

No. 768,617.

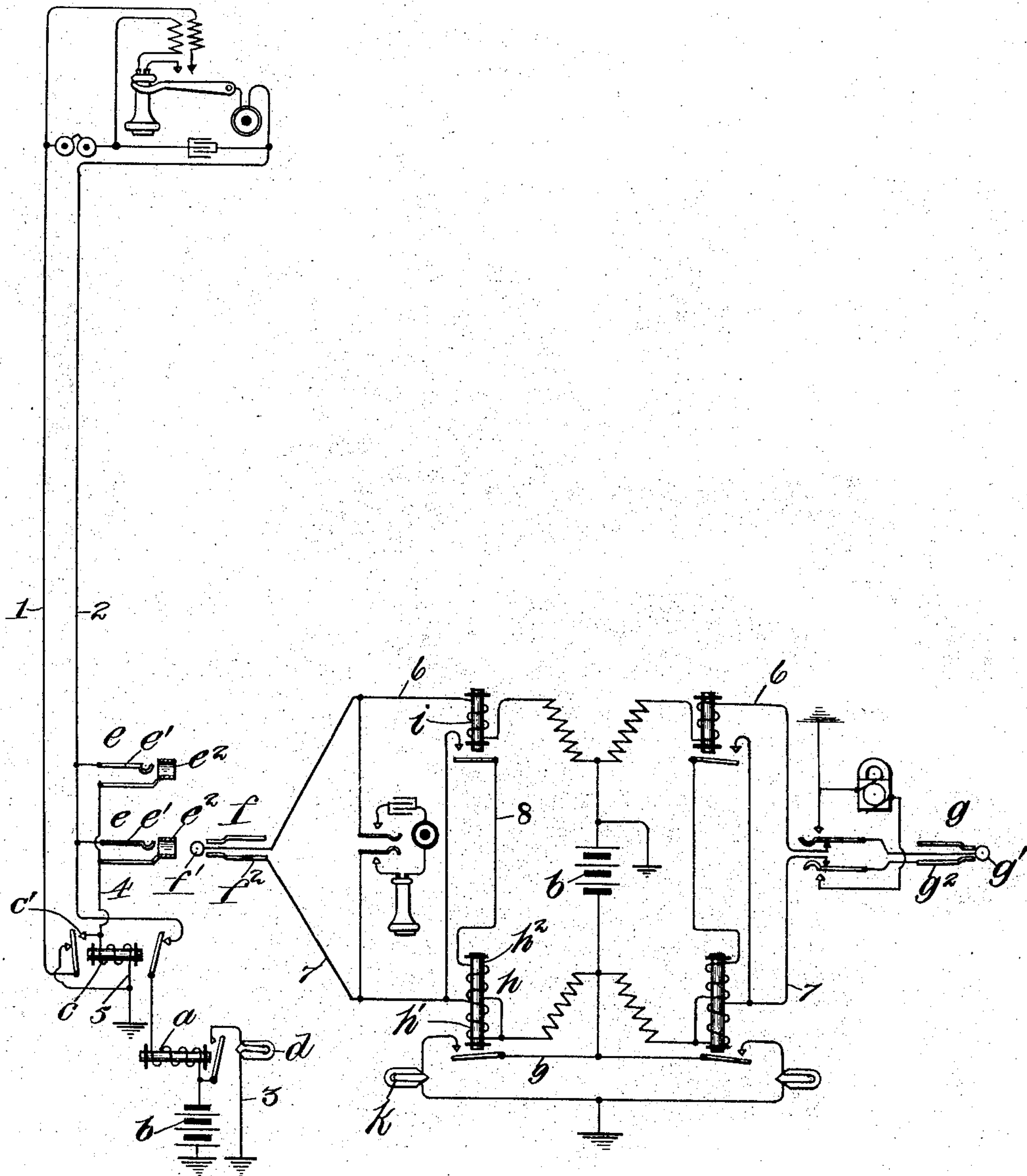
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J. L. McQUARRIE.

SUPERVISORY SIGNAL APPARATUS FOR TELEPHONE SWITCHBOARDS.

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NO MODEL.



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SUPERVISORY SIGNAL APPARATUS FOR TELEPHONE-SWITCHBOARDS.

