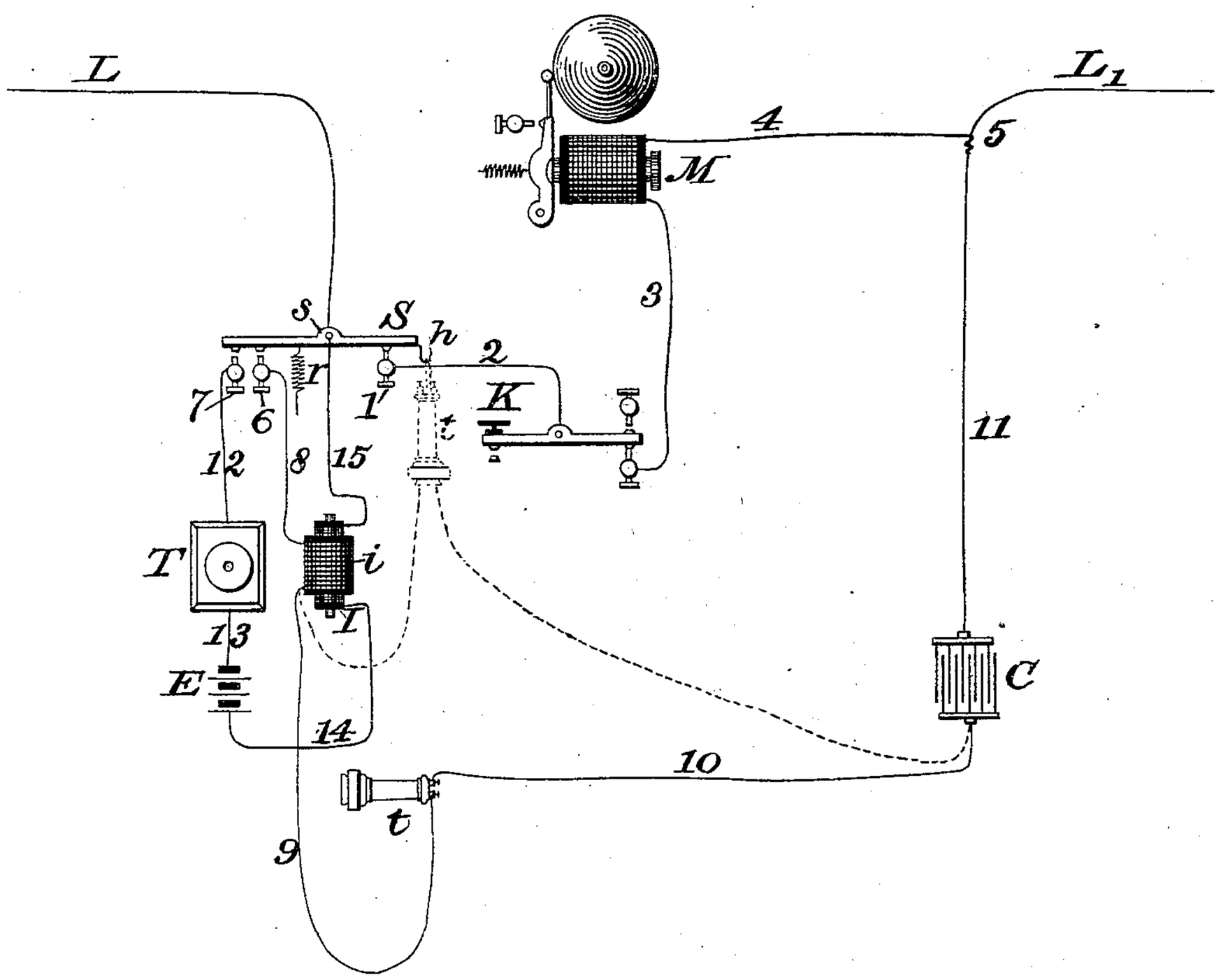
(No Model.) 2 Sheets—Sheet 1.

R. J. HEWETT.

CIRCUIT AND APPARATUS FOR TELEPHONE LINES.

No. 245,494. Patented Aug. 9, 1881.

Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

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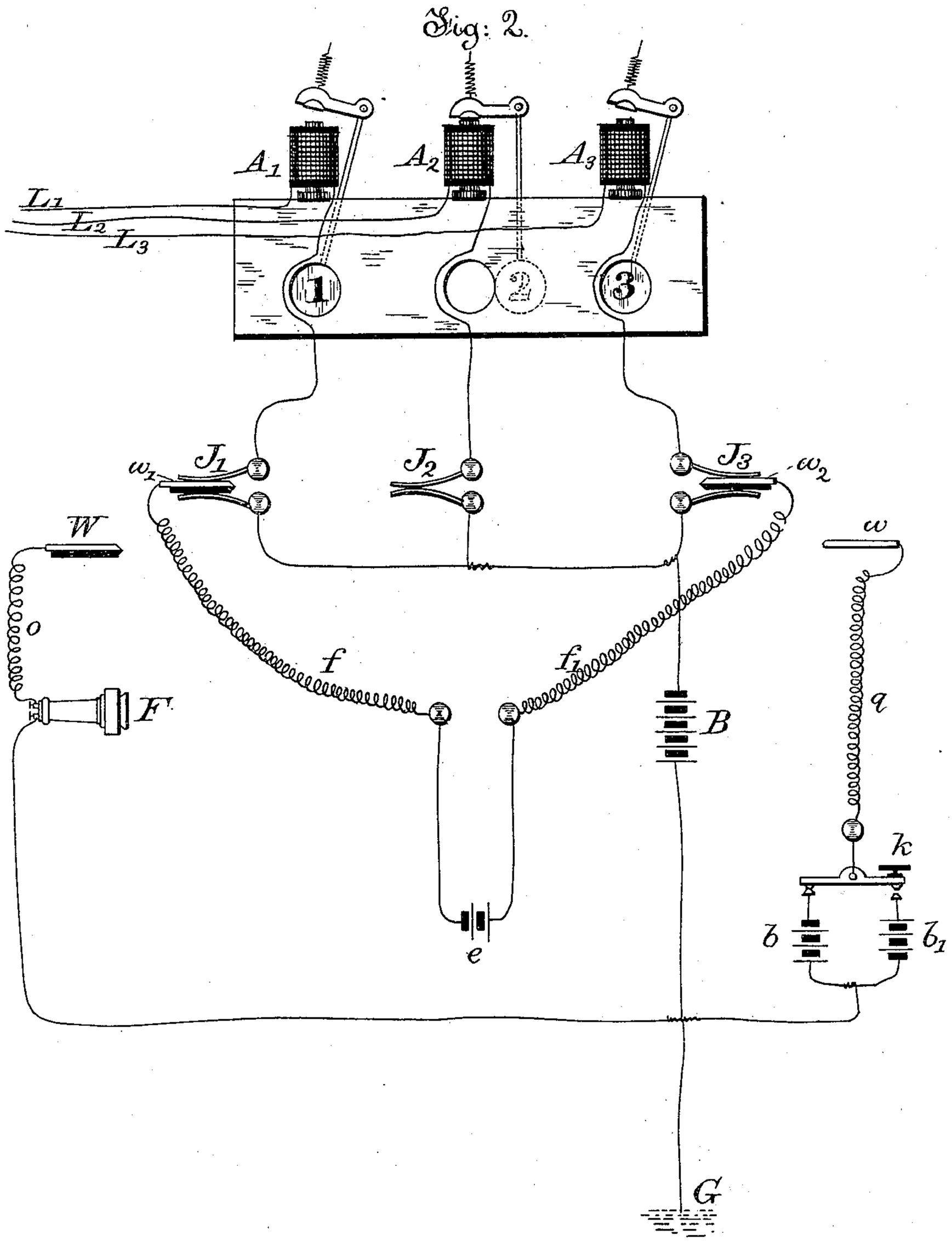
No. 245,494. Patented Aug. 9, 1881.

Fig: 2.



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UNITED STATES PATENT OFFICE.

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CIRCUIT AND APPARATUS FOR TELEPHONE-LINES.

SPECIFICATION forming part of Letters Patent No. 245,494, dated August 9, 1881.

Application filed April 4, 1881. (No model.)

To all whom it may concern:

Be it known that I, ROBERT J. HEWETT, a citizen of the United States, residing at St. Louis, in the county of St. Louis and State of Missouri, have invented certain new and useful Improvements in Circuits and Apparatus for Telephone-Lines, of which the following is a specification.

