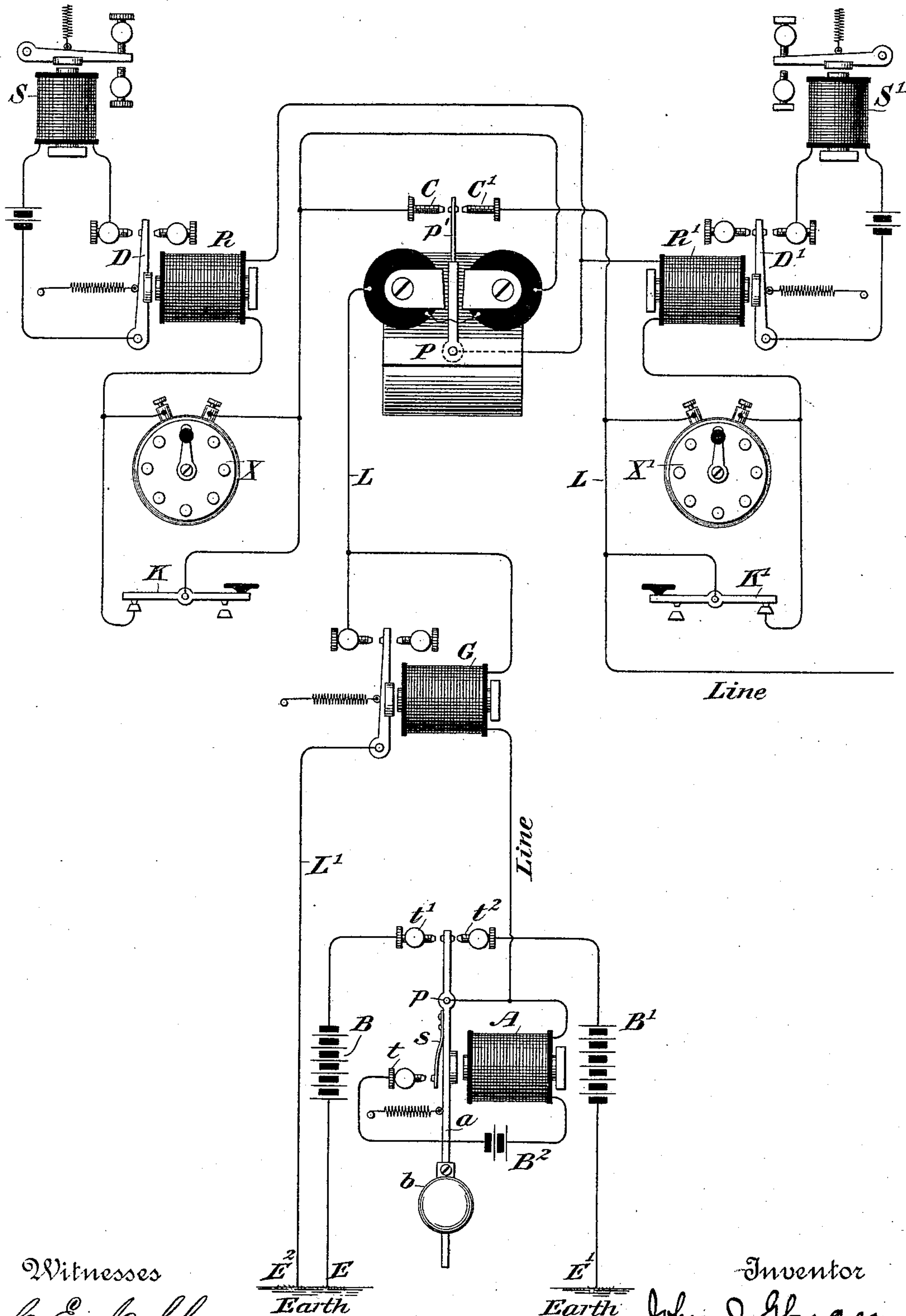


(No Model.)

J. J. GHEGAN.
DUPLIX TELEGRAPHY.

No. 459,930.

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DUPLEX TELEGRAPHY.

