

No. 656,997.

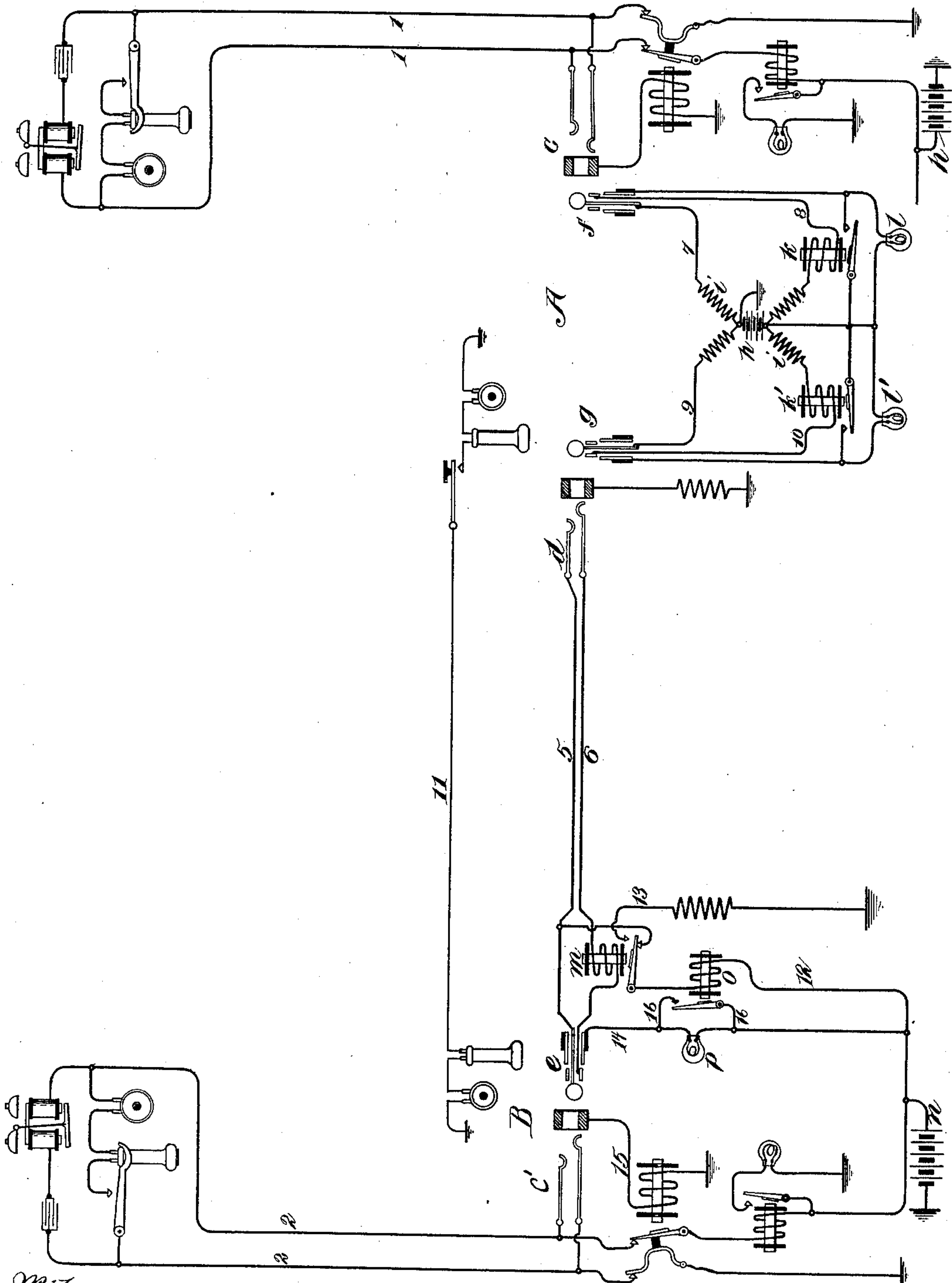
Patented Aug. 28, 1900.

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SIGNAL FOR TELEPHONE TRUNK LINES.

(Application filed Jan. 29, 1900.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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SIGNAL FOR TELEPHONE TRUNK-LINES.

SPECIFICATION forming part of Letters Patent No. 656,997, dated August 28, 1900.

Application filed January 29, 1900. Serial No. 3,071. (No model.)

To all whom it may concern:

Be it known that I, FRANK R. MCBERTY, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Signals for Telephone Trunk-Lines, (Case No. 87,) of which the following is a full, clear, concise, and exact description.

This invention concerns the operation of trunk-lines between central offices of a telephone-exchange in which the lines are adapted for the automatic operation of signals in the switchboards; and it consists in a clearing-out signal for one terminal of the trunk-line, with means for controlling it from the other terminal of the trunk-line, the purpose of the improvement being to effect such control without the aid of earth connections during the use of the trunk-line for conversation.

