and geomantic considerations. Systems were improperly erected in the great rush westward. Telegraphic stations were plagued with static when ground-plates were sunk into the wrong spots.

Samuel Morse experienced this phenomenon when attempting the first telegraphic lines. Ground-burial of cables was the initial plan. This project was quickly abandoned when so much static suddenly appeared that signalling was impossible. The aerial erection of guidelines was the solution. Aerial guidelines were sometimes

plagued with static at odd intervals. Weather and wind had little to do with these spontaneous appearances. The auroral activity could not be cited in these persistent episodes of static congestion.

The anomalous appearance of "static" along buried cables is electrically problematic: grounded objects are supposed to lose charge. Aerial elevations spontaneously "acquire charge" though well grounded at every interval. Therefore charge is the detrital residue of a more fundamental energetic transaction. That energy is VRIL.

Dr.G. LeBon provided experimental evidence for the spontaneous appearance of charge and of radioactivity in matter. His solution did not glimpse the secret truth concerning the manner in which consciousness interacts with matter to produce strange inertio-physical manifestations.

VRIL is the vast consciousness of which we partake. VRIL continually interacts with its own projections. Minerals and metals display strange spontaneous effects in apparent absence of cause. The "instability" of radioactive nuclei is the commonly cited explanation. Tesla suggested that external bombardment caused dense nuclei to explode. His suggestion that space-generated aetheric particles impinge on matter is noteworthy.

Eidetic transaction is the VRIL projection of conscious worlds into inertial space. Projected materials impact inertial space in various exhibited manners. Certain minerals, metals, and organic substances absorb, disperse, accumulate, densify, and project inertial detritus with their eidetic projections.

All material displays and their effects on the inertial space may be comprehended by recognizing that matter is a conscious projection. The vastness which is VRIL projects, generates, and sustains matter and space. Original VRIL matter is mysterious. It may be that many commonplace observations are the direct effects of VRIL original matter.

Ground node connections instantly load systems with inherent meanings and message. These may be entuned with fine precision. Additions of "signal clarifiers" enhance eidetic projectivity of VRIL nodes. The empirical design and efficacious use of specific components was developed throughout telegraphic history.

Componentry cannot be reduced to functions. Componentry must be eidetically studied according to forms. Each form, each material, each orientation gives distinctly different eidetic experience to the examiner. Round clear glass plates differ entirely from squared glass plates. Metals completely differ in their eidetic projections when used in capacitative forms. Variable parallel plate capacitative forms (baffled) eidetically differ from rotating vane capacitors.

The technological garden afforded VRIL Design is exceedingly prolific. VRIL Designers should be glad to recognize the distinctive and individual identity of each item, object, and form. VRIL Science requires careful and detailed empirical account of each separate component.

Strange vortexial rheostats were empirically designed to block the "static discharge" (Field). Tunable wire coil rheostats were employed for "balancing the line" to eradicate static (Buell, Little). Rheostats permit adjustments in proportional balances between VRIL transactivities and inertial reactivities.

Variable vane-capacitors provide sweeping and clarified eidetic views specific to their material composition, geometric form, and physical disposition.

Grounded variable potentiometers offer rotational eidetic views in the vertical plane when aligned perpendicular with local VRIL channelry.

Vertical carbon rods brings eidetic sympathy with formative worlds. One experience the forest-like presence of glowing black cylindrical forms. Slide- contact carbon rod rheostats must be held in flush ground contact for distinct eidetic nodes to appear. Each gives sweeping horizontal view of distinct VRIL channel positions. Angulations along brancated surface threadways are distinct and positionally fixed with regard to component sweep.

The conductive use of substances to provide "slower signal speed" is anomalous. A small section of resistive material does not slow signal speed or store signals as in the manner of loaded transmission lines. The use of water as a message-retarding medium is an anomalous patent entry which is non-electric in principle (Hughes). Water does empirically inhibit, densify, and retard eidetic transactions: this is the true cause of the observed effect on electro-detritus.

All discussion which deal with capacitors and batteries begin with Galvani. Luigi Galvani demonstrated the organismic influence of separated dissimilar metals. Projected strains are sensed in the space between dissimilar metal plates. Proper ground emplacement and plate alignment enhances these vitalizing strain components.

Galvani did not deal with detrital fragments. Galvani especially strove to eliminate such static effects from his arrangements. He equated dangerous detrital components in both thunderstorm conditions and static electrical machines long before Franklin's demonstration. His fair weather observations mention the fact that "...metal plates, aerial terminals, and grounded lines yield sudden, powerful, thrilling shocks...which do not register on the most sensitive gold-leaf electroscope...".

Luigi Galvani described the visceral effects displayed through various spaced metallic arrangements. These were "thrilling...vitalizing...joyful...". Though powerful and impressive the eidetic projections of matter and material configurations are the most fundamental powers ... exceeding the visceral effects.

Galvani did not report these eidetic phenomena. No doubt he and his assistants received them. These would not be part of the experimental record. Anecdotal comments made among the experimenters would include sudden "visitations" of memory, impression, color, mood, and conscious translation. Perhaps most trained observers do not allow themselves the luxury of reporting their every impression, mood, thought, and vision.

Approaching large nonpowered electromagnets produces immediate visceral sensations of sharply focussed vision. Visceral non-acoustic tones are pronounced in the immediate space. Strong diaphragmic oblations cannot be ignored near these structures. Why did not Joseph Henry report these overwhelming effects? Academic Science forbids, limits, and retricts sensation.

Such empirically transient impressions form the strong and valuable part during experimentation. VRIL empirical science stands upon the native phenomena which appear during experimental procedures. Perhaps the prolific amount of such impressions was denied by experimenters whose minds were overcome by them. Perhaps there were those voices which sought to eradicate these eidetic impressions from science altogether; claiming them to be the mere "wanderings of undisciplined minds". Replacing empirical participation and eidetic impressions with meters and statistical analysis has not achieved more humanly valuable knowledge.

The question which designers will address concerns itself with classifying the Galvani designs: are these batteries, condensers, or capacitors? Difference exist among components whose original namings retains the truth.

Capacitors and condensers are not identical. Capacitors and condensers perform different functions when properly empowered and utilized. Capacitors are geometric material dispositions which sustain an energetic flux. Capacitors act as valves and gateways of other worlds. The capacitor is a flowing reservoir.

VRIL capacitative transactors behave as

wells, reservoirs, and fountains. VRIL transactive surges flood the design configurations and project VRIL eidetic experiences through districts and regions: these are sensed in absence of material contact when properly arranged. Capacitors act as experiential terminals and as eidetic retinas for communicants.

VRIL capacitors are connected directly with ground and interlink aerial with ground: they are flowing reservoirs. Capacitors permit modulations and modifying influences. VRIL capacitors behave as valves for eidetic transactions. Such designs remain fixed as stations having specific positional alignments.

Several capacitors in the patent record are anomalous in form, composition and function. There are many capacitor-varieties, configurations, and symmetries. Some capacitor designs were strange hybrids of resistors, accumulators, condensers, and earth batteries (Muirhead, Smith).

Capacitors may be made with dissimilar metals (Galvani). Some took the form of organically coated ducts (Taylor, Muirhead). Capacitors may use minerals and salts (Meinke, Bradford). Capacitors may use vegetable matter, germinating seeds, and green moss (Mesmer).

Special capacitors and conductive arrays enjoined telegraphic and telephonic systems to the ground (Muirhead). Special capacitors and formularies for preparing them include organic pastes and metal powders made to balance the line (Taylor). Viscerotonic effects of VRIL capacitors are notable. Capacitors were designed which acted as intensifiers of eidetic transaction (Vassilatos). Certain capacitor designs greatly collimate and intensify eidetic signals.

Sharp experiential axes transact meaning and code transfers. Capacitors are VRIL active only in specific alignments. Their plates must be parallel with the existing VRIL channelry in a district. Capacitors are flowing eidetic transactors and transformers. Capacitors give special tunnelled tensions when dissimilar metals are used.

One experiences remarkable transformations of immediate surroundings when horizontal dispositions are used and eidetically examined. Zinc horizontal multi-baffled capacitors (air gap) reveal a wintry night world of wonderful snowy starlight. One is eidetically translated up from the ground into the twinkling tufts of penetrating luminous white in varying elevations. Positioning of the plates effects and fixes experiential elevation.

Such experience is comfortable, close, and secure. There is every sense of a comforting presence on all sides...hopeful vision of desire in spaceward directions. Such horizontal baffled zinc plate-capacitors were used in wireless apparatus for good reason. Eidetic access to upper space was instantaneous and strong. Strongly elevational eidetic reactivities are produced in parallel plate capacitors when grounded.

The closing of plates intensifies eidetic content with controllable variable elevations of view. Various VRIL capacitors increase the visceral tones of whole surroundings: pure visceral (non-acoustic) tones are heard louder and highly clarified across a volume of space. This condition also succeeds in drawing sounds of the environment into a focus about the capacitor plates.

Capacitor plates may be grounded. Varieties of aerial or earthed metal plate combinations will reveal unexpected VRIL reactions (Bear, Shoemaker, Murgas et.al.). VRIL active capacitors may be constructed from various materials (Mesmer, Galvani, Reich, Theroux). These designs must be aligned with dissimilar plates perpendicular to VRIL channelry.

The copper plate must face us when copper and zinc is used. Right hand holds copper...left holds zinc. Vague eidetic image of forest periphery in black bloom (during winter!). Amazing result obtained by singing into the plate duct. Capacitor gave sudden strong eidetic images of the far forest wall. Images fade in a few seconds until reactivated by a whistle or vocal utterance. Pitch effects verticality of eidetic view. Higher pitch goes vertical over the eidetic ground node. Angle of view decreases with decreasing pitch. VRIL transactions may be magnified and modulated by organismic intonations. VRIL supplies the projective consciousness.

Capacitors become eidetic-transactive through VRIL thread connections. Eidetic power develops "static" in capacitors through spontaneous VRIL transactions.

Tesla superimposed electrostatic impulses upon the eidetic supply of the capacitor. Kilner, Tesla, Reichenbach, Abrams and others discovered that electrostatic and magnetically impulsed capacitors released greatly expanded eidetic transactions throughout the surroundings. The eidetic causes generate the "electric" effects.

Varieties of capacitors release differing energetic species when viewed eidetically. Eidetic images vanish when capacitors are mildly charged electrically. Positive copper plate faces the operator. Powerful eidetic journey commences when tones or vocal expressions are directed into the plate duct toward the ground. The most astonishing eidetic wandering along certain VRIL threadways is experienced. Visceral effects are instantaneous in the hands and arms and persist for several moments thereafter.

Vacuum tubes as capacitors must be VRIL channel aligned. Pins must face the operator while operator faces the VRIL channel source direction. Sudden highly collimated eidetic tunneling commences toward the horizon. One journeys eidetically through a very highly projective threadway as far as can be sustained.

Glass plate capacitors give eidetic projections which are metal dependent. Touch contact along their lengths gave progressive distancing from the origin contact-point. Zinc plates separated by clear glass give progressive black ground horizons of position out and away from the contact point. Aluminium fixes progressive eidetic projection horizons out into the bright whitened sky.

Scroll-wound capacitors permit directionality of eidetic experience only when physically rotated with respect to the ground. They do not permit eidetic translation through eidetic node contact alone. One must move these devices through space as probes. Vertical positioning brings irritating inertial flux into body but reveals environmental realities not apparent with the 5-sensors.

Scroll-wound capacitors give bilocations.

Electrolytic capacitors project a powerful insensate VRIL thread along axis where pointed. Threads do not permit eidetic participation. Excessive back-inertial flux causes operator certain irritative pain. Small electrolytic capacitors produce high-pitched visceral tones. Larger ones provide mild focussed bilocations out to local ground nodes.

Condensers are specific designs which resemble batteries. Condensers focus, fix, and hold an energetic condition into experiential space. Condensers focus, sharpen, and clarify specific eidetic experience. Condensers have a special function as VRIL Transmuters. Condensers allows the powerfully focussed fusion of multiple eidetic projections. Condensers may be ground-connected through lines but never ground-emplaced. They are made to resist spontaneous transitions which the VRIL environment manifests. Condensers maintain a strict rigor of eidetic entunement for alchymycal purposes.

Condensers are experiential doorways which fix, focus, and project transactions. A condenser is an projective isolator, a reactor terminal where stresses and transmutations remained fixed. Condensers are VRIL eidetic transmutors in which fixed eidetic transmutations may be openly experienced throughout a region.

VRIL condensers are VRIL Reactors.

These are powerful crucibles and lenses of sentient transactivities. It is for these reasons that we conduct lengthy study in archane histories and developments of electro-discharge tubes. In these were arranged mighty and distinct VRIL reactions with district effects.

Batteries are a sub-class of capacitors and condensers. Batteries differ considerably among themselves, and cannot be appreciated according to the electri-detrital products which they produce. Galvani's aerial terminal batteries and space-batteries produced no electri-detrital products at all. Batteries of Volta were radically different from those of Galvani. Galvani politely refrained from criticizing statements by Volta contrary to this effect. Galvani pointed out that his own designs vivified...and that those of Volta caused pain.

The Volta battery is a condenser which utilizes brine to fill the space between dissimilar metals. Metal plates touch in the Volta condenser. The Volta condenser produces copious amounts of detrital products (electric charge) and offers mild eidetic transaction only at the positive pole.

Batteries may be ground emplaced. These "earth batteries" use eidetic ground nodes themselves as the material which fills the space between dissimilar metal plates.

Interleaving ground manifolds are ground-capacitors. Ground-plate end- terminals of telegraphic stations are noumenous sites. These designs became the intense focus of inventors in the mid-1800's. Several such forms are given in Volume 4. These ground capacitors are called earth "batteries" when dissimilar metals were employed. Engineers focussed upon the electro-detrital products of these designs and neglected the eidetic projections which are first encountered on approach. First impressions are soon forgotten by the insensitive and undisciplined!

Earth battery assemblies surround themselves with vibrant visceral whorlings. Vibrant vortices are VRIL surge projections felt across spring fields. Earth batteries enjoin distant empathic communications among the unwary. Earth batteries take on several geometric forms (Dieckman).

Dissimilar metals may be used when properly ground aligned. These enjoin deep eidetic transactions with VRIL channels. Communications of projected experiences are engaged when peering down into their ducted baffles. Properly aligned horizontal ducts often seem to waver and undulate with crenulated black waves. These visceral experiences may be followed by a black radiant projective softness. Contact is not required. Proximity with such ducts brings a sometimes irritating and nervous sensation of heat.

Aerial batteries are special capacitors. Aerial "batteries" are lanceolate terminals made of various metals, minerals, glass, and (rarely) magnets. These compositions are hoisted to a small elevation. Aerial capacitors enjoin project eidetic ground transactions specific to their material form. These do effect district control of weather and viscero-eidetic atmosphere when properly poised. The cavitatation of inertial space has been demonstrated by several researchers (Reich, Constable, Theroux, Vassilatos).

Loading coils as static neutralizers transact tremendously emotional presence. Visceral (emotive) projections may be sensed for several hundred yards from vertically oriented loading coils.

The discovery that induction coils could reduce line-static was instantly implemented by telegraphic systems everywhere. Theoretically these should not help vocal line-transmissions. In addition to these static-blocking inductors, numerous line shields were employed (see Volume 6: Dann, Lapp). The sudden and spontaneous clattering of code unnerved several telegraphic operators.

Eidetic transactivity passes unnoticed by most. Eidetic surges become physically manifest on rare occasion.This mysterious and spontaneous natural language would commence with several telegraphic signals. Telegraphic receiving blocks would respond to these powerful signals for long periods of time. Operators frequently were required to disengage from the line service until the anomalous encounters subsided of their own accord.

These episodes were not always associated with thunderstorms, dry windy conditions, or snow falls. They persisted during fair weather on certain lines.

The greatest objection to a purely electrodynamic solution lies in the fact that telegraphic lines are numerously grounded systems. Every station had its own baffled ground-plate assembly. These grounds were solid and conductive. If static accumulation had formed in the line, then grounding could disperse the "charge" in one close of the switch. Static accumulations sometimes drive the code transfer of telegraph circuits. They sometimes block them entirely: the chronicles tell us they do both at different times.

A second objection deals with the problem of intensity. Telegraphic blocks require some degree of electrical power for the transfer of code. Static does not supply this power. Generative sources necessary to sustain continuous automatic "false signalling" must exceed the power of static. Static is not the cause of the problem. Static is the effect of the problem. Calculations do not indicate fair weather influences sufficient to accumulate such charge. Furthermore, calculations and formulations were largely developed by empirical observations: the formulae fit the condition. They merely cite the effects and do not sufficiently explain the generative cause of the problem.

Station managers cited the intense auroras and dry windy seasons for these unusual conditions. Were the sources of these detrital accumulations magneto-electric or fricto-electric? A third problem persists in numerous reports of the "self-powered lines". Several company lines had disengaged themselves from battery power altogether for years. The registered currents were sizable and had no reasonable explanation.

Static accumulations are not generated by inertial means at all. Inertia does not generate inertia. Inertial space is a closure: an effect which requires initiation.

Static is generated when eidetic transactivity reaches surpassing crescendi. Aurorae and other meteorological conditions may themselves contain eidetic messages. All inertial manifestations are caused by the fundamental agency of VRIL.

Natural eidetic projections are constantly mutually self-transacting. Telegraph lines often were improperly ground-emplaced. Tuning the grounded assemblies of specific telegraph stations gave aid to the individual operators but created an eidetically imbalanced line condition. Eidetic oscillations experientially occur in recipients who are in line-contact with different VRIL nodes. This situation may occur when improper ground connections have been made.

The oscillatory eidetic experience engages the recipient in defined eidetic undulations...from one horizon to another. Speed of these eidetic oscillations varies with ground nodes and line orientation. We cite visceral experiences with train tracks and the sudden "glimmerings" which drag the eye rapidly up and down the track at odd intervals and with variable patterns. The experience can be painful when eidetically engaged.

Static conditions follow natural eidetic transactive events. We observe geo-regional correspondencies when these eidetic surges occur. Several choreographed events are repeatedly chronicled during these episodes: solar flares, sunspots, aurorae, meteor showers, earthquakes, floods, storms, and a host of other correlated phenomena. These events infrequently take place in grand crescendi. They occur in moderate expression with certain periodicity continually.

Eidetic mis-matched ground-plates cre-

ate eidetic undulations of specific periodicity. These eidetic undulations produce experiential drifts. They disturb consciousness when severely mismatched. Eidetic undulations are potent. They disturb consciousness and inertial space.

Eidetic undulations are not clock-regular. Each eidetic sweep impacts inertial space. Cavitations of inertial space release detrital products. Iron is an element which absorbs inertial detritus when grounded. Iron dissolves inertia only when grounded. Telegraphic lines were made of iron. Iron lines absorb inertial detritus into the ground.

Eidetic projections emerge from ground and spread along the wire away from each mismatched station. Projections impact space and generate static. Normal static accumulation in this process is handled by the groundplates. Inertial space is impacted when each eidetic projection sweeps the line. Inertial detritus accumulates between the sweeping eidetic projections and is alternately pulsed from station ground to station ground. These sweeping accumulations may reach excessive thresholds.

Such repeated cavitations continually charge the line with "static".

Chronicles which tell of line disengagement effectively convey one solution to the static problem. Disengaging the line from the ground node misplacement stops the eidetic undulations. Static ceases.

On rare occasions these eidetic nodes surge and flood space around the lines with cavitating projections. Switch spaces remain ensheathed in inertial cavitation. Observations of leaping blue-white sparks among the station switchworks were reported often.

Static is developed in telegraphic lines when eidetic nodes do not concur. Eidetic reentunement and transaction clarification via capacitors produced correlated empirical effects in telegraphic electrical operative modes.

Helices were employed to "reduce static" (Seldon). How this is electrically possible is suspect. "Choke" coils block electrical impulses discharges; but static continually leaks to ground. Chokes do not prevent leakage.

Eidetic examination reveals that inductors produce eidetic tunneling action. Loading coils and static neutralizers proved to be powerful inertia- neutralizing dissolvers along communications lines because of their primary eidetic tunneling effect. Loading coils are static neutralizers because they powerfully focus eidetic projections from ground nodes. Inductors are powerful inertia-neutralizing dissolvers along communications lines because they collimate VRIL transactions (Smith, Varley, Lugo). Increased meaningful eidetic transactions are enjoined by either coils or capacitors. Each are noted for their "clarity of signal" and may be properly combined to promote special transactions. The portrayal of component combination is problematic to the VRIL designer.

Fine wire coils focus, tunnel, propel and clarify eidetic experience.

Telegraphic receiver blocks were mentioned previously. These inductors were potent eidetic projectors. The use of iron cores and copper windings were a powerful combination. VRIL guides the design of componentry toward the preservation of conscious context and meaningful continuity; without which systems become inoperative.

Electrical transformers are primarily eidetic transactors. Transformers and inductors should be made with various metal articulations for use in eidetic applications. Copper should not be the only coil material mass. Organic matter can be used in such instances. The use of water and helical pipelines serves as an eidetic conducting mass (R.Clark). The use of crystal loaded waterhelices works as a powerful eidetic projector (M.Vogel).

Nonpowered transformers entune VRIL when properly directed. Transformers entune VRIL projective eidetic transactions. VRIL travels through the iron cores of transformers. VRIL entwines the iron yokes of inductors. When these components are properly aligned (perpendicular to VRIL channelry) they may be enjoined for exceedingly focussed eidetic translations along paths which seemingly do not end. Fine the copper windings enjoin strong and accelerative eidetic translations.

Remarkable natural tonal phenomena were made audible when telephonic receivers replaced telegraphic blocks. The musically "jangling" tonal line noise in telephony gave new depth to the mystery. These sounds were not sourced in the tonal opening and closing of metal relays. What power could induce musical tonalities in a line? Static caused crishings and sizzlings...but not janglings. Recordings of natural VRIL visceral tones have been made (Theroux, Vassilatos). All these complex harmonic species are forever manifesting themselves in the ground.

Engineers believed that the geo-magnetic field surrounding the telephone lines could induce "rocking" impulses into a windswept line. These were said to generate the "janglings". These tonal generations are only possible with only the strongest of permanent magnet fields and the tightest of lines. To generate a series of bell like tones we require bell-like harmonics. Not every line was perpendicular to the geo-magnetic field. Lines were loose and supported every 50 feet at most. How then does "the wind" enter the line and "sing"?

The disturbing quasi-acoustic "night-vibrations" of telegraphic lines was never satisfactorily explained. Scientific observers discovered that the disturbances which caused line "vibrations and line-hum" proceeded from the bases of telegraphic poles through "some mysterious earth movement...by which great amplitudes were achieved". These line-hums were treated as acoustic vibrations caused by the wind nonetheless.

Such line disturbances produced excessive vibrations in absence of winds however. These disturbances necessitated the development of special artifices to "deaden the sound". Examination of these sound-deadening boards reveal that the sounds themselves were not acoustically generated. The portrayed placement of patented sounding boards on telegraphic lines as could not possibly effect vibration absorptions or nullifications. The passage of VRIL eidetic transactions through iron lines is deferred by the placement of organic deflectors having sinuate guide paths.

Certain sound-deadening designs are problematic (Connor). Examination of one such patent provides a mysterious clue to the source of night telegraph- line vibrations. No such block mounting can suppress line vibrations. If this were true then any weighted block could stop the vibrations at any support point. Furthermore, telegraph lines were loosely strung...and suspended every 50 feet or less. How then did "wind" manage to generate sufficient mechanical force to make telegraph stations "hum like an organ pipe"?

What this patent demonstrates has much to do with the actual vibratory source and the sound species which is in question. These sounds could not possibly have their origin in strict mechanical vibrations. The only way to nullify a vibrating line is to deaden the vibration of whole line lengths.

Line vibrations would continuously permeate the block itself and transfer acoustic sound into the stationhouse. Such an organic block design operates because it modifies a non-acoustic energy. Experiments were performed with bent wires which were grounded to provide strong eidetic transactions. The identical bent metal wire was sandwiched between wooden block (one free terminal grounded again) failed to give the same eidetic representation: deferring the otherwise deep groundward direction of consciousness into a starry region of space. Such deferment of eidetic transaction results in reduced VRIL-induced line vibration.

These block designs dampen eidetic transactions. The sounds stop because the

transaction is deferred and altered. These sounds reached crescendi during the early morning hours and conform with our observation of the telluric sounds which flood enclosures shortly after midnight (2-4 A.M.). These sounds are viscero-organismic, non-acoustic, and are beneficially permeating.

Grounded component assemblies increased eidetic transactivities with sharply focussed clarity when properly engaged. Circuit designers enhanced ground connections by employing coils, capacitors, rheostats, and special designs to ground plates (Field, Jones). The use of capacitors or inductors provide especially focusses eidetic tunnelings. Coil tuners to ground, capacitor ducts, and rheostatic tuners to ground were developed for "reducing static" and enhancing signals (Jones).

Special capacitors and resistors had been combined to produce effects on coded transfer. Eidetically these combinations were not transactive. Special combinations of resistors, capacitors, and inductors had been assembled to achieve stronger code transfer (Varley). Certain of these component assemblies were so viscero-inertive that human contact with them was disturbing.

These innovations were part of the movement toward code-only systems. Their eidetic transactivity blocks the human organism and prevents normal meaningful transaction. Code is there...but fluidity of meaning and eidetic entourage is missing. Eventually machines did all the code transferring as operators were eventually excessed.

Other dangerously inertifying combinations of rheostats, capacitors, batteries, and condensers began to emerge from the halls of design. The more complex the circuitry...the more code-oriented the system became. These combinations altered the telegraphic arts completely and made them de- humanized enterprises.

Telephony appeared during this time. The golden age of telephony transactivity and discovery lasted until Stubblefield made the very first vocal ground transaction 40 years before Fessenden. The telephonic transmitter did what telegraphy could not do: it permitted direct eidetic transaction among persons. Eidetically they were impediments to human conscious transaction.

The design of eidetic transactors is an artistic process...not an engineering problem. The characteristic of all VRIL systems is that their components harmonious blend to project powerful eidetic transactions on behalf of operators and operations.

SECTION 2

FORMATIVE RADIANCE

P. DUBLER PHOTOGRAPHED VRIL LIGHT-INERTIAL COMPLEXES IN THE GROUND

METALLO-DENSIFIERS WERE UTILIZED TO FOCUS VRIL LIGHT

Unterirdische Wasserader.

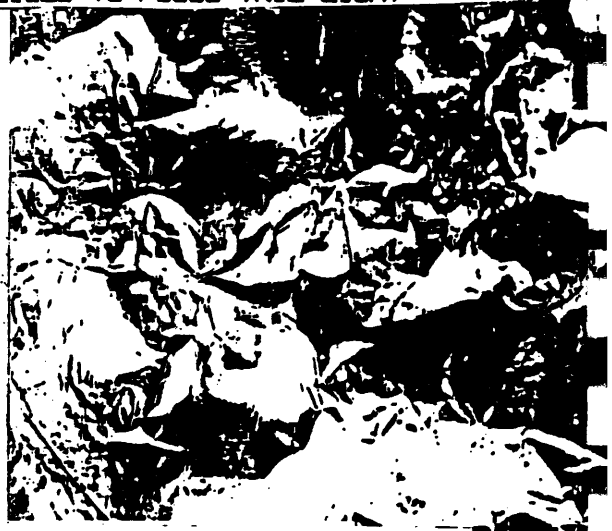

Abb. 2: Erzeugung von Transparentschrift auf Photoplatte, die der Strahlung einer unterirdischen Wasserader ausgesetzt wurde, unter Verwendung einer Aluminiumkassette.

ZINC GIVES STRONG WHITE RAY (SHEATH) PHOSPHORESCENCE

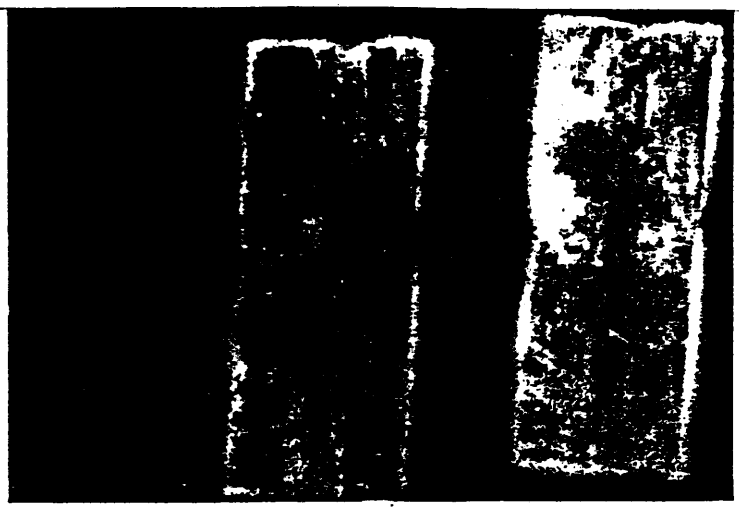

Abb. 3: Ergebnis der Einwirkung je eines bestrahlten Messing-, Zink- und Aluminiumstreifens auf die Photoplatte (links: Messing-, Mitte: Aluminium-, rechts: Zinkstreifen).

VRIL LIGHT CONTENT IS METAL-SPECIFIC

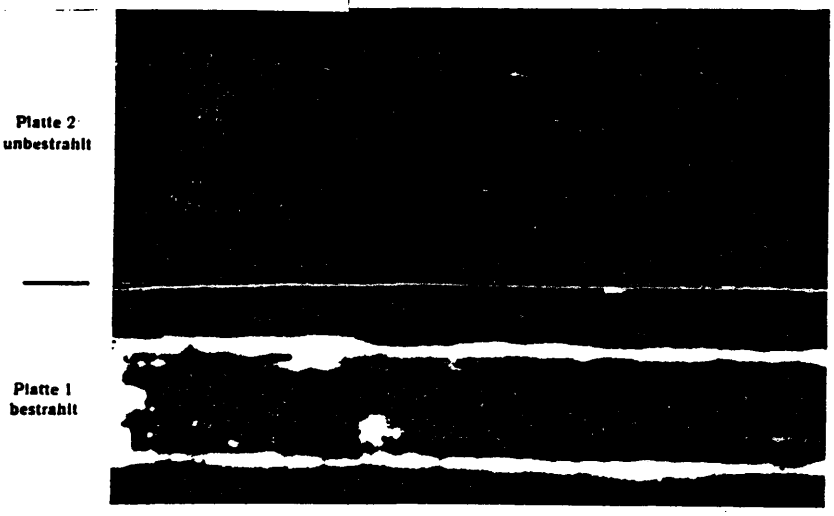

Abb. 4: Nachweis der Strahlung einer unterirdischen Wasserader. Unten: Platte 1, bestrahlt; oben: Platte 2, unbestrahlt. Die Beeinflussung der Platte tritt vorwiegend an den Rändern des Aluminiumstreifens auf, da nur die Ränder blank gemacht wurden. Unterschiede in der Helligkeit der Streifen zwischen oben u. unten sind auf Strahlenwirkung zurückzuführen.

Abb. 5: Nachweis der Strahlung einer unterirdischen Wasserader, wie vor. Untere Hälfte: Platte papierumhüllt; obere Hälfte: Platte metall-umhüllt (= unbestrahlt).

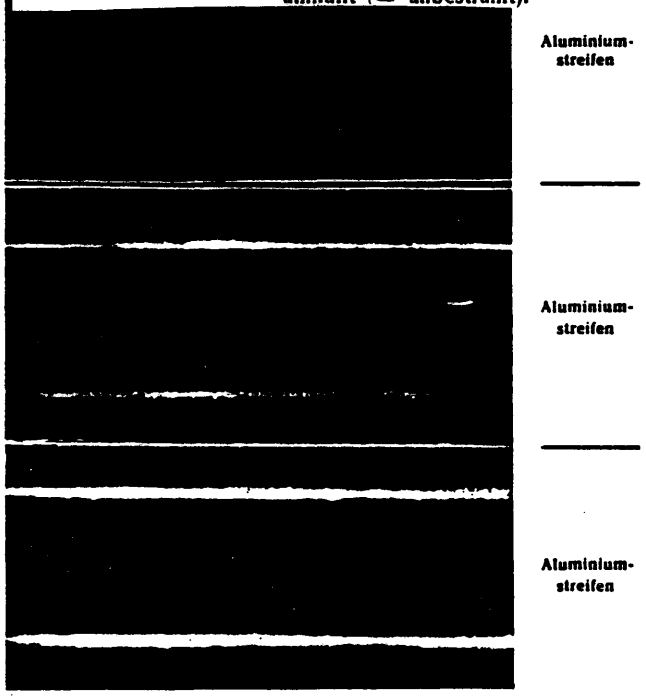

Abb. 7: Nachweis der Strahlung einer künstlichen unterirdischen Wasserader. Oben: Platte 1, in Dunkelkammer aufbewahrt; Mitte: Platte 2, in 1 m Höhe über dem fließenden Wasser ausgelegt; unten: Platte 3, über dem mit Steinplatten und Erde bedeckten Werkkanal ausgelegt. Die Aluminiumstreifen waren nur an den Rändern blank gemacht.

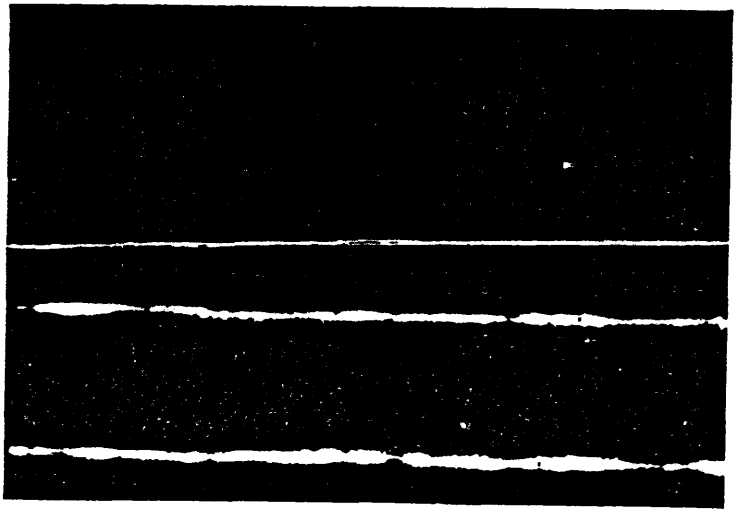

Abb. 6: Nachweis der Strahlung bewegten Wassers. Unten: Platte 1, von Leitungswasser überströmt; oben: Platte 2, in Dunkelkammer aufbewahrt. Der Aluminiumstreifen war nur an den Rändern blank gemacht.

Den Unterschied zwischen einem bestrahlten und unbestrahlten Aluminiumring zeigt Versuch 9:

Aus einem Aluminiumblech von 1,5 mm Stärke schnitt ich zwei gleich große, mit einem radialen Einschnitt versehene Ringe (Abb. 17). Der gleichen Plattenschachtel entnahm ich zwei photographische Platten und legte die Ringe darauf. Die eine Platte setzte ich, lichtdicht verpackt, der Strahlung der bei früheren Versuchen benützten unterirdischen Wasserader aus, die andere bewahrte ich in der Dunkel-

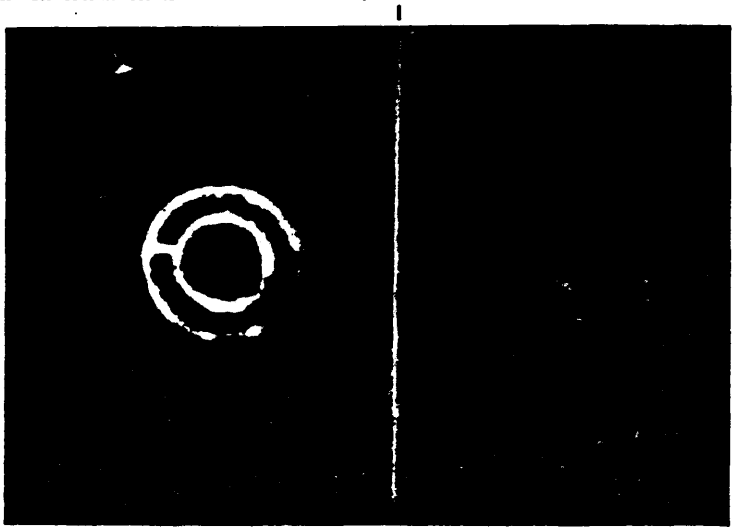

Abb. 19: Versuche mit Hertz'schem Resonator. Unterschied zwischen einer bestrahlten und unbestrahlten Platte. Links: Platte 1, zehn Stunden bestrahlt; rechts: Platte 2, unbestrahlt.

kammer auf. Nach einer Exposition von 10 Stunden entwickelte ich die Platten gleich lang in der gleichen Entwicklerlösung und behandelte sie auch weiterhin gleich. Das Ergebnis zeigt Abb. 19. Die Abzüge wurden im gleichen Kopierrahmen gleichzeitig und gleich lange belichtet, entwickelt, fixiert und gewässert. Die bestrahlte Platte der Abb. 19 zeigt eine viel größere Helligkeit als die unbestrahlte, und die größte Helligkeit tritt an der Unterbrechungsstelle des Resonators auf.

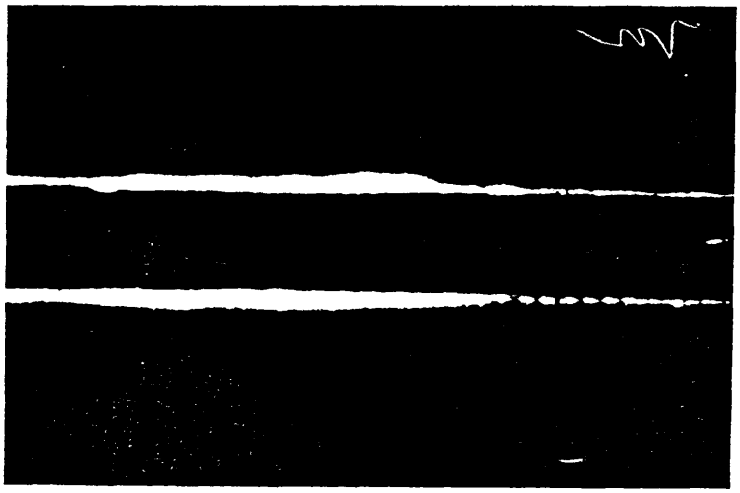

Abb. 20: Bestimmung der Wellenlänge mit Hilfe stehender Wellen. Abstand der Schwingungsbäuche 3 mm, Wellenlänge 6 mm. Die Aufnahme erbringt zugleich den Nachweis der neuen Strahlung im Sonnenlicht (vgl. Abb. 12 e).

Bestimmung der Wellenlänge mit Hilfe des Lecher-Systems.

Zur Bestimmung der Länge elektrischer Wellen dient häufig das Lecher-System, und es läßt sich auch zur Bestimmung der Wellenlänge der neuen Strahlung zwischen Ultrarot und kürzesten Hertz'schen Wellen, z. B. der Strahlung unterirdischer Wasseradern, benützen. Werden in dem Lecher-System elektromagnetische Schwingungen erregt, so bilden sich stehende Wellen. Bringt man das Lecher-System in ein Glasrohr, das luftleer gemacht werden kann, so sieht man das verdünnte Gas an den Bäuchen aufleuchten, an den Knoten dunkel bleiben. An Stelle des aufleuchtenden verdünnten Gases verwendete ich bei meinen Versuchen photographische Platten. Diese wurden an den Spannungsbäuchen geschwärzt und man kann so unmittelbar die Wellenlänge feststellen.

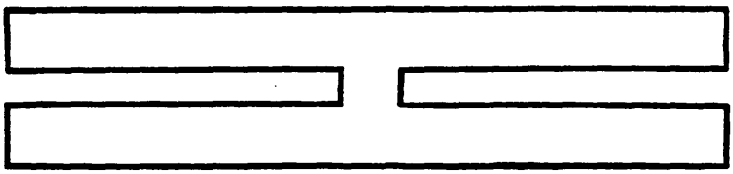

Abb. 21: Schematische Darstellung des Lechersystems.

Meine Versuchsanordnung war folgende:

Aus 1,5 mm starkem Aluminiumblech fertigte ich das Leitersystem, das Abb. 21 zeigt, und legte es auf eine photographische Platte. Diese setzte ich der Strahlung einer unterirdischen Wasserader aus. Das Ergebnis zeigt Abb. 22. Man sieht an den Rändern helle und dunkle Stellen. An den Spannungsbäuchen ist auf dem Negativ stärkere Schwärzung, auf dem Positiv größere Helligkeit zu bemerken. Der Abstand der Spannungsbäuche zeigt, daß man es mit Millimeterwellen zu tun hat.

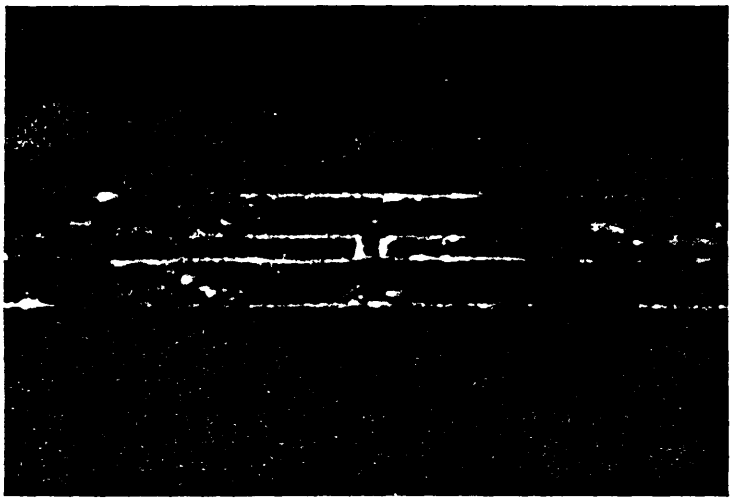

Abb. 22: Bestimmung der Wellenlänge mit Hilfe des Lechersystems. Stehende Wellen von Millimeterlänge.

Messung der Wellenlänge mit dem Spiegelgitter.

Durch die Versuche mit dem Lechersystem und mit Hilfe stehender Wellen ist die Wellenlänge der von unterirdischen Wasseradern ausgehenden Strahlen der Größenordnung nach bestimmt worden. Um die Wellenlänge genauer zu messen, verwendet man wie in der Optik am besten Gittereinrichtungen. Die zu verwendenden Gitter muß man der Wellenlänge anpassen.

COLOR PHOTOGRAPHS OF VRIL LIGHT CONTENT HAVE NOT BEEN REPORTED

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VRIL LIGHT COINCIDES WITH DOWSING CURRENTS AND VISCERAL GROUND-LINES

VRIL LIGHT COINCIDES IN DENSIFICATION WITH LAHOVSKY RESONATORS

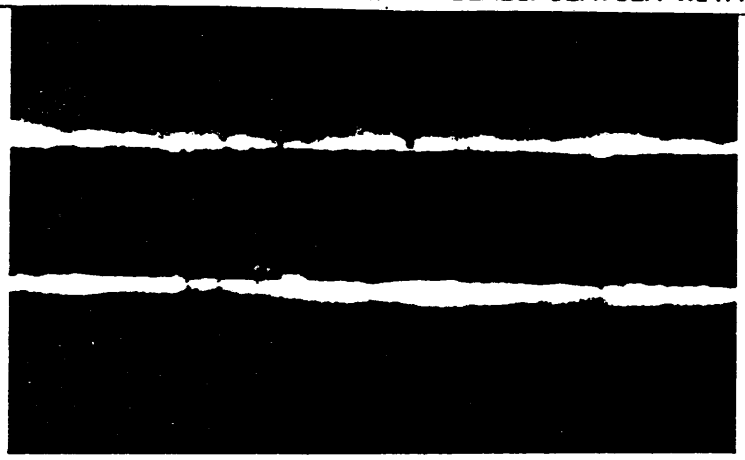

Abb. 8: Nachweis der Strahlung eines mit Eis bedeckten Baches. Der Aluminiumstreifen war nur an den Rändern blank gemacht.

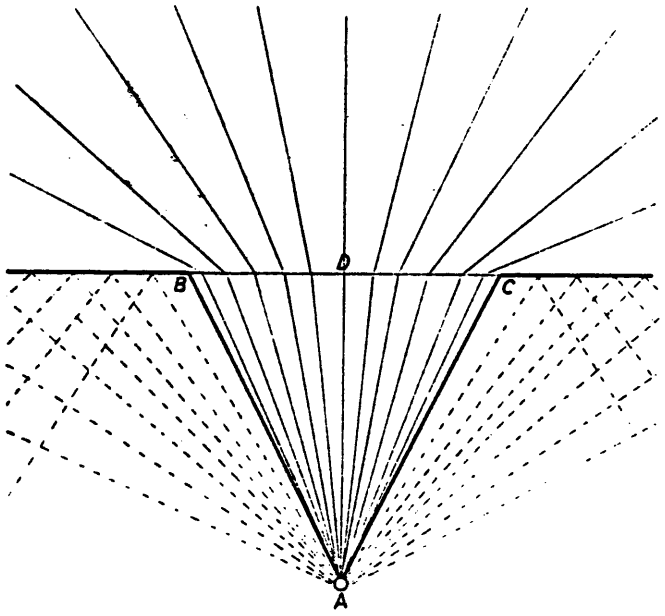

Abb. 9: Schematische Darstellung der Entstehung eines „Reizstreifens" über dem Erdboden. Die Breite B C des Reizstreifens ist durch seitliche Totalreflexion der Strahlen bedingt, die von der unterirdischen Wasserader A ausgehen. Tiefe D A der Wasserader = Breite B C des Reizstreifens.

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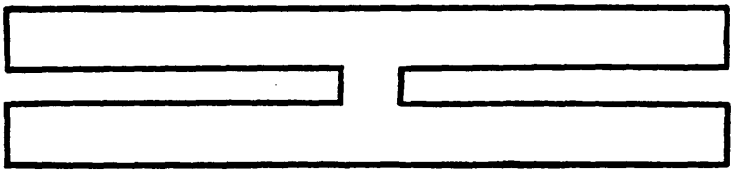
DEVICES MAY ENTUNE THE MANIFESTATION OF VRIL LIGHT



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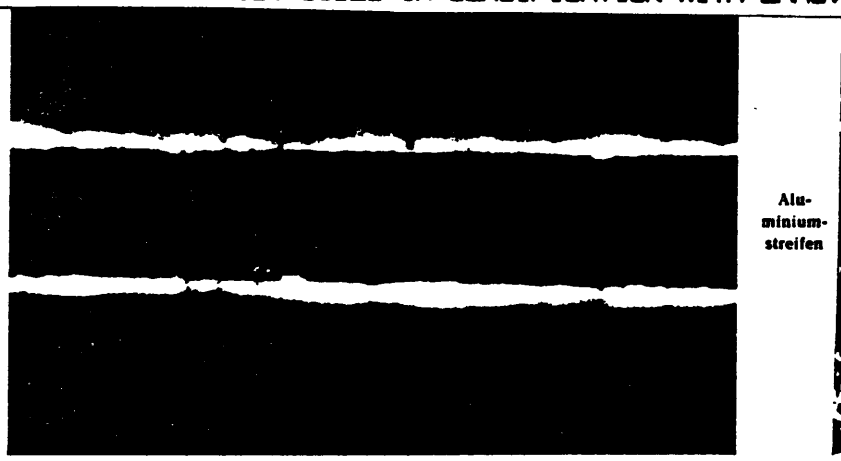

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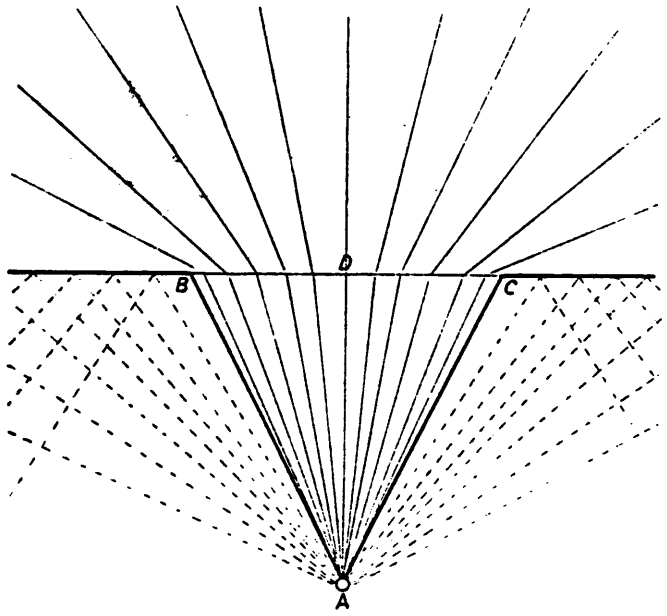

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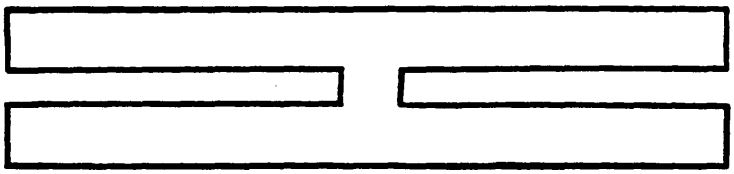

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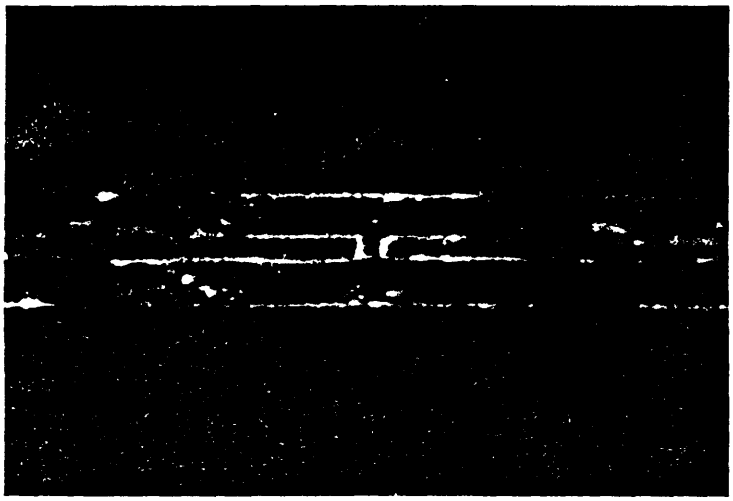

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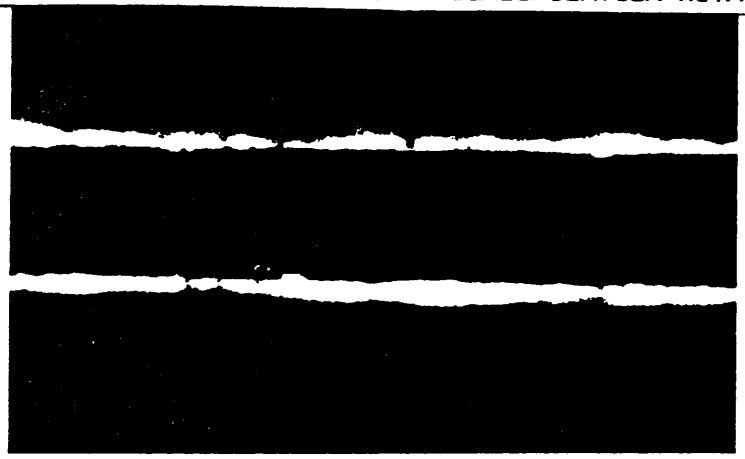

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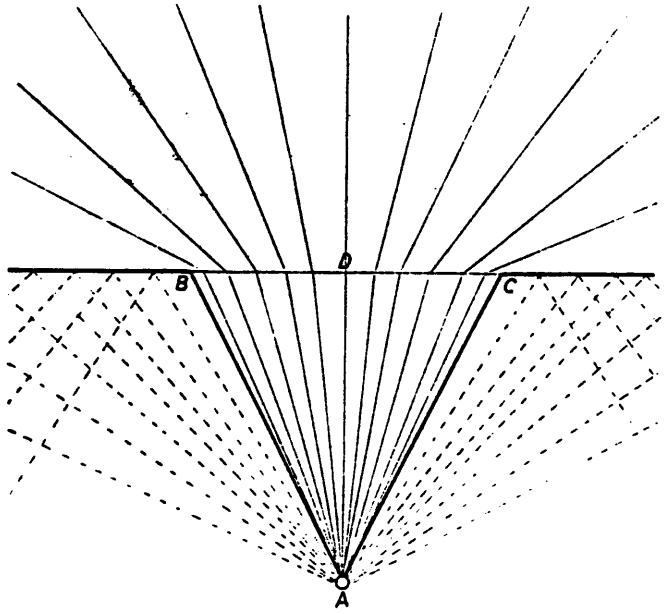

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Abbildungen 24 a — d:

Spiegelgitterspektren der Strahlung von bewegtem Wasser, eines Schmetterlings, des Bergkristalls und des Granats.

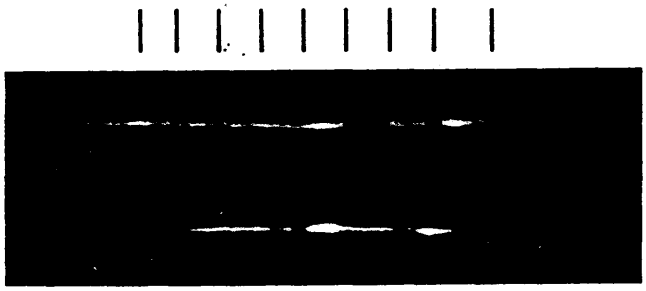
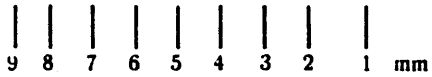


Abb. 24 a: Strahlung des bewegten Wassers (Wasserstrahler, vgl. Abb. 10).

Abb. 24 b: Strahlung eines lebenden Schmetterlings (Acherontia Atropos L., Totenkopf).

Abb. 24 c: Strahlung des Bergkristalls.

Abb. 24 d: Strahlung des Granats.



Skala der Wellenlängen.

Abbildungen 24 e — i:
Spiegelgitterspektren von Kristallen und Salzen.

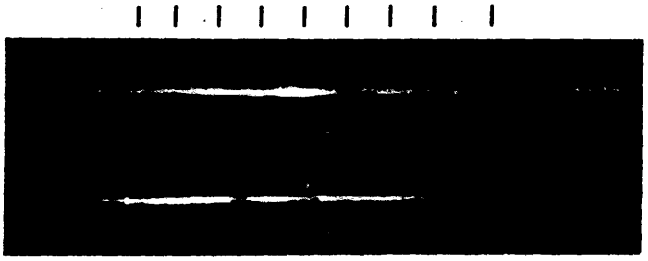


Abb. 24 e: Strahlung des Hornblendekristalls.

Abb. 24 f: Strahlung des Ammoniumchlorids.

Abb. 24 g: Strahlung des Steinsalzes.

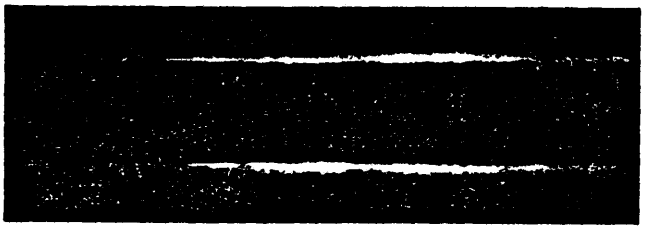
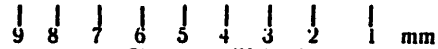


Abb. 24 h: Strahlung des Kalkspats.

Abb. 24 i: Strahlung des Würfelzuckers.



Skala der Wellenlängen.

Bei meinem Apparat waren die Konstanten

$$a = 10 \text{ mm}, \quad b = 10 \text{ mm}, \quad \psi = 27°.$$

Der Winkel φ wurde jeweils nach der Lage des Maximums auf der photographischen Platte bestimmt. Um die Wellenlänge auf einer Skala ablesen zu können, berechnete ich den Abstand der Beugungsbilder für die Wellenlängen 1 mm bis 10 mm von einem festen Anschlag.

Die photographische Platte mit dem Aluminiumstreifen war in dem Spektralapparat so angebracht (Abb. 23 b), daß der untere Rand des Aluminiumstreifens sich mit der strahlenden Substanz S und der Mitte der reflektierenden Metallstreifen ACB, $A_1 C_1 B_1$, ... in einer Ebene befand. Für die Messung der Wellenlänge ist daher nur das Spektrum am unteren Rande brauchbar. Der obere Rand des

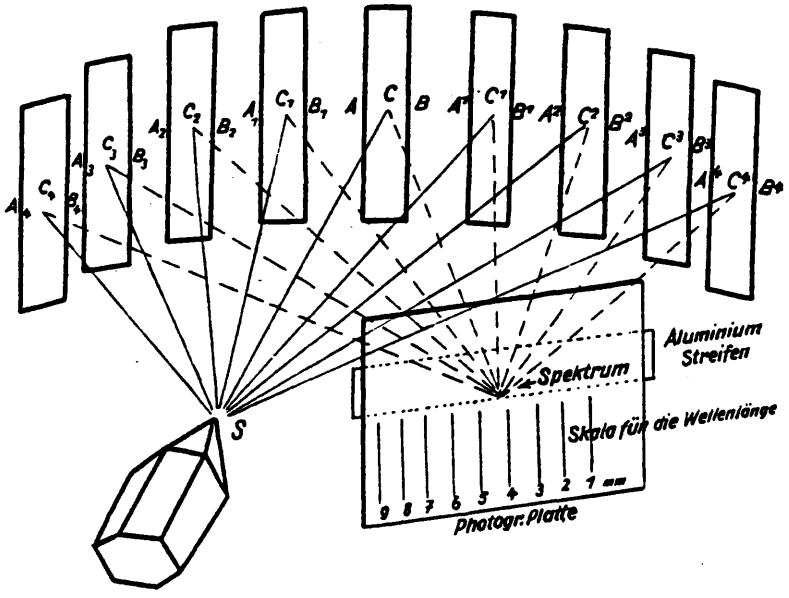


Abb. 23 b: Spiegelgitter wie vor, Schrägbild.

Aluminiumstreifens liegt nicht in der oben angegebenen Ebene, vielmehr ist die durch S und den oberen Rand des Aluminiumstreifens gebildete Ebene geneigt gegen sie. Die reflektierten Strahlen erleiden daher im Spektrum des oberen Aluminiumrandes eine Verschiebung. Diese beträgt für die vom äußersten Streifen links $A_4 C_4 B_4$ reflektierten Strahlen 2,3 mm, für die von mittleren Streifen ACB reflektierten Strahlen 1,5 mm, für die vom äußersten Streifen rechts $A^4 C^4 B^4$ reflektierten Strahlen 1 mm. Das Spektrum des oberen Aluminiumrandes ist daher nicht identisch mit dem Spektrum des unteren Randes und zur Messung ungeeignet. Nur das Spektrum des unteren Randes, das sich in der Ebene $S C_4 C^4$ befindet, kann zur Bestimmung der Wellenlänge verwendet werden.

Bestimmung der Wellenlänge der neuen Strahlung mit Hilfe stehender Wellen.

Die Schwärzung entlang des Aluminiumrandes ist bei manchen Aufnahmen (z. B. Abb. 12b) nicht gleichmäßig, trotzdem der Aluminiumrand ganz gleichmäßig blank gemacht war und mit dem Auge keine Unebenheiten zu bemerken waren. Man wird beim Betrachten der Aufnahmen an die Schwingungen von Platten und sierende Wirkung entsteht, so hat man ein Spiegelgitter. Es treten Beugungsspektren auf und diese gestatten die genaue Bestimmung der Wellenlänge. Folgende Gittereinrichtung, die in den Abbildungen 23 a und 23 b im Grundriß und Schrägbild dargestellt ist, bewährte sich sehr gut:

Auf dem Umfang eines Kreises vom Durchmesser OC = 17,8 cm sind Metallstreifen ACB; A_1 C_1 B_1, ... von 1 cm Breite und 9 cm Länge angebracht. Sie stehen senkrecht auf der Ebene des Kreises und es ist zugleich

$$ACB \perp OC;\ A_1\ C_1\ B_1 \perp OC_1 \ldots .$$

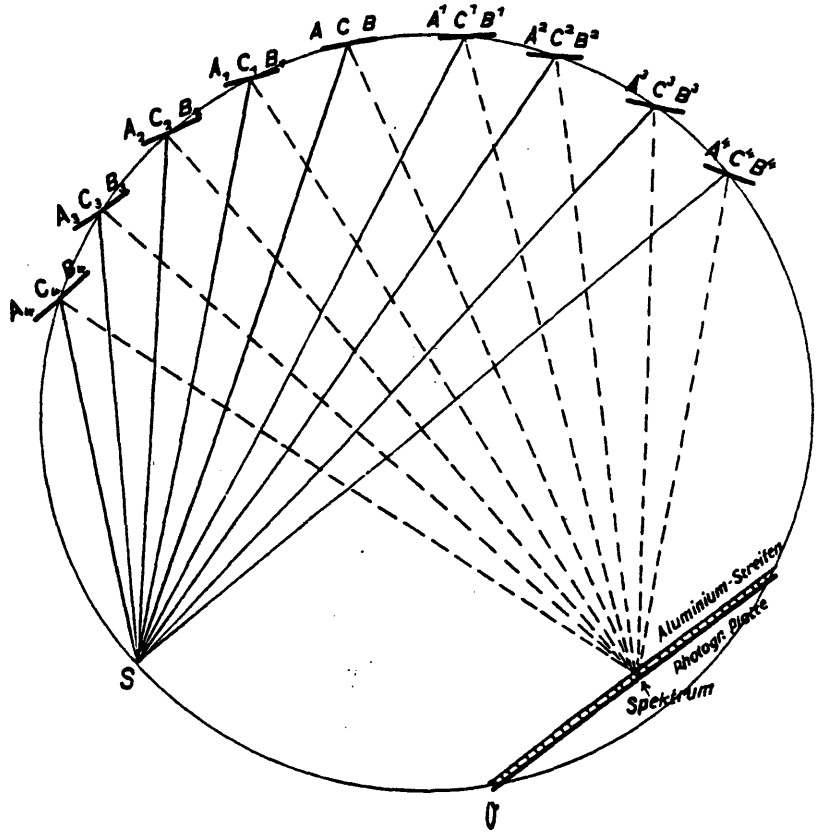


Abb. 23 a: Spiegelgitter, Grundriß.

Die von dem Punkt S des Kreisumfangs ausgehenden Strahlen werden durch die Metallstreifen nach einem Punkte reflektiert, außerdem entstehen Beugungsspektren, die auf einer passend angebrachten photographischen Platte durch aufgelegte Aluminiumstreifen Schwärzung hervorbringen (Abb. 23 a und 23 b). Aus der Lage der Beugungsspektren läßt sich die Wellenlänge bestimmen nach der Formel

$$(a + b) \cdot (\sin \varphi - \sin \psi) = -\lambda .$$

THE same number of the *Comptes rendus* also contains a second note by M. G. Le Bon, on photography with "dark light." By placing a sensitive plate under a negative, covered with a metallic plate 0·5 mm. in thickness, and exposing to the light of a lamp, good images are obtained on development, especially if a piece of lead is bent back over the frame, so that the whole printing frame is in a sort of metallic box. M. G. H. Niewenglowski mentions that these results can be obtained without any lamp at all, and hence suggests that they must be due to luminous energy stored up in the negative. But further experiments by M. Le Bon have completely eliminated this source of error, as the same results are obtained with negatives which have been previously submitted to blank experiments in the dark. From the point of view of Maxwell's theory of light, rays which can pass through 0·5 mm. of copper must differ essentially from ordinary light, and M. Le Bon proposes to next examine within what limits these dark rays submit to the

908. *Action of Metals etc. on a Photographic Plate.* **W. J. Russell.** (Chem. News, 77. pp. 167–170, 1898.)—The paper describes numerous experiments made to investigate the statement made in the Chem. News, 75. p. 302, that certain metals, copal, printing-ink, etc. had an action similar to light on a sensitised film. The active constituents of the organic bodies mentioned were found to be oil and turpentine. Further experiments showed that the following were active substances:—Vegetable and essential oils, paraldehyde, benzaldehyde, guiacum, cinnamon, spirits of nitre, eau-de-cologne, and terebene. The activity seems to depend on the reducing power: thus, linseed oil is very active, while olive oil, which has a far less reducing power, is only slightly so. Also oxidised bodies nearly related to the terpenes—such as terpinol, camphor, and thymol—are inactive. With some of these active bodies solarisation can be obtained. Among the metals, zinc, cadmium, magnesium, aluminium, and fusible metal are active; while lead, nickel, tin, silver, sodium, and mercury are inactive. A very slight trace (so small as one three-hundredth per cent.) of zinc is sufficient to make mercury highly active. Again, alcohol when pure is inactive, but after being in contact with zinc becomes active, this activity remaining after filtration and to a certain extent after distillation. Zinc after long exposure to the air is inactive, and is more active the cleaner its surface.

The experiments show conclusively that the action is due to a vapour emanating from the bodies; the active vapour can, for instance, be carried by a stream of air against the plate. Inactive substances such as cardboard can be impregnated with the vapour so as to become active. The vapour is capable of passing through sheets of various substances, such as gelatin, celluloid, collodion, goldbeaters'-skin, paper, tracing-paper, parchment, and gutta-percha. The transparency is the same to the vapour from the metals or from the other active bodies. Glass, selenite, and mica are quite opaque to the action.

To test the porosity of the transparent substances, the power of hydrogen to diffuse through them was tried. Diffusion takes place through tracing-paper and goldbeaters'-skin; but through thin gelatin and celluloid there was no sign of diffusion until after three days. Increase of temperature greatly increases the activity of both the metals and the organic bodies. The time of exposure in the experiments varied from a day to two months. G. H. Ba.

MANY REPORTS REPLICATE SIMILAR ANOMALOUS PHOTOGRAPHIC EFFECTS

G.LE BON DISCOVERED AND PHOTOGRAPHED GROUND-REGIONAL INSENSATE LIGHT

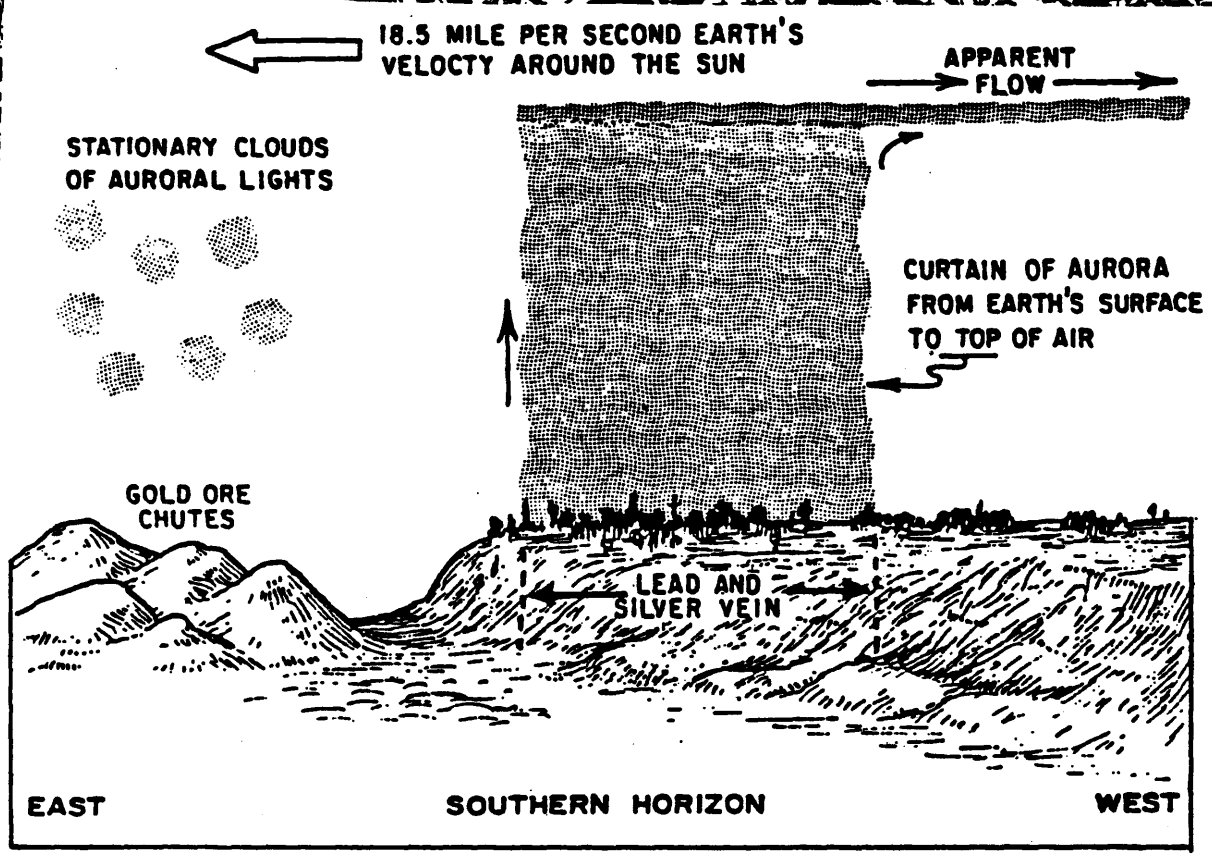
WHICH EXCEEDED INTENSITIES OF SUNLIGHT

VRIL LIGHT IS VISCERO-EIDETIC IN CONTENT

VRIL LIGHT TRANSACTS EIDETIC WORLDS WITH RECIPIENTS

NIGHT EIDETIC TRANSACTIONS ARE INTENSE

NIGHT DREAMS FLOW WITH ESPECIALLY VIVID CONTENTS



DISTRICT GEOLOGY IS INTENSELY ASSOCIATED

WITH VRIL MANIFESTATIONS AND LOCAL LEGEND

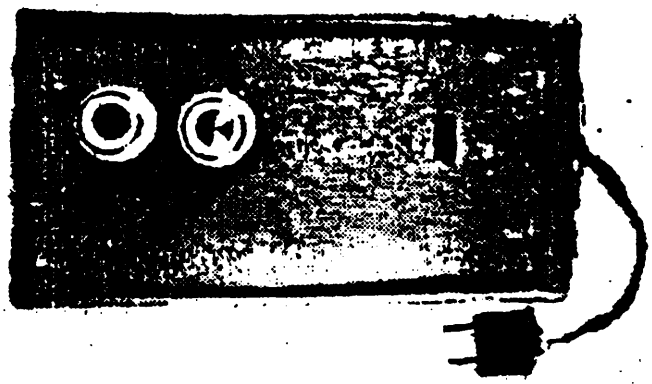
THERE ARE NATURAL GEOLOGICAL STRUCTURES

WHOSE EIDETIC PROJECTIVITY ENJOINS EXTRAORDINARY VRIL MANIFESTATIONS

A MYSTERIOUS ORE

By

DR. S. DUTT



The author came to know of the existence of an electric stone" in the hills round about Bhilwara in Rajasthan. The author was told that this stone has the extraordinary property of conducting electricity and due to the presence of this stone in the Bhilwara area it was claimed that neither Bhilwara nor the neighouring villages have ever been struck by lightening (thunder) even in the midst of rainy season. The author, as a chemist, knew that most of the naturally occurring stones are perfect insulators, for example marble, alabestor, slate, granite, silimanite etc. To taste the extraordinary property of this natural occurring stone the author procured about 25 kilograms of stone from the Bhilwara area and he examined the physical, chemical and electrical properties of the stone.

Physical and Chemical Nature of the Stone.

The stone is a grey-coloured crystalline substance with a steel grey metallic lustre found in the ignious rocks (buff coloured granite) of the Aravalli range of mountains. Its specific gravity is quite high and varies between 6.8 and 7.2. Its melting point is about 11000° C, and the molten substance on cooling solidifies to the original crystalline material, the size of its crystals depending on the rate of cooling. The crystals belong to the cubical system the rock is polycrystalline, and the dimensions of the crystals of the original rock vary between 0.12 to 0.24 mm. on sides. The bed-rock of the stone is a buff-coloured granite, which is usually the principle rock of the Aravalli range of mountains. Normally the colour of the stone is steel-grey, but in some specimens, particularly those containing larger crystals, the colour is smokey-grey, slate-grey or almost black. The hardness of the stone is about 4.5 on Mohr's scale, making it almost at par with such hard substances as quartz, garnet, agate, chalcedony and topaz. Photographic reproductions of the stone are shown in Plates I, II. In Plate III, the stone is shown with portions of the bed-rock (buffcoloured granite), attached. Such ingress of granite matrix within the crystalline stone is a fairly common phenomenon, and is what can be expected in view of the crystalline stone having grown out of a molten ignious rock like granite by the normal process of crystallisation. In an uncut and unpolished stone however, these two different materials are difficult to distinguish, as they have practically the same colour in the freshly fractured surface.

Chemically, the stone is an argenti-zinciferrous-galena, containing lead sulphide as the principle ingredient.

Plate I

VRIL STRIATIONS EXTEND THROUGH ORGANISMS IN RESPONSE WITH VRIL ACTIVITIES

SENSATION IS A TRANSACTIVE PROCESS

WE EXTEND AND BLEND WITH OTHER VRIL (STRIATIONS) AURAE

N-RAYS OF BLONDLOT ARE VRIL GENERATED HEAT-LIKE WAVES OF INERTIAL DISSOLUTION

N-RAYS ARE SEEN NEAR GROUND FISSURES, IRON POLES, ROCK CRACKS, AND CAVITIES

N-RAYS GIVE ORGANISMICALLY VISCERAL EXPERIENCE

PHYSIQUE BIOLOGIQUE. — *Émission de rayons n (rayons de Blondlot) par l'organisme humain, spécialement par les muscles et par les nerfs.* Note de M. Aug. Charpentier, présentée par M. d'Arsonval.

« En répétant à mon laboratoire, et dans des conditions diverses, quelques-unes des expériences qu'a instituées M. Blondlot sur la production et les effets des rayons *n*, et dont il a bien voulu me rendre témoin, j'ai eu l'occasion d'observer une série de faits nouveaux qui me paraît avoir une certaine importance au point de vue physiologique.

» On sait qu'une manière commode d'observer les rayons de Blondlot est de les recevoir dans l'obscurité sur une substance phosphorescente assez peu lumineuse dont ils augmentent l'éclat. Il faut ensuite naturellement les différencier d'autres agents physiques produisant le même effet. On peut aussi prendre comme objets d'épreuve des substances fluorescentes; ainsi je me suis servi souvent avec avantage de platino-cyanure de baryum dont je réglais l'intensité lumineuse à l'aide d'un sel de radium recouvert de papier noir et placé à une distance variable.

» Or j'ai reconnu d'abord que le petit objet phosphorescent ou fluorescent augmentait d'intensité lumineuse quand on l'approchait du corps. En outre cette augmentation est plus considérable au voisinage d'un muscle, et d'autant plus grande que le muscle est contracté plus fortement. Il en est de même au voisinage d'un nerf ou d'un centre nerveux, où l'effet augmente avec le degré de fonctionnement du nerf ou du centre. On peut par ce

m'excusera d'exposer sans beaucoup d'ordre les diverses constatations que je fais chemin faisant.

» I. On pouvait être assuré que l'émission de rayons *n* par le corps vivant n'était pas un phénomène propre à l'homme. Il se retrouve, en effet, chez les divers animaux de laboratoire (lapin, grenouille, etc.), et se retrouve sans nul doute chez les animaux inférieurs.

» Ce sont, encore ici, les muscles et les nerfs qui en forment la principale source, et ils en fournissent d'autant plus qu'ils sont en état de fonctionnement plus actif.

» II. La grenouille, qui, malgré sa petitesse, est un très bon sujet d'étude, peut servir à donner une preuve de plus que l'augmentation de phosphorescence constatée dans ces expériences n'est pas due à une élévation de température : il est facile en cette saison de la maintenir à une température sensiblement inférieure à celle de l'air du laboratoire; les lois générales du phénomène n'en sont pas modifiées.

» On peut du reste, sur les animaux à sang chaud, faire une constatation analogue en chauffant l'objet d'épreuve phosphorescent (qui émet alors plus de lumière) à une température supérieure à celle du corps, vers 40° ou un peu plus. La phosphorescence augmentera comme précédemment au voisinage des muscles, des nerfs et des centres nerveux, même à l'état de repos, et s'avivera encore davantage par le fonctionnement.

» III. Les rayons *n* et les rayons d'origine physiologique agissent sur toutes les phosphorescences, comme l'a prévu M. Blondlot. J'avais vu en été la radiation *n* du Soleil influencer la luminescence du ver luisant commun (*lampyre noctiluque*); actuellement j'ai à ma disposition des cultures de bacilles phosphorescents (*photobacterium phosphorescens*, *phosphobacterium italicum*) que je dois à l'obligeance de M. le professeur Macé et qui réagissent vis-à-vis du cœur, des muscles et des centres nerveux, sensiblement de la même manière que le sulfure de calcium.

» On sait que chez ces bacilles la phosphorescence diminue quand la température s'élève au-dessus de 25° ou 30°.

» IV. Comme les solides soumis à une contrainte mécanique émettent généralement des rayons *n*, j'ai recherché ces derniers dans les tendons pendant la contraction musculaire (tendon d'Achille, tendon de l'extenseur du gros orteil, etc.) Je n'y ai trouvé aucune augmentation de luminescence de l'objet d'épreuve, quelque forte que fût la contraction. En revanche les points d'insertion et les parties osseuses comprimées par les tendons brillent nettement sous l'influence de l'activité musculaire. Or les tendons eux-mêmes sont très pauvres en nerfs, tandis que les points précédents sont

moyen, et quoique l'observation soit assez délicate, reconnaître la présence d'un nerf superficiel et le suivre (nerf médian, nerf cubital, filets divers voisins de la peau).

» Ces effets ne s'observent pas seulement au contact de la peau, ils sont perçus à distance, à l'intensité près. Ils sont transmis à travers les substances transparentes pour les rayons *n* (aluminium, papier, verre, etc.), et arrêtés par l'interposition de substances opaques pour les mêmes rayons, plomb (incomplètement), papier mouillé. Ils ne sont pas dus à une augmentation de température au voisinage de la peau, car ils persistent quand on interpose plusieurs lames d'aluminium ou de carton séparées par des couches d'air et formant écran calorifique.

» Ces rayons se réfléchissent et se réfractent comme les rayons *n*. J'ai produit des foyers réels, manifestés par des maxima d'éclairement, à l'aide de lentilles de verre convergentes. La position de ces foyers, ou maxima quoique difficile à bien délimiter, m'a permis de reconnaître que l'indice de réfraction des rayons émis par le corps était tout au moins de l'ordre de grandeur de celui déterminé par M. Blondlot pour les rayons *n*.

» J'ai répété les mêmes expériences avec succès sur une lentille plan-convexe formée par de l'eau salée à 8 pour 1000 contenue dans une cupule d'aluminium.

» On pourrait se demander si le corps humain émet réellement ces rayons, ou s'il ne fait que les emmagasiner pendant le jour ou à la lumière, à la façon des corps insolés qu'étudie M. Blondlot. Or après un séjour nocturne de 9 heures dans une complète obscurité, les phénomènes se montrent les mêmes, et plus faciles à observer encore à cause de l'adaptation plus parfaite de l'œil.

» Il me semble donc démontré dès maintenant que le corps humain émet des rayons *n*, et que dans l'organisme ce sont les tissus dont le fonctionnement est le plus intense qui les émettent en plus grande quantité. Il y a là en particulier une nouvelle méthode d'étude pour l'activité musculaire et nerveuse, et l'importance de ces nouveaux faits est capitale en ce qui concerne cette dernière, les réactions extérieures du système nerveux étant nulles jusqu'à présent, puisqu'on n'apprécie ses effets que secondairement par la contraction musculaire ou par la sensation.

I have proved that the influence does not depend upon any of the five well-known senses, *i.e.*, sight, hearing, smell, taste or feeling. I have hired a complete diving outfit for a week from Messrs. Siebe Gorman and Co., and dressed myself and four other diviners in it, with the addition of a pair of rubber gauntlets. The glass of the helmet became obscured by condensation, one could not hear much above the noise of the air pump, taste and smell were, of course, excluded, and the constant delivery of air through a long pipe from a neutral site precluded the possibility of the diviner being affected by any change in the temperature or humidity of the atmosphere. Neither I, nor any of the other diviners who were tested separately, noticed any diminution in the influence. We all found water at the same spots, although three of us had no previous knowledge of the sites, and we could not see where we were going, but had to be directed by shouts.

It is obvious that suggestion may, and actually does, often play an important part in divining. I have noticed that if one dowser pretends to feel the influence at a certain spot, others watching him are apt to find their rods turning at the same place when they follow him. I fancy that few experienced diviners could stand in the centre of a bridge, from which they could actually see the water flowing beneath them, without feeling an influence which does not really exist there at all. I have found that blindfolding the dowser is not quite fair to him as it seems to blunt his divining sense in the same way that it blunts his smell and taste. I also agree with Dr. Lintott that security of foothold is essential, as one cannot dowse when one is anxious to prevent one's feet from slipping. In all my experiments I have taken the greatest precautions to exclude any form of suggestion, and I have found that it is advisable for diviners to work separately whenever possible, and that most reliable tests can be made in a motor-van fitted with blinds so that the passengers in the back cannot see out. In this way dowsers can sit comfortably, without being blindfolded, and they can be taken backwards and forwards over a site without their having the slightest idea where they are.

In looking for an explanation to account for the dowsing phenomena it seems obvious that the influence is due to some changing conditions in the medium through which the diviner is moving, and that these changes are caused by variations in the density of matter situated above or below him. The whole surface of the earth appears to be divided up into areas over which certain conditions prevail; these areas being the cross sections of shafts or columns which extend vertically both upwards and downwards

to great distances. On passing from one column to another the dowser is conscious of a movement of his divining rod; the strength of the influence being proportional to the magnitude of the change in the conditions of the two shafts.

I set out to discover in what medium or system these changes take place. The known systems in which such variation might possibly occur are (1) gravity, (2) magnetism, (3) potential gradient in the atmosphere, (4) some form of radiation.

I dismissed gravity at once from my calculations because although it is known that variations in this force do occur at different parts of the world, it is highly improbable that there could be any sudden local change because in this case pendulum clocks would vary in their rate when moved from one side of a room to the other if there were an underground stream beneath them. I know that von Pohl claims that the rate of clocks and watches *does* vary when they come under the influence of the deadly earth rays which he describes, but if there had really been any truth in this statement I feel that Greenwich would have had something to say about it years ago.

Similar arguments show that it is very unlikely that there are sudden changes in the force of magnetism, but in this case I *did* carry out a series of experiments with a coil of copper wire rotating at a uniform speed. The two ends of the coil were connected to a galvanometer, and as the rotating coil cut the lines of magnetic force, a potential was, of course, generated, and the galvanometer gave a definite reading. No variation in this reading could be detected as the coil was moved slowly backwards and forwards across various streams where a strong influence was felt by the dowser; so we can dismiss magnetism from our minds. It does not take long to describe this experiment, but in practice it took several weeks of work to prepare the necessary apparatus and to carry out the tests.

A variation in the potential gradient seemed to offer a more likely solution of the problem. As you probably know, there is an average gradient of about 100 volts per metre out of doors in fine weather; that is to say, the difference of electric potential between two points in the air, one of them one metre vertically above the other, is about 100 volts. It seems quite possible that there might be a variation in this potential gradient over water and that this variation might produce an effect upon the diviner. I rigged up some elaborate apparatus and gave this a thorough testing, but found no connection whatever between the divining influence and a variation of the potential

LOCAL VARIATIONS IN A PENETRATING RADIATION AND THEIR CONNECTION WITH WATER DIVINING

(Lecture delivered to the British Society of Dowsers on November 19th, 1935)

About two years ago I had finished my book on Hunting by Scent and was looking about for some other subject for investigation. Unsolved mysteries have always had a great fascination for me, and when someone suggested that I might take up the study of Water Divining I at once agreed to do so, as I saw that this was a subject with great possibilities. How great these possibilities were I did not realize at the time, or it is probable that I should never have ventured to tackle it at all, but on January 1st, 1934, full of hope, I started off on my investigations, and I have been doing practically nothing else ever since. I knew nothing whatever about the subject, and I think this is a great advantage, as one starts quite free from prejudices and fixed ideas which may lead one astray. I became a member of this Society and read up all the literature that I could find on the subject. I learnt a good deal from conversations with Mr. Timms, of Oxford, and others, but I had no success in dowsing myself until I read Mr. Busby's letter which appeared in the March number of the Society's Journal, 1934. I made one of the rods which he described, and was surprised to find that not only I, but my wife, my two sons, my wards, and practically everybody I tried, were influenced in the same way when passing over the same place. I made an improvement in the apparatus by fitting a handle so that the rod always swings freely and is independent of the dampness of the hands.

The first thing to discover was the reason why the rod, or twig, moves as it does in the diviner's hands, and, as some of you may not understand this, I will show you at the risk of boring those of you who know all about it. When the twig is held in the ordinary way with some tension on it, it is just like a spring which is in a state of unstable equilibrium, so that the slightest *rotation* of the wrists either outward or inward will cause the apex to move upwards or downwards. This movement of the twig must follow the *rotation* of the wrists as a mechanical necessity and if the motion of a wooden twig is sufficiently resisted by the grip of the fingers, the twig will snap or the skin will be taken off the diviner's hands. Exactly the same thing takes place with the rod, which swings to the

right or the left as the diviner's wrist turns to the right or left. It appears that this slight rotation of the diviner's wrists is due to a change of muscle tonus and, as Dr. Lintott has pointed out in his article in Guy's Hospital Gazette, and as Dr. Emslie mentioned in his lecture here last month, the influence is not solely confined to the muscles of the arms, but may also affect the muscles of the jaw, the leg, or other parts of the body. It seems that most people need a little practice before they can relax their muscles sufficiently to make them sensitive, but I have found that nine out of ten normal people can soon acquire the art either with the rod or twig or both.

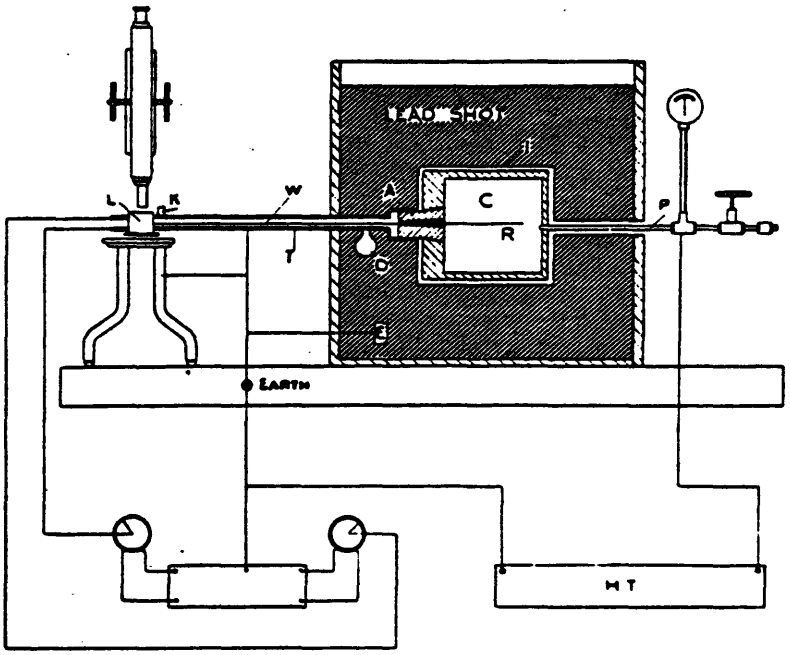
The next thing was to find out the conditions under which one gets the influence. I must apologize for going into these simple details before an audience of experts, many of whom have a far greater experience of divining then I have myself. I can only tell you what I, and those who have worked with me, have found. All of us are amateurs, without much experience, with no axe to grind, with no desire to go one better than the other, and with only one object in view, namely, to find out what was the cause of the influence. I may as well say right away that I have no experience of working with coloured twigs and samples, of locating persons, animals or corpses at a distance, of determining the sex of eggs or of hidden photographs, of dowsing over maps, or, in fact, of anything connected with psychology. My experiments have been confined to the investigation of the influence felt by an ordinary diviner when moving from one point to another without looking for anything in particular. A purely physical matter. At certain places the twig moves in his hands and at other places it doesn't. The thing to find out is where the rod turns and what causes the influence.

I have several wells of various depths on my place, and we found that we could locate the streams running to and from those wells and trace them for miles into the surrounding country. I spent the whole of one morning at the Zoo, here in Regent's Park, crossing and re-crossing a bridge which runs over the canal dividing the gardens. The bridge has fairly high sides and when walking in the middle one cannot see the water below, so that the possible effects of suggestion are eliminated. After some dozens of trials, during which I made chalk marks on the path, I found that I got the influence immediately over both *edges* of the water and I also felt it at both sides immediately above the *edges* of the concrete piers which supported the bridge. During our trials, which were all carried out in this sort of way, we found that we always got the influence over the edges

gradient. After all, this is only what I might have expected, because the divining influence is quite as strong indoors as it is out of doors, whereas there is no potential gradient in a room where the floor, walls and ceiling are all connected to earth and are consequently at zero potential.

