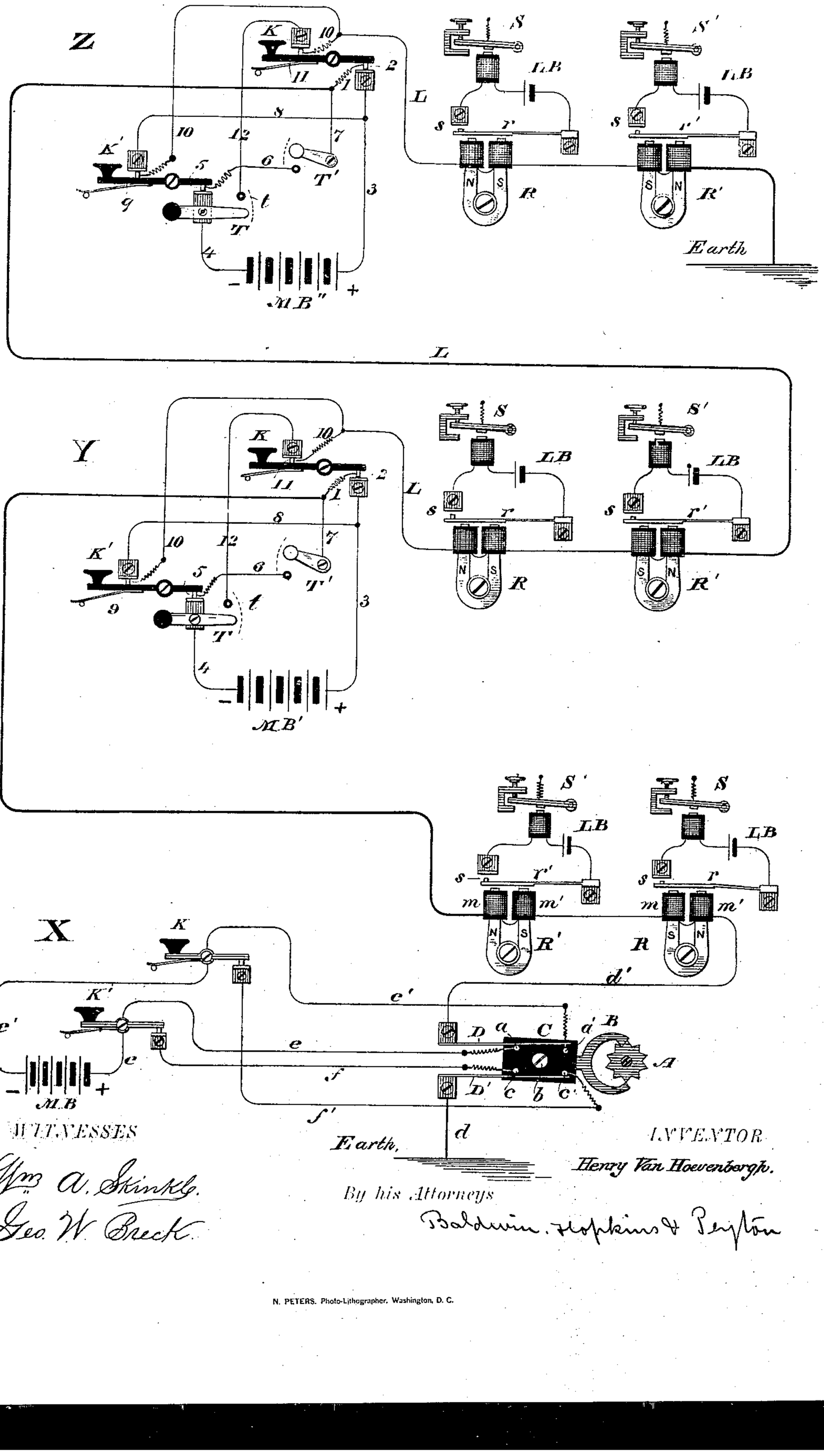
H. VAN HOEVENBERGH.

DUPLEX TELEGRAPH.

