(No Model.)

H. V. HAYES.

TELEPHONE CIRCUIT.

No. 474,323. Patented May 3, 1892.

Fig. 1.

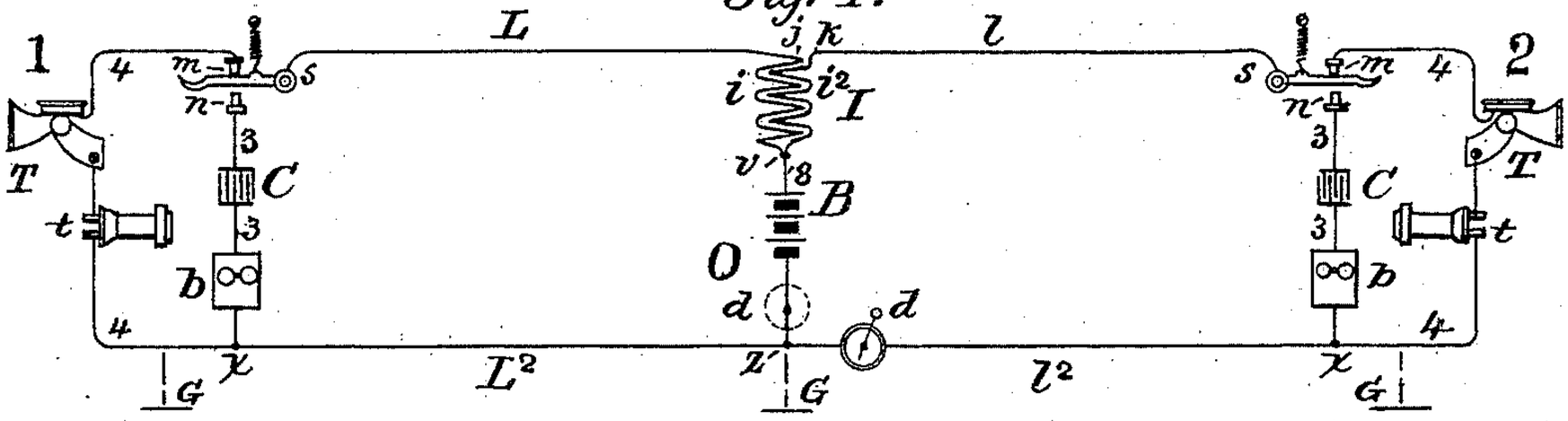


Fig. 2.

