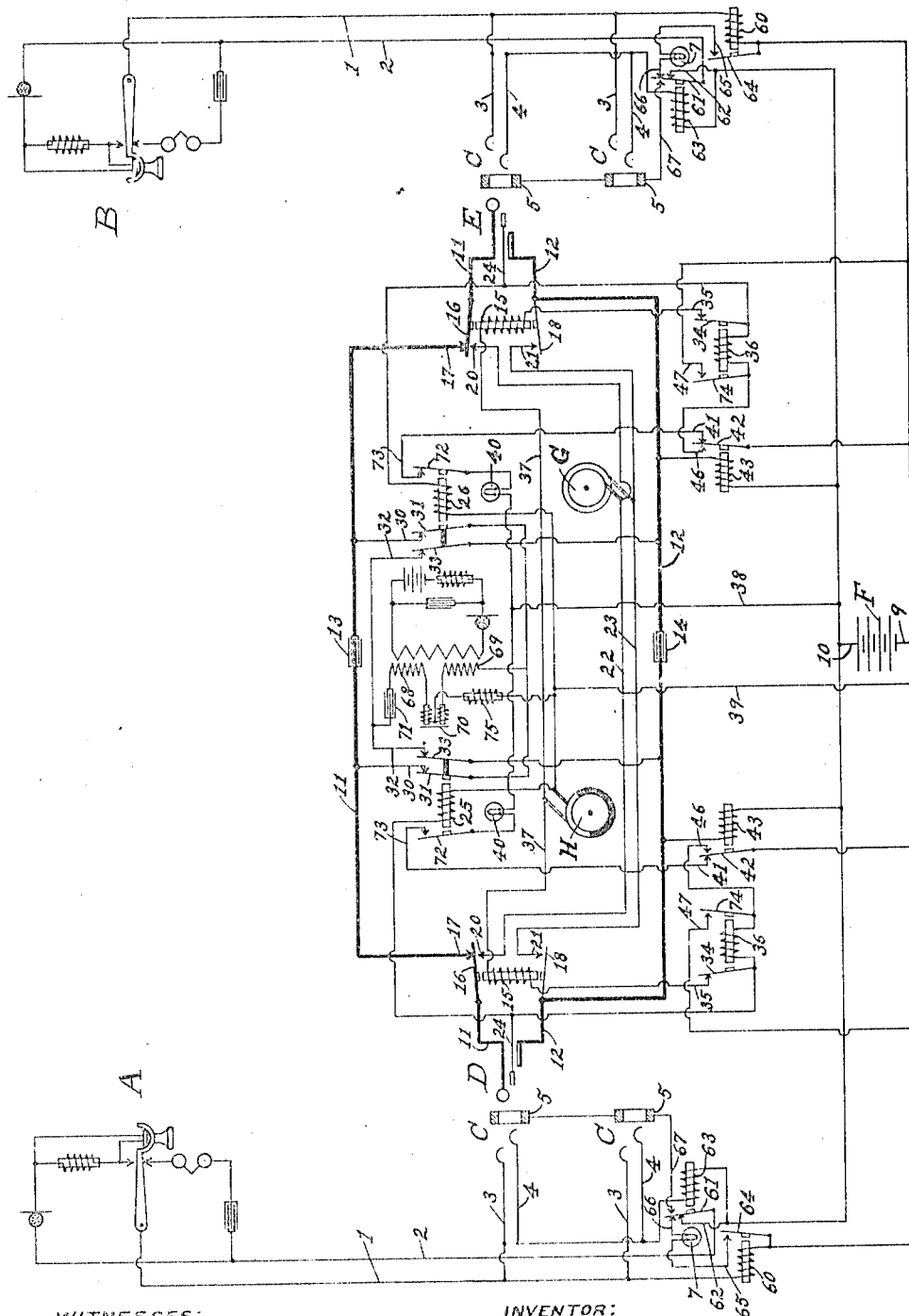


E. R. CORWIN.
TELEPHONE SYSTEM.

APPLICATION FILED FEB. 20, 1908. RENEWED MAY 4, 1911.

1,040,630.

Patented Oct. 8, 1912.



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TELEPHONE SYSTEM.

1,040,630.

Specification of Letters Patent.

Patented Oct. 8, 1912.