No. 253,134. Patented Jan. 31, 1882.



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DUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 253,134, dated January 31, 1882.

Application filed January 16, 1880.

To all whom it may concern:

Be it known that I, HENRY VAN HOEVENBERGH, a citizen of the United States, and a resident of the city of Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in the art of Duplex Telegraphy, of which improvements the following is a specification.

My invention relates to that system of duplex telegraphy in which two messages are simultaneously transmitted by throwing upon the line vibratory or undulatory currents of opposite polarity, either or both of said currents being interrupted at will to transmit intelligible signals.

Duplex telegraphs of the kind above mentioned are exemplified in Brooman's British provisional specification, No. 1,775, of July 15, 1863, and in United States Letters Patent No. 167,685, granted September 14, 1875, to J. Olmsted, for electro-magnetic telegraphs.

Speaking generally, the objects of my invention are to attain greater facility in operation and increased capacity of transmission, while obviating objections incident to the art of duplex telegraphy as heretofore practiced.

The particular objects of my invention are to neutralize at the receiving-station the transmitted current which actuates the armature of its relay; to enable the transmitting-operator to cut off from the line either one of two vibratory currents of opposite polarities; to enable the receiving-operator to neutralize at pleasure either current sent; and, finally, to enable the receiving-operator to neutralize at pleasure either one of two currents of opposite polarity sent from the transmitting-station.

To these ends my improvements comprise the following subdivisions: first, a novel art, method, or system of transmitting through a telegraphic circuit an undulatory or vibratory current of one polarity and neutralizing or extinguishing such vibrations by throwing upon the line at the receiving-station an auxiliary current of proper polarity; second, a novel art, method, or system of transmitting through a telegraphic circuit undulations or vibrations of opposite polarities, cutting off from the line at the pleasure of the transmitting-operator either set of vibrations, and of neutralizing either current so transmitted by throwing upon the line at the receiving-station an auxiliary current of proper polarity; third, a novel art, method, or system of transmitting through a telegraphic circuit undulatory or vibratory currents of opposite polarities, and neutralizing or extinguishing one of said currents (while strengthening the other) by throwing upon the line at the receiving-station an auxiliary current of a polarity opposite to that of one of the transmitted currents.

The accompanying drawing represents a diagram showing all my improvements embodied in a duplex-telegraph apparatus in the best way now known to me. Some of the improvements may, however, be used without the others, and in an apparatus differing in detail of construction from that herein shown. I contemplate the use in such apparatus of the most improved instruments of the present day; but as the construction of such instruments is well understood and forms no part of the subject-matter herein claimed, it is deemed unnecessary to describe that construction in detail.

The organization shown on the diagram comprises a transmitting-station, X, an intermediate or way station, Y, and a terminal or receiving station, Z, the apparatus shown being adapted to transmit in either direction. The arrangement of the apparatus being substantially the same at each station, with the exceptions hereinafter noted, a description of one set of apparatus will be sufficient without describing each set in detail.

Each station is provided with a main battery, M B, keys K K′, and relays R R′, together with suitable connecting-wires, hereinafter described. Each transmitting-station is provided with a commutator, current-reverser, or pole-changer of suitable construction, the form shown being that of a star or toothed wheel, A, rapidly rotated at a definite rate of speed by clock-work or other suitable well-known means, which star-wheel vibrates an escapement-lever, B, rocking on a pivot, *b*, upon which lever is mounted a block, C, of hard rubber or other suitable insulated material, carrying platinum points or pins *a a′ c c′*. This reverser or its equivalent is required at one of the terminal stations only. As the block

