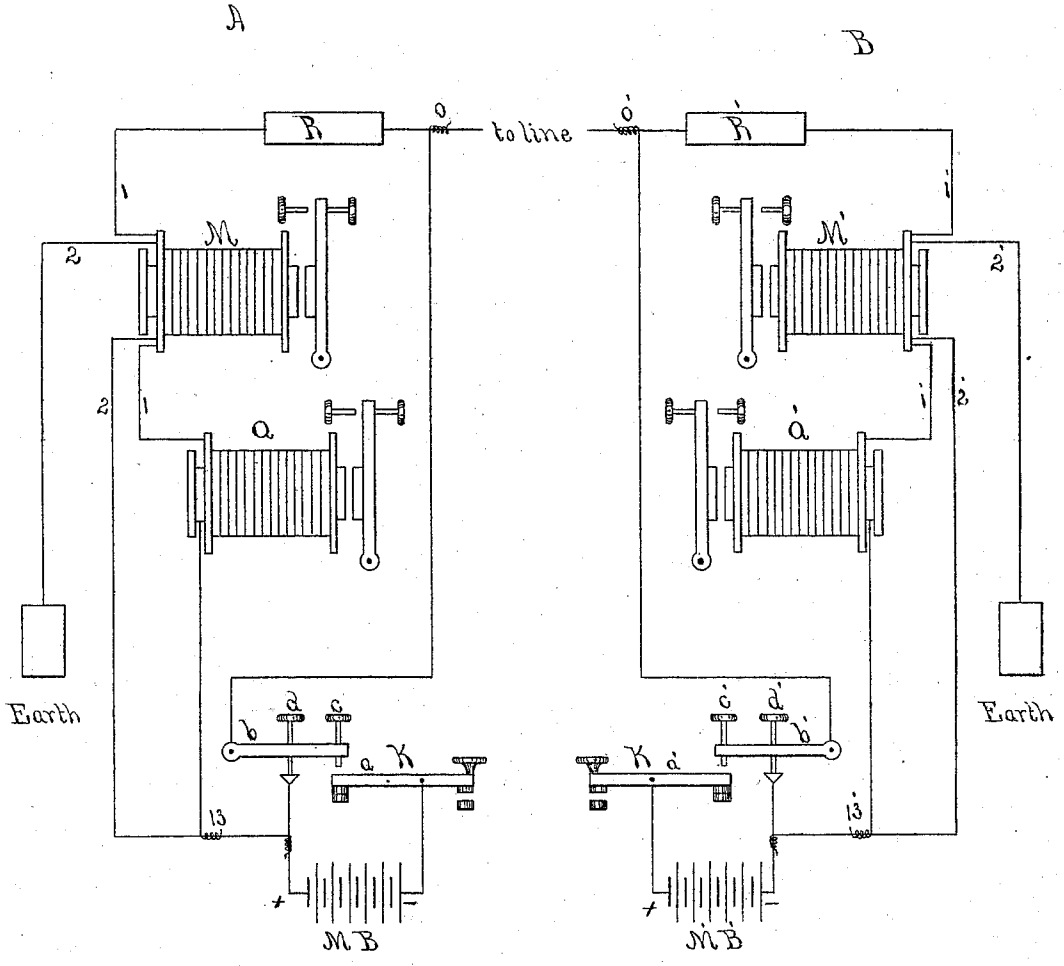
J. B. STEARNS.

Duplex Telegraphs.

No. 147,524. Patented Feb. 17, 1874.



Witnesses.

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UNITED STATES PATENT OFFICE.

JOSEPH B. STEARNS, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN DUPLEX TELEGRAPHS.

Specification forming part of Letters Patent No. 147,524, dated February 17, 1874; application filed February 21, 1873.

CASE C.

