

No. 649,069.

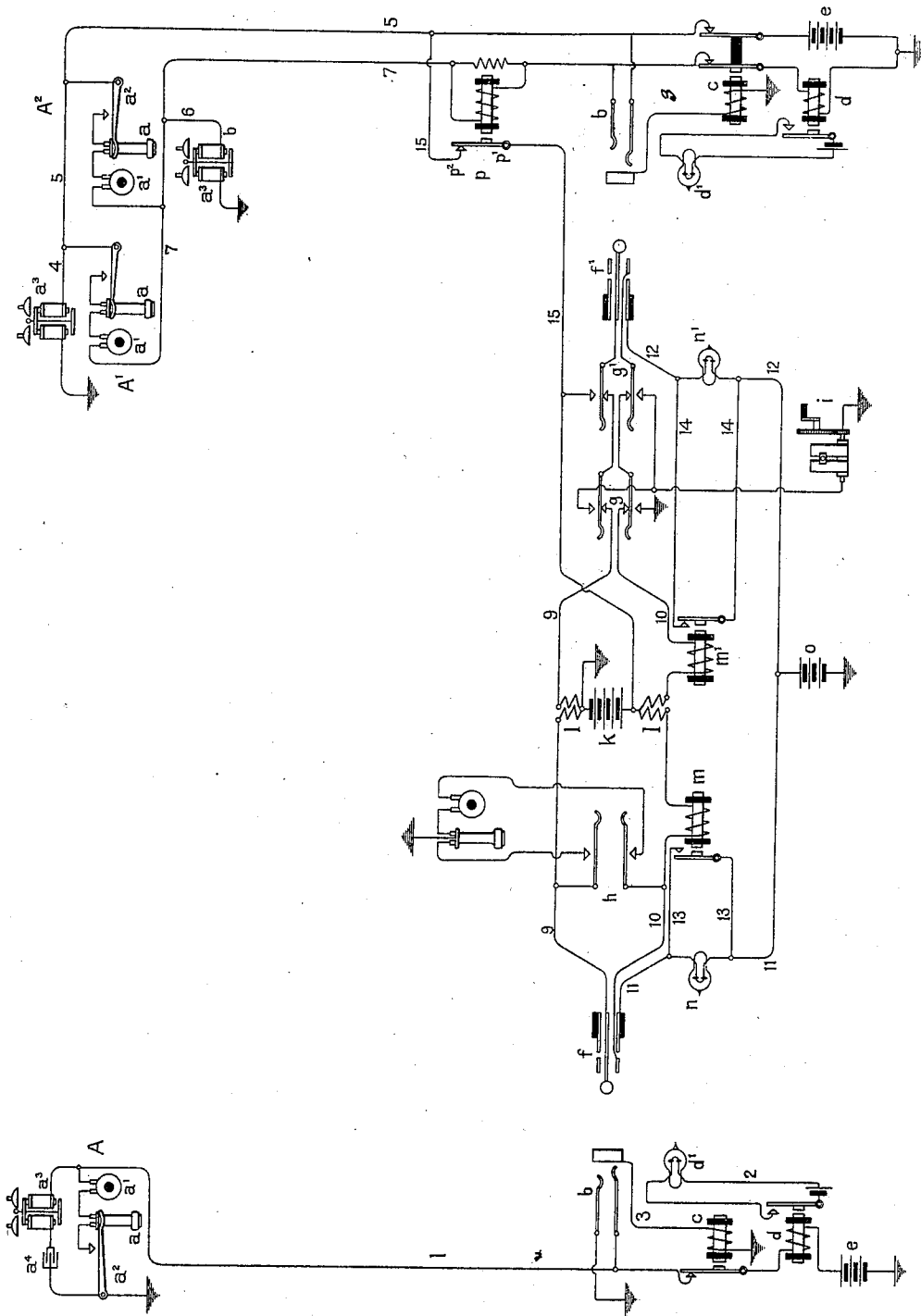
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F. R. McBERTY.

SUPERVISORY SIGNAL FOR TELEPHONE LINES.

(Application filed June 17, 1898.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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SUPERVISORY SIGNAL FOR TELEPHONE-LINES.

SPECIFICATION forming part of Letters Patent No. 649,069, dated May 8, 1900.

Application filed June 17, 1898. Serial No. 683,738. (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 Supervisory Signals for Telephone-Lines, (Case No. 68,) of which the following is a full, clear, concise, and exact description.

This invention concerns the automatic control of supervisory signals or equivalent appliances in telephone-switchboards from substations of telephone-lines having ground branches or other normal connections tending to interfere with the operation of the signals. It applies particularly in switchboards furnished with link conductors and supervisory signals associated therewith which are employed indifferently with grounded lines, with metallic-circuit lines, and with grounded metallic circuits.