C vibrates these pins alternately come in contact with conducting-springs D D′, one of which is connected with the earth or ground wire *d*, the other with the line-wire L through the connecting-wire *d′*. Each of the two platinum points or pins *a a′* is connected with wires *e e′*, each passing through its respective key to the proper pole of the main battery, the arrangement of the circuit being such that the key may be manipulated without disconnecting this circuit, which thus passes from one of the platinum points through the key to the battery, and back through the other key to the other platinum point. Each of the other platinum points, *c c′*, is connected with its respective wire *f f′*, leading through the break-point of its respective key to the wires *e e′*, and thus to the main battery, so that the currents can be sent through this circuit when its key is closed. Under this organization, when the commutator C is vibrated the platinum points strike the conducting-springs and vibratory or undulatory currents of opposite polarities flow through the line-wire, as will be readily understood from the drawing, from which it will be seen that while, for instance, one platinum point, *a*, is in contact with the upper conducting-spring, D, the opposite one, *c′*, will be in contact with the lower conducting-spring, D′, and vice versa. The above-mentioned currents will continue to flow to line as long as the keys are closed. If, however, one of the keys—K, for instance—is depressed or open, currents of negative or minus polarity only will pass to the line under the organization shown, as the circuit through the platinum point or pin *c′* on the commutator is broken. With the key K closed and K′ open the reverse action will take place—that is to say, positive currents only will flow to line. With both keys open the circuit will be broken and no current will pass.

Each receiving-station is provided with relays R R′, preferably consisting of permanent magnets N S, which (or pole-pieces on which) form the cores constituting or serving to magnetize the cores of electro-magnets *m m′*. The permanent magnets might, however, be made of soft iron and magnetized by a battery. The magnetism of the permanent magnets should be so adjusted that its strength should correspond with that imparted to the coils of the electro-magnets by the currents from the commutator. The coils of the electro-magnets of relay R are wound in a direction the reverse of that of the coils of the corresponding magnet, R′, so that a current of a polarity to strengthen one relay-magnet would tend to neutralize that of the other.

r r′ are vibrating armatures to open and close the circuit of local sounders S S′, each operated by its respective local battery L B, each armature making and breaking contact with a platinum point or back-stop, *s*, in a well-known way. Each armature *r r′* is so biased that when no current is passing through the relay-magnets it remains in contact with the platinum point *s*, and thus keeps the local circuit of the sounder closed, the magnetism of the permanent magnets alone being insufficient to open this circuit without the additional magnetism imparted by the passage of a current through the coils of the relay-magnets. When the armatures are vibrating under the influence of continuous currents their rate of vibration is so great as to keep the local circuit practically open, its makes and breaks being caused by the manipulation of the key at the sending-station.

Switches T T′ are provided at each receiving-station. These switches take the place of the circuit-closers generally used in the ordinary Morse keys, and are designed to prevent the auxiliary batteries M B′ M B″ from being left on short circuit when the keys are closed. The keys are in this instance of vulcanized rubber or any other suitable non-conducting material, so that there is no passage through them, the current running through suitable connecting-points, as is clearly shown in the diagram.

The arrangement of circuits at the main terminal station X has already been described. At each of the other stations the line-wire divides, one branch leading, through the wire 1, break-point 2 of the key K, and wire 3, to one pole of the battery, while the other branch leads, through the wire 7, switch T′, wire 6, break-point 5 of key K′, and wire 4, to the minus-pole of the battery. Another wire, 8, leads from break-point 2 through another break-point, 9, of the key K′, thence through wire 10 to another break-point, 11, on the key K, thence through wire 12 to the break-point *t* of switch T, which, when closed, leads through the wire 4 back to the battery. The wire 10 connects with the line-wire L leading through the coils of the relay-magnet.

By the above-described method of running the circuits the battery can be closed by either or both of the keys, with a polarity adapted to neutralize a current of proper relative polarity acting on the armature of the relays. The one acted upon may be made to depend either upon the running of the circuits or the arrangement of the switches. The arrangement on circuit shown is the same as that shown in the way-station Y, and need not therefore be recapitulated.

