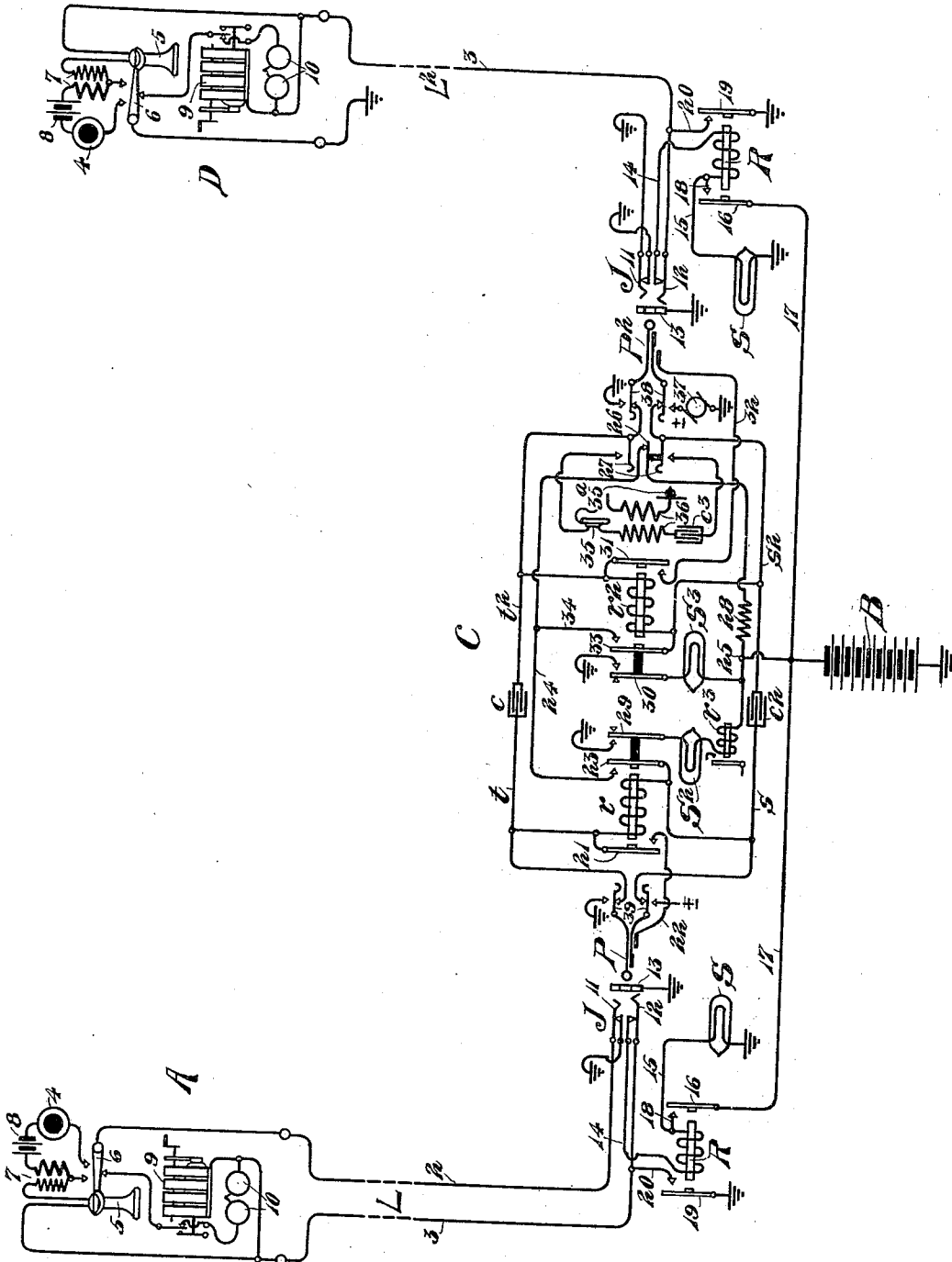


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A. H. WEISS.
TELEPHONE SYSTEM.
APPLICATION FILED SEPT. 3, 1904.