To define the invention more specifically, it consists in the combination, with the line-conductors of a trunk-line and a clearing-out signal associated with one terminal of the trunk-line, of two agents for controlling the clearing-out signal, of which one is in a normal ground-circuit of the trunk-line in operative relation with a circuit at the other terminal of the trunk-line, while the other is in the path of current to the called station and controls, in addition to the clearing-out signal, the ground connection of the first-mentioned agent. Any of several devices may be adopted by which the two agents, which in practice may be electromagnets, are enabled to control the clearing-out signal; but I prefer to provide a circuit closed during connection between the trunk-line and the line of the called subscriber, containing the clearing-out signal, a shunt of the clearing-out signal, controlled by the magnet in the earth branch from the trunk-line, and a magnet in the path of current to the called station which when it is excited breaks the connection of the signal-controlling magnet with the trunk-line and completes a local circuit for its excitement.

The invention is illustrated diagrammatically in the attached drawing. This drawing represents two telephone-lines entering different offices of an exchange with a trunk-

line between the two offices for uniting the telephone-lines, a clearing-out signal and controlling mechanism for it at the so-called "B" or "receiving" terminal of the trunk-line and the usual supervising apparatus and source of current at the "A" or "connection-originating" terminal.

The telephone-lines may have any suitable apparatus at the substations for completing the line-circuits during the use of the telephones, the circuit at the station being broken at the telephone-switch, while the receiver rests on the switch-hook. Several forms of such apparatus are well known in the art of telephony.

The telephone-lines 1 and 2 from the substations lead into central offices A and B, respectively, where they are connected with spring-jacks *c* and *c'*, respectively, in switchboards. The trunk-line 5 6 leads from office A to office B. The trunk-line terminates at the office A in a spring-jack *d*, and at the office B in a terminal plug *e*. It will be understood that several such trunk-lines extend from each office to the other, some having spring-jacks in one office and terminal plugs in the other and others having the reverse arrangement, so that a line calling in either office may be connected, by means of the ordinary switching appliances, with a terminal spring-jack of a trunk-line leading to the other office, where the trunk-line is upon instruction connected with the line wanted. The terminal of the trunk-line adapted for connection with the calling line is known as the "A terminal" or "originating-terminal," while the end adapted for connection with the line called for is termed the "B" or "receiving" terminal. As shown in the drawings, the A terminal of the trunk-line 5 6 is at the office A, and its B terminal is at the office B. At the office A the usual plugs *f* and *g* and a plug-circuit are furnished for joining lines by means of their terminal spring-jacks. The line contacts of these plugs are united through a plug-circuit 7 8 and 9 10, which has a source of current *h* in a bridge of the circuit. The connection of the plug-circuit with the source of current is made through windings of a repeating-coil *i*, by which inductive continuity of the circuit

is maintained with respect to the telephone-currents, while the portions of the circuit leading to the calling and to the called line are separated, so that the current supplied from the central source to either line is independent of that flowing to the other. Conductors 8 and 10 of the plug-circuit traverse windings of supervisory relays k and k' , which control signals l and l' . Each signal is in a portion of a local circuit of battery h , which terminates in a special contact-piece of the connecting-plug with which the corresponding signal is associated. When the plug is inserted in a spring-jack, this special contact makes connection with the conductor associated with the spring-jack, which forms with the conductor terminating in the plug a complete local circuit for the supervisory signal. Each supervisory relay controls its signal by means of a shunt about the signal closed by the relay when excited. The plug-circuit may have the well-known calling key for connecting it with the source of calling current and a listening-key for connecting it with an operator's telephone. An order-wire circuit 11 extends from the office A to the B office. At the A office it may be connected, by means of a special key, with the telephone of the A operator, while at the B office it is permanently connected with the telephone of the B or incoming trunk operator in order that the A operator may at any moment instruct the B operator to connect a given trunk-line with a required subscriber's line.

In applying my invention to the trunk-line I may ground one terminal of the battery h or connect it with any other common conductor between the two offices. At the B office a relay m is connected in the line conductor, adapted to respond to current to the called station when the trunk-line is connected with the subscriber's line and the telephone at the substation is in use. This relay m has a switch-lever with two contact-points, against which it rests alternately. The switch-lever of the relay is connected with the wire 12, leading to earth through the battery n . The wire 12 includes also the magnet-winding of a relay o , having a switch-lever and a front contact therefor. The back contact of the switch-lever of relay m is connected with conductor 5 of the trunk-line, while its forward contact is connected with a conductor 13, leading to earth.

A clearing-out signal p is associated with the terminal plug of the trunk-line. This signal, which is a small incandescent lamp, is placed in a branch wire 14 from the battery n and terminates in a special contact-piece of the terminal plug e of the trunk-line, which is adapted to make connection with the thimble of the spring-jack c' of the subscriber's line and thus to complete a local circuit of the signal p while the plug e is in the spring-jack. The portion 15 of this local circuit terminating in the ring contact of the spring-jack may include the cut-off relay of

the subscriber's line. The switch-lever and its front contact of relay o control a shunt 16 of the signal p .