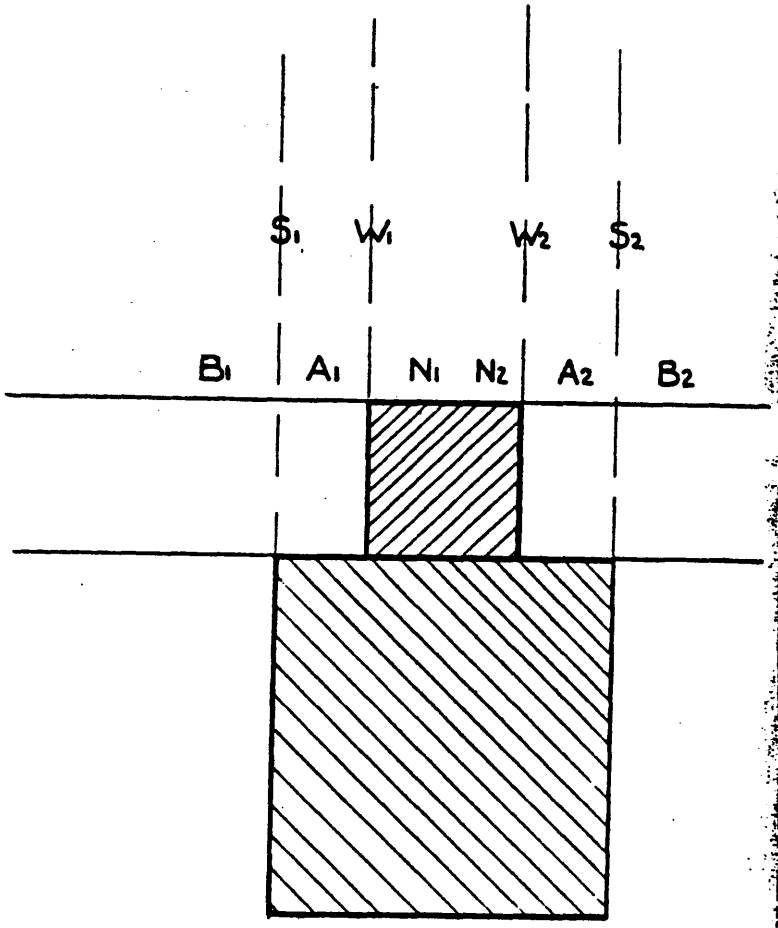
So now we come to our last hope, namely, a variation in some form of radiation, and it is obvious that we can leave out any radiation which has not got an enormous penetration, so that we can dismiss ordinary alpha, beta or gamma radiation, X-rays or Hertzian waves whose influence would be checked by a few inches of metal. We can also eliminate any radiation which is not confined to a vertical or almost vertical direction as compared with the earth's surface, and this disposes of the long-wave wireless radiation which Mr. Franklin, in his lecture here, told us had very great penetration.

So now we have narrowed things down very much, and we see that the effect must be produced by changes in a very penetrating vertical radiation, and in investigating this I found what I was looking for, and here is an apparatus which actually does give different readings as it is moved backwards and forwards across a line over which the diviner feels the influence. I do not want you to get the idea that one can simply take a reading one side of the line and compare it with the reading on the other side, because it is not so easy as that. The effect is so small that one has to take at least 20 or 30 readings alternately on each side of the line and compare their average most carefully before any reliable result can be expected. I have pushed this trolley backwards and forwards some 6,000 times, so I am beginning to get used to it. Normally this box is filled with lead shot and the outfit weighs a quarter-of-a-ton. I have tested it in some 20 different sites where the influence has been felt; above mill races, wells and underground streams and beneath arches and doorways, and in every case I have found a difference amounting to about 0.5 per cent., or 1 in 200, where there is strong influence, down to about 0.1 per cent., or 1 in 1,000, where there is a feeble influence. On the other hand, there is no difference in the readings between two sites where no influence is felt by the diviner. I will try and describe the working of the instrument without going too fully into technical details.



This wooden box contains a strong hollow steel cylinder "C," filled with a gas called Argon to a pressure of about 1,000lb. to the square inch. Inside this cylinder, or bomb, is a steel rod "R," supported and insulated by an amber bush "A," and connected by a wire "W" to a Lindemann Electrometer "L" which is mounted on the stage of the microscope. The wire passes through the metal tube "T," which is connected to earth and has a drying tube "D." The bomb is surrounded by 4in of lead shot and is insulated by the rubber casing "I." The bomb is connected through the pipe "P" to the positive terminal of the high tension battery "HT," and is kept at a constant potential of some hundreds of volts. The steel rod "R" is normally connected to earth, but when a reading is to be taken, the key "K" is opened and the rod gradually acquires a charge owing to the passage of electricity from the inside walls of the bomb. This charge is carried by the wire to the electrometer needle, which moves across the scale contained in the eyepiece of the microscope. The passage of electricity depends on the conductivity, or ionisation, of the gas in the bomb, and this

conductivity, or ionisation, depends upon the intensity of radiation entering the bomb. The object of the lead shot is to keep out all radiations except the very penetrating rays which we are examining. The atmosphere contains a considerable quantity of radio-active emanations which come from uranium, thorium and their products distributed widely throughout the earth's crust. It is possible that the walls and ceilings of a room contain a certain amount of radio-active matter and the lead absorbs any radiation of this nature and prevents it having an effect inside the bomb.



I took this outfit to Kew Observatory, by kind permission of Dr. Whipple, and tested it for a fortnight under the eye of the Superintendent and his staff. It was installed in a large room above a big concrete pillar which at one time must have been the base of a telescope. In dowsing across this room we found four separate lines of influence; two of them strong and two of them weak. The weak ones were 4ft. apart and corresponded to the edges of the concrete pillar beneath the floor. The two stronger ones were equidistant from the pillar and 2ft. 6in. beyond its edge. I think that the pillar must have been mounted on a larger block of concrete sunk to a considerable depth into the ground, but I could get no proof of this.

I prophesied that this machine would register a difference of measurement in passing from N1 to B1 or from N2 to B2 and that the difference in measurement between A1 and B1 and A2 and B2, across lines where the strong influence had been felt, would be greater than that between A1 and N1 and A2 and N2, across the lines of weaker influence. These predictions proved to be correct. The differences between A1 and B1 and A2 and B2 were more than double the differences between A1 and N1 and A2 and N2, whereas there was no difference whatever between the two neutral positions N1 and N2 where no influence was felt above the pillar. Altogether, 750 readings were taken in the room at Kew above this pillar, and many of them were actually observed and recorded by the Superintendent and his head assistant, to whom I am greatly indebted.

I think I have proved that the influence felt by the diviner is, at any rate, associated with, if it is not actually caused by, the variations in the intensity of a very penetrating, vertical ionising radiation, having a considerable absorbtion coefficient in water. This radiation can hardly be identical with cosmic rays, as the latter are supposed to travel from the sky to the earth, whereas the action of the former appears equally evident in both an upward and downward direction and its influence is still in evidence at a depth of 3,000 feet below the ground. Is this a new radiation?

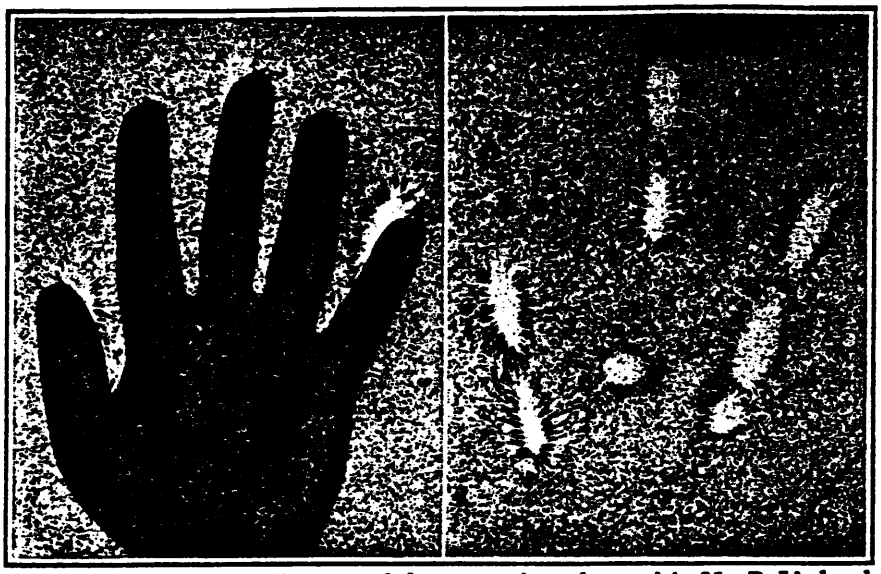
In answer to a question, the lecturer replied that he had observed parallel lines of influence on each side of the main lines of influence and at varying distances from them, one such pair of parallels apparently corresponding to those used by dowsers in estimating depth, but that he was unable to account for this phenomenon.

Magnetism in Human Beings

By Dr. Alfred Gradenwitz

THAT some persons in every respect behave like living magnets, and that this behavior not only is closely connected with physiological and psychic phenomena, but opens up unthought-of vistas on the further investigation of body and soul, is the conclusion reached by Fritz Grunewald. This investigator has carried out a remarkable series of experiments on a Mr. P. I.—a gentleman personally known to the author, who, like Mrs. Ruf (examined, as far back as in 1867, by Fechner) is able with his hands to deflect the magnetic needle, his two hands generally showing opposite polarity.

That this action on the magnetic needle actually is to be ascribed to magnetical rather than electrical or any other effects, was shown conclusively; for on pushing his hand through a coil of copper wire, the person experimented on would induce there an electric current, indicated by the deflection of an ammeter connected with the coil, just in the same way as by pushing through the coil a magnet bar.

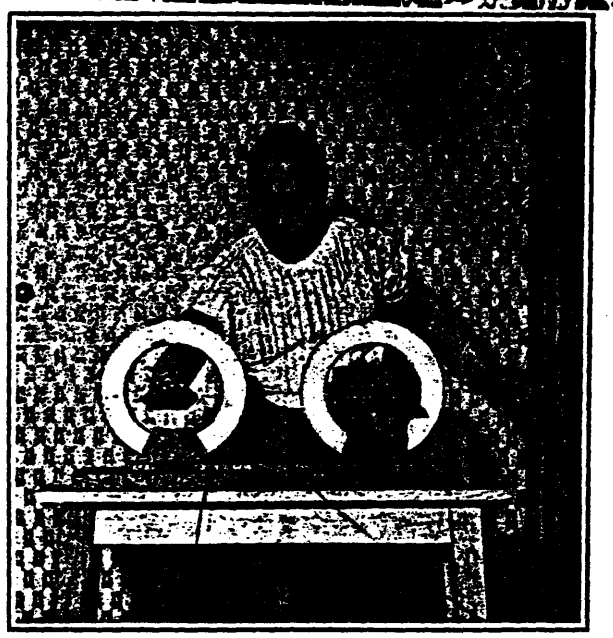


A striking line-of-force diagram of the magnetism observed in Mr. P. I.'s hand. The same diagram is shown, alone and superposed upon the subject's hand

It was, of course, interesting to ascertain whether the will of the person would exert any influence on these phenomena. This was soon found actually to be the case. Mr. P. I., with his hand kept perfectly motionless, was able to alter the magnetic force and, accordingly, the current intensity, by as much as 10 per cent.

By examining the whole body of the person as to the presence of magnetism, Grunewald has been able so far to ascertain that the hands, arms and, temporarily, his head will exhibit magnetic properties. By means of iron filings spread out on a glass plate he has in the usual manner produced pictures of the lines of magnetic force. In several cases the existence of two poles, marked as bright spots on the remaining filings and from which the lines of force would spring forth, could be stated on these magnetic pictures above the person's hand. With an experiment made on the person in a hypnotized condition, Mr. Grunewald could even count no less than 14 different magnetic centers.

Especially interesting are the relations between magnetism and physiological phenomena, as discovered by the experimenter: The deflection of a magnetic needle arranged above the hand would undergo an alternation corresponding to the rhythm of breathing, increasing during inspiration and decreasing during expiration. Not less striking was the fact that the magnetism, which in the morning, immediately after getting up, showed a negligible value, would in the course of the day undergo an increase after each meal.



When the subject pushes his arm through a coil of wire, the magnetic force therein is sufficient to induce an appreciable current in the coil

Though the existence of a vital energy as asserted by "magnetopathists" is as yet denied by most medical men, Grunewald would seem to have been the first to demonstrate in a palpable, objective way, by the use of his ballistic method, the existence of a vital energy transferable from one person to the other. In the case of 115 "magnetic" treatments carried out by Mr. P. I. since 1917, he was able to ascertain a decrease of magnetic intensity attending, it would seem, the giving off of vital energy. In fact, after such a treatment, lasting, as a rule, for a quarter of an hour, this intensity would drop to one-third of its initial figure, and in cases where Mr. Grunewald himself underwent the treatment, the most marked decrease would, strange to say, be noted whenever, previous to the treatment, he had felt especially weak, that is, had been especially in need of a supply of vital energy.

In order now to make sure whether the weakening of the action exerted by the magnetic needle is not simply due to the physical work yielded, Grunewald caused Mr. P. I. to perform a check test, viz., some sort of "blind" treatment, in connection with which similar strokes were made through the air. The result of this blind test was remarkable; the magnetic intensity (and accordingly the susceptibility to "magneto-therapeutical" treatment) so far from decreasing, having undergone a striking increase. In fact, Mr. P. I., as it were, had absorbed something like vital energy, an hypothesis confirmed by the fact that, *without knowing anything of the results of these measurements*, that is, without being under any suggestive influence, he would state that, on striking through the air, he had experienced an increasing resistance, with a strange consciousness of absorbing something. This result of objective tests involuntarily reminds one of the assertion made by Hindoos, that they for thousands of years have been in possession of the art of absorbing "Prana," *i.e.*, vital energy, from the atmosphere, by means of a special technique of breathing or gymnastics.

The Human Atmosphere

The Visibility of the Human "Aura" Demonstrated to the Layman

By Albert A. Hopkins

OUR earth, as it makes its diurnal revolution, carries with it a thin skin of air which starts becoming rarified when we go up a few thousand feet; at about seven miles above the ground the air stops growing colder, at 20 miles above the earth is the upper limit of twilight, and at 50 miles begins a region where the atmosphere consists chiefly of hydrogen. Few of us realize that we are carrying around with us a somewhat similar atmosphere in which every person is enveloped by a haze invisible under ordinary circumstances, but which can be seen by special scientific means. This mist, the prototype of the nimbus, or halo, shown in old pictures, has for a long time been manifest to certain persons possessing a specially gifted sight, who, in consequence, have received the title "clairvoyants." It is not with these persons or their illegitimate practices that we have to deal. It is a scientific phenomenon with which we are concerned, and which has been carefully tested by real scientists of unblemished reputation.

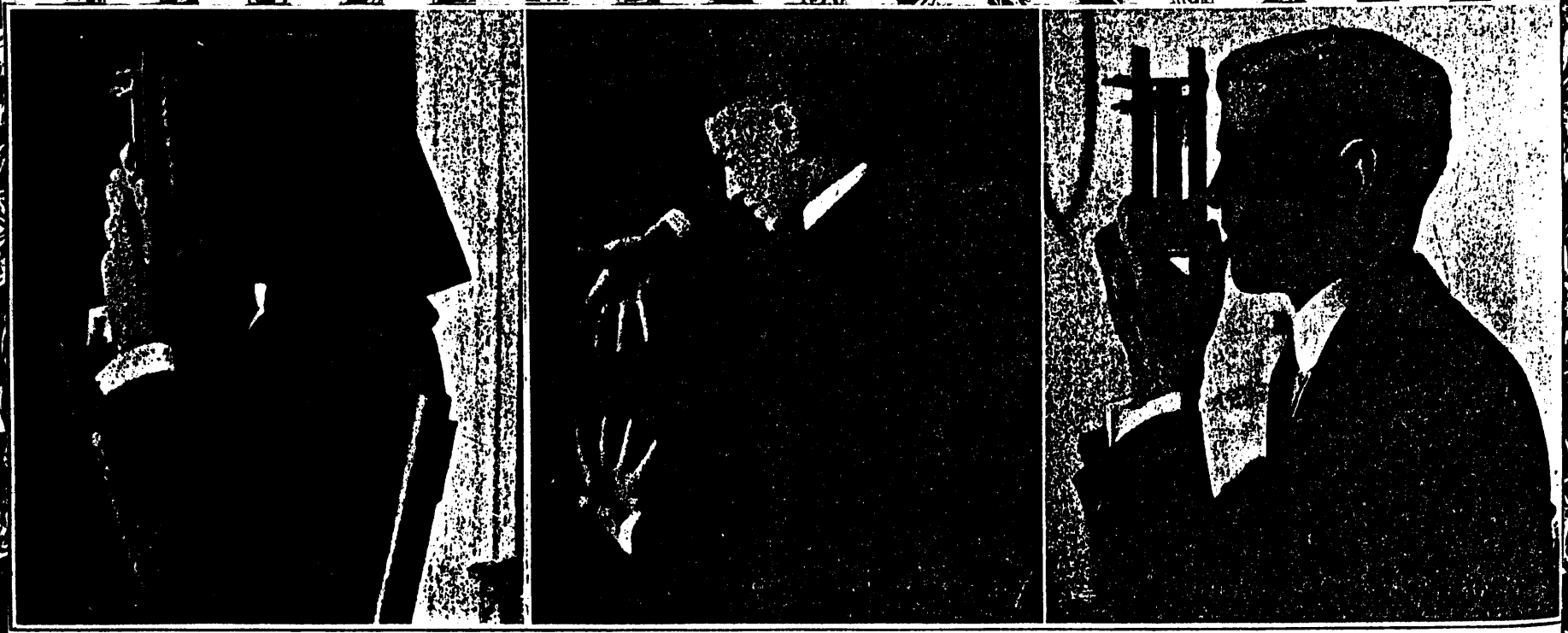
The writer has recently been enabled, through the courtesy of Mr. J. B. Allison of Englewood, N. J., to make an independent investigation of this curious subject. The unquestionable evidence of Walter J. Kilner, electrical expert of St. Thomas' Hospital, London, as given in his book entitled "The Human Atmosphere," sons require only a half minute, but the writer found that in his case a minute and a half was necessary. The eye having been charged, as it were, or at least educated, all is now ready for the test. An ordinary closet lined with black textile-like velvet is satisfactory, the black of the closet itself being what is known as "Chevreul's black," according to the classic experiment in which an imp was cut out of a small black box, and the hole appeared much darker than the surrounding box. Light must shine on the subject sufficiently to illuminate it fairly well, and subdued daylight or artificial light may be used.

The hands answer very well for experimental purposes, although the entire body is, of course, more spectacular. The human object, or patient (for this new contribution to science is valuable from a medical point of view), stands at least a foot in front of the background to prevent shadows or marks on it from producing an optical illusion. We are now ready for the demonstration.

The observer will, as a rule, be almost immediately able to detect streaks proceeding from the fingers of the one hand to the fingers of the other, and a haze in the interval between the two hands. Directly he has perceived the haze and streaks, he will probably be able to see a similar, but not quite as plain, mist opaque, but when examined carefully will be found to be finely striated, looking as if brushed out with a camel's hair brush. At places which vary from minute to minute, the lineation can be more easily distinguished than at others. The striated portion has been named the *inner aura*, and the wide amorphous part, not seen when using the carmine screen, the *outer aura*. At times, but by no means always, a close scrutiny will detect an apparently void space between the body and the inner aura. This area is called the *etheric double*.

It is imperative that the hands and the arms should be viewed exactly as if looking at a picture; there must be no straining of the eyes. The more accurately the observer can focus his eyes upon the plane in which the hands are held, the more easily and plainly will he be able to discern the aura. Straining the eyes is not merely a hindrance, but frequently will entirely prevent the perception of the haze.

Directly the observer feels that he will be able to see the aura fairly easily he may proceed to examine it round a large portion of, or better still, the whole body. For the first trial it is preferable that the subject should be in good health and if possible robust, because the aura always loses in distinctness during illness. It is also useful to remember that the aura varies in clearness from day to day even in rude health.



Schooling the eye with the light filter

The phenomena is observed before a dark space

The glass cell containing the dye "dicyanin"

Investigating the human aura with the aid of a rare dye

should at once set aside any belief that this is a by-product of occultism or charlatanism. Professor Kilner says, "Although at present it is impossible to say exactly of what the aura consists, yet I feel positive that we are dealing with an ultra-violet phenomenon. Some women have the power of changing the colors of their auras by voluntary effort (no man or boy has as yet been found to possess this faculty), and these hues unquestionably do not belong to the ordinary visible solar spectrum, so we must be encountering a second and higher spectrum having shorter wave lengths. The physical aura exhibits another interesting property inasmuch as it can be influenced by external forces such as electricity and chemical action. Naturally a considerable amount of time and thought has been devoted in trying to discover how dicyanin affects the visual organs, but the explanation remains incomplete."

Photography may in time assist the experimenter, but the results are not satisfactory as yet. The aura must be viewed through a color screen made of an alcoholic solution of dicyanin, a rare coal-tar dye, and in practice two cells are used containing the light filter. The modus operandi is very simple. The observer holds the cell containing the liquid solution of the dye before his eyes while a focusing cloth or other medium cuts out the extraneous light. This treatment seems to acclimate the eye for viewing the aura. Some persons around the arm if bared. Now and then there is some slight difficulty at the first trial, which can be generally overcome if the other hand is held at right angles, and a short distance from the arm. (See diagram 2.) By this means the aura will be intensified, and when the hand is removed the observer will be able to see it round the bare arm. Needless to say, as the eyes become accustomed to the subdued light the illumination will periodically require alteration.

A large percentage of persons after gazing through the dark dicyanin screen at the light are able to perceive the aura as described above, but a small minority find it impossible to detect it without the aid of the pale dicyanin screen. It stands to reason that when this screen is used the light will have to be increased a trifle.

After the aura around the arm and hand has been satisfactorily inspected the observer may with advantage inspect it through the deep carmine screen. For this purpose it will be necessary to raise the blinds a short distance, until the arm and hand can be seen through the screen to the same degree as before. He will now find that the larger portion of the aura has vanished, while the part that remains encircles the limb closely, being usually from one and a half to three and a half inches in breadth. At a cursory glance the texture of this portion of the aura will appear more

While the subject is undressing and getting into position for examination the observer, unless he has previously done so, should look through the dark dicyanin screen at the light for a few seconds. The light must now be regulated by drawing down the blinds, when it will be noticed that the amount needed is much less if the whole body is being inspected than when the hands alone are looked at. Standing with his back to the window, and opposite to the subject (using a pale dicyanin screen if necessary), the observer ought to distinguish immediately, or certainly after a few seconds, a faint mist enveloping the body. This varies even in health, according to age, sex, and individual peculiarities.

The first thing to observe is the texture, whether fine or coarse, as no two persons have identical auras. Note the color, which is generally some shade of blue mixed with a greater or less amount of gray. A great help in determining the color is to get the person to place the hands upon the hips, and at the same time to extend the elbows, when in the space between the trunk and the arms the aura emanating from the body will be reinforced by that proceeding from the arms.

Magnetism Produces Remarkable Photographs

BY F. F. MACE

Superintendent of Public Schools, Pecos, Texas

WHAT causes iron, a dense, heavy substance, to ignore or overcome the laws of gravity and to dart thru space to a magnet? What is this mysterious, so called, attraction? Can this swift and sure motion of a heavy body thru space be caused by *lines of force without motion*, by *lines of tension in ether* or by mere *lines of direction*, like lines of latitude or longitude? Can these lines of force tending or extending, moving without motion from one pole to the other, or lines of force or tension "emerging," without motion, from one pole and "entering," without motion, the other pole, produce the same result at both poles? Can any possible arrangement of the molecules of the magnet, supposing this arrangement to be brought about, possibly extend thru space and accomplish this result? Can any or all of these miracles, these things themselves contradictions of the known laws of nature, bring about another miracle—a result opposing, apparently, one of the laws of nature? Is there a cause for these things in keeping with the known laws of nature?

These questions presented themselves when I first studied physics. They asked themselves more insistently when I began to teach physics, and they have been reiterated again and again in varying form by every class of beginners whom I have appeared before. For more than fifteen years I sought to obtain an answer, a true answer, to these questions—an answer which would really account for the facts and which would be in accord with the other known laws of nature. For years only a faint glimmering of the truth appeared. Then gradually the light grew stronger until I had worked out a clear and logical answer. But to answer these questions by pure logic based on the known facts of nature was not sufficient. Modern science demands experiment; tho Newton and Galileo, and Leplace never performed an experiment but based their discoveries on the facts before them. Therefore, I worked patiently for years to demonstrate in a new way that which I knew to be true, until I had proven by experiment that which I had proven by logical deduction, that the attraction of the magnet and all of the phenomena of magnetism are produced by the motion of *ether currents* about and thru the magnet, and until I was able to demonstrate the cause, nature, and direction of these currents, and by the direction of these currents to account logically, consistent with the laws of nature, for all the facts of magnetism.

But even this was not sufficient. The facts of nature had been distorted for years. These experiments, conclusive as they were, might be distorted and thrown aside. It must be proven beyond a shadow of doubt in some striking manner that there are actually *currents* about the magnet—that there is *motion*. How could this be done? I had worked with photography for years and was familiar with the X-ray. While pondering this situation the thought occurred to me: will the photographic plate—a photographic plate in a vacuum—prove this? A photographic plate is only affected by motion; by light, which is *ether motion;* by chemical action, which is molecular motion; by heat, which is molecular motion; and by the X-ray, which is in motion. Even granting the ether currents about the magnet as I had proven them to exist, would their wave length, their rate of vibration, be such as to effect the photographic plate? I could only try it, as I had tried other things, and hope to obtain the result sought.

The result justified the hope. Taking every precaution known to a photographer to prevent the result being effected by light or other influences I exposed a plate on which were placed a number of objects under an exhausted receiver. At the end of three days I removed and developed the plate. *Images were there, faint but unmistakable.* The experiment was a success! I am sorry that I afterwards dropt and broke this first plate while attempting to handle it during a spell of illness.

With certain success before me I took every precaution to render the result beyond question. In a dark room from which every ray of light was excluded, using only a perfectly safe ruby light, I placed objects on a common photographic plate and placed them under the receiver of an air pump as shown in Fig. 1. These articles are shown in Fig. 2, as they appear when photographed with an ordinary camera. "A" is a lead ring or washer. "B" and "C" are metric weights. "D" is a piece of gasket rubber. "E" is a broken metal buckle. "F" is a bone button. "G" is a scrap of acid-eaten zinc. "H" is a wooden button. "J" is a piece of sealing wax. "K" is a lump of resin. The magnet used is an ordinary steel U-magnet, weighing one kilogram (or 2.2 lbs.). The sensitive side of the plate is above and the objects lie on the sensitive side.

After the objects were placed on the plate under the receiver, twelve thicknesses of black cloth were placed over the receiver and the air was exhausted. Then over all of this was placed a light-tight box and the whole was finally wrapt in ten thicknesses of black cloth. The ruby light was then removed from the room and the room was locked and not reopened for twenty days. I may add that the whole operation took place after nightfall.

At the end of twenty days the room was entered after dark and the plate was taken from the receiver and developed by ruby light as with an ordinary photograph. The result is shown in Fig. 3. The articles are lettered to correspond to Fig. 2. The one marked "D" was lost and is not included in Fig. 2.

Here is incontestable proof that there is *motion*, that there are *currents*, about a magnet. No mere line of force, no tension in ether, no mere line of direction

(*Continued on page 70*)

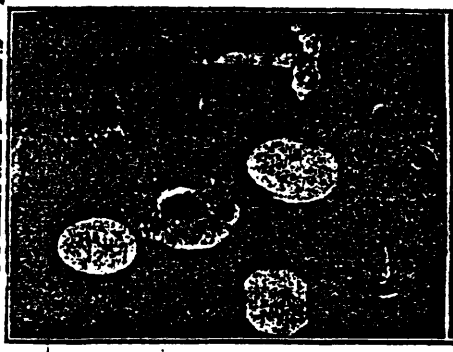


Fig. 2. Photograph Taken in Usual Manner, Showing the Various Objects "Magnetographed."

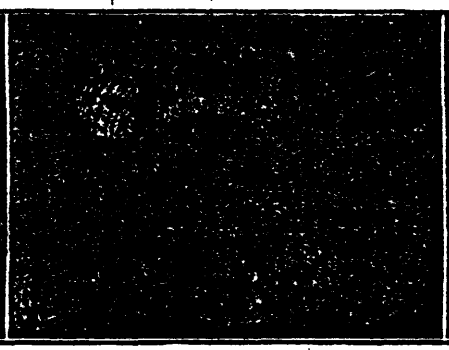


Fig. 3. Here We See the Best "Magnetograph" of the Objects in Fig. 2; It Was Made in a Vacuum.

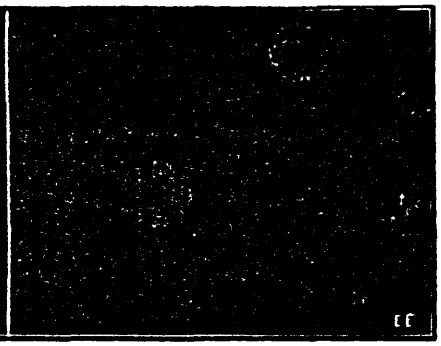


Fig. 4. Exposure of Photo Plate and Various Objects Placed Over a Magnet Under Atmospheric Pressure. Compare with Fig. 3.

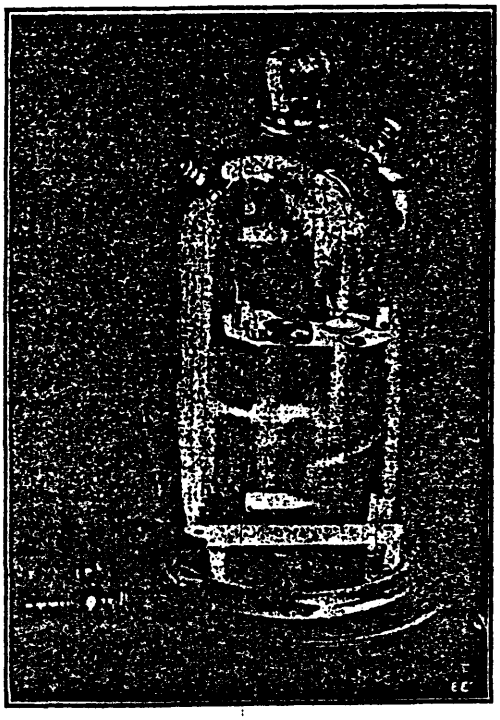


Fig. 1. How the Author Arranged the Objects to Be Photographed by a Magnet, Placing Them on a Photo Plate Under the Bell of a Vacuum Pump, Permitting the Air to Be Exhausted.

MAGNETISM PRODUCES REMARKABLE PHOTOGRAPHS.

(Continued from page 14)

like a line of latitude, no mere arrangement of the molecules of a magnet, can account for the result. There must be motion—*currents of ether*, for there is only ether under the receiver.

A detailed examination of the articles will strenghten this proof. The articles are lettered somewhat in the order in which the impression is made on the plate. Note that at A, but little, if any, impression is made on the plate—the currents could not penetrate—while J and K hardly show at all because the currents past thru them and affected the plate; and to pass thru or to penetrate there must be motion—currents. From A to K, it will be noted that the effect on the plate grows gradually stronger, showing that some are more penetratable than others and this degree of penetration implies motion. Note that D, E and F are penetrated less than G, and that G is penetrated irregularly, plainly showing the location of the acid pits on the surface of the zinc. None of these effects could be produced by light. Again, B and C are iron weights with cavities in the bottoms and openings thru the sides of these cavities. The weights were placed on the plates so that the cavities were downward. Yet these cavities show plainly in the plate. Light could not produce this effect, for in any event it would produce a shadow and enough light could not enter the small opening to effect the plate practically as much as the exterior. But currents of ether following the lines of the iron, as is the well known effect of iron in a magnetic field, could and did produce this result. Moreover, careful measurements show that the cavities are a little larger and the circumferences of the weights as shown in the plates are a little less, than in the weights themselves, conforming to the well known deflection or bending of lines in a magnetic field by the presence of iron. But the crowning proof is in H. Here is a wooden button showing the grain of the wood. The wood was penetrated more in some parts than in others. Light could not produce this effect for it could not penetrate the wood and if it were supposedly possible to bring to bear light strong enough to penetrate the button, it would penetrate all parts equally. The cracks and seams in J and K are shown in the same manner but in a less degree. Here then is unquestionably penetration, and penetration can not possibly take place without motion. Who would now question the existence of currents about the magnet?

Furthermore, here is incontestable proof that the *lines of force, lines of tension, mere lines of direction* do not "emerge from" (without motion) the North pole of the magnet, nor "pass to or enter" (again without motion), the South pole. The effect, the penetration, the currents are equal over both poles. These currents pass into both poles alike. They do not pass out from the poles for the plate is above the poles, both poles, with the sensitive side upward, and the objects are on the sensitive side of the plate above the poles. If the currents were passing upward from either pole, there would be no impression on the plate over that pole, for the current would pass thru the sensitive film before reaching the objects. Instead, it shows plainly that the currents past poleward equally over both poles, penetrated more or less the objects on the plate, affected the sensitive plate more or less according to the amount of penetration, and then past on to the magnet. What then becomes of them will be shown later.

Still there are doubters. Could the result be due to stray light? Could it be due to phosphorescence? To radio-activity? Could the same result be obtained without the magnet? To answer these I placed a plate over a wooden "U" under the receiver, with the objects placed upon it exactly as before and used exactly the same precautions as in the first instance. At the same time and in the same room, far enough away not to effect the plate under the receiver, I placed a plate over the magnet with several objects upon it, but without a receiver, placed a light-tight box over this, and covered the whole with heavy folds of black cloth. In this instance the room was not opened for twenty-two days. At the end of that time both plates were developed with equal care under the same conditions as in the first case. The plate over the wooden support under the receiver was a *perfect blank!* There was no impression on it. The result with the plate over the magnet in the air is shown in Fig. 4. In this A is a key, B and C are pearl buttons, and D, E and F are wooden buttons. The grain of the wooden buttons can be seen as in Fig. 3 showing that the penetration is the same here but the whole plate demonstrating that the result is somewhat less clear, as might be expected, in the air than under a vacuum. The difference in the penetration at D and at E and F is accounted for by the fact that E and F were almost directly over the poles of the magnet while D was at one side and the penetration was much greater at E and F—again proof of the currents and of the effect of the magnet.

I have also produced Magneto-graphs, as I have chosen to call them, over an electro-magnet and over a straight wire bearing a current, but I have not as yet secured clear results, owing to the difficulty of maintaining a steady current for sufficient length of time.

LUMINOUS RADIATIONS FROM THE HUMAN BODY.

At the Société de Biologie, at Paris, Dr. Luys read a paper describing experiments made by him, showing the presence of luminous emanations which surround the human body, and he demonstrated it in the following manner. In the dark room, place your fingers for about 20 minutes on an ordinary photographic plate which is itself in a bath containing the usual solution of hydro-quinone, and after this exposure fix the negative in the usual way. You will see not only your fingers and the lines on the skin reproduced, but also their pores, and, what is still more interesting, round the fingers a sort of zone or halo a third of an inch wide, which would lead one to believe that we live in a luminous fluid, which has enabled us to obtain a photographic print of itself and of the fingers, as if under the influence of light. Dr. Luys has tried the same experiment, but without any results, on patients whose hands were paralysed, benumbed, or insensible to touch. No image appeared on the plate.

Popular Demonstration of Thought-Transference and Other Phenomena

By ALBERT ABRAMS, A. M., M. D., LL. D.

Professor, Cooper Medical College (Medical Dept., Stanford University, 1893—1898.)

We anticipate that this article will create a sensation in scientific circles, as well as with laymen, and we present it for what it is worth. We have not made any of Dr. Abrams' tests, and we print the article with an open mind—neither endorsing nor condemning it. We say with Shakespeare: "THERE ARE MORE THINGS IN HEAVEN AND EARTH, HORATIO, THAN ARE DREAMT OF IN YOUR PHILOSOPHY."

Dr. Abrams is well known as a scientist; he has made this interesting subject his life work, and his views are endorsed by many prominent doctors and scientists. He is the author of numerous works, amongst them an elaborate book:—"New Concepts in Diagnosis and Treatment."

Will our readers please advise us should they be successful with Dr. Abrams' experiments?—The Editors.

DETAILED reference to this subject-matter may be found in my book, "NEW CONCEPTS IN DIAGNOSIS AND TREATMENT" where attention was first directed to the demonstration of these phenomena by ap-

Fig. 2. Once You Have the Straw "Detector" Rigged Up on the "Percipient's" Wrist, Then the Shadow or Even the Movement of the Straw Itself Can Now Be Watched Closely in Front of a Square-Ruled Paper. This is Your "Thought Wave" Detector and Indicator.

paratus not available to the laity. Telepathy is in disrepute and the scientifically minded psychologist doesn't believe it. Science demands that phenomena should be objective, capable of reproduction at all times and demonstrable by instruments of precision.

The simple scientific method which I shall present shows that spiritistic phenomena are independent of disembodied spirits and referable to human energy: that it will serve as a means of disocculting the occult and will enlist the genius of the multitude in corroborating my original investigations.

TELEPATHY.—Derived from tele, at a distance and *pathos*, feeling, it signifies that one mind (*agent*) can influence another mind (*percipient*) without the agency of the recognized organs of sense.

BRAIN-WAVES are an actuality and like light and the impulses of "wireless" are conveyed by the ether.

The ELECTRON THEORY shows that the ultimate constituents of matter are *electrons* or charges of electricity and that RADIO-ACTIVITY is dependent on ethereal disturbances by a change in motions of the electrons.

ANIMAL REFLEXES.—When the pupil of the eye contracts to light it is a REFLEX and involuntary. The reflexes surpass in sensitivity any instrument devised by science and show that RADIATION is a universal property of matter. The perceptive structure of the eye (Retina) is 3,000 times as sensitive as the most rapid photographic plate and the nerve of vision (optic), 2/5 of an inch in diameter contains 500,000 to 800,000 insulated fibers.

The electro-magnetic waves in "wireless" demand an exciter, but the sensitive human reflexes first utilized by the writer in detecting energy make an exciter unnecessary: the revolutions of the electrons *alone* substitute the exciter.

THE HEART.—The writer employs this muscular organ among other reflexes for converting energy waves into a sensible form.

It is coincidently a receiving station and also a detector of etheric thought waves.

TECHNIQUE.—The percipient must have a regular and comparatively large pulse and must be seated in a comfortable chair facing the geographical West. Colored wearing apparel must be avoided by agent and percipient: the latter's eyes must be closed to avoid distraction, breathing regular and mind abstracted during all observations. Experiments should be executed primarily in daylight. All reference to the *pulse*, refers to the movements of the straw connected to the percipient's pulse. Find the latter (Fig. 1) and indicate its location with a pencil.

Cut a very small piece of adhesive plaster and roll it so that the roll presents an adhesive surface on both sides.

Fig. 1.—X indicates the site of the wrist-pulse.

Fix it parallel to the pulse. To the plaster attach one end of a very fine straw (from a broom), 6½ inches long. Place the straw at an angle so that it will approximate a sheet of ruled paper (vertical lines).

Fig. 2.—Position of arm with straw attached to the pulse.

Observe the swing of the straw directly or as a shadow. In the latter event, if the light is from the South use the right and if from the North, the left pulse.

Note that the greatest amplitude of the straw is secured by the arm resting comfortably on a book or cushion with the hand dependent from the side of the table (Fig. 2).

EXPERIMENT I.—*Solving the mystery of*

Fig. 3. Arrangement of "Percipient" to Show the Electrical Effect Created By Concentration of Mind By the "Agent," Even Tho He (or She) Be Situated Forty Miles Away. A Wire Connects the "Percipient" With the House Electreiler.

mind acting upon mind by brain waves traversing the ether.

Prove that the brain wave-theory is correct despite the fact that, telepathic effects unlike other forms of radiant energy do not vary in intensity according to distance. The moment a person (agent) WILLS FORCIBLY (not mere thought) there is a slight hesitancy or retardation of the straw. Close observation shows a slight extra kick of the latter followed by a transitory stop (inhibition). Each time the agent wills in the direction of the percipient (irrespective of distance), the pulse effects may be noted. Before each act of willing by the agent, at least 10 seconds must elapse to permit the percipient's heart to recover from the excited reflex. The latter is easily exhausted by too much experimentation on the same subject. If several persons are present,

Fig. 1. The Mark "X" Indicates the Site of the Maximum Wrist Pulse, and At This Point Dr. Abrams Affixes a Small Piece of Adhesive Plaster, and One End of a Very Fine Straw.

their minds should be passive so that the waves from the agent alone will act. Note by the effects on the pulse that some are able to will more forcibly than others.

(*Continued on page 345*)

the base

The sec Either Side of the Wind-Pipe in of an electr the Two Black Marks Show, *pedo*, its inve-ocated the Right and Left c Nerves. When These Nerves d, the Needle Movements Show le; and When They Are De- Movements Are Greater.

POPULAR DEMONSTRATION OF THOUGHT TRANSFERENCE AND OTHER PHENOMENA.

(*Continued from page* 304)

To note the action on the pulse over a great distance; suspend a coil of wire from a room fixture (aerial) and to the latter connect a wire (see experiment III and Fig. 3) with the pit of the stomach of percipient (over the clothing). If the agent executes willing at a distance (in the percipient's direction) the latter may be informed over the telephone the moment he wills by another who announces the fact the moment the pulse of the percipient is retarded.

I have successfully conducted this interesting experiment at a distance of 41 miles.

EXPERIMENT II.—*Showing the effects of concentrated thought.* When sudden concentrated thought (arithmetical problem) is executed, some agents may influence the pulse but all may do so if RED MATERIAL is placed on the agent's head.

Note the influence of different colors on intense thought or willing by the agent RED and YELLOW increase and PURPLE decreases the effects on the pulse.

EXPERIMENT III.—*Showing that concentration of the mind is literally true.* To prove this brain focusing, let the agent concentrate the mind on one of several wooden or paper objects in the room.

The human is essentially a battery, from the finger tips of one hand positive electricity is discharged and from the other hand, negative electricity. One electricity neutralizes the other and there is no energy evolved until one hand is removed.

The radiations from the hand cause a contraction of the heart (reflex) which is practically telekinesis on a small scale. Note that, with subdued light the energy from the finger tips, has a more accentuated action on the pulse at a further distance than in the light.

Man is a transformer of energy which he receives from his environment. Note that the pulse effects are greater after exposure of your body to an intense light or a current of electricity than before.

Note that when several persons grasp hands and one of the persons presents the fingers of his disengaged hand at the pit of the stomach of the percipient a greater affect is noted.

EXPERIMENT VII.—*Showing that polarity is not the exclusive prerogative of magnetic materials.* On either side of the wind-pipe in the neck, (Fig. 4) are the right and left pneumogastric nerves. When these nerves are stimulated, the needle movements show less amplitude and when they are depressed the movements show greater amplitude.

Fig. 4.—Lines indicating the site of the right and left pneumogastric nerves.

Take a bar-magnet (held at end with fingers at right angles and directed at a right angle) and note the following effects on the amplitude of the needle:

MALE.

Right Pneumogastric Nerve—	
Positive pole (N)	Increases amplitude
Negative pole (—)	Decreases amplitude
Left Pneumogastric Nerve—	
Positive	Decreases amplitude
Negative	Increases amplitude

FEMALE

Right Pneumogastric Nerve—	
Positive pole	Decreases amplitude
Negative pole	Increases amplitude
Left Pneumogastric Nerve—	
Positive	Increases amplitude
Negative	Decreases amplitude

Note that the foregoing refers only to the normal male and female. If, in a male or female, the polarity is reversed, the male would react like a female and *vice versa*. Sexual inclination is a matter of polarity and its determination may thus be demonstrated. A mistake in your deduction is a serious matter. Note that the extended finger tips of the right hand of a normal male directed to the pneumogastric nerve act like the positive pole of a bar-magnet whereas the fingers of the left hand act like the negative pole of a like magnet. The opposite holds good in a normal female. Note that YELLOW MATERIAL on the head of body of a normal male or female will reverse the polarity of their finger tips. That is, the male will show female and the female, male polarity.

COLOR may thus influence sex tendencies. Show effects with the positive or negative end of any dry cell like with the magnet.

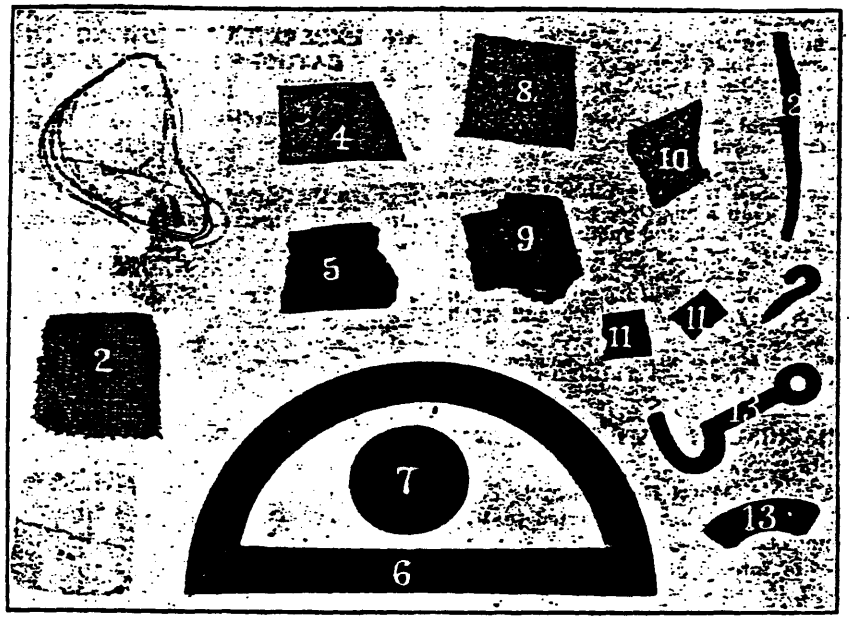
Many other interesting experiments will suggest themselves to the interested experimenter. Remember, however, that the most mystifying phenomena rest upon the least complex causes; and the simpler a thing is the harder it is to understand. Observe all the details as suggested. To demonstrate phenomena which have heretofore baffled the scientific world is at least worthy of patience.

PROF. McKAY'S MAGNETOGRAPHS.

IN acknowledging the receipt of a copy of the book entitled "X-Rays and the Phenomena of Anode and Cathode," by Edward P. Thompson and Prof. W. A. Anthony, Lord Kelvin states his belief that hitherto nothing in the way of diffraction has been discovered for the Röntgen rays, and doubts very much the genuineness of McKay's magnetographs described in the book. No other experimenter, says Lord Kelvin, has given any confirmation of these experiments.

As the matter here referred to seems to be well worthy of further investigation, we reproduce from the work above referred to the part referring to Prof. McKay's experiments:

"Although this experiment does not belong to that class connected with discharge tubes, yet the phenomenon has a theoretical interest in connection with X-rays. He obtained a photograph of different objects in the dark by means of radiations from the poles of an electro-magnet after two hours' exposure, but it need not have been so long, as he obtained clear images in five minutes in one experiment with frequent variations of current by means of a rheostat, and by approach and recession of the armature.



PROF. MCKAY'S MAGNETOGRAPHS.

(X-Ray Phenomena Attributed to Electro-Magnetic Radiation.)

"The elements involved in the experiment were arranged in the following order: First, a large inverted magnet for supporting 100 lbs., the poles hanging downward. Next in order was a wooden board pressing flatwise against the ends of the poles of the magnet. Next the objects and the sensitive plates backed thereby and all enclosed in a completely opaque wrapping extending over the sides, face, back, etc., of these two elements. Next in order was an armature about as heavy as the magnet would support. The cut herein (see illustration) represents the photograph that was produced of the different objects named.

"By reading Prof. McKay's very detailed description in the 'Scientific American," April 18, 1896, p. 249, the reader may feel certain that the photograph was not due to light for he tried the experiments in different ways and with various precautions. In a course of experiments carried on by student Austin, about Feb. 15, 1896, in the Dartmouth laboratory, a sciagraph of what appeared to be the lines of force was obtained by means of X-rays, but upon repeating the experiment the result was negative. See "Elec. Engineer," March 11, '96, p. 257. Article by E. B. Frost."

The numbers on the accompanying engraving designate the following objects: 1. Platinum wire. 2. Copper gauze. 3. Iron gauze. 4. Tinfoil. 5. Gold foil. 6. Brass protractor. 7. Silver coin. 8. Platinum foil. 9. Brass. 10. Lead foil. 11. Aluminum. 12. Magnesium ribbon. 13. Copper objects.

LIGHT RAYS WHICH, IN THEIR PENETRATING POWER, RESEMBLE ROENTGEN'S X-RAYS.

BY N. D. C. HODGES.

The purpose of this note is to call attention to the properties in common of certain radiations which, while somewhat unusual in character, have been classed hitherto as light rays not essentially peculiar in their method of propagation, with those radiations which are now known as Röntgen's X-rays.

Fox Talbot, about 1840, first observed spectra in which the order of the colors was not as usual (red, orange, yellow, green, blue, indigo and violet), but in which the violet was less refracted than the red and other colors of great wave-lengths. This observation was not followed up at the time; in fact, it was not published for nearly twenty years. In 1860 Le Roux discovered that iodine vapor possessed not only a very remarkable absorbing power, but that the spectrum was abnormal, the violet being less refracted than the red. From that time till the present, anomalous dispersion has been frequently investigated by physicists and chemists; but the difficulties have been great, and comparable quantitative results have been few, as witness the labors of Le Roux, Christiansen, Kundt, Soret, Mach and Osnobischin, Wernicke, and others. However, the existence of the phenomenon is no longer denied, as it was by some soon after the announcement of its discovery; and fortunately it is possible very easily to get qualitative results, i. e., to break up a beam of white light into two parts, of which one, consisting of the rays ordinarily most refrangible, is less refracted by some substances than is the other, consisting of the rays of greater wave-lengths. In fact, De Klerker (Comptes Rendus, 1879) maintained that the anomalously dispersed rays were not refracted at all by the substance producing the dispersion. At any rate we have light rays not as subject to refraction as are ordinary rays, and in so far they approach Röntgen's X-rays in character. The question is, Have these two classes of radiations other properties in common?

To test the power of penetration which the anomalously dispersed rays might possess for substances usually opaque to light rays, I used a so-called "pocket kodak," carrying a strip of film sufficient for twelve exposures. This camera was placed in the closely-fitting pasteboard box in which it is sold, the shutter opened, the cover (lined with carbon paper) being immediately shut down. In this way sections 1, 3, 5 and 7 were exposed to pure sunlight (in so far as it could penetrate the pasteboard end of the box) for 5, 10, 15, and 30 minutes respectively. For sections 2, 4, 6, 9 (8 was accidentally allowed to pass unused) the exposure was not to pure sunlight, but upon the end of the box upon which the light fell was placed a prism formed of two microscope slides held together at an angle of only a few degrees, and in which a small quantity of a dilute alcoholic solution of fuchsine was held by capillarity. On development the film showed an increasing amount of fogging as the length of time the different sections had been exposed increased. But as section 8, which had not been exposed, showed a marked amount of fogging, it was evident that light had entered the camera in some way so as to reach the sections of the film which it had been assumed would be protected.

To avoid any overlapping effect and separate as completely as possible the parts of the film acted on by the pure sunlight from those acted upon by the anomalous rays, in the second experiment sections 1, 2, 3, 4 were, in succession, exposed to pure sunlight (so far as it could penetrate the end of the pasteboard box, as above) for 5, 10, 15, and 30 minutes, respectively; sections 5, 6, 7 were passed by without exposure, so as to furnish plenty of film to wrap about the first four sections and to separate the pure sunlight action from that which came later; sections 8, 9, 10, 11 were exposed for 5, 10, 15, and 30 minutes, respectively, to the anomalous rays, as before, the fuchsine prism being attached to the end of the box. On developing, the first four sections were found to be unfogged; a slight fogging appeared on section 6, and from there on the fogging increased with the length of exposure. Again, sections which would be amply protected from ordinary light showed a fogging which could have been produced only by rays which must have passed through the wooden sides of the camera and the paper of the box.

In order to increase any tendency to luminescence inside the camera, a strip of white blotting paper was inserted in the dark chamber of the camera and kept there through all the exposures. It will be understood that the pure sunlight had to pass through the side of the pasteboard box, and that it produced no fogging in the control exposures (which have since been repeated, but without the blotting paper), while the anomalous rays to produce the fogging must have passed through not only the pasteboard but also through the wooden sides of the dark chamber of the camera, and probably through the leather and wood covering of the camera.

It would appear, therefore, that the violet rays which result from anomalous dispersion of sunlight by refraction through a prism of fuchsine have a power of penetration for paper, leather, wood and black cloth—substances which are opaque to the whole light of the sun.

INFLUENCE OF MAGNETISM ON CHEMICAL ACTION.[1]

More than a year ago I gave an account[2] of some experiments which I had performed with the object of determining whether magnetism exerts any influence on chemical action. I succeeded in getting what appears to me to be strong evidence in favor of the view that magnetism does, at least in one case, exert a marked influence on chemical action. The principal experiment upon which this conclusion is based may be briefly described here. A vessel made of thin iron (ferrotype-plates were used) was placed on the poles of a magnet, and a solution of sulphate of copper poured into it. Instead of getting a uniform deposit of copper on the bottom of the vessel, the metal was deposited in distinctly marked lines, the direction of which was at right angles to the lines of magnetic force. Further, directly over the poles, the deposit was uniform; and this uniform deposit was bounded by a band of no deposit, from one-sixteenth to one-eighth of an inch in width.

Since the first paper on this subject was published, I have spent a great deal of time in endeavoring to discover other cases of similar action, and to extend the observations in various directions, in the hope of reaching a satisfactory explanation of the phenomenon described. I shall soon give a full account of the work in the American chemical journal. In the mean time a condensed account is here given.

I should say at the outset, that the subject of this paper has frequently been discussed and experimented upon in past years. In 1847 Wartmann[3] summed up what had been done previous to that time, and also described some new experiments of his own. According to him, magnetism does not influence chemical action. His proof was furnished by two experiments. In the first, the electrolysis of water was carried on in a magnetic field, and the results compared with those obtained with the same apparatus without the magnet. The results were the same in both cases. In the second experiment, iron cylinders were placed in a solution of copper sulphate. Some of the cylinders were magnetized, and others were not. No difference was observed between the deposits formed. The author calls attention to the fact that his conclusion, that magnetism does not influence chemical action, differs from that of a number of earlier writers, among whom may be mentioned Schweigger, Döbereiner, Fresnel, Ampère, and Robert Hunt; but that, on the other hand, it agrees with that of Otto-Linné Erdmann, Berzelius, and the Chevalier Nobili.

Among the experiments referred to by Wartmann, those of Robert Hunt[1] are perhaps the most striking; and to these I turned my attention. Hunt states, that, when a concentrated solution of silver nitrate or of mercurous nitrate is placed on glass over the poles of a magnet, the salts crystallize out in curious lines, of which an illustration is given. While these experiments have no direct bearing on the question whether magnetism influences chemical action or not, I nevertheless repeated them. To my surprise, the effects described by Hunt were not obtained. The conditions were repeatedly changed, — the strength of the solutions, the strength and form of the magnets, the thickness of the glass plates, being varied; but under no conditions were the expected effects obtained. Some of the other experiments of Hunt were also repeated, but only with negative results. So that even the most positive statements of Hunt will require verification before they can be accepted in favor of his conclusion that magnetism influences chemical action and crystallization.

Among the experiments which I have performed since the publication of the first paper already referred to, may be mentioned the following: 1. The action of copper on zinc. In this case the magnet evidently exerted some influence on the action; causing apparently an accumulation of copper on the lines bounding the space directly above the poles. No lines between the poles like those obtained when copper acts on iron were observed. I am unable to say positively whether the faint figure observed in the zinc was due to an increased deposit of copper or to a lack of deposit. 2. Action of silver on zinc. Indistinct lines were observed, which appeared to be at right angles to the lines of force. These were obtained only when the solution of silver nitrate was quite dilute. 3. Action of copper on tin. The action was evidently modified by the presence of the magnet. 4. Action of silver on lead. No action was

[1] Abstract of a paper read before the National academy of sciences, at its semi-annual meeting in New York, Nov. 14–17, 1882.

[2] American chemical journal, iii. 157.

[3] Philosophical magazine, 1847 [3], 30.

[1] Philosophical magazine, 1846 [3], 281.

observed. 5. Action of silver on iron. A slight effect was produced.

It will thus be seen, that the first experiment described is the one which best exhibits the influence of the magnet. The question still remains, whether the striking effect observed is due to the influence of magnetism on the chemical action, or to some indirect influence of the magnet. An examination of the liquid while the action is going on shows clearly that there are currents in it. Small particles of dust, or any light material, on the surface of the liquid, are drawn towards the poles, and then move in circles above the poles, to the right above one, to the left above the other. We have hence electric currents in the liquid; and these revolve under the influence of the magnet, as we would expect them to. This action gives rise to a streaky condition of the liquid, and this may possibly account for the deposition of copper in the peculiar lines which have been described. I am unable to say whether this satisfactorily accounts for the fact, that the lines of deposit are at right angles to the lines of force; but, as far as I have been able to determine, it does not. Further, if the presence of the currents is the cause of the peculiar deposit of copper on iron, it would appear that the same kind of action should be observed whenever one metal is deposited upon another under the influence of a magnet. This, however, is not the case, as was pointed out above. The fact that the action takes place markedly in the case of iron, and only very slightly, if at all, with other metals, suggests, though it does not prove, that the action is in some way connected with the magnetized condition of the iron. Up to the present I have been unable to experiment with cobalt and nickel. Using nickel-plated brass, I did not succeed in getting any displacement of other metals from solutions by nickel in this condition. Experiments with these metals will of course be of special interest. If it can be shown that with them the same kind of action takes place as with iron, and that with non-magnetic metals it does not take place, the influence of magnetism directly on the chemical action would be practically demonstrated. The slight effects observed with other metals already described may possibly be attributed to the presence of small quantities of iron in the metals experimented upon.

Turning from the ridges of copper deposited on the iron, what is the cause of the space around the outline of each pole upon which no copper is deposited? It is sharply defined; and at the end of the operation it is bright, having remained entirely unaffected by the solution of copper sulphate. Here is evidently a region, not by any means inconsiderable, in which no chemical action has taken place. This can hardly be ascribed to the presence of currents in the liquid. The cause must, I think, be looked for in the magnetized condition of the iron; and I venture, though with misgivings, to suggest, that, the influence of the magnetism being most strongly felt in the iron at the outlines of the poles, these parts of the iron resist the action of the copper sulphate. We may imagine, that the molecules of iron in the regions immediately surrounding the poles are held more firmly than those which are less directly under the influence of the magnet, and that the interference with their motion protects them. Just as, in general, any cause which facilitates the motion of molecules facilitates chemical action, so, also, any cause which interferes with the motion of molecules would probably prevent chemical action either completely or partially. I recognize the crudeness of this suggestion. If there are any objections which can be raised against it, I shall be glad to be informed of them. In the mean time it may at least serve as a working hypothesis, and may lead eventually to a more satisfactory view. I intend to continue experiments on the subject under consideration. Unfortunately, the phenomena which can aid in the solution of the problem appear to be but few, and these do not readily lend themselves to quantitative treatment. The work will necessarily advance slowly, but I shall continue it as long as there appears to be any hope of getting results of value.

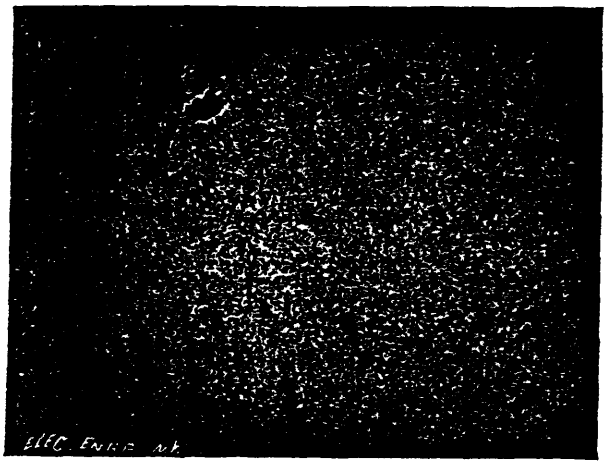
IRA REMSEN.

A MAGNET CATHODOGRAPH.

BY R. B. FROST.

AMONG the numerous photographs obtained with the X-rays in the Dartmouth Laboratory, the one illustrated is of perhaps especial interest to electricians. It was secured about February 15 by Mr. F. E. Austin, graduate scholar in physics, under conditions about as follows: A small horse-shoe permanent magnet was laid flat upon one end of the plateholder, with its poles pointing toward a small bar magnet placed on the opposite end of the plateholder. Our most efficient tube, No. 1,147, in the catalogue of the maker, Dr. Stöhrer, of Leipzig, was used as the source, being placed horizontally, about 15 cms. above the plate.

A glance at the plate at once suggests that we have here



A SUPPOSED MAGNET CATHODOGRAPH.

magnetic lines of force, depicted without the intervention of iron filings or other substances. But we by no means assert that they are really lines of force. Unfortunately, the exact data of the experiment were not recorded, so that we are not absolutely sure that we have precisely repeated the conditions of the exposure in our subsequent attempts. In no case have we obtained any plate like this one, but we have become rather superstitious that the presence of a magnet near a plate renders it liable to fog. Ordinarily, the magnets exhibit the usual metallic obstruction without any such markings as above. However, if the result depends upon having the magnets separated by a distance which must be accurate within a millimetre and having both at a certain precise distance from the source, then it is not likely that we have yet exactly repeated the conditions of the original experiment. Other plates from the same lot exposed under other conditions, but similarly developed, show no markings, so that it seems difficult to believe that the impression was originally on the plate or arose during development. The spots scattered over the plate are due to holes in the film, but we know of no cause for them.

We have endeavored to account for the appearance of the plate on the assumption of mechanical vibrations of the plate from the neighboring interrupter of the induction coil, but this seems hardly a sufficient cause. The result, however, is entirely objective, and we present it in the hope that it may be confirmed by other experimenters, or that suggestions as to the cause may be given from the experience of others. Meanwhile the experiments of Professor Emerson and myself will be continued with a view to a repetition of the result.

ent materials, and shown in Fig. 2—which is an ordinary photograph made with a camera by daylight—was placed on a negative and exposed to the arc for 30 minutes and developed in about 20 minutes. It will be seen (Fig. 3) that the brass escutcheon and the metal and bone buttons have stopped the rays completely, the porcelain partially, and the hard rubber washer 1-16 of an inch thick; but the two pearl buttons had no effect whatever in shutting out the active rays.

In my estimation this negative is the result of X-rays or another action and not of ordinary light, as stated by Professor Stine and Mr. W. H. Freedman, in the issue of "The Electrical Engineer" of March 11. If the result had been due to ordinary light, it is fair to assume there would have been some trace of these bodies on the print.

The fourth experiment consisted in making a negative of an ordinary steel wire gauge fastened to a piece of paper, put in the plateholder and placed in a ½-inch pine box. The result

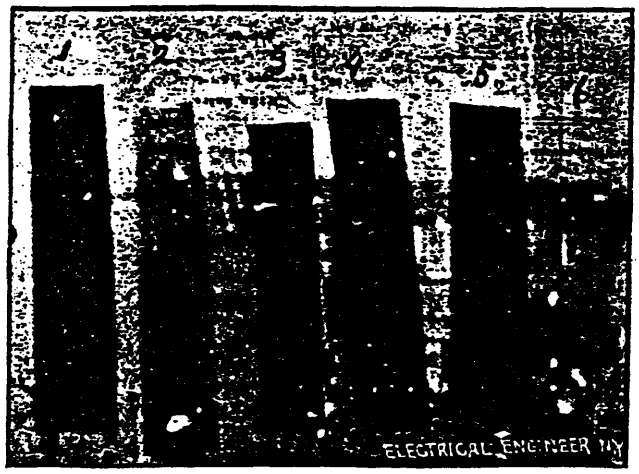


FIG. 6.

of 55 minutes' exposure is shown in Fig. 4. In this case it was necessary for the rays to pass through a ½-inch pine board, the pasteboard slide, and the paper holding the object.

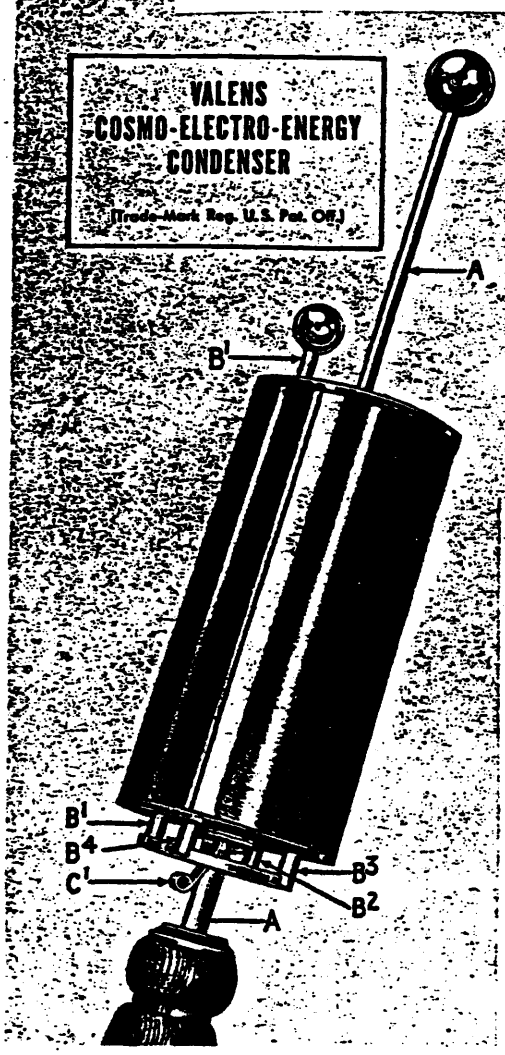
I think the above facts are sufficient to prove that there are X or other rays emanating from the electric arc light.

In order to examine the effect of color by the rays, I fastened a number of colored strips of celluloid to a piece of paper in the usual manner and placed them in the plateholder, which was exposed for 30 minutes, and the result is shown in Fig. 5. The active rays were cut off by the transparent, the two blue and the pink strip; the yellow and red strips, such as are used by photographers to shut out the actinic rays when developing negatives, had allowed the rays to pass without the slightest obstruction, and to act on the plate.

While endeavoring to reproduce the above result under apparently the same conditions, opposite results were obtained, as shown in Fig. 6, and for the first time in my experiments the printing on the paper appeared.

This most interesting phenomenon will be further investigated at the laboratory of Dr. W. J. Morton, who has kindly offered the writer the use of his apparatus for making comparative tests with the vacuum tubes and arc lamp.

DR. GEORGE STARR-WHITE DREW UP VRIL VITALIZING THREADS WITH THIS THERAPEUTIC DESIGNS. ATTACHMENTS WERE FASTENED ABOUT THE MAIN POLE OF THE HOUSEHOLD HELIX AND APPLIED TO NEEDED ORGANISMIC PLACES.



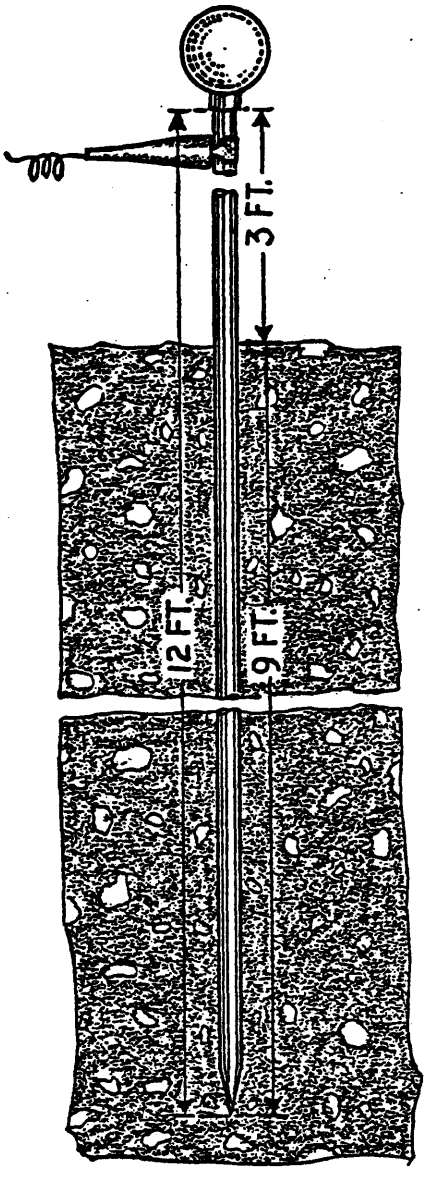
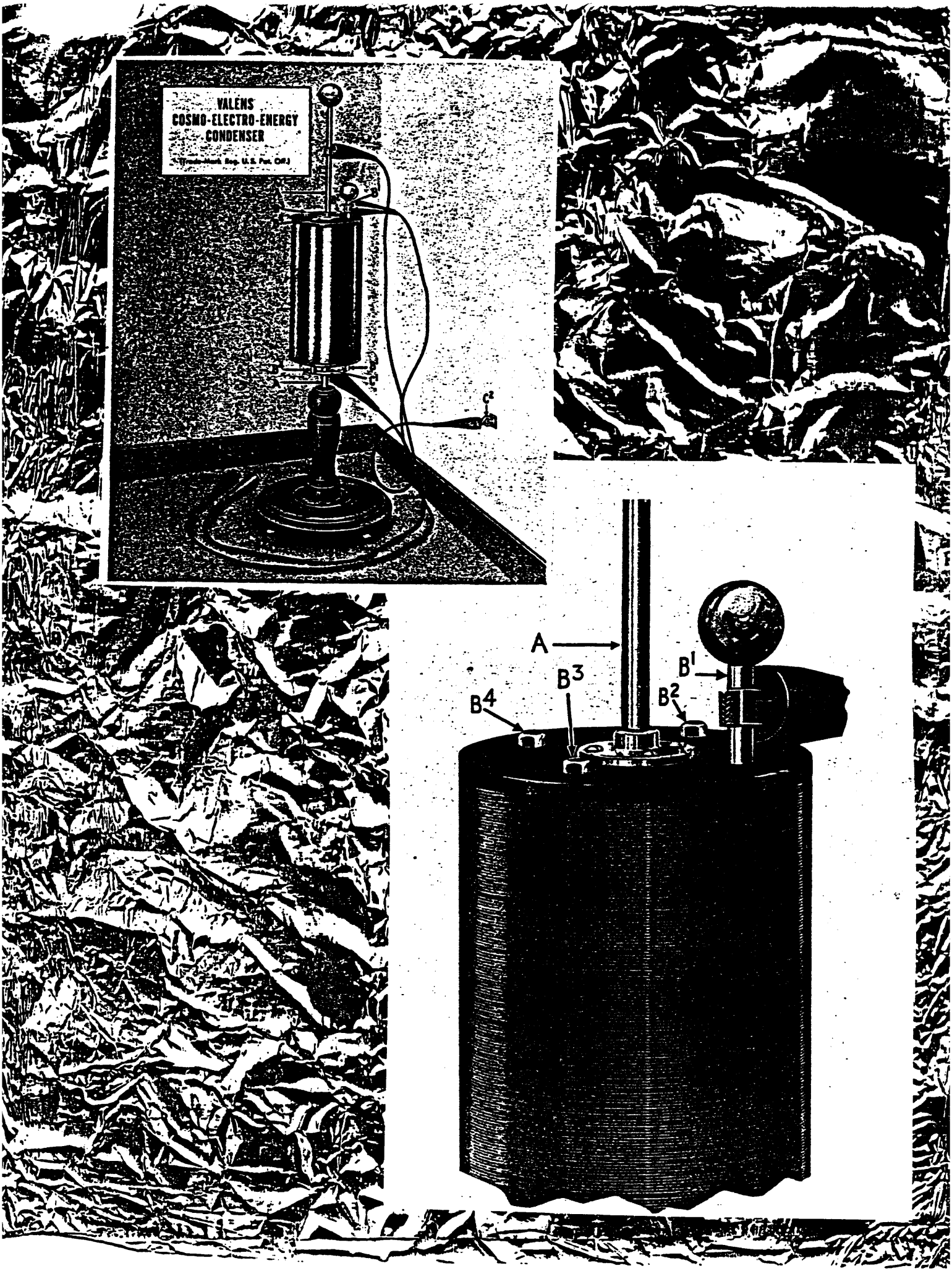


Figure 1

On page 82 of the book, *Cosmo-Electro Culture,* is illustrated a most satisfactory method of taking the *Cosmic Energy* from the erth, but many are not so situated as to put in such a "grounding" sistem.

To simplify, for home treatments, the utilizing of the *Cosmic Forces,* one may use a half-inch hard copper rod 12 feet long as shown in Fig. 1, of this *Supplement.* The end that is driven into the ground is pointed as illustrated. Nine feet are driven into the ground, while three feet remain above the ground. On the end above the ground should be securely fastend a two-inch "hard-copper," or fosfo bronze ball. To this *"ground rod"* may be attacht the *"Ground Wire,"* or *Energy Conductor,* iether by a clip, clamp, or by sodering. This illustration shows a regular "Testing Clip," clipt on the *Rod.*

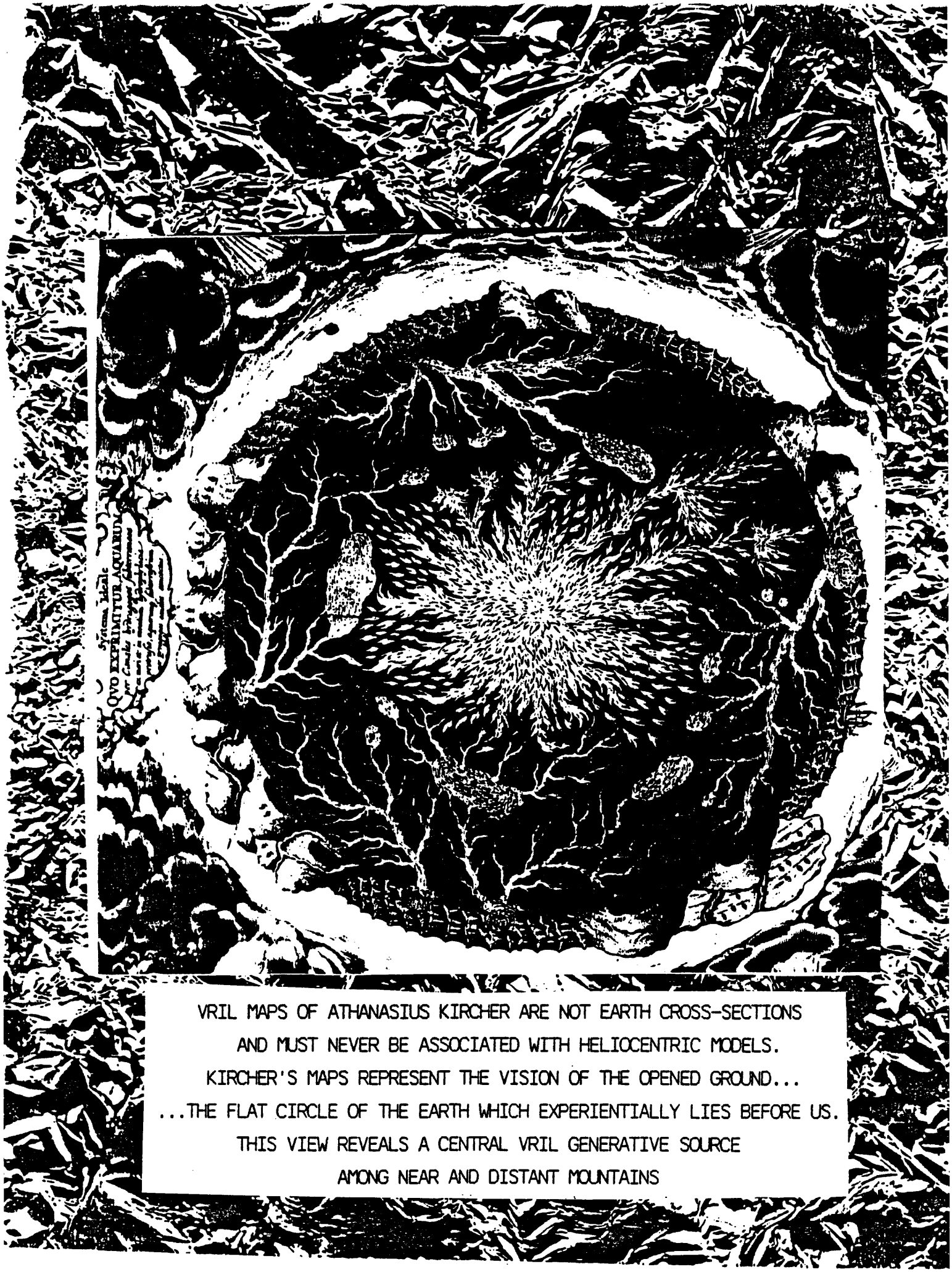

VALENS
COSMO-ELECTRO-ENERGY
CONDENSER
C2
A
B1
B2
B3
B4

WHEN VRIL IS DISTURBED THEN VRIL HEAT DISTURBINGLY EMERGES

VRIL HEAT LONG PRECEDES GROUND TEMPERATURE INCREASE.

VRIL DETERMINES GEOLOGY BY PROJECTING AND SUSTAINING GEOLOGY.

DISTURBED VRIL HEAT SHAFTS OFTEN SEVERELY DISTORT GEOLOGICAL ORDERS



VRIL MAPS OF ATHANASIUS KIRCHER ARE NOT EARTH CROSS-SECTIONS
AND MUST NEVER BE ASSOCIATED WITH HELIOCENTRIC MODELS.
KIRCHER'S MAPS REPRESENT THE VISION OF THE OPENED GROUND...
...THE FLAT CIRCLE OF THE EARTH WHICH EXPERIENTIALLY LIES BEFORE US.
THIS VIEW REVEALS A CENTRAL VRIL GENERATIVE SOURCE
AMONG NEAR AND DISTANT MOUNTAINS

SECTION 3

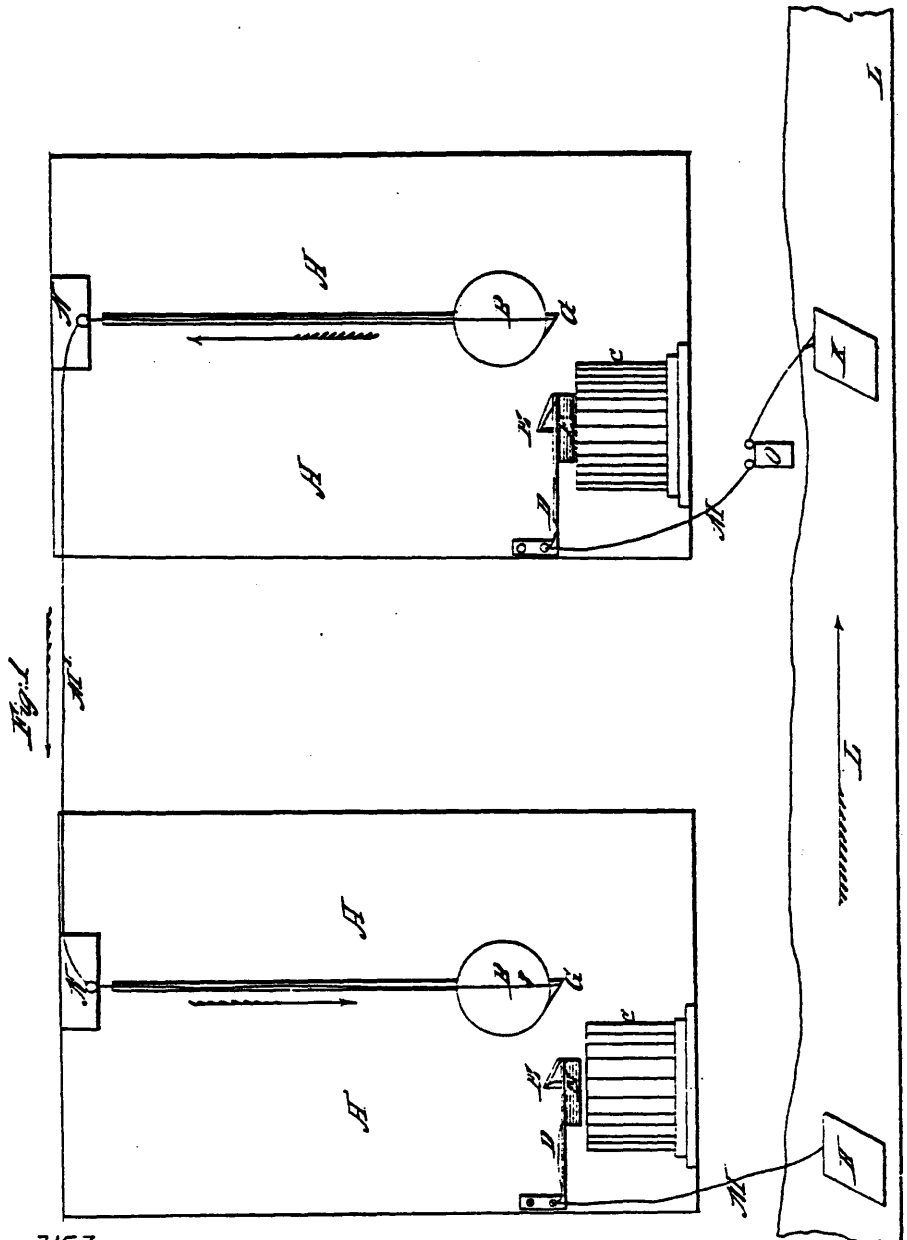
VRIL MOTORS

2 Sheets—Sheet 1.

A. BAIN.

Automatic Telegraph.

No. 5,957. Patented Dec. 5, 1848.



Witnesses:
C. Thorsell
H. Semmes

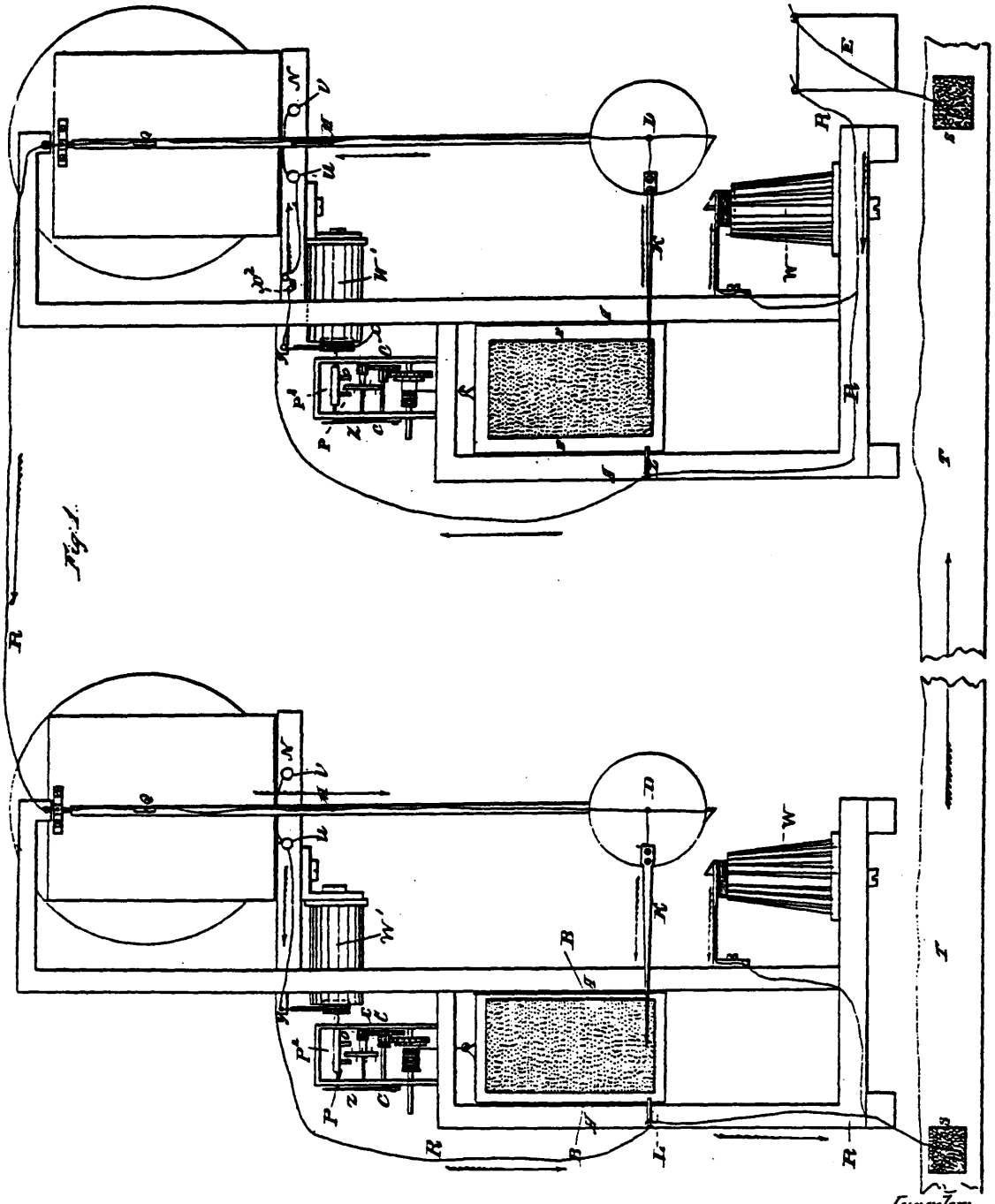
Inventor:
Alexander Bain

2 Sheets—Sheet 2.

A. BAIN.

Automatic Telegraph.

No. 5,957. Patented Dec. 5, 1848.



Witnesses.
[illegible]

Inventor:
Alexander Bain.

UNITED STATES PATENT OFFICE.

ALEXANDER BAIN, OF LONDON, ENGLAND.

IMPROVEMENT IN COPYING SURFACES BY ELECTRICITY.

Specification forming part of Letters Patent No. 5,957, dated December 5, 1848.

To all whom it may concern:

Be it known that I, ALEXANDER BAIN, formerly of the city of Edinburgh, now of the city of London, and Kingdom of England, electrical engineer, at present in the city of Washington, and a subject of the Queen of Great Britain and Ireland, have invented and made and applied to use certain new and useful improvements in the means for taking copies of surfaces by electricity, by which improvements messages may be sent from one place to another at a distance, and for which said improvements I seek Letters Patent of the United States, as the same are shown in the specification of a patent issued to me under the Great Seal of the United Kingdom of Great Britain and Ireland on the 27th day of May, 1843, and which specification was duly enrolled the 27th day of November, in the same year, wherein the said invention and improvements were fully and substantially set forth, as hereinafter described and shown, reference being had to the drawings annexed, which show my improvements for taking copies of surfaces—for instance, the surface of printers' types—at distant places.

In these drawings the conjoined figure in Sheet 1 represents certain improvements in electric time-pieces, as the same are employed by me for the purpose of giving isochronous movements to the transmitting and copying portions of the machinery, and shows a method of making two pendulums at a distance regulate each other so as to keep the same time. The like marks of reference apply to the same parts in both portions of this figure. In these A A are the backs of the inclosing-cases. B B are two pendulums, of the same length, suspended at N N. C C are two permanent magnets. F F are two multiplied coils of wire attached to the springs D D. G G are two similar catches, one attached to each of the pendulum-bobs. L L is a section of the earth. H K are plates of metal. O is a galvanic battery with one pole connected with the plate K. To the other pole is connected or attached the wire M, which leads up to the spring D. This is in connection with one end of the coil F, the other end being connected with the metallic catch E. The end of a similar wire is connected with the catch G of the pendulum and led up the rod into connection with the lower end of the pendulum-spring, the springs of the two pendulums being connected by the top wire, M'. The connections are similar at the other pendulum, and the current returned by the earth, as shown by the arrows at L. The pendulums will be kept in motion by clocks in the ordinary manner, and made to move in the same direction and at the same time. When the two pendulums are near the extremity of their vibrations to the left and the catches on the bobs are in contact with the catches beneath the electric circuit is completed, and the current will pass through the pendulums and wires, at the same causing the coils F F to be attracted by the magnets, and thus depressing the catches E E, and by these means allowing the catches G to pass over them, and when the pendulums have passed over the catch E the current is broken until upon their return vibration the faces of the catches G come into contact with the faces of the catches E; and should one pendulum arrive at this point first it must remain until the other comes up to the like point at the other station to complete the electic circuit, when the catches E will be again depressed by the attraction of the magnets and both pendulums be released simultaneously.

Figures 1 and 2, Sheet 2, represent two machines for transmitting and receiving copies of surfaces, one of which machines may be considered as at Boston and the other at New York. These two instruments are in every respect the counterparts of each other except X^2, Fig. 2, from which the message is sent. A A is a strong wood frame; B B, a metal frame filled with short insulated wires parallel to each other, and at right angles to the plane of the frame. These may be put in as follows: The small wires are previously insulated by thread in the usual manner, then cut into lengths of about an inch, and as many put into the frame as that will receive. Then pour a quantity of liquid sealing-wax on and to fill between them. When cold, grind and polish to a plane and smooth surface on both sides flush with the frame, as represented by the numerous dots. D D are pendulums, which are kept in constant motion by powerful clocks Q Q. The motions of these pendulums are kept isochronous by electric coils and perma-

nent magnets, as shown in Sheet 1. These coils and magnets serve no other purpose and do not act in or form any part of the long telegraphic circuit in which the electric current travels when the marks are making by the current. K is a steel-spring carried by the pendulum, the extreme end rubbing gently upon the surface formed by the insulated wires in the frame B B. L is a spring fixed to the wood frame. The free end of this spring presses upon the metal frame B B. M is a slight spring carried by the pendulum, having a pin projecting through the pendulum that presses gently upon the wood frame N. U and V are two metal studs flush with the frame N. W is a permanent magnet. E is a voltaic battery. T T are sections of the earth. S S is carbon. R R R are conducting-wires. C C is a piece of clock mechanism, to which the metal frames B B act as weights. O P are two pins in the slide-spindle P^2. X is a coil of insulated wire suspended by two insulated springs at Y, to which are attached conducting-wires. W′ is a second permanent magnet. Z is a spring.

When a communication is to be made I proceed in the following manner: I first set up the types composing the communication in the usual manner in a metal frame, which fits into metallic contact with the back of the frame B B, Fig. 2, Sheet 2, with the printing-surface in contact with the back ends of the small parallel wires. In the distant frame B B, Fig. 1, Sheet 2, will be kept placed two thicknesses of damp paper previously saturated with a solution composed of equal parts of prussiate of potassa and nitrate of soda, and at the back of the paper a smooth metal plate, pressing the paper into contact with the ends of the parallel wires and exactly fitting the frame B B. The operator, having set up his types and placed them in the frame B B, Fig. 2, Sheet 2, then joins the connecting-wire at X^2, and when the pendulums are at the extreme ends of their vibrations—that is, when the pins in the springs M M come upon the studs U U or V V—a current is sent through the coils X, which are then repelled by the permanent magnets W′, and, pressing upon the slide-spindles, releases one pin of the top wheel, which allows the wheels to make one-eighth of a revolution. When the pins carried by the springs M M are off the studs U U or V V the current is broken, and the coils being no longer repelled by the magnets, the springs Z Z force the spindles toward the permanent magnets, which releases another pin of the wheels, and by these repeated actions the frames B B continue falling until they reach the bottom of the frames A A.

