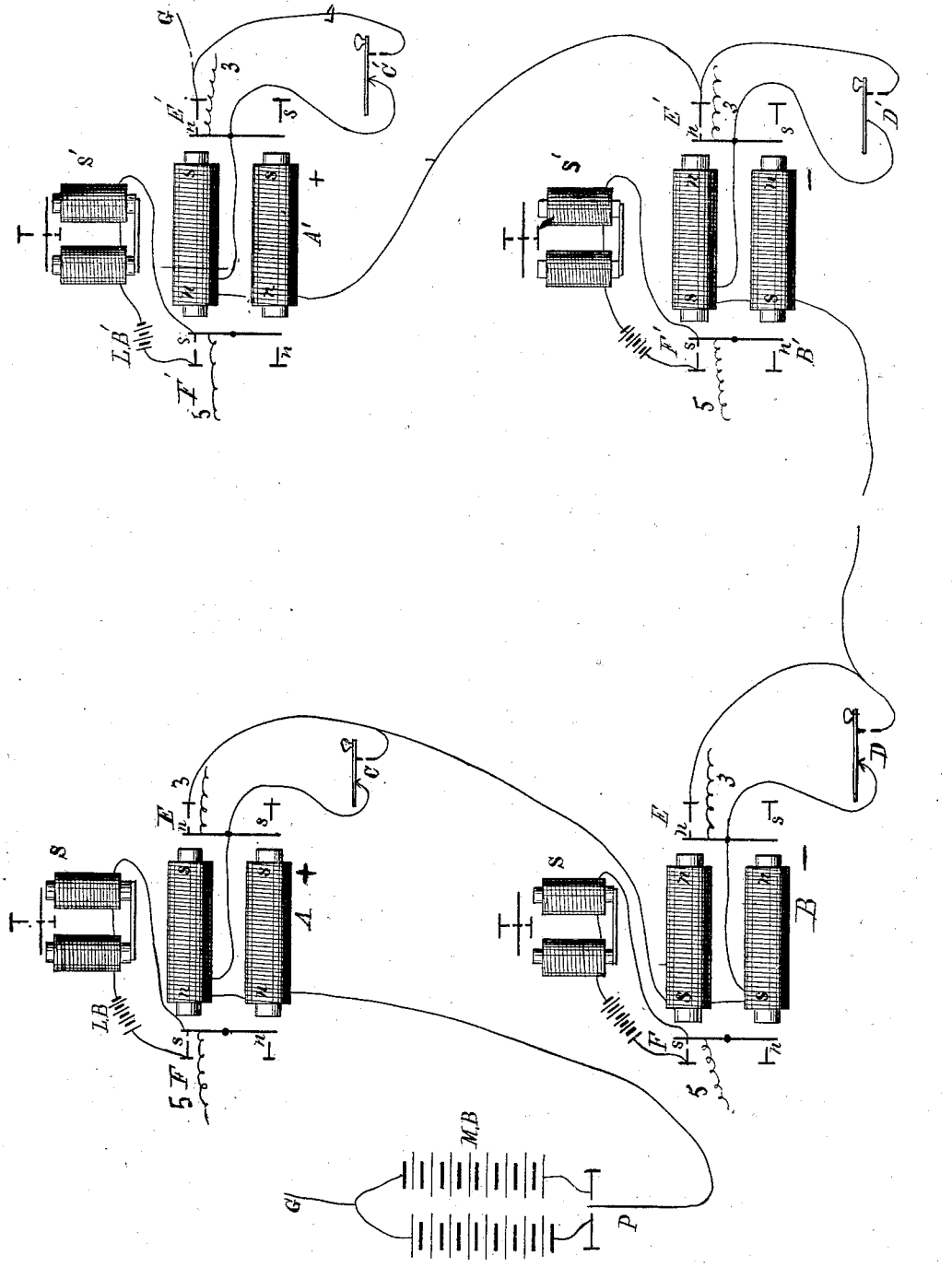
C. H. RUDD.

DUPLEX-TELEGRAPH.

No. 191,887 Patented June 12, 1877.



WITNESSES

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CHARLES H. RUDD, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN DUPLEX TELEGRAPHS.

Specification forming part of Letters Patent No. **191,887**, dated June 12, 1877; application filed January 20, 1875.

To all whom it may concern:

Be it known that I, CHARLES H. RUDD, of Chicago, in the county of Cook, and State of Illinois, have invented a new and useful Improvement in Duplex-Telegraph Apparatus, which improvement is fully set forth in the following specification and accompanying drawings.

This invention relates to an arrangement of telegraph apparatus for transmitting two messages simultaneously on the same wire in the same or opposite directions; and the invention consists in the use of alternate currents of opposite polarity for working the line, in combination with two relays of opposite polarity at each station of the line, having two armatures of magnetized steel, and sounders, local circuits, and keys for each relay, when the sounders and local circuits are each connected through the contact-points of one of the armatures of their respective relays, and the keys are each connected to the other armatures of their respective relays through shunts connected to the line, and the line is connected through the contact-points of the same armatures, the result accomplished by this arrangement being that one relay at the transmitting-station of the line with its corresponding relay at the other stations of the line is operated by currents of one polarity only, and the other relay at the transmitting end of the line with its corresponding relays at the other stations of the line is operated by currents of opposite polarity only, and consequently both series of relays may be simultaneously used for transmitting signals.

The accompanying drawing shows the arrangement of these relays, sounders, and keys at the terminal station of a line, and the main battery and pole-changer connected thereto, and as the construction of these different forms of telegraph apparatus is well known, they are all represented in the conventional manner generally adopted in electrical diagrams. M B represent the main battery, and at P is placed a pole-changer of any desirable form, which may be operated either automatically or mechanically.