The object of the invention is to render the operation of the supervisory signals or equivalent appliances uniform when these are associated with lines of different character.

To this end the invention consists in the combination, with each line of special nature—as, for example, the grounded-metallic-circuit lines—of a device permanently associated with the line responsive to currents in the line determined in suitable acts at the substation and means whereby the device affects the supervisory signal in the same way that a similar act at the substation of a normal line would affect it.

In the specific instance of groups of lines comprising grounded lines and metallic lines consisting of normally-open grounded limbs with means for closing bridges of the metallic lines at the stations thereof, with supervisory signals and controlling-magnets for them, which cause their display in response to the breaking of currents in the lines with which the signals are associated, I provide for each grounded metallic circuit a source of current and a magnet so located that the magnet becomes excited only during the completion of a bridge of the metallic circuit and circuit connections controlled by the magnets to shunt the magnet controlling the supervisory signal temporarily associated with the

line or otherwise to deprive it of current when the magnet in the line is inert.

The accompanying drawing illustrates the invention diagrammatically.

The drawing represents two telephone-lines—one a grounded special circuit and the other a metallic party-line circuit with grounds at different stations containing selective calling appliances—together with signaling and switching apparatus for the lines in the switchboard, the party-line circuit being equipped with a device for maintaining the normal operation of the supervisory signals in accordance with the present invention. All the substations of these lines are furnished with the usual receiving and transmitting telephones *a* and *a'*, telephone-switches *a*² for closing bridges of the line-circuit through these instruments in the use of the telephones, and polarized call-bells *a*³. The bell at station *A* is located in a bridge or ground branch from the line, together with a condenser *a*⁴, which interrupts the continuity of the line as to the battery-currents made use of in signaling to the office, while being complete as respects the alternating calling-current for ringing the bell. The single conductor 1 of this grounded circuit is led to the line-contacts of the spring-jack *b* in the switchboard, from which it is prolonged through the switch-contacts of a cut-off relay *c* and through the magnet-winding of a signal-controlling relay *d* to one pole of a grounded battery *e*. The relay *d* controls a secondary line-signal *d'* associated with the spring-jack *b* in the switchboard through the agency of a normally-broken local circuit 2, which it completes when excited. The actuating-magnet of the cut-off relay *c* is connected in a local grounded conductor 3, which terminates in an insulated contact-ring of the spring-jack *b*.

At each of the stations *A* and *A'* of the party-line the bell *a*³ is connected in a permanent ground branch from one of the line conductors, the bell at station *A'* being in a ground branch 4 from line conductor 5 and the bell at station *A*³ being in a ground branch 6 from line conductor 7. The line conductors lead, like that of the grounded line, to the line-contacts of a spring-jack *b* in the switchboard, from which they are extended

through the switch-contacts of a cut-off relay *c* to earth and to the pole of a grounded battery *e*, respectively. The magnet of the signal-controlling relay *d* is, however, included in the extension of line conductor 7, so that current reaches the magnet only when a bridge of the line is closed through the telephone at one of the stations.

In the switchboard the usual pairs of connecting-plugs *f* and *f'* are provided for the use of the operator in uniting lines. Like line-contacts of the plugs are connected together through conductors 9 and 10, which constitute the plug-circuit, the usual calling-keys *g* and *g'* being interposed in the conductors of the plug-circuit and the listening-key *h* being connected therewith for bringing the telephone into a bridge of the plug-circuit. It will be noted that one of the calling-keys *g* is adapted to apply one pole of a grounded source *i* of calling-current to one line conductor 7 to ring the bell *a*³ at station A², while the other key *g'* is adapted to apply the same pole of the source of calling-current to the other line conductor 5 to ring the bell at station A', the key *g'*, however, when it applied calling-current at the line-wire 5 also connected with the line-wire 7 one pole of a grounded battery *k*, for a purpose which will be hereinafter set forth.

The conductive continuity of the plug-circuit 9 10 is broken by interposing in each conductor thereof two serially-connected windings of a repeating-coil *l* in a well-known way. The points of junction of the windings of these coils are led to the poles of the battery *k*, which thus may serve for supplying current to the substation-transmitters, if desired, as well as for operating supervising-signals associated with the plug-circuit. The conductor 10 of the plug-circuit leading to each of the plugs traverses the magnet-winding of a supervisory relay, these being designated *m* and *m'*, respectively. Each of these magnets controls the display of a supervisory signal, the signals being marked *n* and *n'*, associated with the corresponding plug *f* or *f'*. The signal-lamp *n* is included in a branch 11 from a grounded battery *o* to the contact-sleeve of plug *f*, which is adapted to make connection with the test-ring of the spring-jack *b*. Lamp *n'* is likewise included in a wire 12, leading from the same battery to the corresponding part of plug *f'*. The relays *m* and *m'* control these signals *n* and *n'* through the agency of shunts 13 and 14, respectively, which are completed when the relays are excited. These signals are of usual and well-known character in telephone-exchanges. When a connection is established between lines in the switchboard, it is intended that current shall flow from battery *k* through the conductors 9 and 10 of the plug-circuit to each line, the existence of the current being determined by the condition of the bridge, including the telephones at the substation of the line. A supervisory relay *m* or