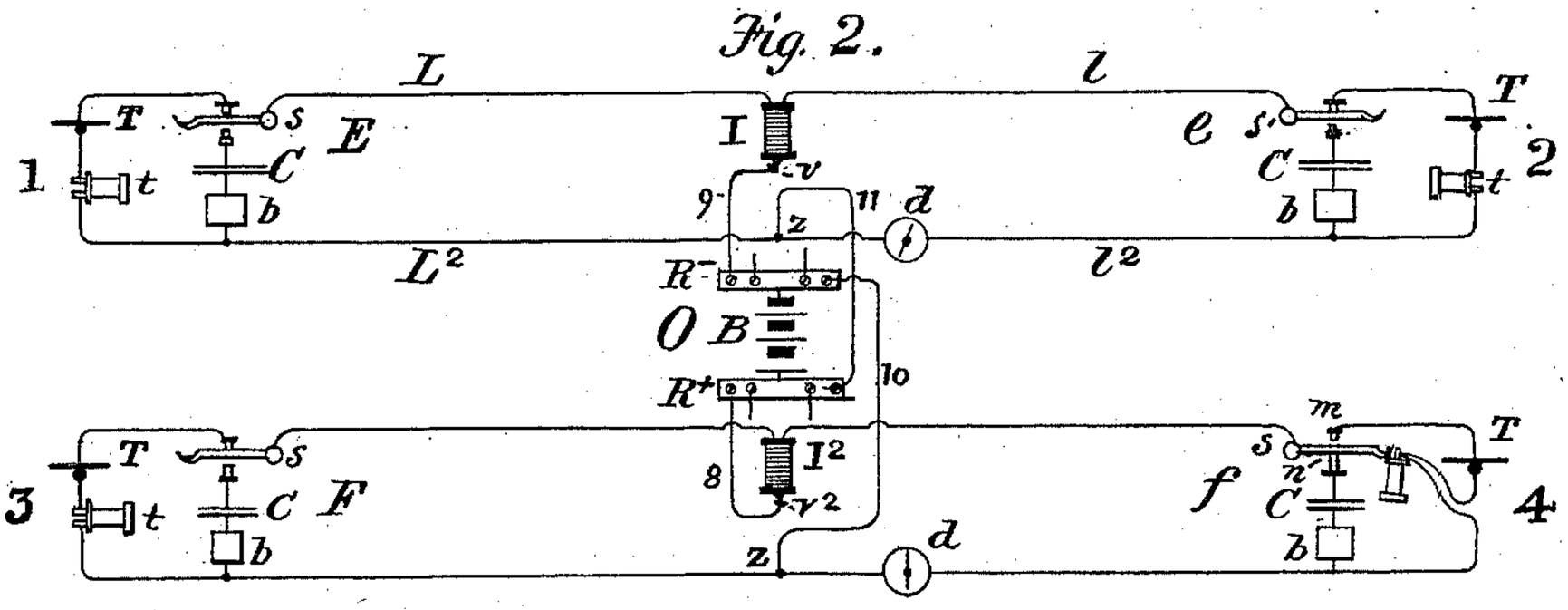
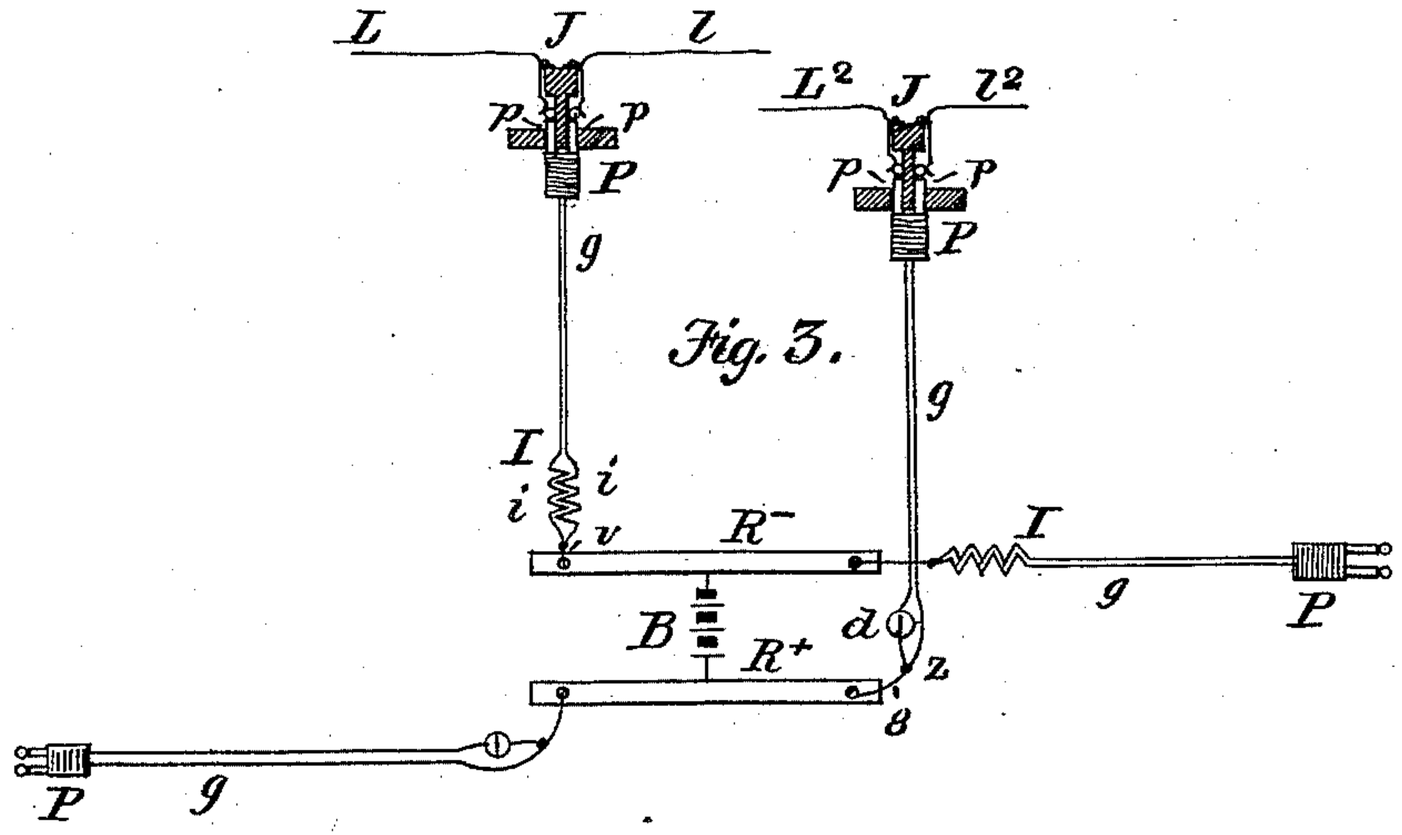