It will be observed that the electric current constantly passes through the portion of the small insulated wires contained in the frames B B that may be in contact with the springs K K, except when the pendulums are at the extreme ends of their vibrations, and the springs K in contact with the frames B B, and as the spring K in Sheet 2, Fig. 2, will only take the current from the short wires whose inner points are in contact with some portion of the type, the current will pass at that point and no other, and consequently the current will be delivered at a corresponding point through the paper in the frame B B of Fig. 1, Sheet 2, and this operation will produce a copy of the printing-surfaces of the type in a series of small dots in the paper by the electric current decomposing the substance and changing the color of the moist chemical compound in the paper.

For simplicity in the representation and references, only one conducting-wire and one spring K are shown in the drawings, Sheet 2, as used with each instrument; but in practice these may be varied and used so as to copy an entire line of types at each vibration of the pendulums.

It is also evident that a copy of any other surface composed of conducting and non-conducting materials can be transmitted and taken by these means.

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

1. The copying of surfaces by the electric current through a single circuit of conductors by means substantially the same as herein set forth.

2. The exclusive right to the use of prussiate of potassa as the most useful ingredient in solutions of chemical compounds for preparing paper to receive marks formed by the action of electric currents thereon for telegraphic purposes.

In witness whereof I have hereunto signed my name, in the city of Washington, this 18th day of November, in the year one thousand eight hundred and forty-eight.

ALEXANDER BAIN.

Witnesses:
B. K. MORSELL,
W. SERRELL.

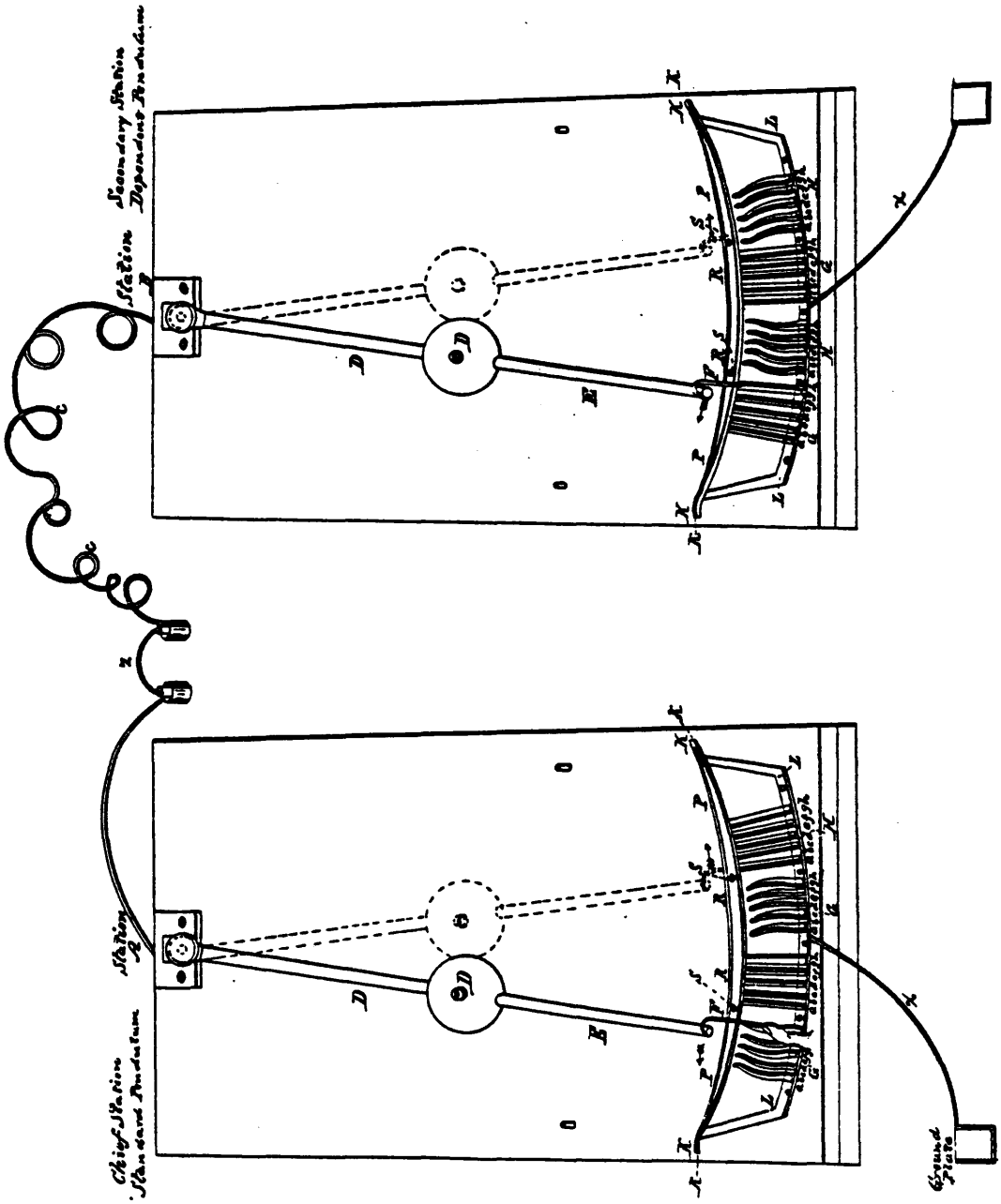
2 Sheets—Sheet 1.

H. G. DYAR.

Telegraph.

No. 17,673.

Patented June 30, 1857.

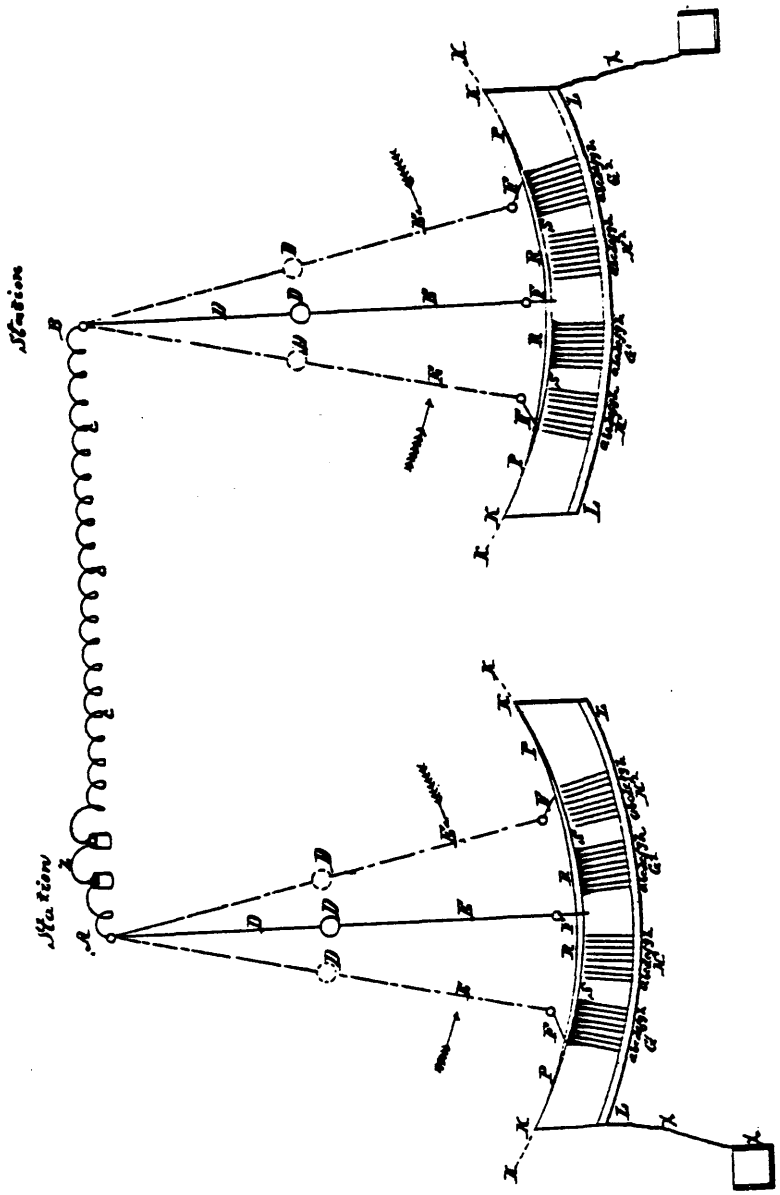


2 Sheets—Sheet 2.

H. G. DYAR.

Telegraph.

No. 17,673. Patented June 30, 1857.



UNITED STATES PATENT OFFICE.

HARRISON GRAY DYAR, OF NEW YORK, N. Y.

IMPROVEMENT IN ELECTRIC TELEGRAPHS.

Specification forming part of Letters Patent No. **17,673**, dated June 30, 1857.

To all whom it may concern:

Be it known that I, HARRISON GRAY DYAR, of the city, county, and State of New York, have invented certain new and useful Improvements in the Art of Communicating Intelligence by Electricity; and I do hereby declare that the following is a full, clear, and exact description of my said invention, reference being had to the drawing which is hereunto annexed.

The apparatus forming the subject of the present invention is termed by me an "electrepode"—*i. e.*, electric-word road—and the species of language or form of communication I designate "electrep"—*i. e.*, electric word.

Electric telegraphs may be divided into two classes—the copying-telegraph and the signalizing-telegraph. By the former a skeleton fac-simile of the message sent is made at the opposite end of the line of communication. The principal telegraphs constructed upon this principle are those of Bain and Bakewell. They are founded upon the fact that a current of electricity has the property of decomposing various chemical substances, and consequently of discoloring or producing a stain upon paper prepared with such substances through which the electric current is passed. Hence if a sheet of an electric conducting material having the characters or letters of a message written upon it in some non-conducting material or ink be connected with some source of electricity and be passed in the direction of the writing and at a given speed beneath a style attached to one end of a main conducting-wire extending between two points, the continuity of the electric current proceeding from the sheet of conducting material to the main conductor through the style will be broken as often as the non-conducting ink of any portion of any written character passes beneath the style, and if there be a style at the opposite end of the main conductor under which a sheet of chemically-prepared paper is passed at the same speed as the sheet of non-conducting material, the paper will be discolored in those portions which pass beneath the style while the electric current is passing, but will be left of its original tint at those parts which pass the style while the electric current is broken by the intervention of the ink of the letters of the message beneath the opposite style. If the styles are pointed, each will describe a line upon its respective sheet, and the first passage of a message beneath the first style will be followed at the other style by the formation on the paper of a line of disconnected dashes separated by dots of the original tint which correspond in position with the parts of the letters of the message which passed beneath the first style. If the message and paper be passed and repassed a number of times beneath their respective styles, and if at each repassage the two be shifted a slight distance transversely to the direction of the writing, the message will be reproduced upon the paper in skeleton letters formed of dots of the original tint separated by discolored dashes.

In some cases the process has been reversed, so that the skeleton letters are formed of discolored dots upon a ground of the original tint. In either case each letter or character of the message requires a number of changes of the electric influence, or the transmission of a number of short electric currents, to give the corresponding skeleton character such a form as shall distinguish it from other characters or letters. Hence it has been customary either to pass the message a number of times beneath one style or to pass it once beneath a number of styles extending in a series the height of the writing or printing. This mode of telegraphing has fallen into disuse, the reasons being, in my opinion, the great number of changes of electric connection required to render the characters distinct and the practical difficulties attending the use of the apparatus employed.

The copying-telegraph, operating on the principles above mentioned, is clearly distinguished from the signalizing-telegraph, to which my invention has reference. In this latter class each letter, word, or syllable of a message is represented by a distinct signal. These signals are transmitted in succession along the main conductor, and are indicated or recorded at the place where they are received. The different kinds of telegraphs constructed upon this principle are distinguished from each other either by the kind of signals employed or by the mode and apparatus by which the signals are transmitted and recorded. In some telegraphs of this description the letters

of which a message is composed are represented by simple signals or single passages of the electric current of different lengths, or they are represented by compound signals formed by successive passages of the electric current separated by intervals; or these two modes are combined. In other telegraphs all the letters have been represented by simple signals or single passages of the electric influence without regard to their duration, and the different significations of the signals are indicated by the different positions which the members of the recording apparatus occupy at the time the different signals are received. In this latter case, as well as in those first referred to, the telegraphing by the main conductor proceeds no faster than the operator can make the muscular efforts required to operate his particular telegraphic apparatus, and the main conductor is occupied exclusively by one operator. The speed with which messages are telegraphed is thus limited by the manual dexterity of the operator, and the main conductor is not employed by any other operator for transmitting messages, either in the same or in the opposite direction, until the first operator has suspended or finished his work; hence, if messages are to be transmitted simultaneously on the signalizing principle, as many operators are put to work as there are messages to be simultaneously transmitted, and as each operator requires the exclusive use of a main conductor extending from station to station, there must be as many main conductors as there are operators at work at the same time.

The object of my invention is to enable two or more operators to be simultaneously employed in telegraphing different messages by signalizing along the same main conductor or wire of communication, and to permit each operator to work as fast as his manual dexterity will permit, so that, although many operators may be required to make the necessary muscular efforts or distinct voluntary acts to transmit the signals representing many different messages, either in the same or in opposite directions, all these signals will proceed along one common wire of communication or main conductor, and will be indicated or recorded at the places where they are received with the same distinctness and with the same speed that they would be if each operator at work at the time was furnished with a distinct and exclusive main conducting-wire.

My invention consists in constructing and operating telegraphic apparatus in such manner that the electric current representing each different signal may be transmitted to the main conductor or wire of communication in a practically instantaneous manner, or in the form of an impulse or pulsation, however long a time is consumed by the operator in making the muscular bodily movement for the purpose, so that the successive impulses representing the various signals forming a telegraphic message will be separated by intervals of time depending upon the dexterity of the operator, and that during these intervals similar impulses representing different messages, resulting from the muscular efforts of other operators employed at the same time, may be transmitted to the same main conductor, either in the same or in opposite directions.

My invention is based upon the circumstance that, practically speaking, no sensible portion, or at best an extremely minute portion, of the time employed in working a signalizing-telegraph is consumed in imparting the electric influence which is the agent of communication to the main conducting-wire, but that the great portion of the time expended is consumed in the operation of making or recording the signals, during which the current or passage of electric influence is unnecessarily maintained. Hence, if telegraphic apparatus be constructed in such manner that the employment of the electric influence is required for but one instant of time to make any required signal, one wire of communication or main conductor reaching between the distant places may be made the instrument of transmitting, either in the same or in opposite directions, an indefinite number of instantaneous impulses representing different signals in a second of time, provided the telegraphic apparatus be constructed in such manner that so many different impulses representing distinct signals may be imparted separately and in succession to either end of the main conductor and correspondingly received, distributed, and indicated or recorded at the other end thereof in an intelligible manner.

This invention may be applied to practice in various modes, differing more or less in the arrangement and construction of the apparatus and in the modifications of electric action applied. It is, however, essential to my invention, so far as my present experience extends, that a telegraphic apparatus embodying it must contain a means by which the different electric impulses resulting from the actions of different operators shall be imparted in succession to the common main conductor, so that the impulses resulting from the action of one operator shall alternate with those of other operators upon the same conductor, and it must also contain a means by which the different electric impulses thus successively imparted to the main conductor shall be received therefrom separately and in the same succession in which they were imparted to it, and that they shall be distinguished from each other, so that each may be appropriated to reconstruct the particular message of which it forms a part. The speed at which the apparatus is driven should be at least equal to the sum or number of the muscular efforts which the different operators employed can make in signalizing in a given period of time. Thus, if an operator can make four muscular movements corresponding with as many signals in a second of time and two operators are put to work at the same

time, the apparatus should at least be capable of making eight changes of electric connection per second, and practically it should be driven faster than this rate.

A simple mode of applying this improvement to practice and for illustrating the principle of the invention is represented in the accompanying drawing, in which are shown two pendulums situated at the opposite ends of a telegraphic conductor, C C, and supposed to be actuated by clock-work or other suitable means, so as to move in harmony, or, in other words, to vibrate from *k* to *k* as nearly as possible together in position and in time of vibration.

At station A is the standard-pendulum or chief station in reference to station B or other dependent telegraphic stations.

D D are the pendulum-rods with their balls or weights.

E are the prolonged ends of the pendulum-rods, which should be made longer in proportion than represented in the drawings.

F are very flexible springs united to the prolonged ends of the pendulum-rods.

P R P and P S P are two grooves or pathways, so made that the springs F shall move in the grooves P S P when the pendulums make the vibrations in moving from left to right and shall fall into the grooves P R P when making the vibration in moving from right to left.

C C C is the main conductor or wire of communication connecting the two telegraphic stations A and B together.

L L are conductors extended in directions parallel with the paths described by the extremities of the pendulums, and connected with ground-plates and ground-wires *x x*.

At K, station A, there are metallic points or edges, over which the spring F passes, touching the surface each vibration, which points are connected with the conductors L, and consequently are in electric communication with *x*.

The groove P S P is made of a non-conducting material, and the groove P R P at station B is of metal and in electrical communication with L and *x*.

The spring F at station A, in moving in either of the grooves P R P or P S P, is kept in its path by an insulated or non-conducting guide.

z is a Leyden jar, a prime conductor of an electrical machine or a galvanic battery, kept constantly charged or capable of giving a great number of visible sparks or electric pulsations per second on making or breaking the electric circuit or line of inductive action.

The main conductor C C C has a metallic connection with the upper end of the pendulum-rods, which are also metallic, as well as their prolonged terminations, and are therefore good conductors of electricity. In this condition of things, whenever the spring F at station A passes over the points K K in its vibration there will be an electric communication or circuit from *z* to K, and thence through L and *x* to the ground at station A; also, from *z* to the metallic groove P R P at station B and to the ground there, provided the pendulum at station B is making its vibration from right to left when the pendulum at station A carries its spring F over the conducting-points K.

H′ and H² at both stations are signal-making wires or keys, and G′ and G² at both stations are signal-receiving wires. The signal-wires are to be supposed as numerous in each set as the numbers of different signals desired to be used—say not less than the letters of the alphabet. A smaller number is shown in the drawings for the sake of distinction. The inner extremities of all the signal-receiving wires are flattened, and reach into the grooves or pathways P S P in such a manner that the spring F shall touch and glide over the flattened faces or ends of these wires in succession each time the pendulums move from left to right. The inner extremities of the signal-making wires, on the contrary, stand a little off out of the grooves or pathways, but are mounted in such manner that each may be raised by the pressure of the finger and brought into the line of the groove or pathway, to be touched by the spring F when the pendulum swings from left to right. All these signal-wires are connected at their outer ends with the conductors L L, but are free and independent at their inner ends.

The free ends of the signal-receiving wires may have a width of half an inch (more or less) where F passes over them, but must not touch each other. The corresponding ends of the signal-making wires should be but an edge or line, so that the signal-making wires can be touched by F but for a moment, while the signal-receiving wires will be touched for a sensible time by F in passing over them, by which arrangement the necessity of absolute synchronism in the movements of the two pendulums is avoided. Under these circumstances, if any one of the signal-making wires H′ at station A be moved without breaking its electric connection with L, so that the end F of the vibrating pendulum will come in contact with the end of the wire, a conducting-circuit or electric current will be established for the moment through the whole system of conductors, for, as the pendulums are moved in harmony, the corresponding pendulum at station B will at that moment be in front of the group of signal-receiving wires G′ of that station. Therefore from the electric circuit existing for that moment of contact there would be a spark visible or an electric pulsation upon the flattened end of that one of the signal-receiving wires at station B which corresponds with that one of the signal-making wires at the other station which may have been pressed upon and brought into the pathway of F. If, therefore, all the signal-wires in each set are marked by and signify the different letters of the alphalet, the left-hand wire of each set being

marked *a*, the next *b*, next *c*, &c., then should *a*, *b*, or *c* of a signal-making group, H′, station A, be pressed upon so as to be touched by F, this act will be known at station B by the appearance of a spark on the end of that one of the signal-receiving wires *a*, *b*, or *c* of group G′, station B, which corresponds to that wire which may have been so touched at station A. Thus at will can any signal or letter be sent from station A to station B; and during the operation of signal-making by one person at station A to a second person at station B by the use of one set of wires, H′, a third person at station B, or the same person who receives the first message or set of signals from A, can telegraph in reply to station A by making use of the set of signal-sending wires H′ of station B, in a manner similar to that in which the wires of station A, before described, were used. The electric pulsations thus transmitted to the main conductor by the action of one operator will alternate with those transmitted to it by the action of the other operator, and if the time of a double vibration of these pendulums is equal to the time necessary for conveniently making and observing a signal, then by the use of the four sets of signal-wires above named a person may send to or receive signals from or between the stations A and B reciprocally; or four persons may be continually and simultaneously employed in making and receiving signals at the two stations over a single main wire. The pendulums in this example combine or connect the main conductor with the sets of signal-sending and signal-receiving wires, making the circuit complete as often as a signal-sending wire is placed in a position to impart electricity to them, and breaking the circuit as often as such signal-sending wire is passed in the movement of the apparatus. The pendulums thus constitute circuit-making and circuit-breaking apparatus, which, as before stated, are moved in harmony at the two stations, and combine the main conductor with the sets of signal-sending and signal-receiving apparatus.

The use of the signal-wires above referred to as able to employ four persons in continual telegraphic intercourse will in no way interfere with the simultaneous employment of two or four other operators using the other signal-wires on the right-hand half of the vibrations marked H^2 and G^2, because the electric pulsations resulting from the actions of the various operators at work will be transmitted in succession to the main conductor, and will at the same time alternate with each other, and they will be correspondingly separated and distributed at the opposite end of the conductor, so that the signal of any one operator will be imparted to the main wire during the short intervals of time occupied by the other operators in making the muscular efforts which are necessary to operate the particular signalizing apparatus. So, also, by lengthening out the ends of the pendulum-rods or increasing the angular motion of the apparatus for circuit-making and circuit-breaking, or by causing them to revolve in a horizontal circle instead of vibrating, more space or places may be had for carrying on a much larger number of telegraphic operations.

At K, on the left-hand side of the standard-pendulum, there are two metallic points or faces near together in communication with L, and the groove P R P at station B is a metallic or conducting groove. By this arrangement it can be known at station B when the pendulum at station A is in motion and the position of its vibration exactly determined, so that the pendulum at B can be from time to time set in motion, accelerated, or retarded, in order to maintain that degree of synchronism in the action of the pendulums and similarity in positions which are necessary for the success of the telegraphic operations. When the pendulum at B is correctly timed in its motion there will be visible two sparks on the left-hand extremity and one spark on the right-hand extremity of the conducting-groove P R P at points K K, station B, equally distant from the center of vibration; but when this pendulum is not in its proper position or motion these sparks will be seen at other places along the groove. The pendulum at station B may thus be kept adjusted to the motion of the regulating-pendulum by the appearance of sparks at K K; but this synchronism may be more perfectly maintained by using any of the known or suitable electro-magnets by which two pendulums or a system of pendulums have been or can be made to vibrate together, in which case the metallic conducting-groove would not be required.

In the above description the electric spark from an electrical machine has, for simplicity, been chosen as the visible signal; but should it be desired to make signals by the hydro-electric current and the deflection of a needle, then each one of the signal-receiving wires, before uniting with the common conductor L, may be lengthened out sufficiently to form the coil of a galvanometer. In this case the current passing through any one of these wires can make itself known or the signal be indicated by the deflection of the needle of the galvanometer belonging to that particular signal-receiving wire so signalized, or in like manner these prolonged signal-receiving wires may each one inclose a bar of iron in place of a magnetic needle, so as to have an electric magnet and keeper belonging to each one of these wires. Then the passage of the current through any of the wires will give magnetism to the bar or actuate the magnet or its keeper, from which motion these signals may be perceived or recorded or printed in any convenient form.

In the above description I have illustrated the nature of the invention by showing its action in connection with two telegraphic stations; but it will be obvious to the skillful en-

gineer that divers stations and complex systems of telegraphic lines of communication can be established on the same general principle. Moreover, in the above description I have supposed the signal to be transmitted along the main conductor by means of a positive electric pulsation or by the establishment of an electric current over a main conductor previously unoccupied by an electric current. It will be obvious to the skillful engineer that a signal may be transmitted equally by means of a negative electric pulsation or by breaking an electric current previously proceeding continuously over a main conductor.

In the apparatus thus described the means by which the electric circuit is made and broken so as to impart the electric pulsations in their proper succession to the main conductor at one end of the line and the corresponding means by which the electric circuit is made and broken so as to distribute the electric pulsations at the other end of the main line and distinguish the different signals are moved in harmony; but these portions of the apparatus have no positive connection with the indicating or recording apparatus, and are not impeded or controlled by the latter. Hence these portions of the apparatus move on under the same constant resistance, whether one or more operators are at work, and will continue to move on under the same constant resistance if permitted to move while the line is not at work. This independent operation of the circuit making and breaking apparatus with respect to the other accessories of the telegraph is of great importance, as experience has proved to me that if the circuit making and breaking apparatus at either end of the line be retarded, even momentarily, by imposing upon it any irregular work—as, for example, by connecting it with mechanism for recording or printing the signals—the motion of the apparatus will be affected to such a degree as to render it difficult to maintain the harmonious or synchronal movement at the two stations.

In the apparatus hereinbefore described the movement of the circuit-making and circuit-breaking apparatus is not stopped at the time of the transmission of the electric influence to or from the main conductor; but these portions of the telegraphic apparatus move on in a continuous manner, however long a time may be required by the indicating mechanism to render a signal visible to the eye or to record it. This portion of the invention is a new feature in signalizing-telegraphs, in which it has been customary to stop the movement of the circuit-making and circuit-breaking apparatus during the indication or recording of the message.

It will also be understood that this invention is susceptible of an indefinite number of modifications or forms as respects the apparatus employed in carrying it into use. Only such, therefore, has been indicated as may be necessary for the distinct understanding of the characteristic quality or nature of this invention which distinguishes it from all other electric telegraphs.

I do not claim any particular mode of obtaining the synchronism of the vibrations, nor confine myself to vibrations or any particular form of motion to produce the like effect, nor the use of any particular means for obtaining the electric action, nor the kinds of signals, signs, marks, or recording, nor particular modes of arranging the apparatus, leaving it to those who use my invention to employ such apparatus, whether vibratory, rotary, or oscillatory, as they may deem best suited to accomplish the objects desired under the different circumstances which may arise; but

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

1. Constructing and operating signalizing telegraphic apparatus in such manner that electric pulsations representing signals resulting from the actions of two or more operators at work at the same time are imparted alternately and successively to a single main conductor or wire of communication and received therefrom and distributed in the same alternating succession, whereby a single main conductor may be made the instrument by which two or more operators can be simultaneously employed in sending different messages either in the same or in opposite directions, substantially as herein set forth.

2. Transmitting different electric signals resulting from the actions of two or more operators working at the time at the same or opposite ends of a single main conductor by means of a single main conductor, combined with two or more sets of corresponding signal-sending and signal-receiving conductors, which represent the different signals in use, and are appropriated to different operators by means of intermediate circuit-making and circuit-breaking apparatus, which are moved in harmony at the signal-sending and signal-receiving stations in such manner as to present themselves successively in all the positions required to permit currents of electricity to be passed alternately through the corresponding members of the signal-sending and signal-receiving conductors, whereby the apparatus at each station can at the same time be employed in transmitting and receiving signals representing messages, substantially as herein set forth.

3. Transmitting electric pulsations to a main conductor and distributing them from the same main conductor by two sets of circuit-making and circuit-breaking apparatus, which are moved in harmony with each other, but are moved by mechanism independently of the other portions of the telegraphic apparatus in such manner that the harmonious movement of the circuit-making and circuit-breaking apparatus at either end of the main conductor

is not impeded or controlled by the irregular movement of other parts of the telegraphic apparatus.

4. Sending and receiving signals, as above stated, by apparatus so arranged and combined with the main conductor that in operating the impulse that closes or opens the circuit shall last but for a moment, while the contact maintained at the station where the signal is received shall last a longer period, so as to obviate the necessity of exact synchronism in the movements of the mechanism at the two stations.

In testimony whereof I have hereunto subscribed my name.

HARRISON GRAY DYAR.

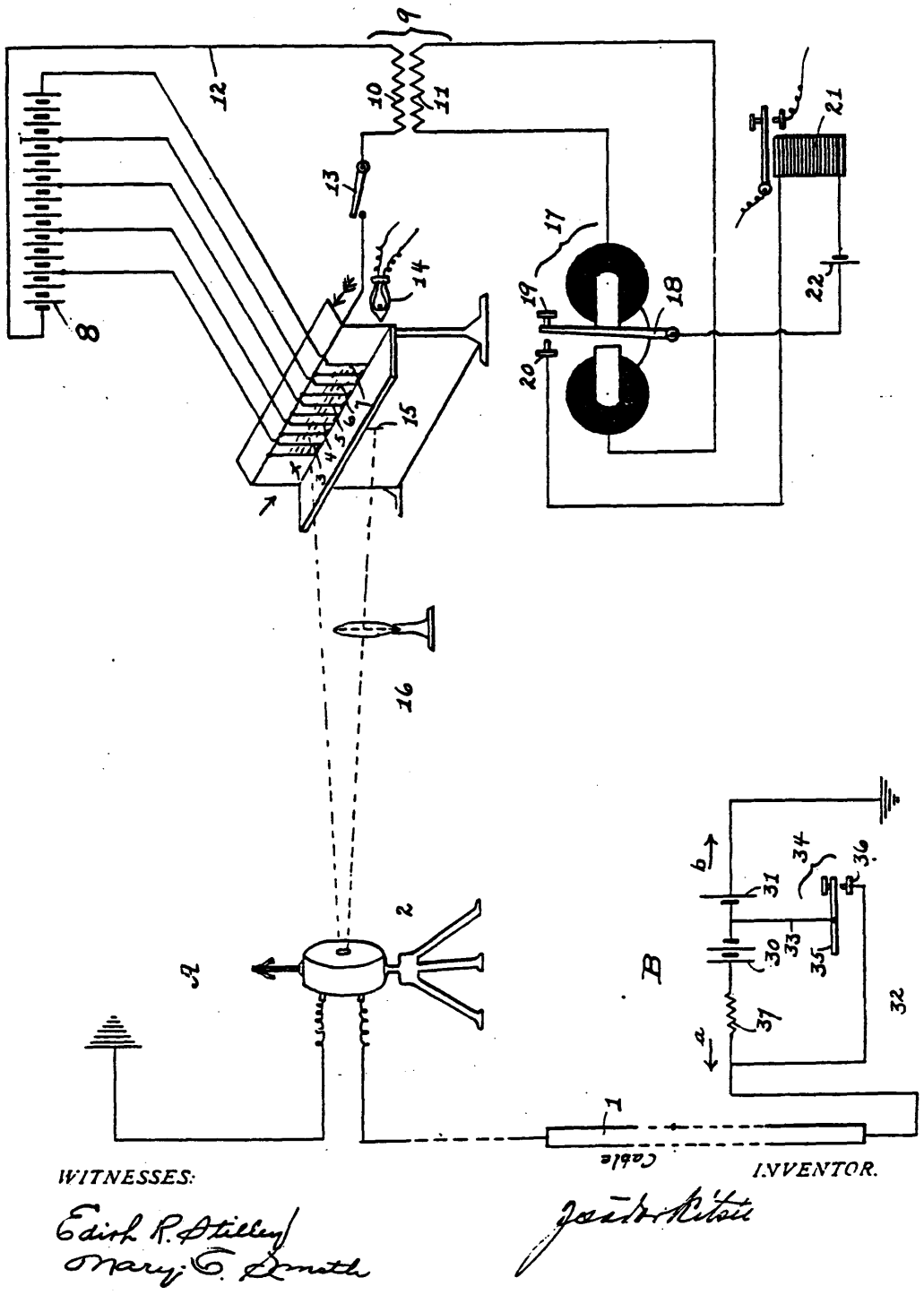
Witnesses:
J. WILSON GREEN,
WM. LEE BENNEM.

I. KITSEE.

TELEGRAPHIC RECEIVING ORGANISM.

APPLICATION FILED JAN. 27, 1910.

985,760. Patented Feb. 28, 1911.



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ISIDOR KITSEE, OF PHILADELPHIA, PENNSYLVANIA.

TELEGRAPHIC RECEIVING ORGANISM.

985,760. Specification of Letters Patent. Patented Feb. 28, 1911.

Original application filed December 6, 1909, Serial No. 531,595. Divided and this application filed January 27, 1910. Serial No. 540,417.

To all whom it may concern:

Be it known that I, ISIDOR KITSEE, citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Telegraphic Receiving Organism, (division of Serial No. 531,595,) of which the following is a specification.

My invention relates to an improvement in telegraphic receiving organism and is a division of an application for United States Letters Patent filed by me December 6, 1909, Serial No. 531,595; the subject matter herein described and illustrated having been originally embodied in the application aforesaid and canceled therefrom by amendment. Its object is, to translate or relay telegraphic impulses with the aid of receiving devices inserted in the line and has more special reference to telegraphing over lines with distributed capacity, such as submarine cables.

To avoid any possibility of injury to the insulating coating of the cable, it is an essential condition that none but very weak currents should be employed and the receiving device has to be, therefore, of a very sensitive nature.

With devices as are now employed in cable telegraphy, such as a reflecting galvanometer or siphon recorder, the messages transmitted can only be read with the aid of the flash or recorded curves. It is the aim of my invention to translate these impulses into sound, if so required, or to relay the same automatically to another line. I make use of the property of a selenium cell to change the resistance through rays of light. A selenium cell having normally a great resistance will offer to the flow of the current far less resistance when exposed to such rays. But the shifting of the zero bars entirely the employment of selenium cells with the arrangements of to-day.

My invention is applicable to that system of telegraphy over submarine cables, in which one character of the alphabet is symbolized by an impulse of one polarity and the second character by an impulse of opposite polarity, both impulses of short duration.

My invention is also applicable to such system whereby an impulse of one polarity signifies the commencing and an impulse of opposite polarity the ending of a character, and the time unit between these two impulses symbolizes if this character is a dot or dash.

My invention may also be practiced with the well known reflecting galvanometer or recording siphon or similar instrument, and it is the aim of my invention to produce an arrangement whereby the shifting of the zero is overcome, and the received impulse can be translated into sound or record with the aid of an electro-magnetic relay, no matter to what extent the incoming impulses actuate the line relay and no matter if the normal zero position is reached by the return movement or not.

For an illustration of one of the forms my invention may take, reference is had to the accompanying drawing, which is a diagrammatic view of a receiving organism embodying my invention.

In the drawing: 1 represents the cable: A the receiving and B the transmitting station. I have not illustrated in any of these stations condensers or similar devices and I have also not illustrated in this figure a duplex arrangement, and these omissions do not in the least interfere with the working of my invention. At the receiving station I have illustrated, in conventional sign, a reflecting galvanometer connected in series as to the cable and have designated the same by the numeral 2. The local arrangement consists here of a series of selenium cells designated respectively by the numerals 3, 4, 5, 6 and 7.

S is a battery consisting here of fifteen cells. I prefer that this battery should be of the storage or secondary type, and so as to avoid misinterpretation, I will use hereafter for the selenium organism the designation "cell" and for the battery organism the designation "secondary." In this drawing, the selenium cell nearest the zero is connected to three secondaries, the succeeding selenium is connected to six secondaries, the third selenium cell to nine secondaries, the fourth to twelve secondaries and the fifth to the whole set of secondaries, that is, to fifteen. It is, therefore, evident that if a ray of light is moving from the zero position, which is here designated as x, in the direction of the unfeathered arrow, it will first impinge on the cell connected to the lowest electro-motive force and will, in its travel, successively impinge upon cells with successive higher electro-motive force, and when,

in its return movement, that ray of light travels in the direction of the feathered arrow, *i. e.*, toward the zero position, then the ray of light will impinge successively on successive cells with successively lower electro-motive force.

9 is a converter or inductorium comprising the primary 10 and the secondary 11. The battery 8 is connected with one pole, here shown as the negative pole, through conductor 12 with one terminal of the primary 10. The other terminal of this primary is connected with the interposition of the switch 13 to one terminal of each of the selenium cells 3, 4, 5, 6 and 7.

14 is a source of light, here illustrated in conventional sign as an incandescent lamp.

15 is a slot or perforation allowing a ray of light to issue from the source of light and to impinge upon the mirror on the reflecting galvanometer 2. In this drawing, a collecting lens 16 is interposed in the path of this ray.

17 is a relay, preferably of the polarized type, provided with the armature 18 and the two stops 19 and 20.

21 is a sounder or similar instrument, one terminal of the coil of 21 is connected to stop 20 and the other terminal is connected with the interposition of battery 22 to the armature 18 of relay 17.

At the transmitting station I have here shown an arrangement whereby with the aid of a single key, ordinary Morse characters may be transmitted, each character made up of two impulses. In this transmitting arrangement, I employ two sets of batteries opposed to each other; one set—by preference—of double the electro-motive force of the other set. The set with double electro-motive force is here designated by the numeral 30 and the opposing set by the numeral 31; the set 30 being provided with the shunt wires 32 and 33 adapted to be closed or opened with the aid of the key 34 comprising the lever 35 and the stop 36. To prevent short circuiting, I have provided the shunt path with the resistance 37.

The operation of this part of the device is as follows:—Normally, a current will flow over the line in the direction of the arrow *a*. When the operator wishes to transmit messages, he operates the key in the usual manner. Through the closing of the key, the shunt around the source 30 is established and the current will flow in the direction of the arrow *b*. The time that the key is closed designates the kind of character the operator desires to transmit; the short closing of the key designating a dot and the longer closing of the key designating a dash.

The operation at the receiving station is as follows:—It is supposed that the operator at the transmitting station has closed the key and that an impulse flows over the line in the direction of the arrow *b* and that this impulse will, at the receiving station, actuate the movable part of the receiving device 2 in a manner so as to deflect the same in the direction of the unfeathered arrow at said receiving station. The rays of light, therefore, will travel also in this direction and will make active one or more of the selenium cells. The rays of light, in their travel from the zero position, will first be impinged on the cell nearest the zero, here designated as cell 3, and will then, in their travel, sweep over a greater or lesser number of said cells. When the operator at the transmitting station opens the key, then the movable parts of the receiving device are deflected in the opposite direction, that is, in the direction of the feathered arrow at the receiving station. The deflected rays of light, therefore will, in their return to the former position, sweep again over that part of the organism which they swept when deflected in the direction of the unfeathered arrow. But, whereas, the rays of light, in their travel from the zero position sweep successively over selenium cells with successive high electro-motive force, the same rays of light, in their return, will sweep successively over the selenium cells with successive lower electro-motive force. When not impinged by the rays of light, all the selenium cells remain inactive. They offer such a high resistance to the flow of the electric current that the primary 10 of the converter 9 remains also inactive.

Normally, no current flows through the primary 10 of the converter 9. When, now, the rays of light, in their travel from the zero position, impinge first on the cell with the lowest electro-motive force, this cell will become active and a current will flow through the primary 10; the farther the rays advance, the greater will be this flow. The commencement of the flow as well as the increase of the flow will result in the generating of a secondary impulse in 11 of a direction opposite to the direction of the current flowing in the primary 10 and no matter how much the increase of flow of the current in the primary 10, the direction of the impulse in the secondary 11 will always remain the same. When, now, the rays of light return toward their zero position, they will successively cease to impinge on successive cells of decreasing electro-motive force, till they have entirely ceased to impinge on any of the cells. The movement of the rays of light from a cell of higher electro-motive force to a cell of lower electro-motive force will reduce the flow of current in the primary 10 and this decrease in the flow of current will result in the generation of an impulse in the secondary 11 opposite to the first induced impulse; and when the rays of light, in their travel toward the zero posi-

tion, entirely cease to impinge on the selenium cell, then the ceasing of the flow of the current in 10 will only intensify the second induced impulse, but this impulse will always be in one and the same direction; that is, opposite to the direction of the first impulse, because the starting of the flow of a current in the primary, or an increase in the flow of a current in said primary, always generates in the secondary an impulse of a direction opposite to the flow in the primary and the decrease in the flow of the current in the primary or the entire ceasing of said flow in the primary induces an impulse in the secondary in the same direction as the current formerly flowing in said primary.

Let us suppose that the impulse generated in the secondary 11 through the commencement or increase in the flow of a current in the primary 10 is of a nature so as to impel the armature 18 of relay 17 from its stop 19 toward and in contact with stop 20. The contacting of the armature 18 with the contact 20 will close the circuit including the repeating sounder 21 and battery 22. The sounder, therefore, will become active and will contact its armature with the lower stop, thereby producing the click denoting a dot or dash, as the case may be, and closing such circuits as are connected thereto for the purpose of translating said click into the required character. In this arrangement, it is immaterial if the rays of light, in their travel from the zero position, sweep the entire number of cells or only part of same; and it is also immaterial if the rays of light, in their return movement to zero, travel backward the whole series of cells, or only part of same. In other words, every movement of the rays of light toward a cell with increasing electro-motive force will produce in the secondary an impulse of one direction and every movement of the rays of light from a cell of high electro-motive force will produce in the secondary 11 an impulse of opposite direction, no matter how many cells were included in this forward or backward travel. In conjunction with this arrangement, it has to be stated that usually condensers are inserted in the cable and that, therefore, the flow of the current from the source 30 or 31 will not be continuous and the device 2 will not be unduly deflected.

I have, in this drawing, only illustrated five selenium cells, but it is obvious that the number of selenium cells may be increased in accordance with requirements; and it should be noted that the deflection of the movable part of the receiving device 2 should be limited to such an extent that the rays of light therefrom, in the course of sweeping over the cells in the direction of the unfeathered arrow, shall not go beyond the cell farthest from the zero position. The source of current 8 consists here of fifteen cells, but it is obvious that the number of cells as well as the taps from said cells may differ in accordance with requirements. In the transmitting arrangement, only two against one cell is employed, but it is also obvious that the number of these cells may be increased in accordance with requirements.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In cable telegraphy, a receiving device inserted in the line of transmission, a source of light, means at the receiving device to deflect the rays from said source, a selenium organism, a source of current comprising a number of individual electric cells and a series of taps from said electric cells to said selenium organism, each tap embracing a number of electric cells differing from the number of cells embraced by the other taps.

2. In cable telegraphy, a receiving device inserted in the line of transmission, a selenium organism, a source of light, means at said receiving device to deflect the rays from said source, a battery consisting of a number of electric cells connected together in series, a series of connections from said battery to said selenium organism, each succeeding connection embracing a number of electric cells greater than the preceding connection, an inductorium, the primary connected to one pole of said battery and one pole of said selenium organism, respectively; the secondary connected to a polarized relay and means for said relay to translate the incoming impulses into readable characters.

3. In a device of the class described, a receiving device, an inductorium, a source of current, means to make active the primary of said inductorium through said source and means to gradually increase the flow of the current through said primary in accordance with the greater degree of movement of the movable part of said receiving device, said means comprising a series of taps connecting the different selenium cells to different parts of said source of current.

4. In cable telegraphy, in combination with means to transmit true reversals, means to receive said true reversals and translate the same into readable characters, said second means comprising a receiving device inserted in the line, a battery comprising a number of electric cells connected in series, an inductorium and polarized relay, and also comprising a selenium organism connected at different parts with different numbers of electric cells of said battery and means operatively related to the movable part of the receiving device to lower the resistance of different parts of the selenium organism.

5. In a receiving organism for cable telegraphy, a selenium organism, a battery comprising a number of electric cells connected

together in series, a number of connections between different parts of the battery and different parts of the selenium organism, each connection embracing a different number of electric cells.

6. In cable telegraphy, means to receive impulses and means to overcome the effect of the shifting zero, said means comprising a receiving device inserted in the cable, a selenium organism comprising a series of selenium cells, a battery comprising a series of electric cells, connections between each selenium cell and different parts of said battery, each succeeding connection comprising a number of cells greater than the number of cells of the preceding connection, a source of light and means at the receiving device to deflect the rays from said source.

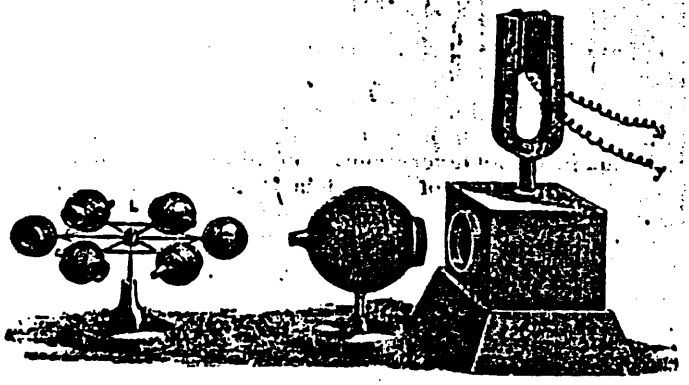
In testimony whereof I affix my signature in presence of two witnesses.

ISIDOR KITSEE.

Witnesses:
EDITH R. STILLEY,
MARY C. SMITH.

Dworak's Sound Radiometer.

A very interesting conversazione was given in London by Prof. Huxley as President of the Royal Society, on the evening of the 7th ult. One of the most interesting contributions to the objects exhibited was Herr Dworak's sound radiometer, which we illustrate on the present page, and which was exhibited by Mr. W. H. Preece, F. R. S. In this apparatus, which attracted considerable attention, a wheel is set into rapid rotation by the sound waves produced by a vibrating tuning fork. Referring to the figure, *T* is a large tuning fork mounted on a resonating chamber *R*, and maintained in continual vibration by an electro-magnet *C* fixed betwen its prongs, to which an intermittent current of electricity is transmitted by a contact breaker consisting of a similar fork tuned in unison with *T*, with which it is connected by the wires *x* and *y*. Opposite the orifice of the resonating chamber *R*, and on the same horizontal axis, is placed a Helmholtz resonator *K*, and in front of its small end is placed the instrument shown at *L*, which consists of six little Helmholtz resonators fixed round the circumference of a wheel which is poised at its centre on a needle point so as to be capable of rotation in a horizontal plane after the manner of a compass card. The little resonators are attached to the wheel in such a manner that their axes are tangential to their circle of rotation, their smaller ends pointing in the direction in which they revolve. When the tuning-fork *T* is set into action the air within the chamber *R* takes up the vibration and the sound is greatly reinforced, and this is more marked if a mass of cotton wool or soft rubber be interposed between the chamber *R* and the table. The action of the Helmholtz resonator *K*, is to take up the sound waves and to concentrate them in the direction of the revolving instrument *L*, and this effect is so strongly produced that, if the finger be placed a short distance in front of the smaller orifice of *K*, a sensation is felt which is indistinguishable from that which would be produced by a rapidly intermittent jet of air issuing from the nozzle. The rotation of the wheel *L* may be due to the fact that as the air within each of the little resonators *L*, is thrown into vibration under the influence of the sonorous vibrations, and in the direction of its axis, and as it is freely open to the external air twards one end of that axis, it is probable that the energy of motion expends itself partly on the envelope and partly on the air, and the former receiving a greater proportion over that part of its surface which is opposite to the large orifice than in the contrary direction, rotation takes place.



We are, however, rather inclined says *Engineering*, to which we are indebted for these details, to place the phenomenon in the same class with those discovered by Professor Bjerknes, and illustrated in the beautiful experiments of himself and his son, and to attribute the action to the effect of one vibrating body upon another through the intervention of a common vibrating fluid medium.

[NATURE.]

SOUND-MILLS.

AFTER the notable researches of Crookes on radiation, which culminated in the discovery of the radiometer, or light-mill, it was a natural transition of thought which suggested to several minds almost simultaneously the possibility of devising an apparatus which should rotate under the influence of sound waves as does the radiometer under the influence of the rays of light and heat. Such instruments were indeed devised independently about six years ago by Lord Rayleigh, by Prof. Alfred M. Mayer of Hoboken, by Mr. Edison, the well-known inventor, by Prof. Mach of Prague, by Dr. A. Haberditzel of Vienna, and by Prof. V. Dvorak of the University of Agram (in Croatia). These researches, though of great scientific interest, have been somewhat overlooked in the rush of scientific inventions during the intervening years. During the course of the past year, however, Dvorak has given to the world, in the pages of the *Zeitschrift der Instrumentenkunde* (vol. iii., Heft 4), a detailed account of his experiments, together with figures of various pieces of apparatus hitherto undescribed. We propose to give a *resume* of the principal points of Dvorak's researches.

Four kinds of sound-mills are described by Dvorak, two of them depending on the repulsion of resonant boxes or cases, and two others on different principles.

The first of these instruments is depicted in Fig. 1, and consists of a light wooden cross, balanced on a needle point, carrying four light resonators made of glass. These resonators are hollow balls of 4·4 cm. diameter, with an opening of 0·4 cm. at one side. They respond to the note g' (=392 vibrations). When the note g' is forcibly sounded by an appropriate tuning fork, the air in each of the resonators vibrates in response, and the apparatus begins to rotate. As a resonator will respond when placed in any position with respect to the source of sound, it is clear that one single resonator properly balanced should rotate; and this is found to be the case, though, naturally, the action is more certain with four resonators than with one.

Before proceeding to the other forms of sound-mill devised by Dvorak, it may be well to explain briefly the cause of the phenomenon, and to describe Dvorak's particular method of exciting the appropriate sound. Dvorak has pointed out, as indeed has been done elsewhere both by Lord Rayleigh and by Prof. A. M. Mayer, that, when sounds of great intensity are produced, the calculations which are usually only carried to the first order of approximation cease to be adequate, because now the amplitude of motion of the particles in the sound wave is not infinitely small as compared with the lengths of the sound-waves themselves. Mathematical analysis shows that under these circumstances the mean of the pressures in the condensed part and in the rarefied part of the sound-wave is no longer equal to the undisturbed atmospheric pressure, but is always greater. Consequently at all nodal points in the vibrations of the air in tubes or resonant boxes, the pressure of the air is greater than elsewhere; and therefore any resonator closed at one side and open at the other is urged along bodily by the slight internal excess of pressure on the closed end. The apparatus, Fig. 1, therefore rotates by reaction, in the same way as the top and bottom, while the air cavity was tuned by enlarging the circular opening in front. In the later researches the box stood on four feet made of India rubber tubing. The note of the fork so mounted was very strong. At 40 cm. distance it would set the sound-mill in motion.

Dvorak's second apparatus, a "rotating resonator," consists of a short cylindrical box, constructed of stiff glazed paper, having four projections, shown in plan and elevation in Fig. 3, each of which bears at its side a short open tube of paper. It is, in fact, a resonator with four openings, arranged so that it can be hung upon a silk fiber. A fine needle projects also below to steady the motion during its rotation, which occurs whenever the apparatus is brought near to the sounding-fork. For the note g' the dimensions were: diameter, 7 cm.; height, 3·6 cm.; diameter of openings, 0·6 cm.

The third apparatus is the "sound radiometer" described by Dvorak before the Imperial Viennese Academy in 1881. Its cause of action is less readily explained, though its construction is even more simple. Its form is shown in Fig. 4, D; there being, as before, a light cross of wood, pivoted by a glass cap upon a vertical needle. To the four arms of the cross are cemented four pieces of fine white card, about 0·08 cm. thick, perforated with holes which are depressed conically at one side, and raised at the other. These holes may be made by punching the card upon a lead block with a steel perforating-punch of the form shown in Fig. 5, A, the dimensions of which are: $a\,b$ = 0·38 cm.; $c\,d$ = 0·2 cm. The holes should be from 0·6 to 0·65 cm. apart from one another. When a card so perforated is held in front of the opening of the resonant box of the tuning-fork, it is repelled if the smaller ends of the conical holes are toward the box; or is attracted if the wider openings are toward the box. A better but less simple way of perforating the cards is by the use of the conical steel punch shown in Fig. 5, B; and the matrix, Fig. 5, C. The angle of the cone is 55°, and the narrow projecting nose of steel is 0·3 cm. The card should be damped, laid on the matrix, C, and the whole pierced by

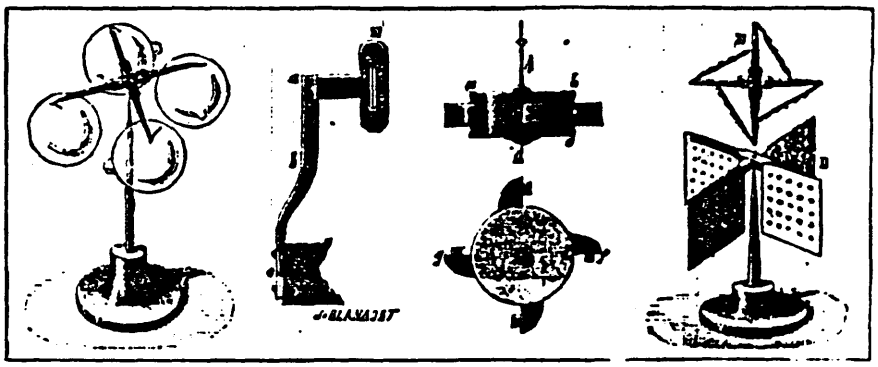


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

prongs of the fork an electromagnet constructed on the following plan. Two plates of iron separated by a sheet of paper are used as a core. They are cut of such a breadth as to lie between the prongs without touching them. This core is overwound with insulated copper wire, as shown at E, Fig. 2, and the electromagnet is then mounted by a bent piece of wood, *a b c*, upon the sounding-box, K, of the fork. The wires are connected in a circuit with a battery, and with the electromagnet of a self-exciting tuning fork of the same note. Dr. Dvorak is extremely particular about the arrange-

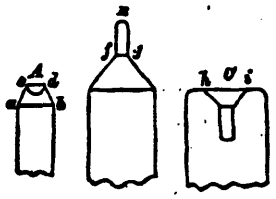


FIG. 5.

ments of the resonant boxes of his tuning-forks. They must not touch the table, the arm, *a b c*, being clipped at about the point, *b*, in a firm support. Moreover, the resonant boxes themselves require to be specially tuned, for all are not equally good. Dr. Dvorak points out that, besides the tone of the fork, and the tone of the air column in the cavity of the box, there is also a tone proper to the wood of the box itself which in most of the forks used in acoustic researches is too base, the wooden walls being too thin. To hear this tone the prongs of the fork should be damped by sticking a cork between them, and the cavity should be filled with cotton wool, while the wooden box is gently struck with the knuckle or with a cork hammer. It is important that the wood-tone should be tuned up to coincidence with the tone of the fork and with that of the air in the cavity. Dr. Dvorak himself used the box depicted further on in Fig. 6, in which drawing F is the socket into which the stem of the fork was screwed. The wood was tuned by planing it away at

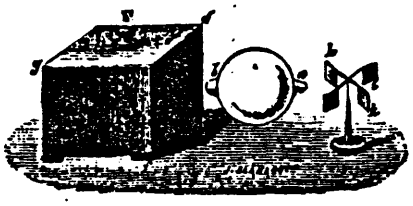


FIG. 6.

The rotations are more rapid if the cards are set on obliquely in the fashion shown in Fig. 4, E, the burred sides being outward. Cards with twenty-five perforations so mounted rotate briskly when the "mill" is set in front of the resonant box.

The fourth apparatus of Dvorak is called by him an "acoustic anemometer." It is shown in Fig. 8. This is merely a little "mill" of simple construction, the vanes being small pieces of stiff paper or card slightly curved. The sounding box previously described is placed a little way from it, and between them is held an ordinary Helmholtz's resonator, with its wide mouth, *b*, turned toward the box, and its narrow opening, *a*, toward the mill. From what has been previously said it will be understood that the internal increase of pressure in the resonator at *a* has the effect of driving a jet of air gently against the sails of the mill, which consequently rotates. Dr. Dvorak also suggests that this two-aperture resonator may be replaced by one having but one aperture, as shown at R, with its open side, *l*, turned toward the mill. This resonator is formed of a glass ball cut away at one side and cemented to a glass plate having a small hole at the center. It may be remarked that when the air ejected from the mouth of this resonator is examined by the method of mixing smoke with it, and then viewing it through slits cut in a rotating disk, the currents are seen to consist of a series of vortex-rings.

A second kind of "acoustic anemometer" may be made by taking a card pierced with 100 conical holes, as previously described, and placing this between the resonant box and the "mill." The latter rotates in the wind which passes through the conical holes.

Space does not admit of a comparison being drawn between these instruments and those of Mayer, Mach, and others, which are very closely akin in their design and mode of action, interesting though such a comparison might be. Nor can we here compare the action of these instruments with the "phonomotor" with which Mr. Edison literally accomplished the feat of talking a hole through a deal board. But this remarkable machine was a purely mechanical toy, which converted the vibrations of the voice, by means of a very finely cut ratchet-wheel, into a motion of rotation round an axis.

SILVANUS P. THOMPSON.

T. A. EDISON
Vocal Engine.

No. 210,767. Patented Dec. 10, 1878.

Fig. 1.

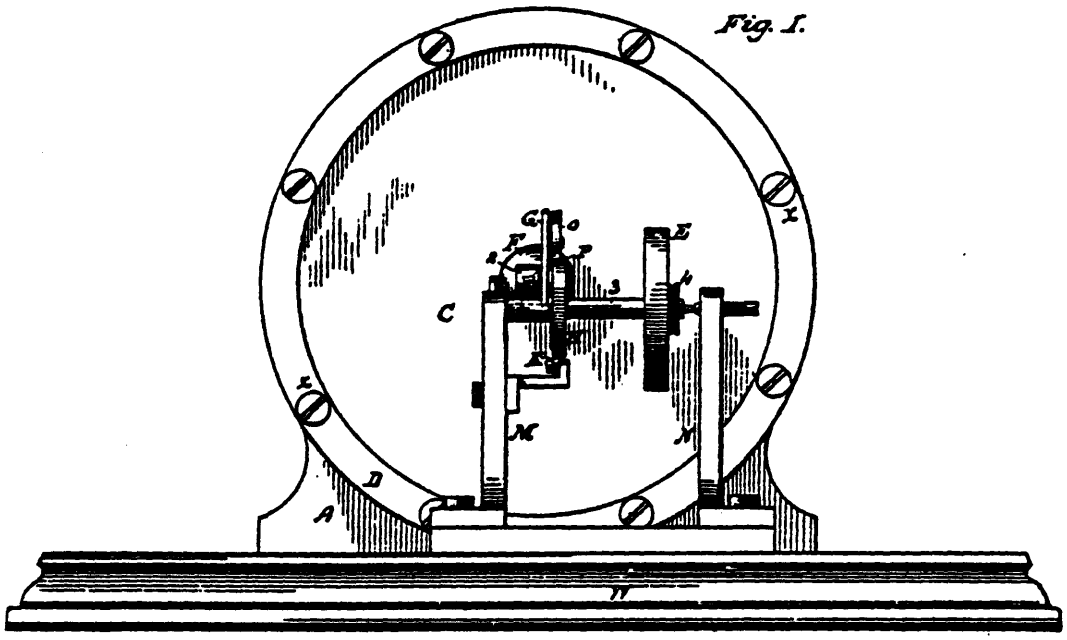


Fig. 2.

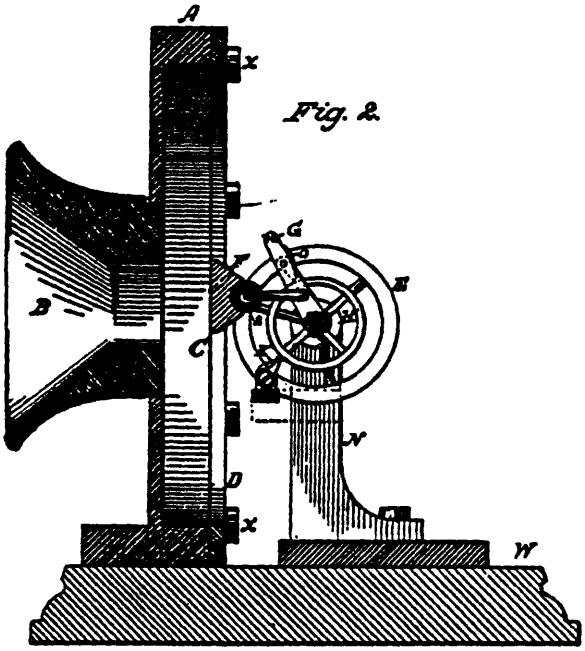
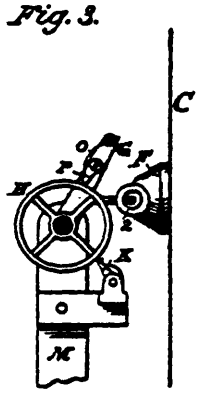


Fig. 3.



Witnesses
C. Clarence Poole
W. H. Painter.

Inventor:
Thomas A. Edison

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY.

IMPROVEMENT IN VOCAL ENGINES.

Specification forming part of Letters Patent No. **210,767**, dated December 10, 1878; application filed November 27, 1878.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, Middlesex county, State of New Jersey, have invented certain new and useful Improvements in Vocal Engines; and 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.

The object of my invention is to transform the vibrations of a diaphragm or other body capable of being set in vibration by sound-waves into continuous rotation of a shaft, to act as a prime motor for various light mechanisms.

My invention consists in the combination, with a diaphragm sensitive to sound-waves, of a shaft between centers having a fly-wheel attached, and combining the diaphragm therewith by a friction-clutch, which, when reciprocated by the vibration of the diaphragm, acts upon a shaft so as to continuously rotate the same when the diaphragm is actuated by sound-waves.

Figure 1 is a front view of my apparatus. Figs. 2 and 3 are side views of the same.

In Fig. 1, C is the diaphragm, of any convenient material, which is secured to the frame A by the ring D and screws X X. B is a mouth-piece for concentrating the air-waves upon the diaphragm. F is a cork secured to the center of the diaphragm. 2 is a rubber tube, into which a pin is secured. This pin connects the rubber with the reciprocating lever G, whose fulcrum is upon the shaft 3.

P is a click or pawl resting upon the wheel H, and pressed against its surface by the spring O. K is another click, secured to the upright M, which serves to prevent a backward motion of the shaft. E is a fly-wheel, for storing, by momentum, the intermittent power, and thus keeping the shaft in continuous rotation. The shaft 3 runs in centers between the uprights M and N. The whole is secured to the base W.

The action is as follows: When the mouth is placed in proximity to the mouth-piece B, and several words are spoken, or a musical note given, the sound-waves, striking the diaphragm, set it in vibration. This, in turn, reciprocates the lever G, causing the shaft to be carried forward a small distance at every vibration, and the momentum of the fly-wheel transforms these minute impulses into continuous rotation of the shaft. A small grooved pulley, 4, Fig. 1, is attached to the shaft, in the groove of which a continuous thread or band may pass to any light mechanism, and thus give motion.

I do not wish to confine myself to any particular mechanism for transforming the vibratory motion of the diaphragm into continuous motion, as a ratchet-wheel and click and many other well-known mechanical equivalents may be used. Neither do I wish to confine myself to a pulley and cord for connecting the prime mover to the apparatus to be set in motion, as a worm and wheel or toothed wheel or friction-wheel may be substituted instead.

A large cone may be inserted in the mouth-piece B, for collecting extraneous sounds and causing them to move the diaphragm.

This apparatus is useful for giving motion to clocks and other small apparatus requiring minute power.

I claim as my invention—

A vocal engine consisting of a diaphragm or other body capable of being set in motion by sound-waves, a shaft, and reciprocating mechanism, substantially as and in the manner set forth.

THOMAS A. EDISON.

Witnesses:
WM. CARMAN,
CHAS. BATCHELOR.

EDISON'S PHONOMOTER.

It is admitted that there is power in the human voice, but hitherto this power has been applied indirectly to produce mechanical results.

Mr. Edison in his telephone and phonograph experiments discovered that the vibrations of the vocal cords were capable of producing considerable dynamic effect. Acting on this hint he began experiments on a phonomoter, or instrument for measuring the mechanical force of sound waves produced by the human voice. In the course of these experiments he constructed the machine shown in the engraving, which exhibits the dynamic force of the voice.

Fig. 1.

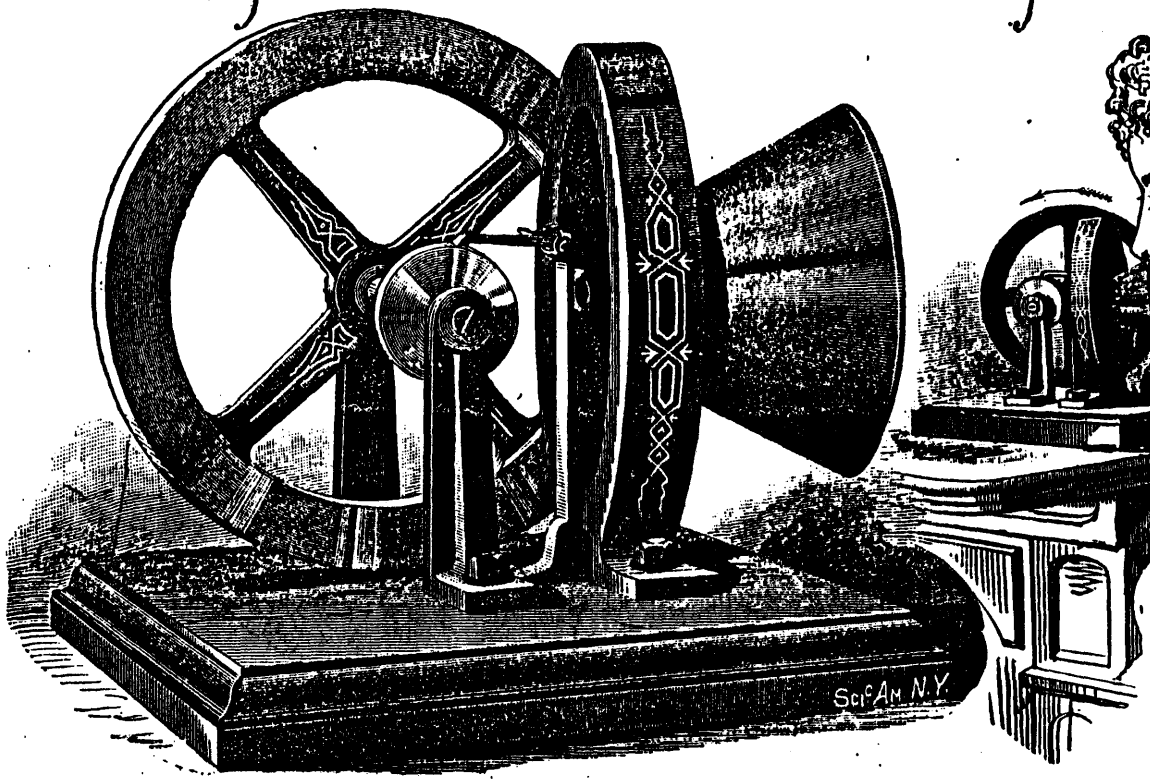


Fig. 2.

EDISON'S PHONOMOTER.

The machine has a diaphragm and mouth piece similar to a phonograph. A spring which is secured to the bed piece rests on a piece of rubber tubing placed against the diaphragm. This spring carries a pawl that acts on a ratchet or roughened wheel on the fly wheel shaft. A sound made in the mouth piece creates vibrations in the diaphragm which are sufficient to propel the fly wheel with considerable velocity. It requires a surprising amount of pressure on the fly wheel shaft to stop the machine while a continuous sound is made in the mouth piece.

Mr. Edison says he will have no difficulty in making the machine bore a hole through a board; but we consider such an application of the machine of very little utility, as we are familiar with voices that can accomplish the feat without the mechanical appliance.

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ing pulled backward and forward between them. The scoop, however, cuts or fills only in one direction, and one of the engines is employed to do this work, the other engine being used only for pulling the loaded scoop to the point where it is required to deliver the spoil.

The scoop, as shown in the engraving, is in position for being filled. The scoop is drawn forward by the engine whose rope is coupled to the chain hanging from the scoop box. When the scoop is sufficiently full the man on the scoop gives the signal to the engine driver to stop pulling which it has deposited is evenly spread by the mouth or cutting edge of the scoop box.

When the implement is far enough away from the place where the spoil has been deposited, the bolt is again withdrawn, the scoop box allowed to resume its middle position, the bolt shot in, and the scoop again run to the place where it left off work at the previous bout. The bolt is then again withdrawn and the box is pulled into position, and is ready for work as before. The implement is a useful one for many purposes, and in suitable situations can perform a

THE HENDERSHOT MOTOR MYSTERY

by J. D. Fleming

Today the world has forgotten a man named Lester Hendershot, who invented one of the most amazing motors of all time—a motor that ran without any detectable fuel input.

"Look, daddy, it won't work." Disappointment filled the voice of the chubby four-year-old as he placed the toy airplane in his father's lap.

The youthful parent picked up the toy and examined it with the practiced eye of a mechanic.

"Don't worry, son," he said comfortingly to the little fellow, "we'll build one that will work."

Later the father, whose name was Lester Hendershot, did build a toy airplane that worked. And the thing that made it work is today one of the most baffling mysteries in the entire field of invention. For the propeller of that toy airplane was turned by a tiny motor powered by neither fuel, spring, nor elastic band. It drew its power, so it was claimed, from the earth's magnetic field.

This was the first working-model of the Hendershot fuelless motor. Later, its story, like an exploding star, suddenly burst forth upon the front pages of every large newspaper in the country, shone brilliantly there for a few days, and just as suddenly passed into the limbo of things forgotten.

Why? Here was an invention that might have revolutionized the entire field of motive power; not only in aviation, but in the automotive, transportation, and industrial fields as well. Colonel Charles A. Lindbergh tested the motor at Selfridge Field, Detroit. So did Major Thomas Lanphier, Commandant of the Field. Both were very favorably impressed with the results of the tests. Pilots and mechanics at the Field who aided in the construction of the motor said they believed it to be the greatest invention of the age, and all appeared sure it would be a practical success as an airplane motor.

On February 25, 1928, The Detroit *Free Press* said in a copyrighted article that the powerful Guggenheim interests had arranged for an immediate conference with Lindbergh, Lanphier, and Hendershot. Other powerful groups of financiers were said to be intensely interested. And then suddenly, for Hendershot and his motor—oblivion. Again, why?

Let's look at the record. Lester Jennings Hendershot, who was twenty-nine years old at the time, lived in a little house next to the railroad tracks in West Elizabeth, Pennsylvania. Of formal schooling he had very little. Several years previously, however, he spent a few months at Cornell University, where he took courses in mechanics. A "free lance" worker, he was

never long employed in any particular job. At various times he worked as a fireman and an engineer on the railroad, inspected concrete, did electrical work, and worked in the mills near Pittsburgh. During the first world war he was a bugler with a machine gun company, but he did not get overseas.

During his early twenties, the idea of a machine which would operate from "earth currents" came to Hendershot in a dream. But it was not until November, 1927, that he started working to make that dream a reality.

His laboratory and workshop consisted of a crude work bench in the cellar of his home. He placed the bench near the furnace where it was warm. From early morning until late at night he could be found there working at his invention.

In a few weeks the miniature model was finished. It was constructed from the parts of a worn-out radio which his uncle had given him. It ran. He found, however, that it had one serious fault. It would always operate when pointed north and south, but would not turn a wheel when pointed east and west. Hendershot experimented for two years before he could overcome this defect.

The motor operated on the principle of a compass, Hendershot later explained. He always steadfastly maintained that there was no mystery connected with its operation. "The force that energizes it is the same force that pulls the needle of a compass around, and there is nothing mysterious about that," he stated flatly again and again. The revolutionary feature was a hitherto unknown manner of winding the armature.

Hendershot went on to explain that during his experiments he learned that by cutting the same line of magnetic force north and south he had an indicator of the true north—not the magnetic north of an ordinary compass. By cutting the magnetic field east and west, he found he could develop a rotary motion. He persevered until he had built a motor on that principle that would rotate at a constant speed, predetermined when the motor was built.

For several weeks the little motor rested in a toy airplane upon a small table in the living room of the Hendershot home. Then one day D. Barr Peat, of Bettisfield, the air mail port near McKeesport, Pennsylvania, heard about it. He came over to see the model and waxed enthusiastic at once. A few weeks later he and Hendershot were at Selfridge Field, where permission had been granted to build a model large enough to operate an airplane.

The model was built and tested. Those present at the tests were convinced that they had witnessed a *bona fide* demonstration of fuelless power and that they stood on

the threshold of a new era which it would bring to pass. Newspapers spread the story far and wide.

Orthodox scientists pooh-poohed the idea, at first. "Interesting if true," and "impossible practically," were the most frequent comments heard from them. Later they tore into it with a vengeance. Dr. Michael I. Pupin, Professor of Electro-Mechanics at Columbia University, pretty well summed up the opinion of his learned scientific brethren in his statement to the *Associated Press*, February 26, 1928: "According to my knowledge of science I cannot understand how sufficient power can be generated in this manner to operate a heavy object. I do not understand it and fail to place any importance in it."

But Dr. Frederick Hoffstetter, head of the Hoffstetter Research Laboratory, of Pittsburgh, went much further. He went, in fact, to New York and hired a lecture room of a large New York hotel. He had come, he told his audience, to expose a fraud. The learned doctor brought with him and exhibited models of the Hendershot motor. He demonstrated that they wouldn't work. And to clinch his arguments, Dr. Hoffstetter announced that he had found, concealed in one of the models, a carbon pencil battery.

This statement was misleading. It is true that, several years before, Hendershot, having no evidence of the good faith of his visitors, had stuck into his motor various devices to lead them away from the real idea he was working on. But in the Selfridge Field tests, there had been no means of concealing anything in the motors built by the mechanics employed by Major Lanphier.

Having done what he considered to be a good job of proving Hendershot to be a fraud, Dr. Hoffstetter packed up and returned to Pittsburgh. A few days later Hendershot's name dropped out of the newspapers completely.

That should have ended the matter. And so far as the general public is concerned, it most definitely did. But to a few thoughtful people several questions still remain unanswered. Charles Fort, in his book "Wild Talents," raises several of the most pertinent ones.

Fort emphasizes the fact that Hendershot was backed by Major Thomas Lanphier, U. S. Army, Commandant of Selfridge Field. During tests at the Field, a model of the motor generated enough power to light two 110-watt lamps, and another ran a small sewing machine. Major Lanphier stated that he had helped to make one of these models and that there was nothing fraudulent about it. To the suggestion that the motor was stealing power from some big broadcasting station Major Lanphier replied: "We thought of that, but we ran it for twenty-six hours, when the stations were going and when they were not, and we got the same results."

Again, Fort points out: "If the thing were a fraud, it would seem that it would have to be obviously a fraud." Here was a simple little contrivance weighing less than ten pounds. It was made by the mechanics of Selfridge Field, under directions. Couldn't they quickly have determined if it were a fraud or not?

And wasn't it extraordinary—or significant—that Dr. Hoffstetter should have traveled so far and gone to so much trouble to expose a fraud, claiming that it would be capable of destroying faith in science for a thousand years? Faith in science destroyed by whom? An unschooled young fellow whom most of the world had never heard of before? "What I pick up," concluded Fort, "is that there must have been an alarm that was no ordinary alarm somewhere."

Lastly, Hendershot dropped out of the newspapers by way of a story that was very strange indeed. On March 9, 1928, the newspapers reported that Hendershot was a patient in the Emergency Hospital, Washington, D. C., recovering from temporary paralysis. He had sustained a severe electrical shock while demonstrating his motor in the office of his attorney in the Washington Loan and Trust Building, Ninth and F Streets. The shock had temporarily paralyzed his arms, legs, and palate, and he could not be discharged for several weeks. Isn't it singular, in view of the charges made by the scientists, that a bolt, estimated at two thousand volts, should have shot from the motor and temporarily paralyzed its inventor?

So, to this day, a gigantic question mark hovers suspended over the story of Hendershot and his motor. The truth of the matter will probably never be revealed, for those who know it are not likely to talk.

A careful study of the matter leads to a number of different conclusions, any one of which may be true. Manufacturers of combustion motors, seeing ruination ahead, may have gotten together and bought Hendershot off. Or, the producers of motor fuels may have combined and bribed him to drop out of the picture. Orthodox scientists, seeing some of their pet theories headed for the ash can, may have found some means of keeping him quiet. Or perhaps, as Fort suggests, Hendershot possessed some wild talent, some power of mind over matter, which caused the motor to run while in his presence.

But certainly, under no circumstances, do the facts sustain the conclusion that the Hendershot motor was a fraud. Therein lies the mystery.

THE END

SECTION 4

VRILLIC IMPRESSION RECORDERS

Electrical Shadows and Images produced by Electricity.

In a paper contributed to the *American Journal of Scienc, and Arts*, Professor Arthur W. Wright, of Williams College admits the possibility of the impression of outline images of objects upon the surfaces of other objects, and accounts for these singular phenomena as follows;

The formation of the electrical shadow, discussed in my former paper, as has been suggested by Mr. C. F. Varley, who has more recently obtained results similar to those there described, appears to afford a satisfactory explanation of a singular and very interesting phenomenon, which has occasionally been observed in the case of objects struck by lightning, especially of persons killed by it. A number of instances are on record where the person struck was found to have, impressed upon some portion of the body, a delineation of some thing near him at the time of the stroke, and a similar effect has been noticed, also, in the case of inanimate objects. Dr Franklin mentions an instance in which an exact representation of a tree was imprinted upon the breast of a man, who was standing near it when struck by lightning. A number of similar and very remarkable cases are cited in a paper presented to the Royal Society of England, by M. Andrés Poey, director of the observatory at Havana.

Mr. Varley also mentions cases, reported by sea captains, of images of certain brass numbers, attached to the rigging of a ship, being printed by the lightning upon the body of persons killed by it, and supposes the brass numbers to have acted as a negative pole in respect to the person struck. But it is unnecessary to suppose that the discharge in such cases always proceeds from the object delineated, and many of the instances recorded forbid such a supposition. The experiments in the production of the electrical shadows show that it is merely necessary that the object should interrupt the lines of action of the electricity, and that it may be at a considerable distance from the electrified cloud, the chief and indispensable condition being that the latter should be negatively electrified. We should then have the body, exposed to the lightning, perfectly electrified by induction, and, as the tension became sufficient, the dark discharge accompanied by the glow would take place, followed by the lightning stroke. If, then, any object should be in the path of the discharge, its image would be formed in the glow, and this might, in rare cases like those recorded, be sufficiently intense to leave a permanently visible impression.

Keraunography (to write with thunder). Mr. Varley, in 1861, published a small volume in which twenty-four illustrative cases are cited. The author starts with the popular notion that the dendritic figures referred to are derived from some near or distant tree, and then proceeds to account for them by means of a photo-electric action in which the surface of the animal is the sensitive plate, the tree, &c., the object; and the lightning the force that impresses it.

But in connection with our subject are other facts, startling, it is true, but recurring from time to time in different parts of the world, and reported by sailors and others, who possess the invaluable art of recording their observations without attempting to explain them. The desire of explaining everything often amounts to a kind of rabies, when the sane course seems to be to wait; for if a reasonable theory is impossible, an unreasonable one is ridiculous. Nevertheless, some observers, if they cannot explain a fact, deny its truth; and yet such facts may exist in nature, and only wait the progress of discovery, when in due time they are gathered in under the sickle of the appointed reaper. Three such facts are the following:—

1. In September 1825, the brig *Il Buon Servo*, anchored in the Bay of Armiro, was struck by lightning, and a sailor who was sitting at the foot of the mizenmast was killed. Marks were found on his back, extending from the neck to the loins, including the impression of a horse-shoe, perfectly distinct, and of the same size as the one that was fixed to the mast.

2. In another case that occurred at Zante, the number 44 in metal was attached to the fixed rigging between the mast and the cot of one of the sailors. The mast was struck and the sailor killed. On his left breast was found the number 44, well formed and perfectly identical with that on the rigging. The sailors agreed that the number did not exist on the body before the man was struck.

3. M. José Maria Dau, of Havannah, states that in 1828, in the province of Candelaria, in the island of Cuba, a young man was struck by lightning, and on his neck was found the image "d'un fer à cheval qui avait été cloué à peu de distance contre une fenêtre."

Unexpected light was thrown upon such cases by Mr. C. F. Varley (Proc. Roy. Soc., Jan. 12, 1871), in following up an accidental observation during the working of a Holtz electrical machine, the poles of which were furnished with brass balls about an inch in diameter. Noticing some specks on the ball of the positive pole, Mr. Varley tried to wipe them off with a silk handkerchief, but in vain. He then examined the negative pole, and discovered a minute speck corresponding to the spots on the positive pole. This pole sometimes exhibits a glow, and if in this state three or four bits of wax, or even a drop or two of water, be placed on the negative pole, corresponding non-luminous spots appear on the positive pole. Hence it is evident that lines of force exist between the two poles, by means of which we may telegraph through the air from the negative to the positive pole. And in explanation of the above cases in which the lightning-burn on the skin is of the same shape as the object from which the discharge proceeded, all that is necessary is that the object struck be + to the horse-shoe, brass number, &c., the discharge being a negative one.

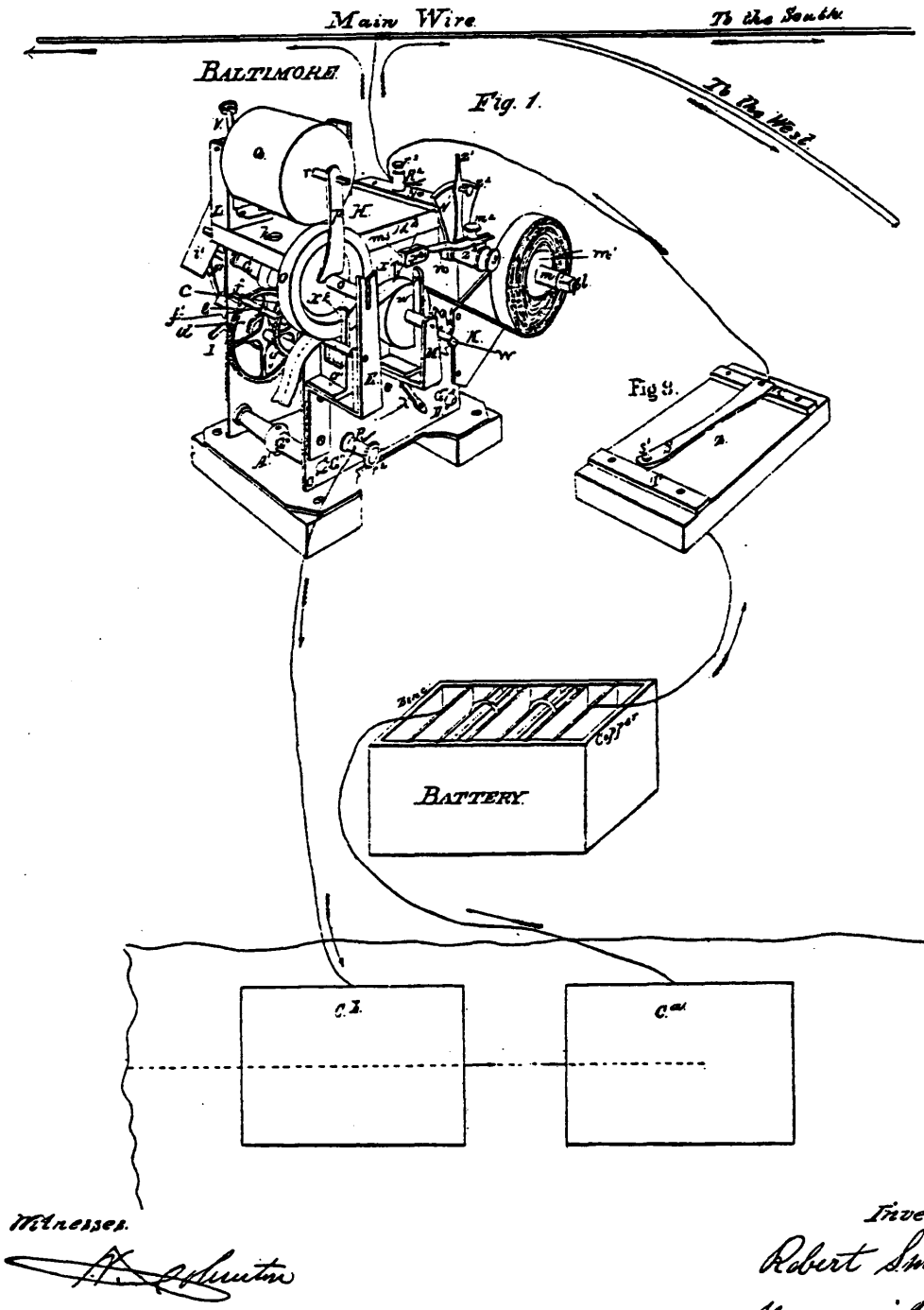
C. TOMLINSON

5 Sheets—Sheet 1.

SMITH & BAIN.

Automatic Telegraph.

No. 6,837. Patented Oct. 30, 1849



Witnesses.

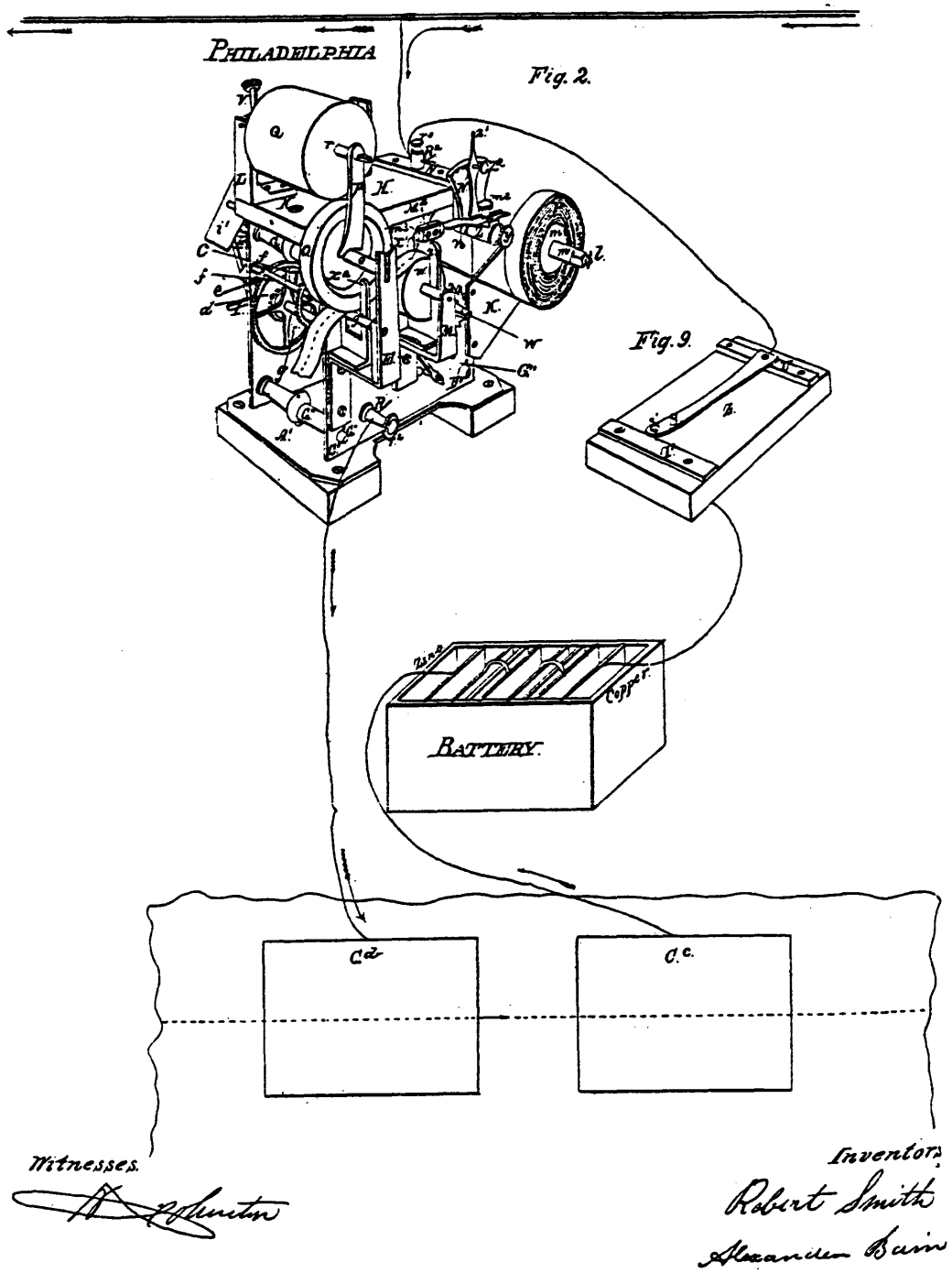
Inventors.
Robert Smith
Alexander Bain

5 Sheets—Sheet 2.

SMITH & BAIN.

Automatic Telegraph.

No. 6,837. Patented Oct. 30, 1849.



Witnesses.