m' is in the path of current to each of the lines. When the relay is excited by current flowing in the line with which it is temporarily associated, it is designed to close the shunt about the signal-lamp, and thus to divert therefrom current flowing in the local circuit completed in the act of making connection to render the lamp dark. Thus each supervisory signal-lamp is to remain dark while the telephone of the station with which it is in temporary association is in use, becoming lighted when the bridge at the station is broken. In providing for the uniform operation of these supervisory signals on grounded metallic circuits like that leading to stations A' and A², I place in the line conductor 7 of the line the magnet of a relay *p*. This magnet may be of moderate resistance and should preferably be shunted by a non-inductive resistance to furnish a free path for telephone-currents. This relay is responsive to currents in the conductor 7, which, however, can occur only when a complete path is established from line conductor 5 through a bridge at one of the stations A' or A². The switch-contacts *p'* *p*² of this relay control the continuity of a conductor 15, leading from the free pole of battery *k* to the line conductor 5.

In order to trace the operation of the supervisory signals and the control of the signal associated with the party-line through the agency of magnet *p*, let a connection be assumed to originate at station A, to be extended to station A'. The removal of the telephone from its switch at station A permits current to flow from the battery *e*, which excites the relay *d* and brings about the display of the line-signal *d'* in the switchboard. Answering the call, the operator inserts plug *f* into the spring-jack *b*, at the same time bringing her telephone into the plug-circuit to learn the order. The insertion of the plug in the spring-jack completes a local circuit of battery *o* through wires 11 and 3, wherein current excites the cut-off relay *c* and causes this appliance to sever the normal ground connections of the line. At the same moment current is permitted to flow from battery *k* through the portion of the plug-circuit connected with the calling-line, over the line conductor, and through the telephones at the station to earth, whereby the supervisory relay *m* is excited and closes the shunt about the supervisory lamp *n*. Upon learning the subscriber's order the operator inserts plug *f'* into spring-jack *b* of the line 5 7 and depresses the key *g'* to ring the bell at the station A'. The insertion of plug *f'* in the spring-jack *b* completes a local circuit 12 3, which includes the signal-lamp *n'* and the magnet of cut-off relay *c* of the called line. The cut-off relay severs the ground connections of the line in the exchange, and the lamp *n'* becomes lighted. The depression of the key *g'* connects one pole of the source *i* of alternating calling-current with the line conductor 5, from which the current finds circuit to station A' and through

the ground branch 4 to earth, ringing the bell at that station. It also applies one pole of battery k to the line conductor 7, whereby a current is produced through relay p , reaching earth through the ground branch 6 at station A^2 , which excites the relay and breaks the conductor 15, leading to earth from line-wire 5 in the central office. Having transmitted the specialized call to call the desired station, the operator releases the key g' . A circuit exists from battery k through a portion of conductor 10 of the plug-circuit, including the supervisory relay m' , to line-wire 5 and thence through the ground conductor 4 at station A' ; but as soon as the relay p becomes inert a short circuit is formed from battery k through wire 15 to the line-wire 5 in shunt of relay m' , whereby the latter is deprived of current and caused to maintain the break in the shunt about signal n' . Hence the supervisory signal n' remains lighted to show that the called party has not responded. The taking of the telephone at station A' in response to a call closes a bridge of the circuit at that station, whereby current is permitted to flow over line-wire 5 through the bridge, including the telephones at station A' , returning through line-wire 7, including the magnet of relay p , through a portion of conductor 9 of the plug-circuit, to earth in the central office. This current excites the relay p , which breaks the short circuit 15 and diverts current through the relay m' . This latter appliance, becoming excited, closes the shunt about lamp n' , and thus brings about its extinction. The darkening of lamp n' is a signal to the operator that the call to station A' has received attention. It will be apparent that the replacement of the telephone upon the switch at either station, by breaking the bridge closed through the telephone at the station, will deprive the corresponding supervisory relay of current, and thus cause the lighting of the corresponding lamp n or n' , this result being attained directly in the case of the grounded line, but indirectly, through the agency of relay p , in the case of the grounded-metallic-circuit line. The display of both signals may be accepted by the attendant as a call for disconnection. If the calling subscriber had required connection with the station A^2 , the operator would make the connection in the same way; but in the act of ringing the relay p would not be involved. The ringing would be performed by pressing the key g , which would apply a current to line conductor 7, thus ringing the bell a^3 at station A^2 . This alternating current would pass through the shunt about the relay p without exciting the relay, or if the relay were excited it would be of no effect in modifying the ringing-current.