The operation of the apparatus is as follows: With both transmitting-keys closed and the commutator vibrating rapidly, undulatory or vibratory currents of opposite polarity will rapidly succeed each other on the line. The power of the magnet of the relay R at the receiving-station will alternately be strengthened and neutralized in rapid succession simultaneously but obversely to that of the relay R′, and their respective armatures will accordingly be thrown into rapid vibration; but the vibrations will be too rapid to close the local circuit of the sounders S S′. When one key—K, for instance—is open, obviously a current of one polarity only

will flow to line. The corresponding relay, R, is consequently neutralized. Its armature flies back and closes the local circuit of the sounder S, while the armature of the other relay, r', continues to vibrate, its magnet being strengthened by the current on the line. Consequently as each key is manipulated to open and close the circuit its appropriate relay at the receiving-station is correspondingly affected, and signals are made upon the sounder by alternately opening and closing the circuit, as is well understood.

So far the operation of the apparatus is similar in principle to that of the Olmsted patent hereinbefore cited. The additional instrumentalities added by me to carry out the objects of my invention are shown at stations Y and Z. A current of the auxiliary battery M B′ may be thrown upon the line by means of keys K K′, so arranged that the polarities are reversed accordingly as the switches T T′ are arranged or the keys depressed. Supposing the armatures of both relays at the receiving-stations to be in vibration at the moment that the current of the auxiliary battery is thrown upon the line, the vibrations of one of the armatures will be stopped, owing to the neutralizing of the current from the main battery by the current from the auxiliary battery, and the local circuit of the sounder will thus be closed, while the strength, and perhaps the rate of vibration, of the other armature will be slightly increased. The armature stopped will of course depend upon the polarity of the current thrown upon the line.

The manner in which the keys reverse the polarity of the current of their batteries is as follows: The key K being open, switch T′ closed, and switch T open, a current of minus polarity is thrown to the left and that of plus polarity to the right, while with the key K closed, switch T′ open, and switch T closed the operation is reversed. If both keys are simultaneously depressed, the continuity of the line will be broken and the armatures of all the relays will rest on their back points, closing all the local circuits.

When thus organized my improved apparatus is operated in the following manner: With the commutator in operation and the line in its normal condition, (which is that of a closed circuit,) undulatory or vibratory currents of opposite polarity flow through the line in rapid succession and all of the relays will vibrate. The operator at the transmitting-station desiring to call the operator at another station—say Z—makes the necessary signals by working one of the keys—K, for instance. This operates all the corresponding relays, R, on the line, alternately breaking and closing their respective local circuits. The operator at the receiving-station, hearing the call from the transmitting-station, depresses his corresponding key, first closing his switch T, which closes all the relays R at the different stations by throwing upon the line a current of proper relative polarity from that sent from the transmitting-station. The operator at the transmitting-station X, noticing this, closes his key, which permits the operator at the other station to answer his call. A corresponding operation may be performed with the other set of keys and relays at the same time without interference, so that the two sides of the system may be worked the same in every respect as two independent wires.

I make no claim herein to the apparatus shown, as that constitutes the subject-matter of another division of this application filed simultaneously herewith.

I claim as of my own invention—

1. The hereinbefore-described improvement in the art of duplex telegraphy, which improvement consists in transmitting through a telegraphic circuit an undulatory or vibratory current of one polarity and neutralizing or extinguishing such vibrations by throwing upon said current at the receiving-station an auxiliary current of proper relative polarity.

2. The hereinbefore-described improvement in the art of duplex telegraphy, which improvement consists in transmitting undulatory or vibratory currents of opposite polarities through a telegraphic circuit, cutting off from the line, at the pleasure of the transmitting operator, either set of vibrations, and in neutralizing either current so transmitted by throwing upon the line at the receiving-station an auxiliary current of the proper relative polarity.

3. The hereinbefore-described improvement in the art of duplex telegraphy, which improvement consists in transmitting through a telegraphic circuit undulatory or vibratory currents of opposite polarities and neutralizing or extinguishing at pleasure either one of said currents (while strengthening the other) by throwing upon said current at the receiving-station an auxiliary current of a polarity opposite to that of one of the transmitted currents.

In testimony whereof I have hereunto signed my name.

HENRY VAN HOEVENBERGH.

Witnesses:

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CHARLES EDGAR MILLS.