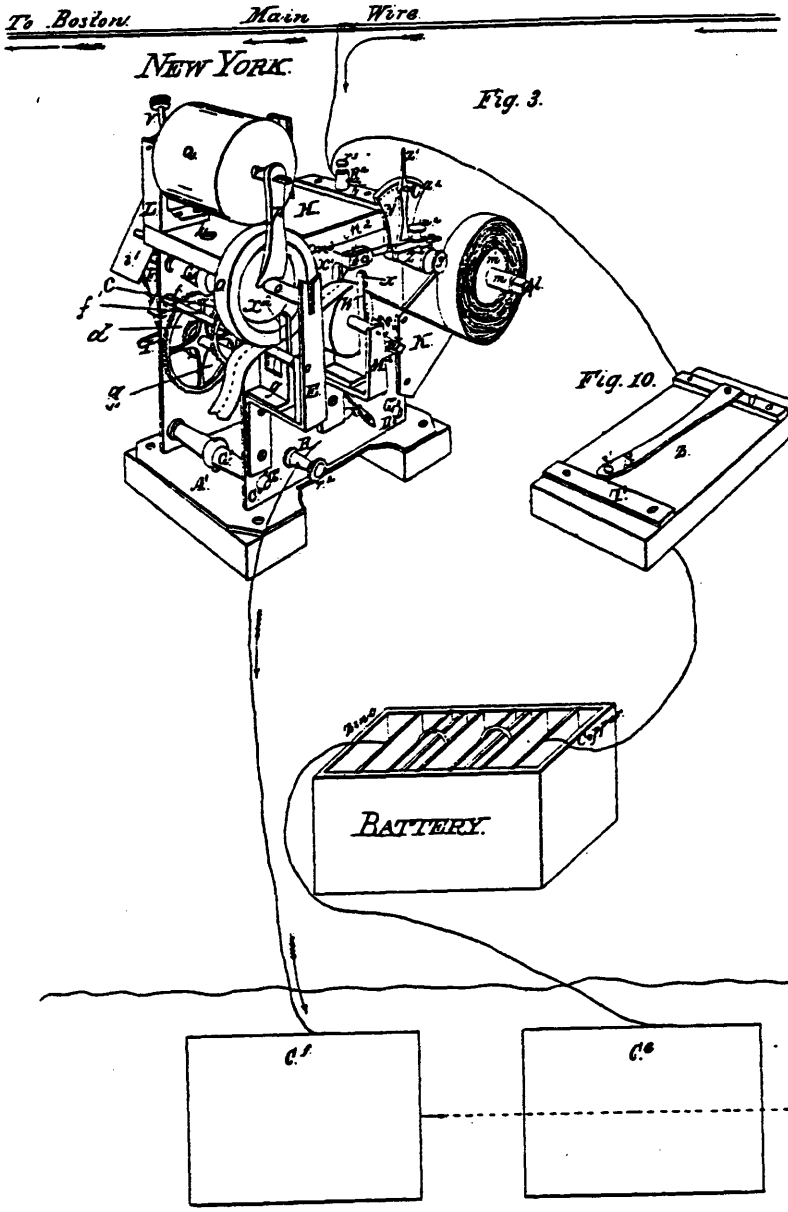
Inventors.
Robert Smith
Alexander Bain

5 Sheets—Sheet 3.

SMITH & BAIN.

Automatic Telegraph.

No. 6,837. Patented Oct. 30, 1849



Witnesses.

Inventor.
Robert Smith
Alexander Bain

5 Sheets—Sheet 4.

SMITH & BAIN.

Automatic Telegraph.

No. 6,837. Patented Oct. 30, 1849.

Fig. 4.

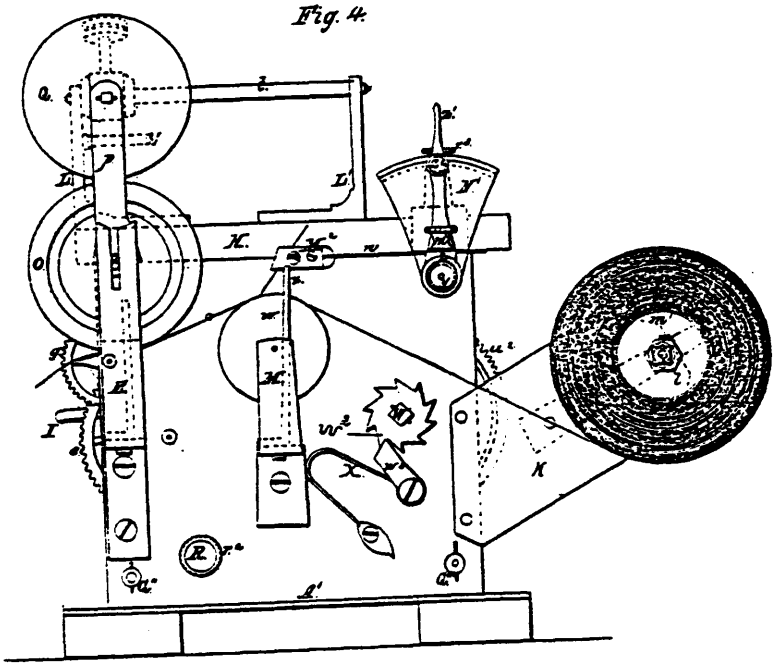
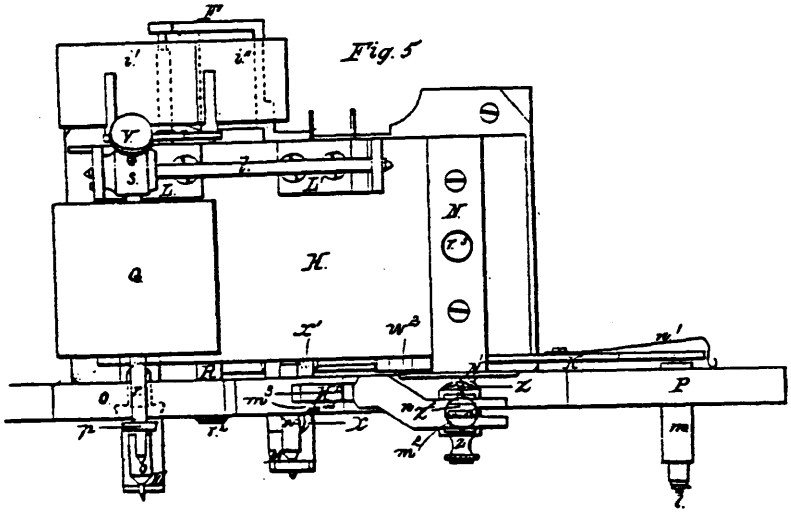


Fig. 5



Witnesses.

Inventors.

Robert Smith

Alexander Bain

5 Sheets—Sheet 5.

SMITH & BAIN.

Automatic Telegraph.

No. 6,837.

Patented Oct. 30, 1849.

Fig. 6.

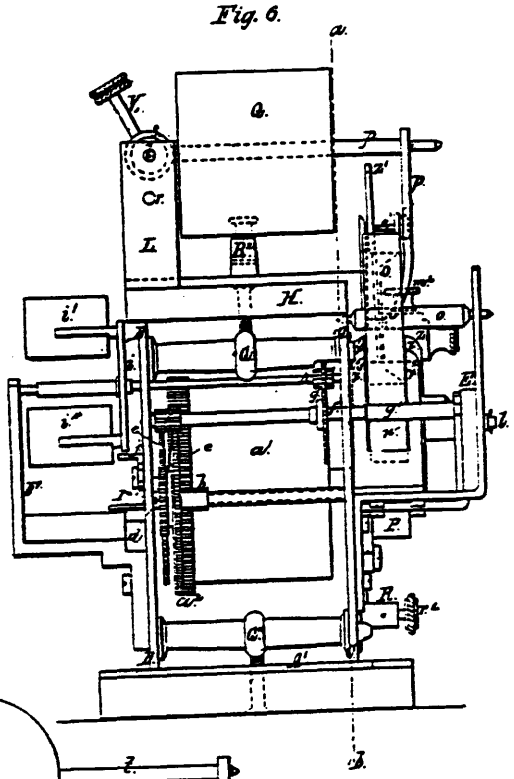
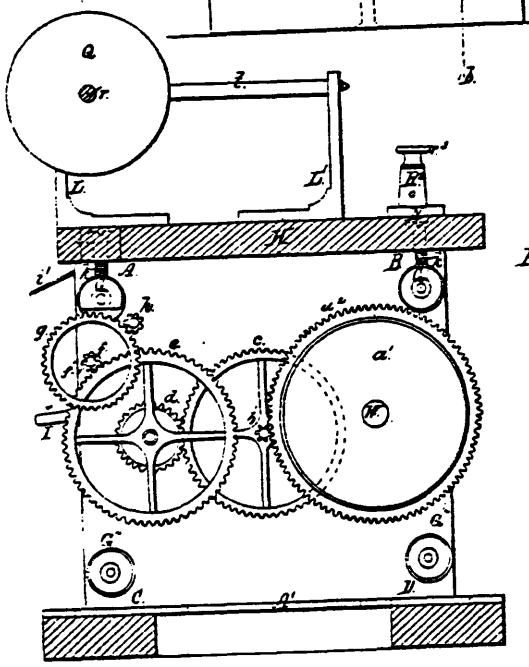


Fig. 7.



Witnesses.

Inventors

Robert Smith

Alexander Bain

UNITED STATES PATENT OFFICE.

ROBERT SMITH, OF BLACKFORD, COUNTY OF PERTH, SCOTLAND, AND ALEXANDER BAIN, OF BEEVOR LODGE, HAMMERSMITH, COUNTY OF MIDDLESEX, ENGLAND.

IMPROVEMENT IN ELECTRO-CHEMICAL TELEGRAPHS.

Specification forming part of Letters Patent No. **6,837**, dated October 30, 1849.

To all whom it may concern:

Be it known that we, ROBERT SMITH, Esquire, lecturer on chemistry, of Blackford, in the county of Perthshire, in Scotland, in the Kingdom of Great Britain, and ALEXANDER BAIN, Esquire, electro-telegraphic engineer, of Beevor Lodge, Hammersmith, in the county of Middlesex, in the Kingdom of England, have invented certain new and useful Improvements in Electro-Chemical Telegraphs.

These improvements consist, first, in the peculiar mode of arranging the several parts herein described of our marking-instruments of electro-chemical telegraphs; secondly, in a mode of constructing a style or point holder so as to afford a ready and convenient mode of regulating the pressure of the style or point on the surface of the chemically-prepared paper or other suitable fabric; thirdly, in a mode of applying a weight for regulating the pressure of an upper on a lower revolving wheel or roller in motion, so as to grasp the strip of chemically-prepared paper or other suitable fabric and insure its being drawn continually forward; fourthly, in a mode of arranging the marking-instruments, keys, wires, and batteries in a single circuit and in branch circuits connected therewith, so that a copy of a message sent from any station may be marked upon the chemically-prepared paper or other fabric at any desired number of stations in communication therewith, and also, if required, at the transmitting-station.

We do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, forming part of this specification.

Figures 1, 2, and 3 are perspective views of three marking-instruments and apparatus as they would be arranged and appear at three distinct and distant stations—as, for instance, at New York, Philadelphia, and Baltimore—which may be portions of an extensive system of telegraphic communication from and at any of which messages may be transmitted and received. These instruments may be at any convenient distances from each other, and although three only are here shown, any number of them may be used, according to the number of places between which it is desired to transmit intelligence. Fig. 4 is an external side elevation of a marking-instrument. Fig. 5 is a plan of the same; Fig. 6, an end elevation, and Fig. 7 a vertical longitudinal section through the line *a b* of Fig. 6.

The same letters and figures refer to similar parts in each of these figures.

Figs. 4, 5, 6, and 7 are drawn of the full size as employed by us. Figs. 1, 2, 3, 8, 9, and 10 are drawn to a scale of eight inches to a foot.

Within a metal frame, A B C D, open at the ends, is a movement consisting of a train of wheels or clock-work set in motion by a spring within the barrel *a'*, the posterior periphery of which is formed into teeth a^2, that work into and drive a pinion, *b'*, on the axle of the first wheel, *c*. The wheel *c* takes into a wheel, *d*, on the axle of the larger wheel *e*, which wheel *e* works into a pinion, *e*, on the axle *f'*, which carries a wheel, *g*. The axle *f'* passes through the front plate of the frame, and is supported by an external bracket, E, screwed or otherwise affixed to the frame. The wheel *g* drives a pinion, *h*, the axle of which projects through the back frame and is supported by a bracket, F, affixed thereto. On this axle, between the side frame and the bracket F, is placed an arm, *i*, carrying an adjustable fly or regulator with two vanes, *i' i''*, the resistance of the air against which as they revolve retards the motion of the train of wheels acted upon by the spring in the barrel *a'*. The two vanes *i' i''* turn spring-tight on pivots in the arm *i*, to admit of their being set at any required angle, and thereby increase or diminish the amount of resistance opposed to the motion of the train of wheels.

The two side frames of the instrument, A B C D, are held together by four pillars, G G' G'' G''', which are riveted to the back frame. The opposite ends of these pillars pass through the front frame, and are pinned on the outside thereof. The side frames, A B C D, and the foundation-plate A' are of metal; but the top H of the frame is of wood or other non-conductor of electricity, and is secured thereto by two sunk

screws, *k k*, which pass down into the pillars G G'.

A detent-lever, I, is centered upon a double-shouldered screw inserted in the back frame of the instrument, and terminates in a projecting arm, j, which, catching the arm *i* of the vanes, prevents their revolving, but being depressed permits them to revolve freely.

The range of the detent-lever I is limited by two pins fixed in the frame. Attached to the front frame externally there is a projecting plate, K, carrying a fixed axle, *l*, on which is mounted a brass collar, *m*, and wooden roller *m'*, upon which is coiled a strip of chemically-prepared paper or other fabric, P.

We would here state that the paper, linen, or other suitable fabric may be prepared by being equally and thoroughly moistened by the following chemical compound, viz: ten parts, by measure, of a saturated solution of prussiate of potash, which will be best made in distilled water, and we prefer to use the yellow prussiate for this purpose; two parts, by measure, of nitric acid of the strength of about 40° by Baumé's scale; two parts, by measure, of muriatic acid of the strength of about 20° by Baumé's scale. To keep the paper or other fabric in a sufficiently moist state favorable for the action of an electric current, we add about one part, by measure, of chloride of lime. This mixture is to be kept stirred about with a glass rod until the chloride of lime is in complete solution.

In connection with this compound, it is proper to observe that we have found that prussiate of potash combined with almost any acids will give marks under the decomposing action of an electric current; but no other mixtures act so quickly or give such permanent marks with feeble currents of electricity as that herein described. The principal use of the chloride of lime is that it absorbs moisture from the atmosphere, and thereby keeps the prepared fabric in a proper state to be acted upon by an electric current in all states of the weather.

At the back of the plate K is screwed a spring, *n'*, the end of which is bent round and presses against the roller *m'*, so as to prevent its turning, except when acted upon by some moving power.

Between the front plate of the instrument and the bracket E, and immediately over the roller *g'*, there is a larger roller, O, the periphery of which we prefer to be of wood. The axle *o* of the roller O turns in slots cut in the side frame of the instrument and the bracket E, the roller O being kept in close contact with the roller *g'* by a stem, *p*, which presses upon the axle *o*. The stem *p* is acted upon by a weight, Q, which slides backward and forward upon a spindle, *r*, so as to increase or diminish the pressure upon the roller O, according as the weight is brought nearer to or farther from the stem *p*. The back end of the spindle *r* is attached to a boss, *s*, held in its required position on the spindle *t* by a set-screw, V. Whenever it is required to take out the roller O the stem *p* and weight Q are lifted and turned back until the set-screw V comes in contact with a stop, *v*, affixed to the standard L, the spindle *t* being pivoted in the two upright standards L L'.

Near the middle, in front of the frame externally, there is affixed a bracket, M, supporting between itself and the frame a metal roller, *w*, which revolves between two upright forks, *x x'*, which are for the purpose of guiding the strip of chemically-prepared paper or other fabric as it passes over the roller *w*. The roller O, before described, revolves between two similar guiding-forks, x^2 x^3, for the same purpose.

On the wooden top of the frame H there is screwed a metal plate, N, terminating in a quadrant-shaped bracket, N', which projects beyond and is quite clear of the metal frame, and therefore has no metallic communication with it. At the lower part of the quadrant-shaped bracket N' there is a projecting spindle, *y*, which carries a socket-piece, *z*, and pointer *z'*, capable of being set at any required angle (within the limits of the quadrant N') by means of a pointed screw, z^2, which takes into a series of indents near the edge of the quadrant.

The top of the socket-piece *z* is made flat to receive the forked spring-stem *n* of a style-holder, M^2, which is secured to the socket-piece *z* by a set-screw, m^2. The style-holder M^2 has a slit in it for the reception of a style or wire, which is held fast therein by a small tightening-screw, m^3. The wire, style, or point placed in the holder M^2 is made to press upon the periphery of the metal roller *w* by adjusting the position of the pointer *z'*, as before described. One end of the chemically-prepared paper or other fabric being led up over the roller *w* and beneath the style or wire inserted in the holder M^2, it is passed between the rollers O and *g'*.

W is the winding-spindle of the spring, with its ratchet-wheel w^2 and pawl w^3. X is a spring screwed to the frame for keeping the pawl and ratchet engaged.

At the lower part of the front of the frame externally there is a projecting pillar, R, having a transverse hole for the insertion of an electric wire, and furnished with a binding-screw, r^2, for holding the wire in contact.

Upon the plate N at the top of the frame there is a second pillar, R^2, furnished, like the former, with a transverse hole and binding-screw, r^3. The first-named pillar, R, is in metallic contact, by means of the frame, with the roller *w*, and therefore an electric current reaching the one would be instantly communicated to the other. The pillar R^2, on the contrary, is not in metallic contact with any part of the apparatus, being attached to the non-conducting top of the instrument. An electric current, therefore, from the pillar R^2 could only reach the pillar R by passing down the style or wire in the holder M^2 and through the chemi-

cally-prepared paper to the roller *w*, a mark being made upon the paper every time and all the time an electric current is passing.

In order to transmit intelligence, a key-board (shown at Figs. 8, 9, and 10) is employed. This apparatus consists of a flat mahogany board, Z, on which are two brass plates, T U. To the plate U a metal spring, S, is screwed in such a manner that its opposite end is directly over but not in contact with the plate T.

In the free end of the spring S a screw, *s'*, is inserted, the point of which, on pressing down the spring, strikes the plate T and makes a contact between the plates T and U. A wire from the copper end of a galvanic battery, being brought through the key-board Z, is permanently attached to the under side of the plate T. A wire is similarly attached to the plate U. On pressing down the spring S, therefore, a continuous metallic communication is established between the two wires, which becomes broken on releasing the spring.

At each telegraph-station there is a similar arrangement of apparatus, and also a suitable battery with two plates of copper sunk in the earth, as shown in the drawings at C^a C^b C^c C^d C^e C^f.

A single main wire is carried through all the stations between which telegraphic communication is to be held, whether they may be in a direct line or radiating therefrom. A wire proceeds from the zinc end of the battery to the copper plate C^a, Fig. 1, while a wire from the opposite end of the battery passes up to the key, Fig. 8, and is in direct communication with the plate T. A wire from the plate U is led up to the pillar R^2, from which there is also a wire communicating with the main wire of the telegraph. A wire from the pillar R is in communication with the copper plate C^b.

The instruments and apparatus at each of the communicating stations are arranged in a similar manner.

Having thus fully described the whole of the machinery and apparatus necessary at each station for transmitting and recording messages, we will now explain its operation.

We will suppose that a communication is to be transmitted from Baltimore to Philadelphia and New York, and to be also recorded at Baltimore. The system of correspondence made use of consists of dots and lines, the number, dimensions, and relative positions of which form an intelligible code of signals, as is well understood. The spring *a'* being wound up and the detent-lever I disengaged from the arm *j*, the train of wheels commence running down, and the chemically-prepared paper or other fabric is gradually drawn forward by the friction of the roller *g'* and the weighted roller O and passes between the style or point in the holder M^2 and the roller *w*. On pressing down the spring S on the key Z, Fig. 8, and striking a blow on the plate T an electric current from the copper end of the battery passes up through the key Z to the pillar R^2, one portion of which electric current goes to the holder M^2, down the style, and through the chemically-prepared paper or other fabric (on which it marks a dot) to the roller *w* and pillar R, from which it goes by the conducting-wire down to the copper plate C^b, through the intervening earth to the plate C^a, and so up to the zinc end of the battery, thus completing the circuit; but at the same instant another portion of the electric current has passed up to the main wire and through the marking-instruments at all the stations in communication with the transmitting-station. Thus, for instance, a portion of the electric current passing from the main wire enters the marking-instrument at Philadelphia by the pillar R^2, passes through the chemically-prepared fabric, (upon which it marks a dot,) and goes by a path similar to that hereinbefore described to the copper plate C^d, and thence through the intervening earth and copper plate C^a to the zinc end of the transmitting-battery. Precisely the same effect takes place at New York. A portion of the electric current, leaving the main wire, passes down through the marking-instrument, taking the same course as before explained, and leaving a dot upon the prepared fabric, passes down to the copper plate C^f, from which it returns through the intervening earth and the copper plate C^a to the zinc end of the battery. The same effect precisely will be produced upon the marking-instruments at every other station within the electric circuit. If the spring S of the key Z is held down, instead of merely striking a blow, a line is produced on the chemically-prepared paper or other fabric of a length proportioned to the time the communication is continued; and in this way, by marking dots and lines upon the prepared fabric, messages may be transmitted from one station to the other. The train of wheels is to be kept constantly in motion at every station where a message is expected; but any of the stations may be thrown out of communication by lifting the style and holder M^2 out of contact with the chemically-prepared fabric and roller *w*, when no current of electricity can pass through the instrument at that station.

We do not claim as our invention the train of wheels constituting the motive part of the marking-instruments. Neither do we claim or confine ourselves to any particular form of battery or other generator of electricity, which may be of any suitable form, several of which are well known and in common use.

We desire it to be understood that what we claim as new and of our invention is—

1. The mode of arranging the several parts of our marking-instrument for electro-chemical telegraphs, substantially as hereinbefore described.

2. The mode of adjusting a style or point holder, as hereinbefore described and shown, so as to afford a ready and convenient mode of regulating the pressure of the style or point upon the surface of the chemically-prepared fabric.

3. The mode of applying the weight Q for the purpose of regulating the pressure, as herein described and shown.

4. The mode of arranging the marking and transmitting instruments, wires, and batteries in a single circuit, and in branch circuits connected therewith, so that a copy of a message sent from any one station may be marked upon the chemically-prepared paper or other fabric at one or any desired number of stations in communication therewith, and also, if required, at the transmitting-station, without requiring the use of any secondary current.

In witness whereof we have hereunto subscribed our names, at Edinburgh, the 15th day of March, eighteen hundred and forty-nine, in presence of the Right Honorable William Johnston, of Kirkhill, Lord Provost and Chief Magistrate of the city of Edinburgh.

ROBERT SMITH.
ALEXANDER BAIN.

The foregoing specification was subscribed at Edinburgh, the 15th day of March, eighteen hundred and forty-nine, by the therein-described ROBERT SMITH and ALEXANDER BAIN.

In presence of—

JAMES ANDERSON,

Of Edinburgh, Clerk to Andrew Dun, writer to the signet.

JAMES STUART,

Of Edinburgh, also Clerk to the said Andrew Dun.

T. A. EDISON.

Circuits for Automatic Telegraphs.

No. 141,776. Patented August 12, 1873.

Fig. 1.

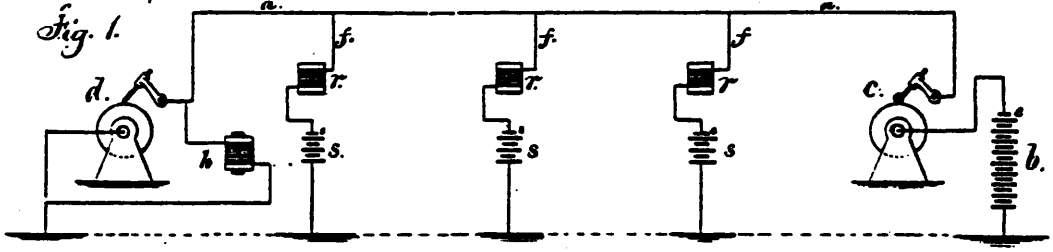


Fig. 2.

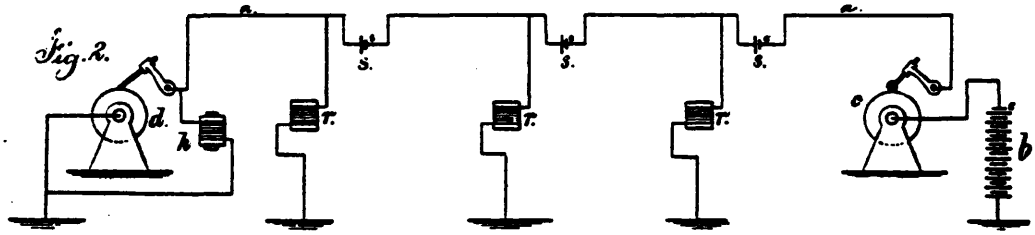


Fig. 3.

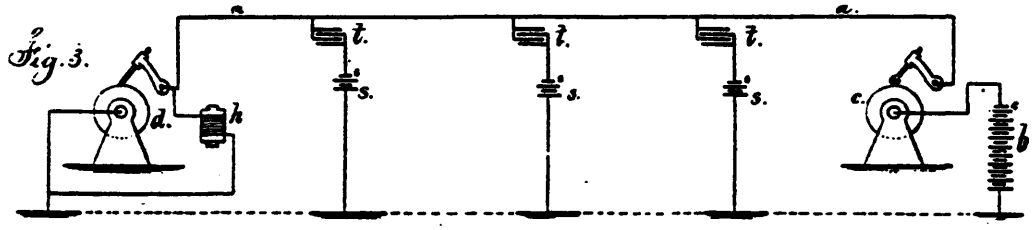


Fig. 4.

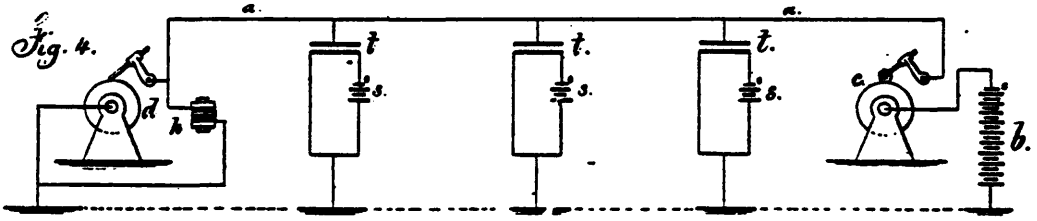


Fig. 5.

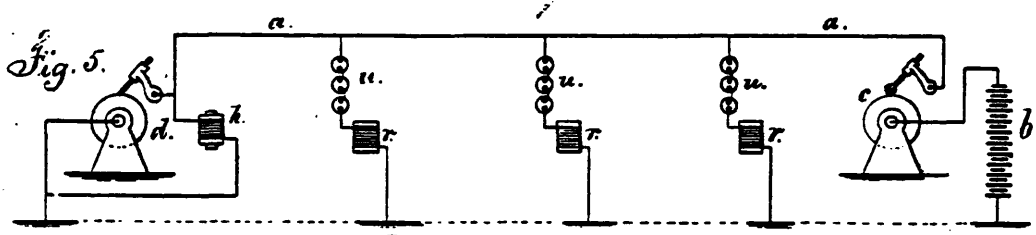
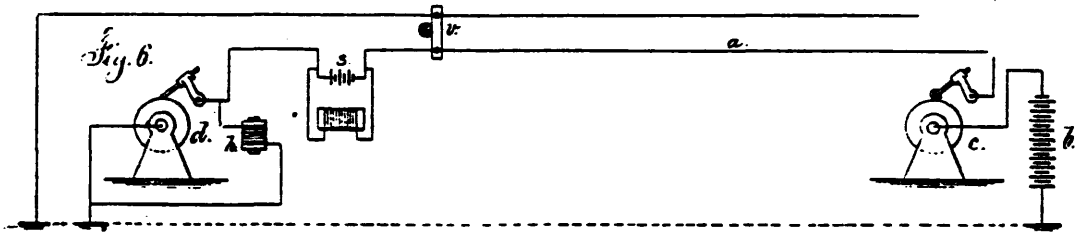


Fig. 6.



Witnesses:

Chas. H. Smith

Geo. J. Pinckney

Inventor:

Thomas A. Edison

Lemuel W. Serrell atty.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF NEWARK, NEW JERSEY, ASSIGNOR TO HIMSELF AND GEORGE HARRINGTON, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN CIRCUITS FOR AUTOMATIC TELEGRAPHS.

Specification forming part of Letters Patent No. **141,776**, dated August 12, 1873; application filed January 15, 1873.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Newark, in the county of Essex and State of New Jersey, have invented an Improvement in Telegraphic Circuits, of which the following is a specification:

In automatic telegraphing the speed of the pulsations is such that the line becomes surcharged, and the mark upon the chemical paper is attenuated to such an extent that one mark runs into another, or dots appear like dashes. The chemical paper is now made very sensitive, and a very feeble current is sufficient for making the mark; but in long lines the difficulty in clearing the line of the static electricity has been so great as to reduce the speed of transmission in order to obtain legible characters.

My present invention has been devised and successfully employed for effecting the clearing of the line without injury to the transmission of the pulsations.

Leaks and ground-connections have before been employed. My invention, therefore, does not relate thereto.

I make use of a battery, or a number of batteries, at a distant station, or distributed along the line, such battery or batteries being much weaker than the sending-battery, and connected in such a manner to the main line as to direct upon the same a current of opposite polarity, which has to be overcome by the pulsations from the sending-station; but these are always sufficient, and the slight reverse current, acting in detail upon the line-wires, keeps them free from any attenuation in the transmitting pulsations, thereby increasing the rapidity of automatic telegraphing, especially on long lines, and rendering the writing clear and sharp.

In the diagrams on the drawing, *a* represents the line; *b*, the transmitting-battery; *c*, the transmitting-instrument; and *d*, the receiving-instrument. In the former a strip of perforated paper and stylus are employed; in the latter a strip of chemical paper and a stylus. In Figure 1 there are several branch circuits, in which are placed rheostats or resistances that may be adjustable, and also batteries that are of the proper power, and placed with the opposite pole to the line to that of the battery *b*, so that the line is operated upon in detail, at suitable distances apart—say every one hundred miles, more or less—and the line freed from tailing; and the same is opposed to the main current, but not sufficiently powerful to neutralize the same or to interfere with the transmission. These batteries *s* are so proportioned or adjusted as to be equal to the static electricity or current generated by the passage of the main current. The rheostats or resistances *r* are sufficient to prevent the battery *b* being short-circuited through the various branch-circuit connections to the earth, and to cause the proper proportion of said battery-current to reach the receiving-instrument.

In Fig. 2 the same parts are employed; but the opposition batteries *s* are placed in the main line, and distributed along the same. The branch circuits to the earth, with resistances, act with the local opposition batteries to establish currents counter to the main current.

In Fig. 3 the effect produced is the same as before described; but in place of rheostats there are condensers *t*, and the opposition local batteries *s*, acting upon the condensers, establish an opposite polarity on the plates of the condenser that are connected with the line to the polarity of such plates when influenced by the transmitting-battery, thereby neutralizing the tailings by charging the line statically in opposition to that from the main current.

The condensers may be connected with the opposition local batteries, in the manner seen in Fig. 4, so that the plates that are connected to the line-wire will also be connected to one pole of the battery, and the other plates of the condenser will be connected with the earth and the other pole of the battery, the operation being similar to that before set forth.

In Fig. 5 the parts are the same in their operation as those before described; but instead of ordinary batteries, cups *u*, containing platina or carbon strips and acidulated water, are employed, so that when the pulsation on the main line ceases to charge such cups a momentary reverse current is established to neu-

tralize the tailing by instantly freeing the line of any electric charge.

In Fig. 6 the line-battery *s* is introduced at the receiving-station, to neutralize any local current that may leak from one insulator to another upon the poles *r*, and tend to charge the line sufficiently to produce a light continuous mark upon the paper, the battery *s* not being sufficient to interfere with the pulsations for the message, although its poles are opposed to the same.

The electro-magnets, at *h*, are in a shunt, connected at both sides of the receiving-instrument, to neutralize any tailings at the instrument, as in my application No. 61, dated November 9, 1872.

I claim as my invention—

The use of an opposition or secondary battery of weak power at one or more points, to act in the main line in opposition to the pulsations from the transmitting-instrument, to free the main line of surplus or static electricity, substantially as set forth.

Signed by me this 12th day of December, 1872.

THOMAS A. EDISON.

Witnesses:
GEO. T. PINCKNEY,
CHAS. H. SMITH.

WESTBROOK & ROGERS.

Automatic Telegraph.

No. 7,406. Patented May 28, 1850.

Fig: 1.

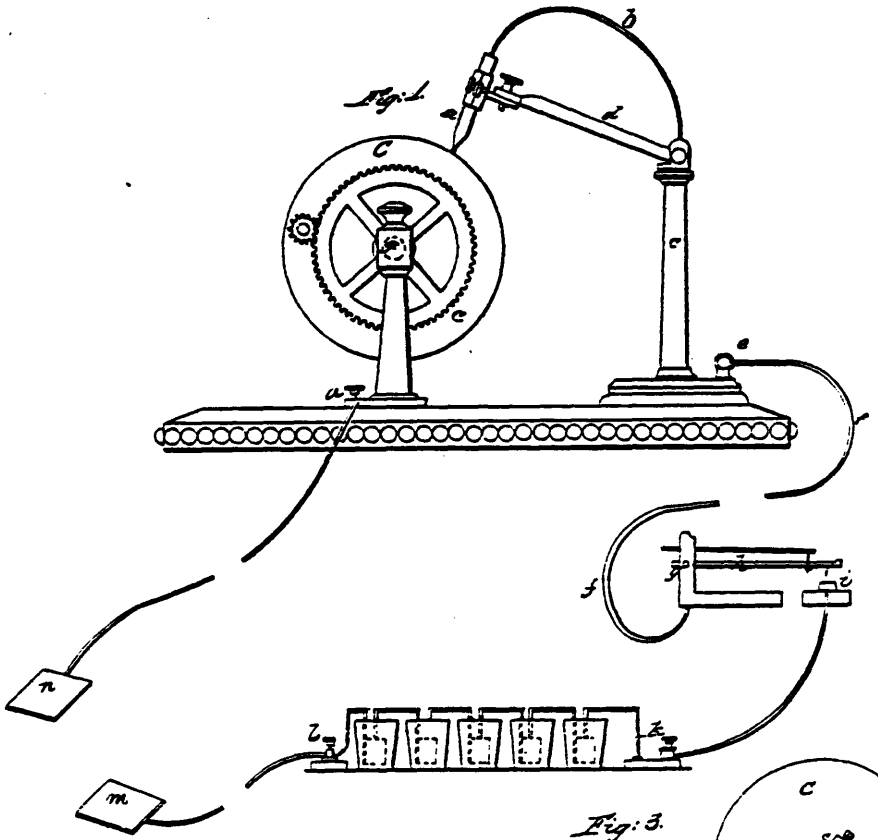


Fig: 3.

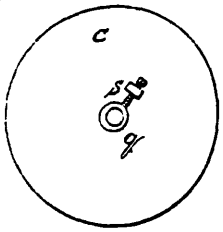
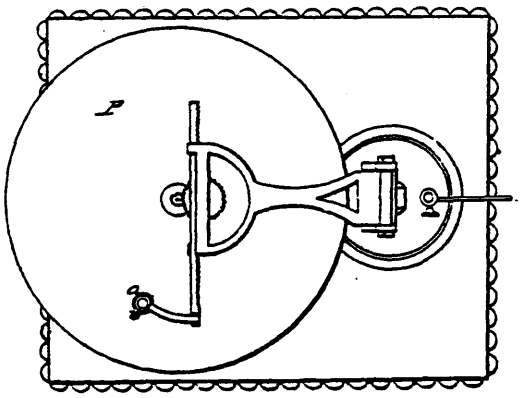


Fig: 2.



UNITED STATES PATENT OFFICE.

C. WESTBROOK, OF WASHINGTON, DISTRICT OF COLUMBIA, AND HENRY J. ROGERS, OF BALTIMORE, MARYLAND.

IMPROVEMENT IN ELECTRO-CHEMICAL TELEGRAPHS.

Specification forming part of Letters Patent No. 7,406, dated May 28, 1850.

To all whom it may concern:

Be it known that we, C. WESTBROOK, of Washington city, District of Columbia, and HENRY J. ROGERS, of the city and county of Baltimore, and State of Maryland, have made certain improvements in telegraphs to dispense with the use of paper on which the signs are recorded, called the "electro-metallic telegraph," which is described as follows, reference being had to the drawings hereunto annexed, which illustrate the connection of the recording-pen with the negative and positive poles of the battery to produce the circuit.

Figure 1 is an elevation, showing the end of the cylinder, part of the propelling-gear, and screw-shaft, tubular glass pen, in which the acidulated water and porous conductor or valve are placed, conducting-wires, manipulator, anvil, galvanic battery, and ground-plates. Fig. 2 is a plan, showing a horizontal circular plate on which the telegraphic signs may be made, pen-holder, and rack and pinion for moving the same gradually from the center as the plate turns horizontally on its axis, by which the telegraphic signals are formed in a spiral line from near the center to the periphery of the plate, the plate being turned by ordinary clock-work or by any convenient means; Fig. 3, end of cylinder, showing the chaser affixed thereto.

The nature of our invention consists in recording telegraphic signs on a metallic surface connected with the earth by a wire conductor at one end, and to a galvanic battery and the earth at the other end, of the circuit by the use of acidulated water or other fluid interposed between the point of the usual wire conductor leading from the operating apparatus, connected with a galvanic battery of the ordinary construction and the metallic surface, by which the use of paper is dispensed with, time also being saved in not having to moisten the chemically-prepared paper when it becomes too dry for use, and in having the telegraphic signs more clear and distinct on the metallic surface than on the paper, and in avoiding the inconvenience arising from the fumes from the chemicals employed in preparing the paper, and evils arising from the corrosion of instruments, and annoyance to the operators in preparing and using chemical paper, and other inconveniences.

The metallic recording-surface, after being filled and transferred, is simply cleansed by the application of a sponge or other soft substance saturated with acidulated water.

a is the pen, made tubular, of some non-conducting substance—such as glass or ivory—open at both ends and made tapering at its lower end for containing a piece of sponge or other porous substance, through which the acidulated water or other fluid passes to the metallic surface on which the telegraphic signs are to be made, the bore of the pen being sufficiently large to contain the requisite quantity of acidulated fluid. By reducing the outlet at the tapered end of the pen the sponge or porous valve may be dispensed with.

A very small barrel-valve might be used to regulate the flow of the fluid instead of the porous substance.

b is a short conducting-wire connected with the metallic stand *c* or pen-holder *d*, and leading into the barrel of the pen *a*, and brought into immediate contact with the acidulated fluid in the pen, thus continuing the conducting-line to the surface of the metallic cylinder or plate, so that the current from the galvanic battery can be made to pass from the metallic conductor through the acidulated fluid or saline solution to the metallic surface of the plate or cylinder upon which the signs or marks are to be made.

e is the binding-screw for securing the main wire. *f* is the main wire connecting the receiving and transmitting stations. *g* is the fulcrum of the manipulator. *h* is the manipulator. *i* is the anvil of the manipulator. *k*, platina pole of a galvanic battery. *l* is the zinc pole of the battery, connected by a wire with the ground-plate *m* at the transmitting-station. *n* is also a ground-plate, connected with the binding-screw *o* at the receiving-station.

q is a horizontal stationary screw-shaft, upon which the cylinder moves to the right and left by means of a chaser, *s*, fixed to the end of the cylinder and revolving with the cylinder in contact with the spiral thread of said screw.

The cylinder may be made to move to the right and to the left over the shaft simultane-

ously with its rotary motion by forming a female screw through its center corresponding with the screw-shaft.

The rotary motion of the cylinder may be produced by ordinary clock machinery or by a coiled-spring pulley, cord, and weight, or by any convenient means.

The cylinder, having the combined rotary and longitudinal movement, as aforesaid, will cause the telegraphic signs to be recorded on the surface of the cylinder or plate in a continuous spiral line in the same manner that we have practiced for some time past.

Operation: Bear down the long arm of the key-lever or manipulator *k*, so that the point comes in contact with the anvil *i*. The current will instantly pass from the platina pole *k* of the battery through the conducting-wire and acidulated solution contained in the pen to the surface of the cylinder C or plate P; thence to the ground-plates *n* and *m*, the earth being part of the circuit, and by the wire to *l*, the zinc pole of the battery leaving a black mark or stain on the cylinder or plate, according to the length of time the circuit is closed, indicating the sign, mark, word, or sentence required to be recorded.

Having thus described the nature of our invention and improvement in telegraphs, what we claim, and desire to have secured to us by Letters Patent, is—

Recording telegraphic signs on the surface of a revolving metallic cylinder-plate or other equivalent surface by means of an acidulated liquid or saline solution or water held between the point of the wire conductor and the metallic recording-surface, by means of a non-conducting porous substance contained in a glass or other non-conducting reservoir in which the recording-fluid is contained, to which the electric current from a battery is applied by means of any of the known forms of manipulators and anvils used for making and breaking the circuit, the recording-fluid being applied to the metallic recording-surface substantially in the manner herein fully set forth, by which the use of every description of paper is dispensed with, thereby saving great expense in telegraphing.

In testimony whereof we have hereunto signed our names before two subscribing witnesses.

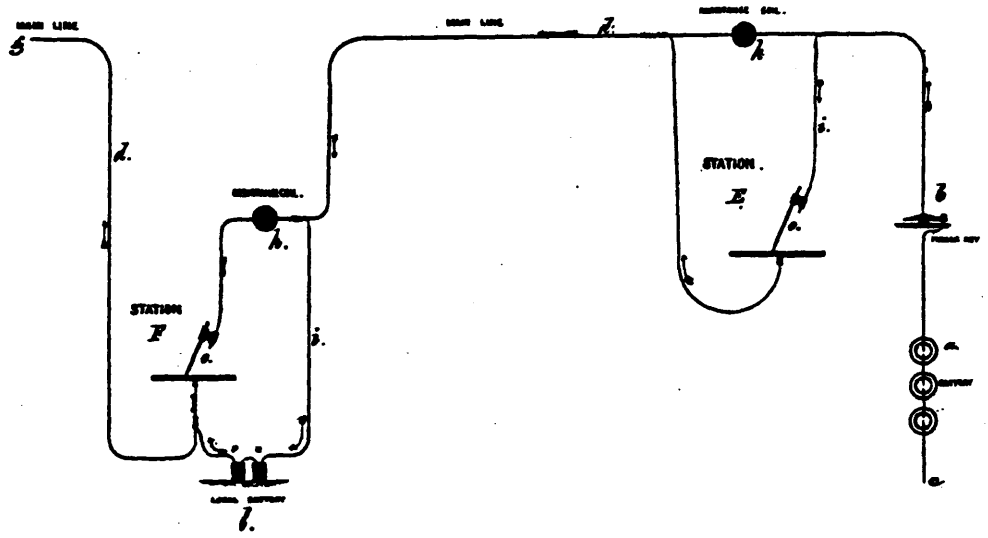
C. WESTBROOK.
HENRY J. ROGERS.

Witnesses:
WM. P. ELLIOT,
WM. DOUGLASS.

MARSHALL LEFFERTS.

Improvement in Chemical Electric-Telegraphs.

No. 114,692. Patented May 9, 1871.



Witnesses,

Chas H Smith

Geo. B. Walker

Marshall Lefferts

Lemuel W. Serrell

atty.

114,692

UNITED STATES PATENT OFFICE.

MARSHALL LEFFERTS, OF NEW YORK, N. Y.

IMPROVEMENT IN CHEMICAL ELECTRIC TELEGRAPHS.

Specification forming part of Letters Patent No. 114,692, dated May 9, 1871.

To all whom it may concern:

Be it known that I, MARSHALL LEFFERTS, of the city and State of New York, have invented and made an Improvement in Electrical Telegraphs; and the following is hereby declared to be a correct description of the same.

In chemical telegraphs a difficulty has existed in taking more than one copy of the message in any one circuit because the resistance to the pulsation in passing through the chemically-prepared material has been such as to weaken the pulsation going to the next station, rendering the second copy indistinct and unreliable; or, if the second copy was of proper character, the first being too dark, the marks spreading into each other or the paper being burnt. Besides this, telegraphic characters, at times, are not distinctly made, being drawn out to a fine line, due to the gradual electrical subsidence or a lateral current.

My invention is designed to obviate these difficulties by the use of a "shunt" or derived circuit in the main line to divert a portion of the current through the instrument, the remainder passing onto the next, by placing a resistance-coil in the main line, between the points of connection of the shunt, and proportioning the resistance to the force of the current, so that only the necessary current is diverted to each instrument, thereby as many copies as desired of a message may be made on one main line, and of nearly uniform character. I also arrange a local battery within this shunt or derived circuit, placing its poles in such a manner that when the main current has ceased to flow a reverse current from the local battery is made to circulate within the derived circuit, the action of which is to clear the apparatus or shunt of the lateral or secondary current, which is the cause of the characters being drawn out so as to render them illegible.

It is to be borne in mind that the mark in a chemical telegraph is in consequence of the decomposition of the materials employed under a positive current passing from the stylus, the reverse current producing no mark.

In the drawing the arrangement of the parts and connections at the different stations is illustrated.

Let *a* represent the battery; *b*, the finger-key or equivalent; and *c*, the ground-connection at one station; *d*, the line-wire passing to the stations E F, or to any number of stations; and *g*, the distant ground-connection.

At station E I have shown a resistance-coil, *h*, in the main line that causes the pulsation to separate, a portion passing by the circuit *i*, through the stylus *o* and chemical paper in the instrument and returning to the main line *d*, thence proceeding with the pulsation, passing through *h* to the distant station; and by proportioning the resistance in the coil *h* to the strength of the current the pulsation necessary will be deflected through the shunt or derived circuit. Several stations may have the connections thus arranged.

At station F the resistance-coil *h* is introduced for the same purpose; but the battery *l* is also employed. This battery is in the shunt, and the connections through the main line and shunt form a local circuit, with the positive pole toward the chemical paper; and hence the stylus is negative, and produces no action on the paper.

The main circuit, passing through the derived circuit, neutralizes the action of the local battery and transmits through the chemical paper sufficient current over and above that of the local battery to produce the character; but when that pulsation ceases the battery *l* comes into action and throws a reverse current on the stylus, rendering the mark sharp instead of attenuated.

The coil *h* is constructed so as to produce the necessary resistance; but I prefer to make use of an adjustable coil or resistance, so that the derived circuit may be regulated as required.

I claim as my invention—

1. A derived circuit or shunt in the main circuit, in combination with a chemical decomposing telegraphic apparatus, substantially as set forth.

2. A local battery within the divided cir-

c uit, in combination with decomposing chemic al telegraphic apparatus, for the purposes substantially as set forth.

3. A series of derived circuits in one main circuit, in combination with chemical decomposing telegraph apparatus, as set forth.

4. An adjustable resistance placed in the main line, in combination with the derived circuit and chemical decomposing apparatus, substantially as set forth.

Signed by me this 11th day of June, A. D. 1870.

MARSHALL LEFFERTS.

Witnesses:

CHAS. H. SMITH,

GEO. T. PINCKNEY.

T. A. EDISON.

Chemical or Automatic Telegraphs.

No. 150,848. Patented May 12, 1874.

Fig. 1.

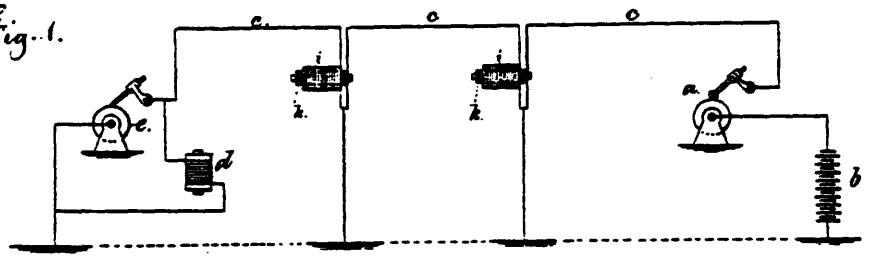


Fig. 2.

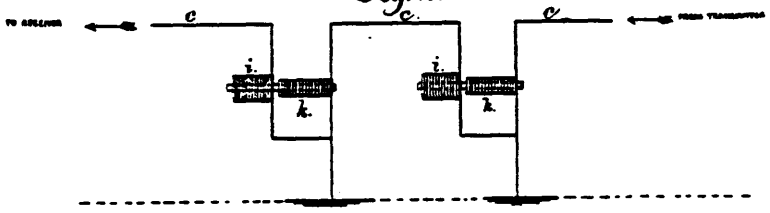


Fig. 3.

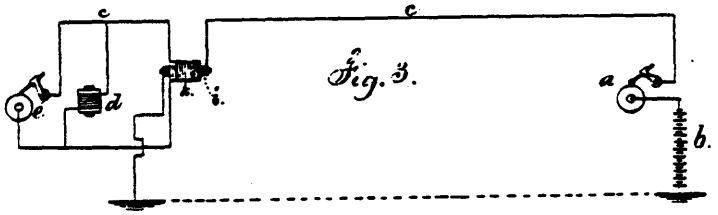


Fig. 4.

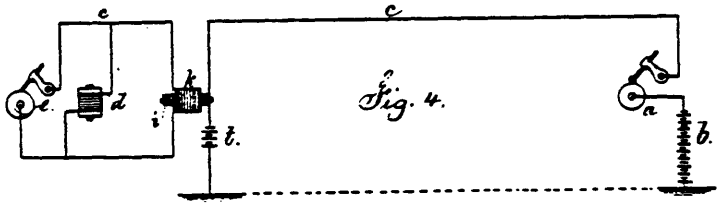
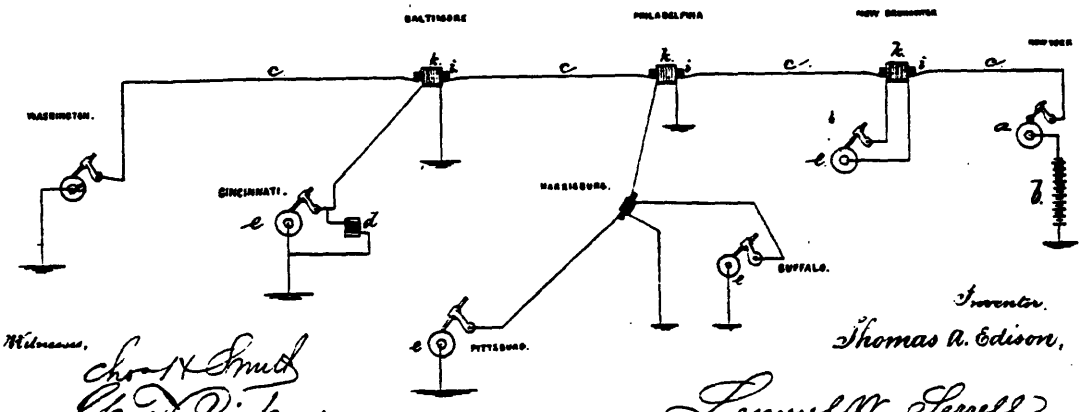


Fig. 5.



Witnesses,
Chas. H. Smith
Geo. J. Pinckney

Inventor.
Thomas A. Edison,
Lemuel W. Serrell atty

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF NEWARK, NEW JERSEY, ASSIGNOR TO HIMSELF AND GEORGE HARRINGTON, OF WASHINGTON, D. C.

IMPROVEMENT IN CHEMICAL OR AUTOMATIC TELEGRAPHS.

Specification forming part of Letters Patent No. **150,848**, dated May 12, 1874; application filed January 15, 1873.

CASE 64.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Newark, in the county of Essex and State of New Jersey, have invented an Improvement in Telegraphic Circuits, of which the following is a specification:

It is well known that in the induction-coil of an electro-magnet or primary helix a secondary current is induced or set up, and that this can be conveyed over a wire, and will pulsate with the primary current through the magnet-helix.

In chemical telegraphs great rapidity can be obtained upon short lines, while upon long lines the speed is rapidly diminished by increasing the distance. The current required in chemical telegraphs and cables is comparatively weak. I therefore make use of the secondary current from an induction-coil of an electro-magnet or primary coil as a relay for continuing the transmission of the message in long lines, and that without lessening materially the rapidity, and without blurring the message, as received, by tailings resulting from surplus or static electricity in the line, as now usual in long lines.

By the means before mentioned, all mechanical devices and movements, such as armatures, levers, and relay circuit-closers, are dispensed with, and the electrical operation alone relied upon, and I am able to operate chemical-telegraph lines with a rapidity heretofore unsurpassed. I divide the line up into sections of suitable lengths—say, about four or five hundred miles each—employing a line from the transmitting-station as long as can be used to advantage, and then introducing an induction-relay, either reaching to the receiving-station or to the next induction-relay. In some instances I make use of the induction-relay in operating local or branch circuits.

In the drawing, *a* is the transmitting-instrument; *b*, the battery; *c*, the line-wire of the main circuit. *k* is the induction-relay, and *e* is the receiving-instrument.

The induction-relay is preferably of large wire with a large number of convolutions, so as to obtain an increased quantity in the induction-current. One coil may be outside the other coil, as shown in Figure 1, or the induction-coil *i* may be separate upon the same core, as the primary helix *k*, as seen in Fig. 2. The primary or main circuit passes through the helix *k*; thence to the earth. The secondary or induction circuit is connected from the coil *i* to line-wire and distant instrument, and also to the earth.

In Fig. 1 the entire line is represented as divided into three sections, the first one being operated by the primary current, and the second section by the induced current, which, in turn, operating in the second induction-relay, operates in the third circuit that extends to the receiving-instrument. The number of circuits operated by induced magnetism may be increased, and I remark that, in consequence of the instantaneous action of the induced current, the transmitting-machine has to be worked with great rapidity, and that the dot-alphabet is preferable to the dot-and-dash alphabet.

In Fig. 3 a single primary circuit is shown, with an induction-circuit to operate the receiving-instrument. A rheostat or adjustable rheostat may be employed to regulate the proportion of current passing to the chemical paper.

In Fig. 4 a battery, *t*, is applied to the line near the induction-relay, of less power than the transmitting-battery, and with the opposite pole to the line, so as to clear said line, with rapidity, of static electricity or attenuation in the pulsations. In this case the induced or secondary current is produced by the increase and decrease of the current.

In Fig. 5 the transmitting-instrument is illustrated as being at New York, and working to Washington, and at Philadelphia and Baltimore primary and secondary coils, so that the induced circuits set up at these places can work to Cincinnati and Pittsburg; and at Harrisburg an induction-coil that sets up a second induction-circuit to Buffalo.

At any of the receiving-stations there may

be an electro-magnet in a local circuit to set up a counter-circuit when the pulsation ceases, to prevent tailing, as shown at *d*.

If required, there may be branch circuits, resistances, and connections to the earth from either the primary or the secondary circuits, to aid in clearing the line of surplus electricity.

In rapid automatic telegraphy the secondary current, although but momentary, is of greater intensity when the primary current is prolonged, (as with a dash,) so that the difference between dots and dashes is apparent in the chemical paper; and in cases where the difference is not sufficiently apparent the dot-alphabet will be used.

I do not claim the secondary circuit acting in a magnet to produce a signal.

I claim as my invention—

A circuit for chemical telegraphs, composed of the primary circuit operated by the transmitting instrument, and an induction-relay coil to act in the receiving-instrument by a secondary circuit, substantially as set forth.

Signed by me this 12th day of December, 1872.

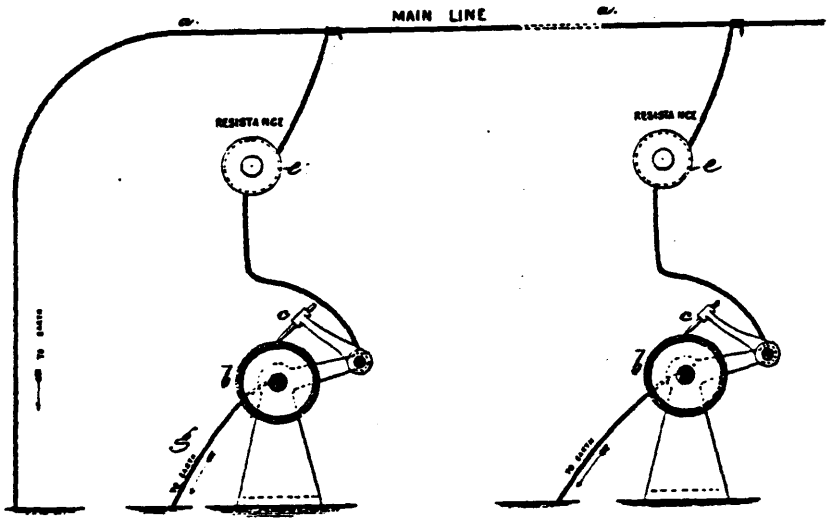
THOMAS A. EDISON.

Witnesses:
GEO. T. PINCKNEY,
CHAS. H. SMITH.

G. LITTLE.

Chemical Telegraph.

No. 108,496. Patented Oct. 18, 1870.



Witnesses,

Chas. H. Smith

Geo. T. Pinckney

George Little

per Lemuel W. Serrell atty.

UNITED STATES PATENT OFFICE.

GEORGE LITTLE, OF RUTHERFORD PARK, NEW JERSEY.

IMPROVEMENT IN CHEMICAL TELEGRAPHS.

Specification forming part of Letters Patent No. **108,196**, dated October 18, 1870.

To all whom it may concern:

Be it known that I, GEORGE LITTLE, of Rutherford Park, in the county of Bergen and State of New Jersey, have invented an Improvement in Circuits for Chemical Telegraphs; and the following is declared to be a correct description thereof.

Chemical telegraphs in which the mark is made on a strip or surface of paper by a stylus have usually only been worked at the end of a main line, because provision had not been made whereby "drop copies," or several copies, could be made on one main line. Recently devised circuits or shunts have been employed in the line-wire of the main circuit for effecting this object.

My improvement, as distinguished from the devices which have preceded it, relates to an arrangement for diverting a portion of the main current, employing the same for giving the mark in the chemical paper, and returning the same through the earth-circuit, while the other portion of the current proceeds to the distant station. By this means the main circuit is subdivided and the current passes off by leakages, or in detail, sufficient to make the mark on the chemical paper, and only so much of the current is employed as is necessary where each copy is taken, and the remainder returns by the earth-circuit.

In the drawing I have represented a diagram illustrative of the improvement.

The wire *a* represents the main line from one station to another. *b* represents the roller, and *c* the stylus, of any chemical telegraph, which, being well known, require no further description.

The roller and stylus, at each station where a drop-copy is to be taken, are in a branch or leakage circuit between the main line *a* and the ground.

The pulsations of electricity from the sending-station will pass through a short circuit, in preference to a long circuit, if the conducting power is uniform; hence, if several chemical telegraphs were connected with the main line, without a resistance or rheostat between the instrument and the main line, the pulsations would pass almost, if not exclusively, through the first instrument, to avoid which a resistance is to be introduced, as at *e*, between each instrument and the main line, and this resistance is to be proportioned by any of the well-known adjustable methods, so that only the amount of galvanic electricity necessary to make the mark is allowed to pass or leak from the main circuit to make the drop-copy at the desired stations, the other portion of the current proceeding to the distant station, and, at the last station, any surplus electricity may pass to the earth by the connection shown at *g*.

The resistance may be a coil, a column of mercury, or any other device that is adapted to the purpose; and I prefer to employ a resistance that is adjustable or variable, so as to proportion the resistance to the current.

By the use of several branch or leakage circuits, connected to the earth, the main line is cleared of surplus electricity with much greater rapidity than in the arrangements heretofore employed; and hence the mark on the chemical paper will be more distinct, and, in cases where desired, a resistance and leakage-circuit to the earth may be employed to clear the wire, even when a chemical recording-instrument is not employed.

I claim as my invention—

1. A branch circuit connected with the main line and the earth, in which is placed the chemical telegraph and a resistance between that and the main line, substantially as and for the purposes set forth.

2. A branch circuit and resistance connected from the main line to the earth, for clearing the wire of surplus electricity, substantially as set forth.

Signed by me this 26th day of August, A. D. 1870.

GEORGE LITTLE.

Witnesses:

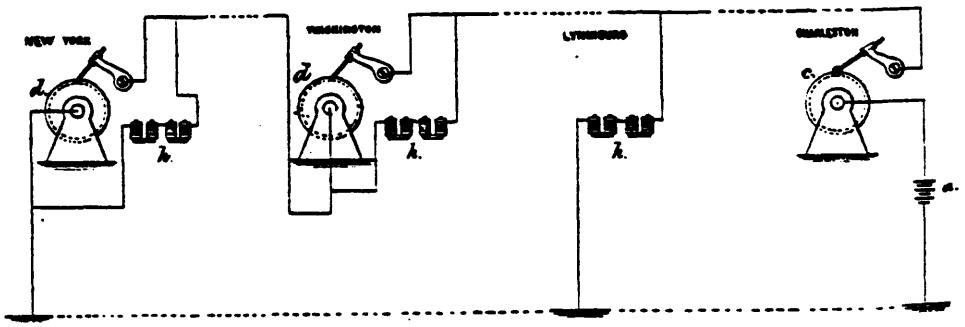
CHAS. H. SMITH,

GEO. T. PINCKNEY.

T. A. EDISON.

Circuits for Chemical Telegraphs.

No. 135,531. Patented Feb. 4, 1873.



Witnesses.
Geo. B. Walker.
Chas. H. Smith

Inventor
Thomas A. Edison.
Samuel W. Serrell
atty

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF NEWARK, NEW JERSEY, ASSIGNOR TO HIMSELF AND GEORGE HARRINGTON, OF WASHINGTON, D. C.

IMPROVEMENT IN CIRCUITS FOR CHEMICAL TELEGRAPHS.

Specification forming part of Letters Patent No. **135,531**, dated February 4, 1873.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Newark, in the county of Essex and State of New Jersey, have invented an Improvement in Circuits for Chemical Telegraphs, of which the following is a specification:

Before this invention telegraphic circuits had been arranged with a rheostat to regulate the portion of the electric pulsation passing to the chemical paper, and allowing the other portions of the pulsation to pass along upon the main line, or to go to the earth as a leakage. In these cases the rheostat did not produce any counter current, and served only to direct portions of the electrical waves through the chemical paper, but the tailing and the attenuation of the mark was not avoided, and upon long lines these marks usually ran together, because there was not sufficient time for the electric action to cease, or the line to free itself before another pulsation succeeded and the line became surcharged. In all cases it has been desired to obtain the most perfect insulation of the line to avoid the use of powerful batteries and to lessen atmospheric influences. It has, however, been found that when the insulation is impaired by atmospheric influences, the marks upon the chemical paper are more distinct, because the surplus electricity finds vent in currents to the earth, lessening the tailing.

When an electro-magnet is charged by a pulsation the electric action, in the circuit of which the helix of the magnet forms a part, is augmented; but when the main or line current is broken the magnet, in discharging itself of the magnetism that has been induced, sets up momentarily a counter current or one of opposite polarity. I avail myself of these various conditions, and arrange the circuits in such a manner that the electro-magnets which are energized by the pulsation that makes the mark on the chemical paper, serve to intensify the electric action upon that paper; but that the counter current, set up when the primary circuit is broken, shall neutralize the tailing or attenuation of the current by the discharge of the magnetism from the electro-magnet, thereby allowing for the use of very feeble currents and rendering the marks upon the chemical paper sharp and clear; and I furthermore employ upon long lines one or more earth connections, in which are placed one or more electro-magnets, with or without rheostats to regulate the proportion of currents passing to the earth, such connections and electro-magnets serving to free the line from surplus electricity and by the reverse polar action, as the electro-magnet discharges itself, to free the line from any attenuation of the primary pulsations.

With long lines it is preferable to employ long electro-magnets; and the reverse, in order that the time occupied by the magnet in discharging its magnetism may be proportioned to the attenuation or tailing of the main current that is increased by the length of line.

In the diagram annexed I have illustrated my improvement by four stations, New York, Washington, Lynchburg, and Charleston. The message is being sent from Charleston to New York by the battery *a*, and any suitable transmitting instrument at *c*, such as a stylus and perforated paper, or a finger-key or other device. The battery may be connected with either the positive or the negative pole to the instrument, and the other to the earth wire. At New York is any suitable receiving instrument, at *d*, such as a drum and stylus, for the chemical paper. If intermediate connections are not required they may be dispensed with and the message will be received only at New York.

I provide a secondary or local circuit connected with the main circuit at both sides of the receiving instrument *d*, and in this I place the electro-magnets *h*. These and the others spoken of may be of ordinary character; but as quantity rather than intensity is required, large wires may be used for the helices, and solid bars, bundles, or tubes for the cores, and many of these may be employed, or a large number may be provided, and more or less may be brought into action by switches or a commutator. The helices might be of iron wire wound in several layers, and cores be dispensed with, the inner portions of the coils forming the electro-magnets.

When the circuit is closed and a pulsation passes in the main line, a local circuit will thereby be set up through the electro-magnets and connections in the same direction as that of the main-line, and thereby intensifying the

action upon the chemical paper, but as soon as the main-line circuit is broken the electro-magnets in discharging themselves set up a local circuit in the opposite direction through the stylus and chemical paper, neutralizing any tailing and causing the mark to be clear and distinct. The same effect is produced where the connections are arranged as at the station marked Washington, in order that a drop copy may be taken at that point.

At the station marked Lynchburg the electro-magnets *h* are placed in a branch or ground circuit, and the amount of the leakage regulated by the resistance of the magnets themselves, or of a rheostat, thereby conveying away, designedly, the proper portion of the current intermediately between the sending and the receiving station; and when the circuit of the main line is broken the electro-magnets set up a counter-current in the line as they discharge themselves, thereby freeing the line at one or more places, as circumstances require.

I claim as my invention—

One or more electro-magnets, arranged in a local or branch circuit, substantially as set forth, in combination with a chemical telegraphic receiving instrument, for the purposes set forth.

Signed by me this 9th day of November, 1872.

THOMAS A. EDISON.

Witnesses:

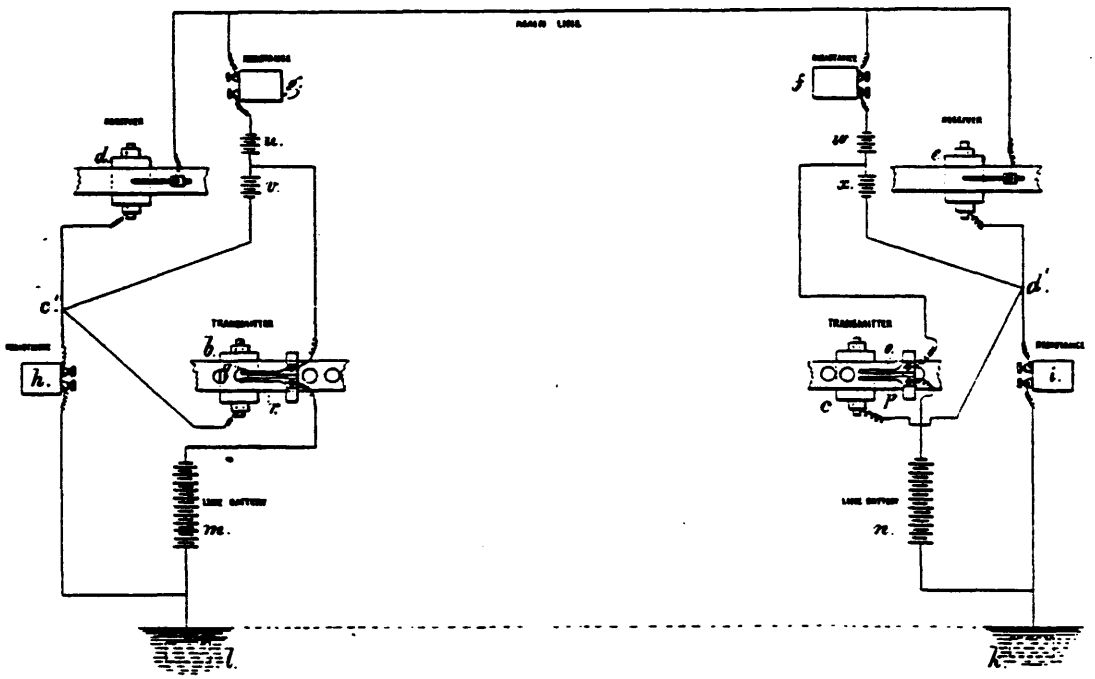
GEO. D. WALKER,

GEO. T. PINCKNEY.

T. A. EDISON.

Duplex Chemical Telegraphs.

No. 156,843. Patented Nov. 17, 1874.



Witnesses,
Chas. A. Smith
Geo. B. Walker.

Inventor
Thomas A. Edison
L. W. Serrell
atty.

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

UNITED STATES PATENT OFFICE

THOMAS A. EDISON, OF NEWARK, NEW JERSEY, ASSIGNOR TO HIMSELF AND GEORGE HARRINGTON, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN DUPLEX CHEMICAL TELEGRAPHS.

Specification forming part of Letters Patent No. **156,843**, dated November 17, 1874; application filed March 13, 1873.

CASE 69.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Newark, in the county of Essex and State of New Jersey, have invented an Improvement in Circuits for Chemical Telegraphs, of which the following is a specification:

The object of this invention is to transmit two dispatches over the same wire at the same time by telegraphs employing perforated transmitting-paper and chemical receiving-paper.

I make use of apparatus for transmitting by perforated paper, and receiving the messages on chemical paper at the respective ends of the line, and employ batteries, resistances, and connections arranged in such a manner that the effect of the transmitting-battery shall be neutralized upon the receiving-instrument at the same end by an equalization of tensions, and the receiver shall be at a point where the tension is equal to all the electric currents, except to that current which comes from the distant station.

In the diagram, *d e* are the receiving, and *b c* the transmitting, instruments. *m n* are the main batteries. *u* and *v* are two batteries in the shunt-circuit opposing each other, and producing no effect upon the receiver. *w x* are batteries operating similar to *u v*. *f g* are resistance-coils, to increase and decrease the length of the shunt-circuits. *h i* are resistance-coils of nearly the resistance of the line. *k l* are the ground-plates. *o p* are the double contact-springs, one spring, *o*, cutting off or "short-circuiting" the battery *x*, and the other spring, *p*, placing the main battery *n* upon the line. This main-battery current divides at *d'*, part going on the line and part to the ground, this route or negative of the battery through the resistance *i* being in fact an artificial line, it being well known that a battery will supply several lines with an undiminished quantity of electricity, and that the addition of a line decreases the total resistance of the battery's circuit, and produces an extra amount of electricity.

To obtain the transmission of two messages over the same wire at the same instant, it is only necessary that no effect shall be obtained upon the receiving-instrument by the putting on of the sending-battery at the same station.

I will now describe how I produce this effect: When the paper of the message to be transmitted intervenes between the contact-springs *q r* and the drum *b*, no current passes upon the line, and the batteries *u v*, being balanced within the shunt-circuit, produce no effect upon the receiver *d*, and a current coming from a distant station passes down the shunt, and also through the receiver *d*, and produces the message in the usual manner.

Supposing no current from the distant station was recording itself upon the receiver *d*, and it is desired to transmit a current to the distant station without producing any effect upon said receiver *d*, it is accomplished as follows:

When the contact-springs *q r* are in metallic contact with the drum *b*, by passing into a perforation in the paper being drawn over said drum, the current from the battery *m* passes by *r* over the line, but it splits in three directions at *c'*, part passing to the ground, and part passing by two routes to the line, via the shunt and the receiver *d*. The passage of the current through the receiver would give a large mark at the receiver were it not that at the same time that the contact-spring *r* placed the battery *m* upon the line the spring *q* short-circuited the battery *v*, which had been opposing the battery *u* in the shunt, hence allowing said battery *u* to have free action, and the current from this battery thus set free acts in a contrary direction through the receiving-instrument *d* to that of the battery *m*, and by means of a switch for putting in and out more or less cups the power of the batteries *m* and *u* are neutralized on the chemical paper at *d*; consequently no effect is produced at the receiver *d* when the battery *m* is placed on the line.

Of course, while the battery *m* is on, if a current from the battery *n* is sent over the line it records itself in the usual manner upon the chemical paper on *d*.

I claim as my invention—

The local batteries *u* and *v* or *w* and *x* in a shunt from the main line and opposing each other, and a connection between them to the transmitting or receiving instrument, in combination with the main batteries, resistances, and circuits, arranged substantially as and for the purposes set forth.

Signed by me this 7th day of March, A. D. 1873.

THOMAS A. EDISON.

Witnesses:
GEO. T. PINCKNEY,
CHAS. H. SMITH.

P. B. DELANY.

Automatic Telegraph.

No. 165,156. Patented July 6, 1875.

Fig. 1.

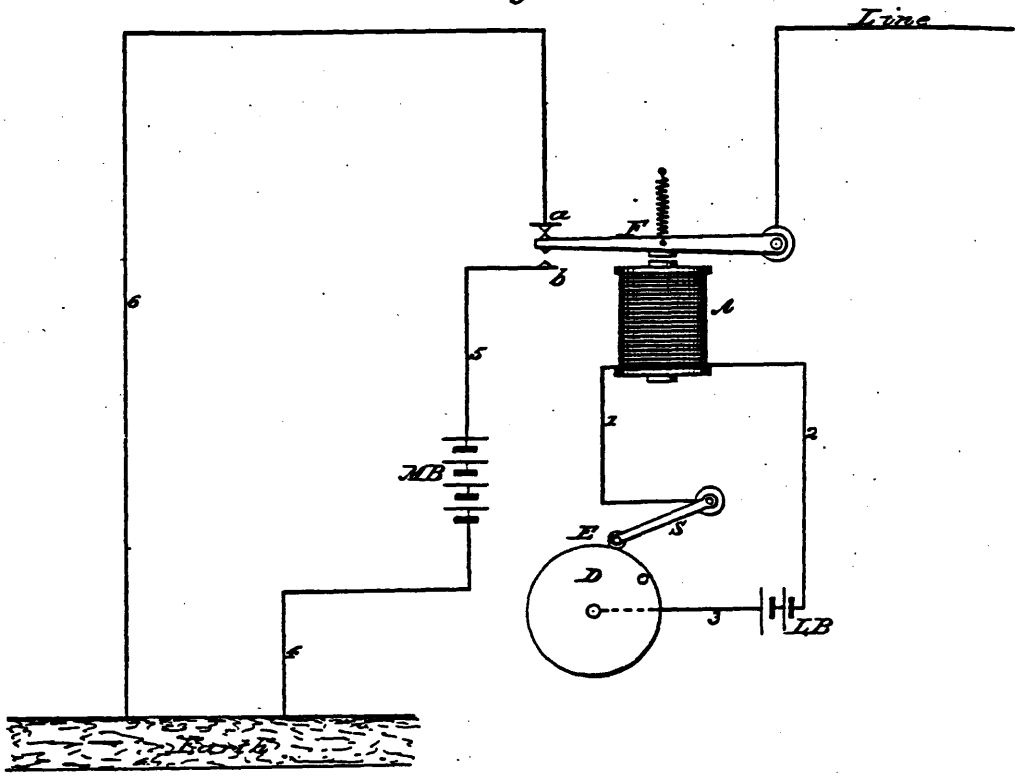
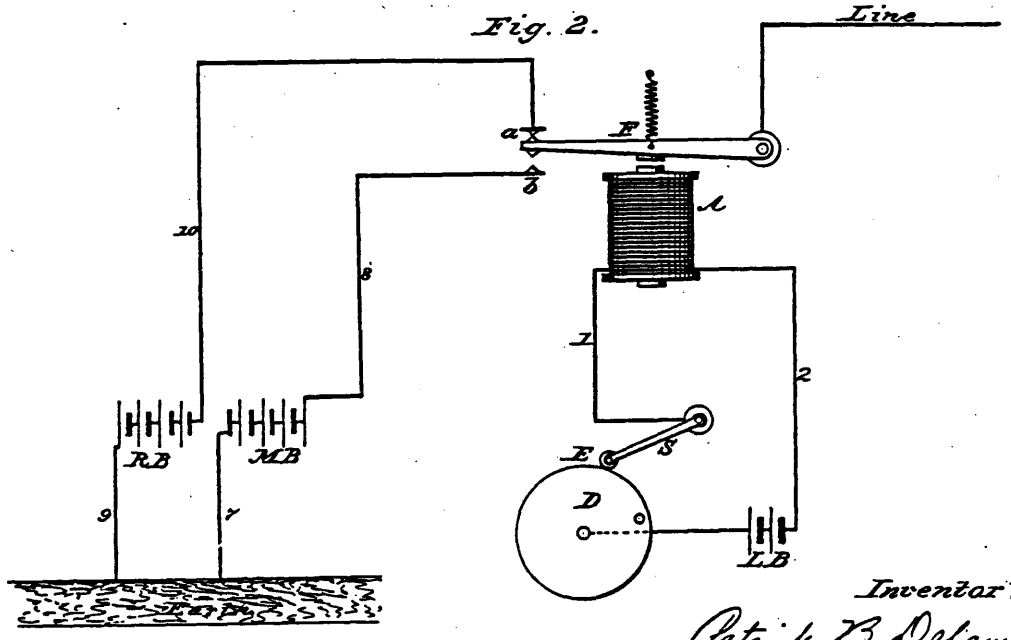


Fig. 2.



Witnesses:

L. F. Royce.

S. A. Graham.

Inventor:

Patrick B. Delany

by Fred W. Royce

Attorney

UNITED STATES PATENT OFFICE.

PATRICK B. DELANY, OF JERSEY CITY, NEW JERSEY.

IMPROVEMENT IN AUTOMATIC TELEGRAPHS.

Specification forming part of Letters Patent No. **165,156**, dated July 6, 1875; application filed October 21, 1874.

To all whom it may concern:

Be it known that I, PATRICK B. DELANY, of Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Automatic Telegraphy; 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.

It is well known that in rapid automatic telegraphy a great difficulty is experienced in false records or signals caused by an extra or induced current in the line itself. When the makes and breaks of the regular transmitting current are made with great rapidity, this current occupies the line during the period devoted to "spaces," causing tailings or blurs.

My invention has for its object the remedying of this; and to this end it consists in the combination in a local circuit, with an automatic transmitter using perforated paper, of a relay, which in one condition throws the current of the main battery upon the line, and in the other condition closes an earth connection, for readily discharging the line of the extra or induced current referred to, or closes the circuit to the line of a reversed battery for neutralizing the same.

In order that those skilled in the art may be enabled to make and use my invention, I will describe it in detail, reference being had to the accompanying drawings forming part of this specification, in which—

Figure 1 is a diagram showing the arrangement of the transmitter, relay, and main-line connections to main-line battery and to earth; and Fig. 2, the same elements with line-connections to main-line and reversing battery.

In both figures, E represents an automatic transmitter of any of the well-known forms, having drum D and stylus *s*, between which the perforated paper is fed. L B is a local battery, whose circuit is controlled by this transmitter. In the circuit 1 2 3 thereof is placed the relay-magnet A, with armature-lever F, to which the main line is connected. This lever F plays between contact-points *a b*. In Fig. 1 the contact *b* is connected to the main-line battery M B by wire 5, the battery having the regular ground 4. To the contact *a* a ground connection, 6, is made.

The relays are made and adjusted to work freely and quickly. The paper being fed through E, as the stylus falls upon drum D through a perforation, the circuit is closed through A drawing its armature down and closing the circuit of M B to the line. As the stylus is lifted from the drum by the unperforated paper and the circuit broken, the lever flies back, closing the earth circuit 6 for the line, allowing the line to discharge, and thus obviating any tailing or blur at the receiving-station.

In Fig. 2 a battery is shown connected to the line oppositely to the signaling or regular main battery. In this case, as the circuit of the main-line battery is broken, the reverse current is thrown upon the line through the contact *a*. This current neutralizes the extra or induced current, so that tailings or blurs are obviated.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

The combination, with an automatic transmitter, of a relay which connects the line on one movement of its armature to the signaling-battery, and upon the other to the earth or to a reversing-battery, substantially as and for the purposes set forth.

In testimony that I claim the foregoing, I have hereunto set my hand this 15th day of October, 1874.

PATRICK B. DELANY.

Witnesses:

H. H. WELLS,

JOHN BULL.

W. E. SAWYER.

Telegraphic-Circuit.

No. 166,305. Patented Aug. 3, 1875.

Fig. 1.

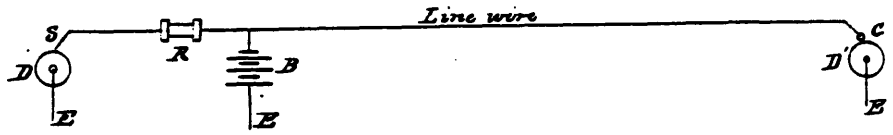


Fig. 2.

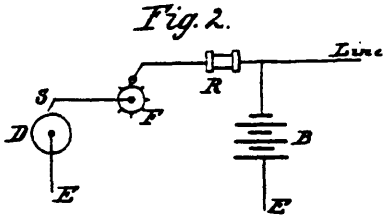


Fig. 3.

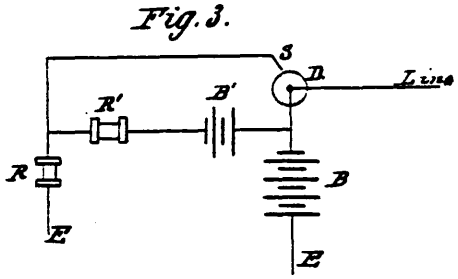


Fig. 4.

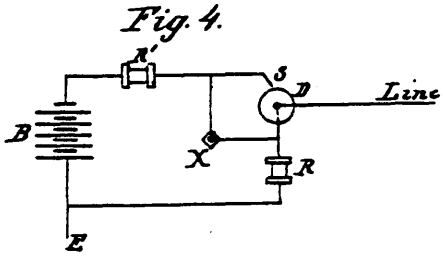


Fig. 5

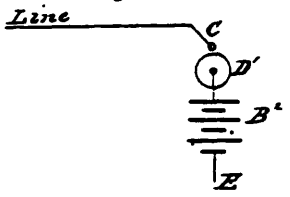


Fig. 6

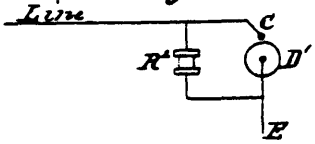


Fig. 7.

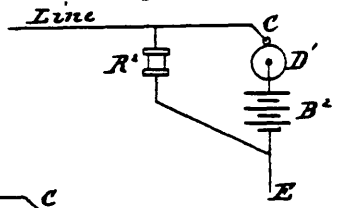


Fig. 8.

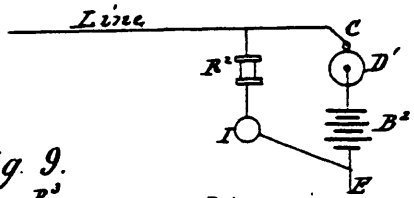
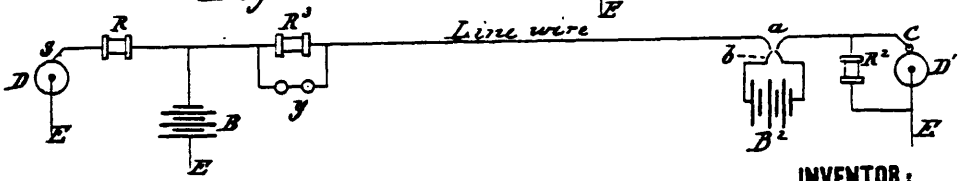


Fig. 9.



WITNESSES:

W. W. Hollingsworth.

Solon C. Kemon

INVENTOR:

Wm. E. Sawyer

BY Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

WILLIAM E. SAWYER, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN TELEGRAPHIC CIRCUITS.

Specification forming part of Letters Patent No. **166,305**, dated August 3, 1875; application filed June 19, 1875.

To all whom it may concern:

Be it known that I, WILLIAM EDWARD SAWYER, of Washington city, District of Columbia, have invented a new and useful Improvement in Telegraphic Circuits; and I 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:

It is my special design to apply these improvements in circuits to my fac-simile or autographic telegraph, but it is obvious that they may be applied to most other telegraphs, such, for instance, as the Morse and the automatic; and I therefore do not limit myself to their application to any particular system.

The main principle of my present invention consists in a division of the transmitting-battery current, and the placing of that battery at the receiving end of a line.

The result of this application of electric force is not to free a line of tailings or the attenuations of impulses transmitted, which may exist to any degree in the line-wire, but to prevent those tailings or attenuations of impulses from producing any effect upon the receiving-instrument.

In order to produce or cut off action or discoloration of chemical paper in the receiving-instrument it is only necessary that the closing of the circuit at the transmitting end of a line shall set the current from the battery at the receiving end to dividing end, a part of it flowing in the direction of the transmitting end. It is not necessary, therefore, that an impulse shall ever reach the transmitting end. It is not necessary that the current shall travel any distance upon the line-wire, but that we reduce the potential of current acting upon the receiving-instrument; and to reduce this potential it is merely necessary that the current shall begin to flow by division toward the transmitting end.

In the operation of my invention I prefer an intensity to a quantity current battery. The battery which gives the best results is that which will not supply enough electricity in quantity to work two or more circuits at the same time. Intensity is desired, and a magneto-electric or an induced current gives surprising results.

In using a carbon-battery, so called, I greatly prefer that both the carbons and the zinc shall be of small size.

In the drawings, I have represented the transmitting and the receiving instruments, each by a drum and a stylus. Their places, it is obvious, may be supplied by any telegraphic mechanism for transmitting and receiving, whether for autographic, automatic, or Morse transmission.

In Figure 1 is shown the simple battery-dividing circuit. E E E are earths. C is the transmitting-stylus. D′, the transmitting-drum, at, for instance, Washington. D is the receiving-drum; S, the recording-stylus; R, an adjustable resistance; and B, the transmitting-battery, at New York. Assuming the resistance of the line to be five thousand ohms, the artificial resistance R should preferably exceed five thousand ohms. It will thus be understood that when the line-wire circuit is broken, the battery B will flow entirely through the stylus S and drum D, producing action or discoloration of chemical paper; but when the line-wire circuit is closed at the transmitting end the battery-current will divide, a part flowing over the line-wire, and this division will so weaken the current flowing through the artificial line as to prevent action or discoloration at S and D. I may employ condensers or coils in connection with the artificial line, and the drum and stylus may be shunted, with adjustable rheostats to regulate the amount of current passing through the receiving-instrument, or with reversed batteries, or with both.

From the description of Fig. 1 it will be apparent that the line-wire tailings or battery-current attenuations can never affect the receiving-instrument. The resistance R is so heavy as to send all, or nearly all, the tailings to earth through the battery B, forming practically a very short circuit for the tailings, the only resistance there being the resistance of the battery. Thus it will be seen that the longer the line-wire circuit the less will the line-wire tailings affect the receiving-instru-

ment, for the greater will be the resistance of the artificial line and proportionally the shorter will be the circuit through the battery B, through which the tailings flow. The period of time required for a line to discharge is therefore of no account, as the action upon the receiving-instrument continues only so long as the line-wire circuit is closed and the battery dividing and flaring into the line-wire, and this action ceases just so soon as the line-wire circuit is broken, as then the charge in the line-wire begins to return through the battery to earth, and the whole of the battery-current again flows through the artificial line. To make my meaning clear, the operation of my invention is comparable only to a vibration of the battery-current backward and forward, which vibration is dependent upon the closing and breaking of the line-wire circuit at the transmitting end.

In order to secure the best results from my invention a "circuit-disturber" should be placed in the artificial line. This is shown at F in Fig. 2. By circuit-disturber I mean an arrangement very similar to any circuit-breaking device—such, for instance, as that shown in my autographic telegraph, Letters Patent No. 159,460—but with the contact-points so arranged that the circuit will never be wholly broken, but that the perfection of contact shall vary—that is to say, I place the metallic contact-points upon the drum, band, or wheel, referring to my autographic Letters Patent, so near together that the contact-point bearing upon them shall make connection with one nearly if not quite as soon as it leaves another point. The effect of this is the same as though a resistance were placed in the circuit, which resistance varies in amount, intermittently, with immense rapidity.

In Fig. 3 is shown another form of division of the main battery-current. R is the resistance forming the artificial line. The adjustable resistance R^1 and the battery B^1 are in a local shunt around the receiving-instrument. The battery B^1 effects the recording or discolors the chemical paper whenever, as before described, the main battery B is diverted in part to the line-wire. The action is so apparent that further description is unnecessary.

In Fig. 4 is shown another method of operation. R is the resistance, forming the artificial line. Preferably it should exceed the resistance of the line-wire. At X in the shunt may be placed an adjustable resistance, or a reversed battery, or an induction-coil, or any two or all of them. R^1 is a resistance exceeding the resistance of R. When the line-wire circuit is broken, so slight a portion of the battery-current passes through the stylus that no record is effected, but when the line-wire circuit is closed at the transmitting end the battery flows through the stylus and drum in sufficiently greater volume to produce the record. The line-tailing will mainly flow to earth through the resistance R, owing to the greater resistance in the circuit through R^1 and B.

In Figs. 5, 6, 7, and 8 are indicated various employments of batteries, &c., at the transmitting end, in connection with the arrangements at the receiving end already described, and additional to the simple circuit, Fig. 1.

In Fig. 5, B^2 is a reversed battery, designed to be of sufficient power to force a perceptible neutralizing portion of its current over the battery B at the receiving end, and therefore through the artificial line, thus making more complete the cessation of action of battery B upon the receiving-instrument when the main-line circuit is established.

In Fig. 6 is shown a shunt around the transmitting-instrument, in which a heavy resistance, R^2, is placed. The object of this is to keep the line-wire statically charged by furnishing a constant long circuit for the division of battery B at the receiving end. When the contact between C and D′ is made, a shorter circuit being established, the battery B flows into the line-wire in increased volume, thus accomplishing the necessary division of current to actuate the receiving-instrument or effect the recording.

In Fig. 7 the resistance and battery are shown combined.

In Fig. 8 are shown the battery and resistance in combination with a primary induction-coil.

The application of this invention to autographic or fac-simile telegraphs is clearly apparent. By its use, as shown in Fig. 9, I am enabled to duplex the line-wire, using one circuit for the chemical discoloration and the other for the regulation of the apparatus, by means of which the transmitting and receiving instruments are kept in synchronous motion. *y*, at the receiving end, is an electro-magnet in a shunt, R^3 being the adjustable resistance by which the quantity of line-current passing through the magnet is regulated. At the transmitting end of the line-wire, *a* is a spring-connection; *b*, the two insulated poles of the Morse battery B^2. The operation is obvious, the throwing of battery B^2 into the line-wire being caused by inserting between the two springs *a* the electrically-separated ends of the battery *b*. This arrangement may be attached to any ordinary telegraph-key. The circuit at the transmitting end is the same as in Fig. 6. The current proceeding from battery B, whether over the long circuit of line-wire and resistance R^2 to earth, or over the short circuit of line-wire C and D to earth, is not of sufficient strength to operate the instrument Y; but battery B^2 is of sufficient strength, whether flowing through the long or short circuit, to affect Y. On the other hand, battery B^2 will produce no effect upon the receiving-apparatus S and D, because it will flow through the shorter circuit of battery B to earth.