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Witnesses.

R. H. Burdette
Edith F. Grier.

Inventor:
Alfred H. Weiss
By Robert Lewis Ames,
Attorney.

UNITED STATES PATENT OFFICE.

ALFRED H. WEISS, OF EVANSTON, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD & SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ALFRED H. WEISS, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to improvements in telephone systems whereby lamp or other signals may be employed for the line-signals instead of the usual annunciator or drop-signals in connection with so-called "magneto-lines" employing small hand magneto-generators at the substations for the purpose of signaling.

The invention is found particularly useful where it is desired to later change the system into a full common-battery system in which the central-office battery furnishes the current for all purposes except calling the subscriber from the central office, since then the necessary relays and lamps are already provided and the change is a comparatively small matter. The arrangement also admits of quicker and more efficient service than in the old-style magneto systems. A practical system of this character requires that the line-relay which controls the signal shall remain energized after its armature is once attracted by the alternating current sent over the line by the hand-generator, and this is usually accomplished by current from a central common battery, which is directed through the said relay as soon as its armature pulls up. In some systems in which this has been attempted trouble has been experienced by the restoration of the signal and, perhaps, its entire failure to operate on account of the last alternation or wave of the generator-current being opposed to the current of the battery, and therefore acting to overcome the latter and restore the line-relay. In my invention I seek to avoid such trouble by arranging a short circuit or by-path for the generator-current around the relay-winding immediately upon its energization, whereby any further current from the generator may pass by without affecting the relay. This by-path may conveniently form part of the locking-circuit for the relay.

The invention is illustrated by the aid of the accompanying drawing, in which the figure is a diagram of a telephone system embodying my improvements.

In this figure, L and L² represent subscribers' lines extending from the subscribers' stations A and D to the central office C, where they are represented upon the switch-board by the connection-terminals or spring-jacks J. The line L is represented as of the so-called "metallic" type having a pair of conductors 2 and 3 extending from the substation to the central office, while the line L² is of the so-called "grounded" type, in which only a single conductor 3 extends from the subscriber's station to the central office, while the other conductor is replaced by the ground or common return.

At the substation, which is of the local-battery type, a transmitter 4 and receiver 5 are adapted to be suitably connected in the circuit by a switch-hook 6 when the receiver is taken therefrom, together with an induction-coil 7 and a source of current 8, the transmitter, source of current, and primary of said induction-coil being connected in a local circuit and the receiver and the secondary of said coil in the main-line circuit when the hook is raised. When the receiver is upon the hook, as shown in the drawing, the circuits through the said instruments are open and the line-circuit completed through the lower contact of said hook, the normal contacts of the hand-generator 9, and the signaling-bell 10 to the other side of the line-circuit. This hand-generator is of the usual type, in which under normal conditions its armature is shunted out of the circuit; but upon its handle being turned the armature is cut into the circuit and a current is generated and sent over the telephone-line. All of this apparatus is of the usual type, and the arrangement will be readily understood.

At the central office the spring-jacks J are each provided with tip and sleeve springs 11 and 12 and with a third ring-contact 13, the normal contact of the tip-spring being grounded while the normal contact of the sleeve-spring 12 is connected by means of conductor 14 with one terminal of the line-relay R, whose other terminal is connected by a conductor 15 with the adjacent terminal of the small incandescent lamp S, forming the line-signal and whose other terminal is grounded. The contact 13 of the jack is also grounded. This line-relay R is provided with two sets of normally open contacts, one contact 16 of one set being joined by a suit-

able common wire conductor 17 with the live pole of the battery B, whose other pole is grounded and the other contact of said set being connected by conductor 18 with the said conductor 15 and one terminal of the relay. One of the contacts 19 of the other set is joined to ground, while the other contact of said set is connected by a short conductor 20 with the sleeve side 3 of the telephone-line.

The grounding of the line, as indicated in connection with the line L^2 , makes no difference in the connection of these central-office parts, and no further description is thought to be needed to explain the construction and arrangement of the same, since it will be readily understood from the diagram, which shows the tip side of the line grounded at the substation D and the tip-spring 11 of the jack J grounded at the central office C.