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To all whom it may concern:

Be it known that I, JOHN J. GHEGAN, a citizen of the United States, and a resident of Newark, in the county of Essex and State of New Jersey, have made a new and useful Invention in the Art of Duplex Telegraphy, of which the following is a specification.

My invention has for its objects, first, to duplex ordinary telegraphic lines with as small an amount of apparatus as possible and to simplify the same in its construction and mode of operation; second, to so arrange the apparatus that all of the offices, intermediate as well as terminal, may use either circuit of the duplexed line at will for transmitting and receiving; third, to economize battery and consolidate the same at some central point.

To this end my invention consists in the improvements hereinafter described, but particularly pointed out in the claims which follow this specification.

Prior to my invention it was old in the art to transmit two independent messages over a single wire through the agency of a revolving commutator, which sent currents of alternate polarity to line and to actuate independent polarized relays by such currents, each of said relays receiving an independent message sent by an independent key, both messages being sent from the same end of the line or in the same direction. It was also old to transmit alternate impulses over a single line from a single battery through the agency of a pole-changer actuated by an electro-magnet and a local battery and to control independent polar relays at the receiving-stations. Both of these systems, however, were capable of use only as duplex apparatus in which the messages were transmitted in the same direction. I am aware also that a system of duplex telegraphy has been devised utilizing impulses of opposite polarity to transmit to outgoing stations, wherein polarized relays were made to receive individual messages, the impulses having been sent to line by a mechanically-operated pole-changer and from a single battery located at one end of the main line, and that duplex messages were transmitted from the outlying stations through the agency of additional main-line batteries, one at each outlying local or main station. I disclaim, therefore, any of the foregoing features. My invention differs

from these in that I simplify the construction and use no outlying batteries, each of the offices at the end and intermediate stations being provided with duplex transmitters and receivers, and the battery being located, preferably, at one station.

My invention will be better understood by referring to the accompanying drawing, which is a diagrammatic view illustrating my preferred form of apparatus.

A represents an electro-magnet connected in circuit with a local battery B². The armature-lever *a*, pivoted at *p*, is provided with a contact-spring *s* on its rear side, of well-known form, adapted to contact with the stop *t*, so that the metallic contact-points on its upper end are caused to contact successively with the points *t'* *t''*.

b is an adjustable weight for varying the vibrations of the lever *a* by adjusting it at the desired point.

B and B' are the main-line or transmitting batteries having poles of opposite polarity to line and earthed, as shown at E and E'. These two batteries may of course be replaced by a single battery having the necessary well-known pole changer and connections controlled by electro-magnet A, whereby alternate currents are sent to line. Each station is provided with a polarized relay P of well-known form, and two relays R and R' with keys K and K' and local sounders S and S', actuated by local batteries, as shown.

X and X' are adjustable rheostats of well-known form located in shunts about the local keys K and K' of the apparatus at each station.

The apparatus at all of the outlying stations is like that shown in the upper portion of the drawing, there being only one vibrator A and batteries B and B' therefor, located preferably at one end of the line.

G is an electro-magnet located directly in the main line, and its armature constitutes part of an earth-circuit L' earthed at E². The function of this portion of my invention is to discharge the line at the instant that the battery is disconnected therefrom. This portion of my apparatus may be dispensed with on lines of moderate length or such as have small electrostatic capacity, as is well understood by those skilled in the art.