I do not limit myself to the application of this duplex circuit to any particular kind of telegraph. All of the resistances shown and described herein should be adjustable, and preferably should be liquid resistances.

I claim as my invention—

1. The method of operating a line of telegraph, consisting in placing the transmitting-battery at or near the receiving end of the line-wire, and effecting the record or actuating the receiving instrument by making and breaking the line-wire circuits at the transmitting end, whereby the battery-current passing through the receiving-instrument is alternately, equally, or unequally divided and restored to its normal strength or required maximum value, as set forth.

2. The method of operating a line of telegraph, consisting of the employment of two circuits, the line-wire circuit and an artificial line-circuit, in the latter of which is placed the receiving-instrument, which is actuated, or in which the record is effected, by causing an increment and decrement, through breaking and making the line-wire circuit of the quantity or force of the battery-current flowing in the artificial line-circuits, as set forth.

3. The artificial circuit at the receiving end of a line of telegraph, in which the battery-current flows at its required maximum of quantity or force, excepting when a greater or less portion of the battery-current is diverted into the line-wire by establishing the line-wire circuit, as set forth.

4. The method of effecting a record at the receiving-instrument, or of actuating the receiving-instrument, consisting in wholly or partially short-circuiting the main battery, which is placed at the receiving-station, by wholly or partially diverting its current from an artificial circuit into the line-wire circuit.

W. E. SAWYER.

Witnesses:
SOLON C. KEMON,
CHAS. A. PETTIT.

SECTION

5

ENTUNING VRIL

J. B. STEARNS.

Telegraph Apparatus.

No. 78,547. Patented June 2, 1868

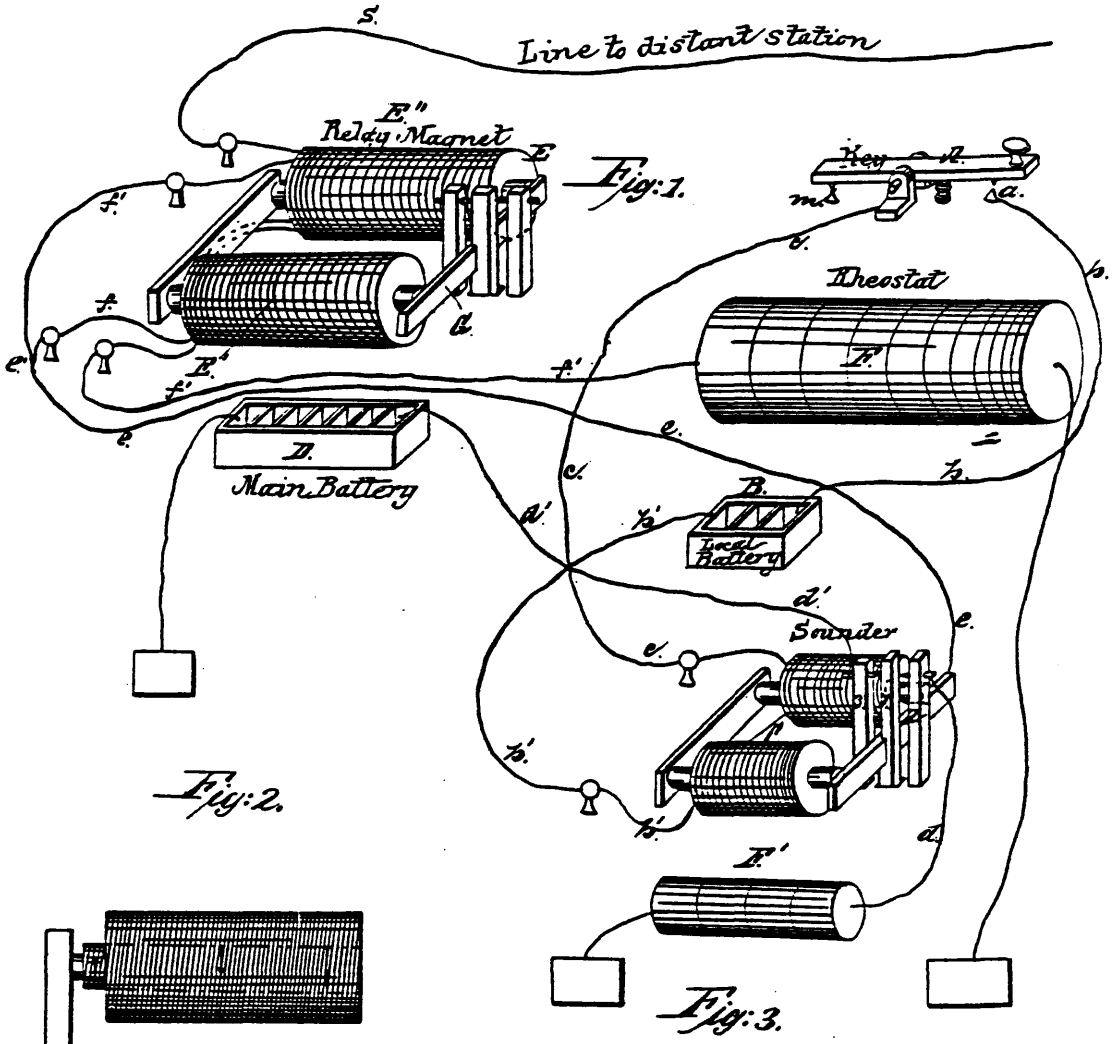


Fig: 2.

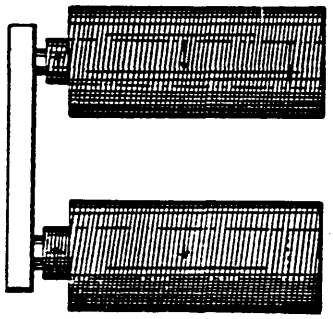
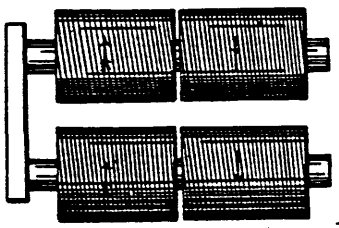


Fig: 3.



Witnesses:

J. H. Adams

M. L. G. Wilde

Inventor:

Jos. B. Stearns.

UNITED STATES PATENT OFFICE.

JOSEPH B. STEARNS, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN TELEGRAPH APPARATUS.

Specification forming part of Letters Patent No. 78,547, dated June 2, 1868.

Be it known that I, JOSEPH B. STEARNS, of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Telegraphic Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings making a part of this specification, and representing the various parts of a telegraphic apparatus for carrying out my invention.

Figure 1 represents a general view of the apparatus. Figs. 2 and 3 are modifications of the relay-magnet.

The object of my invention is to provide an efficient means for transmitting messages simultaneously over a single wire in opposite directions; and the invention consists in so constructing and arranging the "keys" or other circuit-breakers and the "electro-magnets" that the current from the battery of what may be termed the "home station" will be divided so as to pass around the "cores" of the electro-magnet in opposite directions, one portion passing over the line to the "distant station," and the other portion passing through a "rheostat" or other resistance to the ground, the one portion thus neutralizing the effect of the other portion, and producing no magnetism in the "cores," or effect upon the "armature," while at the same time a current from the distant battery can pass through one-half of the wire, or one set of wires on each helix, to the key or circuit-breaker, and thence through the battery to the ground if the circuit-breaker is in contact with the "front stop," or through a rheostat to the ground, if in contact with the "back stop," or through all the wire on each helix, and a larger rheostat, to the ground, if between the two stops, and in contact with neither, the magnetism produced in the cores in each of the three positions of the circuit-breakers, as above mentioned, being practically constant.

In practice, I prefer to make the key or circuit-breaker in the form of a common "sounder," the lever of which corresponds to the lever of a common key, and, being furnished with an armature, may be manipulated by means of an electro-magnet, "local battery," and common key, as shown in the drawing.

Referring to the drawings, A represents a key of the ordinary construction, and with which the sending operator works. From the point *a*, or front stop of said key, the wire *b* passes to one pole of the local battery B, from the other pole of which the wire *b'* passes to and around the electro-magnet of the sounder C, and thence to the key A. From the rear stop 2 of the sounder, which in this description may be considered as the key for the "main battery" and line, a wire, *d*, passes to and through the rheostat F', which is so adjusted that its resistance is equal or about equal to that of the main battery D, and thence to the ground. From the sounder-lever or main-line key 1, when in contact with the front stop 3, the current from battery D passes through a wire, *e*, to the relay or electro-magnet E, near which, at a point, *e'*, it is divided, one portion passing by wire *f*, through half the wire on each helix, in one direction to the line *s*, leading to the distant station; the other portion passes by the wire *f'*, through the other half of the wire on each helix, in the opposite direction, and thence to and through the rheostat F to the ground. The object of the rheostat F is to furnish, by its proper adjustment, the same or nearly the same resistance as is offered to or experienced by the current from battery D, in passing over the line to the distant station, and through the apparatus there to the ground. The object of the rheostat F' is to furnish, by its proper adjustment, the same or nearly the same resistance to the current of the battery at the distant station, when the key 1 at the home station is in contact with the back stop 2, that it meets with in passing through the battery D, when the key 1 is in contact with the front stop 3. This adjustment of resistance is necessary to prevent the destruction of the neutralization of the electro-magnet at the distant station, when the key at the home-station is in different positions, and the rheostat F is not employed. It is obvious that if the rheostat F at the distant station is adjusted, while the key 1 at the home station is in contact with the front stop 3, it will contain the same resistance as the line, instruments, and battery D. If, now, the resistance of battery D is removed, and the line put on "short circuit" to the ground, the resistance met with by the current of the battery at the distant station is greatly reduced, while the resistance of the rheostat F

at that station remains unchanged, in consequence of which the neutralization of the electro-magnet at the distant station is destroyed, and the sending operator at that station hears his own writing on the relay there, and the writing from the home station is thus interfered with and confused. The wire *d*, rheostat F′, and ground connected with back stop 2, may be in some cases entirely dispensed with, the current from the distant station having at all times a passage to the ground, either through battery D or rheostat F; but in most cases I prefer to use them.

The operation is as follows: The key A being depressed, and brought in contact with point *a*, a current is established through wire *b*, battery B, wire *b′*, electro-magnet of sounder C, wire *c*, and key A, thus completing the circuit, and attracting the armature and lever 1, or main-line key. As soon as the lever 1 comes in contact with the front stop 3, to which the wire *d′* leading to the main battery D is attached, the current from battery D passes by wire *e*, connected with lever 1, to the point *e′*, where it is divided, one portion passing around the helices E′ E″ of the relay E to the line *s* leading to the distant station, the other portion also passing around the helices E′ E″, but in an opposite direction to and through the rheostat F, which offers a resistance equal to, or as nearly so as is possible, that of the line to the distant station and the apparatus there, and thence to the ground. Thus the currents passing through the two channels are equalized, and the magnetism of the cores is neutralized, or, more strictly speaking, prevented, and the armature is unaffected. At the same time, however, a current from the battery of the distant station may pass over the line *s*, through one-half the wire on each helix, by wire *f*, to the point *e′*, where it separates, one portion passing by wire *f′* through the other half of the wire on each helix, and in the same direction as before, thence by wire *f″* to and through the rheostat F to the ground, the other portion passing directly to the lever 1, thence through the battery D to the ground, if the lever 1 is in contact with the front stop 3, or through the rheostat F′ to the ground, if lever 1 is in contact with the back stop 2. In case the lever 1 is between the stops 2 and 3, and in contact with neither, then the current from the distant station passes through all the wire on each helix, and through rheostat F to the ground. In either of the cases mentioned above the current from the battery at the distant station magnetizes the cores of the relay at the home station, and the armature G is consequently attracted. It is also obvious that the armature-post of the relay E may be made to close another local circuit, and thus operate another sounder for the accommodation of the receiving operator at the home station. It is also obvious that the sounder C may be dispensed with, the key A being made to act as the main-line key, it taking the place of lever 1, and the front stop *a* taking the place of the front stop 3, and the back stop *m* taking the place of the back stop 2; but in practice the former method is preferred.

The coils of the electro-magnets E are constructed by winding the wires side by side throughout their whole length, so that the number of turns and length of each wire of which the helices are formed shall be equal.

As a modification of the method described of winding the wires over which the opposing currents pass side by side through their whole course, to form the helices, the wire for one current may be wound in one direction, forming a cylinder of any number of turns of wire, and the wire for the other current may be wound in the opposite direction, forming a cylinder outside of and containing an equal number of turns of wire as the first cylinder; or the two concentric cylinders may be wound in the same direction, and connected so as to pass the current through them in opposite directions, the magnetism produced by the passage of the current through the inner cylinder being thus neutralized by that of the current passing through the outer cylinder. This modification is shown in Fig. 2.

Another modification consists in making each helix in two or more separate sections, as shown in Fig. 3, which sections may be so wound or so connected as to allow the current to pass through one half in the opposite direction, and through the other half in the opposite direction, the magnetic effect produced by one half being neutralized by the other.

Either of the methods above described of forming the helices produces a more uniform and absolute neutralization than the method adopted by Frischen and Siemens, of passing the current through the whole helix in one direction, and through the other helix in the opposite direction. The defect in this method is the tendency of the cores to become separate magnets, and not to completely neutralize each other, and the consequent action upon the armature by the polarity of the cores, and also by the helices themselves, which, acting separately, tend to produce polarity in the armature.

The method of Frischen and Siemens, which my method more nearly resembles than any other, has two great defects, which, when taken in connection with each other, and with the varying conditions of a telegraph-line, conspire to render it practically useless. One of these defects is in the construction of the electro-magnet, as already pointed out, and the other consists in the great variation in resistance which each battery meets with in the different positions of the key at the other station, and the consequences of this variation, as already pointed out when describing the rheostat F′ and its use. These defects I have sought to remedy in order to produce a practical and useful instrument.

I am aware that it is not new to make an electro-magnet with two sets of wires, through

which a current or currents may be passed in opposite directions, for the purpose of neutralizing the magnetism in the cores; neither is it new to make a key or circuit-breaker that will, when in one position, connect the line with the battery, and in another position with the ground. But I believe it to be new to construct the helices of an electro-magnet in the manner first described, by winding the wires side by side throughout their whole length. I also believe it to be new to construct the helices, as in the second modification described, by winding them in two or more separate sections on each core. I also believe it to be new to employ a rheostat or other resistance in the wire connecting the back stop of the key or circuit-breaker with the ground, for the purpose described. I also believe it to be new to combine an electro-magnet constructed according to either of the methods above described, or as used by Frischen and Siemens, with a key or circuit-breaker, having a rheostat or other resistance in the wire connecting its back stop with the ground, or with a key or circuit-breaker having no connection between its back stop and the ground. I also believe it to be new to move or manipulate the key or circuit-breaker constructed and connected, as described, by an electro-magnet and local battery, as shown in the drawing, to the end that the sending operators may hear their own writing, and thus the better guard against mistakes; and to combine the key so constructed and manipulated with the electro-magnet and other apparatus herein described as forming parts of this invention.

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

1. In an electro-magnet coil, constructed of two opposing or neutralizing conductors, making each of the conductors of the same length, and giving them each an equal number of turns, as and for the purpose set forth.

2. A key or other circuit-breaker, the back stop of which is connected with the ground by a wire, in which is placed a rheostat or other resistance, and for the purpose set forth.

3. Combining an electro-magnet, constructed as described, or in any other manner, to produce either complete or partial neutralization of its cores, with a key or circuit-breaker having a connection between the back stop, or its equivalent, and the ground through a rheostat or other resistance, as and for the purpose described.

4. Combining an electro-magnet, constructed as described, or in any other manner by which either a complete or partial neutralization of its cores is produced, with a key or circuit-breaker having no connection between its back stop and the ground, as specified.

5. In combination with an electro-magnet, constructed substantially as described, the key A, the key or circuit-breaker C, local battery B, and rheostat F, all constructed and operating substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

Witnesses: JOSEPH B. STEARNS.

J. H. ADAMS,

E. L. DYER.

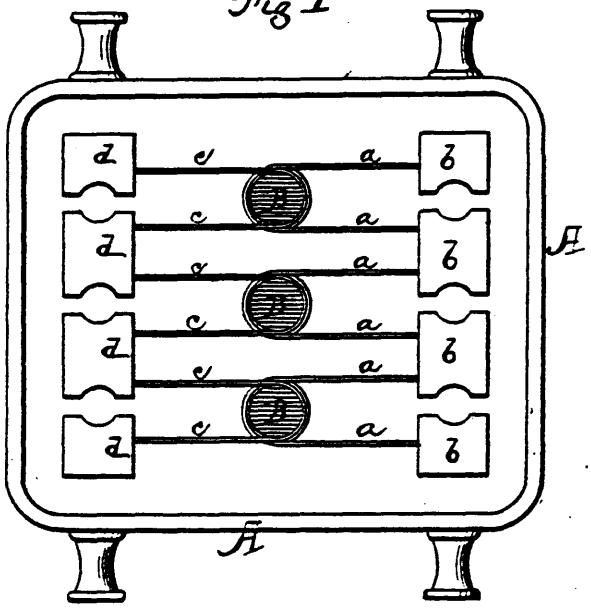
(No Model.) 2 Sheets—Sheet 1.

M. BUELL.

RHEOSTAT FOR MULTIPLE TELEGRAPHY.

No. 256,458. Patented Apr. 18, 1882.

Fig 1



Witnesses:
D. K. Parsons.
I. R. Drake.

Madison Buell,
Inventor, by
J. R. Drake,
Atty.

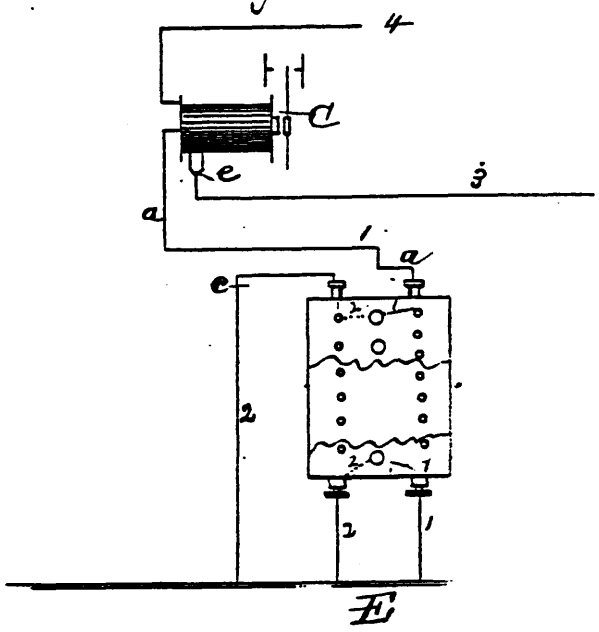
(No Model.) 2 Sheets—Sheet 2.

M. BUELL.

RHEOSTAT FOR MULTIPLE TELEGRAPHY.

No. 256,458. Patented Apr. 18, 1882.

Fig. 2



Witnesses:
D. H. Parsons
J. R. Drake

UNITED STATES PATENT OFFICE.

MADISON BUELL, OF BUFFALO, NEW YORK.

RHEOSTAT FOR MULTIPLE TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 256,458, dated April 18, 1882.

Application filed January 23, 1882. (No model.)

To all whom it may concern:

Be it known that I, MADISON BUELL, a citizen of the United States, residing at Buffalo, county of Erie, and State of New York, have made certain Improvements in Rheostats for Duplex or Multiplex Telegraphy, of which the following is a specification.

The object of this invention is to improve the manner of regulating or adjusting the artificial lines or circuits in systems of duplex or multiplex telegraphy; and the invention consists in introducing an insulated and adjustable earth-circuit side by side of and throughout the entire length of the artificial lines in the rheostat.

In all systems of duplex and multiplex telegraphy a differential arrangement of the transmitting and receiving instruments is employed, and the accuracy of the system depends upon an artificial circuit having exactly the same electrical resistance and capacity as the real line.

In my invention I adjust for the variations of the insulation of the main line by merely adjusting the insulated artificial resistances of the earth-circuit until it equalizes the static condition of the main line, thereby preventing the false signals which occur by what are termed "charge" and "discharge" currents.

To this end my invention consists more especially in a new and improved construction of the rheostat, in order that it may not only bear a proper proportion to the main line, so far as its adjustable resistances are concerned, but also an adjustable and proper proportional electro-static capacity, as fully hereinafter explained.

In the drawings, Figure 1, is represented a top plan of a rheostat, the box cut off longitudinally, and without the cover being shown. Fig. 2 is a plan showing the invention in circuit.

A represents the box of the rheostat; B B B, three spools, this number being sufficient to show my invention.

As is well known, the rheostat, as usually constructed and used in connection with duplex and multiplex telegraphy, consists of a series of spools, B, of one wire, having resistances ranging from one ohm up to ten thousand or more ohms, so as to give any resistance of a whole number of ohms up to the desired amount. The terminals of each of the spools are two pieces of brass fixed on top of the box containing the spools, with a space between each piece for the insertion of conical brass plugs, and which serve to throw the spools in and out of circuit. This construction is that in common use.

My improvement consists in so constructing a rheostat that each and every spool shall have two wires side by side, instead of one. The ends of the first wire, *a*, of every spool are brought to their proper terminal pieces *b* on the right-hand side of the top of the box. The second wire, *c*, of every spool is brought to its proper terminal piece *d* on the left-hand side of the top of the box, as shown. By this arrangement the second wire, *c*, or inductive earth-circuit can be adjusted in the same manner as the first wire, *a*, or usual artificial lines in the same spool.

In Fig. 2 the rheostat as thus constructed is connected in duplex telegraphy as follows: The currents formed by each contact of the transmitter (not shown, as any will do) by the line 3 are divided into two parts, as shown at *e*, one portion going through a relay, C, to the main line 4, and operating the receiving-instrument at the distant station, the other portion passing through relay C to wire *a* (No. 1) of spools of rheostat, thence to earth E. The wire (No. 2) *c* is also connected to earth.

In using the improved rheostat as thus constructed the first wire, *a*, of the spools is used for the artificial line or resistance in precisely the same manner as is usual. Both terminals of the second wire, *c*, of the spools are connected with the earth, and in consequence of such connection the artificial line *a* or resistances are brought into close proximity through any portion or throughout its entire length, and thereby by proper adjustment an electro-static condition is, so far as practical results are concerned, established in it—the artificial line. By this new, and I believe novel, arrangement in the rheostat of an adjustable earth-circuit alongside of or in close proximity to that of the artificial line *a*, or any portion thereof, as stated, the latter line *a* can be made to have an in-

ductive capacity proportional to that of the main line, and when the proper adjustments are made upon both wires *a* and *c* of the rheostat the charge and discharge currents take place equally upon the main and artificial lines and transmission of false signals is entirely obviated. All changes in the main-line insulation are compensated for by adjusting the resistances of the earth-circuit—that is to say, suppose the resistance of the artificial line *a* to be six thousand ohms corresponding to that of the main line, all insulation variations can be balanced by adjusting the resistance of the earth-circuit *c* anywhere from one ohm up to six thousand ohms, or more, if necessary.

I claim—

1. An adjustable artificial line or circuit which consists of the adjustable artificial line-circuit *a* and an adjustable artificial earth-circuit, *c*, both combined together in one or more spools, substantially as and for the purpose hereinbefore set forth.

2. A rheostat composed of a series of spools of adjustable resistances, each separate spool having two wires, *a c*, thereon, side by side, one representing the artificial line *a*, the other the earth-line *c*, and insulated from each other, and arranged and operating substantially in the manner and for the purpose herein specified.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

MADISON BUELL.

Witnesses:
J. R. DRAKE,
T. H. PARSONS.

G. LITTLE.

Improvement in Rheostats for Telegraphic Purposes.

No. 131,171. Patented Sep. 10, 1872.

Fig. 1.

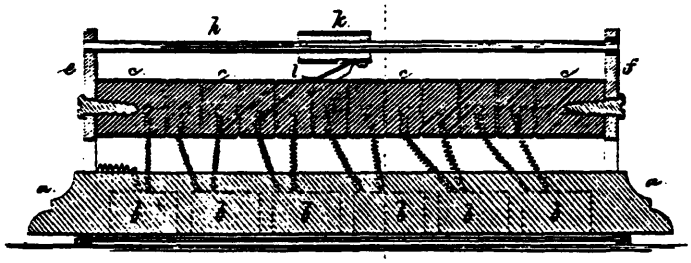


Fig. 3.

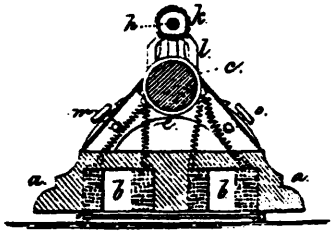
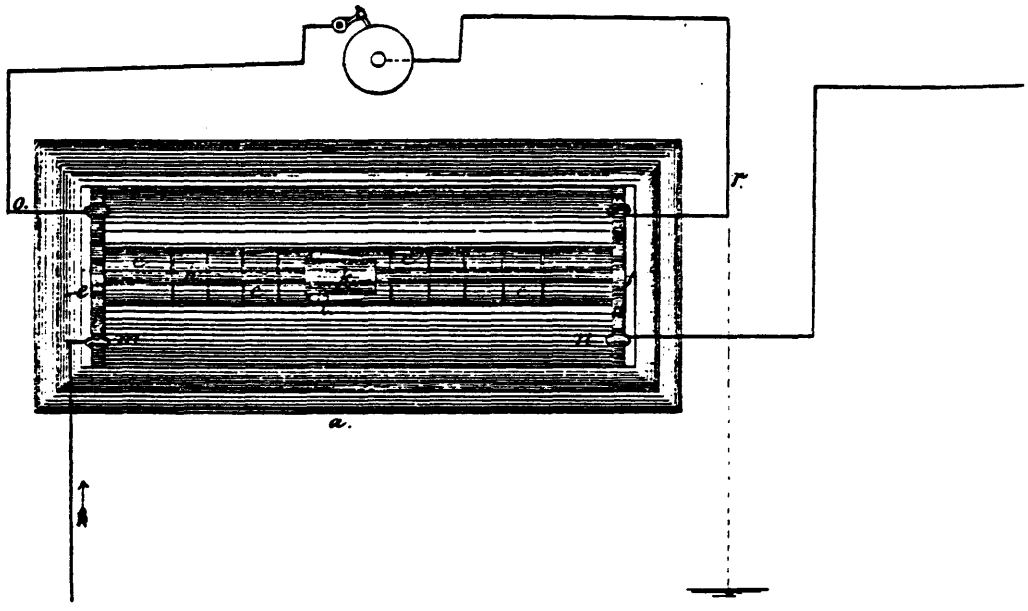


Fig. 2.



Witnesses,

Chas. H. Smith

Geo. D. Walker

Inventor

George Little.

Samuel W. Serrell

UNITED STATES PATENT OFFICE.

GEORGE LITTLE, OF RUTHERFORD PARK, NEW JERSEY.

IMPROVEMENT IN RHEOSTATS FOR TELEGRAPHIC PURPOSES.

Specification forming part of Letters Patent No. **131,171**, dated September 10, 1872.

Specification of Improvements in Rheostat for Telegraphic Purposes, invented by GEORGE LITTLE, of Rutherford Park, Bergen county, New Jersey.

Rheostats have heretofore been employed to regulate the force of the electric current directed into the main line or into a telegraph instrument, and the proportion of that current returned to the battery or to the ground or other connection in the circuit. In these instruments the springs or arms of the adjuster, bearing upon the surface of the helix, and being moved back and forth (often unnecessarily) by the operator, sometimes injure the delicate wires of the helix; besides this the surfaces of these wires are exposed to atmospheric influences and the insulation is sometimes rendered imperfect.

My invention consists in a range of separate helices connected to insulated plates or rings in combination with the metallic heads and sliding adjuster, whereby one or more of the said helices can be brought as a resistance into the line to regulate the relative force of branch or shunt circuits.

In the drawing, Figure 1 is a vertical section of the said rheostat. Fig. 2 is a plan of the same, and Fig. 3 is a cross-section.

In the base *a* there are introduced wire coils or helices *b b*, of any desired character and resistance, and the wires from these pass up and connect alternately to the insulated rings *c c* that are upon a tube or bar of hard wood, ebonite, or other non-conducting material, that is supported between the heads *e* and *f*; or, in place of the rings, plates may be employed upon an insulated bar. The rod *h* is sustained by the heads *e f*, but insulated at the head *f*, and upon this rod *h* is the adjuster *k*, made with prongs or forks *l* that bear upon the surface of the insulated rings *c c* or plates. The battery or line wires are connected at *m* and *n*, and the wires at *o* and *r* lead to the instrument; or the connections may be made in any of the modes usual where a rheostat is employed. The first helix *b* is connected with the head *e* and with the first ring *c*; the second helix is connected with the first and second rings; the third with the second and third, and so on; and the last helix with the last ring and the next to the last; hence, if the adjuster *k* is near the head *e*, the electricity will pass through all the helices to reach the head *f*, because the rod *h* is insulated at the head *f*, and thereby there would be the entire resistance of the coils to the circuit between the respective heads, and the circuit would be directed off through the line or other wire; and by positioning the adjuster so more or less of the helices will be brought into the circuit.

When the adjuster is moved contiguous to the head *f*, then there will be but little resistance, as the current will pass from the head *e* through the adjuster-rod *h* and the head *f* to the binder *n*. The fingers of the adjuster are not of the same length, and will bear upon two rings in passing from one to the next; hence there will not be any interruption in the flow of the current by the act of adjustment. The helices might be placed within the rings and connected, as aforesaid, thereby rendering the apparatus more compact. The return-wire from the instrument may be connected to the head *f*, as shown, and thence the circuit be completed by an earth-connection; or else the return-wire may go direct to the earth-connection, as represented by dotted lines.

I claim as my invention—

A series of helices connected to insulated plates or rings, substantially as set forth, in combination with a sliding adjuster, substantially as set forth.

Signed by me this 10th day of July, A. D. 1872.

GEORGE LITTLE.

Witnesses:

GEO. T. PINCKNEY,

CHAS. H. SMITH.

(No Model.)

S. D. FIELD.

Rheostat.

No. 242,092. Patented May 24, 1881.

Fig: 1.

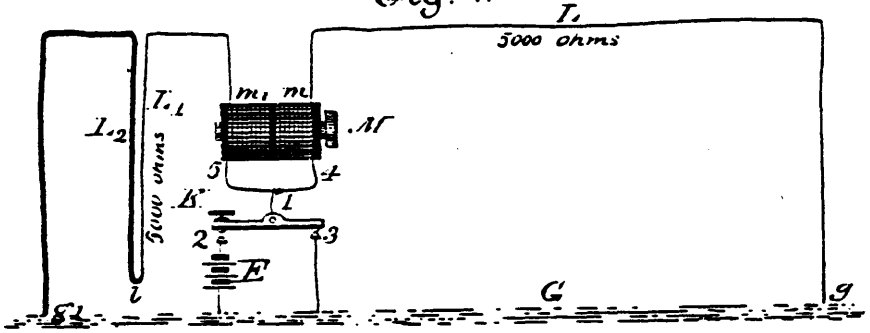


Fig: 2.

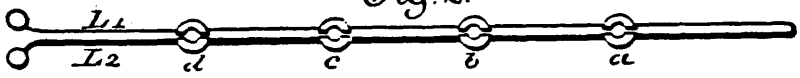


Fig: 3.

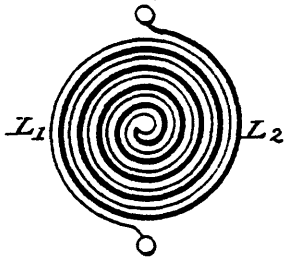


Fig: 5.

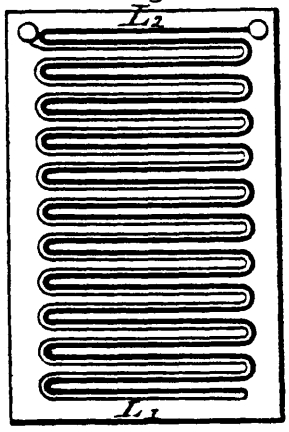
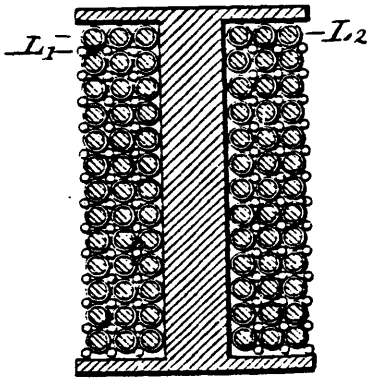


Fig: 4.



Witnesses;

Mrs. F. Lockwood French.

Miller & Earl

Inventor

Stephen D. Field,

by his Attorneys

Frank L. Pope

UNITED STATES PATENT OFFICE.

STEPHEN D. FIELD, OF NEW YORK, N. Y.

RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 242,C92, dated May 24, 1881.

Application filed April 1, 1881. (No model.)

To all whom it may concern:

Be it known that I, STEPHEN D. FIELD, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Rheostats for Duplex Telegraphs, of which the following is a specification.

My invention relates to certain improvements in apparatus for the transmission of independent telegraphic signals simultaneously from opposite ends of the same line.

The object of my invention is to neutralize or prevent the production of the false signals which tend to be manifested upon the receiving-instrument at the transmitting, or, as it is technically termed, the "home," station, by the so-called "static discharge," which consists in the sudden escape to earth of a quantity of electricity stored up or accumulated upon the main line by inductive action during the outward flow of the electric current, which takes place when a telegraphic signal is transmitted.

The invention relates more particularly to an improved construction of the rheostat which constitutes the equating-circuit, commonly termed the "artificial line;" and it consists in forming the said rheostat of two parallel conductors, placed in close proximity to and insulated from each other, the said conductors being of substantially equal length, but having different resistances. These are joined together at one end to form a loop, which is inserted in the artificial line and forms the principal portion thereof.

In the accompanying drawings, Figure 1 is a diagram illustrating the principle upon which my apparatus is constructed. Fig. 2 is a diagram showing the manner in which the length of the artificial circuit may be varied. Figs. 3, 4, and 5 show different modifications in the construction of my apparatus.

In Fig. 1 I have represented one terminal station arranged for duplex transmission according to the ordinary method, together with a line extending to the earth at the distant station.

K is an ordinary open circuit or three-point key, the rear contact-stop, 3, of which is connected directly to the earth, while the front contact-stop, 2, is connected to one pole of a battery, E, the other pole of which is to earth.

m m' are the two equal and opposing helices of a differential electro-magnet, M, which actuates the receiving-instrument. When the key K is depressed and brought in contact with its front stop, 2, a current from the battery E passes through the key to the point 1, where it divides, one portion going by the wire 4, through the helix *m*, over the line L, to the distant station, and thence to the earth at *g*, returning through the earth to the opposite pole of the battery. In like manner the remaining portion of the current goes, by the wire 5, through the helix *m'*, thence through the artificial line $L' L^2$ to the earth at *g'*, and thence returns in like manner to the other pole of the battery. This latter branch circuit is technically termed the "artificial line" in order to distinguish it from the main line, which extends to the distant station. If the resistance of the artificial line be so adjusted as to be approximately the same as that of the main line, the current transmitted by the key will divide at the point 1 into two equal portions, which will produce equal or opposite electro-dynamic effects upon the armature of the electro-magnet M, and the said armature will therefore remain at rest when the key K is depressed, notwithstanding that a current is passing over the line L to the distant station. If, however, the distant station transmits a current from its own battery (not shown) at the same time, the strength of the current in the main line is augmented by the combined action of both terminal batteries, its electro-dynamic effect overpowers that of the current of the artificial line, the armature of the electro-magnet M is attracted, and a signal produced at the home station. Thus it will be understood that the receiving-instrument at the home station responds only to currents or signals coming from the distant station, and not to those transmitted by the key at the home station, and consequently the two stations, when provided with similar apparatus, can transmit signals simultaneously to each other without interference, the receiving-instrument at each station, although at all times traversed by the current of the main line, responding only to the signals produced by the transmitting-key at the other station.

In order to produce the result hereinbefore

set forth it is obviously essential that the resistance of the artificial line should be as nearly as possible equal to that of the main line. This has heretofore been effected by placing one or more rheostats in the artificial line. These consist of a suitable length of comparatively thin wire, preferably made of some metal which is a poor conductor of electricity. A sufficient length of such wire is wound upon one or more spools or bobbins, and so arranged in connection with commutators that any required length of it may be included in the circuit of the artificial line. By this means an equal division of the current from the battery E between the main and artificial lines may be readily brought about.

Having thus explained the construction and mode of operation of an ordinary duplex-telegraph apparatus, I will next describe the nature of my present improvement, and the manner of its application thereto in the best manner now known to me.

It is well known that an insulated telegraphic line-wire of considerable length, whether suspended above the earth or submerged beneath the water, is capable of accumulating or storing up a quantity of electricity while connected with a source of electricity. This property of an insulated conductor is termed its "inductive" or "electrostatic" capacity, and the electricity so stored up and retained is called the "static charge" of the conductor. The electrostatic capacity of the insulated conductor is a quantity depending upon the extent of its superficial area, and upon the thickness of the non-conducting space which separates it from the earth, or from other conductors in electric connection with the earth, which insulating-space is called the "dielectric." Thus in the case of an ordinary telegraph-line suspended upon poles in the air the earth and the surrounding objects connected therewith—such as buildings, trees, and the like—form the outer inductive surface, while the air constitutes the insulating medium or dielectric surrounding the conductor. In the case of a submarine cable the insulating-coating of gutta-percha constitutes the dielectric, and the iron armor of the cable, or the surrounding water, as the case may be, the outer inductive-surface. It will appear, therefore, from the hereinbefore-mentioned considerations, that when a long line of telegraph is connected with the battery by depressing the key at the sending-station, as for the purpose of transmitting a signal, the line will acquire a considerable static charge. At the completion of the signal, when the key is raised, the line is first disconnected from the battery and immediately afterward connected directly to the earth at the home station, whereupon the accumulated induced electricity stored up in the line will suddenly escape to the earth, traversing one coil of the electro-magnet M of the home receiving-instrument, and producing what is termed the "static discharge." If the rheostat and the artificial line in which it is placed have practically no electrostatic capacity, there will be no corresponding discharge from the artificial line through the opposing coil of the electro-magnet M, and consequently an extra or false signal of short duration will be produced by the uncompensated action of the static discharge of the main line in the electro-magnet.

I have discovered that the disturbing effects of the static discharge from the line upon the apparatus at the home station may be compensated or neutralized by an improved construction of the equating-rheostat which constitutes the principal portion of artificial line, by which method of construction it is placed under electrical conditions corresponding to those of the main line.

In Fig. 1 the main circuit consists of a line-wire, L, which we may assume to have a total resistance of, say, five thousand ohms, extending to the distant station, and of the earth G, which constitutes the parallel return-conductor, and which has little or no resistance. Now let the artificial line L′ in like manner be constructed of a thin wire composed of metal of inferior conductivity, but of sufficient length to offer a resistance of five thousand ohms, and let this be joined at the point *l* to another conductor of very small resistance, L^2, laid parallel with it and extending to the earth at *g′* or to the other pole of the battery. It is obvious that an inductive action must take place between the conductors L′ and L^2 of the artificial line, which will correspond in its nature to that which takes place between the main-line conductor L and the earth G beneath it, and that these effects will balance or neutralize each other in the opposing coils *m* and *m′* of the receiving-magnet M. I avail myself of this principle in the construction of my improved rheostat, which consists of a conductor of great resistance and a conductor of little resistance, equal in length, placed parallel to each other and properly insulated. The construction and arrangement of the rheostat may be modified in various ways, according to circumstances. It may be rolled up in a flat spiral, as shown in Fig. 3, or upon a bobbin, as shown in Fig. 4. I consider it preferable, however, to lay it to and fro upon a plane surface, as shown in Fig. 5. The particular arrangement, however, may be varied in many ways, so long as the principle is kept in view.

The electrostatic capacity of the open-air line L varies materially in different conditions of the weather, being much greater in cold or dry weather, when the insulation is good, than in wet or damp weather, when the insulation is poor. It results from this that the effect of the static discharge upon the home instrument is much greater at some times than at others. As the artificial line is not exposed to these changes in the weather, its electrostatic capacity and the force of its discharge remain practically constant. Hence, unless some means are provided for adjusting this, the

compensation will frequently become very imperfect. I therefore prefer to arrange my rheostat in a greater or less number of sections, in the manner indicated in Fig. 2, with peg-commutators or other equivalent devices placed between the sections, as shown at *a*, *b*, *c*, and *d*, whereby the length and resistance of the operative portions of the artificial line may be varied at pleasure, and its electrostatic capacity likewise varied at the same time in corresponding ratio.

I do not desire to limit myself to the use of the rheostat constructed substantially as set forth exclusively in connection with the particular form of duplex telegraph hereinbefore described, as it may be employed with equally good results in combination with many other known forms of such apparatus. The modifications necessary to adapt it to such use will readily suggest themselves to those skilled in the art without further description.

I claim as my invention—

An equating-rheostat for duplex telegraphs, constructed, substantially as hereinbefore set forth, of two parallel conductors placed in close proximity to and insulated from each other, having substantially the same length, but different resistances, and joined together at one end to form a continuous conductor.

In testimony whereof I have hereunto subscribed my name this 31st day of March, A. D. 1881.

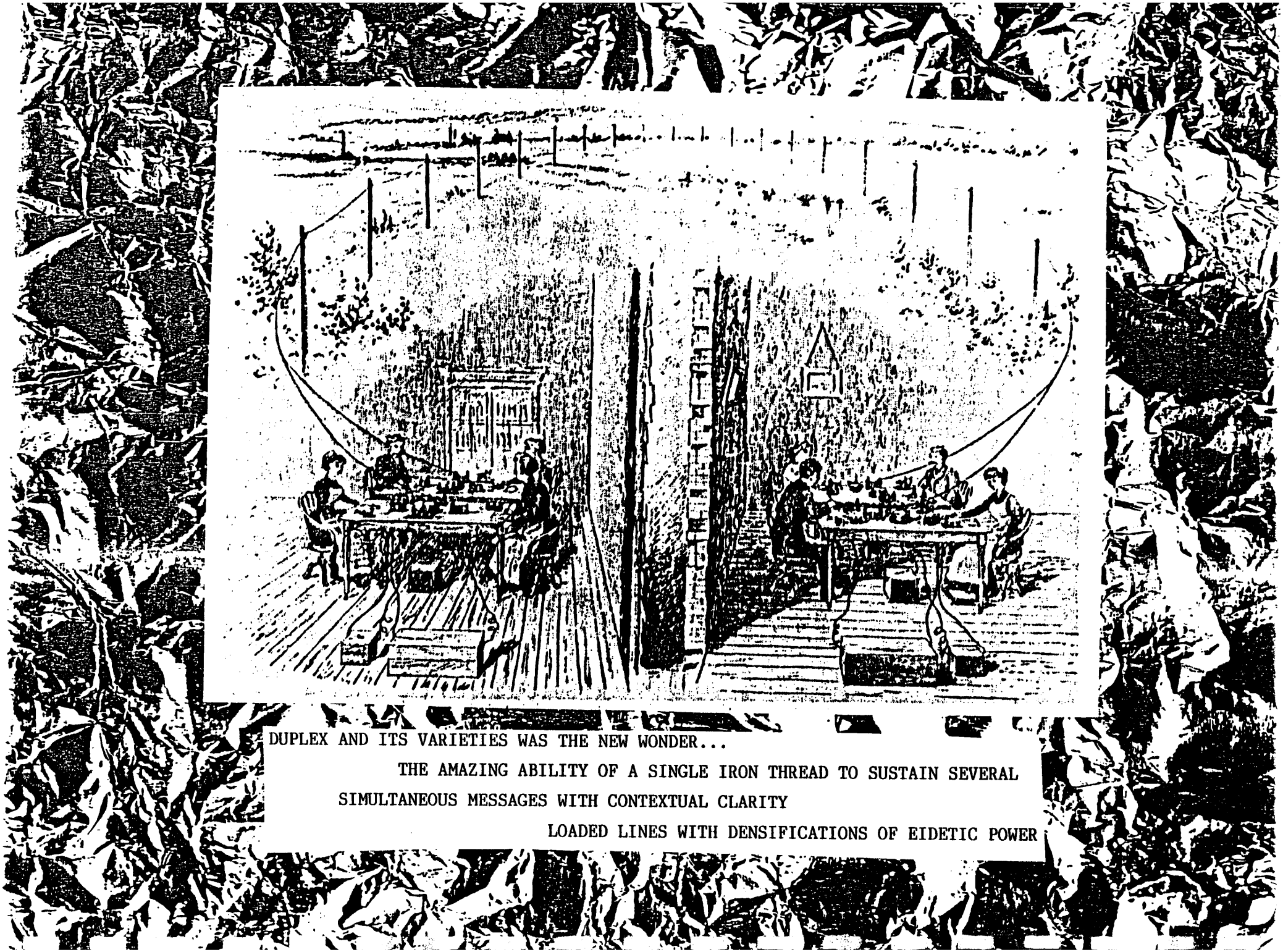
STEPHEN D. FIELD.

Witnesses:
MILLER C. EARL,
CHAS. A. TERRY.

SECTION 6

MULTIPLE RATE LOADS

Sending a telegram meant a stiff climb. The world's first paid telegrams were sent from Telegraph Cottage at Slough on 16 May 1843.



DUPLEX AND ITS VARIETIES WAS THE NEW WONDER...

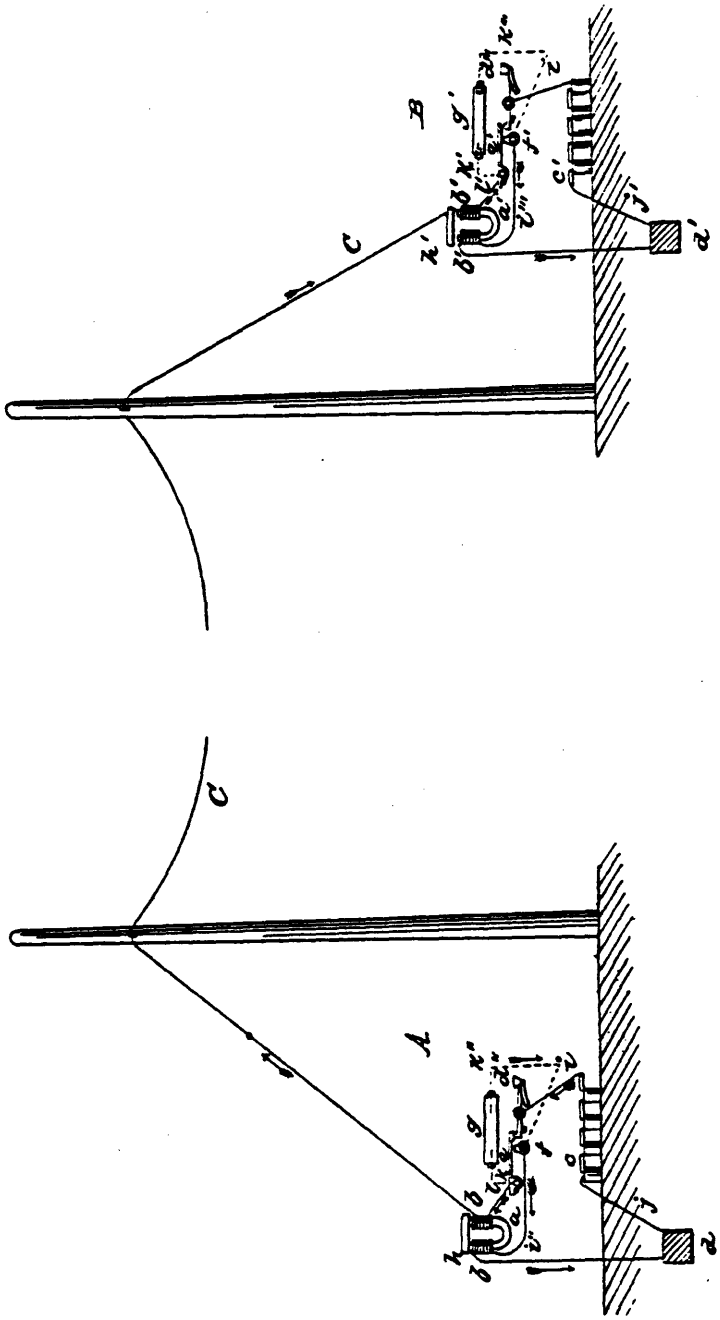
THE AMAZING ABILITY OF A SINGLE IRON THREAD TO SUSTAIN SEVERAL SIMULTANEOUS MESSAGES WITH CONTEXTUAL CLARITY

LOADED LINES WITH DENSIFICATIONS OF EIDETIC POWER

D. E. HUGHES.

Duplex Telegraph.

No. 22,531. Patented Jan. 4, 1859.



Witnesses.
S. H. Maynard
George Talbot.

Inventor.
D. E. Hughes
By his Attorneys
Lemuel W. Serrell

UNITED STATES PATENT OFFICE.

DAVID E. HUGHES, OF NEW YORK, N. Y., ASSIGNOR TO THE AMERICAN TELEGRAPH COMPANY.

IMPROVEMENT IN ELECTRO-MAGNETIC TELEGRAPHS.

Specification forming part of Letters Patent No. 22,531, dated January 4, 1859.

To all whom it may concern:

Be it known that I, DAVID E. HUGHES, of New York, county of New York, and State of New York, have invented certain new and useful Improvements in Telegraphing; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being made to the annexed drawing, making a part of this specification, which is fully referred to by letters—that is to say—

My invention consists in certain improvements in that class of electric-telegraph apparatus whereby messages may be transmitted from both ends of a line over a single wire at the same time without interference. In the present plan of operation I employ the system of natural magnets and electro-magnets as patented to me on the 20th of May, 1856, although I do not wish to be limited to the mode or mechanism therein set forth, as my invention is also applicable to other systems. I shall use said patent and description in illustrating this invention so far as the same may be applicable thereto. The principle consists, chiefly, in retarding the current of electricity, whenever the circuit is closed by the operating-key, from arriving at the ground-plate nearest to the operator any sooner than the current which passes over the line-wire arrives at the distant ground-plate at the opposite end of the line. Since by using only a single line-wire every current of electricity sent over the same must necessarily pass through both telegraphic instruments, it will be seen that an operator would, unless provision were made to prevent it, write or print both upon his own telegraph-machine and at the distant one. By my invention and by the means above set forth the machine near the operator is not affected by the passage of the electric current through its electro-magnet, but the distant one is only operated upon.

The letters A and B represent two stations, being at each end of a single line-wire, suspended, as usual, upon poles, and as seen at C.

At *a* and *a'* are the soft-iron bars, inclosed within the coils *b* and *b'*, as described in my aforementioned patent.

At *c* and *c'* are the batteries, of usual construction; *d* and *d'*, the respective ground-plates.

At *d''* and *d'''* are operating-keys to close the circuit in connection with a signal-cylinder, as set forth in the said patent, and represented by the spring-finger *e* and *e'* as equivalents for the purposes of this description.

f and *f'* are the insulated supports upon which the spring-fingers rest, and which form the connecting-pieces for the circuit-current to pass to the opposite pole of the battery at the distant station when *e* and *f* or *e'* and *f'* are in contact.

Many substances may be employed to effect the desired retarding of the electric current, but the method which I have found most convenient is to employ the known property of fluids for that purpose, and my invention will therefore be described with reference to the use of water.

At *g* and *g'* is seen the retarding apparatus, and, as represented, it consists of a cylinder of glass stopped at both ends, and is to be filled with water, as being the most convenient fluid to be employed. Conducting-wires pierce the corks and terminate a little within said cylinders. These wires are to be capable of being pushed in or out, so that the distance at which their ends are from each other may be regulated, because the proper retarding of the electric current depends upon the distance these ends are apart, as compared with the length of line-wire intervening between the two stations A and B. The operation of this part, then, is to proportion the effect of water as a retarding medium with that of the line-wire, and it may, for the purpose of illustration, be stated to be a space of one inch between the ends of the wire in the retarded for every hundred miles of line-wire. Thus it will be seen that if the stations A and B were one hundred miles apart, in order that the current from the battery *c*, which flows through the retarder *g*, should reach the ground-plate *d* at the same moment that the current which passes over the line-wire C should reach the ground-plate *d'*, the ends of the conducting-wire within the retarder must be one inch apart. The time, therefore, of the passage of the current through the intervening column of water is retarded to the same that it took the current to pass over the wire C to *d'*. The application of this principle to telegraphing will now be explained.

The two permanent magnets or armatures *h*

and h' are held to the electro-magnets by the attractive force of the same, and are so retained as long as said force continues. When, however, the circuit is closed with the galvanic battery, the poles of the electro-magnet and those of the permanent magnets are made the same. The permanent magnet will then be no longer held, and consequently flies up by the force of the spring-power attached to it, as set forth in the said aforementioned patent. The clock-work is thus set in motion and a letter is printed, as therein described. These permanent magnets are seen at the letters h and h'. A current of electricity is now to be sent from A to B, the order of the conducting-wire being as follows: From one pole of each of the batteries c and c' there is a conductor, i i', leading to the signal-keys d'' and d'''. From the other pole are also two, j and j', leading to the ground-plates, as shown. From each spring-finger e and e' there are two conductors, one set, k and k', (shown in red lines,) leading to one end of the retarder, and the other set, l and l', leading to and connecting with one helix of the electro-magnet b and b', and from said helix to the line-wire C, as shown. From f and f' there are also two sets of conductors. The first, k'' and k''', lead into the retarders, and the second, i'' and i''', to the second of the helices b and b', and thence to the ground-plate, as shown.

The operation will now be as follows: First, the distance apart of the ends of the wire in the retarder must be adjusted, and for this the operator presses down the key d'' and thereby closes the circuit. If the permanent magnet h flies up, it shows that the current reaches the ground-plate d too soon, and the distance between the ends of k and k'' must be increased. This is done by pulling them apart until the magnet h is no longer acted upon. Press down d'', which raises the spring-finger e from the support f. The circuit will be thus established, and one of the currents of electricity immediately flows along i in the direction of the arrow to d'' and e. From e it divides into two branches, one along k through the retarder g, thence by the wire shown in red back to f, thence through one helix, as shown, and thence to the ground-plate d. The other portion flows through l and one helix, and so on the line-wire to the helix of the machine at the station B, thence through l' e' f' to the second helix and the ground-plate d'. As a' thus becomes an electro-magnet, the poles of which correspond with those of the permanent magnet h', the latter is released and is immediately raised by the force of its spring, all which takes place before the other portion of the current can flow through the retarder g to the ground-plate d and establish a like polarity for the electro-magnet b, consequently the permanent magnet still holds itself to the soft iron a. It will thus be seen that an operator can send an electric current through his own instrument, over the line-wire, to the distant instrument without setting his own instrument in motion. In case both operators happen to establish a current at the same moment, of course both permanent magnets would immediately fly up, and setting both machines in motion would print a letter, which letter will in all cases be of the same name at both stations, because the circuit on both machines can only be simultaneously closed when the cylinders of both machines and the type-wheels of each are to print the same letter—that is to say, if it happens that the operators at each end of the line were about to transmit the letter Z and thus should press the keys for that letter of their respective machines at the same instant, of course both would print said letter, for as the cylinder at station A runs in unison with the type-wheel at station B, and vice versa, (that of B in unison with the type-wheel at A,) both machines print a letter of the same name. If, however, the operators strike at the same instant the keys of different letters, it will be seen that they cannot interfere; for if the operator at A desires to print X on the B machine and the operator at B at the same instant desires to print Z on the A machine, it is obvious that two circuits will not at the same instant be established, for the current for the letter X will be sent first, and that letter printed on B's machine, while the circuit will not be established for B until his cylinder comes round, so that the Z-pin will strike his Z-key, when that letter will be printed upon the A machine, according to the principles described in my aforementioned patent.

I claim—

~~Introducing into that portion of the electric~~ current which passes to the opposite pole of the machine at the station where the operator is working a retarder, such substantially as herein described, whereby said portion shall not reach the near ground-plate until after the other portion of the same current shall have passed over the line-wire and reached the distant ground-plate, whereby said current is enabled to flow through the machine situated at the place of the operator, as aforesaid, without setting said machine in motion, substantially as described.

In testimony whereof I have hereunto subscribed my name.

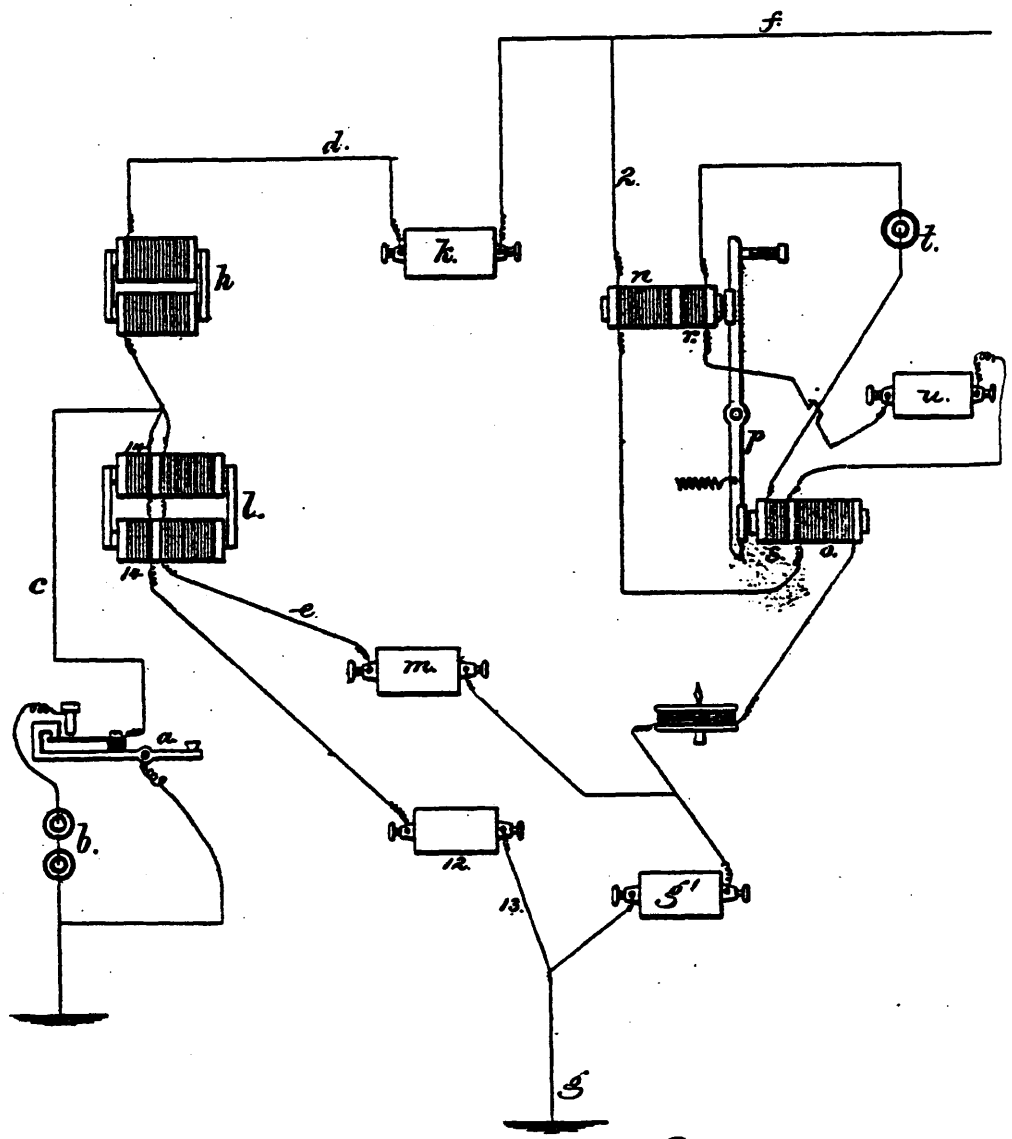
DAVID E. HUGHES.

Witnesses:
J. P. PIERSSON,
S. H. MAYNARD.

T. A. EDISON.

Duplex Telegraph.

No. 168,385. Patented Oct. 5, 1875.



Witnesses

Chas. H. Smith

Geo. E. Pinckney

Thomas A. Edison

per Lemuel W. Serrell

atty

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF NEWARK, NEW JERSEY.

IMPROVEMENT IN DUPLEX TELEGRAPHS.

Specification forming part of Letters Patent No. **168,385**, dated October 5, 1875; application filed January 26, 1875.

CASE 111.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Newark, in the State of New Jersey, have invented an Improvement in Duplex Telegraphs, of which the following is a specification:

The object of this invention is to more perfectly balance and neutralize the static discharge of the line, so that there will not be any false pulsations.

In the accompanying diagram the pulsation is given at the sending-station by the circuit-preserving key *a*, battery *b*, and connections *c* to the bridge-wires *d e* between the line *f* and earth *g*. In the portion *d* of the bridge is the electro-magnet *h* and rheostat *k*, and in the portion *e* is the electro-magnet *l* and rheostat *m*, and the receiving-instrument is placed in the circuit 2 between the two portions *d e* of the bridge. Said receiving-instrument is made of two electro-magnets, *n o*, that are placed at opposite sides and ends of the armature-lever *p*, so as to act thereon in unison with each other, and the cores of these electro-magnets are extended and surrounded with the additional helices *r* and *s*, that are in a local circuit from the battery *t*, and provided with a rheostat, *u*, the object of this being to set up a sufficient magnetizing power in the helices of the local circuit to neutralize in the cores the magnetism that may result from permanent currents upon the line, thereby balancing such currents, and leaving the receiving-instrument free to respond to the pulsation from the distant instrument. This local circuit and helices also serve to neutralize any residual magnetism in the cores. This arrangement of electro-magnets and helices in a local circuit is not herein claimed, and it is set forth in a previous application made by me.

The electro-magnets *h l* set up in the triangular or bridge-circuit *d e* 2 a secondary current when the circuit from *b* is broken, so as to neutralize the static discharge from the line *f* and artificial line *g g'*.

In consequence of the differences of condition between the actual line *f* and the artificial line *g g'*, it is difficult to adjust the rheostats *k m g'* so as to perfectly neutralize the static discharges, and equalize their action in the bridge *d e*, so that the receiving-instrument will be at a neutral point. To facilitate this operation we make use of a second artificial line, formed of a rheostat, 12, earth-connection 13, and helices 14, around the cores of the electro-magnet *l*, so that, the pulsation from *c* dividing, a portion goes through 14, 12, and 13, as well as through *h* and *l*, the result of which is that the cores of *l* are more highly energized than of *h*, and the reactionary or secondary current set up in *e* by *l* is increased to whatever extent may be required to equal the static discharge from the line circulating through *d* and the receiving-instrument.

I claim as my invention—

The electro-magnets *h* and *l*, placed in the bridge-circuit between the sending-instrument and the line and artificial lines, respectively, in combination with the second artificial line 12 13 and the helices 14 around the cores of the electro-magnet *l*, for the purposes set forth.

Signed by me this 18th day of January, A. D. 1875.

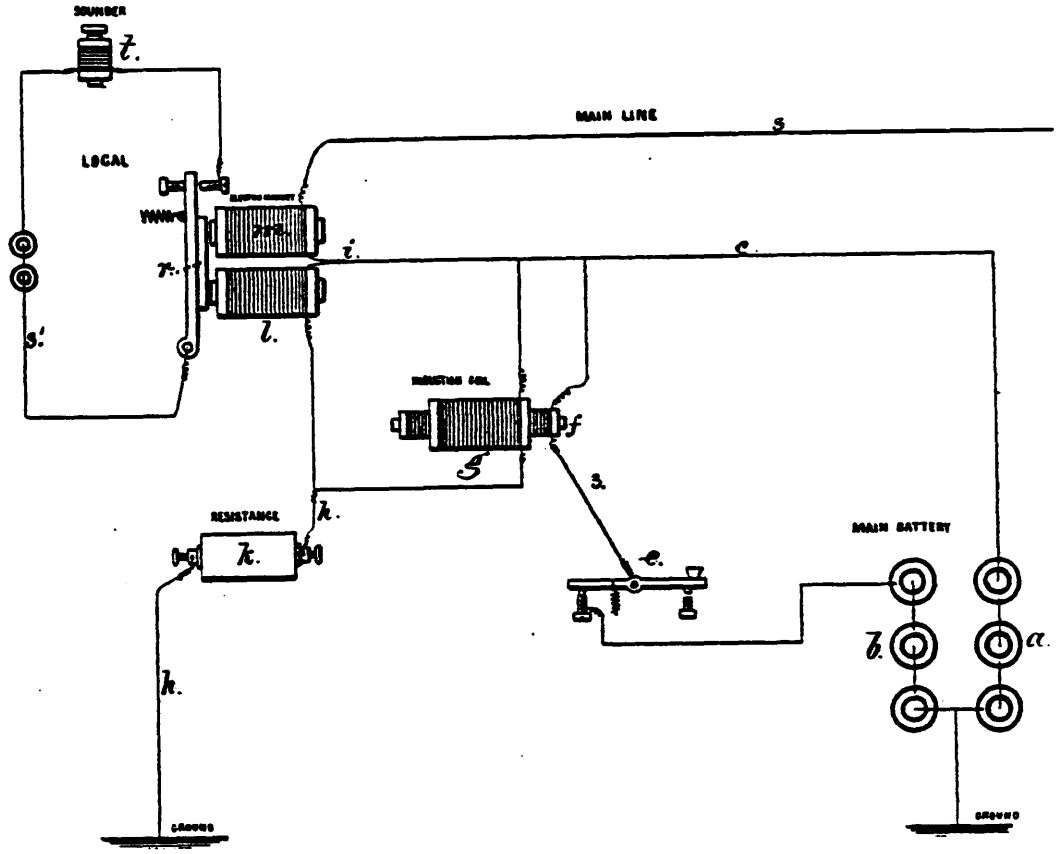
THOS. A. EDISON.

Witnesses:
GEO. T. PINCKNEY,
CHAS. H. SMITH.

T. A. EDISON.

DUPLEX TELEGRAPH.

No. 178,222. Patented May 30, 1876.



Witnesses

Chas. H. Smith

Harold Sewell

Inventor

Thomas A. Edison

per Lemuel W. Serrell

atty

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF NEWARK, NEW JERSEY, ASSIGNOR OF ONE-HALF HIS RIGHT TO GEORGE B. PRESCOTT, OF NEW YORK CITY.

IMPROVEMENT IN DUPLEX TELEGRAPHS.

Specification forming part of Letters Patent No. **178,222**, dated May 30, 1876; application filed September 1, 1874.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Newark, in the county of Essex and State of New Jersey, have invented an Improvement in Duplex Telegraphs, of which the following is a specification:

A balanced battery is used for transmitting when the balance is disturbed. An electro-magnet is used, through which both the received and transmitted pulsations pass, and the connections are made so that the action of the current sent is balanced, while that coming from the distant station is operative, to work a balanced relay and local circuit or sounder.

In the accompanying diagram drawing, the battery *a b* is connected at an end to the line-wire *c*, at the other end to the closed key *e*, and in the middle to the ground. The connection 3, from the key *e* to the line *c*, passes through the induction-coil and core *f*, and there is a second induction-coil, *g*, around the coil *f*, that is in a shunt between the line-connection *c* and the branch *h* to the ground, in which branch *h* there is a resistance, *k*, that is adjustable.

The line-connection *c* bifurcates at *i*, passing one way through the helix *l* to the ground-branch *h*, and the other way through the helix *m* to the main line *s*. The electro-magnet *l m*, being wound in the usual way, will not respond when the connection is made in the middle, because the current passing from *e* goes one way through one helix, and the other way through the other, polarizing the cores, so that the armature *r* is not attracted.

It is important that the resistance of the branch *h* and rheostant *k* should be about the same as that of the main line *s*, so as to cause the current to divide equally at *i*.

It will now be understood that any current from the distant station passing through the magnet *m*, in the usual direction, will cause the armature to respond, whether there is any current passing through the helices or not from the sending-station, and this electro-magnet *m* and armature act as a relay to operate the local circuit *s'* and sounder *t*.

The main battery, it will be seen, is in a local circuit when the key *e* is closed; hence, if both sides are equal, there is no current passing upon the main line; but when the key *e* is open the local circuit is broken, and the portion *a* of the battery sends the pulsation through *l* and *m*, and upon the line *s*, to the distant station, where the pulsation passing through *m* operates the local and sounder or receiver, the portion through *l* returning to *a* through the branch *h* and ground.

When the key *e* is closed the induction-coil *f* is charged, and it discharges when the key *e* is opened. The helix *g*, that has been charged by induction, also discharges, and sets up in *l* a current that equals that resulting from the static charge of the line, and the reverse currents are produced in the induction-coils as the circuit is closed at *e*. Thus such induction-coils serve to neutralize or balance the effect of the static charge, and prevent any false pulsation on the main line resulting from the return static charge acting in *m*.

It will be apparent that the closing of the key *e* and the connecting of the battery *b* with the line tends to set up in the line and to earth currents of opposite polarity to those resulting from the battery *a*, because the positive of the one and the negative of the other are to the ground and line, respectively, and this local circuit (*c a* 3 *e b*) serves to maintain an unbroken connection, that offers but little resistance to the pulsation from the distant instrument passing to the earth, and the resistance is nearly uniform to the current received, whether there is a current that is being sent or not.

I claim as my invention—

The battery *a b* in a local circuit, connected to the line, in which is a circuit-breaker, a finger-key, in combination with the magnet *l m*, branch *h*, and resistance *k*, and the induction-coils *f g*, the parts operating substantially as set forth.

Signed by me this 19th day of August, A. D. 1874.

THOS. A. EDISON.

Witnesses:

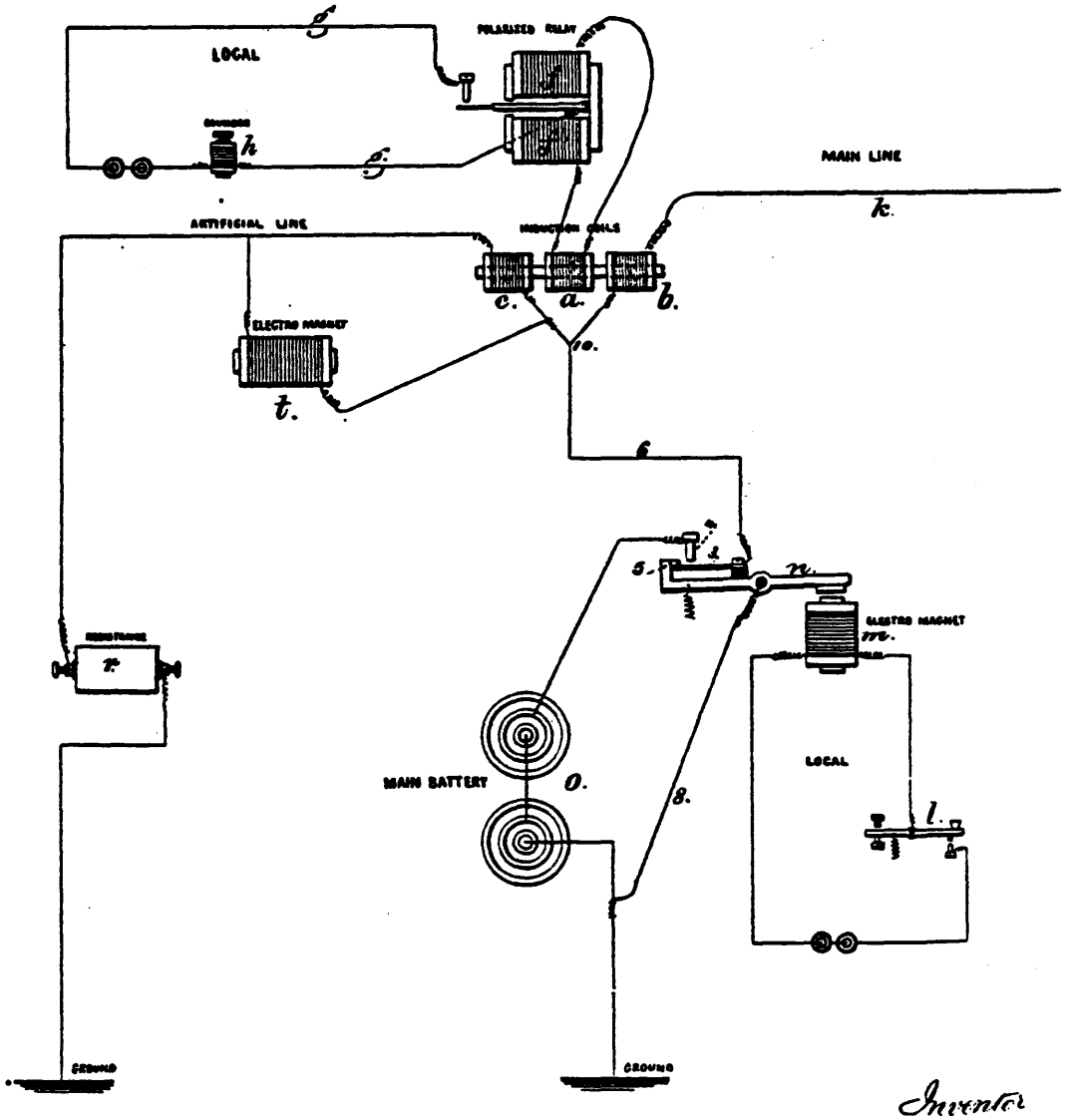
CHAS. H. SMITH,

GEO. T. PINCKNEY.

T. A. EDISON.

DUPLEX TELEGRAPH.

No. 178,221. Patented May 30, 1876.



Witnesses

Chas. H. Smith

Ronald Sinell

Inventor

Thomas A. Edison.

per Lemuel W. Serrell

atty.

UNITED STATES PATENT OFFICE

THOMAS A. EDISON, OF NEWARK, NEW JERSEY, ASSIGNOR OF ONE-HALF HIS RIGHT TO GEORGE B. PRESCOTT, OF NEW YORK CITY.

IMPROVEMENT IN DUPLEX TELEGRAPHS.

Specification forming part of Letters Patent No. 178,221, dated May 30, 1876; application filed September 1, 1874.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Newark, in the county of Essex and State of New Jersey, have invented an Improvement in Duplex Telegraphs, of which the following is a specification:

I make use of a compound induction-coil, through which the currents pass, and those from the sending-station are balanced, but the current from the distant station is operative.

The helix *a* surrounds the central part of the core that passes through the electro-magnets *b* and *c;* hence a secondary or induced current is set up in the helix *a* only when there is an excess of current in one of the helices *b* or *c*, because if the current acting in *b* is equal to that acting in *c*, and the helices are properly wound, the magnetizing actions of the helices on the core will neutralize each other, and there will not be any secondary or induced current in *a;* but when the current in one helix is greater than that in the other, the core will be magnetized, and a secondary current set up in the helix *a*.

I avail of this feature of the compound differential induction-coil to operate a duplex-telegraph instrument, by causing the current at the sending-station, where this compound differential instrument is placed, to divide and act equally in both *b* and *c;* but when the current from the distant station increases the energy of the helix *b*, then the induction or secondary current set up in the helix *a* magnetizes the core sufficiently to set up a current in *a*.

The current in *a* operates in the polarized magnet *f* to open and close the local circuit *g*, in which is placed the receiving or sounder instrument *h*.

When the pulsation passing along the line *k* from the distant station ceases, the core of the helix *b* demagnetizes, and in so doing sets up a second induced current in *a* of opposite polarity to the first, and that acting in the polarized magnet *f* instantly throws the contact-point of the armature the other way and opens the local circuit.

These operations in the compound differential induction-coil being borne in mind, it now becomes necessary to explain the manner of sending through such coils without producing any action on the helix *a*.

The key *l* in the local circuit to the magnet *m* operates the lever *n*, that contains an insulated spring-closer, 3, acting against the circuit-point 4, and the hook end 5 of the lever *n*, so that when the key *l* is closed, the lever *n* moves the spring 3 into contact with 4, closing the circuit from the battery *o*, through 4 3 and the wire 6, to the helices *b* and *c*, and at the same time breaking the contact of 3 and 5, and hence cutting out the ground-wire 8 from the lever *n;* but the moment the lever *n* returns to its normal position by the demagnetizing of *m*, the spring 3 closes the circuit at 5, just before separating from 4; hence there is always a metallic circuit complete for the pulsation coming from the distant station, whether the circuit of the sending-battery *o* is opened or closed.

In order to balance the action of the sending-current, that divides at 10, and passes through *b* and *c*, I introduce, in connection with the helix *c*, an artificial line equal in resistance and conditions to the line *k*, hence compelling an equal current to pass through *b* and *c*. To effect this the resistance *r* is placed in the ground-connection from *c*, which resistance should be adjustable, so that the rheostat or resistance *r* equals the line; and in order to set up in *c* a counter magnetism equal to that set up in *b* by the static from the line, I make use of the electro-magnet *t*, placed in a shunt that passes around *c*.

By this construction of compound differential induction-coil, and the arrangement of the connections, the inductive effects of pulsations from the sending-instrument are balanced and neutralized, while the pulsations from the distant station operate the receiving-instrument.

I claim as my invention—

1. The compound differential induction-coils *a b c*, in combination with the polarized relay *f* and the circuit-connections, substantially as set forth.

2. The artificial line, composed of the rheostat *r* and magnet *t* and ground-connection, in combination with the compound induction-coil and line-connections, substantially as set forth.

Signed by me this 19th day of August, 1874.

THOS. A. EDISON.

Witnesses:

CHAS. H. SMITH,

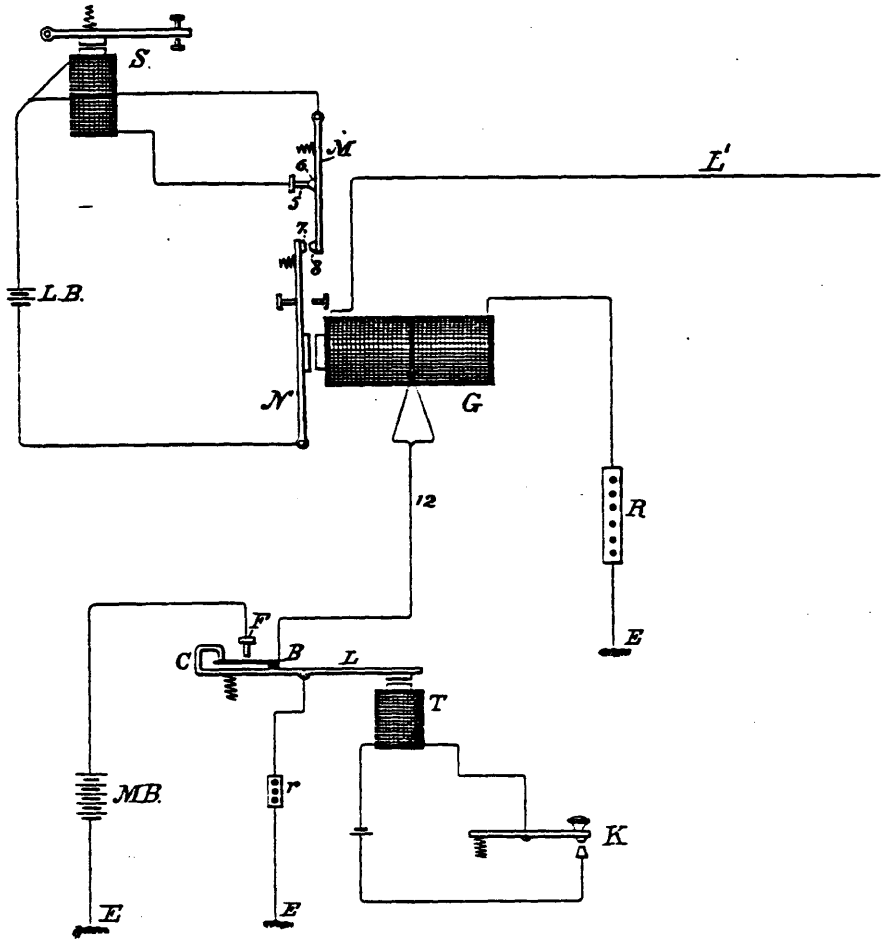
GEO. T. PINCKNEY.

(No Model.)

B. THOMPSON.

DUPLEX AND MULTIPLEX TELEGRAPH.

No. 264,372. Patented Sept. 12, 1882



ATTEST:

Julian A. Hundle.

Thos. Tormey

INVENTOR:

B. Thompson

by H. B. Townsend

Atty.

UNITED STATES PATENT OFFICE.

BENJAMIN THOMPSON, OF BUFFALO, NEW YORK.

DUPLEX AND MULTIPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 264,372, dated September 12, 1882.

Application filed May 18, 1882. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN THOMPSON, a citizen of the United States, and lately a resident of Toledo, in the county of Lucas and State of Ohio, but now a resident of Buffalo, Erie county, New York, have invented certain new and useful Improvements in Duplex and Multiplex Telegraphs, of which the following is a specification.

My invention relates to telegraphic apparatus designed for the simultaneous transmission of messages in opposite directions over the same wire; and the object of my invention is to obviate the disturbing effects upon the receiving-instruments which accompany the charge and discharge of the main line.

In all duplex and multiplex telegraphs in which the outgoing signals are prevented from affecting the receiving-instruments at the home station by the employment of an artificial line the resistance of which is adjusted to correspond to that of the main line, so that the currents for outgoing signals shall divide equally between said lines, an obstacle to correct working arises from the fact that at the beginning of the outgoing signal more current flows to the main line than through the artificial line, although after the current is fully established it will flow in properly-proportioned quantities. Owing to this momentarily greater flow to line the receiving-instruments at the home station are often caused to give a false signal. A greater difficulty is that caused by what is known as the "static discharge of the line," which also causes false signals.

My aim is to overcome the above difficulties by a simple arrangement of the receiving-instruments, and without recourse to condensers and artificial arrangements for producing in the artificial line a static capacity and static discharge resembling that of the main line.

In carrying out my invention I employ a differentially-wound reading-sounder, and for the front contact of the relay-armature lever I use a supplemental lever connected to one of the differential coils of the reading-sounder and normally resting against a stop connected to the other differential coil. Said supplemental lever is held against its stop by a spring applied so as to resist the action of the armature-lever when drawn forward by the relay electro-magnet, while the armature-lever itself is connected to one pole of the local battery for the reading-sounder, and in its position of rest does not complete the connection of either differential coil. When said lever is drawn forward it first comes into contact with its supplemental lever, and if the force drawing it forward be not sufficiently strong or prolonged it will fail to separate said supplemental lever from its stop, so that the only effect will be to close a circuit through both coils of the differentially-wound sounder, which latter will therefore be unaffected. If the current in the relay-magnet be sufficiently strong and prolonged, the tension of the springs on the armature-lever and the supplemental lever will be overcome, and the supplemental lever will be carried away from its stop, so as to break the circuit of one differential coil, whereupon the other coil, the circuit to which is already closed, will immediately act and cause the sounder-lever to be attracted. The movements of the armature-lever, caused by abnormal action of the relay-magnet, due to the disturbing influences before mentioned, although sufficient to bring the armature-lever into contact with its front contact supplemental lever, are insufficient, when the spring of the latter is properly adjusted, to carry said lever away from its stop. Incoming or signaling currents, however, which should cause the sounder to operate, act with sufficient strength to cause said supplemental lever to break the circuit of one of the differential coils, whereupon the current flowing through the other, and which began to flow at the moment that the armature-lever made contact with the supplemental lever, will cause the operation of the sounder.

Having described the general principles of my invention, I will proceed to describe one construction of apparatus for carrying the same into effect, and for the sake of simplicity shall show it applied to the receiving-instrument of a differential duplex telegraph, operating upon the plan commonly attributed to Frischen and Siemens-Halske, although it is to be understood that the invention is not limited in its scope and is applicable to the receiving-instruments of duplex, quadruplex, or multiplex telegraphs of all kinds in which the effects of static discharge from the main line upon the

receiving-instrument are a source of confusion, or in which the difference of static capacity of the main and artificial lines causes a false signal from outgoing currents.

G represents a relay electro-magnet, having two coils wound in opposite directions—one of which coils is in the circuit from the transmitter and battery to earth at the transmitting-station, through an artificial resistance, R, adjusted to equal the resistance of the main line, while the other coil is in the main-line circuit L'. These circuits and connections are clearly indicated in the diagram 12, being the wire connected to the transmitter.

L indicates the lever of the transmitter, which is operated in the usual manner by an electro-magnet, T, in a local circuit with a key, K, and a local battery. Said transmitter-lever carries a spring, B, insulated from the lever and connected to wire 12, and is provided with a hook, in contact with which the spring B normally rests, so as to complete a connection to earth for incoming currents through a resistance, *r*, connected to lever L, and of approximately equal resistance to the main-line battery MB.

F is the contact-stop for spring B, connected to the battery M B, so that when the lever L is operated by electro-magnet T the spring B, coming into contact with the stop F, completes the circuit from wire 12 to the main battery, the contact between B and C being simultaneously broken.

S represents the reading-sounder, which responds to signals from the distant end of the line. It is wound differentially, in a well-known manner, with two separate coils of wire connected at one end to one pole of the local battery LB and separately connected at their other ends, the one to a circuit-closing point, 6, through a lever, M, which carries and operates said point 6, and the other to a contact-stop, 5, with which the point 6 normally makes contact, the lever M being drawn toward said stop by a spring applied as indicated.

Upon the end of lever M is another circuit-closing point, 8, which forms in effect the front contact for the armature-lever N of relay G, said lever being provided with a circuit-closing point, 7, adapted to come into contact with the point 8 on M, thus completing an electric circuit between the local battery L B, connected to N, and that coil of the differentially-wound sounder that is connected to M, and also with the other coil through circuit-closer 5 6.

Armature-lever N is provided with the usual retracting-spring, as indicated, and also with the ordinary adjustable stops.

The operation of the apparatus shown is as follows: Signals sent by key K do not energize relay G, because the currents from battery MB circulate through its two coils in opposite directions. If, through the difference in the charge capacity of the main and artificial lines, the current in the coil connected to line (being momentarily greater than that in the coil connected to the artificial line) cause the core of the relay to be energized and to attract lever N, the armature-lever will be momentarily drawn forward; but, even if it make contact with M, no effect will be produced in the sounder S, since the further movement of lever N will be prevented by the retracting-spring applied to M, which is adjusted sufficiently high for that purpose, so that the latter cannot break the connection at 5 6, and the only result therefore will be the closing of the local-battery circuit of L B through both coils of the differential sounder, which will obviously not produce any attractive influence in its core. So, also, the only effect of the static discharge from line, which flows whenever the main battery M B is removed, will be to close the circuit through both coils of the sounder, the spring applied to M being adjusted so high that, even if the momentary discharge-current cause lever N to make contact with M, it will not break the contact at 5 6, since it is not sufficiently prolonged to bring the lever N fully forward, nor of sufficient strength to overcome the tension of the springs applied to both N and M. When, however, the core of the relay is energized in the well-known manner through the operation of the transmitting-key at the distant end of the line the armature-lever N is drawn forward into contact with M, thus, as before, closing the circuit through both differential coils of the sounder S, but upon a continuation of its forward movement, owing to the prolongation and greater strength of the attraction, breaking the circuit through one coil of the differential sounder by breaking the contact at 5 6, so that the current in the coil connected to M, being free to act unopposed, will energize the sounder-magnet and cause its armature-lever to be attracted. When the armature-lever N recedes the circuit through both differential coils is broken and the sounder-lever falls against its back-stop. The retractor-springs applied to M and N are made adjustable in the well-known way. The retractor applied to N is set to a moderate degree of tension, sufficient to hold said lever firmly against its back-stop. The retractor applied to M is to be adjusted according to the varying conditions of the main line. Any desired proportional adjustment may be, however, given to the springs, provided their combined strength be insufficient to prevent the breaking of contact at 5 6 when the armature-lever is drawn forward in response to the operation of the key at the distant end of the line.

My invention is not limited to any particular construction of the circuit-closing devices, and others may be used in connection with the supplemental lever and armature-lever for causing the latter to complete the circuit of both differential coils when it is borne against the supplemental lever and to break the circuit of one of said coils when it is carried forward so as to overcome the tension of the spring applied to the supplemental lever. Other mechanical devices may be used in place of the lever M.

It is obvious that my invention is applicable

to the receivers of other systems of duplex and multiplex telegraphs, and that it may be used with any duplex or multiplex telegraph-receiver which is so placed as to be affected by the difference in charge capacity of the main and artificial lines or by static discharge from the main line.

What I claim as my invention is—

1. The combination, substantially as described, with a duplex or multiplex telegraph receiving-instrument, of a differentially-wound reading-sounder, both coils of which are normally broken, a supplemental lever connected to one of said coils, a contact-stop for said lever, connected to the other coil, and an armature-lever for completing the circuit between both differential coils and the local battery when it is drawn forward against the supplemental lever and breaking the circuit of one coil when it overcomes the tension of the spring acting upon the supplemental lever.

2. The combination, substantially as described, of a differential sounder-circuit closing and breaking points in circuit with one of its coils, a supplemental lever connected to the other coil, an armature-lever for completing the circuit between both coils and the local battery when it makes contact with the supplemental lever, and springs applied to both levers in the manner described, so as to oppose the movement of the armature-lever, so that the circuit-closing points controlled by the supplemental lever can be broken only when the attractive force is sufficient to overcome the tension of both springs.

3. The combination, substantially as described, of a differentially-wound receiver, armature-lever therefor, supplemental lever, with which said armature-lever makes electrical contact when it is attracted, a stop for the supplemental lever, connected to one coil of a differentially-wound sounder, a connection from the other coil of said sounder to the supplementary lever, a spring tending to keep the supplemental lever in contact with the stop connected to the sounder when the lever is acted upon by the armature-lever, and connections from the local battery to the armature-lever, so that when it is drawn forward against the supplemental lever it completes the local circuit of both coils at the moment of making contact with said lever.

4. The combination, substantially as described, of a differentially-wound sounder and local battery, a relay-armature and supplemental lever therefor, a contact-stop for the lever, connections from the local battery to the sounder, and the supplemental lever, as set forth, so that when the lever is disconnected from its stop the circuit of one differential coil is broken and a retractor applied to the supplemental lever and adjusted, in the manner described, to prevent the removal of said lever from its stop when the armature-lever is drawn forward against the same by the action of a static charge or discharge current.