The cord-circuit which I prefer to use in connection with my invention includes an answering-plug P and a calling-plug P^2 , having tip, sleeve, and ring contacts adapted to register with the corresponding contacts of the spring-jacks of the telephone-lines when inserted therein, the tip-contacts of said plugs being joined by the strands t and t^2 and the interposed condenser c , while their sleeve-contacts are similarly connected by the flexible strands s and s^2 and the condenser c^2 . A supervisory or clearing-out relay r is bridged across the answering end of the cord-circuit between the strands t and s and is provided with a plurality of normally open sets of contacts, the spring 21 of one of these sets being connected with the bridge of said relay at one side of the same and the forward contact thereof being connected by conductor 22 with the third contact of the answering-plug P.

The spring 23 of another of these sets of contacts is joined to said relay-bridge on the other side of said relay, and its forward contact is electrically united through the medium of the conductor 24 with the junction-point 25, from which a conductor leads direct to the live pole of the battery. This conductor 24 includes normal contacts 26 of the listening-key (indicated by the springs 27) and a resistance 28 of suitable dimensions. A third spring 29 of said relay r is connected with the supervisory or clearing-out lamp S^2 , that is associated with the answering-plug P, while its forward contact is grounded. The circuit of said lamp S^2 includes the winding of the pilot-relay r^3 , as well as battery B. A similar supervisory or clearing-out relay r^2 is bridged across the calling end of the cord-circuit between the strands t^2 and s^2 and serves in like manner to control, through its contact 30, the circuit of the supervisory lamp S^3 , associated with the calling-plug P^2 . This relay has also a spring 31, connected upon one side with the relay-bridge, with its forward contact joined by a conductor 32 with the third contact of the calling-plug P^2 , and a third

spring 33, connected with said relay-bridge upon the other side of the relay and the forward contact of which is connected by a conductor 34 with said conductor 24.

The operator's head-receiver 35, the secondary of her induction-coil 36, and a suitable condenser c^3 are adapted to be bridged across the calling end of the cord-circuit by means of the listening-key springs 27 when they are operated. The primary winding of said coil and her transmitter 35^a are energized from any suitable source of current and which may be the battery B. A calling-generator 37, having one pole grounded, is adapted to be connected with the sleeve side of the calling-plug by the ringing-key springs 38, the tip-spring being at the same time grounded. An additional ringing-key 39 is shown in the answering end of the cord-circuit and is adapted to be connected in the same way with the ringing-generator 37, the complete connection being omitted for the sake of clearness.

In the operation of my invention a subscriber at station A operates the hand-generator in order to send a calling-signal to the central office. The current from this generator flows over the sleeve side 3 of the telephone-line, spring 12 of the jack, the normal contact of said spring, thence by way of conductor 14, and on through the relay-winding R, thence through conductor 15 and the signal-lamp S and to ground, and thence via the grounded contact of the tip-spring 11 of the jack and back over the line conductor 2 to the substation and the other side of the generator. The alternating current from the generator in this path is sufficient to energize the relay R, which attracts its armatures 16 and 19, thereby closing the path for current from the central-office common battery B, over conductor 17, contact 16, conductor 18, through the winding of the relay R, conductor 14, normal contact and spring 12 of the jack J, over conductor 3, branch 20, and spring 19 of relay R to ground, this circuit forming the locking-circuit for said relay and serving to cause its energization until the subscriber's call is answered. At the same time current flows from said battery B through conductor 17, spring 16, over conductor 18 and thence by way of conductor 15 through the signal-lamp S and to ground, this current serving to light the lamp S to indicate to the operator that the subscriber has called. It will be noted at this point in the operation that the further turning of the generator-handle at the substation has no effect upon the relay R, for the reason that said relay is short-circuited or shunted by means of the path through conductor 20 and contact 19 to ground. The line-relay is thus not deenergized by the opposing wave from the hand-generator. Upon observing the signal S the operator inserts the answering-