Telephone-lines have heretofore usually been provided with an audible or visual signaling apparatus in addition to the instruments for transmitting and receiving oral communications at each station, which signaling apparatus has been operated through the agency of an electro-magnet. In connection with said apparatus switches have been applied and operated, either manually or automatically, whereby either the signaling or the telephonic apparatus might be placed in connection with the main line. The operator at any particular station, wishing to communicate with another station at a distance, would first transmit a call-signal, either by means of a battery-current or the current from a magneto-generator, over the line to the distant station, and, having received a response from that station, consisting of an audible or visual signal, would then disconnect that branch of the main circuit in which the signaling apparatus was included and connect the latter through another branch, in which were situated the transmitting and receiving telephones. The telephones at the other station having been placed in the same relation to the line, the two correspondents were then enabled to converse with each other without difficulty. The apparatus pertaining to the groups of individual private lines which are brought together in connection with a central point common to all, termed an "exchange-station," have each been arranged in a manner substantially similar to that described. An objection to the use of such an organization arises when more than two stations are placed upon the same circuit, for the reason that a third station may attempt to transmit a call-signal over the line without being aware that the line is already in use by others, and the signals thus transmitted by him pass through the receiving-telephones at the other stations and interrupt the conversation.

My invention is designed to obviate this difficulty, and to prevent the transmission of call-signals when the telephones are in use.

It consists, broadly speaking, in the application of a condenser to that portion of the circuit at each station which includes the transmitting and receiving telephones. The condenser, when thus inserted in the circuits, causes an actual interruption of its continuity; hence no signaling-currents from a battery or magneto-generator can be made to pass through it, while at the same time it offers no perceptible obstruction to the passage of rhythmical or telephonic electrical vibrations, which are transferred from one set of plates to the other of the condenser by inductive action, in a well-known manner.

In the accompanying drawings, Figure 1 is a diagram representing the apparatus and circuit-connections at a telephone-station, and illustrates one mode in which my invention may be practically applied; and Fig. 2 represents the corresponding apparatus at a central or exchange station.

In Fig. 1 L represents the main line entering the station from one direction, which is connected to the fulcrum *s* of the switch S, which I have represented in the drawings as an automatic switch of well-known construction, adapted to be operated by the weight or pressure of the receiving-telephone. At the switch two branches of the main line L diverge. When in its normal position of rest, as shown, the switch-lever rests upon the contact-stop 1, and the main circuit passes from this line L through the wire 2 to the key K, thence by the wire 3 to the electro-magnet M of the signaling apparatus, which may be an audible or a visual signal, either or both, according to the requirements of the particular case. From the electro-magnet M the circuit continues by the wire 4 to the point 5, where it joins the main line L′, going out from the station. Thus it will be understood that in the position in which the apparatus is represented in the drawings the circuit of the main line is continuous through the station, and traverses the signal-magnet M and the key K. Signals may therefore be transmitted to any other station upon the line by closing and breaking the circuit in the usual manner at the key K, the circuit being traversed

by a constant current from the battery at the terminal station or stations, or at the exchange-station, as hereinafter described. The principle of action remains the same in case the battery is dispensed with and a small magneto-electric generator substituted for the key K at each station, which, when actuated, transmits a current, usually in the form of a series of pulsations, over the line, passing through the signal-magnet M at each station. After receiving a response to his signal the operator removes the hand-telephone *t* from its rest, which may consist, for example, of a hook, *h*, placed upon the extremity of the switch-lever S, (the telephone being represented in the drawings by dotted lines.) The withdrawal of the weight of the hand-telephone *t* permits the spring *r* to act upon the lever S, and thus interrupts the contact between it and the stop 1, at the same time bringing it into contact with the stops 6 and 7. The main line L is now disconnected from the signal-magnet M and placed in connection with the branch leading from the stop 6 by the wire 8 to the secondary wire of an induction-coil, *i*, and thence by a wire or other suitable flexible conductor, 9, to the hand or receiving telephone *t*, and thence by the wire 10 to one set of plates of the condenser C. The latter is constructed in the usual manner, and consists, preferably, of a number of sheets of tin-foil interleaved with paraffined Manila paper or other insulating material in thin sheets, the alternate plates being connected together, so as to form two independent groups, in the manner indicated in the figure. The wire 11 connects the opposite set of plates of the condenser with the main line L′ at the point 5. When a voltaic transmitter is employed, as is usually the case, it may be arranged in connection with the other apparatus in the manner shown in the figure.