Fig. 3.



Witnesses.
Thomas Willis Pierce,
Frank C. Lockwood.

Inventor.
Hammond V. Hayes

UNITED STATES PATENT OFFICE.

HAMMOND V. HAYES, OF CAMBRIDGE, ASSIGNOR TO THE AMERICAN BELL TELEPHONE COMPANY, OF BOSTON, MASSACHUSETTS.

TELEPHONE-CIRCUIT.

SPECIFICATION forming part of Letters Patent No. 474,323, dated May 3, 1892.

Application filed January 13, 1892. Serial No. 417,957. (No model.)

To all whom it may concern:

Be it known that I, HAMMOND V. HAYES, residing at Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Telephone-Transmitter Circuits, of which the following is a specification.

This invention relates to the centralization of telephone-transmitter batteries. More especially it comprises a mode of operation and an arrangement of circuits whereby two circuits united at a station, to which both converge, may independently and reciprocally employ for their transmitters one and the same source of current located at such central point, and also an organization wherein such mode and arrangement are made applicable to the common use of the same generator simultaneously by more than one such pairs of telephone-circuits.

Figure 1 is a diagram showing two telephone-circuits united for conversation in accordance with the terms of my invention; Fig. 2, a diagram showing two sets or pairs of telephone-circuits respectively united for conversation, the transmitters of which are all energized by the same generator. Fig. 3 is a diagram indicative of an apparatus embodying the central-office part of my invention in a form adapted for practical use.

In Fig. 1, which shows the principle of my invention embodied in a simple system of two telephone-circuits, extending, respectively, from sub-stations 1 and 2 to a central station 0, where their terminals are united for intercommunication. L and L^2 are the main conductors of the circuit extending between 1 and 0, and $l l^2$ the main conductors extending between 2 and 0.

The apparatus and connections at the two sub-stations may be identical in character and comprise two alternative branches of the main line—viz., a signal-apparatus branch 3 and a telephone branch 4—which diverge from one of the main conductors at a convenient point x and which alternatively may be used to complete the circuit of the said main line according to the position of the switch s, which is also intended as a support for the receiving-telephone and which is operated by the removal or replacement thereof in a manner well understood. When the said receiving-telephone is in place, the stem of the switch, which permanently constitutes the main-line terminal, makes contact with the terminal point n of the signal branch 3; but when the telephone is removed the said switch makes contact with the terminal point m of the telephone branch 4. The signal branch 3 includes a condenser C and a polarized call-bell b. The telephone branch includes the transmitting and receiving telephones T and t. It will be of course understood that the two branches and the switch s may at the sub-stations exchange places, if desired, without any difference in result. In the figure the receiving-telephones t are shown as being removed from their switch-supports, the two circuits being formed into a compound talking-circuit by their union at the central office. At the central station 0 is a suitable source of electricity B, which may preferably be a secondary or storage battery or other voltaic battery, which is practically of like low internal resistance, and an induction-coil I. The two helices of the induction-coil are of uniform resistance, which may vary from one to ten ohms, and are wound in the same helical direction. The two circuits are connected up to form the compound talking-circuit by uniting the ends of the conductors L and l, respectively, to the approximate ends j and k of the two induction-coil helices i and i^2, by connecting the other ends of the said helices at v to a single conductor 8, which includes the source of electricity B and which at z is united to the two remaining ends of the respective main circuits. By this arrangement it will be seen that the source B is included in a bridge-conductor between the two sides of the compound main circuit and that the two component parts of one side of the said main circuit each include one of the windings of the induction-coil.