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To all whom it may concern:

Be it known that I, ELMER R. CORWIN, a citizen of the United States of America, residing at Chicago, in Cook county, Illinois, have invented a new and useful Telephone System, of which the following is a specification, reference being had to the accompanying drawing, illustrating same.

My invention relates to telephone systems and deals principally with the signaling in such systems.

The principal objects of my invention are to provide an improved automatic-ringing arrangement for multiple telephone systems; to provide improved means for controlling the line signals in such systems; to provide improved means for controlling the supervisory signals in such systems; and to provide improved means for automatically controlling the operator's circuit in connection with the plug-cord connecting circuits for such systems.

Other objects will be apparent from the following specification.

In this invention I supply a ringing relay and an operator's disconnecting relay, both associated with a plug of the plug-cord connecting circuit, with current from a line connection extending through a third conductor of the cord, plug and any one of a plurality of line jacks, for operating the said relays when connection is made with the line. Then I provide a locking relay in the plug-cord circuit and supply this relay with current through the said line connection when the subscriber removes his receiver from the switch-hook while connection is made with the line, to cause the latter said relay to lock the ringing relay in a non-ringing position until the connecting plug is removed from the line jack. The operator's disconnecting relay in addition to controlling the operator's circuit also helps control a supervisory signal. I also provide a supervisory relay associated with the said plug of the plug-cord circuit, for partially controlling the supervisory signal, and a line relay, through both of which relays the subscriber's line is supplied with current for talking purposes during conversation. The supervisory relay in addition to controlling the supervisory signal also places the locking relay in

locked position when the subscriber removes his receiver from the switch-hook while connection is made with the line.

I preferably provide each of the pair of plugs in a plug-cord connecting circuit with all of the relays above mentioned, to provide automatic ringing for each of the plugs and to properly control the operator's circuit and supervisory signals, as will be hereinafter described, but I wish it to be understood that I may do away with the ringing relay and the locking relay associated with one of the plugs, if it is desired to ring out over only one plug of the pair.

I will now describe my invention more in detail, by reference to the accompanying drawing which illustrates two subscribers' telephone lines and the plug-cord connecting circuit therefor, the whole being adapted, and provided with apparatus, to carry out my present invention.

In the drawings the lines A and B are each provided with a substation at which the circuit of the line is closed when the receiver is removed from the switch-hook, in the usual manner, the circuit of the line being open when the receiver is hung upon the switch-hook.

Limb 1 of each line extends to terminals 3 3 of line spring-jacks C C, in multiple, and also through a line relay 60 to pole 9 of a central battery F. Limb 2 of each line extends through a normally closed contact 61—62 of a cut-off relay 63 to pole 10 of battery F. Relay 63 is connected from pole 10 of battery F to terminals 4 4 of the jacks C C, in multiple. When relay 60 is energized it closes contact 64—65 in the circuit of a line lamp 7. When relay 63 is energized it opens contacts 61—62 and 61—66, and closes contact 61—67, contact 61—66 being in the circuit of line lamp 7 and contact 61—67 being in circuit with the terminals 5 5 of the jacks C C, which terminals 5 5 are in multiple.

In the plug-cord connecting circuit the talking strands 11 and 12 of each plug D and E are connected together through condensers 13 and 14, respectively. Each plug D and E has a ringing relay 15 associated therewith to control suitable contacts. When either of the relays 15 is energized, spring

members 16 and 18 thereof are caused to engage contacts 20 and 21, respectively, which are connected through conductors 22 and 23, respectively, to a ringing generator G, spring member 16 also disengaging contact 17.

Each of the plugs D and E is provided with a third strand or conductor 24 adapted to furnish a connection through any one of the several jack-springs 4 4 when the plug is connected with a line jack, to furnish current supply for operating the several relays in the plug-cord circuit. A pair of operator's disconnect relays 25 and 26 are connected from the respective strands 24 24 of the plugs D and E, to pole 9 of battery F, such connections causing these relays to become energized when their respective plugs are connected with line jacks. The secondary 68 69 of an operator's induction coil, an operator's receiver 70, and a condenser 71, are bridged from talking strand 11, on opposite sides of condenser 13, to talking strand 12, on opposite sides of condenser 14, preferably as shown, through normally-closed contacts 30—31 and 32—33 of each of the relays 25 and 26, in multiple, so that the operator's set will be entirely disconnected from the talking strands 11 and 12 of the cord circuit when both of the relays 25 and 26 are energized.