Signed at Buffalo, in the county of Erie and State of New York, this 8th day of May, A. D. 1882.

BENJAMIN THOMPSON.

Witnesses:
GEO. O. M. BUCKNER,
JAS. SWEENY.

(No Model.) 2 Sheets—Sheet 2.

J. M. STEARNS, Jr.

Duplex Telegraph.

No. 243,410. Patented June 28, 1881.

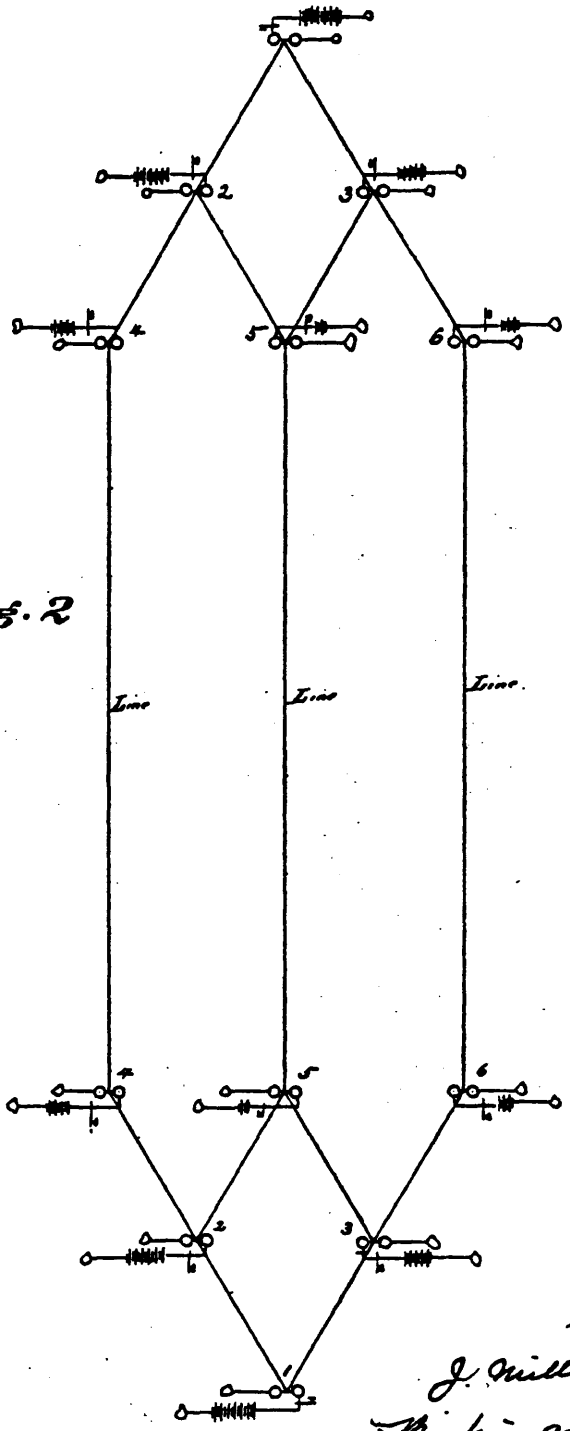


Fig. 2

Attests
L. J. Mátos.
J. M. Davies Jr.

Inventor
J. Milton Stearns Jr
By his atty

UNITED STATES PATENT OFFICE.

J. MILTON STEARNS, JR., OF BROOKLYN, NEW YORK.

DUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 243,410, dated June 28, 1881.

Application filed December 30, 1880. (No model.)

To all whom it may concern:

Be it known that I, J. MILTON STEARNS, Jr., of the city of Brooklyn, in the county of Kings and State of New York, have invented an Improvement in Telegraphy, of which the following is a specification.

My invention relates particularly to what is known as "duplex telegraphing" or transmitting messages both ways at the same time on one wire or single electric circuit; but it also has reference to multiplex telegraphing and optional transmission, or ability at one extremity of a single wire to signal and transmit to any one of many lines or circuits which may be connected to or at the other extremity of said single wire, or work on the same principle at the said point of junction or extremity of said single wire any particular electro-magnet.

The object of my invention is to utilize for the specific purposes specified the common instruments now in use, and to save time and expense; and the novelty consists in duplex telegraph and multiplex telegraph set up with common instruments in use, and a duplex perfectly adapted for local stations at will without interfering with the ordinary instruments, all of which tend to cheapen telegraph intercourse.

In the drawings, Figure 1 is a plan of my invention adapted to duplex telegraphing. Fig. 2 is a diagram of arrangement in which the system shown in Fig. 1 is adapted to the transmission of twelve messages over three wires.

Each of the pairs of relays in the multiplex system controls a local circuit and sounder, (not shown in Fig. 2,) as in the case of the duplex shown in Fig. 1, and operates in precisely the same way, one of said relays having a forward contact and the other a back contact.

Let there be two terminal stations, X Y, connected by a single wire or conductor, L, over which it is desired to establish a duplex system of telegraphy. At each of said stations is provided a line-battery, N, sufficient to work the line in the usual manner. Each of said stations is provided with two relays, A and B, a key, M, local battery K, and sounder J. One of such relays, A, so provided is what is called a "forward-contact relay," making contact for a local circuit when its armature is attracted toward its poles. The other of such relays, B, is what is known as a "back-contact relay," or making contact for a local circuit when its armature is from or not attracted toward its poles. The line-battery N of the station being properly set up and connected in series, either pole may be, but for convenience of description I will say its zinc pole is, connected to the earth by wire L′, either direct or with the common connection for earth of other instruments. The copper pole of said battery is connected to the anvil of an ordinary telegraph-key, M, and the key is connected to one of the terminals or screw-cups of the back-contact relay B. The remaining screw-cup or terminal of said back-contact relay is connected to one terminal of screw-cup of the forward-contact relay A, and the other terminal or screw-cup of said forward-contact relay is connected to earth at G through such resistance as may be required, according to the length and character of the line. On short lines none is necessary. The line-wire L is connected to the conductor joining the two relays, or between said relays at any point. The sounder J on one screw-cup or terminal is connected to the local battery K by wire I on one side direct. The other connection from the other terminal or screw-cup of said sounder passes through both the forward and back contact-points of the said respective relays to the other side of said local battery.

The apparatus of the other station, Y, is arranged precisely like the one above described, and the line-wire connected in the same relative place—to wit, between the two relays of such station.

The operation is as follows: The apparatus being arranged as specified, each main battery N having zinc poles to ground, and both keys M being open, no currents of any kind traverse the line or apparatus. Now close the key M at X station. Both relays A B at X station draw up their armatures, and the current from battery N, passing through the key M, passes through both relays A B to the ground G beyond. It will now be seen that, as the local contact F D of the back-contact relay B is drawn apart or broken before the front contact E C of the same local current or circuit is made, the local circuit is never formed

through the sounder J, and consequently it remains silent, no matter how violently the key be worked; but a part of the current passes down the line L to station Y from the divide between the two relays A B. At Y key M is supposed to be open. Its only path is through the forward-contact relay A at Y station to earth G. This causes that relay to operate its contact-points E C, and as the back-contact relay B has no magnetism or current in it, the other contact, F D, of the local circuit at Y is already made, and the full local circuit being made on the forward-contact relay A, the armature of Y sounder J is drawn up and instantly responds to X key. Thus we see that operating X key keeps its own sounder still, while the other or Y sounder responds, and this with Y key open. Now shut Y key. This draws up both its relays A B, the forward and back contacts, and its own sounder or local circuit is not formed, for the reasons stated in relation to the arrangement before. The operation of the sending-key at X station opposes the battery-current in the back-contact relay B at Y station and demagnetizes it. It falls on and off with the operation of the sending-key M and works the sounder J, since the front contact on the other relay, A, remains drawn up. Hence it appears that working X key causes Y sounder to go whether Y key is open or shut. If keys at both stations were both shut at exactly the same instant of time, it is obvious that the opposed currents would cause the back-contact relays to remain demagnetized. The forward-contact relays would draw up and the sounders would both respond—that is, they would attract their armatures and produce a sound. Suppose we are sending to opposite station, its key being closed—that is, we are working its sounder with the back-contact relay-points thrown off. Now let the opposite or Y station suddenly open its key while the levers of the back-contact relay B are just beginning to move back to make signal. It is obvious that the only effect will be to hasten the back-contact relay on its journey, there now being no current at all in it. As the forward-contact relay A is not in action at all, opening the key will cause it to fall back, provided the key at the other Y station is open. If shut, no effect or motion is produced. If the other key is open, the resultant effect of the two is to break the sounder or local circuit, as it ought to be, when the opposite key is open, and the break is a point, not a line, as in the case of the make.

It is impossible to contrive any shifting of the keys that would cause the sounders to trip over each other, since in every position they seem to help each other out. Suppose key at Y station is being shut, and before that current has time to draw up the relays at home or complete the signal at the other station the other key at X station is suddenly closed, a false signal would not be made. The position is one that would not occur probably once in a week; but still it is a possible position. The closing of one key draws up the relays at home and the forward-contact relay at the distant station. Now, while the relay-levers are in transition, in that infinitesimal period of time the other key is suddenly shut. The effect will be to throw the back-contact relay back and help draw up the front contact, and the signal is made by the responding of the sounder. In short, the sudden closing of the opposite key merely helps a signal in transition to completion in a shorter time, but with no change of form.

To adapt my invention to multiplex telegraphy I merely couple up the apparatus shown in Fig. 1 with one or more sets of the same kind as shown in Fig. 2, in which there are six sending-keys at each station and three main or line wires. The working of the whole simply depends on keeping the relay-springs adjusted, as the batteries of each key at one station are of different powers. The actual line-wire of keys 1 is really the three line-wires. The actual lines of keys 2 and 3 are really two of the line-wires, and of keys 4, 5, and 6 only one of the line-wires. Any number of keys may be arranged in such an apparatus, adding such additional main or line wires as become necessary; but it is evident that there are enormous facilities to be had by such an apparatus, for with twelve line-wires one hundred and fifty-six messages may be transmitted over the wires at the same instant.

I do not confine myself to any particular arrangement of wires, relays, sounders, &c., since my invention has reference, broadly, to duplex and multiplex telegraphy and repeaters when arranged for use with front and back contact relays, and without the use of any auxiliary complicated mechanism, as heretofore used.

I am aware of Thompson's patent, No. 195,055, for quadruplex telegraph, of 1877; but it works on an entirely different principle from that herein described, and I claim nothing therein shown or described.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. Telegraphic apparatus for transmitting two messages over a single wire, consisting of the usual line-wire, main batteries, keys, local circuits, sounders, and their batteries, combined with two relays capable of making or breaking the same local circuit, one of said relays being provided with a front-contact point and the other with a back-contact point, substantially as and for the purpose specified.

2. In a duplex or multiplex telegraph, the line wire or wires, main batteries, keys, sounders, local circuits, and local batteries, combined with two relays located at each of the ends of each line-wire, and at the connection or junction of wires connected with two or more of said line-wires, one of said relays being provided with a front contact and the other with

a back contact, the armatures of each pair of said relays working in a local circuit, the back-contact relay always breaking the local circuit before the front contact relay makes it, unless said relays are rendered inactive by demagnetization, so that the sounders in said local circuits shall respond correctly to any action of the keys, in the manner and for the purpose specified.

3. In a duplex telegraph, the combination, with line-wire, its batteries, and key at either end of said line, of two relays located at each station in circuit with the line-wire, and provided respectively with front and back contact points, the actions of which are regulated by the currents in the line-wire and govern the local circuits and cause the sounders to respond correctly to the opposite key, substantially in the manner and for the purpose set forth.

4. In a system of duplex telegraphy, the line-wire, battery, and key, combined with a front-contact relay and a back-contact relay, said relays being connected together by a conductor, which, in turn, is connected to the line-wire between the relays, the front and back contact points being in circuit with the sounder and local battery, substantially as shown and described.

5. In a system of telegraphy, the combination, with the regular line-wire, its batteries, and key, of a front-contact relay and a back-contact relay, said relays operating on a single local circuit for the purpose of controlling the action of the sounder, and allowing messages to be sent over the wire in one or both directions at the same time, as and for the purpose specified.

In testimony of which invention I hereunto set my hand.

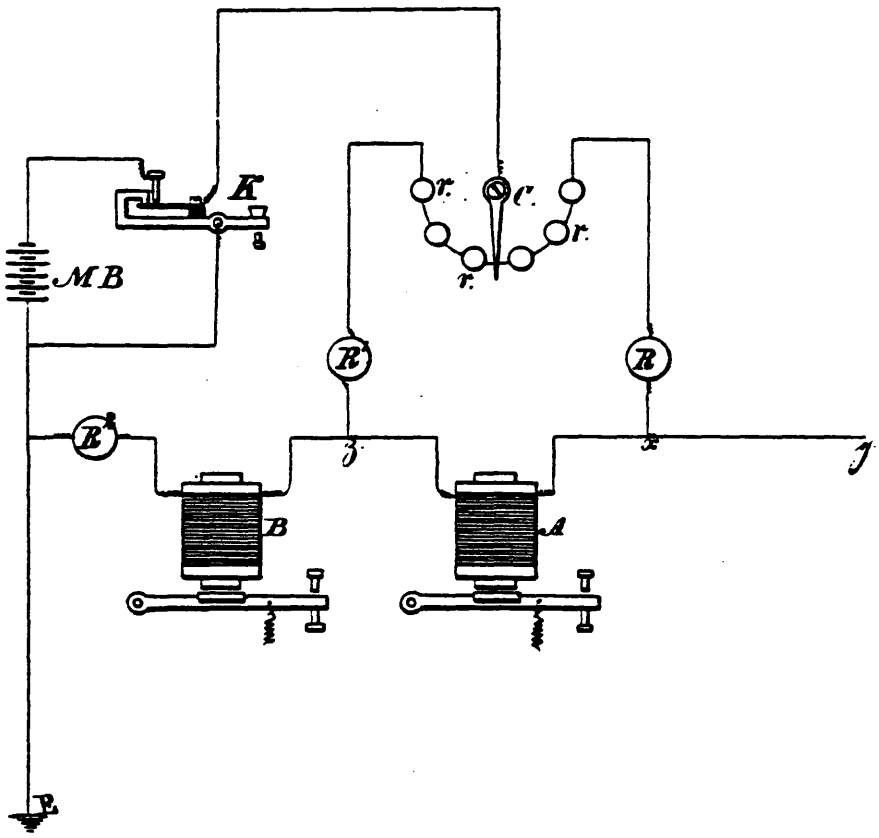
J. MILTON STEARNS, JR.

Witnesses:
GEO. H. SONNEBORN,
JAMES F. DOYLE.

J. B. STEARNS.

Duplex Telegraph and Circuit Therefor.

No. 6,508. Reissued June 22, 1875.



Witnesses
Chas. H. Smith
Geo. T. Quickney

Inventor
Joseph B. Stearns
per L. W. Serrell
Atty

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N. Y.

the proportion or ratio which it is necessary to maintain between the different branches of the circuit. This compensation or adjustment is preferably effected by means of the movable arm or contact-point C. By moving the point of contact along the series of resistances *r r r r r r*, the ratio of the resistance of the branch C *x* to that of the branch C *z* may readily be adjusted so as to correspond to the altered resistance of the main line *x y* relatively to that of the artificial or branch line *z* E, and thus without difficulty a balance may be maintained at the receiving-instrument. If, now, a current be set in action by the key at a distant station, it will, upon reaching the point *x*, find two paths open to it—one through R and C to the earth, at E, either direct or through the main battery, as the case may be, and the other through the bridge-wire and receiving-instrument A, and thence by *z* and R² to C, where it rejoins the first-mentioned route to the earth.

A portion of the current also diverges at the point *z*, and goes to the earth by the way of B and R²; but, on account of the much greater resistance by this latter route, only a small portion of the whole current arriving at *x* will pass through it. The receiving-instrument A is consequently actuated by that portion of the current which passes through the bridge-wire *x z* when the key at the distant station is depressed.

The rheostat or artificial resistance R², which is placed in the artificial line between the point *z* and the pole of the main battery which is connected with the earth, may be made adjustable, or the adjustment may be effected entirely by means of the series of resistances R *r r r r* R¹.

For the purpose of enabling the operator at the home-station to hear the signals sent by him, I make use of an electro-magnet, B, placed in the artificial line between the key and the pole of the main battery, which is connected with the earth, so that a portion of the current of the main battery, after it divides at C, shall pass through such electro-magnet and cause it to respond, and this electro-magnet may actuate a sounding or recording apparatus, either directly or by means of a secondary circuit.

The electro-magnet B may constitute a portion or the whole of the resistance, which is inserted in the artificial line between the point *z* and the main battery-pole at E, and the adjustment of the different resistances is in either case made with reference thereto.

By the hereinbefore-described arrangement two operators at stations distant from each other may simultaneously make use of one and the same line-wire for transmitting different and distinct communications without either party interfering with the signals of the other, and such signals may be indicated or recorded by means of any suitable telegraphic receiving-instrument.

I claim as my invention—

1. A duplex telegraph having a receiving-instrument placed between the main line and an artificial line, and a connection from the transmitting-key to both sides of the receiving-instrument, so that such receiving-instruments may be at a neutral point with reference to the electric pulsations produced at that station, substantially as set forth.

2. A duplex telegraph containing a receiving-instrument placed at a neutral point, and an electro-magnet in the artificial line, substantially as set forth.

3. The combination of the receiving-instrument with the resistances R R¹ R², in the manner and for the purpose set forth.

4. The combination of the receiving-instrument and the resistances R R¹ R² with a series of smaller resistances, *r*, as and for the purpose set forth.

5. The combination of the receiving-instrument A with the electro-magnet B, as and for the purpose set forth.

Signed by me this 19th day of February, 1875.

J. B. STEARNS.

In presence of—
ROBT. M. HOOPER,
DAVID T. S. FULLER.

(No Model.) 2 Sheets—Sheet 1.

J. M. STEARNS, Jr.

Duplex Telegraph.

No. 243,410. Patented June 28, 1881.

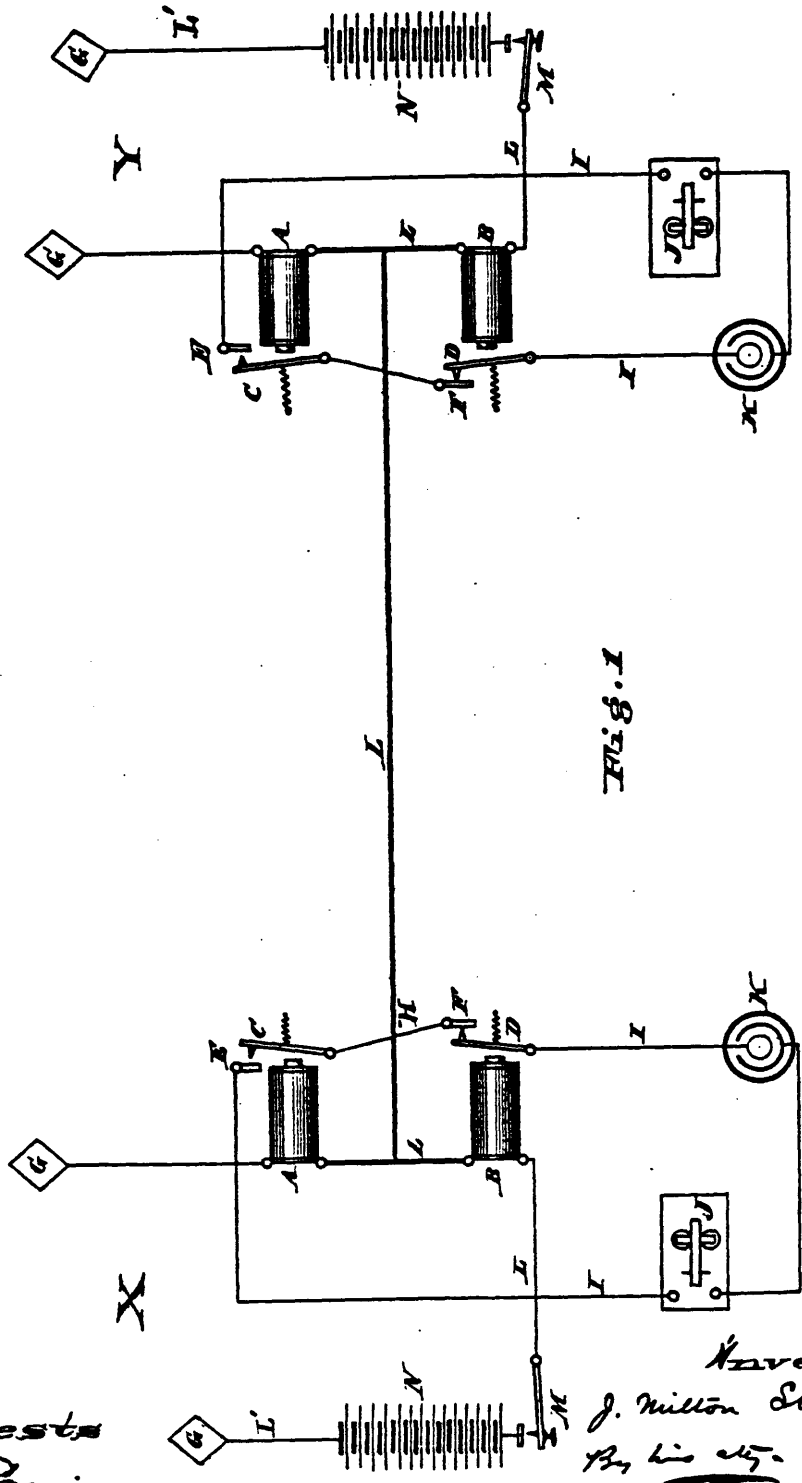


Fig. 1.

Witnesses

Inventor

J. Milton Stearns Jr.

By his Atty.

(No Model.) 2 Sheets—Sheet 2.

J. M. STEARNS, Jr.

Duplex Telegraph.

No. 243,410. Patented June 28, 1881.

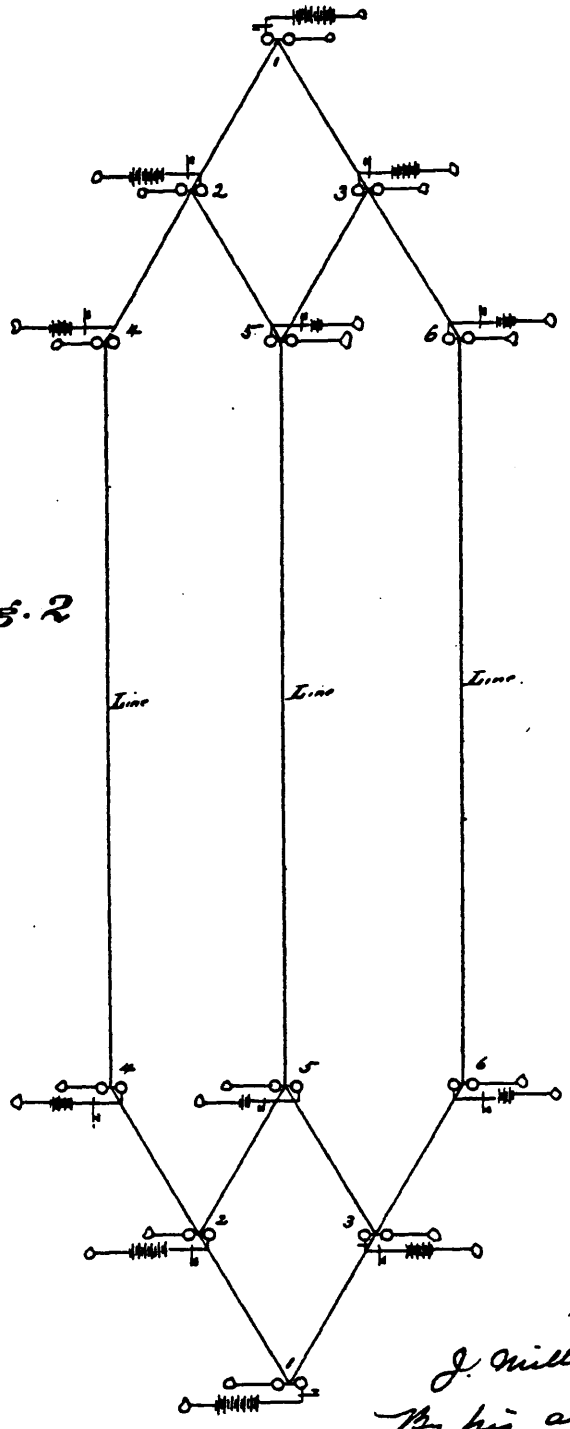


Fig. 2

Attests
L. J. Mátos.
J. M. Davies Jr.

Inventor
J. Milton Stearns Jr
By his atty

UNITED STATES PATENT OFFICE.

J. MILTON STEARNS, JR., OF BROOKLYN, NEW YORK.

DUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 243,410, dated June 28, 1881.

Application filed December 30, 1880. (No model.)

To all whom it may concern:

Be it known that I, J. MILTON STEARNS, Jr., of the city of Brooklyn, in the county of Kings and State of New York, have invented an Improvement in Telegraphy, of which the following is a specification.

My invention relates particularly to what is known as "duplex telegraphing" or transmitting messages both ways at the same time on one wire or single electric circuit; but it also has reference to multiplex telegraphing and optional transmission, or ability at one extremity of a single wire to signal and transmit to any one of many lines or circuits which may be connected to or at the other extremity of said single wire, or work on the same principle at the said point of junction or extremity of said single wire any particular electro-magnet.

The object of my invention is to utilize for the specific purposes specified the common instruments now in use, and to save time and expense; and the novelty consists in duplex telegraph and multiplex telegraph set up with common instruments in use, and a duplex perfectly adapted for local stations at will without interfering with the ordinary instruments, all of which tend to cheapen telegraph intercourse.

In the drawings, Figure 1 is a plan of my invention adapted to duplex telegraphing. Fig. 2 is a diagram of arrangement in which the system shown in Fig. 1 is adapted to the transmission of twelve messages over three wires.

Each of the pairs of relays in the multiplex system controls a local circuit and sounder, (not shown in Fig. 2,) as in the case of the duplex shown in Fig. 1, and operates in precisely the same way, one of said relays having a forward contact and the other a back contact.

Let there be two terminal stations, X Y, connected by a single wire or conductor, L, over which it is desired to establish a duplex system of telegraphy. At each of said stations is provided a line-battery, N, sufficient to work the line in the usual manner. Each of said stations is provided with two relays, A and B, a key, M, local battery K, and sounder J. One of such relays, A, so provided is what is called a "forward-contact relay," making contact for a local circuit when its armature is attracted toward its poles. The other of such relays, B, is what is known as a "back-contact relay," or making contact for a local circuit when its armature is from or not attracted toward its poles. The line-battery N of the station being properly set up and connected in series, either pole may be, but for convenience of description I will say its zinc pole is, connected to the earth by wire L', either direct or with the common connection for earth of other instruments. The copper pole of said battery is connected to the anvil of an ordinary telegraph-key, M, and the key is connected to one of the terminals or screw-cups of the back-contact relay B. The remaining screw-cup or terminal of said back-contact relay is connected to one terminal of screw-cup of the forward-contact relay A, and the other terminal or screw-cup of said forward-contact relay is connected to earth at G through such resistance as may be required, according to the length and character of the line. On short lines none is necessary. The line-wire L is connected to the conductor joining the two relays, or between said relays at any point. The sounder J on one screw-cup or terminal is connected to the local battery K by wire I on one side direct. The other connection from the other terminal or screw-cup of said sounder passes through both the forward and back contact-points of the said respective relays to the other side of said local battery.

The apparatus of the other station, Y, is arranged precisely like the one above described, and the line-wire connected in the same relative place—to wit, between the two relays of such station.

The operation is as follows: The apparatus being arranged as specified, each main battery N having zinc poles to ground, and both keys M being open, no currents of any kind traverse the line or apparatus. Now close the key M at X station. Both relays A B at X station draw up their armatures, and the current from battery N, passing through the key M, passes through both relays A B to the ground G beyond. It will now be seen that, as the local contact F D of the back-contact relay B is drawn apart or broken before the front contact E C of the same local current or circuit is made, the local circuit is never formed

through the sounder J, and consequently it remains silent, no matter how violently the key be worked; but a part of the current passes down the line L to station Y from the divide between the two relays A B. At Y key M is supposed to be open. Its only path is through the forward-contact relay A at Y station to earth G. This causes that relay to operate its contact-points E C, and as the back-contact relay B has no magnetism or current in it, the other contact, F D, of the local circuit at Y is already made, and the full local circuit being made on the forward-contact relay A, the armature of Y sounder J is drawn up and instantly responds to X key. Thus we see that operating X key keeps its own sounder still, while the other or Y sounder responds, and this with Y key open. Now shut Y key. This draws up both its relays A B, the forward and back contacts, and its own sounder or local circuit is not formed, for the reasons stated in relation to the arrangement before. The operation of the sending-key at X station opposes the battery-current in the back-contact relay B at Y station and demagnetizes it. It falls on and off with the operation of the sending-key M and works the sounder J, since the front contact on the other relay, A, remains drawn up. Hence it appears that working X key causes Y sounder to go whether Y key is open or shut. If keys at both stations were both shut at exactly the same instant of time, it is obvious that the opposed currents would cause the back-contact relays to remain demagnetized. The forward-contact relays would draw up and the sounders would both respond—that is, they would attract their armatures and produce a sound. Suppose we are sending to opposite station, its key being closed—that is, we are working its sounder with the back-contact relay-points thrown off. Now let the opposite or Y station suddenly open its key while the levers of the back-contact relay B are just beginning to move back to make signal. It is obvious that the only effect will be to hasten the back-contact relay on its journey, there now being no current at all in it. As the forward-contact relay A is not in action at all, opening the key will cause it to fall back, provided the key at the other Y station is open. If shut, no effect or motion is produced. If the other key is open, the resultant effect of the two is to break the sounder or local circuit, as it ought to be, when the opposite key is open, and the break is a point, not a line, as in the case of the make.

It is impossible to contrive any shifting of the keys that would cause the sounders to trip over each other, since in every position they seem to help each other out. Suppose key at Y station is being shut, and before that current has time to draw up the relays at home or complete the signal at the other station the other key at X station is suddenly closed, a false signal would not be made. The position is one that would not occur probably once in a week; but still it is a possible position. The closing of one key draws up the relays at home and the forward-contact relay at the distant station. Now, while the relay-levers are in transition, in that infinitesimal period of time the other key is suddenly shut. The effect will be to throw the back-contact relay back and help draw up the front contact, and the signal is made by the responding of the sounder. In short, the sudden closing of the opposite key merely helps a signal in transition to completion in a shorter time, but with no change of form.

To adapt my invention to multiplex telegraphy I merely couple up the apparatus shown in Fig. 1 with one or more sets of the same kind as shown in Fig. 2, in which there are six sending-keys at each station and three main or line wires. The working of the whole simply depends on keeping the relay-springs adjusted, as the batteries of each key at one station are of different powers. The actual line-wire of keys 1 is really the three line-wires. The actual lines of keys 2 and 3 are really two of the line-wires, and of keys 4, 5, and 6 only one of the line-wires. Any number of keys may be arranged in such an apparatus, adding such additional main or line wires as become necessary; but it is evident that there are enormous facilities to be had by such an apparatus, for with twelve line-wires one hundred and fifty-six messages may be transmitted over the wires at the same instant.

I do not confine myself to any particular arrangement of wires, relays, sounders, &c., since my invention has reference, broadly, to duplex and multiplex telegraphy and repeaters when arranged for use with front and back contact relays, and without the use of any auxiliary complicated mechanism, as heretofore used.

I am aware of Thompson's patent, No. 195,055, for quadruplex telegraph, of 1877; but it works on an entirely different principle from that herein described, and I claim nothing therein shown or described.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. Telegraphic apparatus for transmitting two messages over a single wire, consisting of the usual line-wire, main batteries, keys, local circuits, sounders, and their batteries, combined with two relays capable of making or breaking the same local circuit, one of said relays being provided with a front-contact point and the other with a back-contact point, substantially as and for the purpose specified.

2. In a duplex or multiplex telegraph, the line wire or wires, main batteries, keys, sounders, local circuits, and local batteries, combined with two relays located at each of the ends of each line-wire, and at the connection or junction of wires connected with two or more of said line-wires, one of said relays being provided with a front contact and the other with

a back contact, the armatures of each pair of said relays working in a local circuit, the back-contact relay always breaking the local circuit before the front contact relay makes it, unless said relays are rendered inactive by demagnetization, so that the sounders in said local circuits shall respond correctly to any action of the keys, in the manner and for the purpose specified.

3. In a duplex telegraph, the combination, with line-wire, its batteries, and key at either end of said line, of two relays located at each station in circuit with the line-wire, and provided respectively with front and back contact points, the actions of which are regulated by the currents in the line-wire and govern the local circuits and cause the sounders to respond correctly to the opposite key, substantially in the manner and for the purpose set forth.

4. In a system of duplex telegraphy, the line-wire, battery, and key, combined with a front-contact relay and a back-contact relay, said relays being connected together by a conductor, which, in turn, is connected to the line-wire between the relays, the front and back contact points being in circuit with the sounder and local battery, substantially as shown and described.

5. In a system of telegraphy, the combination, with the regular line-wire, its batteries, and key, of a front-contact relay, and a back-contact relay, said relays operating on a single local circuit for the purpose of controlling the action of the sounder, and allowing messages to be sent over the wire in one or both directions at the same time, as and for the purpose specified.

In testimony of which invention I hereunto set my hand.

J. MILTON STEARNS, JR.

Witnesses:

GEO. H. SONNEBORN,

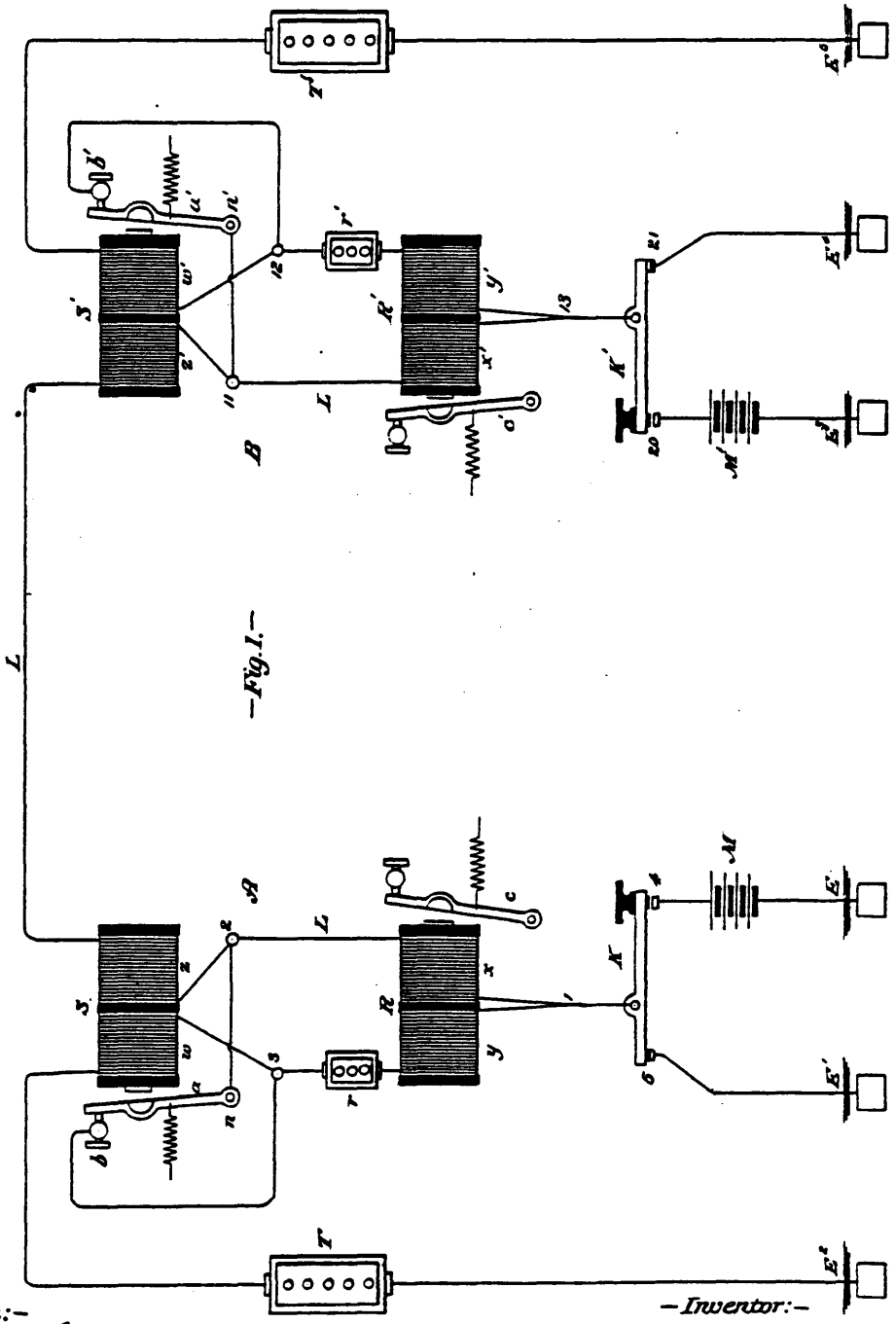
JAMES F. DOYLE.

(No Model.) 2 Sheets—Sheet 1.

C. L. BUCKINGHAM.

DUPLEX TELEGRAPH.

No. 253,154. Patented Jan. 31, 1882.



—Fig. 1.—

Attest:—
R. F. Barnes
John C. Sanders

Inventor:—
C. L. Buckingham

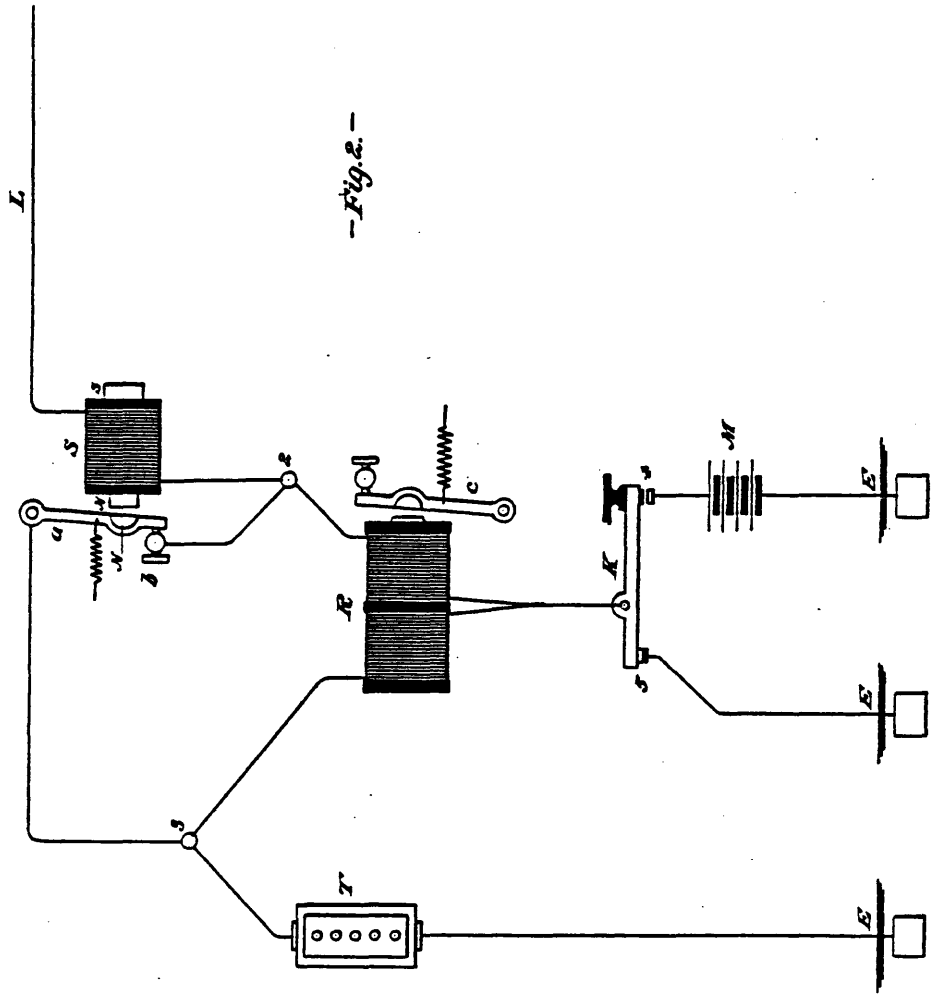
(No Model.) 2 Sheets—Sheet 2.

C. L. BUCKINGHAM.

DUPLEX TELEGRAPH.

No. 253,154. Patented Jan. 31, 1882.

-Fig. 2.-



-Witnesses:-

R. F. Barnes

John C. Sanders.

-Inventor:-

C. L. Buckingham

UNITED STATES PATENT OFFICE.

CHARLES L. BUCKINGHAM, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY, OF NEW YORK, N. Y.

DUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 253,154, dated January 31, 1882.

Application filed December 27, 1881. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. BUCKINGHAM, of Elizabeth, county of Union, and State of New Jersey, have invented a new and useful Improvement in Telegraphy, of which the following is a description, reference being had to the accompanying drawings, forming a part herewith.

My invention is applicable to differential systems of telegraphy for the simultaneous transmission of messages upon a single line in opposite directions, and has for its special object the neutralization, in the receiving-instruments of duplex, quadruplex, or sextuplex telegraphy, of disturbing effects due to static induction upon the main line; and to this end I employ at each station a normally-closed bridge or branch conductor to join the main and artificial lines. The bridge or branch conductor is normally closed through a contact-point and the armature of an electro-magnet, and the position of said armature, whether to open or close the bridge, depends upon the currents which are transmitted by the keys of the home and distant stations. Where only signals are being sent from the home station the bridge remains closed, and from this fact equal strengths of current will flow through the two oppositely-wound coils of the home receiving-relay, both while the main line is receiving its inductive charge and thereafter, during the continuance of a signal, and after the main line has received its full inductive charge.

It is well understood in the art of duplex telegraphy that in a differential duplex, while the main line is receiving its inductive charge, a stronger current will flow through the main-line coil than through the oppositely-wound coil in the artificial circuit, and that the differential receiving-relay will respond to give a false signal. The bridge, however, which I employ effects a complete balance of currents sent through them from the home station. Following each signal that is sent from the home station is a quick static or inductive discharge from the main line in a direction opposite to that of the current of charge. The direction of the current of inductive discharge is such as to tend to cause the bridge to be broken. However, the armature of the bridge is so adjusted that the bridge will practically remain unbroken from the effects of said inductive discharge, and it will distribute itself, in passing to earth, equally through the two oppositely-wound coils of the receiving-relay, and no false signal will follow. While the bridge will not be broken by a quick inductive discharge from the main line, a battery-current sent from a distant station sufficiently prolonged to produce a signal at the home station will cause the bridge to be opened and remain open during the signal, wherefore the current will only pass through one coil of the home receiving-relay, and a signal will be given. By this means the main-line inductive charge and discharge produce neutral effects upon receiving-relays when signals are sent from the same stations, and this end is accomplished without the necessity of adjustment to change the electro-static capacity of an artificial line to balance the highly variable inductive condition of the main line.

I will now explain my invention by reference to the accompanying drawings.

Figure 1 represents an ordinary duplex system in which the bridge at each station is broken by means of an ordinary differential electro-magnet whose coils are in the main and artificial lines, respectively. Fig. 2 shows a modified means for breaking the bridge-conductor, which consists of a polarized relay whose coil is in the main line alone.

In Fig. 1, A and B represent two distant stations joined by a main line, L.

M and M′ are two main-line batteries arranged to oppose each other when simultaneously connected to line. In all other respects the devices of station B are identical with those of station A, and a description of apparatus of one station will suffice for that of both.

R is an ordinary differential receiving-relay, having oppositely-wound coils *x* and *y*, forming parts, respectively, of the main and artificial circuits; and *c* is its armature-tongue.

K is an ordinary transmitter-key, though in practice a continuity-preserving one is preferable.

T is a resistance placed in the artificial circuit, equal in amount to the main-line resist-

ance. The artificial line is connected to earth at E^2.

S is a differential electro-magnet, altogether similar in general respects to relay R, its coils *z* and *w* being oppositely wound and forming parts of the main and artificial lines.

2 and 3 are points in the main and artificial lines joined with a bridge or branch conductor of very low resistance, which is usually closed through armature *a* and stop *b*.

r is a small rheostat for establishing a proper proportion of resistances between points 1 and 2 and 1 and 3. When K is depressed the current of battery M divides at point 1, one portion passing through coils *x* and *z* and the other through coils *y* and *w* of the relay R and electro-magnet S. When the two portions of the current thus divided are equal, the electro-magnetic effects of *x* and *y* are neutral, also those of *z* and *w;* but owing to the greater capacity of the main than the artificial line for a static charge, the current from M at the beginning of each signal will, if there be no compensating device, be stronger through coils *x* and *z* of the main line than through coils *y* and *w* of the artificial circuit. However, if points 2 and 3 be connected by a bridge which is normally closed, it is obvious that until such bridge is broken the current flowing through coil *x* must equal that passing through *y*, even if the current which flows to the main line from point 2 is much greater than that flowing over the artificial line from point 3 to E^2. Primarily, therefore, owing to the normally-closed bridge joining points 2 and 3, the current of M will be divided equally through the coils *x* and *y;* but while the bridge causes an equal division of current between coils *x* and *y*, more current at the same time will flow through coil *z* than *w*, whereby S will become magnetic and tend to attract its armature. However, if S be slightly sluggish and armature *a* properly adjusted, the bridge will not be broken until the main line will have received its inductive charge. After the line has received its inductive charge the current from M will divide itself at 1 equally, and it will be immaterial should the bridge be momentarily broken.

When the resistance of the bridge, compared with that of either *x* or *y*, is practically zero and resistances of *x* and *y* are equal, it will be observed that at the moment of charging the main line, when more current is flowing into said main line than to the artificial circuit, a current will be set up in the bridge from 3 toward 2, and that the division of current at point 1 will be equal through *x* and *y*. The removal of battery M after sending each signal is accompanied by a static discharge opposite in direction to the corresponding current of charge. The current of static discharge, which would otherwise pass through only coil *x* of the differential relay R, divides equally at point 2, one portion passing to earth by coil *y* and the other by the oppositely-wound coil *x*, whereby the effects of static discharge are neutral upon the receiving-relay. As the static discharge from the line passes through only one coil of S it will tend to break the bridge; but by a proper construction of S and adjustment of *a* the bridge will not be broken before a complete discharge can occur.

While the static discharge of the main line is not sufficient to cause the bridge to be broken, a sufficiently prolonged current from a distant station to make a telegraphic character will attract armature *a* and retain it during the time of the signal, and the current will thereby pass wholly through coil *x* to effect a signal. If the batteries M and M′ are both simultaneously upon the line and battery M be then removed, the accompanying static discharge will not neutralize itself by passing through both coils *x* and *y*, as the bridges are broken at both stations when both batteries are to line, and as the bridge at station A so remains broken when M is removed. The static discharge under this condition takes place wholly through *x;* but this will produce no false signal by attracting *c*, as *c* is already attracted from the agency of the closed key at the distant station. The static discharge will therefore only conspire to hold *c* in its proper position.

I will now describe my modification illustrated in Fig. 2.

S is a relay having a polarized core and a polarized armature-tongue, *a*, for the purpose of breaking and closing the bridge-conductor joining points 2 and 3, the functions of which are fully set forth in the description of Fig. 1. The coil of S is in the main line, and when no current is flowing through said coil the polarized armature *a* is repelled, as the magnetism of *a* and the adjoining end of S are of like polarity—say positive. When a current is sent from M the armature is more strongly repelled, as the direction of the current is such as to induce positive magnetism in the end of core S facing *a;* but when a current is received from a distant station to effect a signal the armature will no longer be repelled, but the magnetism of the core will be reversed, the armature will be attracted, the bridge will be broken, and a signal received. The retractile force of the armature, however, is so adjusted as not to be materially moved by the static discharge from the line, though its direction be the same as a current giving a signal. By means of the polar circuit-breaker the bridge cannot by any possibility be broken when the line is receiving its inductive charge, as its action is wholly independent of the current of the artificial line. However strong and prolonged the effect of static charge, polar armature *a* will not be moved, and equality of current strength in coils *x* and *y* will remain unchanged.

This application is a division of that filed by me June 16, 1881, and I do not desire to claim herein the method of rendering the receiving relay or relays of a telegraph system for simultaneous transmission in opposite directions insensible to the effects of the inductive charge and discharge of the main line, consisting in

causing both the inductive charge and discharge respectively to be divided through the transmitting-instrument before passing through said instrument, to avoid false signals; nor do I herein claim anything claimed in said application filed June 16, 1881.

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

1. In a telegraph system for simultaneous transmission in opposite directions, the combination, substantially as specified, at each station of the main line, an artificial line, a differential receiving-instrument, an electro-magnet, and a bridge-conductor joining the main and artificial lines, which is opened and closed by the agency of said electro-magnet.

2. In combination with a duplex-telegraph line, an artificial circuit, a differential receiving-relay, a normally-closed bridge or branch conductor, and an electro-magnetic circuit-breaker whose armature is adjusted to be insensible to the static discharge from the line, but which is actuated by a sufficiently prolonged current from a distant station to make a signal whereby the static discharge will pass to earth through both coils of the differential relay, while a prolonged signal-current sent from a distant station will cause the bridge-conductor to be broken.

3. The combination, substantially as specified, of a main and artificial line, differential relay R, polarized circuit-breaker S, and a normally-closed bridge which is broken and closed by means of said circuit-breaker S.

4. In combination with a duplex-telegraph line, an artificial circuit, a differential receiving-relay, a bridge or branch conductor connecting the main and artificial lines, and means for opening and closing said bridge, whereby said bridge may be closed to cause an equal division of current between the two oppositely-wound coils of the receiving-relay, both at the time of inductive charge and discharge of the main line, substantially as specified.

Executed by me this 22d day of December, 1881.

CHARLES L. BUCKINGHAM.

Witnesses:
JOHN C. SANDERS,
WM. ARNOUX.

(No Model.) 3 Sheets—Sheet 1.

F. W. JONES.

SEXTUPLEX TELEGRAPH.

No. 254,220. Patented Feb. 28, 1882.

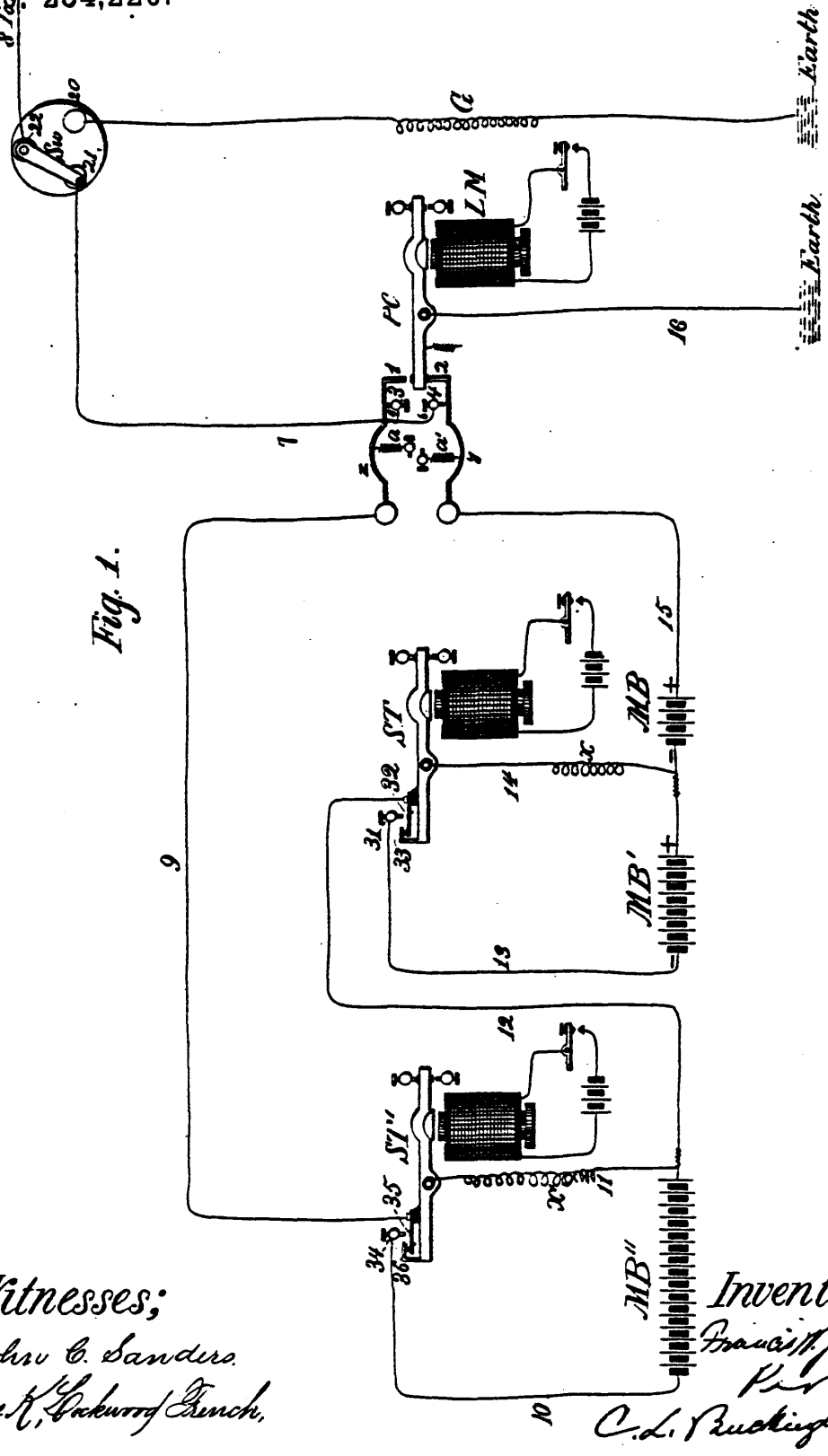


Fig. 1.

Witnesses;
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Francis W. Jones
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(No Model.) 3 Sheets—Sheet 2.

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SEXTUPLEX TELEGRAPH.

No. 254.220 Patented Feb. 28, 1882.

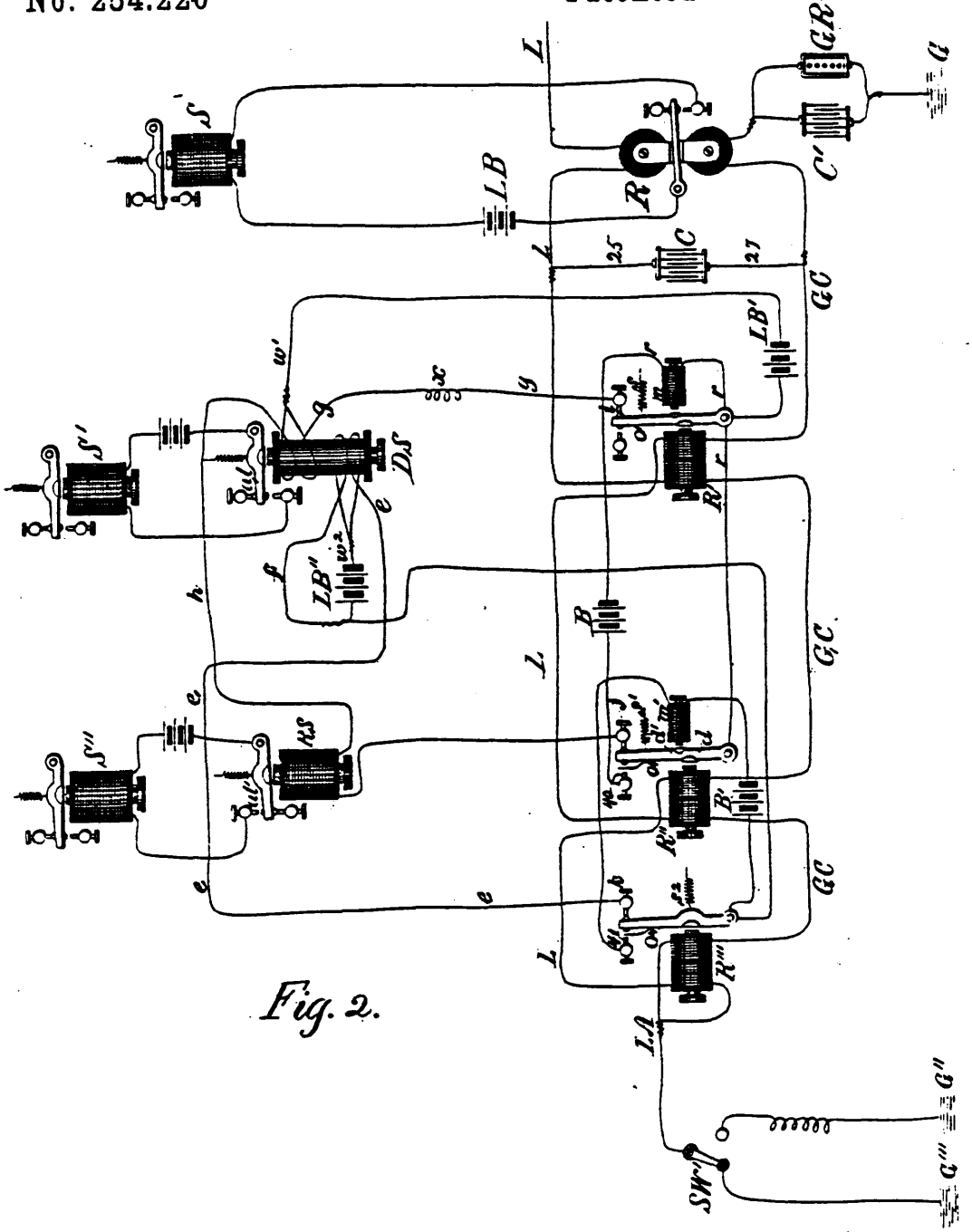

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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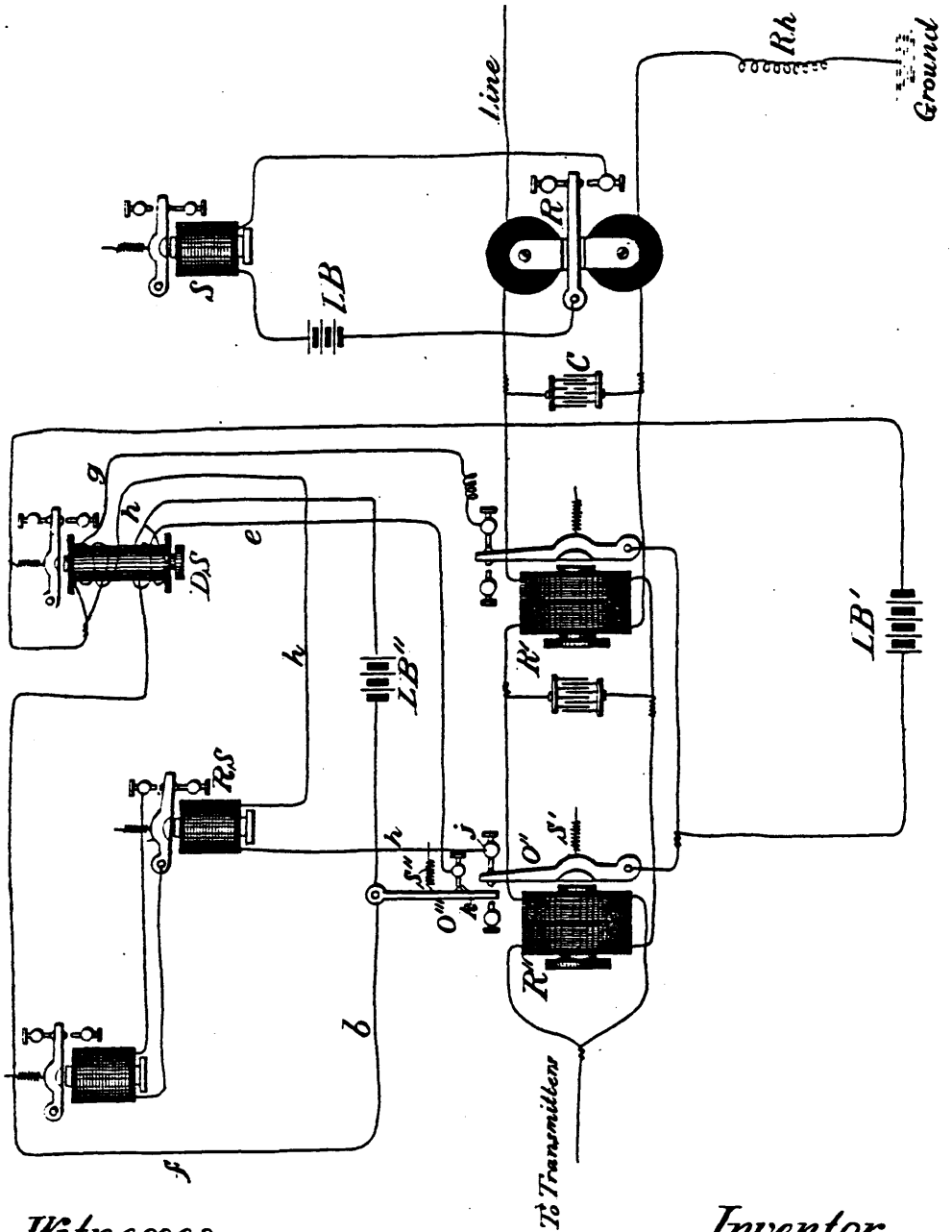
SEXTUPLEX TELEGRAPH.

No. 254,220. Patented Feb. 28, 1882.

Fig. 3.



Witnesses;

John C. Sanders.

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UNITED STATES PATENT OFFICE.

FRANCIS W. JONES, OF NEW YORK, N. Y.

SEXTUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 254,220, dated February 28, 1882.

Application filed February 9, 1881. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS W. JONES, of the city, county, and State of New York, have invented a new and useful Improvement in Sextuplex Telegraphs, of which the following is a specification.

My invention consists of improvements in respect to the transmitting and receiving telegraphic apparatus of a system whereby three independent messages may be sent in one direction while three messages are being sent in the opposite direction over one line-conductor.

Heretofore systems have been devised by which one message may be sent wholly by reversals of current, while two others could be sent simultaneously in the same direction from the same station by successively increasing the current strength. In such systems a weak battery is normally connected to line and earth through a pole-changing key. By operating such key the poles of the weak battery are reversed in respect to the earth and line and signals are transmitted. At the same station two additional battery-sections and two ordinary continuity-preserving keys are provided, whereby the strength of current from the battery normally to line may be successively increased three times. By closing the first continuity-preserving key the current from the battery normally to line receives its first increase. By closing the second continuity-preserving key a second increase results, while a simultaneous closing of both continuity-preserving keys gives a third increase. The three increases of current result, first, from the insertion to line of a second battery stronger than the one normally to line; second, from an insertion of a third and still stronger battery; and the third increase is due to the insertion of both the second and third batteries. The second and third batteries are so inserted that they form an addition to the weak battery normally to line, and a reversal of the weak battery is accompanied by a reversal of either or both of the stronger batteries upon the line, providing they are connected to line through the closing of the second and third keys. At the receiving-station there is a combination of main-line relays and local sounders, consisting of a main-line polarized relay, which brings into action a local sounder by the reversal of the main-line currents, regardless of their strength. In addition to the polarized relay, neutral relays are provided, by means of which either or both of two local sounders may be brought into action either when the local sounder controlled by the polarized relay is or is not operating. The reversal of the weak battery normally to line will operate the polarized relay and actuate the first local sounder, but will not suffice to affect the neutral relays. The first increase of current upon the line will cause the first neutral relay to actuate the second local sounder. The second increase of current will actuate the second neutral relay to give a signal upon the third local sounder, and while the second increase of current will actuate the armature of the first neutral relay, it will actuate other devices to prevent the second local sounder from operation. The third increase of current operates neutral-relay devices to cause the simultaneous production of signals upon both the second and third local sounders. This invention, therefore, I do not broadly claim as my own, but desire to limit myself to improvements thereon.

My improvement in respect to transmitting devices consists of such an arrangement of keys, circuit-connections, resistances, and batteries that either or both of the stronger battery-sections, which are normally out of the main-line circuit, may be placed therein in tension with the weak battery, which is always upon the line, in such manner that incoming currents from the distant station shall encounter the same resistance when one or both of the stronger batteries are in the main-line circuit; also, the arrangement of resistances and batteries is such that all the outgoing currents, as well as incoming, shall meet the same resistance at the transmitting-station whether the stronger sections of main-line battery are or are not connected in circuit. The first or weakest battery-section is continually in the main-line circuit, and is operated to charge the main line with alternately positive and negative currents by a reversing-key, whereby one operator is enabled to send signals by means of reversals of current independently of changes in strength. Two additional operators are enabled each to send a set of signals from the same station by means of changes in strength of current independently of reversals. Two transmitting-keys for sending signals by changes in

strength of current are located upon a single continuous conductor forming a fragment of the main-line circuit. Both ends of said fragment of the main-line circuit are connected with a reversing-key, which also effects the transmission of signals from the weaker section of battery, and the opposite ends of the said main-line fragment are alternately changed from line to earth and earth to line, and vice versa. In connection with each of the transmitting-keys for sending signals by changes in strength are two conducting-branches, through either of which the electrical continuity of the fragment of the main-line circuit may be maintained. One of said conducting-branches has thereon a section of main-line battery, while the other branch has an artificial resistance therein equal in amount to the resistance of the battery-section. When the transmitting-key is upon its back-stop the branch having the battery-section is broken, while the branch having the artificial resistance at the same time serves to maintain electrical continuity throughout said fragment of the main-line conductor. However, when the key is pressed upon its front contact the branch having the artificial resistance is broken, and the circuit is maintained through the branch having the battery-section, and said battery-section is placed to line for the purpose of effecting a signal at a distant station, and at the same time the main-line resistance is maintained unchanged in respect to currents arriving at the home station from a distant one. The two transmitting-keys are by this arrangement placed in different portions of a single conductor.

My invention in respect to the receiving devices relates to the main-line relays, their circuit-connection, and local sounders. The first local sounder is controlled by the action of a polarized relay, which is actuated by reversals of the weak battery normally to line, or by the reversals of currents from either or all of the batteries at the transmitting station combined. This feature, however, *per se*, forms no part of my invention. The second local sounder is actuated by a double differentially-wound local relay. By virtue of two differential windings upon the single relay four independent coils are provided, two of which branch from one local battery, while the remaining two coils branch from a second local battery. Such local branches are opened and closed by the action of main-line neutral relays, through the agency of currents of increased strength, though never by reversals. When the main-line current receives its first increase, or the second operator closes his key, the first neutral relay at the receiving-station responds and breaks one of the four local branches of the double differential local relay. When the four branches of said relay are all closed the magnetic effects in the relay are neutral; also, when either differential set of the relay-coils is closed the magnetic effects are likewise neutral. The first increase of line-current is not sufficient to operate the second neutral relay, which controls the second local branch of the local relay. Thus when the main-line current receives its first increase one local branch is broken, and the local relay responds to operate the second local sounder. Now, if the main-line current receive its second increase of current from the third operator, the first main-line neutral relay will still respond to break one of the local branches of the double differential relay; but at the same time the second neutral relay operates to also break the second of the first set of differential or oppositely-wound coils upon the local relay, which branch also operates the second sounder; but, as above observed, when one differential set of oppositely-wound coils is alone closed in the local relay a balance will ensue and magnetic effects will be neutral. While the action of the second neutral relay is such as to prevent the first neutral relay from actuating the second local sounder, the action of the second neutral relay at the same time breaks a local circuit to bring into action the third local sounder.

My invention thus far explained provides for the separate operation of either of the second or third local sounders; but a further device is necessary to enable both sounders to simultaneously operate. Such result is accomplished by the third increase of battery-current strength, which serves to give the second neutral main-line relay an additional movement, or else to actuate a third main-line relay, by means of which one branch of the second differential set of local coils of the local relay is broken, thus leaving said differential local relay subject to the action of a single local coil, whereby the magnetic balance is destroyed, and operation of the second local sounder is the consequence. The greatest strength of current operates all of the main-line relay-armatures, and the third local sounder will work as when the next lower strength of current is to line. As the main-line neutral relays are subject to three widely-varying tensions of current, I provide local counteracting electro-magnets, to be called into action when increased currents are sent. A retractor properly adjusted to correspond with the strength of current necessary to actuate the first or weakest neutral relay would be out of adjustment in the case of current strength sufficient to operate the next neutral relay. Therefore I make the currents sent to line, which are too strong for the adjustments of the retractors, call into action local electro-magnets to aid such retractors. It is obvious that a differential winding of the main-line relays will enable three messages to be simultaneously sent in opposite directions.

I will now explain my invention by reference to the accompanying drawings, which form a part of my specification.

Figure 1 represents the transmitting-keys, batteries, and circuit-connections necessary for the transmitting end of the line. Fig. 2 represents the main-line relays, local relays, local sounders, circuit-connections, and devices employed at the receiving end of the line. Fig.

3 represents a modification of devices illustrated in Fig. 2.

Like letters of reference in the drawings indicate corresponding parts.

As shown in Fig. 1, P C is a pole-changing key by means of which main-line batteries M B M B′ M B″ are connected to line and earth, and through the agency of which the poles of the batteries may be reversed in respect to the line and earth.

z and *y* are springs tending to rest upon stops 3 and 4. Main line 7 is joined to stops 3 and 4 by wires 5 and 6. Key P C is connected to earth through 16.

S T and S T′ are ordinary continuity-preserving keys, by means of which batteries M B′ and M B″, normally cut out, may be put in main-line circuit by closing the keys.

Transmitting-keys S T and S T′ are located upon a fragment of the main-line circuit, having its ends connected with the springs *z* and *y* of key P C, and said fragment consists of conductor 15, battery M B, and branches 13 or 14, transmitting-key S T, conductor 12, branches 10 or 11, key S T′, and conductor 9. By operation of the pole-changing key P C the opposite ends of this fragment of main-line conductor are alternately reversed from line to earth and earth to line, and vice versa.

It will be observed that the keys S T and S T′ are situated at different positions in the length of one conductor, and that the fragment of the main line containing said transmitting-keys has only a single earth-connection, 16. When key S T is open battery M B is closed to line through wire 14, containing resistance *x*. When S T is closed M B is connected to line through battery M B′, 13, 31, and 12. When S T′ is open M B and M B′ are joined to line through resistance *x′* of 11, key S T′, 36, and 35. If S T′ be closed, the main-line circuit will not be closed through *x′*, but through M B″, 10, 34, 35, and 9. Resistances *x* and *x′* are made equal respectively to the resistances of batteries M B′ and M B″, since both incoming and outgoing currents will traverse either resistances *x x′* or batteries M B′ M B″, according to the positions of keys S T and S T′.

M B is a weak battery, whose relative strength may be represented by 1. M B′ is a stronger battery, whose strength is 2, and M B″ is of strength 4. By reversing currents upon the line a polarized armature at the receiving-station is operated.

M B′ and M B″ are added in circuit by closing keys S T and S T′ to increase the strength of current of M B. When keys S T and S T′ are closed, M B′ and M B″, as well as M B, are reversed upon the line by operating P C. The several current strengths upon the line are, normally, strength —1; key S T closed, S T′ open, strength —3; key S T open, S T′ closed, strength —5; key S T closed, S T′ closed, strength —7. When P C is closed the currents are respectively +1+3+5+7.

It will be seen from this description that my key system enables eight different conditions of current to be sent to line, and that the battery-sections and resistances are so arranged that a circuit of constant resistance is always provided for all incoming and outgoing currents.

S W is a switch by means of which the key system may be disconnected and the line put to earth through resistance G equal to resistance of the key system, whereby the distant relays may be conveniently balanced.

In Fig. 2, which represents my receiving apparatus, R is a polarized relay controlling local sounder S. Relay R responds to a reversal of current strength of 1. It will also respond as well to a reversal of current of strengths 3, 5, or 7. Thus sounder S will respond while strong currents operate the neutral relays for independent signals. R is the first main-line neutral relay, and is operated by a current of either polarity of strength 3 or currents from M B and M B′ jointly. R″ is the second neutral relay, and will respond to currents of either polarity of strength 5 or currents from M B and M B″ jointly. R‴ is the third neutral relay, which will respond to either polarity of current of strength 7 or current from M B M B′ M B″ jointly. S′ is the second local sounder, which is to be brought into action by key S T. The local circuit of S′ is opened and closed through the agency of the double differential local relay D S.

Relay D S is differentially wound with the two branches *h* and *g* of wire *w′*, leading from one pole of local battery L B′. Branch *h* is connected to the back stop of relay R″, and branch *g* is connected to back stop of relay R′, while armature-levers *o′* and *o″* of R′ and R″ are joined to the opposite pole of L B′. Relay D S is also differentially wound with branches *f* and *e* from wire joined to one pole of local battery L B″. Branch *e* is carried to back stop *k* of relay R‴, from which connection is made through the armature *o‴* to the opposite pole of L B″. Branch *f* is also connected with branch *e* to the same local-battery pole.

It will be observed that the third local sounder is controlled by relay R S, placed in the branch *h*, forming one coil of the first differential set of coils upon double differential relay D S.

Coils *g* and *h* are oppositely-wound differential coils connected with the poles of local battery L B′. Thus when both branches are closed the magnetic effects in D S due to L B′ are neutral. Also, *f* and *e* are oppositely-wound differential coils connected with local battery L B″, and magnetic effects in D S due to L B when both *e* and *f* are closed are neutral.

The operation of local sounders S′ and S″ may now be explained. Normally the four branches *e*, *f*, *g*, and *h* of the double differential windings upon D S are closed and no magnetism is developed to attract armature-lever *a l*; but if a strength of current 3 be sent to line of either polarity the neutral relay R′ responds and lever *o′* is withdrawn from back

stop *i* and the branch *g* is broken, and D S will be subject to the action of the remaining three coils, *e*, *f*, and *h*. Coils *e* and *f* neutralize each other; but coil *h* develops magnetism and armature-lever *a l* closes the local circuit of sounder S′. However, when a current of strength 5 is sent to line not only will armature of R′ be moved and branch *g* be broken, but armature of second neutral relay, R″, will cause *o″* to be drawn from back contact *j* to break branch *h*. When branches *g* and *h* are both broken relay D S is subject only to the effects of differential coils *e* and *f*, which are neutral. Therefore armature-lever *a l* will not close the local of second local sounder S′. A current strength of 3 is sufficient to break one of four differential branches of D S to destroy magnetic equilbrium, while a current strength of 5 operates to break two branches, and thus re establish magnetic equilibrium; but while the breaking of *h* establishes magnetic equilbrium in D S to leave S′ unaffected, the breaking of branch *h* demagnetizes R S, and *a l′* moves to its back stop to close the local of *s″* to give a signal upon the third local sounder. Again, when a current due to the joint action of all the batteries or of strength 7 is sent to line both local sounders S′ and S″ should operate. When current 7 of either polarity is sent to line, armature-levers of all the local relays R′, R″, and R‴ are withdrawn from their back stops, and three of the differential branches, *e*, *g*, and *h*, of D S will be broken, and branch *f* will alone remain closed, when again the magnetic equilibrium of D S will be destroyed and *a l* will close the local of S′ to give a signal; also, as *h* is broken at the same time, S″ will simultaneously respond.

In winding the double differential relay with its four coils in branches *e*, *f*, *g*, and *h* it is apparent that coils of branches *f* and *g* must each be wound and connected to their batteries in such a manner that they may each tend to polarize D S alike—that is, if *f* causes a north magnetic pole in the upper part of D S, *h* likewise should be wound to induce a coincident north pole in the upper part of D S. Should *f* and *h* induce opposite magnetic polarities in D S at certain times, a reversal of polarity in D S would occur. For example, if all the branches but *f* were broken, D S would be charged by *f*. Therefore, if *f* induce a north pole in the upper part and a south pole in the lower part, this polarity would be wholly reversed when *g* alone is broken, as at such time *e* and *f* neutralize each other and magnetic effects in D S would be due to *h* alone. When key S T alone is operated magnetism in D S is wholly due to coils of branch *h*. When both keys S T and S T′ are operated magnetism in D S is wholly due to coil in branch *f*. Therefore to avoid a reversal of magnetic polarity in core of D S coils of branches *f* and *h* must both induce in each end of D S magnetism of the same polarity. If both keys S T and S T′ are closed to operate both sounders S′ and S″, relay D S will have a given magnetic polarity. If, now, key S T′ be opened, the polarity of D S will not be reversed, nor will its magnetic strength even be reduced, and no flutter of armature-bar *a l* will occur to mutilate signals upon S′. Armature-levers of R′, R″, and R‴ all close the local sounder-circuits upon their back contacts. Thus when the armature-levers are attracted a reversal of line-current that would reverse the magnetic polarity of R′, R″, or R‴ would occur too rapidly to permit the armature-levers to close one back contact, even if they were to move back slightly from the poles of the relays.

To still further obviate all possible difficulty from the momentary release of the relay-armatures upon reversal of current, I introduce between relays R and R′ condenser C, which is joined by conductors 25 and 27, respectively, to main line L and artificial circuit G C. If a current from line passes over L A to G‴ it will charge condenser C in such a manner that when the line-current is broken the condenser will discharge and effect a continuation of the previously-broken current up to the time that a reverse current is sent over the line, thus filling the gap in the current at the moment of reversal. The discharge of the condenser occurs through the circuit 25, L to L A, thence over G C and 27 back to condenser C. This device, however, is covered in my Patent No. 191,439, of 1877, and I make no claim to it in this application.

A further part of my invention consists in employing local magnets *m* and *m′* with relays R′ and R″. Armature of relay R′ is obliged to act under three different strengths of current, while armature of R″ is operated by two different strengths of current.

It is desirable that a definite ratio be established between the attractive and retractile forces upon a relay-armature. If the current be strong, the tension of the retractile spring should be adjusted high. Thus, if the retracting-spring of relay R′ be adjusted for a current strength of 3, its adjustment would be wrong for a current-strength of 5 or 7—that is, the tension of the retractor would be too low.

To compensate for a high strength of current I cause a local circuit to be closed by the effects of such a high strength of current, and the local circuit acts in aid of the weak retractor. If spring *s* of relay R′ is adjusted for a current of strength 3, a current of strength 5 would overpower *s*; but as the current 5 actuates armature of R″ to close on front contact local circuit of battery B and magnet *m*, *m* acts in conjunction with *s*, and the retractile force upon lever *o* is automatically increased and made to bear the same ratio to the current 5 that the force of spring *s* alone bears to force of current 3. It is obvious that according to the same plan the retractile force of *s* could be still further aided by calling in more local battery by the action of relay R‴ when current of strength 7 is sent. A local electro-magnet, *m′*, is applied in the same manner to aid the retractile force of *s′*. *m′* is only called into ac-

tion when a current of strength 7 is sent to line.

Local electro-magnets *m* and *m'* will act upon their respective armatures when armatures *o'* and *o''* of R'' and R''' are upon their front contacts; but, should the front contacts be momentarily broken by reversals of the main-line current, *m* or *m'* would exert a variable retracting force. To avoid such difficulty I have placed springs 40 and 41 upon the ends of armature-levers *o''* and *o'''*, leaving a slight range of movement of the armature without breaking the local of *m* or *m'*. Thus the front contact may be preserved even if armature-bars *o'* and *o''* are slightly vibrated upon reversals of current.

It is obvious that many equivalents of springs 40 and 41 may be employed to preserve a front contact to avoid breaking the locals of *m* or *m'*, and I do not limit myself to the use of springs alone.

Fig. 3 illustrates a modification of the receiving system shown in Fig. 2. Fig. 2 shows a third neutral relay, R''', which responds only to currents of the highest tension. Instead, however, of employing a separate relay, R''', which shall respond only to currents of the highest tension, I may modify the relay R'', which, as shown in Fig. 2, only responds to currents of the next highest tension by rendering the armature of said relay susceptible to a certain movement by one strength of current and to a further movement by the highest or greatest strength. The function of R''' is to break the branch *e* of relay D S, and this result may be accomplished by a second or additional movement of the armature of R''. Fig. 3 shows a relay, R'', substantially the same as relay R'' of Fig. 2, with the exception that the front stop of armature *o''* consists not of a fixed anvil, but a lever, *o'''*, held by a retractile spring, *s''*. The next to the highest strength of current employed is sufficient to attract armature *o''* and overcome spring *s'* against the lever *o'''*; but this strength of current is not adequate to overcome the retractile spring *s''*. However, by an additional strength of current not only is armature *o''* attracted and spring *s'* overcome, but the lever *o'''* is moved from its stop *k* against the action of spring *s''* and the branch *e* is broken. It is therefore to be observed that the first movement of armature *o''* serves to break the branch *h*, while the second movement of that due to the highest strength of current causes the branch *e* to be broken.

Throughout this specification I have designated the strengths of battery as bearing the relation of one, two, and four to each other, though I do not limit myself to such proportions, as they may under different circumstances be widely varied.

While I have thus far described my invention as an element of a sextuplex telegraph, it is obvious that I could dispense with the pole-changing key P C at the transmitting-station and the main-line polarized relay R and local sounder S at the receiving-station, and thereby have a complete quadruplex capable of operation without reversals of current. My device therefore will enable double sending from one end of a line by changes of tension of current alone.

In an earlier application for a patent filed by me I have specifically set forth and claimed a transmitting or key system arranged upon a single conductor, consisting of the combination of a fragment of said conductor and a series of transmitting-keys thereon and two branch conductors at each transmitting-key, through either of which branches the main-line circuit may be established, one of said branches being normally open, having thereon a section of main-line battery, and the other branch normally constituting a portion of the main-line circuit, having an artificial resistance substantially equal to that of the battery and the normally-open branch, the two branches of each key being so combined with said key that by its movement the two branches may each separately and alternately be placed in the main-line circuit; wherefore I desire to disclaim such matter from this case in favor of my application of earlier date when not employed in combination with a pole-changing key.

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

1. In a system for simultaneous transmission upon a single line, a transmitting or key system arranged upon a single conductor, consisting of the combination of a fragment of said conductor, whose ends may be reversed by means of pole-changing key in respect to the earth and main-line connections and a series of tension-changing transmitting-keys thereon, and two branch conductors at each transmitting-key, through either of which branches the main-line circuit may be established, one of said branches being normally open and having thereon a section of main-line battery, and the other branch normally constituting a portion of the main-line circuit, having an artificial resistance substantially equal to that of the battery in the normally-open branch, the two branches of each key also being so arranged with said key that by its movement the two branches may each separately and alternately be placed in the main-line circuit, substantially as described.

2. A fragmentary portion of a main-line conductor, the opposite ends of which are connected to a main-line pole-changer, said fragmentary portion of the main line having its continuity preserved through the branches having the resistances *x x'* when the transmitting-keys are upon their back stops, and through the battery-branches of M B' and M B'' when the keys are upon their front stops, substantially as described.

3. The combination, substantially as described, of the pole-changing key P C, connected to earth, conductor 15, main-line battery M B, branches 13 and 14, having respectively sections of battery M B' and resistance *x*,

that g and h are broken by action of relays R′ and R″, while branch e is broken by an increased strength of current through the agency of relay R‴.

19. Armature-levers o'' and o''' of relays R″ and R‴, provided with continuity-preserving devices, in combination with local electro-magnets m and m', whereby the retractile force of m and m' may not be varied by slight movement of arms o'' or o''' upon the reversal of line-currents.

20. The combination of the relay-arm o'' of R″ and spring 40 with local retracting electro-magnet m of relay R′, whereby the action of m may be uniform upon reversing the line-currents.

FRANCIS W. JONES.

Witnesses:
WILLIAM Y. H. BOK,
WILLIAM ARNOUX.

(No Model.)

J. W. LARISH.

MULTIPLE TELEGRAPHY.

No. 257,499. Patented May 9, 1882.

Fig. 1.

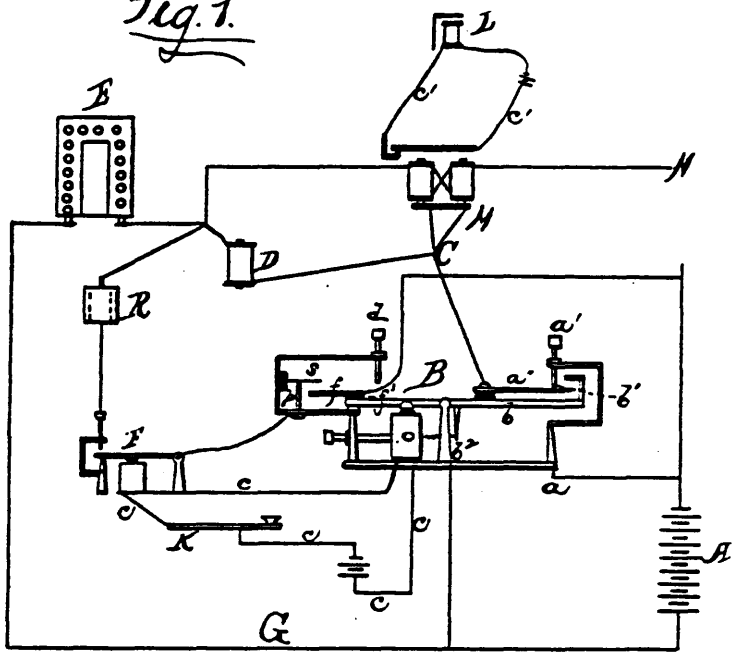
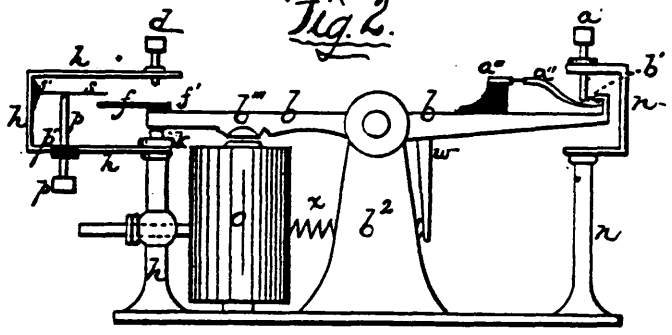


Fig. 2.



Witnesses:

J. W. Killingbeck.

D. K. Parsons.

J. W. Larish,
Inventor, by
J. R. Drake,
Atty.

UNITED STATES PATENT OFFICE.

JOSEPH W. LARISH, OF BUFFALO, N. Y., ASSIGNOR OF SIX-TENTHS TO JAMES W. TILLINGHAST AND FRANK KITTON, BOTH OF SAME PLACE.

MULTIPLE TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 257,499, dated May 9, 1882.

Application filed January 20, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH W. LARISH, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have made certain Improvements in Multiple Telegraphy, of which the following is a specification.

~~The object of this invention is to simplify~~ multiple telegraphy, more especially the working of the "duplex" system.

The main improvement consists in dispensing with the use of condensers entirely and substituting therefor two devices, as follows: first, an electro-magnetic shunt for overcoming static charge and discharge; second, a device consisting of an improved transmitter, arranged as hereinafter described, whereby the home battery is made to overcome extra-current effects on breaking the battery-circuit at the home station. These two devices are combined for the purpose of preventing mutilated signals at the home station, and the arrangement and operation of the devices separately and as a whole is hereinafter fully explained.

~~In the drawings, Figure 1 is a diagram of~~ the whole, including lines, instruments, &c.; Fig. 2, a side elevation of the improved transmitter.

~~A represents the battery, B the transmit-~~ ter; D, an electro-magnet used as a shunt.

E is a rheostat forming part of the artificial line common to all duplex instruments.

R is another rheostat in the extra circuit, which circuit is for the purpose of overcoming extra-current effects due to extra or induced currents on long circuits, as hereinafter described.

F is a repeating-sounder, which closes the circuit on the upstroke.

K is the key placed in the local circuit, which operates the transmitter and the repeating-sounder.

M is a differential relay.

The operation of the whole is as follows: The current from the battery A passes to the transmitter B at *a*, thence through the set-screw *a'* and spring *a''*, which is insulated from the lever *b*, to the point C, where the current divides, one part passing through the differential magnet M to the main line N, the other part passing through said magnet and the electro-magnetic shunt D, through the rheostat E, to earth at G. The transmitter B and repeating-sounder F are operated by a local circuit, *c*, broken by the key K. When the circuit *c* is closed at K the current from battery A passes through at *a a' a''*, and through the magnets to the main line, through the magnets M and shunt D, to the artificial line, and through the rheostat E to earth. In this manner the shunt D receives a portion of the current, which causes an induced current from the magnet, and the induced current so formed being of same strength and polarity, and going through artificial side of relay M in opposite directions around cores to the current through true line side of relay M, thereby neutralizing and overcoming static charge, consequently preventing a false signal on relay from that source. When the local current is broken at K the lever *b* of the transmitter is released, breaking the main-line current from A at *a'' a'*, simultaneously forming a circuit through the spring *a''* and lever *b*, at *b'*, post b^2, to earth G. When at the home station a momentary return-current—technically known as "static discharge"—is found to be coming through the true line side of home relay M, which is met and overcome by the reaction of shunt D in sending a current of equal strength through the other or artificial half of relay M, thereby neutralizing and overcoming static discharge, so that no false signal is produced. At same time, however, with static discharge an extra current excited on true line by home battery is encountered of sufficient strength (varying in accordance with conditions of line) to produce a false signal on relay M. This is met and overcome by means of the second device, whereby with the aid of the improved transmitter a momentary charge from the home battery is thrown through artificial side of relay M in opposite directions (on the core) to extra current, and of sufficient strength (regulated by resistance R) to neutralize and overcome its effect, thereby preventing false or mutilated signals at home station. To illustrate: When the battery is put to the line an induced current opposite to battery-current is produced on true line is thus thrown from battery to earth

line side of relay M with a force, say, of twenty-five. At same moment an induced current is excited in shunt D (which is of adjustable strength) with a force of twenty-five, and this current, going through relay M in an opposite direction to current or static charge on true line side, serves to neutralize and overcome it. Consequently no effect is produced on the home relay M, and the signals are therefore not mutilated.

