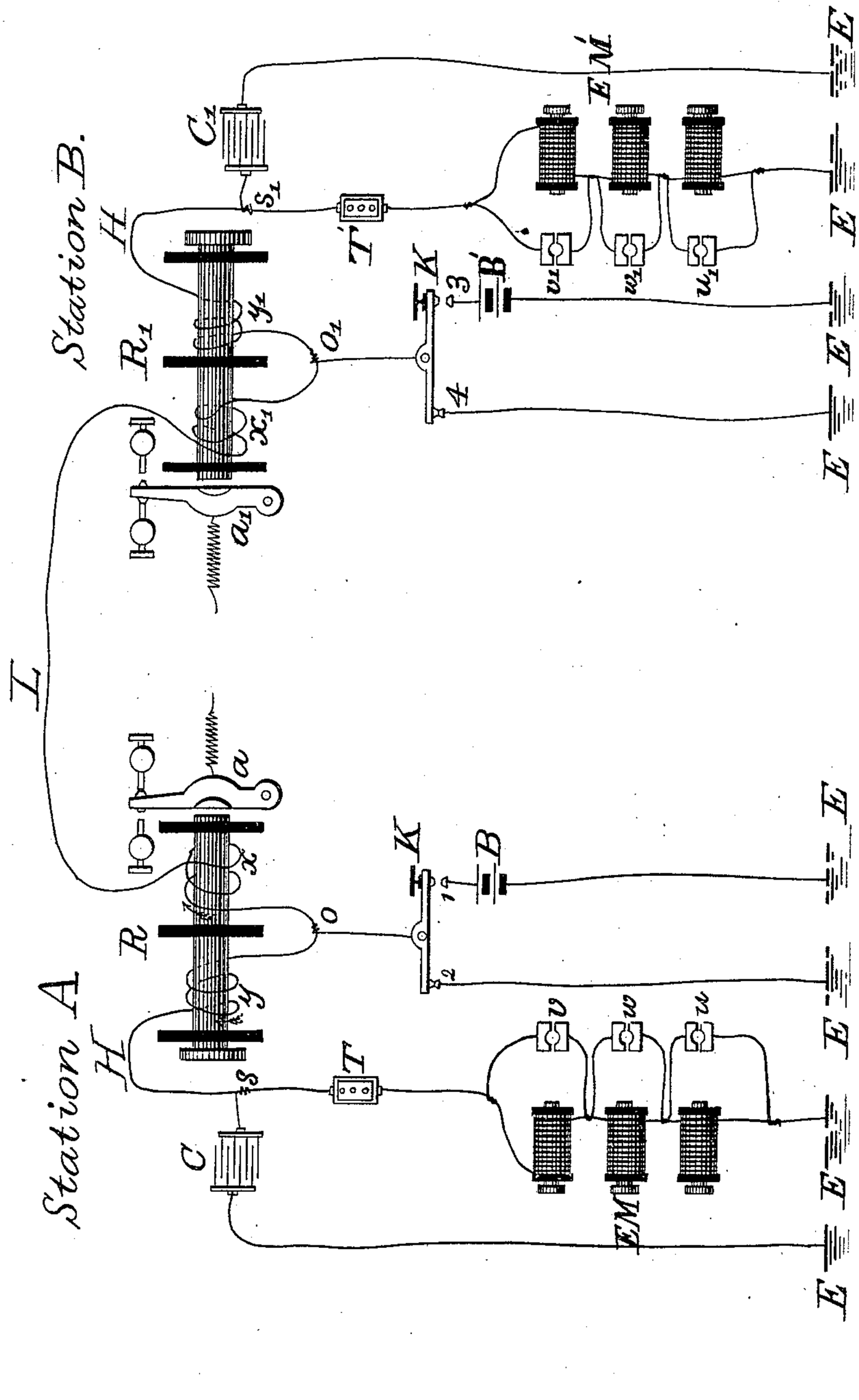
(No Model.)

J. E. FENN.

DUPLEX TELEGRAPH.

No. 258,636. Patented May 30, 1882.



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DUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 258,636, dated May 30, 1882.

Application filed January 5, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH E. FENN, of Elizabeth, county of Union, and State of New Jersey, have made an Improvement in Telegraph Apparatus for Simultaneous Transmission in Opposite Directions, of which the following is a description, reference being had to the accompanying drawing.