I will now describe the mode of operation of my invention: The weight *b* having been placed at such a point on lever *a* as to regulate the desired number of vibrations and the vibrator A started, the batteries B and B' are alternately put to line. Battery B' sends positive impulses direct to line, while battery B sends minus impulses; or, as it is ordinarily expressed, "plus and minus impulses" are sent in rapid succession over the line. The armature of the polarized relay P vibrates between the stops *c* and *c'* at each change of polarity due to the action of the vibrator A and batteries B and B'. The receiving-relays R and R' and rheostats X and X' are also in the circuit with relay P. It will be noticed on inspection of the drawing that the armature and local contact-points *c* and *c'* of the polarized relay P are so connected that they shunt or cut out one or the other of the receiving-relays R or R' with its corresponding rheostat and key K or K', according to which of the points *c* or *c'* is in contact with said armature. Therefore it will be readily understood that as the armature of the polarized relay responds to the changes of polarity of the pulsations sent to the line, it alternately shunts or cuts out the receiving-relay R or R', so that one of them is influenced by the positive and the other by the negative pulsations only, and consequently any variation in tension or current strength of the positive pulsations will only affect the corresponding receiving-relay, and vice versa. These receiving-relays R and R' are so adjusted that by throwing in circuit a suitable resistance X or X' the tension or current strength is so varied that their armatures fail to respond to the pulsations thus weakened and are drawn against their back-stops. This resistance need not be sufficient to prevent the armature of the polarized relay P from responding, said resistance being in circuit only while its corresponding set of relays are in circuit also. It consequently does not effect the relays which correspond to the opposite pulsations. Suppose now any operator desires to signal. On depressing his key he interrupts the low-resistance path of the circuit around the rheostat X, and thereby changes the current-tension on the line on that side at each recurring impulse of that polarity. All of the armatures of relays R will therefore fall back and close the sounder-circuits of sounders S as long as the key K is held down. Similarly on depressing key K' all of the armatures of relays R' will fall back and actuate sounders S'. Thus it will be seen that all the sounders S will receive signals for impulses of one polarity, while sounders S' will receive signals for impulses of the reverse polarity on actuating the keys K and K', respectively. In other words, all of the operators having keys K have the line one half the time for minus impulses, while the other set of operators having keys K' have it for the remaining half for the plus impulses.

The apparatus as illustrated shows the vibrator in operation and the transmitting-keys on both sides closed.

I do not desire to limit myself to the use of the specific apparatus herein shown and described for the practice of the methods which I have hereinbefore described.

I do not limit myself to the specific apparatus herein described and shown for transmitting two messages simultaneously over a single line at will in either direction from a single primary source of electricity and through the agency of a single relay located at each station.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. A duplex telegraphic system having two sets of transmitters and receivers at each station of the line, in combination with a transmitting-battery located at one station only, and shunts, including resistances around the transmitters, whereby two messages may be sent in the same direction or in opposite directions at the will of the operators without interrupting the line-circuit, substantially as described.

2. In a duplex-telegraph system, the combination of the following elements: a source of electrical energy, a main line, a device for sending currents of opposite polarity to line in succession, polarized relays at each station, a pair of neutral relays located in the main line at each station, a pair of transmitters or keys, and means for varying the tension of the current sent over the line, substantially as described.

3. The combination of a main line, a vibrator, a battery, and an electro-magnetic device located in the main line and having electrical connections through its armature with the earth for automatically discharging the line at each rupture of the circuit, substantially as described.

4. In a system of duplex telegraphy, the combination of the following elements: a main line, a source of electrical energy adapted to send current impulses of reverse polarity over the line, a polar relay and two receiving-relays at each station, each in the main-line circuit, transmitters and rheostats for varying the tension of the current pulsations, and circuit connections, as described, whereby two messages may be sent in the same or in opposite directions at the same time.

5. In a system of duplex telegraphy, a polarized relay, in combination with two independent receiving-relays, all three located in the main-line circuit, the latter having connections with the armature of the polar relay, and a shunt and circuit connections, as described, whereby the current impulses which actuate the polar relay are alternately passed through one of said independent relays and shunted around the other, substantially as described.

6. A duplex telegraphic receiver consisting of a polar relay and a pair of independent receiving-relays, all of said relays being located in the main circuit, the receiving-relays having shunts and electrical connections with the armature of the polar relay, whereby they are alternately shunted out of the main-line circuit, substantially as described.

7. In a duplex-telegraph system, the combination of the following elements: a main line, a source of electrical energy adapted to send alternate current impulses over the line, polarized relays, one at each station, a pair of receiving-relays at each station, a pair of transmitters or keys, and a pair of rheostats, one for each transmitter or key, said rheo-

stats being located in shunts around the keys, substantially as described.

8. In a system of duplex telegraphy, the combination of a pole-changer for automatically transmitting plus and minus currents to line, with means located at each station for varying the resistance of the line at will for the impulses of either polarity without interfering with the normal resistance of the line for the passage of the impulses of opposite polarity.

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