The second device acts as follows: When the line is thrown from battery to earth an extra current excited by home battery passes to earth through home relay M. This current of course varies in strength with the length and conditions of the line. Let us say on a line of five hundred miles the extra current has a force of fifty. It is therefore found necessary to throw a current (by means of the second device) having a force of fifty through artificial side of relay M, and in an opposite direction in relay to extra current from true line, whereby the effect of extra current on relay is neutralized and overcome, so that no mutilations of signals are felt at home station. At the same time the lever of the repeating-sounder F is released. Immediately thereafter contact is formed between the points at *f*, but is no sooner formed than broken by raising the insulated spring *s* from the post *p*. At the instant of contact a current from the battery A passes through the points *f s p* and the lever of the repeating-sounder F, through the rheostat R, to the artificial line, thence through differential relay M, and through shunt D, point C, *a''*, *b'*, *b*, b^2, to earth. A sufficient portion of this momentary current (regulated by resistance R) passes through the magnet M to neutralize the effect of the extra or induced current from true line on long circuits where the conditions thereof require it, thus doing away with condensers. Upon closing the local circuit the circuit through repeating-sounder F for the current from A is broken by the repeating-sounder before contact is made at *f*, *s*, and *p*.

The following is a description of the transmitter B, (see Fig. 2:) *n* is a metallic frame on a wooden base. *a'* is an adjustable screw set in frame *n*. *a''* is a spring; *b*, a lever, with a metallic fulcrum, b^2, in the center, resting on same base as *n*. *h* is a metallic frame resting on same base with *n* and b^2. *f* is a small metallic arm extending from lever *b*, and insulated from it at *f'*. *p* is an adjustable screw insulated from frame *h* at *p'*. *s* is a metallic spring insulated from *h* at *s'*. *d* is an adjustable screw set in *h*. *o* is an electro-magnet. Spring *a''* is insulated from *b* at *a'''*. *w* is an arm attached to lever *b*. *x* is a coil-spring fastened to arm *w*, and held by an adjustable screw and nut to frame *h*. *b'''* is a soft-iron bar acted upon by the magnet *o*.

The operation of this transmitter in connection with the system has been hereinbefore fully described. The novelty of its construction consists in putting a momentary current through points *f*, *s*, and *p* after the lever *b* has left its point of rest at the bottom, and breaking the connection again at *s* before lever *b* comes to a rest at screw *d* on the upstroke, so that a charge from battery A is thrown through these points *f*, *s*, and *p*, only for an instant, while lever *b* is in the center of its stroke between point *k* and end of screw *d*.

The construction of the other parts of this device is similar to transmitters used by the Western Union and other telegraph companies.

L represents the local receiving-sounder and the local current *c'*, by which it is operated in connection with the differential relay M.

I claim—

~~1. The combination of the battery A, transmitter B, differential relay M, electro-magnetic shunt D, rheostats E and R, repeating-sounder F, circuit-breaker K, and the local circuits *c* and *c'*, and the metallic conductor (wire or otherwise) connecting battery A with metallic arm *f* of transmitter B, the metallic conductor connecting adjustable screw *p* with armature of repeating-sounder F, metallic conductor connecting repeating-sounder F with artificial line through adjustable resistance R, all arranged and operating substantially in the manner and for the purpose specified.~~

2. The combination of elements or parts in a system of multiple telegraphy, consisting of a metallic connection between battery A and point *f* on transmitter B, a like connection between set-screw *p* on transmitter and armature on repeating-sounder F, a like connection between set-screw of frame of repeating-sounder F, through resistance R, to artificial line between rheostat E and differential relay M, a like connection from rheostat E, or any point between it and differential relay M, through electro-magnetic shunt D, to point of division C, all combined and operating as described, and in combination with the local circuit *c c c*, with circuit-breaker K, whereby repeating-sounder F is worked in same circuit with transmitter B, as specified.

3. An improved transmitter, B, one part constructed substantially as those in common use, with continuity-preserving points, a lever with fulcrum in the center, said lever operated by an electro-magnet, and in combination with circuit-breaking or contact points at the opposite end to the continuity-preserving points, consisting of a metallic arm, *f*, extending from lever *b* and insulated from it at *f'*, an adjustable screw, *p*, insulated from frame *h* at *p'*, and a metal spring, *s*, insulated from *h* at *s'*, all arranged and operating in this system of multiple telegraphy substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JOSEPH W. LARISH.

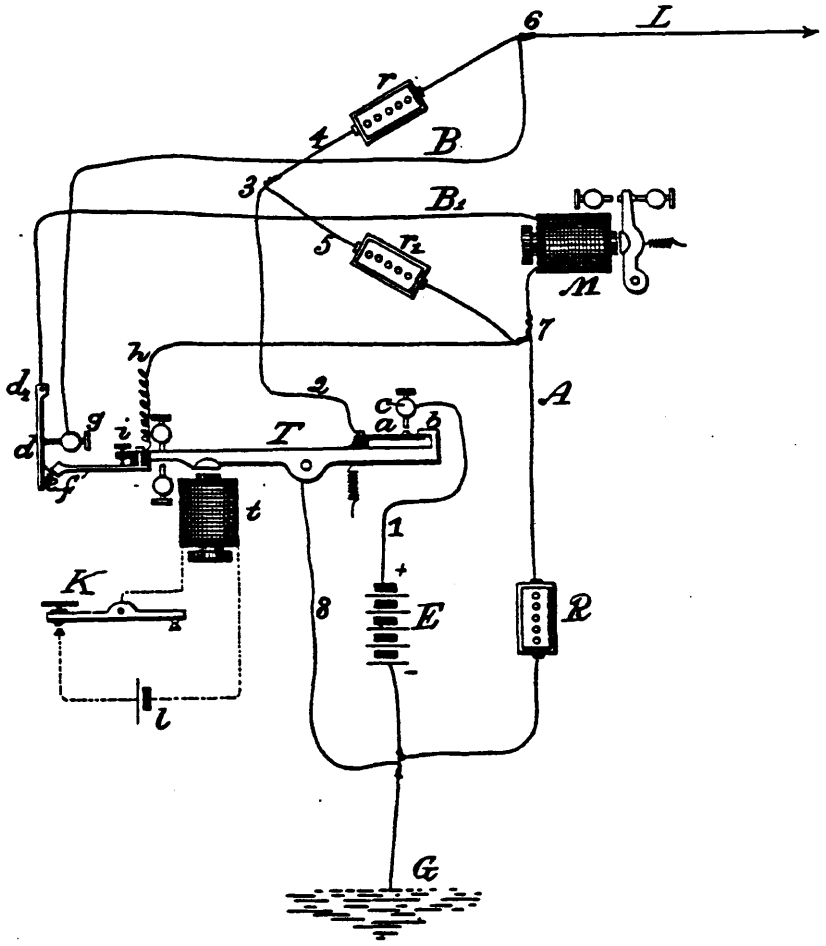
Witnesses:
J. R. DRAKE,
J. W. TILLINGHAST.

(No Model.)

S. D. FIELD.

DUPLEX TELEGRAPH.

No. 244,218. Patented July 12, 1881.



Witnesses:

Mrs. H. Lockwood French

Miller C. Earl

Inventor:

Stephen D. Field,

by his Attorney,

Frank L. Pope.

UNITED STATES PATENT OFFICE.

STEPHEN D. FIELD, OF NEW YORK, N. Y.

DUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 244,218, dated July 12, 1881.

Application filed June 8, 1881. (No model.)

To all whom it may concern:

Be it known that I, STEPHEN D. FIELD, a citizen of the United States, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Duplex Telegraphs, of which the following is a specification.

In transmitting two sets of signals simultaneously in opposite directions over one and the same telegraph-line much interference and confusion arise from the false signals which are produced upon the receiving-instruments by currents of charge and discharge, which are due to the electrostatic or inductive capacity of the line. The phenomenon manifests itself more especially when the line is of considerable length and well insulated. The conditions under which this effect occurs are as follows: If an insulated telegraph-line of considerable length, having its remote end connected with the earth, is suddenly placed in connection with one pole of a battery whose opposite pole is likewise connected with the earth, a powerful current of electricity of momentary duration flows into the conductor, which is termed the "current of charge." As soon as the conductor has received its maximum charge a continuous and uniform current is established, which flows from the battery through the whole length of the conductor and returns through the earth from the distant station. The longer the line and the greater its resistance the greater is the strength of the current of charge in proportion to that of the permanent current which traverses the line after it has received its charge. If after the current has thus been established the line is disconnected from the battery at the home station and instantly connected with the earth, another powerful momentary current flows from the conductor back to the earth at the home station, which is termed the "current of discharge."

The essential condition required for the simultaneous transmission of telegraphic signals in opposite directions is that the signals transmitted by the key at either terminal station shall not produce any effect whatever upon the associate receiving-instrument at the same station.

In order to prevent the receiving-instrument at the home station from being actuated by the outgoing currents transmitted from the home battery, and which are designed to produce signals at the distant station, it is usual to employ a device termed an "artificial line," which consists of a branch or derived circuit, diverging from the main line at a point near its junction with the transmitting-key and proceeding directly to the earth, or, what is in effect the same thing, returning to the other pole of the battery. This derived circuit is provided with one or more adjustable artificial resistances, collectively termed a "rheostat," by means of which its total resistance may be so regulated as to bear a definite proportion to that of the main line. The home receiving-instrument may be rendered neutral to outgoing currents by well-known methods, one of which consists in placing it in the circuit of a bridge-wire, which is a branch or cross circuit, connecting the main and artificial lines at points of equal potential with reference to such currents. It has, however, been found by experience that while the resistance of the main and artificial lines may be the same, or may be in proper proportion to each other, their inductive or electrostatic capacity may be very different, the main line having great inductive capacity, while the artificial line has little or none. Hence, when a signal is transmitted by connecting the battery to the line, a current of charge will flow into the latter, and as this is not compensated by a similar current of charge flowing into the artificial line, a false signal is produced upon the receiving-instrument. So, also, when the battery is disconnected and the line put to earth at the home station, the discharge which takes place in part traverses the bridge-wire and receiving-instrument, and another false signal is produced.

The object of my invention is to prevent this action of the charge and discharge currents upon the receiving-instrument.

To this end my invention consists in a method of preventing the effects of the static charge and discharge of the line upon the receiving-instrument of a duplex telegraph, which consists in temporarily disconnecting the branch of the circuit containing the receiving-instru-

the key K is closed and the battery E connected to the line by means of the transmitter-lever T, the V-shaped end of the arm *f* comes in contact with the wedge-shaped projection *e* and forces the spring *d* away from the screw *g*. The contact between *f* and *e* closes the shunt connecting the terminals of the coils of the receiving-magnet M, while at the same time the circuit of the bridge-wire is interrupted between *g* and *d*. The result of this change in the connections is that the current of charge passes directly by the wires 2, 3, and 4 to the line L, and can produce no effect upon the receiving-instrument M, as the latter is at that moment disconnected from the circuit. The current of discharge coming from the line at the terminal of a signal, in like manner and for the same reason, passes directly to the earth by the wires 4, 3, and 2, without reaching the receiving-magnet M.

It is obvious that the momentary disconnection of the receiving-magnet M from the main current which takes place at the beginning and end of each outgoing signal would have a tendency to cause a break or interruption in any signal which might at the time be coming from the distant station. This effect is prevented by the simultaneous closing of the shunt-circuit uniting the terminals of the electro-magnet, as hereinbefore described, which, by forming a path for the induced current arising from the discharge of the electro-magnet itself, prolongs the duration of its magnetism for a sufficient length of time to hold its armature in position until the normal current is restored by the closing of the bridge-wire. The duration of the time during which the bridge-wire is disconnected and the shunt-circuit is connected by the action of the transmitter is capable of being adjusted by means of the screw *g*, while the time at which the same operation commences with reference to the movement of the transmitter T is regulated by means of the screw *i*, which adjusts the position of the arm *f*.

It is obvious that the distribution of the continuous current between the main and artificial lines will take place precisely as in the ordinary duplex apparatus.

I remark that although I have found the mechanism hereinbefore described well adapted to produce the result set forth I do not desire to confine myself thereto, as many mechanical combinations of apparatus may be devised, by means of which the bridge-wire may be temporarily disconnected at the instant of charge and discharge and the receiving-magnet shunted at the same instant, and this may obviously be done without departing in the least from the general principle of my invention. I also remark that it may be sufficient in some instances to merely shunt the receiving-magnet without disconnecting the bridge-wire, or under other circumstances to disconnect the bridge-wire without shunting the receiving-magnet; but I have found in practice that the best results are obtained by the simultaneous action of devices whereby both these results are produced, substantially in the manner hereinbefore described.

I claim as my invention—

1. The hereinbefore-described method of preventing the effects of static charge and discharge of the line upon the home receiving-instrument of a duplex telegraph, which consists in temporarily disconnecting the branch of the circuit in which said instrument is included at the instant the line is connected either to the battery or to the earth at the home station.

2. The hereinbefore-described method of preventing the effects of static charge and discharge of the line upon the home receiving-instrument of a duplex telegraph, which consists in temporarily disconnecting the branch of the circuit in which said receiving-instrument is included at the instant the line is connected either to the battery or to the earth at the home station, and in simultaneously establishing a temporary connection between the terminals of the electro-magnet of the receiving-instrument.

3. The combination, substantially as hereinbefore set forth, of a main line, an artificial line, a battery, a key or transmitter which connects and disconnects said battery to and from said main line simultaneously, a receiving-instrument included in the circuit of a bridge-wire between the main and artificial lines in a position neutral to outgoing currents, and a circuit-breaker actuated by said key or transmitter, whereby said bridge-wire is temporarily disconnected at the instant the connection between the battery and the main and artificial lines is either broken or closed.

4. The combination, substantially as hereinbefore set forth, of a main line, an artificial line, a battery, a key or transmitter which connects and disconnects said battery to and from said main line simultaneously, a receiving-instrument included in the circuit of a bridge-wire between the main and artificial lines in a position neutral to outgoing currents, a normally-open shunt-circuit, which, when closed, unites the terminals of the electro-magnet of the receiving-instrument, and a circuit-closer actuated by said key or transmitter, whereby said shunt is momentarily closed at the instant the connection between the battery and the main and artificial lines is either broken or closed.

5. The combination, substantially as hereinbefore set forth, of a main line, an artificial line, a battery, a key or transmitter which connects and disconnects said battery to and from said main line simultaneously, a receiving-instrument included in the circuit of a bridge-wire between the main and artificial lines in a position neutral to outgoing currents, a normally-open shunt-circuit which, when closed,

ment, or in establishing a temporary connection between the terminals of the electro-magnet of the receiving-instrument, or preferably in performing both these operations simultaneously at the instant a connection is formed between the line and the battery or the earth at the home station.

The invention also consists in certain combinations of electric circuits and of mechanism whereby the hereinbefore-mentioned results are effected.

The accompanying drawing is a diagram representing the apparatus and electrical connections at one terminal station of a duplex telegraph to which my invention has been applied.

Referring to the diagram, E represents the main battery, the negative pole of which is connected directly to the earth at G in the usual manner.

T represents the lever of the transmitter, which is preferably actuated by an electro-magnet, *t*, placed in the circuit of the local battery *l*, (represented by a dotted line,) which is opened and closed by the manipulation of the key K. Upon the transmitter-lever T is mounted an insulated contact-spring, *a*. This normally rests against a contact-stop, *b*, formed upon the end of the lever T, which is therefore termed the "resting-stop." Just above the contact-spring *a* is placed a fixed stop, *c*, in such a relative position thereto that when the transmitter-lever T is actuated by depressing the key K the contact-spring *a* is brought against the stop *c*, which is termed the "working contact," and at the same instant the contact between the said spring and the stop *b* is interrupted. The positive pole of the main battery E is connected by a conductor, 1, to the stop *c*. The lever T of the transmitter is connected directly with the earth by a conductor, 8. A conductor, 2, is attached to the insulated contact-spring *a*, and divides at the point 3 into two branches, 4 and 5. The branch 4 extends to the point 6, where it joins the main line L extending to the distant station. The other branch, 5, extends to the point 7, where it joins the artificial line A, which returns directly to the earth at G. Between the point 6 on the main line and the point 7 on the artificial line, a bridge-wire, B B′, extends, (which, for the present, may be regarded as a normally-closed or continuous circuit,) in which is included the electro-magnet M of the home receiving-instrument. Rheostats or adjustable resistances *r r′* are inserted in the wires 4 and 5, respectively, and another rheostat, R, is placed in the circuit of the artificial line A. In accordance with the well-known laws of electrical conduction, it will be evident that, if the amount of resistance in the rheostat R is made exactly equal to that of the line-wire L leading to the distant station and the resistances *r* and *r′* are made equal to each other, no current will pass through the bridge-wire B B′ between the points 6 and 7. Moreover, the result will be the same in any case in which the proportion of the rheostat *r* to the line L is the same as that of the rheostat *r′* to the artificial line A, inclusive of the rheostat R. The rheostat R is preferably made adjustable, in order to compensate for the varying resistance of the main line under different conditions of insulation.

The organization which I have thus far described is well known and in common use, and in itself forms no part of my invention. Its practical operation is as follows: In transmitting a signal from the home station the key K is depressed by the operator, which causes the electro-magnet *t* to attract its armature, and thereby raise the opposite extremity of the transmitter T. This brings the insulated spring *a* into contact with the stop *c*, and thereby forms a connection between the battery E and both the main and artificial lines, L and A. In consequence of the inductive capacity of the line L, a current of charge traverses the wire 4 at the instant the battery is connected therewith, which current is not compensated by any corresponding current of charge in the wire 5, and consequently a difference of potential is caused between the points 6 and 7 and a false signal is produced upon the receiving-instrument. So, also, when the key K is released and the contact-spring *a* is detached from the battery-contact *c* and connected with the earth-contact *b*, a current of discharge takes place through the wire 4, which, in like manner, is not compensated by any corresponding current in the wire 5, and thus another false signal is produced.

I will now describe the improved apparatus which I have invented, by means of which this difficulty is obviated.

Upon the lever of the transmitter T is mounted a rigid insulated arm, *f*, which is capable of adjustment with reference to the position of the lever upon which it is mounted by means of a screw, *i*, or any equivalent device serving the same purpose. The arm *f* is V-shaped at its extremity, and this portion of it, when actuated by the movement of the transmitter-lever T, is brought into contact with a wedge-shaped projection or tooth, *e*, mounted upon a flexible spring, *d*, which is attached to a suitable fixed support, *d′*. The spring *d* is also provided with a contact-point, which normally rests upon the adjustable contact-screw *g*. The two parts of the bridge-wire, B and B′, are respectively connected with the spring *d* and the contact-screw *g*. The insulated arm *f* is also connected, by means of the wire *h*, with the point 7 at the junction of the bridge-wire B′ and the artificial line A. By an inspection of the diagram it will be understood that when a connection is formed between the wires B′ and *h* they act to shunt or short-circuit the coils of the electro-magnet M of the receiving-instrument.

The practical operation of the hereinbefore-described organization is as follows: When

unites the terminals of the electro-magnet of the receiving-instrument, and a circuit-changer actuated by said key or transmitter, whereby said bridge-wire is interrupted and said shunt-circuit simultaneously closed at the instant the connection between the battery and the main and artificial lines is either broken or closed.

In testimony whereof I have hereunto subscribed my name this 7th day of June, A. D. 1881.

STEPHEN DUDLEY FIELD.

Witnesses:
WILLIAM H. KENYON,
MILLER C. EARL.

(No Model.)

C. L. BUCKINGHAM.

DUPLEX TELEGRAPH.

No. 258,366. Patented May 23, 1882.

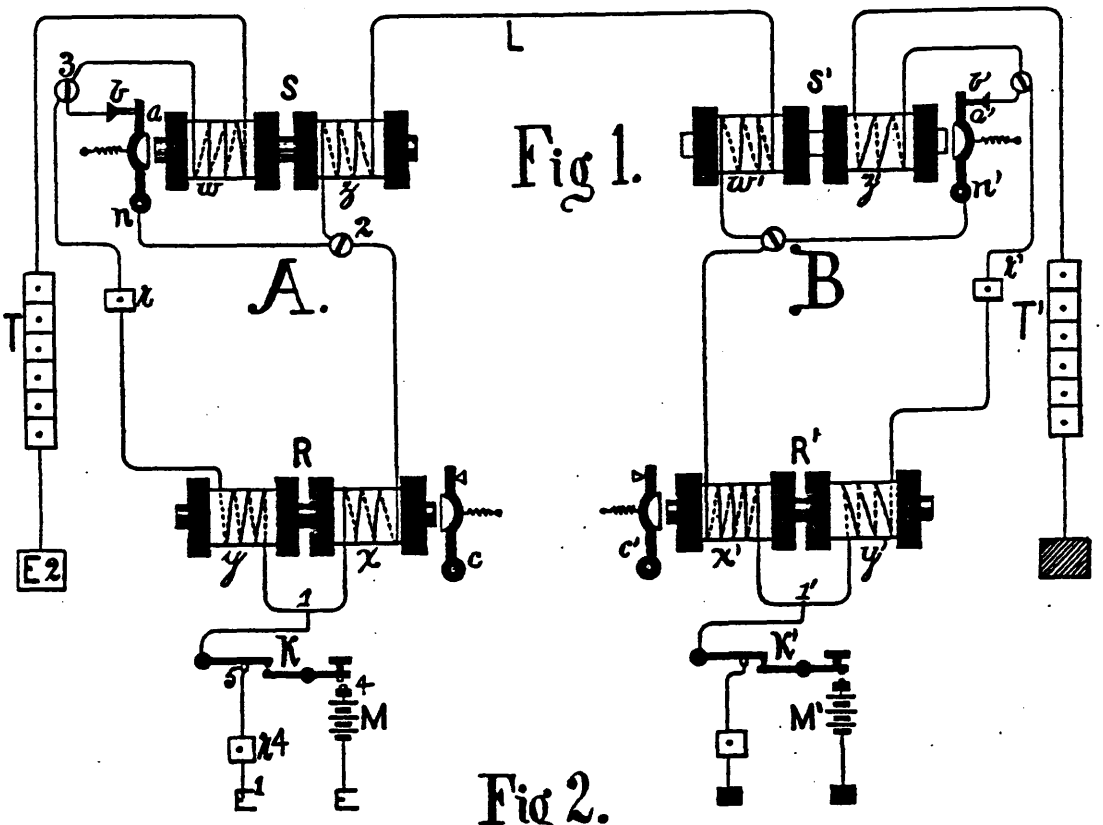
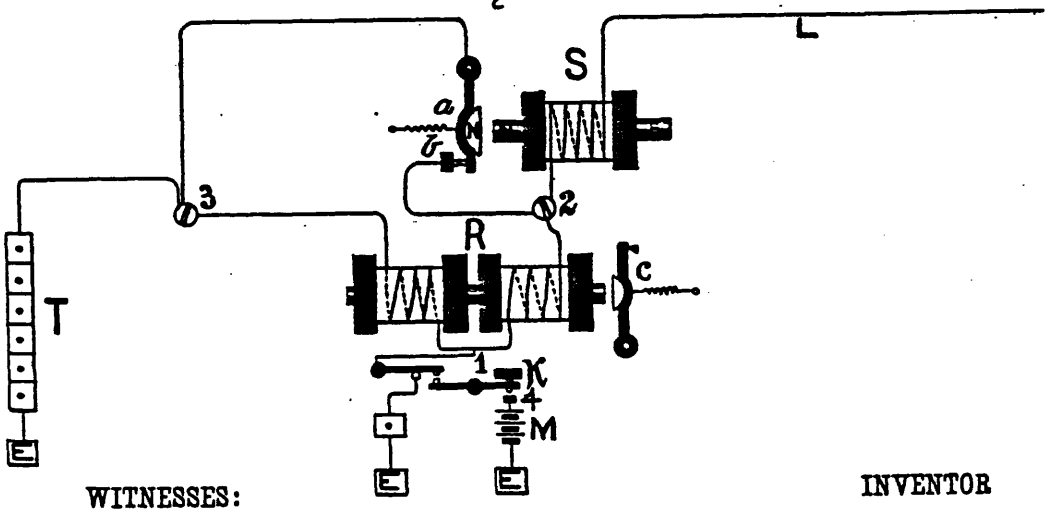


Fig 1.

Fig 2.



WITNESSES:

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Wm. Arnoux

INVENTOR

C. L. Buckingham

BY

ATTORNEY

UNITED STATES PATENT OFFICE.

CHARLES L. BUCKINGHAM, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY, OF NEW YORK, N. Y.

DUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 253,366, dated May 23, 1882.

Application filed June 16, 1881. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. BUCKINGHAM, of Elizabeth, county of Union, and State of New Jersey, have invented a new and useful Improvement in Telegraphy, of which the following is a description, reference being had to the accompanying drawings, forming a part hereof.

My invention is applicable to differential systems of telegraphy for the simultaneous transmission of messages upon a single line in opposite directions, and has for its special object the neutralization in the receiving-instruments of duplex, quadruplex, or sextuplex telegraphy of disturbing effects due to static induction upon the main line; and to this end I employ at each station a normally-closed bridge or branch conductor to join the main and artificial lines. The bridge or branch conductor is normally closed through a contact-point and the armature of an electro-magnet, and the position of said armature, whether to open or close the bridge, depends upon the currents which are transmitted by the keys of the home and distant stations. When only signals are being sent from the home station the bridge remains closed, and from this fact equal strengths of current will flow through the two oppositely-wound coils of the home receiving-relay both while the main line is receiving its inductive charge and thereafter, during the continuance of a signal and after the main line has received its full inductive charge.

It is well understood in the art of duplex telegraphy that in a differential duplex while the main line is receiving its inductive charge a stronger current will flow through the main-line coil than through the oppositely-wound coil in the artificial circuit, and that the differential receiving-relay will respond to give a false signal. The bridge, however, which I employ effects a complete balance of currents sent through them from the home station. Following each signal that is sent from the home station is a quick static or inductive discharge from the main line in a direction opposite to that of the current of charge. The direction of the current of inductive discharge is such as to tend to cause the bridge to be broken. However, the armature of the bridge is so adjusted that the bridge will practically remain unbroken from the effects of such inductive discharge, and it will distribute itself in passing to earth equally through the two oppositely-wound coils of the receiving-relay, and no false signal will follow. While the bridge will not be broken by a quick inductive discharge from the main line, a battery-current sent from a distant station sufficiently prolonged to produce a signal at the home station will cause the bridge to be opened and remain open during the signal, wherefore the current will only pass through one coil of the home receiving-relay and a signal will be given. By this means the main-line inductive charge and discharge produce neutral effects upon receiving-relays when signals are sent from the same stations, and this end is accomplished without the necessity of adjustment to change the electro-static capacity of an artificial line to balance the highly-variable inductive effects of the main line.

I will now explain my invention by reference to the accompanying drawings.

Figure 1 represents an ordinary duplex system in which the bridge at each station is broken by means of an ordinary differential electro-magnet whose coils are in the main and artificial lines, respectively. Fig. 2 shows a modified means for breaking the bridge-conductor, which consists of a polarized relay whose coil is in the main line alone.

In Fig. 1, A and B represent two distant stations, joined by a main line, L.

M and M′ are two main-line batteries, arranged to oppose each other when simultaneously connected to line. In all other respects the devices of station B are identical with those of station A, and a description of apparatus of one station will suffice for that of both.

R is an ordinary differential receiving-relay, having oppositely-wound coils *x* and *y*, forming parts respectively of the main and artificial circuits, and *c* is its armature-tongue.

K is an ordinary continuity-preserving key.

T is a resistance placed in the artificial circuit equal in amount to the main-line resistance. The artificial line is connected to earth at E^2.

S is a differential electro-magnet altogether similar in general respects to relay R, its coils *z* and *w* being oppositely wound and forming parts of the main and artificial lines.

2 and 3 are points in the main and artificial lines, joined with a bridge or branch conductor of very low resistance, which is normally closed through armature *a* and stop *b*.

r is a small rheostat for establishing a proper proportion of resistances of conductors between points 1 and 2 and 1 and 3.

When K is depressed the current of battery M divides at point 1, one portion passing through coils *x* and *z* and the other through coils *y* and *w* of the relay R and electro-magnet S. When the two portions of the current thus divided are equal the electro-magnetic effects of *x* and *y* are neutral, also those of *z* and *w*; but owing to the greater capacity of the main than the artificial line for a static charge the current from M at the beginning of each signal, if there be no compensating device, will be stronger through coils *x* and *z* of the main line than through coils *y* and *w* of the artificial circuit. However, if points 2 and 3 be connected by a bridge which is normally closed, it is obvious that until such bridge is broken the current flowing through coil *x* must equal that passing through *y*, even if the current which flows to the main line from point 2 is much greater than that flowing over the artificial line from point 3 to E^2. Primarily, therefore, owing to the normally-closed bridge joining points 2 and 3, the current of M will be divided equally through the coils *x* and *y*; but while the bridge causes an equal division of current between coils *x* and *y*, more current at the same time will flow through coil *z* than *w*, whereby S will become magnetic and tend to attract its armature. However, if S be slightly sluggish and armature *a* properly adjusted, the bridge will not be broken until the main line will have received its inductive charge. After the line has received its inductive charge the current from M will divide itself at 1 equally, and it will be immaterial if the bridge be momentarily broken.

When the resistance of the bridge compared with that of either *x* or *y* is practically zero, and resistances of *x* and *y* are equal, it will be observed that at the moment of charging the main line, when more current is flowing into said main line than to the artificial circuit, a current will be set up in the bridge from 3 toward 2, and that the division of current at point 1 will be equal through *x* and *y*.

The removal of battery M after sending each signal is accompanied by a static discharge opposite in direction to the corresponding current of charge. The current of static discharge which would otherwise pass through only coil *x* of the differential relay R divides equally at point 2, one portion passing to earth by coil *y* and the other by the oppositely-wound coil *x*, whereby the effects of static discharge are neutral upon the receiving-relay. As the static discharge from the line passes through only one coil of S, it will tend to break the bridge; but by a proper construction of S and adjustment of *a* the bridge will not be broken before a complete discharge can occur. While the static discharge of the main line is not sufficient to cause the bridge to be broken, a sufficiently-prolonged current from a distant station to make a telegraphic character will attract armature *a* and retain it during the time of the signal, and the current will thereby pass wholly through coil *x* to effect a signal. If the batteries M and M′ are both simultaneously upon the line, and battery M be then removed, the accompanying static discharge will not neutralize itself by passing through both coils *x* and *y*, as the bridge is broken when both batteries are to line, and so remains when M is removed. The static discharge under this condition discharges wholly through *x*; but this will produce no false signal by attracting *c*, as *c* is already attracted from the agency of the closed key at the distant station. The static discharge will therefore only conspire to hold *c* in its proper position.

I will now describe my modification illustrated in Fig. 2.

S is a relay having a polarized core and a polarized armature-tongue, *a*, for the purpose of breaking and closing the bridge-conductor joining points 2 and 3, the functions of which are fully set forth in the description of Fig. 1. The coil of S is in the main line, and when no current is flowing through said coil the polarized armature *a* is repelled, as the magnetisms of *a* and the adjoining end of S are of like polarity—say north. When a current is sent from M the armature is more strongly repelled, as the direction of the current is such as to induce north magnetism in the end of core S facing *a*; but when a current is received from a distant station to effect a signal the armature will no longer be repelled; but the magnetism of the core will be reversed, the armature will be attracted, the bridge will be broken, and a signal received. The retractile force of the armature, however, is so adjusted as not to be materially moved by the static discharge from the line, though its direction be the same as a current giving a signal. By means of the polar circuit-breaker the bridge cannot by any possibility be broken when the line is receiving its inductive charge, as its action is wholly independent of the current of the artificial line. However strong and prolonged the effect of static charge, polar armature *a* will not be moved and equality of current strength in coils *x* and *y* will remain unchanged.

I do not herein claim the combination at each station of a main line, an artificial compensating-circuit, a receiving-instrument, a bridge or branch conductor connecting the main and artificial lines, and an automatic circuit-breaker for opening and closing said bridge, since I shall claim said combination in a separate patent.

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

1. The method, substantially as specified, of

rendering the receiving-relay of a differential duplex system insensible to the effects of the inductive charge and discharge of the main line, which consists in causing both the inductive charge and discharge respectively to be divided or differentialized through the two oppositely-wound coils of the differential relay.

2. The method, substantially as specified, of rendering the receiving-relay at a transmitting-station in a telegraphic system for simultaneous transmission in opposite directions insensible to the effects of the inductive charge and discharge of the main line, which consists in causing both the inductive charge and discharge respectively through the receiving-instrument at the transmitting-station to be divided before passing through said receiving-relay, whereby the divided portion will act oppositely thereon to produce neutral effects and avoid false signals.

Executed June 13, 1881.

CHARLES L. BUCKINGHAM.

Witnesses:
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F. L. FOULKS.

(No Model.)

G. SMITH.

QUADRUPLEX TELEGRAPH.

No. 319,428. Patented June 2, 1885.

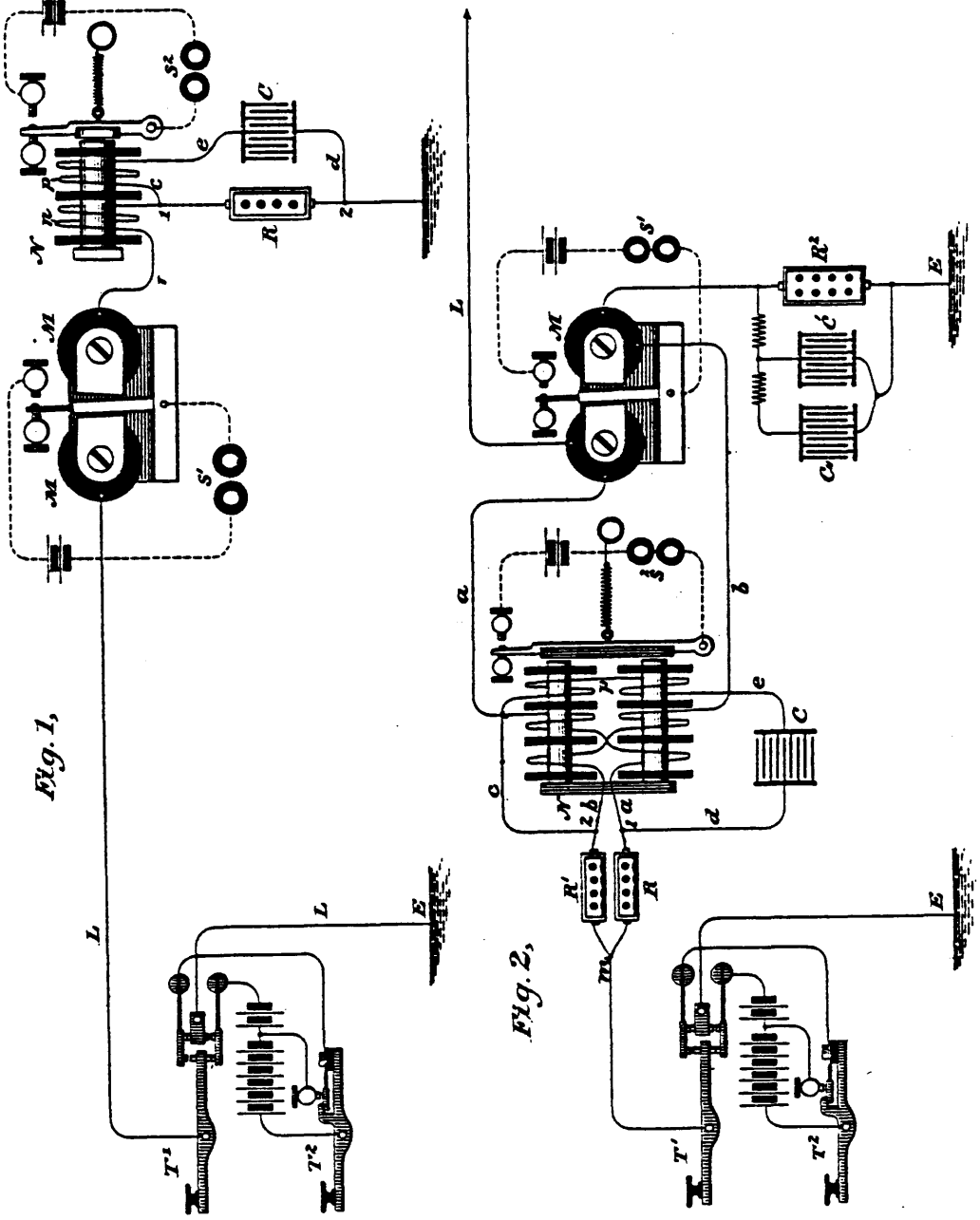

Fig. 1,

Fig. 2,

Witnesses

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UNITED STATES PATENT OFFICE.

GERRITT SMITH, OF ASTORIA, NEW YORK.

QUADRUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 319,428, dated June 2, 1885.

Application filed January 2, 1885. (No model.)

To all whom it may concern:

Be it known that I, GERRITT SMITH, of Astoria, county of Queens, State of New York, a citizen of the United States of America, have made a new and useful Improvement in Diplex and Quadruplex Telegraphy, of which the following is a specification.

In diplex and quadruplex telegraphs in which a polarized and a neutral relay are employed—one to record a message by changes of polarity, and the other a message by changes of current strength independent of polarity it is well known that—upon each reversal of current for operating the polar relay a momentary cessation of magnetism occurs in the neutral relay, and that from such momentary demagnetization of the neutral relay its armature, if held at front contact at the moment of reversal, will be withdrawn by its retracting-spring, and if said armature is permitted to reach back contact, will cause a false signal to be made.

The object of my invention is to shorten the period of demagnetization of the neutral relay during reversals; and to this end, in a a quadruplex circuit, I employ a condenser whose opposite poles are respectively connected to the main and artificial lines at points between the junction of said lines and the receiving-instruments, and in case of a simple diplex I connect the two poles of a condenser, one to the main line at the receiving end, between the earth and the receiving-instruments, and the other directly to earth. A condenser as thus described may be advantageously used, though it is preferable to include in said condenser branch or circuit an electro-magnetic coil, which is so wound upon the core of the neutral relay as to cause the currents established by the charge and discharge of the condenser to so act as to hold the armature of said neutral relay to its core when it would otherwise be left free to the action of its retracting-spring and would be withdrawn to back contact.

It is well known that an insulated telegraph-line of considerable length, whether suspended above the earth or submerged in water, is capable of accumulating or storing up a quantity of electricity when connected with a battery. This property of an insulated conductor is termed its "inductive" or "electro-static" capacity, and the electricity so retained is termed the "static charge of the line." Owing to the capacity of a line for receiving a static charge, a current is not established throughout its entire length until a perceptible period of time has elapsed after connecting a battery thereto; and the period required for a current to become fully established at the remote end of a line is proportional to the length of line. Thus in case of a very long line, where its static capacity is great, a galvanometer placed in line at the distant end will not indicate a current in that part of the line until perhaps half a second after the battery has been connected thereto at its opposite end. If, instead of merely connecting a battery to line and then disconnecting it a battery permanently in line is reversed, there will be a period between a maximum current of one polarity and a maximum current of opposite polarity about equal to the time required for the line to receive its full charge, and during the larger part of said period the current will either be practically of zero strength or too weak to enable the neutral relay to retain its armature against the force of its retracting-spring. Not only is much time consumed in charging a long line, but from the same cause almost the same time is lost in the discharging of the line. In my invention the condenser is so arranged as to absorb a large static charge at a point of the main line just beyond the neutral relay at the receiving-instrument, and while said condenser is receiving its charge an abnormal current will flow through said relay. A large current will flow into the condenser before it will pass to earth over the main line, since the condenser has practically no resistance, while the main line from the junction of the condenser branch to earth has many hundred ohms. The necessity for connecting the condenser branch to the main line at the receiving end between the relay and the earth is obvious from the fact that if it were connected with the main line between the relay and the transmitting end the current set up by charging the condenser would not pass through the relay-coils, but would merely pass over the main line to the condenser branch, down said branch

to the condenser, and thence to earth from the other pole of the condenser, thus finding a path to earth short of the relay. By winding the condenser branch into an electro-magnetic coil upon the neutral relay not only does the current due to the charging of the condenser exert a beneficial effect by passing through the primary coil of the relay, but it also acts through the secondary coil forming a part of the condenser branch. Upon connecting a battery to line at the transmitting end the current due to the charging of the condenser would first act to attract the neutral armature of the distant relay in advance of the establishing of a full current at the earth end of the line, and upon removing the battery from line the discharging of the condenser sets up a current which continues to hold the armature of the relay toward its core. The discharge of the condenser occurs immediately upon a cessation of the main-line current at the receiving end, due to removing the battery from line at the transmitting end; but the current of the condenser-discharge establishes an opposite polarity of magnetism in the relay from that set up by the preceding main-line current. Thus at the moment of cessation of the main-line current the condenser current, discharging only feebly at first, acts differentially, or in opposition to the main-line current, and gradually increases in strength until the main-line current has become materially reduced, when the magnetism of the neutral relay becomes reversed. The current of discharge from the condenser at the termination of a battery-current acting in a direction opposite to that of the battery-current upon the neutral relay produces a magnetism in said relay of the same polarity as a reverse battery-current. Thus if the main-line current is reversed the discharge of the condenser following the first direction of current acts in the same manner upon the neutral relay as the reverse current. The condenser-discharge precedes the battery-current reversal, and bridges over any absence of current at the receiving end of a long line during said reversal, and while the main line is discharging and recharging. The period of reversal is thus rendered only momentary, and continues only while the main-line current is falling and the condenser is beginning to discharge.

Figure 1 is a diagram of a diplex-telegraph apparatus in which one message is transmitted by reversals of current independently of changes in strength and received upon a polar relay, and in which a second message is transmitted by change in current strength independently of reversals of current and received upon a neutral relay. Fig. 2 is a diagram showing a quadruplex set at one end of the line—that is, a set of transmitting and receiving instruments at one station in which two messages, one by reversals and the other by changes in current strength, may be received from a distant station, while simultaneously two separate messages, one by reversals and the other by changes in current strength, may be transmitted to the distant station.

In Fig. 1 L is a main line normally including a weak battery whose poles may be alternately reversed by key T'. An additional section of battery may be added and removed in a well-known manner, and as indicated in the diagram by T^2. Key T' normally serves to reverse the small section of the battery while key T^2 is open, and to reverse the entire battery when key T^2 is closed.

M is a receiving-instrument which is only responsive to reversals of main-line current, whether of a section only or of the entire main-line battery.

N is a neutral relay responsive only to changes of current strength, and not to reversals. The neutral relay N is provided with coils *n* and *p*.

n is the primary coil of the neutral relay, and forms a portion of the main line L, which is connected to earth by a resistance, R, of several hundred ohms. Coil *p*, beginning at point 1 of the main line, is wound upon the relay-core as though it were a continuation of coil *n*. The wire *c* of coil *p*, beginning at point 1, is continued by wire *e* to the upper pole of condenser C, while the opposite pole of said condenser is connected by wire *d* to point 2 of the main line, and thence to earth. Resistance R should usually be of four hundred or five hundred ohms. It must, however, under all circumstances be sufficient to cause the condenser to receive an adequate charge for the purpose required. It will therefore be seen if a main-line current were passing from the transmitting-station over line L and through coil *n* that while line L through coil *n* was receiving its charge only a small current would be established, owing to the resistance R. If, however, the resistance R were removed and the current were afforded a free passage to earth, or to any other reservoir offering no resistance, a strong current would be established through coil *n* almost at the instant that the current in the line had become established through said coil.

To enable the establishment of a current through coil *n*, and before it could otherwise be established owing to resistance R, connection is made from point 1 by wires *c* and *e* with the upper pole of condenser C. When a current arrives at point 1, instead of being compelled to pass wholly over resistance R, a great portion will pass by wires *c* and *e* into the condenser, and while the condenser is receiving its charge a strong current will necessarily be set up through coil *n*. The advantage of condenser C is thus apparent, whether coil *p* is included in the wires *c* and *e* or not. However, by including the coil *p* in said wire, not only does the condenser afford a free path for the main line to flow into, but all of the current flowing into said condenser passes around to coil *p*, and therefore enables coil *p* to establish a magnetic action helping that due to coil *n*.

The necessity for connecting wires *c* and *e* to line L at a point between the neutral relay and the earth, rather than between the transmitting-station and the relay, is apparent from the fact that if the condenser were connected to the line between the relay and the transmitting-station any current flowing into the condenser would in no wise add to the current flowing through the primary coils of the neutral relay. If a battery were first connected to the main line at the transmitting-station, as has before been stated, a perceptible length of time would be required for the main line to receive its charge at the receiving end, and if the battery, after the line had become fully charged, were removed from line, a period would also be required for the discharge of said line. Now, if the line has been fully charged and the battery is removed at the instant the current on the main line diminishes, a current of discharge from the condenser will flow from said condenser over wire *e*, through coil *p*, wire *c* to point 1, resistance R, point 2, and by wire *d* to the opposite pole of the condenser, thus tending to establish magnetism of a polarity opposite to that established by the preceding main-line current, and as the main-line current still further diminishes the condenser-discharge will increase until finally magnetism due to the condenser-discharge will exceed that due to the diminished main-line current until the magnetism in the neutral relay will become reversed. Thus it is seen that from the action of the condenser a reversal of magnetism in the neutral relay will occur before the main-line current at the receiving end has been fully discharged, and that the function of the condenser is to obliterate all effects commonly known as those due to "tailings." Upon removing a main-line battery, as has just been seen, a reversal of magnetism in the neutral relay occurs from the action of the condenser—that is, from the discharge of the condenser in a direction opposite to that of the preceding main-line current. Now, if the main-line current is reversed, the succeeding or reversed main-line current will be in the same direction as that of the condenser-discharge due to the preceding main-line current. Thus the condenser-discharge in each instance sets up a current in the neutral relay in advance of each succeeding main-line current, and no interval which might otherwise occur between two reversals of current at the distant end, owing to the time required for the line to discharge and become recharged, can occur. With the condenser, instead of there being any perceptible interval in the discharge of the line at the receiving end and the recharge of said line, the reversal occurs at the very instant that the main-line current has discharged below a certain amount. Thus the armature of the neutral relay at the time of current reversals will be firmly held at front contact, and will not have time to be withdrawn to its back or working contact by its retracting-spring. In a quadruplex arrangement, where transmission must be effected without causing false signals upon the associated receiving-instruments, it is necessary that the condenser branch should be connected by wires *c* and *d* (see Fig. 2) to points of equal potential, Figs. 1 and 2, of the main and the artificial lines. Therefore the resistance R of, say, four hundred and fifty ohms, in the main line between *m* and 1 must be supplemented by an equal resistance, R′, between points *m* and 2 on the artificial line *b*. If the resistances R and R′ were not substantially equal in a differential system, the potentials of points 1 and 2 would not be equal, and currents transmitted from this end of the line would cause condenser C to be charged and discharged with each transmission from the home station, thus causing false signals upon relay N, which should only be responsive to currents from a distant station. As will be seen by inspecting Fig. 2, a current arriving from a distant station over the main line will pass through relay M, neutral relay N, and thence by wire *a* to point 1. At point 1 the current will divide, a portion flowing over resistance R and thence to earth. Another portion of the current will flow from point 1 by wire *d* to one pole of condenser C, thence from the other pole of the condenser by wire *e* to coil *p*, and from coil *p* by wire *c* to point 2, and thence through resistance R′ to point *m* and to earth. As has been described in connection with Fig. 1, it will be readily seen by inspection of Fig. 2 that the current set up in coil *p* by the condenser-discharge will serve to bridge over reversals in the main-line current, and will therefore prevent the retraction of the armature-lever during such reversals, and the consequent mutilation of signals upon the sounder of the neutral relay.

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

1. In a diplex or a quadruplex telegraph system, the combination of a neutral relay, and a condenser connected to the main line at a point between the neutral relay and the earth at the receiving end and to the earth.

2. In a diplex or quadruplex telegraph system in which reversals of current are employed for the transmission of one set of signals, a neutral relay, a resistance between said relay and the earth at the receiving end of the line, and a condenser whose opposite poles are respectively connected to the earth and to the main line between the relay and the earth, substantially as shown.

3. In a diplex and quadruplex telegraph system in which reversals of current are employed for the transmission of one set of signals, a neutral relay provided with two coils, one of which is embraced in the main line and the other in a branch, which branch also includes a condenser and is connected with the main line at a point between the earth and said neutral relay and with the earth, substantially as described.

4. In a quadruplex-telegraph system, the combination of main and artificial lines, a differential neutral relay, a condenser branch, including auxiliary coils *p* and condenser C, connected to the main and artificial lines at points of equal potential, and means at both ends of said telegraph-line for transmitting messages by reversals of current, substantially as described.

5. In a quadruplex-telegraph system, the combination of a neutral differential relay, a condenser branch connecting auxiliary coils *p* and condenser C joining the main and artificial lines at points of equal potential between said neutral relay and the earth-connection at the same station, and a main line having means at both ends, respectively, for the transmission of messages by current reversals, substantially as described.

6. In a quadruplex-telegraph system, the combination of a neutral differential relay, of a main and an artificial telegraph line, a condenser branch, including condenser C, joining said main and artificial lines at points of equal potential between said neutral relay and the earth at the same station, and means for transmitting messages respectively from both ends of the telegraph-line by current reversals.

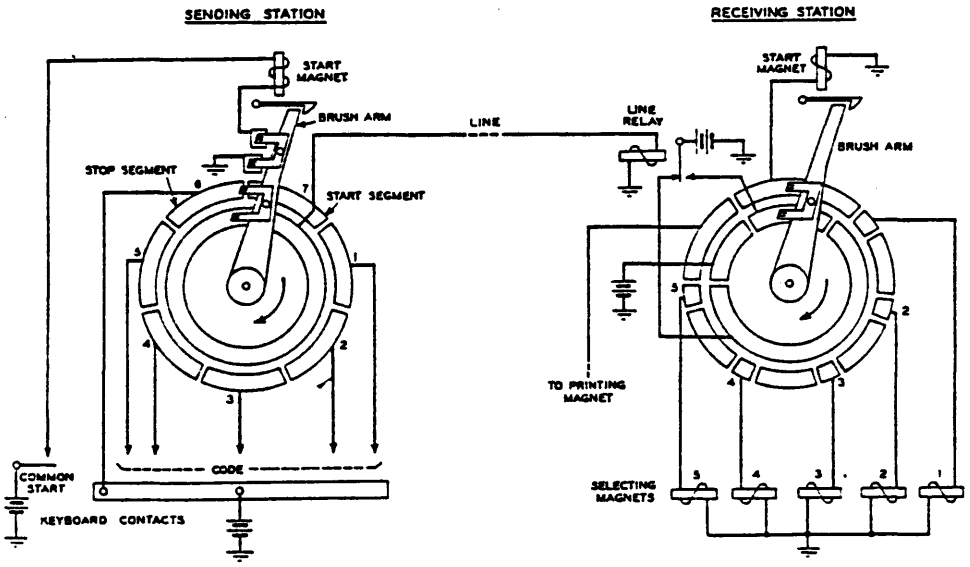
7. In a diplex or quadruplex telegraph system, the combination of means for transmitting reversals of current on the main line, a neutral relay, N, having coils *n p*, resistance R, and condenser C, substantially as described.

8. In a telegraph system, the combination of a main line, a condenser branch, a neutral relay having a primary coil in the main line and a secondary coil in the condenser branch, and a resistance in said main line between said relay and the earth at the receiving-station, to the extremities of which resistance the condenser branch is connected, substantially as described.

GERRITT SMITH.

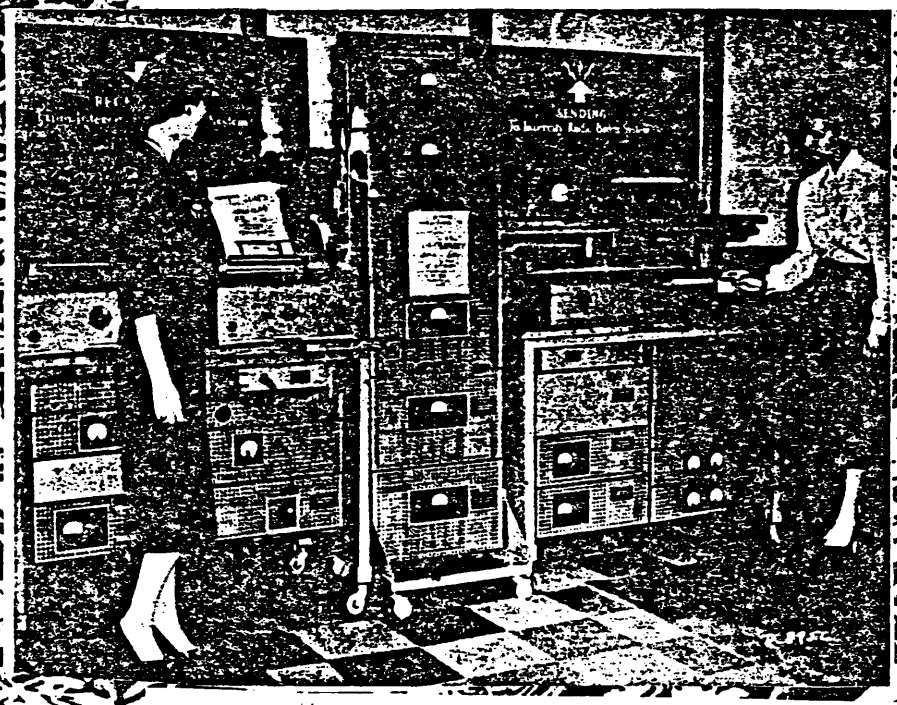
Witnesses:
WM. ARNOUX,
S. S. WATTERS.

Simplified diagram of the start-stop system



ELEVATING THE SIGNAL ABOVE THE MEANING

ENHANCING SIGNAL AND TRANSMISSION OF IMPRESSED SIGNAL



EXAMINATION OF COMMUNICATIONS SYSTEMS

DEMANDS IGNORING THE ELECTRICAL FUNCTIONS

FOR THE DISCOVERY OF VRIL FUNCTIONS

GEOMETRIC STRUCTURE OF CIRCUITRY

PRE-EMINATES IN VRIL FUNCTION

SECTION 7

VRIL DIFFRACTORS

2 Sheets—Sheet 1.

C. F. VARLEY.

Telegraph.

No. 78,495. Patented June 2, 1868.

Fig. 1.

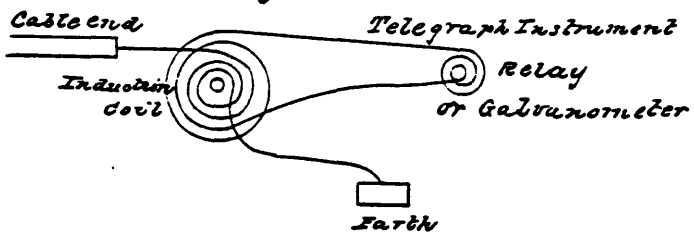


Fig. 2

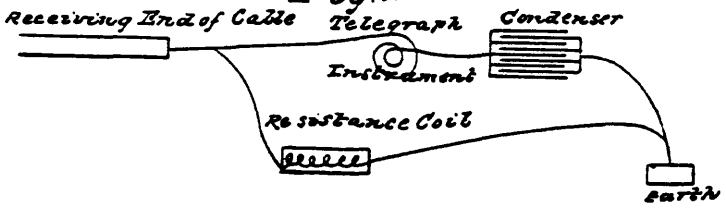


Fig. 3

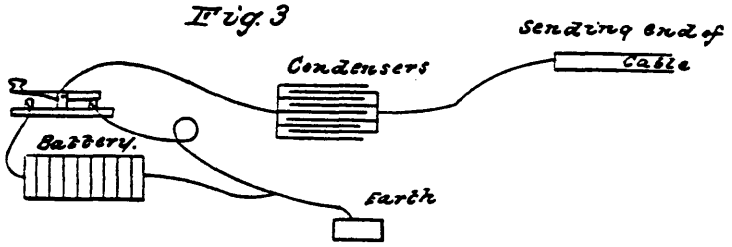
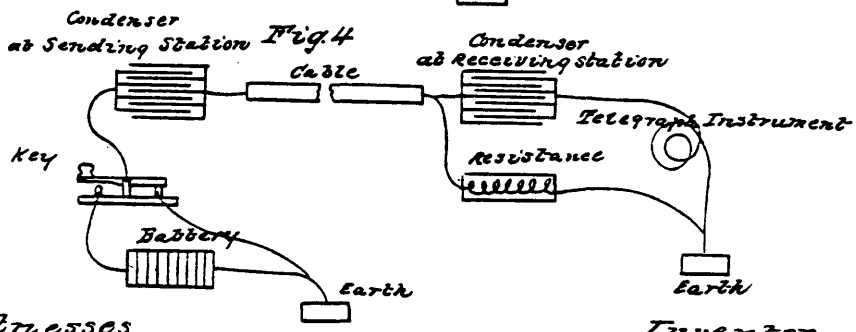


Fig. 4



Witnesses
M. Bailey
C. Sage Jr.

Inventor
Cromwell Fleetwood Varley
by his attorney

UNITED STATES PATENT OFFICE.

JOHN MUIRHEAD, JR., OF WESTMINSTER, ENGLAND.

IMPROVEMENT IN CONDENSING RESISTANCE FOR ELECTRIC TELEGRAPHS.

Specification forming part of Letters Patent No. **208,665**, dated October 1, 1878; application filed May 15, 1878.

To all whom it may concern:

Be it known that I, JOHN MUIRHEAD, Jr., of 29 Regent street, Westminster, England, have invented new and useful Improvements in Electric Telegraphs, and in apparatus connected therewith, which improvements are fully set forth in the following specification.

This invention has for its object to construct an accumulator having also power of conduction, which is adjusted to the requirements. Such an accumulator can be constructed combining both the conductive resistance and capacity required to imitate exactly a real line, and, so constructed, is specially adapted for use in duplex-working systems, and may be called an "artificial line." The artificial line may be constructed with two strips of tin-foil, (or other thin metallic sheet,) laid one over the other, and separated by an insulating material. Each end of one of the strips of metal foil is connected with connecting-clamps on the instrument, and is arranged in one continuous line to the length required, so that the resistance of the entire length of thin metal comes into play. The other strip of metal foil is furnished with earth-connections. The conducting-strips are made of proper dimensions to give the desired resistance and amount of surface; or, instead of employing two strips, a single strip which will give the requisite resistance and capacity may be arranged, as above described, on one side only of the dielectric, while on the other side a continuous metallic sheet, equal in superficies to the whole of the area of the dielectric over which the tin-foil strip is spread, may be used in connection with the earth instead of a second strip. The two strips, with the non-conductor between them, are folded into a convenient shape.

The way in which this instrument is used in duplex telegraphy is as follows: The current established by each contact made by the signaling-key is caused to divide into two parts. One part is passed through the actual cable, and affects the indicator at the receiving end, and the other part is caused to pass through the accumulator by the continuous strip of thin metal attached, as before mentioned, to the connecting-clamps, and so this portion of the current passes to earth. The other strip (or strips) of thin metal has also an earth connection or connections.

The signaling-currents passing into the cable and into the accumulator, which is made to imitate the cable, neutralize each other as to their effect on the indicator at the transmitting-station.

The resistance of the thin metal used in the accumulator is ascertained by experiment, and the conducting-sheet of the accumulator is so proportioned as to make its resistance to the passage of a current the same as that of a given length of the real cable, while its surface is of such dimensions that, with the insulating material employed, its capacity to receive a charge may also be the same as that of the same length of actual cable.

It is obvious that two or more of these accumulators may be coupled in continuous circuit, so as to obtain their combined effects in augmenting both resistance and capacity; or they may be coupled side by side or in multiple circuit, so as to obtain their combined effects in augmenting capacity, while the resistance is decreased in the ratio of the number employed.

When the instrument is in use one end of the artificial line or balancing apparatus may be connected with the transmitter and the other to earth, while the sheets of tin-foil have a direct earth-connection. This is the arrangement I prefer when the cable has a direct connection with the transmitter and with the receiving-instrument; or if, as is now very usual, condensers are interposed at both ends between the cable and the instruments, we make similar arrangements in respect to the artificial or balancing line. When the cable is worked on other systems the connections will be varied to suit the particular system in use, as will be well understood by electricians, the object being in all cases to assimilate as closely as possible the conditions under which the actual and the imitation cable are worked.

If I desire to make an artificial line or balancing apparatus to work with an existing telegraph-cable of which the resistance and capacity are known, I can so construct one unit as to represent both in resistance and capacity a given length of cable, and then it is only

necessary to couple up these units in continuous circuit to correspond to the entire length of the cable; but in other cases it is convenient to make the units with comparatively high resistance as compared with the capacity, and then by arranging the units in parallel circuit a balancing arrangement or artificial line can be readily arranged corresponding approximately to any cable likely to be met with in practice, the resistance being dependent on the dimensions and arrangement of the plumbago paper and the capacity or power of condensation or extent of surface of the tin-foil which faces it.

These instruments are not only useful in duplex telegraphy, but also for other purposes, such as the experimental working of telegraphic transmitting and receiving instruments.

Having thus described the nature of the said invention and the manner of performing the same, I would have it understood that I claim—

1. The accumulator, having also power of conduction or artificial line, as a new manufacture.

2. The combination of the accumulator, having also power of conduction or artificial line, with an electric telegraph cable or line, for the purpose of duplex working.

3. The construction of the accumulator, having also power of conduction or artificial line, by combining the following parts: first, the conducting strip or strips of metal foil by which the current passes through the instrument; second, the metal foil, having an earth-connection, through which it charges and discharges itself; third, the separating-sheets of dielectric or insulating material.

London, 17th December, 1877.

J. MUIRHEAD, JR.

Witnesses:
CHAS. BERKLEY HARRIS,
W. RIMELL,
Both of No. 17 Gracechurch Street, London.

UNITED STATES PATENT OFFICE.

GERRITT SMITH, OF ASTORIA, NEW YORK.

DUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 238,448, dated March 1, 1881.

Application filed December 14, 1880. (No model.)

To all whom it may concern:

Be it known that I, GERRITT SMITH, a citizen of the United States, residing at Astoria, in the county of Queens and State of New York, have invented certain new and useful Improvements in Duplex Telegraphs, of which the following is a specification.

My invention relates to certain improvements in the apparatus which has heretofore been employed for the transmission of two independent sets of telegraphic signals simultaneously from opposite ends of one and the same line-wire.

The general object of my invention is to neutralize or prevent the production of the false signal which would otherwise be manifested upon the receiving-instrument situated at the transmitting, or, as it is technically termed, the "home," station by the so-called "static discharge," which consists in the sudden escape to earth of a quantity of electricity stored up or accumulated upon the main line by induction during the outward flow of the electric current which constitutes a telegraphic signal.

My invention comprises the following subdivisions: first, the combination of a main line, a differential receiving-instrument, and two independent artificial lines, each permanently connected with the earth through the said receiving-instrument, one of which lines serves to compensate the dynamic and the other the static effects of the current transmitted from the home station, whereby the home receiving-instrument remains unaffected either by the dynamic or static action due to the transmission of signals from that station; second, in the combination of a battery, a main line, an artificial line, a differential receiving-instrument, and two inductive surfaces separated from each other by a dielectric, one of said surfaces being included in or connected with the main line and the other permanently with the earth through the receiving-instrument, whereby the inductive discharge from the main and artificial lines are caused to neutralize the effect of each other upon the home receiving-instrument; third, in the combination of a transmitting-key, a battery placed between said key and the earth, a main line extending from said key to the earth at the distant station, an artificial line extending from said key to the earth at the home station, and an auxiliary artificial line, one end of which is permanently connected to the earth at the home station, while the other end terminates in an inductive surface capable of receiving a charge from the main line, whereby the said artificial line is inductively charged from the main line and its charge, when set free, is conducted to the earth at the home station; fourth, in the combination of the apparatus set forth in the third subdivision hereof with an adjustable resistance interposed in the auxiliary artificial line at a point between the inductive surface and the earth, whereby the duration of the flow of the inductive discharge to the earth may be regulated or controlled; fifth, in the combination of a main telegraph-line, an artificial line permanently connected with the earth and capable of receiving a charge by induction directly from said main line, and a differential electro-magnet having one of its coils included in said artificial line, whereby the simultaneous discharges of the main and artificial lines are caused to neutralize each other's effect upon the armature of said electro-magnet; sixth, in the combination of an electro-magnetic core, an armature, and three independent coils capable of acting simultaneously thereon, which are included, respectively, in the circuit of a main line, an artificial line for compensating the dynamic effects of the main-line currents, and an auxiliary artificial line for compensating the static effects of the main-line currents, whereby both the static and dynamic effects of the main-line current in one coil of the electro-magnet are compensated by the simultaneous action of the static and dynamic electric influence in the outer two coils; seventh, in the combination of a battery, a main line, an artificial line, two inductive surfaces separated from each other by a dielectric, one of said surfaces being included in or connected with a main line and the other with the earth, and suitable devices for disconnecting or rendering inactive any required portion of one of said inductive surfaces, whereby the quantity of electricity induced in the said artificial line by a given main-line current may be regulated and controlled.

To the end that the nature of my invention may be more readily understood, I will first describe the construction and mode of operation of one of the ordinary and well-known sys-

tems of telegraphy for the simultaneous transmission of signals in opposite directions over the same line-wire, which are technically termed "duplex telegraphs," and will then explain the application of my improvements thereto.

In the accompanying drawings, Figure 1 is a diagram representing my improvements in connection with one of the ordinary forms of duplex telegraphs. Fig. 2 shows its application to the same in a modified form. Figs. 3, 4, and 5 are detached views, illustrating certain details of the construction of my apparatus.

In the transmission of simultaneous signals in opposite directions upon the same line, there exist two essential conditions which must be complied with: First, the receiving-instrument at each station must remain at all times in connection with the line, and, second, the currents transmitted by the key at the home station must not produce a signal upon the receiving-instrument at the same station. The manner in which these conditions are fulfilled in my improved apparatus will be hereinafter explained.

In the drawings, Fig. 1 represents, in the form of a diagram, the apparatus at one terminal station of a duplex line; the other or distant station is precisely the same in its construction and operation. M represents the electro-magnet of a receiving-instrument, having the usual soft-iron cores, *m m*, which, in the present instance, are supposed to be connected together by a yoke, and to act upon a movable armature of soft iron in a manner well understood. K is a transmitting-key of the ordinary and well-known construction. The front contact, 1, of this key is connected to one pole (in this instance, the positive pole) of a main battery, E, the other pole thereof being connected to the ground at G. The rear contact, 3, of the key K is connected directly to the ground at G, preferably including in the latter circuit a resistance, *r'*, which should be approximately equal to the average internal resistance of the battery E. From the lever of the key K two lines diverge, the first or main line L passing first around the left-hand and then around the right-hand core of the electro-magnet M, thence through the inductor I, and thence to the ground at the distant station. The other branch, L', passes in the opposite direction, first around the right-hand and then around the left-hand core of the magnet M, and thence through the rheostat or adjustable resistance R to the ground at G' at the home station. It will be understood, therefore, that when the key K is depressed or brought into contact with the stop 1, the current from the battery E passes through the key to the point 2, where it divides, one portion passing through the coils of the electro-magnet M, and thence through the inductor I and the line to the distant station, while the other portion passes through another coil of the electro-magnet M in the opposite direction, and returns directly to the earth through the artificial line L' and the rheostat R. This latter branch of the circuit is technically termed the "artificial line," in order to distinguish it from the main line, which extends to the distant station. By adjusting the resistance at R so that it is approximately the same as that of the main line, the current from the key will divide at the point 2 into two equal portions, which will produce equal and opposite electro-dynamic effects upon the armature of the electro-magnet M, and the armature will therefore remain at rest notwithstanding that a current is passing over the line L to the distant station. If, however, the distant station transmits a current at the same time, the strength of the current in the main line is augmented by the combined action of both terminal batteries, and its dynamic effect overpowers that of the current in the artificial line L'. Consequently the armature of electro-magnet M is attracted and a signal is produced at the home station. Thus it will be understood that the receiving-instrument at the home station responds only to currents or signals coming from the distant station, and not to those transmitted by the key at the home station, and consequently the two stations can transmit signals simultaneously to each other without interference. The receiving-instrument at each station, although at all times traversed by the current of the main line, responds only to the signals produced by the transmitting-key at the other station.

Having thus explained the construction and mode of operation of an ordinary duplex-telegraph apparatus, I will next describe the nature of my improvement and the mode of its application thereto in the best manner now known to me.

It is well known that an insulated telegraphic line-wire of considerable length, whether suspended above the earth or submerged beneath the water, is capable of accumulating or storing up a quantity of electricity while connected with a source of electricity, such as a battery. This property of an insulated conductor is termed its "inductive" or "electro-static" capacity, and the electricity so stored up and retained is called the "static" charge of the conductor. The electro-static capacity of the insulated conductor is a quantity depending upon the extent of its superficial area, and upon the thickness of the non-conducting space which separates it from the earth, or from other conductors in electric connection with the earth, which insulating-space is called the "dielectric." Thus, in the case of an ordinary telegraph-line suspended upon poles in the air, the earth and the surrounding objects connected therewith—such as buildings, trees, and the like—form the outer inductive surface, while the air constitutes the insulating medium or dielectric surrounding the conductor. In the case of a submarine cable the insulating coating of gutta-percha constitutes the dielectric, and the iron armor of the cable or the surrounding

In the diagram, B represents the batteries, K the keys, and S the sounder or receiver. The diagram shows only one line; but obviously any number of lines may be employed, each one being provided with its separate electrolytic or decomposing apparatus.

When organized in accordance with my invention, telephone or telegraph lines working with different strengths of battery may be intermingled or approximated without interference, as I have demonstrated by experiment.

The operation of the apparatus, being in accordance with the well-known laws of chemical electricity and physics, needs no further elucidation.

I claim as of my own invention—

1. The hereinbefore-described improvement in the art of telegraphy, which improvement consists in neutralizing, dissipating, or extinguishing the electro-motive force of the battery after its work is done by interposing an electrolytic or decomposing apparatus between the line-wire and the earth.

2. The combination, substantially as hereinbefore set forth, of the electric circuit, including line and connecting wires, batteries, and receiving and transmitting instruments, with an electrolytic or decomposing apparatus interposed between the battery and earth to neutralize the electro-motive force of the battery after its work has been performed.

In testimony whereof I have hereunto subscribed my name this 5th day of June, 1880.

ORAZIO LUGO.

Witnesses:
WM. D. BALDWIN,
WM. J. PEYTON.

(No Model.)

G. SMITH.

Duplex Telegraph.

No. 238,448. Patented March 1, 1881.

Fig: 4.

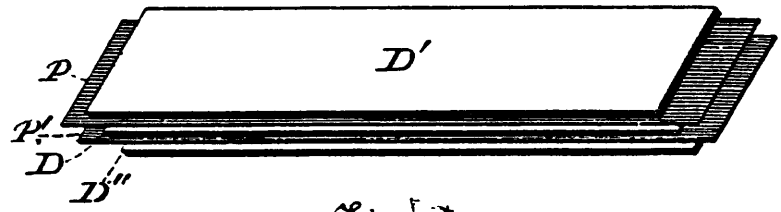


Fig: 5.

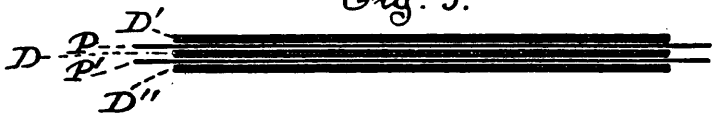


Fig: 1.

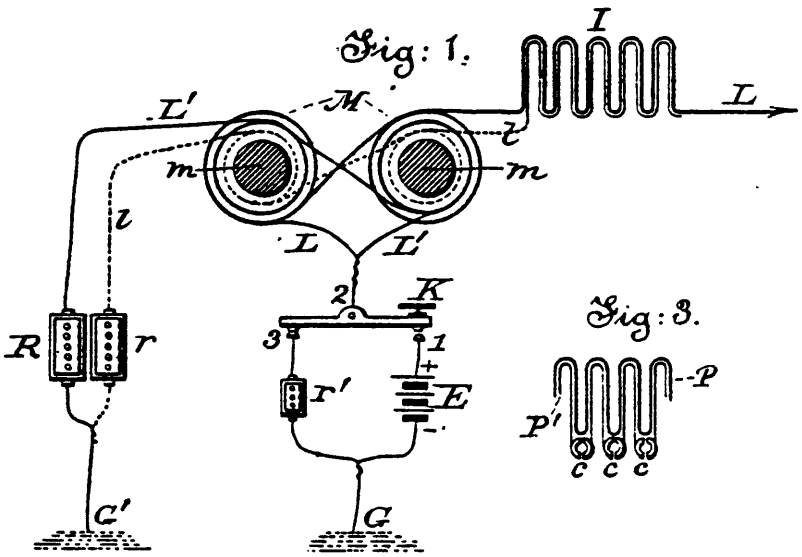
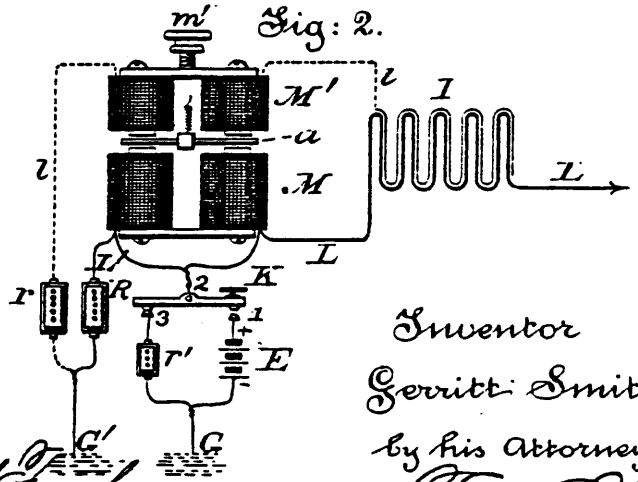


Fig: 3.

Fig: 2.



Witnesses:

Miller C. Earl

Mrs. F. Lockwood French

Inventor

Gerrit Smith,

by his Attorney,

Frank L. Poe

by having a very wide working margin between the primary and secondary coils—that is to say, having a primary circuit of very low resistance and a secondary coil of comparatively very high resistance. For instance—as an example—I have used with great advantage a line-wire having a resistance of sixteen thousand ohms, primary coils with a resistance varying from two-tenths of an ohm to one ohm, and secondary coils with resistances varying from twelve thousand to four thousand ohms.

An ordinary Morse key may be used to make and break the primary circuit. When contact is made the circuit is closed from the battery through the primary coil.

The sounder shown, although resembling an ordinary magneto-telephone in appearance, differs essentially from it in the fact that it is not necessarily a reproducer of sound—that is, a silent electric signal at the transmitting-station will produce sound at the receiving-station. The induced current of electricity of very high tension coming from the secondary wire of the induction-coil at the transmitting-station is conveyed to the secondary wire of the induction-coil at the receiving-station, and there induced inversely through such secondary wire into the primary wire of said induction-coil, (which primary wire or circuit is of very low resistance,) and passing through the helix of the sounder, which is in circuit with said primary wire, causes a metal dial or plate, *e*, in the receiving-instrument to vibrate, and thus give an audible sound. This plate constitutes a sounder, and may be greatly varied in thickness and tension. I prefer to use a diaphragm or plate, as it can be thrown into vibration with very small expenditure of electro-motive force.

In order to obtain the best results the helix of the sounder should have a very low resistance—equal to that of the primary wire of the receiving induction-coil.

The operation of an apparatus organized as above described is as follows: The closing of the transmitting-key forms a closed circuit from one pole of the battery to the other pole through the primary wire of the transmitting induction-coil, thereby inducing a current in the secondary wire of the transmitting induction-coil, the line-wire, and the secondary wire of the receiving induction-coil. When the circuit is broken, by opening the key a reverse current of high intensity is induced in the secondary wire of the transmitting induction-coil and in the line-wire. The secondary wire of the receiving induction-coil being included in the main line, is correspondingly affected, and acts inductively and inversely on the primary wire of said induction-coil, and as the key of the primary circuit at that station is open and the switch closed the interruptions of the current at the transmitting-station are audibly produced as intelligible signals on the sounder, as is well understood.

Under the organization shown it will be observed that the primary circuit is made and broken by the key when transmitting, thus throwing the battery into and out of circuit, while at the receiving-station the key is open and both the battery and key are short-circuited or cut out, and the battery is again thrown in by closing the key.

Any number of intermediate stations may be employed, the line being continuously connected at each of such stations with the secondary wire of the induction-coil, and by an arrangment of apparatus similar to that shown and described at the terminal station messages may be sent to and taken from the primary wires of the induction-coils at any or all of such intermediate stations.

I have found by practical tests that with the above-described apparatus electric signals made at a transmitting-station may be made to produce audible sounds at a receiving-station so distant that the resistance of the line-wire is equal to about four thousand miles.

I claim as of my own invention—

1. The hereinbefore-described improvement in the art of producing intelligible signals at a distance in an electric circuit, which improvement consists in causing signals to be made by makes and breaks of the electric current in the primary wire of an induction-coil at the transmitting-station, (which primary wire or circuit is of very low resistance and constitutes a metallic circuit,) thereby inducing corresponding currents, but of very high tension, in the secondary wire of said induction-coil in the line-wire, and in the secondary wire of a corresponding induction-coil of high resistance at the receiving-station, the currents of which wire act inversely by induction upon the primary wire of the receiving induction-coil, (which primary wire is of very low resistance,) and the helix, also of low resistance, actuating a diaphragm or plate-sounder, included in said primary wire, which constitutes a metallic circuit.

2. The combination, substantially as herein set forth, of the primary wire of an induction coil constituting a metallic circuit of very low resistance, the battery, the key, and the helix, (actuating the diaphragm or plate-sounder,) included in a branch of said primary circuit, whereby the key and battery are both cut out of circuit by opening the key.

3. The combination, substantially as herein set forth, of the battery and the key in the primary wire of an induction-coil at the transmitting-station, (said primary wire constituting a circuit of very low resistance,) the secondary wire of said induction-coil, the secondary wire of the receiving induction-coil, (both secondary coils being of very high resistance,) the line-wire connecting said secondary wires, and the helix, actuating the diaphragm or plate-sounder, included in a branch of the primary wire of the receiving induction-coil, constituting a metallic circuit of very low resistance, whereby the key and battery are both cut out of circuit by opening the key.

4. The combination, substantially as herein set forth, at each station, of the primary and secondary wires of an induction-coil, a battery and a key in one branch of the primary circuit or wire, and a helix of low resistance, actuating a diaphragm or plate-sounder included in another branch of said primary circuit, with a line-wire connecting the secondary wires of the respective induction-coils, each primary circuit being of very low resistance and having the capacity of cutting out its battery and key, and each secondary of comparatively very high resistance.

In testimony whereof I have hereunto subscribed my name.

ORAZIO LUGO.

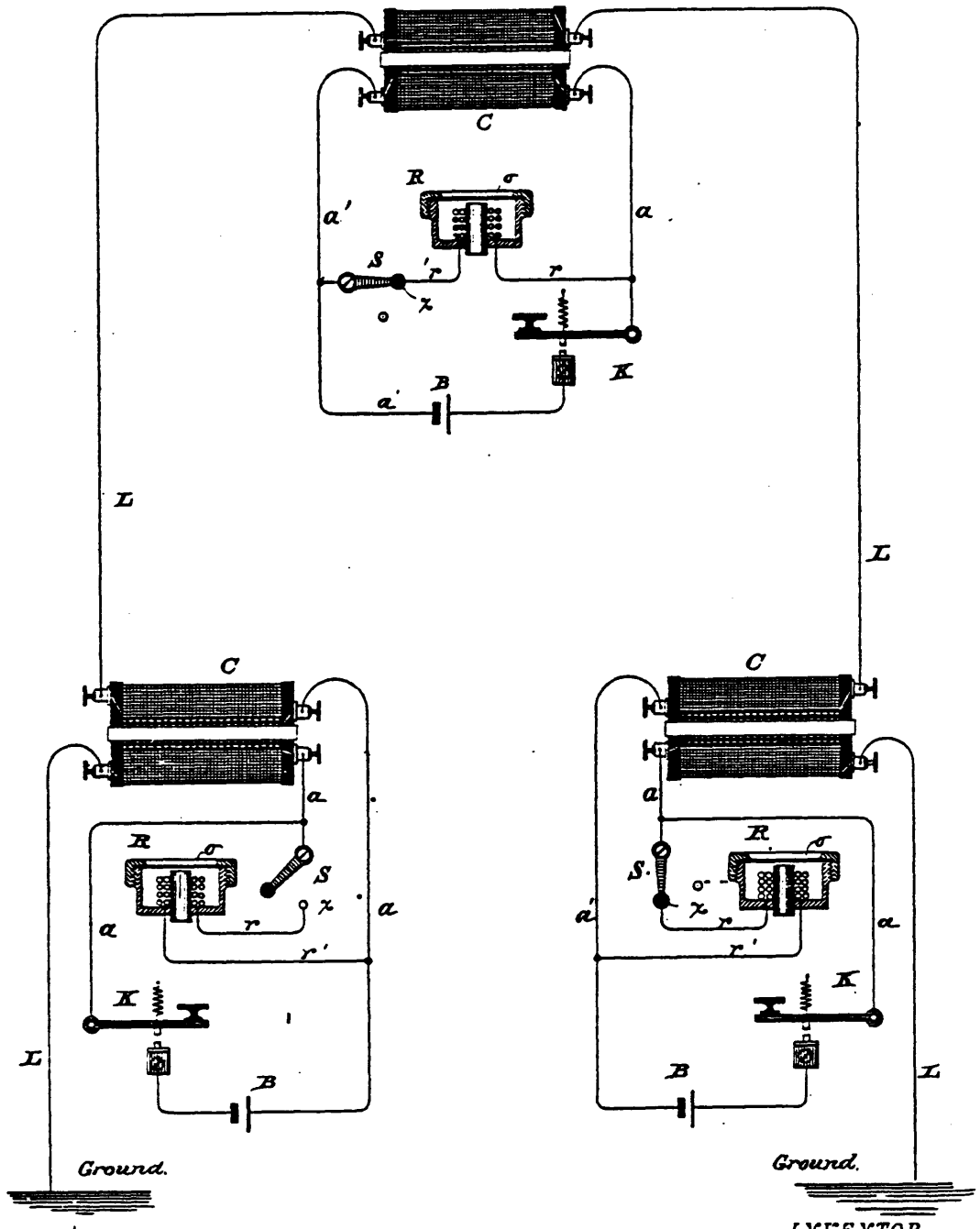
Witnesses:
WM. A. SKINKLE,
CHAS. H. BAKER.

(No Model.)

O. LUGO.

Electric Telegraphs.

No. 235,161. Patented Dec. 7, 1880.



WITNESSES.

Wm. A. Skinkle.

Chas. H. Baker.

INVENTOR

Orazio Lugo.

By his Attorneys

Baldwin, Hopkins & Peyton

UNITED STATES PATENT OFFICE.

ORÁZIO LUGO, OF NEW YORK, N. Y., ASSIGNOR TO SAMUEL L. M. BARLOW, OF SAME PLACE.

ELECTRIC TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 235,161, dated December 7, 1880.

Application filed May 10, 1880. (No model.)

To all whom it may concern:

Be it known that I, ORAZIO LUGO, a citizen of the United States, residing in the city, county, and State of New York, have made an invention of certain new and useful Improvements in the Art of Communicating Intelligence by Electricity, and in Apparatus therefor, of which improvements the following is a specification.

The object of my invention, speaking generally, is to produce intelligible signals in a long telegraphic circuit with great distinctness while employing a comparatively small battery-power. This object I attain by a novel organization of old instrumentalities, the essential features of which organization are at the transmitting-station the primary metallic circuit of an induction-coil, including a battery, provided with means for making signals by making and breaking said circuit, said primary coil being of very low resistance, a secondary coil included in the line-wire, and at the receiving-station; a secondary coil also included in the line-wire, both secondary coils being of comparatively very high resistance, and a primary coil of very low resistance included in metallic circuit with a helix of low resistance actuating a diaphragm or plate-sounder.

The above-described organization is adapted for transmission in one direction only; but the apparatus can readily be adapted for reciprocal transmission by including a battery, a key, a switch, and a sounder in each of said primary circuits.

My invention, broadly stated, consists in a novel art, method, or system of producing intelligible signals at a distant station in an electric circuit by making and breaking at the transmitting-station an electric current in the primary wire of an induction-coil constituting a transmitting or generating circuit of very low resistance, thus producing corresponding electric currents of very high tension in the secondary wire of said induction-coil, which constitutes part of the line-wire, and transmitting said currents through the secondary wire of a corresponding receiving induction-coil, also of very high resistance, and included in the line-wire, which operation induces corresponding currents of low intensity in the primary circuit of said receiving induction-coil, in which primary circuit a helix of low resistance actuating a diaphragm or plate-sounder is included, and which primary circuit is again of very low resistance. The interrupted currents thus produced in the primary wire of the receiving induction-coil correspond exactly with those produced in the primary wire of the transmitter, and, being rendered audible by the sounder, are converted into intelligible signals.

The subject-matter of my invention is set forth in the claims at the end of this specification.

I deem it unnecessary here to describe the details of the apparatus employed by me, as such details constitute no part of my invention. Their construction is well known, and may obviously be varied in various well-known ways.

In the accompanying drawing I have shown a convenient organization of apparatus for carrying out the object of my invention, an intermediate and two terminal stations being shown.

The arrangement of apparatus at each station being substantially alike, a description of one will be sufficient for the proper understanding of the whole.

Under the organization shown in the drawings a battery, B, a key, K, and a sounder, R, consisting of a diaphragm or plate actuated by a helix surrounding a core, are shown as included in the primary metallic circuit *a a'* of an induction-coil, C, the sounder being provided with a switch, S, for throwing it in or out of circuit, its wires *r r'* being connected with the primary circuit in such manner as to cause the current to pass through them when the switch S is closed. When signals are being received the switch S should be at X—that is to say, the helix of the sounder is then in the metallic circuit of the primary wire of the induction-coil. This switch, although convenient for shunting the sounder out of the circuit, is not essential, as the apparatus would work effectively without it.

The secondary wire of the induction-coil C constitutes part of the line-wire L, which is an earth-circuit.

I have found the best results to be produced

of the sounder S, its contact-point, the tongue *r* of the relay, and wire D, back through the point 2 to the north pole N, to the generator, thence through the generator to the starting-point. The organization at the receiving-station is substantially the same, and the parts are similarly lettered. Under this organization it will be seen that the sounder is in branch circuit with the shunt-wire and transmitting-key, and that while the tongue or armature of the sounder is controlled by the primary circuit from the generator its circuit is made or broken by the vibrations of the tongue or armature of the relay, which is actuated by the secondary current of the line-wire.

The operation of the apparatus will readily be understood from the foregoing description.

When the transmitting-key is closed a portion of the charge of the machine passes through the primary circuit, the makes and breaks in which circuit induce corresponding impulses in the secondary circuit in a well-known way, and vibrate the tongues of the relays, the effect of which is to open and close the circuit of the sounders, causing them to respond correspondingly.

My pending applications above referred to show methods of and apparatus for practicing the art of dynamo-electric telegraphy without induced currents. I therefore make no claim to the methods or apparatus shown in those applications, but limit the claim herein to apparatus involving the use of a secondary or induced current, or induction apparatus.

I claim as of my own invention—

The combination, substantially as herein set forth, of a dynamo-electric machine or generator, a shunt-wire or short circuit connecting the opposite poles of its armatures, a primary circuit (in which is included a key and the primary helix of an induction-coil) in branch circuit with said shunt-wire, with a telegraphic circuit or main line in which are included the secondary helix of the induction-coil, and signaling-instruments actuated by the currents induced in the secondary circuit by the makes and breaks of the primary.

In testimony whereof I have hereunto subscribed my name this 23d day of September, A. D. 1880.

ORAZIO LUGO.

Witnesses:
WM. J. PEYTON,
NELLIE L. HOLMES.

(No Model.)

G. SMITH.

Duplex Telegraph.

No. 238,448. Patented March 1, 1881.

Fig: 4.

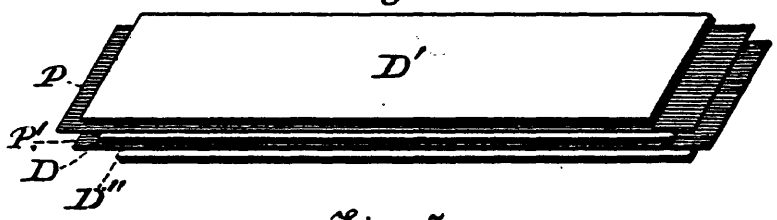


Fig: 5.

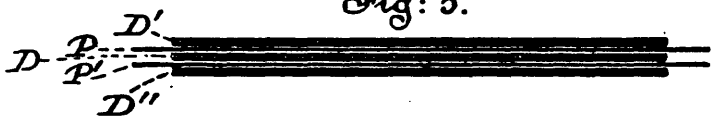


Fig: 1.

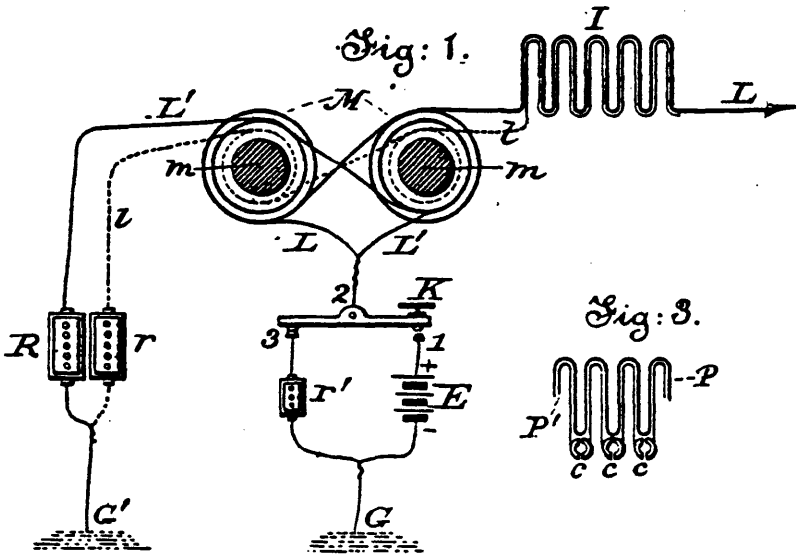
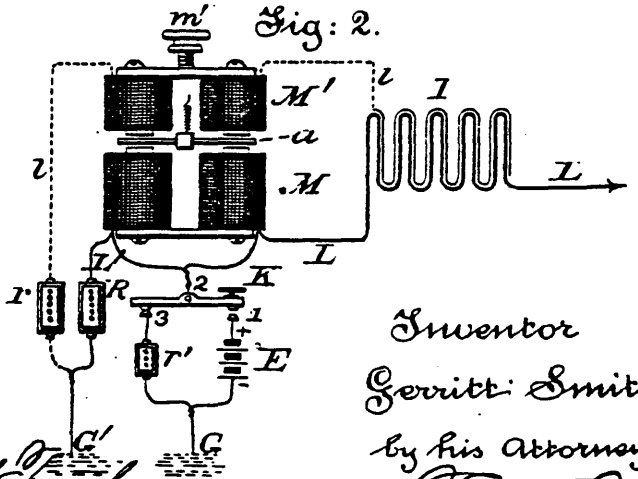


Fig: 3.