I have discovered in the transmission of messages that after a signal has been completed upon the receiving-instrument at a distant station, and after the battery has been disconnected from the main line at the transmitting-station, a secondary current of momentary duration will be set up throughout the main-line circuit in the same direction as the primary current of charge, occurring with and due to the demagnetization of the receiving-instrument at the distant station. This secondary current, having its origin at the distant station, will obviously energize the receiving-instrument at the transmitting-station. Thus by and accompanying the transmission of signals to a distant station will the receiving-instrument at the home station be actuated to give false signals in violation of the essential condition of a telegraph system for the simultaneous transmission of messages over a single line in opposite directions, which is that the operation of the transmitting apparatus shall not cause signals to be made upon its associate receiving-instrument. The strength of the momentary secondary current is proportional of course to the amount of magnetism discharged from the receiving-magnet, and is inversely proportional to the electrical resistance of the line. I have therefore found where several electro-magnetic receivers, as in a quadruplex or sextuplex system, are employed at one station, and where the main line has little electrical resistance, that the strength of the secondary current will be sufficiently strong to cause the mutilation of signals upon the receiving-instrument at the home station.

In the accompanying drawing, A and B represent terminal stations, at which the apparatus of one is similar to that of the other.

R is an ordinary differential relay, having oppositely-wound coils *x* and *y*, forming parts, respectively, of the main and artificial lines.

L and H are the main and artificial lines, coming together at *o* and connecting with key K, which, when open, connects the line to earth through a back contact with point 2, and when closed connects battery B to the main line through front contact-point, 1. The artificial line forms a circuit through rheostat T and a series of electro-magnets, E M, to earth E.

v, *w*, and *u* each show sockets divided into two parts insulated from each other for the reception of metallic switch-plugs, whereby one or all of the electro-magnets E M may be short-circuited from the artificial line.

C is an ordinary condenser, one pole of which is connected to the artificial line between T and R.

As the apparatus of one station is similar to that of the other, devices at station B need not be specifically described.

I will now describe the operation of my invention.

When key K is depressed and battery B is thereby connected to line the current divides and acts oppositely upon relay R, and, owing to the agency of condenser C, no false signal upon relay R will be made, either by the direct action of the current sent to line or by the effects of static induction upon the line; but upon completion of a signal sent from station A and after removal of battery B from the line the core of relay R′ at station B will discharge its magnetism, and thereby cause a secondary current to be set up from earth, through coil *x* at station A, main line L, and coil *x′* at station B to earth, of the same polarity as that from battery B, employed in transmitting the signal. The polarity of this secondary current is opposite and subsequent to that of the static discharge of the main line at station A, and is therefore uncompensated by the action of condenser C. The secondary current acts upon the relay at A to produce a false signal as it passes only through coil *x* on its way to earth. To compensate the action of the secondary current, having its origin in the relay of station B upon relay R of station A, I develop an artificial secondary current in the artificial line at station B, which acts over the artificial line and through coil *y* of the relay, in point of polarity, time, and quantity, in the same manner as does the main line secondary current through coil *x*. To develop such a current I

employ a series of electro-magnets whose coils, one or all, may be inserted in the artificial line, and between these coils and the differential relay is placed a resistance equal or proportional to that of the main line. The secondary currents in the artificial and main-line coil are of the same polarity as those of the currents of charge from the battery, and will therefore neutralize each other. The resistance of the artificial line must be placed between the relay and the compensating electro-magnets to cause the secondary currents to act upon the relay simultaneously. Otherwise, instead of preventing one false signal, two others will be produced. I employ one or all of the electro-magnets in the artificial line, according as there are one or more receiving-relays in line at the distant station.

Instead of employing a series of induction-magnets, some of which may be shunted from the artificial line, I may use any of the well-known forms of electro-magnetic devices, whereby the currents of induction produced therein may be varied in strength and time of discharge. In all cases it is necessary to put the induction-magnets in the artificial or compensating circuit or branch with a resistance proportional to that of the line between the relay and induction magnets. In a differential system said intervening resistance must equal that of the main line. In the bridge system it need not be equal, but should be proportional thereto.

For convenience I have shown only one receiving-relay at each station, as in a duplex, though I do not limit myself in this respect. In quadruplex or sextuplex telegraphy several relays are necessary at one station.

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

1. The method of preventing the extra current upon a telegraph-line, set up by receiving-instruments at distant stations, from producing false signals upon the receiving-instrument at the home station in the process of transmitting signals therefrom, which consists in the simultaneous production at the home station of an artificial extra current capable of exerting an effect substantially equal but opposite to that due to the distant instrument set up in the main line upon the receiving-instrument at the home station.

2. In a telegraph system, for simultaneous transmission in opposite directions, the combination, at each and both terminal stations, of transmitting devices, duplex receiving-instruments, and an artificial line having a resistance proportional to that of the main line, and electro-magnetic induction apparatus, said resistance being located upon the artificial line between the receiving-instrument and the induction-magnets, as specified.

3. In a telegraph system for simultaneous transmission, the combination, at each station, of duplex receiving-instruments, and an artificial line, having an adjustable electro-magnetic device, substantially as specified, and a resistance proportional to that of the main line, situated between the receiving-instruments and the electro-magnetic devices, for the purpose set forth.

Executed by me this 29th day of December, 1881.

JOSEPH E. FENN.

Witnesses:
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