The taking of the telephone at the substation of the calling line brings about the display of the line-signal, indicating the call, and the call is answered by inserting a plug f into the spring-jack of the calling line. Having learned the subscriber's order for the line with which connection is required at office B, the A operator presses the order-wire key and states the order to the listening B operator, who assigns the idle trunk-line 5 6 for use in completing the connection. Following the assignment, the A operator inserts the plug g in the terminal spring-jack d of the trunk-line 5 6. At the same time the B operator inserts the terminal plug e of the trunk-line in the spring-jack of the line called for. Placing the plugs f and g in the spring-jacks c and d , respectively, closes the local circuits of the signal-lamps l and l' . Closing the local circuit through the lamp l and the local conductor of the calling line excites the cut-off relay of the calling line and breaks the normal ground connections of the line. The battery h now finds circuit to and through the line to the calling station. The current in this circuit excites the relay k , which closes the shunt about the signal l . The insertion of plug g into spring-jack d of the trunk-line applies a ground to line conductor 5 of the trunk-line and a battery h to the other line conductor 6. Battery h finds no circuit through the conductor 6 since the circuit through this conductor is interrupted at the telephone-switch of the called station. Hence the supervisory relay k' remains inert and the lamp remains lighted to indicate the position of the telephone-switch at the called station. The completion of the path to ground from conductor 5 of the trunk-line permits current to flow from the battery n at the B terminal through the relay o and through the conductor 5 to earth at the A office, the relay m being inert. The relay o therefore closes the shunt 16 about the clearing-out lamp p . At this moment the signaling-circuit for controlling the clearing-out lamp involves a direct ground connection at the B terminal of the trunk-line, as in the signaling systems heretofore provided. When, however, the telephone is taken for use at the called station, current is permitted to flow from battery h at the office A through a circuit formed of conductor 6 of the trunk-line, line-wires 2 and 2 and conductor 5 of the trunk-line returning to battery h at the central office, which excites both the supervisory relay at k' at the A office and the relay m at B office. The first-mentioned relay shunts the supervisory signal l' , and thereby signifies the response of the called party to the A operator. The excitement of the relay m breaks the connection of wire 12 with the trunk-line, thus freeing the trunk-circuit from all ground connections, and closes a local circuit through

the relay *o* and wire 13, which maintains its excitement and prevents the illumination of the clearing-out signal. Thus the electrostatic balance of the trunk-line is maintained, the entire circuit between the repeating-coil at the A office and the called substation being free from all external connections. If the telephone be replaced on its switch at the called station, the first condition is restored, the circuit first traced through the relay *o* being reestablished, so that the clearing-out signal *p* is not lighted. When, however, the telephones are replaced on their switches at both stations, the supervisory signals *l* and *l'* are lighted before the A operator, indicating to her that the communication is finished. The A operator then breaks the connection by withdrawing plugs *f* and *g* from the spring-jacks of the subscriber's line and the trunk-line. The ground connection from the conductor 5, which forms a part of the circuit for relay *o*, is then removed, the relay becomes inert, and the clearing-out signal *p* is lighted. Its illumination is a signal to the B operator to break the connection of the trunk-line with the called line.

I claim as my invention—

1. The combination with a trunk-line between A and B offices, a subscriber's line connected with the B terminal of the trunk-line, a switch at the substation controlling current in the line and a source of current in the trunk-line, of a clearing-out signal at the B terminal of the trunk-line, a magnet in a branch from the trunk-line controlling said clearing-out signal, and a magnet in series in the trunk-line in the path of current controlled at the telephone-station also controlling said clearing-out signal, said last-mentioned magnet being adapted to break the said branch when excited, substantially as described.

2. The combination with a trunk-line and a telephone-line connected with the B terminal thereof, a telephone-switch at the telephone-station controlling the line-circuit, and a source of current in the trunk-line, a signal at the B terminal and a magnet in a branch

from the trunk-line controlling the signal, said branch forming a part of an operative circuit controlled at the A terminal, a magnet serially in the trunk-line in the path of current controlled by the telephone-switch, said last-mentioned magnet being adapted to disconnect the branch through the other magnet from the trunk-line when excited, substantially as described.

3. The combination with a trunk-line between A and B offices, and a telephone-line connected at the B terminal of the trunk-line having a telephone-switch for closing the line-circuit in the use of the telephone, a clearing-out signal at the B terminal of the trunk-line in a circuit controlled at the A terminal and formed in part of a line conductor of the trunk-line and a branch therefrom, and a magnet serially in the trunk-line in the path of current controlled at the telephone-station, said last-mentioned magnet being adapted when excited to disconnect the branch from the trunk-line and complete a local circuit through said branch, as described.

4. The combination with a metallic-circuit trunk-line united with a telephone-line at its B terminal, and a telephone-switch for controlling the circuit of the telephone-line, a clearing-out signal at the B terminal of the trunk-line, a ground branch from the trunk-line at the B terminal including a magnet adapted to control the display of said signal, and another magnet serially in the trunk-line in the path of current controlled by the telephone-switch also adapted for the independent control of said clearing-out signal, said last-mentioned magnet being adapted to break the branch through the other magnet, and means for applying current to the trunk-line at the A terminal for exciting either of said magnets, substantially as described.

In witness whereof I hereunto subscribe my name this 6th day of January, A. D. 1900.

FRANK R. McBERTY.

Witnesses:

ELLA EDLER,
GERTRUDE EYSTER.