An impedance coil 75 is connected from between the magnet coils of the receiver 70, through conductor 39 to pole 9 of battery F. This coil 75 is to enable a busy-test to be made as hereinafter described, and as claimed in my copending application for Letters Patent on busy test for telephone systems, Serial No. 416,857, filed herewith.

The arrangement of the operator's relays 25 and 26 is practically the same as in my copending application for Letters Patent on telephone system, Serial No. 414,078, but in addition to controlling the operator's circuit these relays are in this present invention also arranged to control the supervisory signals as will be hereinafter described. When either of the relays 25 or 26 is energized it closes a contact 72—73 in the corresponding supervisory signal circuit.

To each strand 24 of the plugs D and E is connected the corresponding ringing relay 15, through a normally-closed contact 34—35 of a locking relay 36, the circuit from each ringing relay 15 extending through conductor 37, rotary intermittent circuit-closer H, and conductor 39, to pole 9 of battery F. Each supervisory lamp 40 is connected through conductor 38 to pole 10 of battery F.

From talking strand 12, on opposite sides of condenser 14, are connected a pair of supervisory relays 43 43, to pole 10 of battery F. When either of the supervisory relays 43 43 is energized it causes spring

member 42 thereof to disengage contact 41 and to engage contact 46 which leads to the winding of the corresponding locking relay 36. Thus in addition to controlling the supervisory signals, the relays 43 43 are also arranged to control the circuits of the respective locking relays 36 36. When either of the locking relays 36 36 is energized it causes spring member 34 thereof to disengage contact 35, and spring member 74 to engage contact 47, spring member 34 being connected to the corresponding strand 24 and contact 47 being connected to pole 9 of battery F.

The operation of the system is as follows: When a party at substation A desires to make a call, he lifts his telephone receiver from the switch-hook in the usual manner, which closes the circuit between limbs 1 and 2 of his line and thereby closes a circuit from pole 9 of battery F, through his line relay 60, line A, and contact 61—62, to pole 10 of battery F. Current from battery F flowing through this circuit energizes line relay 60 and thereby causes same to close contact 64—65 which bridges the line lamp 7 through contacts 66—61—62 across battery F. Current from battery F now flowing through line lamp 7 lights this lamp which signals the operator at the central station for a connection, whereupon the operator inserts one of the plugs D or E into a jack C of line A to answer the call. The plug contacts 11, 12 and 24 now engage jack terminals 3, 5 and 4, respectively, thereby closing a number of circuits through battery F, which circuits will now be traced and explained as follows:

First. From pole 9 of battery F, through conductor 39, one of the operator's disconnect relays 25 or 26 (say 25), strand 24 of the connected plug, a jack-spring 4, and cut-off relay 63, to pole 10 of battery F. Current from battery F flowing through this circuit energizes relay 25 and thereby causes its armature to be attracted and to open contacts 30—31 and 32—33 and close contact 72—73. Although contacts 30—31 and 32—33 of relay 25 are now open, the operator's telephone set is still bridged across the plug-cord talking circuit from talking strand 11, through contacts 30—31 and 32—33 of relay 26, to talking strand 12. Contact 72—73 being closed does not cause the supervisory lamp 40 associated therewith to light, because contact 41—42 is simultaneously opened as will be hereinafter described. The current now flowing in circuit 39, 25, 24, 4, 63, also energizes the cut-off relay 63 and thereby causes its armature to be attracted and to open contacts 61—62 and 61—66 and close contact 61—67. Contact 61—66 being open extinguishes line lamp 7. Contact 61—62 being open disconnects pole 10 of battery F from limb 2 of

line A. Contact 61—67 being closed connects limb 2 of line A to the several line-jack terminals 5 5.