Fig: 2.



Witnesses:

Miller & Earl

Mrs. J. Lockwood French

Inventor

Gerrit Smith,

by his Attorney,

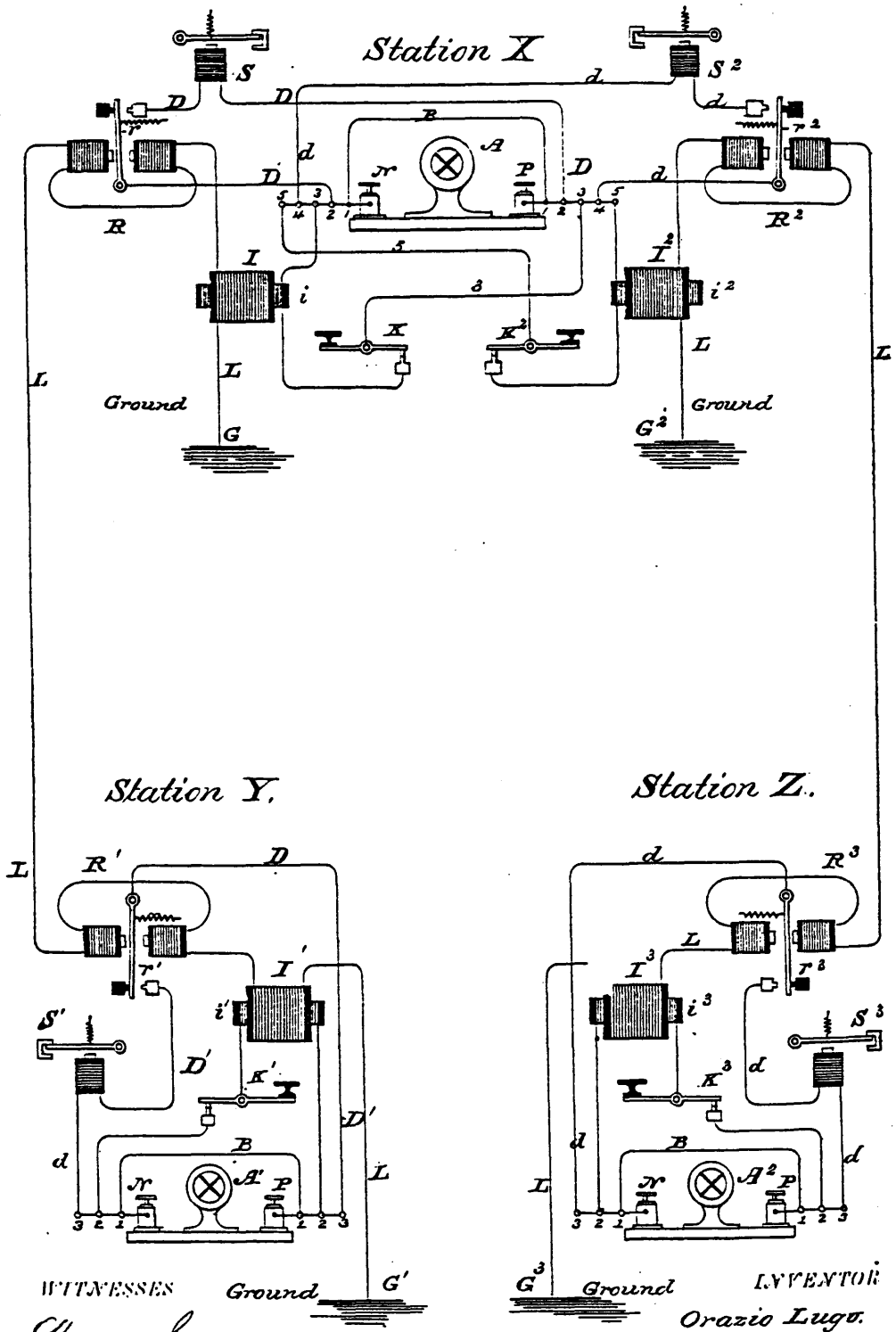
Frank L. Phelps

(No Model.)

O. LUGO.

Dynamo Electric and Inductive Telegraphy.

No. 235,690. Patented Dec. 21, 1880.



WITNESSES

Wm. A. Skinner
L. B. Wright.

INVENTOR

Orazio Lugo.

By his Attorneys

Baldwin, Hopkins & Peyton

UNITED STATES PATENT OFFICE.

ORAZIO LUGO, OF NEW YORK, N. Y.

DYNAMO-ELECTRIC AND INDUCTIVE TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 235,690, dated December 21, 1880.

Application filed September 25, 1880. (No model.)

To all whom it may concern:

Be it known that I, ORAZIO LUGO, a citizen of the United States, residing in the city, county, and State of New York, have invented a certain new and useful Improvement in Dynamo-Electric and Inductive Telegraphy, of which the following is a specification.

My invention relates to that class of telegraphs in which dynamo-electricity is substituted for voltaic electricity or chemical batteries, as shown in sundry applications for Letters Patent of mine now pending.

The subject-matter claimed is specifically set forth at the end of this specification.

The essential elements of my improved organization are a dynamo-electric machine or generator, a shunt-wire or short circuit connecting the opposite poles of the armatures thereof, the resistance of which shunt-wire is greater than the internal resistance of the machine, a transmitting-key in the primary circuit of an induction-coil, and suitable signaling apparatus in a telegraphic circuit, including the secondary wire of said induction-coil.

The accompanying drawing represents a diagram of my improved apparatus organized in the best way now known to me.

My improvement contemplates the employment of the most approved apparatus of the present day. The details of construction of such apparatus, however, are well known, and need not, therefore, be herein described, as the construction and arrangement of the apparatus may be modified in various ways without departing from the principle of my invention. I prefer to employ under this system a generator at each station; but any number of instruments at such station may be operated from the same generator.

The diagram represents three stations—a central one, X, and two terminal stations, Y Z. The organization of apparatus of each station being substantially similar, a description of one will be sufficient, the arrangement of the two sets of transmitting apparatus at the central station requiring nothing beyond the mere skill of the workman in running the circuits properly. Each dynamo-electric machine or generator A A' A^2 is shown as having the opposite poles, N P, of its armatures connected by a shunt-wire, B, the resistance of which shunt-wire is greater than the internal resistance of the machine, but less than that of the telegraphic circuit or circuits. Each station is provided with one or more transmitting-keys, K K' K'' K''', each included in the primary metallic circuit of an induction-coil in branch circuit with the shunt of the generator—that is to say, including the opposite poles of the armature in its circuit. The secondary wire of these induction-coils I I' I^2 I^3 and relays R R' R^2 R^3 are included in the main line L, which is an ordinary earth-circuit. The primary circuits may be kept either normally open or closed, as preferred.

The sounder S S' S^2 S^3 of each relay might be worked with a local battery in the ordinary way; but I prefer to charge it direct from the main generator, which I do by including it in an independent branch circuit, D *d*, which circuit, starting from one pole of the generator, passes through the armature r r' r^2 r^3 of each relay, and through the helix of the sounder back to the other pole of the generator.

I will now describe the circuit-connections between the home station and one of the terminal stations. The arrangement under the organization shown being duplicated for each station, a description of one will be sufficient for the proper understanding of the other.

The transmitting-key K at the sending-station X is included in a primary closed metallic circuit, starting from the south pole P of the generator A at 3, and running through the wire 3, key K, the primary helix *i* of the induction-coil I, and the wire 3, again back to the north pole of the generator, and through the generator to the starting-point at 3. The makes and breaks in the primary current caused by key K in this circuit are reproduced upon the helix *i* of the induction-coil I, which is included in the line-wire. The latter is what is known as an "earth-circuit," starting from the ground at G', passing through the secondary helix of the induction-coil I, thence through the relay R, line-wire L, relay R', and the secondary helix of the induction-coil I' at station Y to the ground at G'. The sounder S at the sending-station X is always included in a metallic circuit passing through the point 2, connected with the south pole of the generator, through the wire D, the helix

(No Model.)

P. D. CONNOR.

Device for Deadening Sound Vibrations of Telegraph Wires.

No. 243,513. Patented June 28, 1881.

Fig. 1.

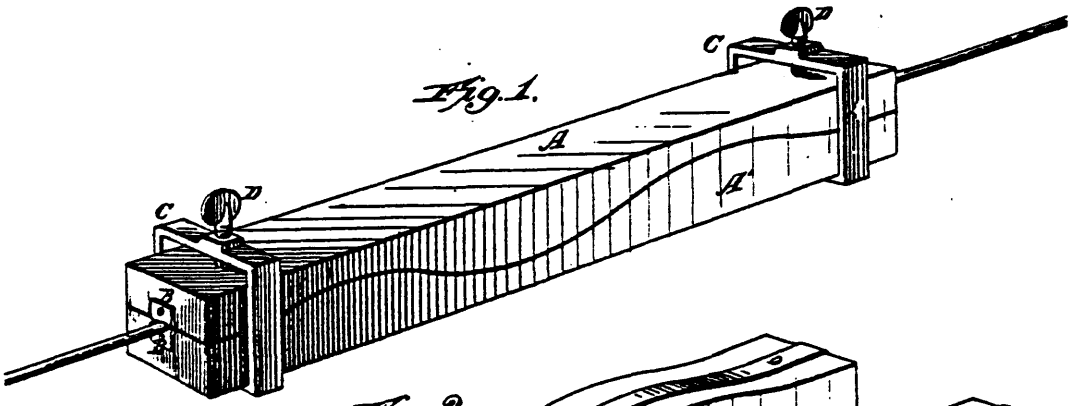


Fig. 2.

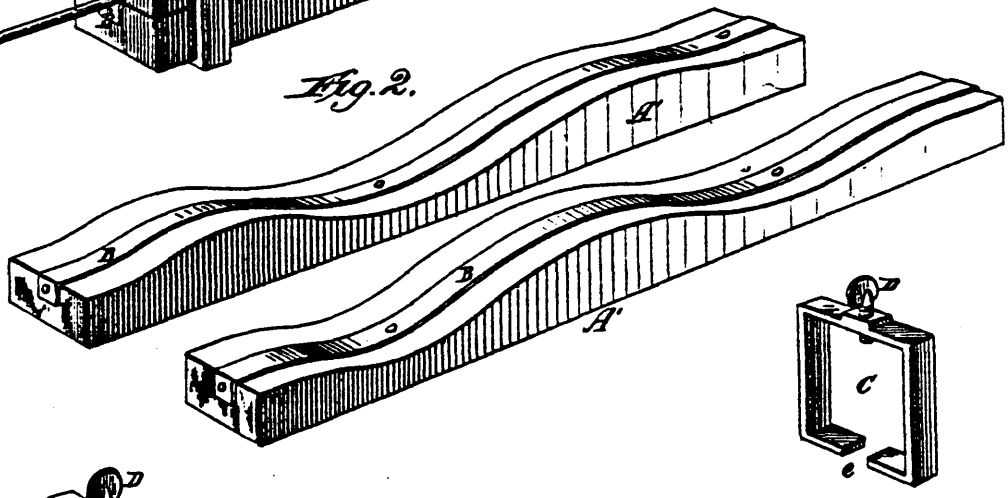
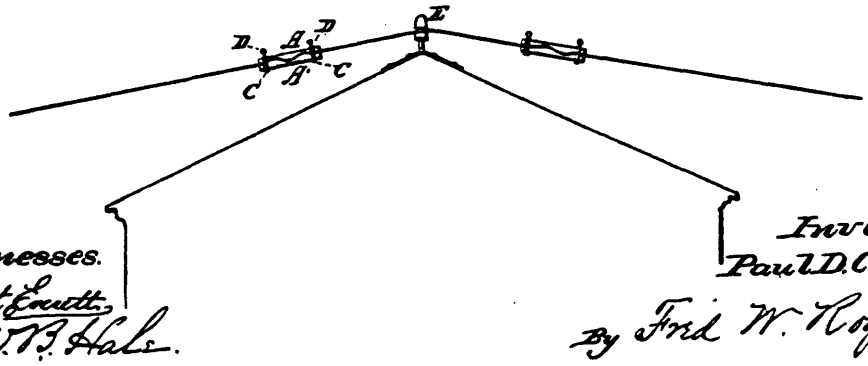


Fig. 3.



Witnesses.
Robt. Ewett.
W. B. Hale.

Inventor.
Paul D. Connor.
By Fred W. Royce
Atty.

UNITED STATES PATENT OFFICE.

PAUL D. CONNOR, OF WASHINGTON, DISTRICT OF COLUMBIA.

DEVICE FOR DEADENING SOUND-VIBRATIONS OF TELEGRAPH-WIRES.

SPECIFICATION forming part of Letters Patent No. 243,513, dated June 28, 1881.

Application filed May 2, 1881. (No model.)

To all whom it may concern:

Be it known that I, PAUL D. CONNOR, a citizen of the United States of America, residing at Washington, in the county of Washington and District of Columbia, have invented certain new and useful Improvements in Devices for Deadening Sound-Vibrations of Telegraph-Wires; 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 appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The object of this invention is to prevent the annoyance to occupants of houses occasioned by the humming sound transmitted from telegraph and telephone wires supported by insulators attached to the roofs or walls.

The supporting of telegraph and telephone wires on a house top or wall has the effect, as is well known, of converting the house into a huge resonator or sounding-board to such an extent that in many cases, when a breeze plays on the wires and sets them vibrating, sleep is impossible to many persons, and to sick and nervous persons the sound is excessively annoying and injurious.

An attempt has been made to intercept the æolian vibrations of the wires on each side of their supports which are attached to houses, and thus prevent the annoyance referred to, and this attempt has been in a great degree successful; but it involves the cutting of the wires on each side of their supports and inserting between the ends devices for preventing the vibrations from being communicated to said supports, unstrained loops of wire passing around the said devices and connecting the ends of the wires electrically to preserve the circuit. The cutting of the wires is very objectionable, and the insertion of the devices referred to is expensive and troublesome. In my invention I obviate the cutting of the wires and produce a sound-intercepting device which is cheap in construction, easily applied, and effectually accomplishes the purpose intended.

In the accompanying drawings, Figure 1 is a perspective view of my invention applied to a wire. Fig. 2 is a similar view of the parts detached from each other. Fig. 3 illustrates the application of the invention to use.

The letters A and A′ denote bars of wood, each of which has one of its longitudinal surfaces undulated or corrugated to fit a correspondingly-shaped surface of the other. Upon the longitudinal central portion of the undulating surface of each bar is secured a thin strip, B, of lead. When the two bars are placed upon opposite sides of a wire, with their lead strips in contact with the same, a clamp, C, is slipped over the bars at each end, so that its clamping-screw D bears upon the back of one of the bars. The screws D being tightened or driven inward, the two bars are forced together, so that the wire is bent to conform to the undulating surfaces of the lead strips, the resilience of the wire assisting materially to produce a close contact and friction, which holds the bars in place. The lead being non-resonant, its contact with the wires intercepts the æolian vibrations and prevents them from being communicated to the bars. The short length of wire between the bars and the insulator, when the device is in use, is incapable of vibration to any harmful extent.

The clamp C consists of an open metal frame cleft on one side, as shown at *e*, to permit it to be passed over the wire, in order that it may be slipped over the ends of the bars after they are placed in position on opposite sides of the wire. The screw D is preferably inserted through the opposite side of the frame from its cleft; but it may be inserted through either of the other sides, as the frame may be turned to proper position after being passed over the wire.

I do not confine myself to bars of wood having undulated or corrugated surfaces, as straight surfaces with straight strips of lead to bear upon the wire would have the effect of intercepting the sound-vibrations of the wire; but the undulating surfaces clamp the wire better and hold the bars more firmly in place, while intercepting sound better. The bars might be made of any other substance than wood, or entirely of lead, in which case, of course, the separate lead strips would be omitted. In practice the bars are about eighteen inches in length, an inch and a half wide, and an inch thick at their thinnest portions,

water, as the case may be, the outer inductive surface. The thickness of the dielectric being necessarily very much less in a submarine cable than in an air line, the inductive surfaces are brought nearer together. Hence the electro-static capacity of a submarine line is many times greater than that of an air line of equal length. It will appear, therefore, from the hereinbefore-mentioned considerations, that when a long line of telegraph is connected with the battery by depressing the key at the sending-station—as for the purpose of transmitting a signal—the line will acquire a considerable static charge. At the completion of the signal, when the key is raised, the line is first disconnected from the battery and immediately afterward connected directly to the earth at the home station, whereupon the accumulated induced electricity stored up in the line will suddenly escape to the earth, traversing one wire of the electro-magnet M of the home receiving-instrument, and producing what is termed the "static discharge." As the rheostat R and the short artificial line in which it is placed have practically no electro-static capacity, there will be no corresponding discharge from the artificial line L′ through the opposing wire of the electro-magnet M, and consequently an extra or false signal of short duration will be produced by the uncompensated action of the static discharge of the main line in the electro-magnet. I have discovered that this effect of the static discharge from the line upon the home instrument may be compensated or neutralized by making use of an inductor in connection with the main line, the receiving-instrument, and the earth, in a manner which I will now proceed to describe.

Referring to Figs. 4 and 5, P and P′ are two broad thin strips of metal, which are conductors of electricity. Between them is placed a dielectric, D, of similar form, composed of some insulating material—such, for example, as linen paper saturated with paraffine.

Such an apparatus is analogous in its construction to a Leyden jar, in which P represents the inner metallic coating, D the non-conducting material of the jar, and P′ the outer metallic coating, which is connected with the earth. It is well known that if the metallic coating corresponding to the plate P be charged with positive electricity from any source, it will induce an equal charge of negative electricity in the coating corresponding to the plate P′, connected with the earth, and that when the jar is thus charged, if the plate P be disconnected from the source of electricity and connected directly to the earth, a double discharge takes place, the positive electricity from P and the negative electricity from P′ flowing simultaneously to earth and there neutralizing each other. I avail myself of this principle for the purpose of neutralizing the static discharge from the line which produces the false signal in the receiving-instrument of a duplex telegraph. To this end I place between the home relay and the line-wire leading to the distant station an inductor, I, which consists, essentially, of two strips of tin-foil or other suitable metal, P P′, separated by a strip of dielectric, D, of the same breadth, and preferably inclosed by two additional strips of insulating material, D′ and D″, arranged as shown in Figs. 4 and 5. This apparatus may be constructed of any required length, and is preferably folded up, so as to occupy as little space as possible, thus constituting the inductor I of Figs. 1, 2, and 3. One of the metallic strips, P, is included in the circuit of the line-wire L; the other strip, P′, is connected to the earth at the home station by means of a wire, *l*, which may be termed the "auxiliary artificial line." This wire passes, by an independent helix, around both cores of the electro-magnet M in the same direction as the main line L. When a signal is transmitted over the line L from the positive pole of the battery E, an electro-static charge is stored up in the plate P′ of the inductor I, which is equal in quantity but opposite in polarity to that of the corresponding portion of the main line. When the key K is raised and the main line is connected with the earth at the point 3, the charge of the main line escapes to earth through the wire L, and at the same time the opposite charge in the inductor I is also set free and escapes to earth by the wire *l*. As these two wires both pass in the same direction around the coils of the magnet M, and as the polarities of the two discharges are unlike, they compensate each other's effect upon the cores of the receiving-instrument, and no false signal is produced.

It is evident that as the inductive surface connected with the auxiliary artificial line *l* does not extend the whole length of the main line L, the electro-static capacity of the latter, and consequently the quantity of electricity discharged, will be greater than that of the artificial line. This inequality may be compensated by a proper adjustment of the relative resistance of the rheostats *r r′*. I prefer, however, in many cases to make use of the modification of the apparatus which is shown in Fig. 2. In this case the auxiliary artificial line *l* is arranged in the same manner as hereinbefore described, with the exception that it passes through an independent electro-magnet, M′, which is arranged, as shown in the figure, so as to exert an attraction in the opposite direction upon the armature *a* of the electro-magnet M. In this case the comparative weakness of the artificial discharge may be readily compensated by adjusting the screw *m′* so that the auxiliary electro-magnet M′ may be nearer to the armature *a* than the main magnet M. The rheostat *r* is employed in this instance principally for the purpose of regulating the duration of the discharge.

I have shown in Fig. 3 a device for regulating the quantity of electricity which the inductor is capable of storing up. I effect this by dividing the plate P′ into any required number of detached sections, which are connected together by means of peg-commutators

c c, of the usual construction. By withdrawing one or another of these pegs any required portion of the plate P′ may be disconnected from the earth, in which case it ceases to be active, and its electro-static capacity is reduced to zero.

By the method and apparatus hereinbefore described I am enabled to utilize the inductive charge stored up in the outer conductor, which has hitherto been wasted, and to utilize the same advantageously in neutralizing the effects of the discharge from the line upon the home receiving-instrument.

I do not limit myself to the use of the inductor constructed substantially in the manner described solely in connection with the peculiar forms of the duplex telegraphs hereinbefore referred to, as it may be employed with equally good results in combination with other well-known forms of apparatus. The modifications necessary to adapt it to such use will readily suggest themselves to those skilled in the art.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of a main line, a differential receiving-instrument, and two independent artificial or compensating lines, each permanently connected with the earth through the said receiving-instrument, one of which lines acts to compensate the dynamic and the other the static effects of the current transmitted from the home station.

2. The combination, substantially as hereinbefore set forth, of a battery, a main line, an artificial or compensating line, a differential receiving-instrument, and two inductive surfaces separated from each other by a dielectric, one of said surfaces being included in or connected with the main line, and the other permanently with the earth through the receiving-instrument.

3. The combination, substantially as hereinbefore set forth, of a transmitting-key, a battery placed between said key and the earth, a main line extending from said key to the earth at the distant station, an artificial line extending from said key to the earth at the home station, and an auxiliary artificial line, one end of which is permanently connected to the earth at the home station, while the other end terminates in an inductive surface capable of receiving a charge from the main line.

4. The combination, substantially as hereinbefore set forth, of a transmitting-key, a battery between said key and the earth, a main line extending from said key to the earth at the distant station, an artificial line extending from said key to the earth at the home station, an auxiliary artificial line, one end of which is permanently connected to the earth at the home station, while the other end terminates in an inductive surface capable of receiving a charge from the main line, and an adjustable resistance interposed in the last-named artificial line at a point between said inductive surface and the earth.

5. The combination, substantially as hereinbefore set forth, of a main telegraph-line, an artificial line permanently connected with the earth and capable of receiving a charge inductively from said main line, and a differential electro-magnet having one of its coils included in said artificial line.

6. The combination, substantially as hereinbefore set forth, of an electro-magnet, core, and armature, three independent coils or helices capable of acting simultaneously thereon, which are included respectively in the circuit of a main line, an artificial line for compensating the dynamic effects of the main-line currents, and an auxiliary artificial line for compensating the static effects of the main-line currents.

7. The combination, substantially as hereinbefore set forth, of a battery, a main line, an artificial or compensating line, two inductive surfaces separated from each other by a dielectric, one of said surfaces being included in or connected to the main line and the other to the earth, and means for disconnecting or rendering inoperative any required portion of one of said inductive surfaces.

In testimony whereof I have hereunto subscribed my name this 13th day of December, A. D. 1880.

GERRITT SMITH.

Witnesses:
NELSON ZABRISKIE,
MILLER C. EARL.

UNITED STATES PATENT OFFICE.

GERRITT SMITH, OF ASTORIA, NEW YORK.

DUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 238,448, dated March 1, 1881.

Application filed December 14, 1880. (No model.)

To all whom it may concern:

Be it known that I, GERRITT SMITH, a citizen of the United States, residing at Astoria, in the county of Queens and State of New York, have invented certain new and useful Improvements in Duplex Telegraphs, of which the following is a specification.

My invention relates to certain improvements in the apparatus which has heretofore been employed for the transmission of two independent sets of telegraphic signals simultaneously from opposite ends of one and the same line-wire.

The general object of my invention is to neutralize or prevent the production of the false signal which would otherwise be manifested upon the receiving-instrument situated at the transmitting, or, as it is technically termed, the "home," station by the so-called "static discharge," which consists in the sudden escape to earth of a quantity of electricity stored up or accumulated upon the main line by induction during the outward flow of the electric current which constitutes a telegraphic signal.

My invention comprises the following subdivisions: first, the combination of a main line, a differential receiving-instrument, and two independent artificial lines, each permanently connected with the earth through the said receiving-instrument, one of which lines serves to compensate the dynamic and the other the static effects of the current transmitted from the home station, whereby the home receiving-instrument remains unaffected either by the dynamic or static action due to the transmission of signals from that station; second, in the combination of a battery, a main line, an artificial line, a differential receiving-instrument, and two inductive surfaces separated from each other by a dielectric, one of said surfaces being included in or connected with the main line and the other permanently with the earth through the receiving-instrument, whereby the inductive discharge from the main and artificial lines are caused to neutralize the effect of each other upon the home receiving-instrument; third, in the combination of a transmitting-key, a battery placed between said key and the earth, a main line extending from said key to the earth at the distant station, an artificial line extending from said key to the earth at the home station, and an auxiliary artificial line, one end of which is permanently connected to the earth at the home station, while the other end terminates in an inductive surface capable of receiving a charge from the main line, whereby the said artificial line is inductively charged from the main line and its charge, when set free, is conducted to the earth at the home station; fourth, in the combination of the apparatus set forth in the third subdivision hereof with an adjustable resistance interposed in the auxiliary artificial line at a point between the inductive surface and the earth, whereby the duration of the flow of the inductive discharge to the earth may be regulated or controlled; fifth, in the combination of a main telegraph-line, an artificial line permanently connected with the earth and capable of receiving a charge by induction directly from said main line, and a differential electro-magnet having one of its coils included in said artificial line, whereby the simultaneous discharges of the main and artificial lines are caused to neutralize each other's effect upon the armature of said electro-magnet; sixth, in the combination of an electro-magnetic core, an armature, and three independent coils capable of acting simultaneously thereon, which are included, respectively, in the circuit of a main line, an artificial line for compensating the dynamic effects of the main-line currents, and an auxiliary artificial line for compensating the static effects of the main-line currents, whereby both the static and dynamic effects of the main-line current in one coil of the electro-magnet are compensated by the simultaneous action of the static and dynamic electric influence in the outer two coils; seventh, in the combination of a battery, a main line, an artificial line, two inductive surfaces separated from each other by a dielectric, one of said surfaces being included in or connected with a main line and the other with the earth, and suitable devices for disconnecting or rendering inactive any required portion of one of said inductive surfaces, whereby the quantity of electricity induced in the said artificial line by a given main-line current may be regulated and controlled.

To the end that the nature of my invention may be more readily understood, I will first describe the construction and mode of operation of one of the ordinary and well-known sys-

tems of telegraphy for the simultaneous transmission of signals in opposite directions over the same line-wire, which are technically termed "duplex telegraphs," and will then explain the application of my improvements thereto.

In the accompanying drawings, Figure 1 is a diagram representing my improvements in connection with one of the ordinary forms of duplex telegraphs. Fig. 2 shows its application to the same in a modified form. Figs. 3, 4, and 5 are detached views, illustrating certain details of the construction of my apparatus.

In the transmission of simultaneous signals in opposite directions upon the same line, there exist two essential conditions which must be complied with: First, the receiving-instrument at each station must remain at all times in connection with the line, and, second, the currents transmitted by the key at the home station must not produce a signal upon the receiving-instrument at the same station. The manner in which these conditions are fulfilled in my improved apparatus will be hereinafter explained.

In the drawings, Fig. 1 represents, in the form of a diagram, the apparatus at one terminal station of a duplex line; the other or distant station is precisely the same in its construction and operation. M represents the electro-magnet of a receiving-instrument, having the usual soft-iron cores, *m m*, which, in the present instance, are supposed to be connected together by a yoke, and to act upon a movable armature of soft iron in a manner well understood. K is a transmitting-key of the ordinary and well-known construction. The front contact, 1, of this key is connected to one pole (in this instance, the positive pole) of a main battery, E, the other pole thereof being connected to the ground at G. The rear contact, 3, of the key K is connected directly to the ground at G, preferably including in the latter circuit a resistance, *r'*, which should be approximately equal to the average internal resistance of the battery E. From the lever of the key K two lines diverge, the first or main line L passing first around the left-hand and then around the right-hand core of the electro-magnet M, thence through the inductor I, and thence to the ground at the distant station. The other branch, L', passes in the opposite direction, first around the right-hand and then around the left-hand core of the magnet M, and thence through the rheostat or adjustable resistance R' to the ground at G' at the home station. It will be understood, therefore, that when the key K is depressed or brought into contact with the stop 1, the current from the battery E passes through the key to the point 2, where it divides, one portion passing through the coils of the electro-magnet M, and thence through the inductor I and the line to the distant station, while the other portion passes through another coil of the electro-magnet M in the opposite direction, and returns directly to the earth through the artificial line L' and the rheostat R. This latter branch of the circuit is technically termed the "artificial line," in order to distinguish it from the main line, which extends to the distant station. By adjusting the resistance at R so that it is approximately the same as that of the main line, the current from the key will divide at the point 2 into two equal portions, which will produce equal and opposite electro-dynamic effects upon the armature of the electro-magnet M, and the armature will therefore remain at rest notwithstanding that a current is passing over the line L to the distant station. If, however, the distant station transmits a current at the same time, the strength of the current in the main line is augmented by the combined action of both terminal batteries, and its dynamic effect overpowers that of the current in the artificial line L'. Consequently the armature of electro-magnet M is attracted and a signal is produced at the home station. Thus it will be understood that the receiving-instrument at the home station responds only to currents or signals coming from the distant station, and not to those transmitted by the key at the home station, and consequently the two stations can transmit signals simultaneously to each other without interference. The receiving-instrument at each station, although at all times traversed by the current of the main line, responds only to the signals produced by the transmitting-key at the other station.

Having thus explained the construction and mode of operation of an ordinary duplex-telegraph apparatus, I will next describe the nature of my improvement and the mode of its application thereto in the best manner now known to me.

It is well known that an insulated telegraphic line-wire of considerable length, whether suspended above the earth or submerged beneath the water, is capable of accumulating or storing up a quantity of electricity while connected with a source of electricity, such as a battery. This property of an insulated conductor is termed its "inductive" or "electro-static" capacity, and the electricity so stored up and retained is called the "static" charge of the conductor. The electro-static capacity of the insulated conductor is a quantity depending upon the extent of its superficial area, and upon the thickness of the non-conducting space which separates it from the earth, or from other conductors in electric connection with the earth, which insulating-space is called the "dielectric." Thus, in the case of an ordinary telegraph-line suspended upon poles in the air, the earth and the surrounding objects connected therewith—such as buildings, trees, and the like—form the outer inductive surface, while the air constitutes the insulating medium or dielectric surrounding the conductor. In the case of a submarine cable the insulating coating of gutta-percha constitutes the dielectric, and the iron armor of the cable or the surrounding

swelling to an inch and a quarter at their thick portions when undulated, and in applying them to use, as shown in Fig. 3, they are placed on the wire at about three feet from the insulator E, which is attached to the house on each side of said insulator.

What I claim is—

1. A device for intercepting the sound-vibrations of wires, consisting of two bars having corrugated or undulated non-resonant surfaces, and a clamp for embracing said bars and binding them upon a wire, with said surfaces of the respective bars facing each other, substantially as described.

2. In a device for intercepting the sound-vibrations of wires, the combination of two bars of wood, each having a lead-covered surface, and one or more clamps for binding said bars upon a wire, substantially as described.

3. In a device for intercepting the sound-vibrations of wires, the combination of two bars of wood, having undulated or corrugated surfaces, with strips of lead arranged thereon, with a suitable device or devices for binding the same upon a wire, substantially as described, and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

PAUL D. CONNOR.

Witnesses:
H. J. STEVENS,
J. F. CONNOR.

(No Model.)

C. SELDEN.

STATIC NEUTRALIZER FOR TELEGRAPHS.

No. 291,096. Patented Jan. 1, 1884.

Fig. 1.

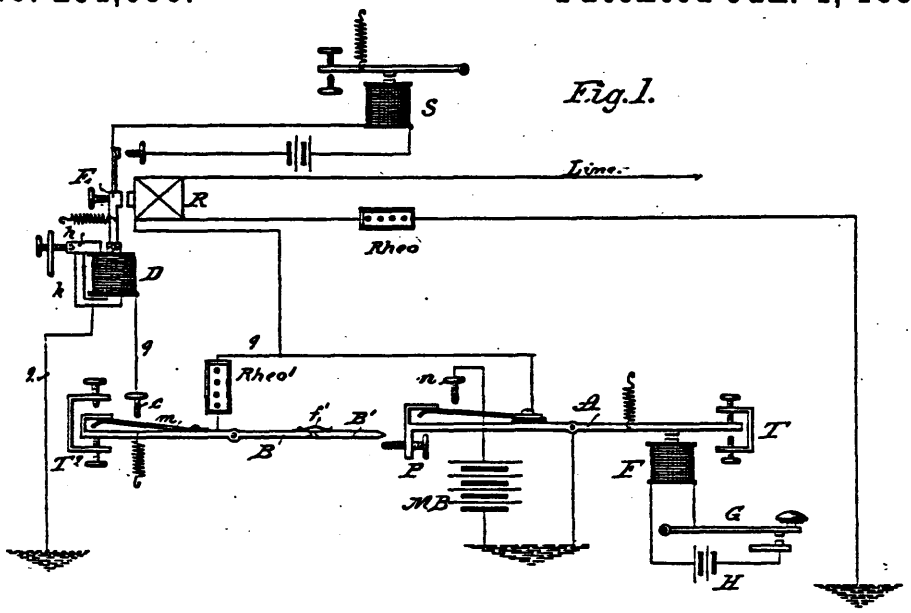


Fig. 2.

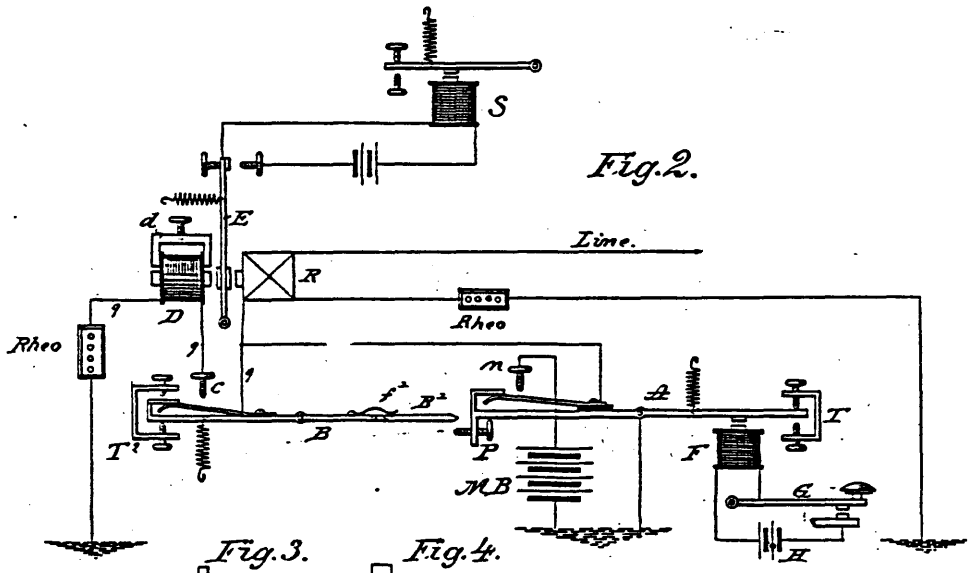


Fig. 3.

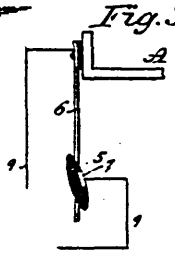
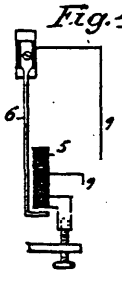


Fig. 4.



WITNESSES

Ernest Abshagen.

Albert F. Leonhard

By his Attorney

INVENTOR

C. Selden

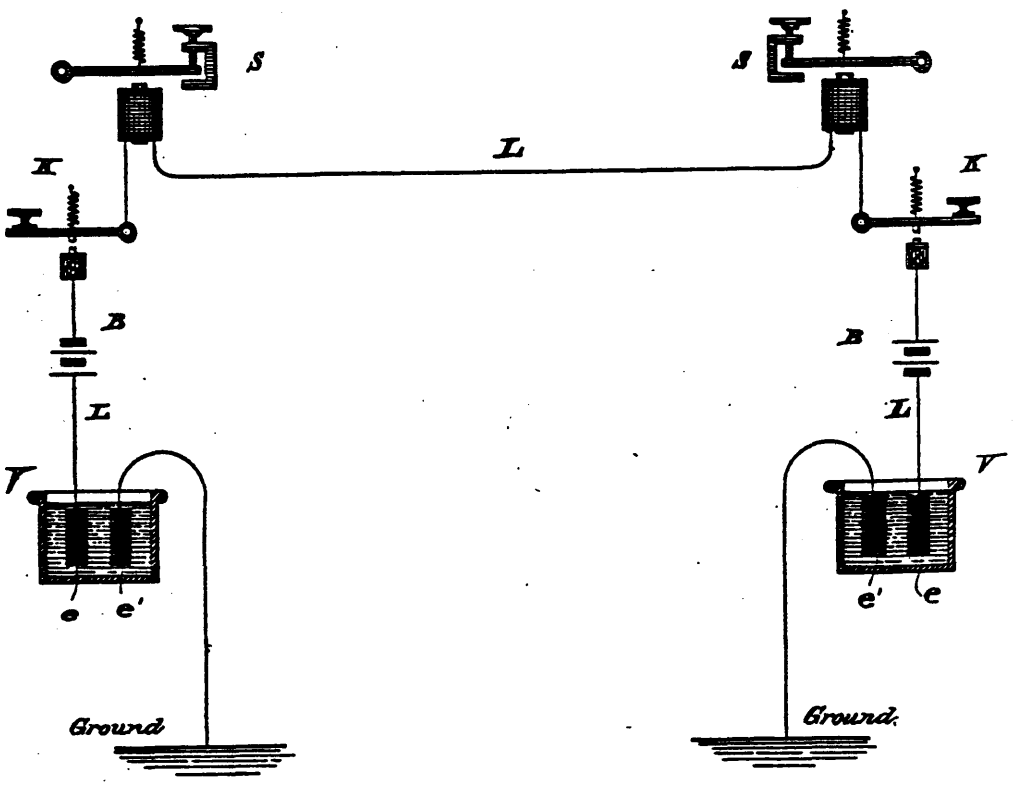
H. B. Townsend

(No Model.)

O. LUGO.

Electric Telegraphs.

No. 235,159. Patented Dec. 7, 1880.



WITNESSES

Wm. A. Skinkle,

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UNITED STATES PATENT OFFICE.

ORAZIO LUGO, OF NEW YORK, N. Y.

ELECTRIC TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 235,159, dated December 7, 1880.

Application filed June 10, 1880. (No model.)

To all whom it may concern:

Be it known that I, ORAZIO LUGO, a citizen of the United States, residing in the city, county, and State of New York, have invented or discovered certain new and useful Improvements in Telegraphy, of which improvements the following is a specification.

Great difficulty is often experienced in operating parallel and adjacent lines of telegraph by the transference of signals made upon one line to another. This is especially the case when a wire charged and worked with a strong battery-current approximates one operated with a magneto-current or with a weaker electric current, as in the case of the speaking-telephone. The theory generally accepted prior to my invention has been that this interference was entirely caused by "induction," so called. Numerous attempts have been made to get over this difficulty by braiding, twisting, or arranging wires parallel and close together, so that the so-called "induced current" passing in one direction might be neutralized by an opposite or reversed current of induction.

The difficulty above mentioned is believed not to arise in the case of a metallic circuit perfectly insulated from the earth or from connection with other lines; but such metallic circuits are seldom practically used on account of the expense and the difficulty of maintaining insulation.

My invention is based upon the discovery made by myself that this so-called "induction" from one parallel line to another consists really in the continuity of the circuit through the ground-connections of the respective lines, the intensity of the so-called "induction currents" being dependent on the perfectness of the operation of the ground as a conductor.

The object of my invention is to obviate this so-called "induction" in adjacent telegraph-lines, which end I attain by preventing communication between the ground-connections of the respective lines.

The invention by which I attain this object is based upon another discovery of my own, that the electro-motive force of the battery, after doing its work upon the line, can be neutralized, dissipated, or extinguished by decomposing an electrolyte, and the ground-connections thus be dispensed with, or the current at least be so attenuated or reduced before reaching the earth as to be practically ineffectual to disturb the other lines.

My invention therefore, broadly stated, consists in a novel art, method, or system of neutralizing by electrolysis the electro-motive force of the battery after its work upon the telegraph-line is accomplished.

The subject-matter of my invention is specifically set forth in the claims at the end of the specification.

I attain the objects of my invention by a novel organization of old instrumentalities, the essential features of which organization are a telegraphic circuit, including a battery, a line-wire, receiving and transmitting instruments, suitable connecting-wires, and, in addition, in lieu of the ordinary earth-connections, a decomposing or electrolytic apparatus interposed between the line and the earth.

My invention contemplates the use of the most efficient apparatus of the present day, the construction of which is well known, and therefore need not be herein described, especially as the details of construction of such apparatus form no part of the subject-matter of my invention.

In the accompanying drawing, which is a diagram of my improved apparatus, terminal stations only are shown. Obviously, however, any desired number of intermediate stations may be used in the ordinary way, the only thing necessary being to interpose an electrolytic or decomposing apparatus between the line and the earth at each station.

The electrolytic apparatus I prefer to use is constructed on the principle of the well-known voltameter, and consists, preferably, of two carbon or plantinum electrodes, *e e'*, immersed in a suitable electrolytic fluid contained in a vessel, V, one of said electrodes, *e*, being connected with the line-wire L, while the other, *e'*, which is separated a suitable distance from it, may, if preferred, be connected with the earth.

Sulphuric acid and water make a very good electrolyte, as is well known. Means must, of course, be adopted for replenishing the electrolytic fluid from time to time to compensate its decomposition by the action of the electric current.

UNITED STATES PATENT OFFICE.

HERBERT A. TAYLOR, OF CORNHILL, LONDON, AND ALEXANDER MUIRHEAD, OF 159 CAMDEN ROAD, MIDDLESEX COUNTY, ENGLAND.

IMPROVEMENT IN TELEGRAPHIC ACCUMULATORS AND CONDENSERS.

Specification forming part of Letters Patent No. **206,366**, dated July 23, 1878; application filed May 15, 1878; patented in England, February 24, 1875.

To all whom it may concern:

Be it known that we, HERBERT ARNAUD TAYLOR, of 7 Pope's Head Alley, Cornhill, in the city of London, and ALEXANDER MUIRHEAD, of 159 Camden Road, in the county of Middlesex, England, have invented new and useful Improvements in Electric Telegraphs and in apparatus connected therewith, which improvements are fully set forth in the following specification.

This invention has for its object to construct an accumulator having also power of conduction, which is adjusted to the requirements as in Muirhead's English Patent No. 3,663, of October 23, 1874, upon which this is an improvement. The subject-matter claimed is hereinafter stated.

With paper-pulp is mixed a substance, such as black lead (plumbago) or precipitated metals, gold, silver, copper, or other good conducting substance, by which a moderate conducting power is imparted to the paper produced from the pulp, or by chemical processes conducting materials may be precipitated in the body of the paper. The paper so prepared is arranged between alternate layers of a dielectric, which may consist of paper treated with paraffine wax or shellac, of gutta-percha or mica. In accumulators thus prepared the conducting-paper takes the place, partly or in whole, of the metallic sheets (tin-foil or lead) hitherto generally employed.

To form the imitation telegraph-line this conducting-paper, insulated, as in the condenser, by sheets of a dielectric material, is so arranged by connecting a number of the sheets, either in continuous or parallel circuit, that the electrical properties of the telegraph line or cable are imitated, so that uniformly throughout the imitation line the conductive resistance bears the same ratio to the electrostatic capacity as the resistance (either total or per unit of length) of the telegraph line or cable bears to its electrostatic capacity.

Paper made as above described may be used in constructing standards of high resistance.

We obtain a paper which contains intimately intermixed with the pulp a conducting-powder. Plumbago we prefer. The paper we have used, and which works well, contains about fifty per cent. of plumbago. It is of the substance of stout blotting-paper, and we obtain it in sheets about eleven by eighteen inches; but other sizes, of course, may be obtained if required. The plumbago is mixed with the paper-pulp in the same way as other powders have sometimes been introduced, with a view to give substance to the paper. When this paper is to be used in conjunction with paraffine paper, we apply, in order to render it less porous, a weak solution of shellac in alcohol, either by dipping or brushing; but this is unnecessary when shellacked paper is used for the insulator. We also obtain sheets of a suitable dielectric. Paper saturated with paraffine wax we employ by preference. We also obtain sheets of a material which is a good conductor of electricity. We employ tin-foil by preference. We place these sheets the one on the other in the following order: Paraffine paper, tin-foil, paraffine paper, plumbago paper, paraffine paper, tin-foil, paraffine paper, plumbago paper, and so on until we have accumulated as many sheets as we think desirable—say, for example, we use twenty sheets of plumbago paper. The pile will then consist of eighty-three sheets in all. The sheets of plumbago paper are (if we intend the conduction to be along the length of the paper) made longer than the paraffine sheets—say, by an inch and a half, or thereabout—so that one sheet of plumbago paper comes into contact with another sheet of the same material at the margin all along each end; and to hold the sheets tightly together along these margins we pass copper rivets through them. The sheets of paraffine paper are somewhat wider than the plumbago paper, so that they effectually prevent the sheets of plumbago paper coming into contact the one with the other, except at the margins, as already stated. The sheets of tin-foil are smaller than the sheets of paraffine paper, so as to insure that they shall be kept out of contact with the plumbago paper; but the sheets of tin-foil or tongues projecting from them are allowed to come into contact one with the other at one or both sides remote from the projecting margins of the plumbago paper.

It is advisable to put the sheets together when the paraffine is hot, and to press them between hot plates of metal from time to time

Fig. 1, is represented as exposed to inductive disturbances between the points *c* and *d*, and also between *b* and *e*, and to avoid the effects of such disturbance the circuit is wholly metallic, consisting of two wires between these points. In the plans previously adopted it would be necessary that the circuit between *a* and *c* should also be metallic, as shown by the dotted line, or else that it should be metallic all the way from *b* to *c*, in either case passing over space not exposed to disturbance, although by grounding the terminals of one of the wires of the metallic circuit, as shown at *d* and *e*, a single wire is sufficient between those points.

Supposing it were attempted to omit the second wire, 3, between *a* and *c*, and the wire 2 were connected with the earth-plate *g* at *a*, and then connected with the end of one of the wires, as 4, between *c* and *d*, the said wire 4 being connected at *d* with the wire 5, passing to *b*, and there connected with the return-wire 6, extending from *b* to *e* and grounded at *e*, the electric currents and impulses would pass from *a* over wires 2, 4, 5, and 6, through *b* to the ground *g* at *e*, and thence to the ground at *a*, and it would not pass over the return-wire 7 between *c* and *d* even if it were grounded at *c* as well as at *d*, so that this portion of the line would still be subject to disturbance. If, however, an induction-coil, *i*, having its helices properly proportioned relatively to the circuits of which they are to form a part, be placed at *c*, and the circuit-wire 2 be grounded at *a* and *c*, after passing through one of its helices, and the closed metallic circuit 4 7 pass through the other, then every impulse passing through the circuit *a* 2 *c* will induce in the circuit 4 7 an impulse which will be felt at *d*. If, now, I place another induction-coil, as *i'*, at *d*, include one of its helices in the closed circuit 4 7, and the other in the earth-circuit *d* 5 *b* 6 grounded at *e*, then every impulse or variation felt in the earth-circuit *a* 2 *c* will induce corresponding currents in the metallic circuit 4 7, which will, in turn, induce in the earth-circuit *d* 5 *b* 6 *e* impulses which will be felt at *b*, and I shall be put to the expense of a metallic circuit only where needed.

It is obvious that the second induction-coil, *i'*, will not be necessary, as both metallic portions *c d* and *e b* of the circuit may be included in a single grounded circuit; but when there are more than two regions of disturbance, or if there are two and neither of them is adjacent to the end of the line, the induction-coils will have to be properly arranged to separate the grounded circuits from each other, as will be readily understood. This arrangement may be used where a number of lines are to pass through one cable in a part of their course and diverge at each end thereof, and it is also obvious that a very valuable application of this system will be to connect, by double wire or metallic circuit trunk-lines, two telephone-exchange offices, and at the same time allow these trunk-lines to be used by subscribers to each exchange whose instruments are connected with it by grounded circuits. Fig. 2 shows such an arrangement, and also shows a method by which a third office or set of lines can be connected with the system at an intermediate point in the metallic circuit.

The central offices *x y z*, each containing the terminals of several of the usual grounded subscribers' circuits 10 11 20 21 30, &c., are connected together by one or more trunk-lines, each consisting of two wires, 8 9, both included in the circuit, it being supposed that there are other circuits which would disturb, by their inductive effect, the said trunk-line if single lines were used with the ground as the return circuit in the usual manner.

When it is desired to place a subscriber on one of the circuits, as 12, centering in office *x*, with a subscriber on one of the circuits, as 21, centering at *y*, the end of the said circuit 12 at the office 2 may be directly connected to one of the wires, as 8, of the trunk-line, the other wire, 9, of said trunk-line being connected to the ground *g* at station *x*, as indicated by the dotted lines. If the ends of the wires 8 9 are connected at office *y*, a complete circuit will be formed through the said circuit 12 and the wire 8, and back through the wire 9, and thence by the ground between the office *x* and the subscriber's station in question on circuit 12. By placing instruments in the said circuit at office *y* communication would be established between said office and the subscriber's station, and the effects of induction over the portion of the line between offices *z* and *y* exposed to such effects would be neutralized, as before described.

If the subscriber's circuit 21 were connected with the wire 8 of the trunk-line, it will be seen that the wire 9 will be cut out of the circuit, whether it be grounded or not, at office *y*, the said circuit now passing from the subscriber's station on circuit 12 over said circuit and wire 8 and circuit 21 to the subscriber's station, returning directly by the ground, and thus throwing out the wire 9 and rendering the circuit liable to cause or receive disturbances from induction.

To establish communication in accordance with my invention and include both the wires 8 9 in the circuit, I connect them at office *y* with the electrodes of one helix of the induction-coil i^2, the other helix whereof is connected at one end with the circuit 21 and at the other end with the ground. When connected in this manner the electric impulses in the circuit 12 and trunk-line and helix of the coil i^2 in circuit therewith induce similar impulses in the other helix of the induction-coil i^2 and the grounded circut 21, in connection therewith, and similarly the currents are transmitted from circuit 21 by induction to the trunk-line 8 9 and connected circuit 12. If desired, induction-coils i^2 might be placed at both ends *x y* of the trunk-line 8 9, and the elec-

stant applied E.M.F. the amplitude diminished in more or less direct proportion to the frequency. It is apparently taken for granted that the recorder signals are truly representative of the received currents. Further, the remarkable result was arrived at that the amplitude of the received signals, working duplex, within the limits of observation with a particular recorder, for a given frequency, is more or less directly proportional to the applied volts. This result will of course require further investigation before it is accepted as general. The second part of the paper deals with the theory of the measurement of current and phase and their variations with frequency. As an example the constants for the Canso-New York cable are calculated. Comparing the E.M.F.'s employed when using a battery with those of an alternator, it is pointed out that the term "equivalent voltage" requires special interpretation. The speed of signalling is not proportional to the applied volts, but it does increase with the volts; there is an upper limit, however, which, according to the authors, depends upon the dielectric strength of the guttapercha. [The authors appear to have forgotten the lightning-protector of the cable, which in practice determines, or should determine, the upper limits of dielectric strength.] It is pointed out that, whereas for air the dielectric strength is independent of the time during which the difference of potential is applied, for guttapercha and indiarubber the time element is important. When a battery is applied to a cable without condensers, the whole pressure is upon the dielectric during the entire length of a signal, but with a sine-form generator the maximum potential is momentary, and cannot be prolonged even if desired. Hence, for equivalent voltages, conditions would appear to favour the sine form. The value of the virtual alternating potential or sine-wave E.M.F. which, applied between the sending end of a cable and earth, would produce the same maximum E.M.F. at each alternation as the maximum E.M.F. applied similarly by a battery, is 70·7 per cent. of the E.M.F. of the battery. This is true whether there are sending-condensers or not. But the fundamental component of the battery impulse has a maximum much below the maximum potential of the battery; hence, for the same maximum potential at the transmitting end of a cable, the amplitude of the wave at the receiving end is greater when a sine-wave alternator is employed than when a battery is used, and more energy is transmitted at each impulse. Moreover, the secondary components of the battery impulse introduce useless static changes which have to be got rid of between each signal. In conclusion the authors describe experiments made with the apparatus, using sending-transformers, after the manner of Dearlove. R. A.

1970. *Telephony over Telegraph Lines.* **F. Walloch.** (Elektrotechn. Zeitschr. 21. pp. 237–240, March 22, 1900. Paper read before the Elektrotechniker-Verein of Hanover, Jan. 9, 1900.)—The author describes the methods adopted for enabling simultaneous telegraph and telephone messages to be transmitted over a single line, as in the Van Rysselberghe system. All these methods depend upon the use of condensers, interposed in such a way that the slow telegraphic impulses do not affect the rapid undulations of telephony. At each station, the telephone is connected between line and earth, through a condenser; and the telegraph instrument is connected between line and earth with no condenser. In practice it is found that the capacity of each condenser need not exceed 0·2 mfd., and in place of a tin-foil "plate" condenser, it is found better to use one formed of parallel insulated wires wound together on a bobbin. For this purpose the wires may be 0·1 mm. diameter copper, double-covered with silk, each of the wires having a

resistance of about 800 ohms. Plate condensers are found to transmit more loudly but less distinctly than these wire condensers. The author suggests that loudness and clearness might possibly be both attained by combining a plate condenser with a wire condenser.

The Morse-key contacts are of carbon, so as to avoid abrupt changes of current, which would affect the telephone circuit. Or a resistance bobbin may be connected permanently between the contacts of the key. In the event of there being intermediate telegraph stations between the two stations that are to communicate by telephony, each intermediate telegraph instrument should be bridged over by a condenser; so far as the telephone circuit is concerned, this is equivalent to cutting out the resistance of all the intermediate telegraph instruments. Further, each telegraph instrument, including the terminal instruments, should be provided with an inductive resistance of about 500 ohms, to act as a choking coil for the telephonic currents. A description is given of the application of this system to the fire-alarm service in Berlin; by means of a portable telephone apparatus communication can be made with the central fire station from any of the 800 fire-alarm posts.

R. A.

1971. *A Telephone Experiment.* **E. Piérard.** (Électricien, 19. pp. 309–311, May 19, 1900.)—The author recapitulates the experiments referred to in Abstract No. 1226 (1900), and describes how the "singing condenser" is operated. A vibrater, before described, is put in circuit with a battery and the primary of an induction coil. In the secondary circuit is a condenser formed of sheets of tin-foil in size a square decimetre, separated by paper. When the vibrater is sung to, the condenser reproduces the melody more or less strongly according to the power of the battery.

E. O. W.

1972. *Telephone Switchboards.* **J. Anizan.** (Journ. Télégraph. 24. pp. 97–102, May, 1900.)—The author describes the arrangements in force in small telephone exchanges in France where from 10 to 500 subscribers have to be provided for. There are four types of board with the usual fittings, for 10, 25, 50, and 100 lines. The first is fixed to the wall, the others stand in cabinets in the usual way. When extensions are required, another board of the same type is set up side by side with the first, and connections can be made across to the various subscribers either with the ordinary cords and plugs if long enough, or through the service or local jacks. There is an arrangement by which, during busy hours, the 100-line board can be worked by two operators. In all the exchanges, except for 10-line, the lines are brought first to distribution boards, furnished with carbon plate lightning protectors. The connections behind the switchboards are so made that jacks and annunciators can be withdrawn for repair or adjustment without detaching the wires. The microphone of the operator is furnished with two batteries for greater security in working, either of which can be plugged in or out by a switch.

E. O. W.

ment of the transmitter the spring will slide upon the face and momentarily close the circuit 9. By making the piece 5 adjustable the moment at which the circuit shall be closed may be determined.

I do not limit myself to any particular device for opposing the action of the relay on the armature at the proper time, as other means of utilizing the static discharge-current itself for the purpose will readily suggest themselves. Any suitable device, instead of coil D, may be employed that will properly respond to the effects of an electric current.

I do not limit myself to any particular method of or device for connecting the coils D, or other electro responsive device acting directly or indirectly in opposition to the relay to the main line, as the essence of my invention consists in making use of the static discharge-current acting through said coils for neutralizing the effects of such current on the receiving apparatus.

I do not limit myself to the means described for completing circuit 9, as it is obvious that other means may be employed without departing from the spirit of my invention. It is likewise obvious that my invention may by suitable modifications be applied to other systems of single, duplex, or multiplex telegraphy.

What I claim as my invention is—

1. The combination, with a relay, of an auxiliary electro-responsive device arranged to neutralize the effects of a static discharge-current flowing in the relay-coils, and means for connecting said auxiliary device with the line simultaneously with the flow of the static discharge-current in the relay-coils, so that the said discharge may flow in whole or in part through said auxiliary device.

2. The combination, with a relay, of auxiliary coils or helices for neutralizing the effects of the static discharge-current in the relay, and means for admitting the static discharge-current to said helices simultaneously with its flow in the coils of the relay.

3. The combination, with a relay, of auxiliary coils D, branch connection 9, and means for closing the latter simultaneously with the flow of the static discharge-current in the relay, whereby a portion of said current may flow in branch 9, and neutralize the effects of such current in the relay-coils.

4. The combination of an auxiliary neutralizing device, a transmitter, and a circuit-closer for connecting the auxiliary device with the line simultaneously with the movement of the transmitter in removing the main battery from line, so as to admit a portion or all of the static discharge-current to the auxiliary neutralizing device, as and for the purpose described.

5. The combination of coils D, circuit 9, transmitter, and supplemental circuit-closer operated simultaneously with the transmitter, and serving to close circuit 9, connected to main line, so that when the circuit is closed the static discharge-current may flow into the same, simultaneously with the movement of the transmitter in disconnecting the battery.

6. The combination of neutralizing-coil D, circuit 9, connected to main line, so as when closed to receive a current of static discharge, circuit-closer B B′, and transmitter A.

Signed at St. Louis, State of Missouri, this 18th day of January, A. D. 1883.

CHARLES SELDEN.

Witnesses:
H. C. TOWNSEND,
THOS. TOOMEY.

1968. *Military Telegraphs.* **P. Giron.** (Soc. Belge Élect., Bull. 17. pp. 253–261; Discussion, pp. 261–263, June, 1900.)—The author describes the modes of communication in the Belgian army and makes comparisons with those of England. The weight of the cable carried in waggons has been much reduced. It is now only 22 kg. per km. This permits of an infantry advance at the rate of 3½ km. per hour being accompanied by the telegraph. In England with very light equipment the telegraph with calvary has been run out at 12 km. per hour. Reference is chiefly made to the vibrating sounder of Cardew, with a telephone receiver, or modifications of the same. It can be worked through imperfectly insulated circuits. A case is quoted in the Soudan where it was employed on twenty-seven miles of bare wire lying upon the ground. It can also be hooked on to existing telegraph lines working on the Morse system without disturbing regular communication, a condenser or separator dividing it from the line in order to obviate a fault of derivation. Any temporary earth connection suffices. E. O. W.

1969. *Cable Signals.* **A. C. Crehore and G. O. Squier.** (Amer. Inst. Elect. Engin., Trans. 17. pp. 343–388, May, 1900.)—In the ordinary system of signalling through long cables a dot is transmitted by a positive current, and a dash by a negative current. During the latter portion of each impulse it is usual to connect the cable to earth. The authors replace the battery by a drum-wound alternate-current generator designed to give successive impulses of true sine form; it is provided with a third brush which connects the middle of the armature to line. An automatic transmitter, slightly modified, with brush contacts somewhat like those of the Delaney instrument, is geared to sychronism with the generator. The paper slip of the auto-transmitter has four rows of punched holes in place of the usual three; the fourth row provides for the discharge of the cable between letters and words by connecting it to earth. With this arrangement, whenever contact is established on the dot side of the transmitter-slip, a positive sinus is sent to line; similarly, when contact is made on the dash side, a negative sinus is transmitted to line; and for all intermediate spaces the cable is connected automatically to earth through the holes in the fourth line of the slip. No sounder-transmitter or earthing device is necessary. According to Kelvin's theory of cable transmission the component corresponding to the first term of the Fourier series is the only impulse appreciable at the distant end of a long cable; hence, although the generator may not send to line a current impulse of true sine form, the received current at the far end is approximately of that form. This result was demonstrated by the authors experimentally by replacing their drum-wound generator by a shuttle-wound armature. Under these conditions the recorder signals at the distant station approached to sine forms, and at con-

UNITED STATES PATENT OFFICE.

CHARLES SELDEN, OF ST. LOUIS, MISSOURI.

STATIC NEUTRALIZER FOR TELEGRAPHS.

SPECIFICATION forming part of Letters Patent No. 291,096, dated January 1, 1884.

Application filed February 7, 1883. (No model.)

To all whom it may concern:

Be it known that I, CHARLES SELDEN, a citizen of the United States, and a resident of St. Louis, in the county of St. Louis and State of Missouri, have invented certain new and useful Improvements in Telegraphs, of which the following is a specification.

The object of my invention is to neutralize the disturbing effects of the static discharge-current from a telegraph-line, which occurs simultaneously with the removal of main battery from line and the putting of the line to earth, and which is productive of false signals on the receiving-instrument at the transmitting end of the line.

My invention is designed more particularly for application to duplex or multiplex telegraphs, and I have in the accompanying drawings illustrated one method of applying the same to a duplex telegraph. I do not, however, limit myself to such application of the invention.

My invention consists, broadly, in employing the static discharge-current as a means of neutralizing the effects of said current upon the receiving-instrument, to effect which I cause the whole or a portion of the static discharge-current to momentarily flow through a circuit containing an electro-magnet or other electro-responsive device, which, by suitable means, will either magnetically or mechanically oppose and neutralize the effects of said static discharge-current acting in the coils of the relay.

My invention consists, likewise, in the combination, with coils or helices which act either magnetically or mechanically to neutralize the effects of the static discharge upon the home-relay, of means for momentarily connecting said coils with the main line simultaneously with the withdrawal of the main-line battery, so that the static discharge-current (all or a portion) will flow momentarily through said coils.

My invention consists also of certain combinations specified in detail in the claims.

In the accompanying drawings, Figure 1 is a diagram of circuits and apparatus illustrating one method that may be used for carrying my invention into practice. Fig. 2 illustrates a modified plan. Figs. 3 and 4 show a device that may be used for closing the circuit to the neutralizing-coils momentarily upon movement of the transmitter in one direction only.

In Fig. 1, R indicates a differentially-wound relay electro-magnet, of the usual construction for a duplex telegraph, one of whose coils is in the line-circuit, while the other is in a split or branch circuit to earth containing an artificial resistance Rheo. Said relay is connected, as ordinarily, with the insulated spring of the transmitter-lever A, which spring normally rests against a hook on the end of the lever, thus completing the normal connection between line and earth through the transmitter. The resistance usually employed in the earth-connection and adjusted to equal resistance of main-line battery is omitted for the sake of simplicity.

The contact-stop, with which the spring makes connection when the transmitter is operated, is indicated at *n*, while M B is the main-line battery connected with said stop, so as to be placed to line by the operation of the transmitter.

T indicates the usual stops for the transmitter-lever A, and F, H, and G, respectively, the electro-magnet, local battery, and key by which the transmitter is controlled.

S is the sounder in a local circuit controlled by the relay.

E indicates the armature of the relay, which armature is arranged in the present case to be subjected to the polarizing influence of an electro-magnet coil, D, and is for that purpose mounted directly on the core of the coil D, as shown, or may form the core itself, being suitably pivoted to act as an armature. The armature is of soft iron, and in the normal condition of the device is not polarized by the coil D, and is therefore free to be attracted by the core of the relay. When, however, the static discharge-current flows in the coils of the relay, the armature is simultaneously polarized by the coils D, but in such a way as to tend to neutralize the inductive effects of the core of the relay, and to thus render the armature incapable of attraction by the relay. This device is described and claimed in another application for patent filed by me, and I therefore herein make no claim to it. It is shown here merely for the purpose of illustrating one of the methods that may be employed for utilizing the static discharge-cur-

rent, which latter is allowed to flow in the coils D in the manner to be now described, or in any other suitable manner. The coils D are included in a branch wire to earth connected to the main-line circuit, and indicated by the numeral 9, which branch wire includes a rheostat Rheo′ for the purpose of determining the amount of current that shall flow in said branch, and is closed at the proper time by the action of lever B, carrying contact-spring *m*, and, playing between stops at T², spring *m* makes contact with screw *c*, when the lever B is turned on its fulcrum, thus completing circuit 9. At the end of lever B is pivoted a piece, B′, having a shoulder or step, which abuts against the end of lever B. A spring, *f*′, tends to hold the piece B′ in the position shown, and if said piece be moved downward the lever B moves with it and closes circuit 9. The shoulder is, however, so formed as to allow the piece B′ to swing upward freely without interference with or from the lever B.

Upon the end of transmitter A is an adjustable stud or pin, P, which rides under the end of B′ and lifts it when the transmitter is operated to put the main battery to line, but finally slips by the end of B′, allowing the same to resume its normal position shown. This movement of the transmitter does not produce any effect on lever B or circuit 9. When the transmitter returns to its normal position, however, the stud P engages with the other side of B′, thus carrying lever B with it and closing circuit 9. This closing of circuit 9 is by proper adjustment of the parts made to take place simultaneously with the removal of the main-line battery M B from line and the connection of the line to earth. Just before reaching its position of rest the stud P slips by the end of B′, and the parts resume their normal position. The devices just described for closing circuit 9 are described and claimed in another application for patent filed by me. Other means might be used in their place for momentarily closing the circuit 9 at the proper time.

The general operation is as follows: In the normal position of the parts the armature E can be attracted, there being no current in coils D, and said armature is therefore free to respond to signaling-currents from the distant station, and the sounder S is operated. The transmitter-lever being at rest and battery M B disconnected, the circuit from line to coils D is broken at *m c*. When the transmitter is operated so as to put the main battery to line, the circuit 9 still remains open for the reason already explained, and the current from the main battery flows in the ordinary way, dividing between the two coils of the relay R, so as to produce no effect on the armature. When the transmitter returns to its normal position, the circuit 9 is closed for an instant simultaneously with the flow of the static discharge-current in the relay-coils, and the armature remains at rest. The time during which circuit 9 is closed is, however, so short that there is no interference with signals from the distant station. The rheostat Rheo′ enables the operator to adjust the strength of the neutralizing effects produced by the static discharge-current in the neutralizing-coil D or other device. To adjust the duration of the current in coil D, I propose to employ a device consisting of a piece of soft iron, *h*, mounted on and in magnetic connection with an extension, *k*, from one pole of the core of D, and adjustable to and from the opposite pole, so as to close, more or less, the magnetic circuit, and thus vary, in a well-known way, the facility with which the core, having been momentarily charged with magnetism, will lose its magnetic charge.

In Fig. 2 the armature-lever of the relay carries the usual armature or armatures, and is arranged in such a way that the core of D and the core of the relay R will act in mechanical rather than in magnetic opposition to one another. If separate armatures be employed for the cores of D and R, and said armatures are not in inductive proximity, the opposition will be purely mechanical. If, however, the cores are placed on opposite sides of the same armature, the element of magnetic induction will be present also to a greater or less degree. The lever E is in the present case supposed to be of the ordinary material—such as brass, carrying an iron armature or armatures. The general operation is substantially the same as with the arrangement of Fig. 1, with the exception that the core of D pulls mechanically against the core of R at the instant of the flow of static discharge-current in the coils of the relay. To adjust the duration of the pull of D so that it shall correspond somewhat to the time during which the effects of the static discharge-current are felt in the relay, but so that, nevertheless, it shall not be necessary to keep the circuit 9 closed during the whole of that time, I may employ such a device as has been already described in connection with Fig. 1, or an equivalent device, consisting of a piece, *d*, of iron, adjustable to and from the ends of the core of D, so as to act like the armature of a horseshoe-magnet in bridging the poles and completing, to a greater or less extent, the magnetic circuit.

Instead of lever B and its attachments I may use the device shown in Figs. 3 and 4, in side and rear view. In these figures, 5 indicates a block of some insulating material, carrying on one face a piece of conducting material, 7, which forms one side of a break in the circuit 9, while 6 is an insulated contact-spring carried by transmitter A and forming the other side of said break. When the transmitter is at rest, the parts are in the position shown, so that when the transmitter is operated to put the main battery to line the spring 6 will ride up on the inclined back of the piece 5, and will slip by the top and assume such a position that on the return move-

as the sheets are accumulated, so that the paraffine sheets may adhere closely together all round except where the projecting parts or tongues of the tin-foil come between them. This completes the construction of one unit or section of the artificial line or balancing apparatus.

To form a complete artificial line or balancing apparatus a number, more or less considerable, of such units are combined the one with the other by connecting their riveted margins in such a way as to establish a good electric communication between them, and when the instrument is in use one end of the artificial line or balancing apparatus may be connected with the transmitter and the other to earth, while the sheets of tin-foil have a direct earth connection. This is the arrangement we prefer when the cable has a direct connection with the transmitter and with the receiving-instrument; or if, as is now very usual, condensers are interposed at both ends between the cable and the instruments, we make similar arrangements in respect to the artificial or balancing line. When the cable is worked on other systems the connections will be varied to suit the particular system in use, as will be well understood by electricians, the object being in all cases to assimilate as closely as possible the conditions under which the actual and the imitation cable are worked.

If we desire to make an artificial line or balancing apparatus to work with an existing telegraph-cable of which the resistance and capacity are known, we can so construct one unit as to represent both in resistance and capacity a given length of cable, and then it is only necessary to couple up these units in continuous circuit to correspond to the entire length of the cable; but in other cases it is convenient to make the units with comparatively high resistance as compared with the capacity, and then, by arranging the units in parallel circuit, a balancing arrangement or artificial line can be readily arranged corresponding approximately to any cable likely to be met with in practice, the resistance being dependent on the dimensions and arrangement of the plumbago paper and the capacity or power of condensation or extent of surface of the tin-foil which faces it.

These instruments are not only useful in duplex telegraphy but also for other purposes, such as the experimental working of telegraphic transmitting and receiving instruments.

Having thus described the nature of the said invention and the manner of performing the same, we would have it understood that we claim—

The construction of artificial lines or accumulators having also power of conduction by combining the following parts: first, conducting-strips of paper prepared with plumbago or other conducting material, by which the current passes through the instrument; second, metal foil or other conducting material having an earth connection, through which it charges and discharges itself; third, separating sheets of dielectric or insulating material, the whole arranged substantially as described.

London, 20th December, 1877.

H. A. TAYLOR.
ALEX. MUIRHEAD.

Witnesses:
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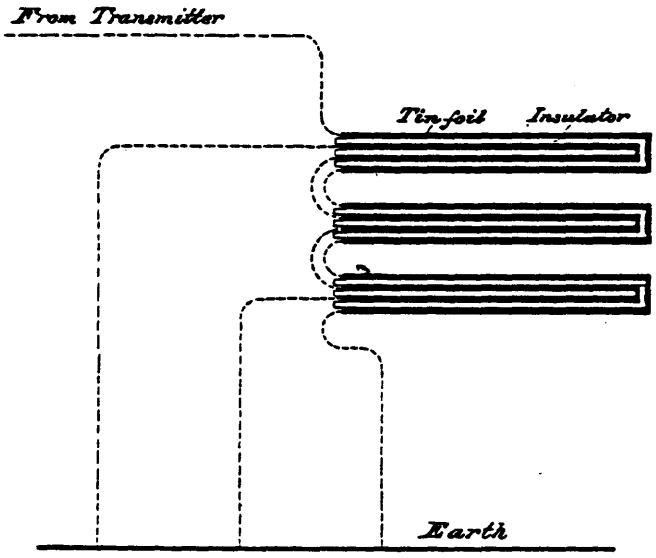
J. MUIRHEAD, Jr.

Condensing Resistance for Electric Telegraphs.

No. 208,665. Patented Oct. 1, 1878.



WITNESSES

Wm A Stinkle

Geo H Breck

INVENTOR

John Muirhead Jr.

By his Attorneys

Baldwin, Hopkins & Peyton

2 Sheets—Sheet 2.

C. F. VARLEY.

Telegraph.

No. 78,495. Patented June 2, 1868.

Fig. 5

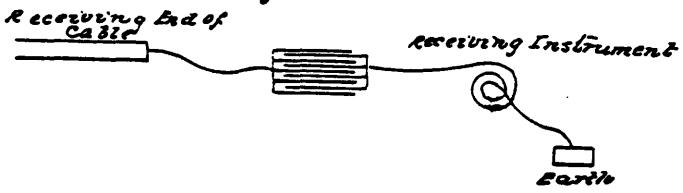


Fig. 7.

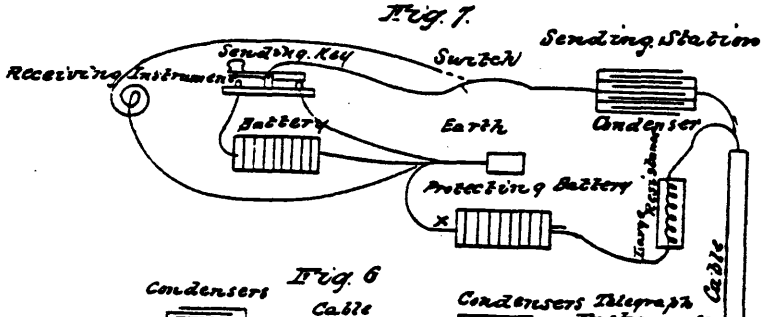


Fig. 6

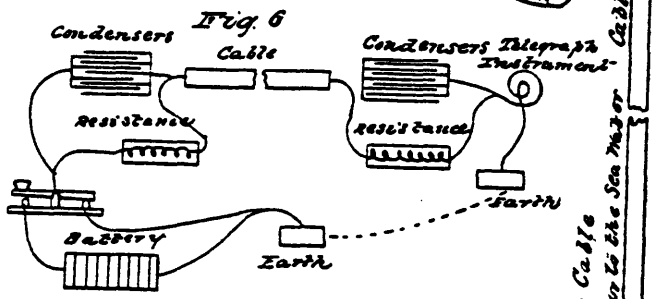
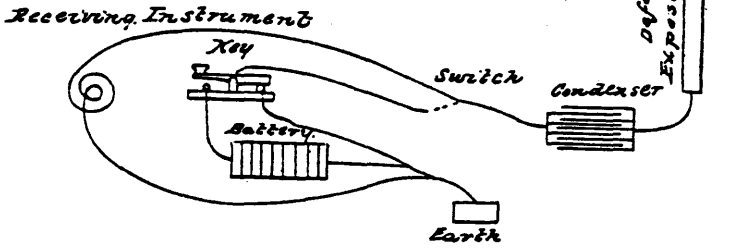


Fig. 7



Witnesses
M Baily
E. H. Page Jr

Inventor
Cromwell Fleetwood Varley
by his attorney

UNITED STATES PATENT OFFICE.

CROMWELL FLEETWOOD VARLEY, OF LONDON, ENGLAND.

IMPROVEMENT IN TELEGRAPHING.

Specification forming part of Letters Patent No. **78,495**, dated June 2, 1868.

To all whom it may concern:

Be it known that I, CROMWELL FLEETWOOD VARLEY, of London, England, temporarily residing in New York, county of New York, and State of New York, have invented certain new and useful Improvements in Electric Telegraphs; and I hereby declare the following to be a full, clear, and exact description of the same.

The objects of my invention are to cut off the disturbance arising from earth-currents, to obtain a high speed of signaling through long circuits, and, should the conductor become partially exposed, to preserve it from being eaten away by electrolytic action.

No means, prior to my invention, had been devised for effecting the first and third of these results. I have devised several other methods less perfect than those hereinafter described, but all embodying the general principle of my invention.

The invention consists of the arrangement of well-known apparatus, whose action, being of an electric and magnetic character, cannot be explained by drawings or models; but the accompanying diagrams and specification will enable those skilled in the art to understand the invention.

The telegraphic signals in this invention are made to depend upon the rate of change of electrical potential, and not upon the strength of the current or charge in the cable.

As the earth-currents—*i. e.*, the electric variations in the earth itself—change their strength slowly, the indications produced by them with this invention, in which the strength of the signals depends upon the rate of change of strength, are so feeble as to escape notice, and the embarrassment arising from this cause on long lines is, to all practical purposes, avoided.

There are two modes by which this is effected and a higher rate of signaling through long cables obtained. The first plan is by means of an induction-coil. The cable, at the receiving end of the circuit, is connected to the primary wire of an induction-coil, and through it to the earth. The secondary wire is connected to the telegraph-instrument. This arrangement is represented by Diagram No. 1.

Explanation of its action: On a current passing through the primary wire of the induction-coil, the iron core becomes magnetized, and this magnetization produces a current in the secondary wire, which acts upon the telegraphic instrument.

When the current in the primary wire has reached its maximum force, and is flowing steadily through, the iron core is magnetized to a certain fixed amount, and then the current in the secondary wire ceases. If, now, any change in the strength of the current through the primary wire occurs, the amount of magnetization of the iron core will vary, and a corresponding current in the secondary wire will result.

The earth-currents seldom pass from zero to their maximum and back again to zero (prior to changing sign) in less than five or six minutes, while the telegraphic signals are generally produced in a small fraction of a second.

With the former, although the currents are often very strong, the rate of change of strength is extended over several minutes, and consequently the current in the secondary wire is very feeble, as its strength is mainly dependent upon the rate of variation of the magnetism of the iron core.

The signaling currents or impulses are much more rapid or sudden, and consequently the variation of the magnetism of the iron core is much more sudden, and the currents generated thereby in the secondary wire are comparatively powerful and distinct.

Thus, then, suppose the earth to send a current through the line—say a positive (+) current from the sending to the receiving station—and to slowly magnetize the iron core, and, for ease of explanation, suppose this earth-current to remain for a time steady and uniform in strength; let, now, the sending-station make a signal. In doing so his battery adds its strength to or opposes the earth-current, accordingly as the signal sent is + or —, (positive or negative.)

This sharp and comparatively sudden addition to or subtraction from the earth-current produces a rapid augmentation or diminution of the magnetism in the iron core, and thus produces a distinct signal in the secondary wire.

For still further explanation, suppose the

earth-current to be +, and to have a strength of 100 plus or positive, and the signal-current to have a strength of 10, if a positive signal be sent, the current will rapidly rise at the receiving end in the proportion of 100 to 110. This rapid increment of magnetism will produce a positive signal in the secondary wire, corresponding to the increment 10. But if a negative signal be sent, then the battery will be opposed to the earth-current, and the current will rapidly fall at the receiving end in the proportion of 100 to 90, the magnetism in the iron coil will experience a rapid decrease, and a negative signal will be produced in the secondary wire corresponding to the decrement (or negative increment) 10, although the current through the line or cable still remains strongly positive.

As the strength of those secondary signals is almost entirely dependent upon the *rate* of increment and decrement of the current through the primary wire, and as the slowest line yet constructed need not require so much as half a second to produce a clear signal, while the earth takes five minutes or six hundred half-seconds, the current arising in the secondary wire from the earth-current (which, although assumed to be ten times stronger, is six hundred times slower) is $\frac{10}{600} = \frac{1}{60}$ part only of the strength of the signal, and the effects of the earth-current are consequently practically cut off.

When signaling through a very long cable, a rapid succession of signals charges the cable and produces an electric wave, which is a long while subsiding, and acts at the receiving end in a somewhat analogous manner to the earth-current just described. This prevents signals from being transmitted in rapid succession by the ordinary means.

The above apparatus, which may be popularly described as disentangling the short high-crested waves from the large long swells, enables clear distinct signals to be produced rapidly one after the other.

The strength of the signals through the cable or telegraph-circuit is produced by the rate of the increments and decrements of current, and not by the current itself; and, as an imperfect illustration, if the great earth-current through the cable be compared with an Atlantic swell whose height is five fathoms, but spreading horizontally over five or six hundred fathoms, and whose sides will have an angle of, say, one hundred and seventy-eight degrees, and if the signals be compared with the ripples produced by the wind upon the back of the swell, and whose angles are each, say, sixty degrees, then an apparatus that will indicate these angles would scarcely notice the angle of one hundred and seventy-eight degrees, which is nearly a straight line, (or one hundred and eighty degrees,) while the small waves, with an angle each of sixty degrees, would be distinct, and such apparatus would disentangle the small signals from the big swell, paying almost no attention to the latter. Electric waves are entirely different from water waves; but the illustration may serve to explain the action of the former.

The second plan of effecting the above is more expensive in construction, but more perfect in action. A large condenser is inserted in the circuit at one or both ends, according to the circumstances of the case. At the receiving end of the line I prefer the following arrangement, (Diagram No. 2,) which gives a rapid rate of signaling.

The cable is connected to the one armature of the condenser through the telegraph receiving-instrument, and the other armature is connected with the earth. The cable is also connected to the earth by means of a resistance-coil, which is best when made of a long length of insulated copper wire wound round an iron core.

On a current running through the line or cable, it finds at the distant end two routes or channels, viz., the resistance-coil and the condenser. The condenser-route at the first moment offers no other sensible resistance than that of the receiving-instrument, while the other, owing to the magnetic inertia of the iron core, offers at the first moment a considerable resistance. The condenser is rapidly charged, and, as soon as it is charged to the full force or potential of the current in the cable, all the rest of the electric current goes through the resistance-coil to earth, and no more current is shown upon the receiving-instrument. If, now, the potential in the cable be reduced or increased a little, the charge in the condenser is reduced or increased in proportion, and a negative or positive signal can be distinctly produced at pleasure, although the electric current or charge in the line or cable has not changed sign, but only varied in strength. The resistance-coil between the cable and the earth may be dispensed with; but then the little signal-wave does not reach its maximum so rapidly, and consequently the signals are not so rapid. (*Vide* Diagram 6.)

Observe, the receiving-instrument may be placed between the second armature of the condenser and the earth or ground, instead of between the cable and the first armature. A condenser may also be employed at the sending end of the line or cable, either with or without a condenser at the receiving end of the line or cable. When a condenser is inserted at the sending end only of the line, the resulting signal is very similar to that produced by a condenser at the receiving end only; but the disturbing action of the earth-current, however, is more felt when the condenser is only placed at the sending end, because the earth-current has to charge the cable in addition to the condenser, all of which charging-current has to pass through the receiving-instrument. When the condenser is used at the sending end of the cable or line (Diagram 3,) the cable is connected to the one

armature of the condenser and the telegraph-key to the other armature of the condenser. An ordinary double or reversing key is generally used, so that when the one is depressed a positive charge is communicated to the condenser-armature attached to it, and when the other is depressed a negative charge is communicated to it.

If the key had been connected to the line or cable in the usual manner, a constant or permanent current would have been produced through the cable so long as the contact was maintained, and this current would only begin to die away when the contact with the battery was broken or reversed. But when the condenser is interposed in the circuit, as described, so soon as the current from the battery has charged the condenser the current from the condenser is arrested, and variations in the length of the battery-contact beyond a fixed amount will produce no change in the amount of current thrown into or induced in the cable. In this way great uniformity and regularity of signals are obtained.

At the sending end of the line it is sometimes advisable to use a smaller condenser than at the receiving end, and higher battery-power, because the more sharp and sudden the impulse is given the quicker will the signal appear at the distant end.

If the dimensions of the condenser be reduced—say halved—and the battery-power be augmented in the inverse ratio, then the shock or impulse will be the same in amount, but more sudden, producing a rather more rapid signal at the distant end; but the disturbing action of the earth-currents is reduced as the dimensions of the condenser are reduced at the receiving end.

In some cases—such, for example, as where the Morse instrument is used—it is advisable to connect together the two armatures by means of a very large resistance, as shown in Diagram 6, so that after the condenser is charged the current through the cable shall not entirely cease. Thus the sharp, sudden impulse of the condenser charges the cable, and would produce a dot, but not a line or dash. The weak current through the large resistance, however, maintains the current in the cable, and a dash is produced, the Morse armature being held down by this weak current so long as the key is held down.

On the key being elevated, the charged condenser is connected to the ground, if the condenser be at the sending end; and in discharging itself the condenser produces a short, sharp current in the cable in the opposite direction, which rapidly terminates the signal at the distant end of the cable.

All cables are liable to have their insulation impaired. When this is the case, and the copper conductor is exposed to the sea-water, the copper is decomposed whenever a positive current is permitted to flow from the copper into the water, forming chloride of copper, which is soluble, and diffuses itself and floats away.

If the cable be kept always negative to the water, the action of the positive current flowing into the wire from the water is to preserve the wire from decomposition. To effect this I place a condenser at each end of the cable, (Diagram 7,) and also connect to the cable, through a large resistance, (or long coil of fine wire,) a battery whose positive pole is connected to the earth and negative pole to the resistance-coil. This keeps the cable always negative to the water, and yet the signals through it and the condensers are either positive or negative, at pleasure. Suppose the signal-impulse to be a positive one, it weakens the negative character of the charge in the cable and also in the distant condenser, and immediately a corresponding positive signal is produced in the distant instrument.

If the signal-impulse be negative, it increases the negative charge in the cable and also in the distant condenser, and therefore produces a negative signal in the distant instrument, and thus, although positive and negative impulses are produced at the distant end, the cable has been only less or more negative, but never positive, to the sea, and therefore, the conductor has been constantly under the preservative action of the negative current. Thus, then, the action of the condensers and battery has been not only to cut off the effect of the earth-currents and to expedite the transmission of signals, but also to preserve the conductor of the cable from destruction, if exposed to the sea-water.

In Diagram 7 the place of the switches or commutators is shown. These have been omitted in the other diagrams to simplify them. These commutators are of the ordinary well-known form common to most systems of submarine telegraphing, and are not a part of this invention.

Having now described my invention, and the manner in which the same is or may be carried into effect, what I claim, and desire to secure by Letters Patent, is—

1. In so arranging telegraphic apparatus as to work by the variation of the increment and decrement of electric potential, and not by the direct action of the electric current itself, as and for the purposes set forth.

2. The use of an induction-coil at the receiving end of the cable, one of its wires being connected between the cable and the ground, and the other or secondary wire connected with the receiving-instrument, as and for the purposes set forth.

3. The use of a condenser or condensers between the receiving end of the cable and the earth, with or without resistance-coils between the cable and the earth, as and for the purposes set forth.

4. The use of a condenser at the sending

end of the cable, with or without resistance-coils connecting its two armatures, as and for the purposes set forth.

5. The use of a condenser at each end of the cable, the cable being connected with the ground through a resistance-coil and a battery, so as to keep the cable always negatively electrified, as and for the purposes set forth.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

C. F. VARLEY.

Witnesses:
W. BAILEY,
C. G. PAGE, Jr.

H. A. TAYLOR & A. MUIRHEAD.

Telegraphic Accumulators and Condensers.

No. 206,366. Patented July 23, 1878.

Fig 1.

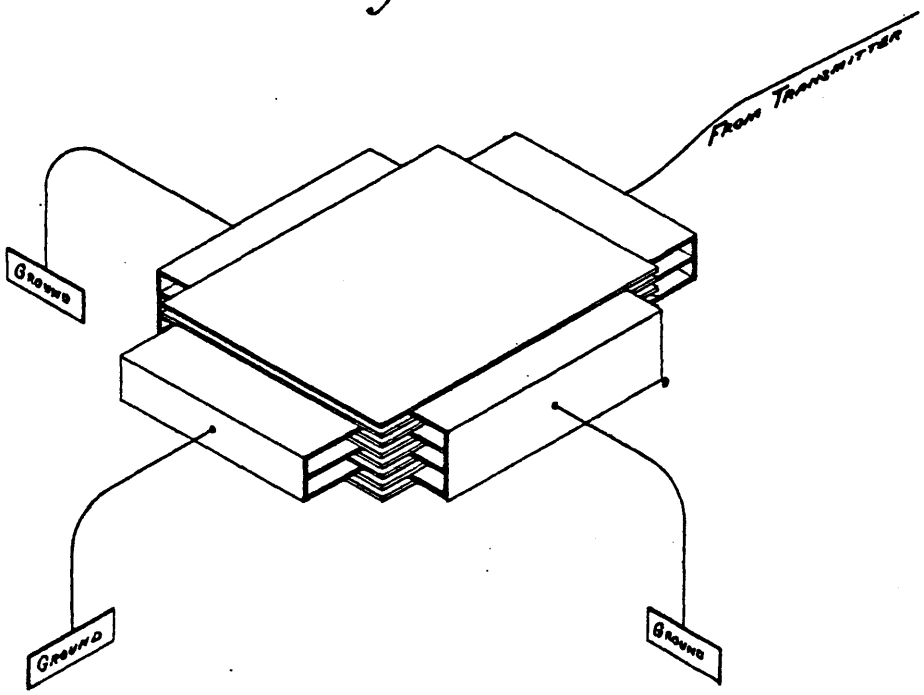


Fig 2.

WITNESSES

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