The office of this pole-changer is to send to the main line a suitable number of currents per second, alternately positive and negative, and instead of a battery and pole-changer a magneto-electric machine may be used for the purpose.

The number of currents per second which must be transmitted cannot be definitely given, but it is probable that about sixty currents per second in each direction is the proper number.

A A′ are relays at opposite stations, which respond to the positive currents, and B B′ are relays which respond to the negative currents. C C′ D D′ are their respective keys, and S S S′ S′ are their respective sounders, operated by local batteries, as usual.

These relays are constructed, as shown, of two cores of soft iron placed side by side and covered with insulated wire, after the manner of electro-magnets generally, except that the helices must be so connected together that the current passing through them will be in the same direction in both helices, so that, as indicated in the accompanying diagram, the same polarity will be imparted to the cores. In this diagram the letters *n* and *b*, indicating respectively north and south polarity, are placed on the relays on the supposition that the line has been charged positively.

At each end of these relays is an armature of magnetized steel, and the position of said armatures with respect to each other must be such that both the armatures of each of the relays A A′ will move only when positive currents pass, and both the armatures of each of the relays B B′ only when negative currents pass.

These armatures are pivoted at their centers, and at one end of each is placed a platina point, which makes contact with a platina-pointed insulated stop-screw, when the armature is retracted by its spring. At the other end of each of these armatures is a plain-pointed screw, which acts as a stop when the armature is attracted.

One of these armatures of each of the relays I call the "receiving"-armature, and its contact-point F is connected in the local circuit which passes through the sounder, and the other armature of each of the relays I call the "transmitting"-armature, and its contact-point E is connected to the line.

It is advantageous to have the adjusting-spring of the receiving-armature stronger than the adjusting-spring of the transmitting-

armature, or to have the receiving-armature farther from the poles of the relay than the transmitting-armature, so that the receiving-armature will require a stronger current to move it than is required to move the transmitting-armature. The keys C C′ and D D′ are of the usual construction, and each is placed in a shunt passing from each transmitting-armature to the line, as shown in the diagram.

The operation of the apparatus is as follows: If all the keys are closed and the pole-changer set in operation, a succession of currents of alternate polarity will flow to the line. The relays A A′ will respond to the positive currents and the relays B B′ to the negative currents; consequently, as the currents succeed each other rapidly, and are of full intensity, the receiving-armature of the relays will vibrate so rapidly on their contact-points that sufficient time will not be afforded to enable the local batteries to charge the sounders, the retracting-springs of the armatures of which being drawn to such a tension that the said armatures are prevented from vibrating unless a full close of the local circuit is made.

If, now, one of the keys is opened—as, for instance, the key C of the relay A—at the transmitting-stations, the path of the main current to the line at the relay A must be through the contact-point E of its transmitting-armature; but as the contact is broken at this point, whenever the armature moves, as will be the case when a positive current passes, this positive current will be so shortened and weakened that it will not act on the relay with sufficient force to overcome the retracting-spring of the receiving-armature of the relay A, and the retracting-spring of the relay A′ at the receiving-station, and, consequently, the local circuits through the sounders S S′ will be closed at F F′, and the sounders will attract their armatures and give a signal.

As the negative currents have no effect on the relays A A′ neither their receiving nor transmitting armatures will be moved by these currents, and, therefore, as long as the key C remains open the local circuits will remain closed at F F′, and as the spring of the transmitting-armature causes it to instantly close the main circuit at E, when the positive current is interrupted by the movement of the armature the passage of the negative currents to the line will not be prevented.

If the key D is opened instead of the key C, a similar action, as above described, is produced by the negative currents on the relays B B′, and no effect will be produced on the relays A A′.

It will be obvious that these relays act independently of each other, and that the opening or closing of the key of one relay has no effect on the relays which are operated by the current of opposite polarity; consequently, by this system, two messages can be simultaneously transmitted on the same wire.

The arrangement of the sounders is such that the operator reads what would ordinarily be called the "back-stroke," but as the adjusting-spring of the sounder draws the armature upward more promptly than the battery draws it down, the signals are not confused.

The sending and receiving relays need not be at the extreme ends of the line, but at intermediate stations—as, for example, New York could transmit to Washington, and Baltimore to Philadelphia, simultaneously, and on the same wire.

The transmitting-armature can be made to do the work of the receiving-armatures, but the arrangement shown is preferred.

If one armature is used both for sending and receiving, the keys, local batteries, and sounders must be connected into the shunts of the contact-points of said armatures.

The same method of connection applied to a Morse relay would be of value in working such relays over escapes.

At any station, say, the end station of a long line, the transmitting-key of usual construction would be connected in a shunt around the back points of the relay-armature, and the main circuit would pass through those same back points.

When the key is closed, the full strength of the main circuit is on the line, as usual, but when the key is opened the main circuit becomes self-breaking at the back points.

By giving the armature-spring a proper tension the tendency of the current to break itself may be made to exactly counterbalance the escape on the line; consequently with such adjustment of the relay-spring the signals from a distant office over an escape will be received with the same adjustment as that suited to the key in connection with the relay.

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

1. In combination with a relay, the armature of which and its insulated back-stop screw form a part of the main circuit, a key connected in a wire running from the armature to the back-stop screw, substantially as and for the purpose set forth.

2. A relay consisting of two straight electro-magnets arranged parallel to each other, having helices connected in the same circuit, and wound in the same direction, and having two magnetic armatures at opposite ends of the relays, respectively, in combination with a sounder and local circuit connected through the contact-points of one armature and a key placed in a shunt connecting the other armature to a line, substantially as and for the purpose set forth.

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Witnesses:
W. E. VIGUS,
A. C. WOOD.