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To all whom it may concern:

Be it known that I, JAMES L. McQUARRIE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Supervisory Signal Apparatus for Telephone-Switchboards, of which the following is a full, clear, concise, and exact description.

My invention relates particularly to telephone-exchange systems of the class in which the connection-terminals or spring-jacks of the lines are constructed each with only two contact-pieces connected with the two line conductors, respectively, the connecting-plugs being correspondingly provided each with only two contacts, these forming the terminals of link conductors by which lines are temporarily switched together.

The object of the invention is to provide an improved organization of apparatus and circuits for controlling the supervisory signals in systems of this character.

In accordance with my invention a supervisory-signal-controlling magnet is provided in one of the link conductors of the plug-circuit in which a flow of current is produced during connection with a subscriber's line independent of the substation-switch. The excitation of this magnet is, however, subject to the control of another magnet in the other link conductor of the plug-circuit responsive to the substation-switch. The last-mentioned magnet may be arranged to control a branch containing a neutralizing-winding for the signal-magnet, whereby the magnet will be rendered inert during a connection, but will be excited to display a disconnect-signal when the circuit is opened at the substation, as by the replacement of the telephone-receiver on its switch.

I will describe my invention by reference to the accompanying drawing, which is a diagram illustrating a telephone-line extending from a substation to a central office, together with a pair of plugs and a plug-circuit equipped with the improved supervisory apparatus of my invention.

The telephone-line shown in the drawing extends in two conductors 1 2 from the usual substation apparatus to the poles of a grounded central battery *b*. The back contacts of the armature of a cut-off relay *c* control the connection of said conductors with the battery, and the winding of a line-relay *a* is included in the circuit of conductor 2 between a back contact of said cut-off relay *c* and the free pole of battery *b*. Said line-relay is adapted when excited to complete a normally open local circuit 3, containing a line-signal *d*.

Multiple spring-jack terminals *e e* are provided for the line on the several sections of the switchboard, each spring-jack comprising a line-spring *e'* and a thimble or test-ring *e''*. The line-springs *e'* of the several spring-jacks are permanently connected to the limb 2 of the telephone-line, while the thimbles *e''* of said spring-jacks form the terminals of a conductor 4, extending to the front contact *c'* of the cut-off relay. The magnet of the cut-off relay is included in a branch 5, extending to earth from the conductor 4. When the cut-off relay *c* is energized, the circuit of limb 1 to the thimbles *e''* of the spring-jacks *e* is completed at the front contact *c'*.

The operator is provided with a pair of plugs *f g* and a plug-circuit for connecting lines together. Said plugs are provided with tip-contacts *f' g'* and sleeve-contacts *f'' g''*, respectively. The tip and sleeve contacts of each plug are connected to the corresponding contacts of its mate by link conductors 6 7 of the cord-circuit. A battery *b* is connected in a bridge of the plug-circuit between the windings of a repeating-coil in the usual manner. Two batteries (marked *b*) are shown in the drawing; but it will be understood that in accordance with the usual practice a single battery may be employed, connected as indicated.

A supervisory-signal-controlling relay *h* is provided having two differential windings *h' h''* included in parallel branches of the strand 7 of the plug-circuit. The branch 8, containing the winding *h''*, is normally broken at the front contact of a relay *i*, included in the strand 6 of the plug-circuit, said relay being

responsive to the telephone-switch of the line with which plug f may be connected. Said winding h^2 when its circuit is completed by relay i is adapted to neutralize the effect of winding h' , thereby rendering relay h inert. Said relay when excited is arranged to close a local circuit 9, including a supervisory signal k . The windings h' h^2 may be "twin wound," so that the relay will present no appreciable impedance to telephonic currents.

Supervisory apparatus similar to that just described is included in the portion of the plug-circuit between the other plug, g , and said battery b .

The usual listening and ringing keys are provided whereby the operator may connect her telephone in circuit and may transmit call-signals.