Second. From pole 10 of battery F through supervisory relay 43 on the connected-plug side of the cord-circuit, strand 12, a jack terminal 5, contact 67—61, line A, and line relay 60, to pole 9 of battery F. Current from battery F flowing through this circuit energizes relay 43 and thereby causes its armature to be attracted and to open contact 41—42 and close contact 42—46. Contact 41—42 now being open prevents the supervisory lamp 40 associated therewith from displaying a signal. Contact 42—46 being closed closes a circuit from pole 9 of battery F, through contact 42—46, locking relay 36, strand 24 of the connected plug, a jack terminal 4, and cut-off relay 63, to pole 10 of battery F. Current from battery F flowing through this latter circuit energizes relay 36 and thereby causes its armatures to be attracted and to open contact 34—35 and close contact 74—47, respectively. Contact 34—35 now being open prevents ringing relay 15 from becoming energized. Contact 74—47 being closed closes a circuit from pole 9 of battery F, through contact 47—74, relay 36, strand 24, jack terminal 4, and cut-off relay 63, to pole 10 of battery F. Current from battery F flowing through this latter circuit will keep relay 36 energized and its armatures attracted, even if contact 42—46 is opened, contacts 47—74 and 42—46 being in multiple in the circuit of relay 36. Thus the armatures of relay 36 are locked in attracted position until the connecting plug is removed from the line jack C.

The operator now receives from the party at substation A, instructions to connect his line for conversation with substation B, whereupon the operator takes the idle connecting plug of the pair and tests line B to ascertain whether it is busy or not, as will now be described.

In making the busy test on line B the operator merely touches the tip contact of the idle connecting plug against a terminal 5 of a jack C of line B, in the usual manner. If line B is idle the jack terminals 5 5 will all be disconnected from the battery F at contact 67—61 which is then open, so that the testing plug will be unable to close any complete circuit, by its tip being touched against one of the jack terminals 5 5, to give a signal to the operator. If line B is busy, the jack terminals 5 5 thereof will be connected to pole 10 of battery F, through a circuit similar to the circuit including a supervisory relay 43 and strand 12, established by some other connecting plug in the system. Under this latter condition the operator in making the busy test closes a circuit from a jack terminal 5 of line B, which is connected to pole 10 of battery F as above described,

through tip strand 11 of the testing plug, contact 30—31 of relay 26, a portion 69 of the secondary of the operator's induction coil, a portion of the winding of the operator's receiver 70, impedance coil 75, and conductor 39, to pole 9 of battery F. When the operator touches the tip of the testing plug against the ring or sleeve 5 of a jack of line B, an impulse of current from battery F flows through the last-described circuit and thereby produces a "click" in the operator's receiver 70 which indicates to her that line B is busy, or in use. The loudness of the operator's busy click can be regulated by regulating the resistance of the coil 75.

Assuming that the line B is not in use, the operator inserts the idle connecting plug of the pair into a line jack C of line B, thereby closing a number of circuits through battery F which circuits will now be traced and explained as follows:

First. From pole 9 of battery F through conductor 39, the operator's disconnect relay 26, strand 24 of the calling plug, a jack-spring 4 of line B, and cut-off relay 63, to pole 10 of battery F. Current from battery F flowing through this circuit energizes relay 26 and thereby causes its armatures to be attracted and to open contacts 30—31 and 32—33, and close contact 72—73. Now the operator's telephone set is entirely cut off from the talking strands 11 and 12 of the plug-cord circuit. Contact 72—73 being closed closes a circuit from pole 10 of battery F, through conductor 38, supervisory lamp 40 which is associated with relay 26, contact 72—73 of relay 26, and contact 41—42 of supervisory relay 43 which is associated with the calling plug, to pole 9 of battery F. Current from battery F flowing through this circuit lights the supervisory lamp 40 which shows to the operator that the circuit of line B is open. The current now flowing in circuit 39, 26, 24, 4, 63, also energizes the cut-off relay 63 of line B and thereby causes its armature to be attracted and to open contacts 61—62 and 61—66 and close contact 61—67. Contact 61—66 being open prevents line lamp 7 from displaying a signal when the circuit of the line is closed. Contact 61—62 being open disconnects pole 10 of battery F from limb 2 of line B. Contact 61—67 being closed connects limb 2 of line B to the several line-jack terminals 5 5.

Second. From pole 9 of battery F through conductor 39, intermittent circuit-closer H, conductor 37, ringing relay 15 associated with the calling plug, contact 35—34 of locking relay 36, strand 24 of the calling plug, a jack-spring 4 of line B, and cut-off relay 63, to pole 10 of battery F. Current from battery F flowing through this circuit, when the circuit-closer H closes the circuit, energizes ringing relay 15 and thereby causes its armatures to be attracted and to

close contacts 16—20 and 18—21, respectively, armature 16 also opening contact 16—17. While the ringing relay 15 is energized, a circuit is closed from ringing generator G, through conductor 22, contact 20—16 of ringing relay 15 which is associated with the calling plug, strand 11, jack-spring 3, limb 1 of line B, the ringer and condenser at substation B, limb 2 of line B, contact 61—67 of relay 63, jack-terminal 5, strand 12 of the calling plug, contact 18—21 of ringing relay 15, and conductor 23, back to the generator G. Current flowing from the generator G through this circuit rings the ringer at substation B and thereby signals the party at this telephone. The ringer at substation B is rung intermittently, due to the fact that the ringing generator circuit over line B is closed intermittently by ringing relay 15 which is energized intermittently from battery F through the intermittent circuit-closer H.