The nature of the controlling device p will be dependent on the nature of the line with which it is associated. Both its character and the means by which it controls the supervisory signal to compensate for the special nature of the line to bring the operation of the super-

visory signals in connection with the line into harmony with their operation in association with other lines may be varied to a considerable extent. In general, the present invention contemplates, broadly, the provision of a device for each line of special nature which responds to some predetermined act at a station of the special line and which in its response controls the supervisory signals to make them operate in the way usual with lines of ordinary character.

The invention is defined in the following claims:

1. The combination with telephone-lines, a supervisory signal and means for temporarily associating it with any line, said lines being provided with different instrumentalities at the stations thereof for operating the supervisory signal, of a device in each line of one kind responsive to current of the same line for operating the supervisory signal, and mechanism actuated thereby controlling the supervisory signal to make it operate in the same way as when it is associated with lines of different character, as described.

2. The combination with telephone-lines provided at their substations with different instrumentalities for operating supervisory signals, said lines entering a switchboard, link conductors in the switchboard for uniting any two lines, and supervisory signals associated with the link conductors, said supervisory signals being directly responsive to current for operating them in one class of lines, and a device in each of the other class of lines responsive to the special current therein for operating the supervisory signals, and intermediate mechanism actuated thereby adapted to control the supervisory signal when associated with the same line, whereby the operation of the supervisory signals from all substations is uniform, but is exercised through different agencies, as described.

3. The combination with grounded lines and grounded metallic circuits in the same switchboard, and means at each substation for determining current in the line in the use of the telephone, of a link conductor for uniting any two lines, and a supervisory signal associated with the link conductor adapted to be brought into direct connection with one of the line conductors to be responsive to current therein, an electromagnet permanently connected with the other line conductor of the metallic-circuit line, and mechanism actuated by said magnet to control the supervisory signal; whereby the action of the supervisory signal in connection with grounded lines and grounded metallic lines is uniform, as described.

4. The combination with grounded-circuit and grounded-metallic-circuit telephone-lines entering the same switchboard, each line having a switch at its substation for completing the circuit during the use of the telephone, of a link conductor for uniting lines, a grounded source of current connected with

said link conductor, and supervisory signals in the path of current from said source of current to the line conductors, a magnet permanently connected with the metallic - circuit
 5 line responsive to current therein determined in the completion of a bridge of the line at the station thereof, and circuit connections of said magnet adapted to be completed with the supervisory signal during connection,
 10 controlling the operation of the supervisory signal associated with the line, whereby the operation of the signals is made uniform, as described.

5. The combination with a metallic-circuit
 15 telephone-line with a permanent ground from one conductor thereof, and a telephone-switch at the station adapted to close a bridge of the circuit in the use of the telephone, of a link conductor for uniting lines adapted for connection with said grounded line conductor, a
 20 source of current connected with the link conductor and a supervisory signal in the path of current therefrom to the line, an electromagnet permanently connected with the
 25 other line conductor of said metallic circuit, and a short circuit of said supervisory signal controlled by said electromagnet, as described.

6. The combination with a metallic-circuit telephone-line having a ground branch from
 30 one line conductor and provided with a telephone-switch for closing a bridge of the circuit while the telephone is in use, of link conductors adapted to form temporary extensions of said line conductor, each of said link
 35 conductors being grounded, and a battery in-

cluded in the ground branch from that conductor which is directly connected to the grounded line conductor, a supervisory signal in the path of current from said battery, an electromagnet permanently interposed in
 40 the other line conductor, and a shunt of said signal controlled by said magnet, as described.

7. The combination with a metallic-circuit party telephone-line with call-bells in ground branches from the different limbs thereof at
 45 different stations, and with a telephone-switch at each station for closing a bridge of the line in the use of the telephone, link conductors for extending the line conductors into connection with other lines, a ground branch
 50 from each of said link conductors, a source of current in one of the ground branches, a supervisory signal in the path of current therefrom to one of the line conductors, an electromagnet permanently connected with
 55 the other line conductor, and a shunt of the supervisory signal controlled by said magnet, calling-keys in the link conductors, one for applying calling-current to each of the line-wires, and means controlled by one of said
 60 keys to render said shunt inoperative while calling-current is being sent in the line conductor to which the shunt is applied, as described.

In witness whereof I hereunto subscribe my
 65 name this 11th day of May, A. D. 1898.

FRANK R. McBERTY.

Witnesses:

ELLA EDLER,
 MYRTA F. GREEN.