To all whom it may concern:

Be it known that I, JOSEPH B. STEARNS, of Boston, in the county of Suffolk, State of Massachusetts, have invented a new and useful Improvement in Telegraph Apparatus, of which the following is a specification:

This invention relates to apparatus for the simultaneous transmission of two signals from opposite ends of the same line-wire; and consists in the arrangement at each station of two relays or receiving-magnets and their connecting-circuits, one of which relays or receiving-magnets responds to the signals from the distant station, and the other relay or receiving-magnet responds to the signals from the home station.

The accompanying drawing forming part of this specification represents my invention, A and B being the apparatus at the terminal stations, which apparatus is similar at each station. The apparatus consists of the differential relay or receiving-magnet M, the common relay or receiving-magnet Q, the circuit-changing key K, rheostat R, and the connecting-wires and the battery M B.

The conditions necessary for success in the double transmission of signals on a single line-wire are, first, having the relay or receiving-instrument at each station always in the circuit on the line; second, preventing the signals transmitted from either station from affecting the relay or receiving-instrument at that station; and, third, maintaining the resistance of the line always the same.

The manner in which these conditions are fulfilled in this invention is shown by the following description of its construction and mode of operation, reference being had to the drawing.

The principle of operation in this apparatus is founded on the established fact that an electric current will divide itself between any two conductors open to it in inverse proportion to their respective resistances. If the two resistances be equal to each other, the strength of the respective divisions of the current will likewise be equal; also, if the equal currents be transmitted in opposite directions through two parallel wires, each having an equal number of convolutions around an electro-magnet, they will neutralize each other, and their effect upon the magnet will be null. As before stated, A B represent the two terminal stations of a line. The main battery M B at station A is placed with its negative or — pole to the line, while the battery M B′ at station B has its positive or + pole to the line, each battery being grounded through the relays M M′, respectively. These relays have their helices wound with two parallel wires of equal length and resistance, and having an equal number of convolutions. 2 2′ are relays of the ordinary construction. The rheostat or resistance R is capable of adjustment, and is so regulated as to be always equal to the line and one wire of the relay M′ at B, and the rheostat or resistance R must be equal to the line and the resistance of one wire of M at A.

The manner in which the apparatus is made to operate is as follows: If the transmitting-key K be depressed, the current from the main battery M B will flow from the lever *b* to the point *o*, where it will divide, one portion passing through the resistance R and the wire 1 1 of the relay M, the relay 2, the point 13, and thence to the opposite pole of the battery. The other portion passes to the line, the point *o′* at station B, thence to 13′; then, by the wire 2′ 2′, through one coil of the relay M′, thence to earth, and through the wire 2 2, through one coil of the relay M at station A, to the opposite pole of the battery. The relay M′ at station B and the relay 2 at station A, being affected by currents in one direction only, respond to the signals, while the relay M at the home station, being affected by currents in two directions, which neutralize each other, remains silent. If, now, the key K′ at station B be depressed, the same action takes place, one-half the current passing over the line, combining with the current from station A, and the other half returns to the battery, the resistance R′,

one coil of the relay M′, and wire 1 1. The relay-wires 2 2 and 2′ 2′ are now traversed by a double current, equal to $\frac{M\,B}{2}+\frac{M'\,B'}{2}$; but the wires 1 1 and 1′ 1′ are traversed only by the current of a single battery, having at station A the force of $\frac{M\,B}{2}$, and at station B the force $\frac{M'\,B'}{2}$. The latter current being in an opposite direction to the former, the relays at both stations are affected by the difference in the forces of these currents—the relay M by $\left(\frac{M\,B}{2}+\frac{M'B'}{2}\right)-\frac{M\,B}{2}$, and the relay M′ by $\left(\frac{M\,B}{2}+\frac{M'B'}{2}\right)-\frac{M'\,B'}{2}$. Thus each relay responds only to the action of the distant battery, and not to the battery at the home station, and the two stations can send simultaneously. The relays 2 2′ respond to the currents from the batteries M B M′ B′, respectively.

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

The combination of the differential relays M, sounder or relay 2, resistance R, key K, battery L B, and their connecting-circuits, as and for the purpose as set forth.

JOSEPH B. STEARNS.

Witnesses:
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