It will be seen that the ringing relay 15 connects the source of ringing current G direct to the cord strands and line, without causing the ringing current to traverse any coils or other resistances or impedances at the central station which would hinder its flow somewhat. It will also be seen that the ringing relay 15 primarily controls the application of ringing current to the line, and that the interrupter H primarily controls the circuit of the ringing relay 15, when connection is made with a line.

When the party at substation B answers his call and lifts his receiver from the switch-hook, he closes the circuit between limbs 1 and 2 of his line and thereby closes a circuit from pole 10 of battery F, through supervisory relay 43 which is associated with the calling plug, strand 12, jack-terminal 5 of line B, contact 67—61 of relay 63, line B, and line relay 60, to pole 9 of battery F. Current from battery F flowing through this circuit energizes relay 43 and thereby causes its armature to be attracted and to open contact 41—42 and close contact 42—46. Contact 41—42 being open extinguishes lamp 40 which indicates to the operator that the party at substation B has answered his call. Contact 42—46 being closed closes a circuit from pole 9 of battery F, through contact 42—46, locking relay 36, strand 24 of the calling plug, jack-spring 4, and relay 63, to pole 10 of battery F. Current from battery F flowing through this circuit energizes relay 36 and thereby causes its armatures to be attracted and to open contact 34—35 and close contact 74—47, respectively. Contact 34—35 being open renders ringing relay 15 incapable of further operation and thereby stops the ringing over line B. Contact 74—47 being closed closes a circuit from pole 9 of battery F, through contact 47—74, locking relay 36, strand 24 of the calling

plug, jack-spring 4 of line B, and relay 63, to pole 10 of battery F. Current from battery F flowing through this latter circuit will keep relay 36 energized and its armatures attracted, even if contact 42—46 is opened, contacts 47—74 and 42—46 being in multiple in the circuit of relay 36. Thus the armatures of relay 36 are locked in attracted position until the connecting plug associated therewith is removed from the line jack C. Now the parties at substations A and B are connected for conversation with each other, over limbs 1 and 2 of their lines and talking strands 11 and 12 of the plug-cord circuit. When the conversation is completed, the party at substation A hangs his receiver upon the switch-hook, which breaks the circuit of his line in a manner well understood and thereby stops the flow of current through the supervisory relay 43 which is associated with line A. This supervisory relay 43 is now deenergized whereupon the armature thereof releases and closes the back contact 42—41 which closes a circuit from pole 9 of battery F, through contact 42—41, contact 73—72, supervisory lamp 40 which is associated with line A, and conductor 38, to pole 10 of battery F. Current flowing from battery F through this latter circuit causes the supervisory lamp 40 to light and thereby convey to the operator the signal for disconnection of line A.

The party at substation B by hanging his receiver upon the switch-hook, controls circuits and gives his disconnect signal to the operator the same as just described in connection with line A. Now the operator, having received both disconnect signals from substations A and B, withdraws the connection plugs D and E from the line jacks and thereby opens the circuits of the locking relays 36 36 and the operator's disconnect relays 25 26, over the line connections, thus deenergizing all of the relays 36, 36, 25 and 26 and causing the armatures thereof to release. Relays 36 36 now close contacts 34—35 34—35 in the respective circuits of ringing relays 15 15, but these latter relays are not energized by such contacts being closed because the circuits of the relays 15 15 over the line connections are now open at the connecting plugs. Relays 25 and 26 now open the contacts 72—73 72—73 in the respective supervisory lamp circuits and thereby extinguish the said lamps 40 40. Now all of the circuits and apparatus are restored to normal position and condition preparatory for another cycle of operations as just described. It will be seen that the locking relays 36 36 keep the ringing relays 15 15 from ringing back on the lines after the parties at the substations A and B have hung their receivers upon the switch-hooks and the supervisory relays 43 43 have been deenergized and opened con-

tacts 42—46 42—46 in the first closed paths through the locking relays 36, 36, while connection is still made with the lines, due to contacts 47—74 47—74 being closed.