plug P of her cord-circuit in the jack J and connects her head-telephone with the cord-circuit through the medium of the listening-key 27. The insertion of the answering-plug P extends the circuit of the line conductors 2 and 3 through the strands t and s and t^2 and s^2 to the operator's instrument. This also lifts the springs 11 and 12 from their normal contacts, thus disconnecting the ground branch from the tip side of the line and the conductor 14 from the sleeve side, which latter opens the locking-circuit through the line-relay R, permitting the same to be deenergized and retiring the signaling-lamp S and at the same time disconnecting the ground branch through conductor 20 from the sleeve side of the line. The line is therefore left entirely free from ground branches or other connections and in suitable condition for talking. Upon learning the order of the calling subscriber the operator inserts the plug P² into the jack of the wanted line and operates her ringing-key 38. Assuming that the line L² is the one wanted, the insertion of the plug P² in the jack J of said line results in disconnecting the line-relay R and all of the ground branches from the line. The operation of the ringing-key causes the generator 37 to be connected with the sleeve side of the telephone-line, which sends out ringing-current over the sleeve conductor 3 through the call-bell at the substation, thence through the shunt of the generator 9, the switch-hook, and in the case of the grounded line L² back to the central office through ground or common return and thence to the other side of the ringing-generator. In the case of a metallic line this line-circuit would include the tip side 2 of the telephone-line and the tip-contacts of the jack and plug and thence through the grounded contact of the tip-spring of the ringing-key to the other side of the generator. If the calling subscriber hangs up his receiver before the called subscriber has answered, the calling subscriber may be readily called by the ringing-key 39, associated with the answering-plug. This key may be used at any other time desired for calling a subscriber. Upon the response of the called subscriber the parties are in communication, the current for the energization of the substation-transmitters being furnished by the local battery 8 and the voice-currents being propagated from one end of the complete talking-circuit to the other by means of the condensers c and c^2 in the cord-circuit strands. At the termination of the conversation the subscribers hang up their receivers and operate their signaling-generators 9. Assuming the subscriber A to have thus operated his generator, the current flows over the metallic line and through the bridged relay r , connected with the end of the cord-circuit associated with that line. This relay responds to this current and attracts its armature with the result that a path for current from the battery B is closed from the live pole of the battery to point 25, thence through conductor 24, including resistance 28 and contact 26 of the listening-key to the forward contact of spring 23 of said relay, thence to the relay-winding itself and the spring 21 thereof and its forward contact, and thence by way of conductor 22 to the third contact of the plug and jack to ground. This forms a locking-circuit for said relay r to maintain the same energized after the subscriber has ceased to operate his generator. The operation of this relay also closes, through a spring 29, the circuit of supervisory lamp S to indicate to the operator that the subscriber A has ceased conversation. The closing of these contacts provides a shunt-path for the generator-current around the relay r , which may be traced from the strand t over the bridge of the relay to and through spring 21 and forward contact of said relay, conductor 22, third contact of plug, and contact 13, thence to ground at the jack J, from which the current finds a path to the grounded pole of the battery B, thence through said battery to point 25, conductor 24, spring 23, and out over the sleeve-strand r of the cord-circuit. This shunt-path, although including the battery and resistance-coil 28, is of lower resistance and retardation to the generator-current than the relay r . Likewise current from the magneto-generator 9 at the substation D flows to ground at the substation through said generator and signal-bell and thence over the conductor 3 through the sleeve-strands s^2 of the cord-circuit, through the relay r^2 , the strand t^2 , and the ground-tip of the jack. This energizes the relay r^2 , which causes it to close a locking-circuit from the live pole of the battery through said conductor 24, branch 34, spring 33, relay r^2 , spring 31, conductor 32, and a ground-contact of the spring-jack. The circuit of the supervisory lamp S² is likewise closed, and the said lamp is lighted to indicate that the subscriber has hung up his receiver. In a similar manner, as described in connection with relay r , a shunt-path for the generator-current is provided through the battery B and ground as soon as the spring 33 closes upon its forward contact. At the termination of the conversation when both lamps S² and S³ are lighted the operator takes down the connection, thus opening the locking-circuits of the clearing-out relay r and r^2 , which are deenergized, to restore all parts to normal condition. The contacts 26 in the listening-key are opened whenever the subscriber listens in upon the cord-circuit and serve to open the locking-circuits of the relays r and r^2 , so that in case one should have become accidentally operated either in plug-

ging in or in any other way, the same will be deenergized and placed in condition to respond to the clearing-out signal.