T represents the voltaic transmitter; E, the local battery by which it is operated, and I the primary coil of the induction apparatus, whereby the vibrations set up in the local circuit are transferred to the main line. The local circuit of the transmitter is formed by the wires 12, 13, 14, and 15, and it is closed by the switch S through the contact-point 7 when the telephone is to be operated. It will be understood, therefore, that the main line divides into two branches at each station, one containing the apparatus for transmitting and receiving visual or audible signals and the other containing the transmitting and receiving telephones and the condenser, and that by means of the switch either one of these branches, but not both at the same time, may be placed in connection with the main line.

It is well known that a condenser constructed in the manner hereinbefore described offers no perceptible obstruction to the passage of rhythmical or telephonic electric vibrations, which are propagated by inductive action from one set of plates to the other, and thus pass freely across the condenser, although the circuit is actually discontinuous. When, therefore, the branch containing the telephones and the condenser is included in the circuit, oral conversations may be carried on between two stations without difficulty by means of the telephones; but should the operator at a third station attempt to transmit a call-signal over the line he would be unable to do so, for the reason that the signaling-currents would be unable to pass the condenser, and the effect would be the same as if the circuit were wholly disconnected at that point.

In order that the condenser may operate efficiently, for the purpose hereinbefore explained, its size or capacity should be adjusted with reference thereto. If the electrostatic capacity of the condenser is too great the pulsations from a magneto-generator will be transmitted through it by induction, and the signaling apparatus thereby operated. On the other hand, if the capacity of the condenser is too small the telephonic vibrations passing through it will be reduced in strength, thereby causing a corresponding reduction in the loudness of the sounds at the receiving-station. I have found by experiment that the best effect is obtained by making use for this purpose of a condenser composed of about fifteen square feet of tin-foil interleaved with Manila paper, although the superficial area of the condenser may in practice be considerably greater than that above stated without injurious effects.

My invention may be applied with great advantage in connection with telephone-exchanges in which a large number of wires proceeding from numerous sub-stations are brought together. The apparatus at each sub-station is preferably arranged as hereinbefore described and shown in Fig. 1, L′ representing the line proceeding from the central station, while the wire L is connected with the earth. Under this arrangement it is only necessary for the operator at the sub-station, when he wishes to signal the central station, to take his hand-telephone *t* from its support *h*, the effect of which is to switch the telephone and condenser into the main circuit. The condenser at once interrupts the continuous current, in consequence of which the indicating-magnet at the central station releases its armature and exhibits a visual signal bearing the numerical or other arbitrary designation of the particular line.

I have shown in Fig. 2 the arrangement of the apparatus at the central or exchange station.

L′, L², and L³ are three independent line-wires converging at the central station from a corresponding number of sub-stations, each of which is similar to that represented in Fig. 1. These several lines upon entering the central station are conducted first to an electro-magnet, which actuates a visual signal, constituting a device which is technically termed an "annunciator," and which may be of any suitable or well-known construction. I have shown in

Fig. 2 a simple disk attached by the means of a light rod to the armature-lever of the electro-magnet, and so arranged that when the current passing through the electro-magnet is interrupted and its armature falls off, the disk bearing a numeral or other character designating the particular line to which it appertains is exhibited through an opening in a case or box, as shown at A′; but when the electro-magnet is in action the armature is drawn up and the numeral is concealed, as shown at A^2. From the annunciators the several line-wires are conducted to a series of spring-jacks, one for each line J′, J^2, and J^3, and they then unite upon a common wire, which leads to one pole of a main battery, B, the other pole of which is connected to the earth at G.

F is a telephone, which is permanently connected with the earth at G, and also by a flexible conductor, *o*, with the metallic plate of a wedge, W, which is composed of a conducting and a non-conducting plate united together in a well-known manner.

e is a main battery, the respective poles of which are connected by means of flexible conductors *f f′* with wedges *w′* w^2, constructed in the same manner as the wedge W. *k* is a key, constructed and arranged in a well-known manner, so as to transmit alternate positive and negative currents from two batteries, *b b′*, to which key a metallic wedge, *w*, is attached by a flexible conductor, *q*.