Any change in the current circulating in either winding of the induction-coil will act inductively upon the other winding, and changes produced by operating the transmitter at the sub-station of either circuit are therefore enabled to inductively effectuate corresponding changes in the receiver at the sub-station of the other circuit. The two

helices may either be wound together or one over the other, as preferred. I have obtained good results by employing an induction-coil in which each winding has a resistance of one ohm, and with condensers having an electrostatic capacity of from .75 to .8 of a microfarad. By employing the condenser the line, when connected with its calling branch, is practically an open circuit so far as respects steady or uniform currents, although the polarized bells included in circuit therewith are fully responsive to rapidly-alternating ringing-currents. The telephones will preferably have resistances proportionate to that of the line.

A disconnecting or clearing-out annunciator *d* of the galvanometer type, in which a needle deflected by the current moves a disk to one side or to the other, may be connected in one side of the compound circuit in one of the independent halves thereof; or, if desired, a similar device may be connected on both sides of the point *z*, in which case either substation would be able to send the disconnecting-signal. When this device is employed, the clearing-out signal is automatically sent by the act of hanging up the telephone. The needle and signal disk of the galvanometer-drop is arranged to be deflected to one side when the connection is made, and the battery B is thereby included in the circuit; but as soon as the receiver *t* at the sub-station is replaced the condenser branch is substituted for the conductively-closed branch through the telephones, and the battery-current ceases to flow. The deflection of the needle therefore ceases and the signal is displayed.

In Fig. 2 I show two sets of united telephone-circuits E *e* and F *f*, energized at the central station 0 by the same source B. Each of the compound circuits so formed has its own bridge connections and its own induction-coil. Thus the compound circuit E *e*, extending through 0 from 1 to 2, is arranged with its line L, including one winding of the induction-coil I, and connected at the point *v* with the other line *l* through the second winding of the induction-coil, while the energizing source for the two component parts of the through-circuits is included between the two mains L *l* L^2 l^2 in a bridge extending from the point *v* by wire 9 to the bus-bar R^-, thence through the generator B to bus-bar R^+, and thence by wire 11 to the point *z*. In the same way the main conductors of one side of the other compound circuit F *f* are united, serially, through their independent induction-coil I^2 and have their bridge connections 8 and 10 also leading to the bus-bars R^- and R^+, so that the two compound circuits may be described by saying that they are two metallic circuits passing through a common intermediate station where each has an independent bridge-conductor uniting its mains, a portion, however, of both bridges being formed of a conductor common to both, which common section includes a suitable electric generator, which thereby independently energizes both metallic circuits and both sections of each metallic circuit. Not only so, but the said generator B may, by this mode of connection, be enabled to supply without confusion a number of such compound circuits, such number being dependent upon the ratio between its internal resistance and the joint resistance of all the circuits which it supplies. A storage-battery will supply without interference a considerable number.

The sub-station devices in Fig. 2 are identical with those in Fig. 1.

At sub-station 4 of circuit *f* the receiving-telephone *t* is shown as having been replaced upon its support. The battery-current has accordingly ceased to flow and the indicator *d* has accordingly resumed its normal position.

Fig. 3 illustrates a practical apparatus whereby my system of transmitter-battery connections can readily be connected with and disconnected from any circuit or pair of circuits. The generator B has its poles connected with bus-bars R^+ and R^-, as in Fig. 2. To each of these any number of flexible conductors *g*, initially single but presently bifurcating into two independent conductors, (preferably, of course, made up into the said flexible cord,) may be connected. One member *g* of each pair of connecting-cords divides at *v* and includes in the circuits of its two conductors, respectively, the two helices *i* and *i'* of the induction-coil I, while the other member of the same pair, leaving the bus-bar R^+ by the conductor 8, divides at *z*, and one of its conductors, or both, if desired, includes the disconnecting-indicator *d*. Both terminate in double connecting-plugs P, the two stems *p* of which (each representing one of the cord-conductors) are adapted to be inserted into sockets J and to connect with suitable terminals of the lines to be united. Thus the conductors of one of the cords *g* are shown as uniting the lines L and *l* together through the two helices of the induction-coils, and with the remaining two line ends L^2 and l^2 through the other cord *g* and the generator B, the said remaining ends being, moreover, united to each other at the point *z* and through the indicator *d*. Other cord and double-plug connectors are shown connected in like manner to the bus-bars R^+ and R^-, and it is obvious that by the apparatus described a small number of connecting devices and a single-transmitter-current generator may be enabled to supply a much greater number of main circuits. Each, therefore, while transmitting is the primary, and while receiving the secondary circuit of the induction-coil. By this mode of connection each two circuits united for through communication constitute, practically, a single conversation-circuit, composed of two independent battery-circuits, each of which, its current being varied, is capable of acting inductively upon the other.