It will be understood that the several grounds mentioned at the central office may be one and the same or the common office return and that various other alterations, changes, and modifications may be made in the details of the system without departing from the spirit and scope of the same. I do not claim the cord-circuit herein, as in its individual capacity it forms no part of my invention.

The further objects of my invention—to wit, to produce a system of the class described that shall be inexpensive to install and maintain that shall be efficient in operation, and one in which the service is rapid and satisfactory—are thus attained.

Having thus described my invention, what I claim is—

1. In a telephone system, the combination with a telephone-line, of a magneto-signaling generator therefor at the substation, a relay at the central office adapted to be actuated by current from said generator, a lamp-signal controlled by said relay, a source of steady current at the central office, said relay when energized by said generator-current serving to close a circuit from said steady-current source through its own windings to maintain it actuated, and a by-path not including said source of steady current for the generator-current around its windings also closed by said relay when actuated, substantially as described.

2. In a telephone system, the combination with a telephone-line, of a magneto-generator therefor at the substation, a relay at the central office adapted to be actuated by current from said generator, a lamp-signal controlled by said relay, a source of steady current at the central office, said relay when energized by said generator-current serving to close a circuit from said steady-current source through its own windings to maintain it actuated, and a by-path not including said source of steady current for the generator-current around its windings also closed by said relay when actuated, said by-path forming also a part of the path for current from the steady-current source through said relay, substantially as described.

3. In a telephone system, the combination with a telephone-line, of a magneto-generator therefor at the substation, a relay at the central office adapted to be actuated by current from said generator, a signal controlled by said relay, a source of steady current at the central office, said relay when energized by said generator-current serving to close a locking-circuit from said steady-current source through its own windings and not including said signal to maintain it actuated and at the same time to short-circuit the

limb of the subscriber's line, and means for opening said locking-circuit and said short circuit when a connection is established with the line, substantially as described.

4. In a telephone system, the combination with a telephone-line, of a magneto-generator therefor at the substation, a relay at the central office adapted to be actuated by current from said generator, a signal controlled by said relay, a source of steady current at the central office, said relay when energized by said generator-current serving to complete a path for current from said steady-current source through its own windings to maintain it actuated, a by-path not including said source of steady current for the generator-current around its windings also closed by said relay when energized, and means for opening said locking-circuit when a connection is established with the line, substantially as described.

5. In a telephone system, the combination with a telephone-line, of a magneto-generator therefor at the substation, a relay at the central office adapted to be operated by current from said generator, a signal controlled by said relay, and a battery at the central office, said relay when energized by said generator-current serving to close a circuit from said battery through its own windings to maintain it actuated and at the same time to connect the two limbs of the line together, thus maintaining them at the same potential and offering an unobstructed path for the generator-circuit, substantially as described.

6. In a telephone system, the combination with a telephone-line, a relay and a signal for said line normally connected in series between ground and one limb of the telephone-line, a magneto-generator at the substation adapted to send current through said relay and signal to actuate the relay, a central source of current adapted to be connected with that portion of the line conductor lying between said signal and the coil of said relay by the actuation of said relay, whereby said signal is displayed, a second contact of said relay adapted to place ground upon said limb of the telephone-line beyond the coil of said relay, whereby the relay is locked in actuated position by current through its own contacts, and a contact associated with the jack of the telephone-line situated between the coil of said relay and said ground connection adapted to be opened when a connection is established with the telephone-line, whereby said relay is deenergized and said signal is effaced, substantially as described.

In witness whereof I hereunto subscribe my name in the presence of two witnesses.

ALFRED H. WEISS.

Witnesses:

ROBERT LEWIS AMES,
EDITH F. GRIER.