The operation of the system is as follows:

The subscriber transmits a call in the usual manner by removing his telephone from its switch, thereby closing the line-circuit 1 2. The line-relay a thus becomes energized and completes the local circuit 3 to display the line-signal d . The operator, observing the signal, inserts plug f in the spring-jack e of the line. This act completes circuit from the free pole of grounded battery b in the plug-circuit, through strand 7, ring-contact f^2 of plug f , thimble e^2 of spring-jack e , conductors 4 5, winding of cut-off relay c , and to ground. The cut-off relay c is thus actuated and draws up its armatures, removing the line-signal apparatus from connection with the line. At the same time the front contact c' of the cut-off relay is closed, thereby completing the circuit of limb 1 to the free pole of battery b . A complete metallic circuit may now be traced from the positive pole of battery b , through strand 6 of the plug-circuit, tip f' of plug f , line-spring e' of spring-jack e , limb 2 of the telephone-line, through the substation apparatus, and back over line conductor 1, contact c' of cut-off relay c , conductor 4, thimble e^2 of spring-jack e , ring f^2 of plug f , sleeve-strand 7, to the negative pole of battery b . The winding of relay i being included in the circuit just traced, said relay becomes energized and draws up its armature, thereby closing the branch 8, including the winding h^2 of relay h . The branch 5 forms a return-path for current from the conductor 7 independent of the telephone-switch at the substation of the line, so that a local circuit will be provided for current through the winding h' of relay h as long as connection is made with the line whether the substation-telephone is in use or not. Both windings h' h^2 of relay h are now included in the battery-circuit; but the effects of the currents in these two windings neutralize one another, and the relay remains inert, thus maintaining the local circuit 9, containing the supervisory signal k , open. When upon the termination of conversation the subscriber replaces the

telephone upon its switch, the circuit through the winding of relay i is broken, thus opening the branch 8, containing the winding h^2 . The neutralizing effect of winding h^2 being thus removed and winding h' being directly included in the circuit 7 4 5, previously traced, said relay h becomes excited, drawing up its armature and completing the local circuit 9, containing the supervisory signal k . This constitutes a signal to the operator that the conversation is finished, and she thereupon takes down the connection.

Having thus described my invention, I claim—

1. The combination with a telephone-line and a substation-switch controlling the line-circuit, of a connection-terminal for the line having two line-contact pieces, a pair of link conductors and a switch-terminal therefor having two corresponding contact-pieces adapted for engagement with the said line-contacts, respectively, a source of current, a signal-controlling magnet in one of said link conductors, a branch adapted to complete a circuit for said magnet independent of the substation-switch, and means controlled by said telephone-switch for rendering said magnet inert.

2. The combination with a telephone-line and a switch at the substation thereof controlling its circuit, of a spring-jack for the line at the central office, having two terminal contacts, a corresponding plug and plug-circuit for making connection therewith, a source of current in a bridge of the plug-circuit, a supervisory-signal-controlling magnet having two differential windings in parallel branches of one of the plug-circuit conductors, a branch from the corresponding line conductor adapted to complete a local circuit independent of the substation-switch, and a supervisory relay in the other conductor of the plug-circuit, having switch-contacts arranged to control the flow of current through one of the differential windings of said signal-controlling magnet.

3. The combination with a telephone-line and a switch controlling its circuit, a spring-jack for the line, a plug and plug-circuit, a battery in a bridge of the plug-circuit, a relay having a winding included in one strand of the plug-circuit, a branch from the corresponding line conductor adapted to complete a circuit of said battery through said winding when connection is made with a line, a subsidiary signal in a local circuit controlled by said relay, a supervisory relay included in the other strand of said cord-circuit responsive to the substation-switch, and means controlled by said supervisory relay for rendering the first-mentioned relay inert.

4. The combination with a metallic-circuit telephone-line extending from a substation to a central office, of a source of current in a bridge of the circuit at the central office, a

5 signal-controlling magnet having a winding included in one of the limbs of the line at the central office, a branch from said limb of the line adapted to complete a local circuit to energize said magnet, a switch at the substation controlling the circuit between the limbs of the line, a relay included in the other limb at the central office, and a differential winding for said signal-magnet included in the circuit

of the first-mentioned limb when the said relay is actuated, whereby the signal-controlling magnet is neutralized and rendered inert.

In witness whereof I hereunto subscribe my name this 6th day of June, A. D. 1903.

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Witnesses:

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