A magneto-electric generator of any suitable character may be substituted for the key *k* and batteries *b b′*, for the purpose of transmitting signaling-currents.

When the lines and apparatus are in their normal position the wedges *w′* and w^2 are withdrawn from the spring-jacks *j′* and j^3, and a constant current from the battery B traverses each of the sub-station lines L′, L^2, and L^3, and consequently the visual signals of the annunciators A′, A^2, and A^3 are concealed. If, now, a person at a sub-station, as shown in Fig. 1, puts his telephone and condenser into the circuit of the main line as hereinbefore explained, the current upon the line—for example, line L′—is interrupted, the electro-magnet of the annunciator A′ is demagnetized and the visual signal attached thereto is exhibited, thus indicating to the attendant at the central station that a communication is to be sent. The attendant then inserts the wedge W into the spring-jack J′, the effect of which is to disconnect the line L from the earth and to connect it with the central-station telephone, T′, by means of which he is enabled to converse with the person at the sub-station and ascertain which line he desires to be connected with. The attendant next withdraws the wedge W and inserts the wedge *w′* in its place, and also inserts the wedge w^2 in the spring-jack of the line with which the connection is to be made, which, in this instance, we may assume to be the line designated as line L^3; consequently the wedge is inserted in the spring-jack J^3. The two lines L′ and L^3 are now connected directly together, with the battery *e* and the annunciators A′ and A^3 included in the circuit. The attendant then proceeds to call the sub-station on line L^3, by inserting the metallic wedge *w* into the spring-jack J^3, between the metallic side of the wedge w^2 and the spring in contact therewith, and manipulating the key *k*. The current or pulsations thus transmitted go to the sub-station on line L^3, but not to the sub-station on line L′, for the reason that the condenser at the last named-station is in the circuit. Thus the call-bell is actuated at the desired station only. At the same time the annunciator A^3 is vibrated, which shows that the currents from the key *k* are passing to line. When the sub-station on line L^3 answers by putting his telephone and condenser in circuit the annunciator ceases to vibrate, showing that the call has been answered. The wedge *w* is then withdrawn by the attendant at the central station, leaving the two lines L′ and L^3 connected directly with each other. When the two sub-stations have finished their conversation and replaced their telephones, their respective condensers are thereby removed from the circuit, thus allowing the current from the included battery *e* at the central station to traverse both lines and act upon the annunciators A′ and A^3, concealing the visual signals connected therewith, and thus giving notice to the attendant at the central station to disconnect the lines from each other and restore them to their normal relations. The whole operation is thus rendered automatic. This feature renders the apparatus exceedingly well adapted for use in connection with a call-circuit of any description—such, for example, as those used in the municipal and fire-alarm or other similar services.

Heretofore it has been necessary for one or both sub-stations to transmit a special signal for the disconnection of the lines when the conversation is finished; but this was frequently forgotten, especially by persons unaccustomed to the use of the apparatus, thus rendering it necessary for an attendant at the central station to insert a telephone in the circuit at frequent intervals in order to listen and ascertain whether or not the lines are still in use.

By the use of my invention nearly all the signaling required in the telephone service may be made automatic, whereby the amount of labor required on the part of the attendants at the exchange-station may be materially reduced, and the cost of the service lessened.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of a main line, a condenser, a telephone, an electro-magnetic signal or alarm, a switch, and circuit-connections, substantially such as described, whereby the condenser may be cut out of the line to permit the electro-magnet of the signal to operate.

2. The combination, substantially as herein-before set forth, of a main line, two branch lines, an electro-magnetic signal or alarm included in one branch, a transmitting or receiving telephone and a condenser included in the other branch, and a switch whereby either branch may be independently placed in connection with the main line.

3. The combination, substantially as herein-before set forth, of a main line, two branch lines, an electro-magnetic alarm or signal included in one branch, a telephone and a condenser included in the other branch, and a switch which normally keeps the main line in connection with the first-named branch, but is automatically actuated by the removal of the telephone from its rest to connect the main line with the last-named branch.

In testimony whereof I have hereunto subscribed my name this 31st day of March, A. D. 1881.

ROBERT JOSEPHUS HEWETT.

Witnesses:
K. McKENZIE,
GEO. F. DURANT.