It will now be seen that my invention consists in so connecting two telephone-circuits which terminate at the said station that a common electric generator—such as a storage-battery—shall be bridged between them and made effective for the energization of both by the interposition of an induction-coil between the said generator and the main conductor, the two helices of said coil being included one in each circuit, so that each shall be capable of operating either as a primary or secondary helix, as either circuit acts as a transmitting or a receiving circuit, and in certain other details of construction, as described herein. It will also be apparent that in cases where but one pair of circuits is associated with the battery B, they may be either metallic circuits, as shown, or earth-completed circuits, as indicated in dotted lines in Fig. 1, and that in the latter case it will be necessary to include the disconnecting-indicator *d*, also, as shown in dotted lines, in the common bridge or derivation conductor 8.

Having now fully described my invention, I claim—

1. Two telephone-circuits, each extending from a sub-station to the same central station and completed or closed through a section of conductor common to both, which common conductor includes an electrical generator, such as a storage-battery, and an induction-coil interposed between the said generator and one of the conductors of the said circuits and having its two helices or windings included in the said two circuits, respectively.

2. The combination of two telephone-circuits extending from sub-stations to the same central station, each provided at its sub-station with suitable transmitting and receiving telephones and both completed at the central station through a section of conductor common to both, a battery of low internal resistance included in the said common section of both circuits and supplying both with currents, and an induction-coil the two helices or windings of which are of like length and resistance located at the central station and having its said helices connected in the said two circuits, respectively, whereby each circuit when transmitting constitutes the primary and when receiving the secondary circuit of said induction-coil, substantially as described.

3. A compound telephone-circuit extending between two terminal stations through an intermediate station, provided at each terminal station with receiving-telephones and variable-resistance transmitters and constituting a single conversation-circuit composed of two independent battery-circuits, the battery being common to both and included in a bridge or branch between the direct and return conductors at the intermediate station, combined with an induction-coil the two windings of which are substantially alike and connected, respectively, in the said two battery-circuits, substantially as described.

4. A compound telephone-circuit extending between two terminal stations through an intermediate station, a transmitting and receiving telephone at each terminal station, an induction-coil at the intermediate station having its two windings or helices in series in the direct conductor of said circuit, and an electrical generator, such as a storage-battery, in a bridge or derivation extending from the return conductor to a point on the direct conductor between the said two helices of said induction-coil, substantially as described.

5. The combination, in a system of centralized transmitter-batteries, of a number of telephone-circuits, each extending from sub-stations to a central station and each provided at its sub-station with suitable transmitting and receiving telephones, switch connections for connecting the said circuits in pairs for through communication and for simultaneously establishing a bridge or derivation between the two conductors at the two circuits concerned, a battery of low internal resistance adapted to be included simultaneously in the bridge-circuit of several such pairs, and an induction-coil for each pair, having its two helices connected, respectively, in the two circuits constituting such pair, substantially as described.

6. The combination, in a compound telephone-circuit extending between two sub-stations through a central station, of a main-line transmitter-battery therefor, and a disconnecting-annunciator included in the said circuit or in a derived circuit thereof, with two branch circuits at the sub-stations, one including the telephones and the other including a condenser and a call-bell, and an automatic switch actuated by the removal of the telephone from its support to close the battery-circuit by connecting the telephone branch and by the replacement of said telephone to break the battery-circuit by connecting the bell and condenser branch, whereby the replacement of said telephone is enabled to automatically operate the disconnecting-signal.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 11th day of January, 1892.

HAMMOND V. HAYES.

Witnesses:
GEO. WILLIS PIERCE,
JOSEPH A. GATELY.