5 Attention is called to my two co-pending applications Serial No. 590,384, filed November 2, 1910, and Serial No. 644,042, filed August 14, 1911.

10 I do not wish to limit this invention to all of the particular details of construction, or to the particular types of apparatus, herein shown, as many modifications may be made therein without departing from the scope of the appended claims.

15 What I claim as my invention is:

1. A telephone line extending to a connection terminal at a central station, a relay associated with the line for controlling a signal, a suitable signal to be controlled, a
20 connecting circuit for the line, a source of ringing current associated with the connecting circuit, a ringing relay associated with the connecting circuit for connecting the said source of ringing current in circuit
25 with a portion of the connecting circuit and the line when connection is made with the line, a supervisory relay associated with the connecting circuit and adapted to be operated by current over the line when connection
30 is made with the line and the latter is in use, a locking relay under control of the supervisory relay, a contact in circuit with the ringing relay and controlled by the locking relay, and means for supplying the
35 ringing relay with current over a line connection through the first mentioned relay and the said contact of the locking relay, for operating the ringing relay, when connection is made with the line, the ringing relay
40 being rendered incapable of operation by the locking relay when the latter is energized by the operation of the supervisory relay which is in turn energized by current over the line when connection is made with the line and the latter is in use.

2. A telephone line extending to a plurality of connection terminals at a central station, a relay associated with the line for controlling a signal, a suitable signal to be controlled, a connecting circuit for the line,
50 a source of ringing current associated with the connecting circuit, a ringing relay associated with the connecting circuit for connecting the said source of ringing current in circuit with a portion of the connecting circuit and the line when connection is made
55 with the line, a supervisory relay associated with the connecting circuit and adapted to be operated by current over the line when connection is made with the line and the latter is in use, a locking relay under control of the supervisory relay, a contact in circuit with the ringing relay and controlled by the locking relay, and means for
60 supplying the ringing relay with current

over a line connection through the first mentioned relay and the said contact of the locking relay, for operating the ringing relay, when connection is made with any one of the said line connection terminals, the
70 ringing relay being rendered incapable of operation by the locking relay when the latter is energized by the operation of the supervisory relay which is in turn energized by current over the line when connection is
75 made with the line and the latter is in use.

3. A telephone line extending to a connection terminal at a central station, a relay associated with the line for controlling a signal, a suitable signal to be controlled, a
80 connecting circuit for the line, a source of ringing current associated with the connecting circuit, a ringing relay associated with the connecting circuit for connecting the said source of ringing current in circuit
85 with a portion of the said connecting circuit and the line when connection is made with the line, a source of direct current and an intermittent circuit-closer in circuit with the ringing relay, a supervisory relay associated with the connecting circuit and adapted to be operated by current over the line when connection is made with the line and the latter is in use, a locking relay under control of the supervisory relay, a contact in circuit with the ringing relay and controlled by the locking relay, and means for supplying the ringing relay with current over a line connection through the first mentioned relay and the said contact of the locking relay,
100 for operating the ringing relay, when connection is made with the line, the said intermittent circuit-closer operating the ringing relay intermittently, the ringing relay being rendered incapable of operation by the locking
105 relay when the latter is energized by the operation of the supervisory relay which is in turn energized by current over the line when connection is made with the line and the latter is in use.

4. A telephone line extending to a plurality of connection terminals at a central station, a relay associated with the line for controlling a signal, a suitable signal to be controlled, a connecting circuit for the line,
115 a source of ringing current associated with the connecting circuit, a ringing relay associated with the connecting circuit for connecting the said source of ringing current in circuit with a portion of the connecting circuit and the line when connection is made with the line, a source of direct current and an intermittent circuit-closer in circuit with the ringing relay, a supervisory relay associated with the connecting circuit and adapted to be operated by current over the line when connection is made with the line and the latter is in use, a locking relay under control of the supervisory relay, a contact in circuit with the ringing relay and
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controlled by the locking relay, and means for supplying the ringing relay with current over a line connection through the first mentioned relay and the said contact of the locking relay, for operating the ringing relay, when connection is made with any one of the said line connection terminals, the said intermittent circuit-closer operating the ringing relay intermittently, the ringing relay being rendered incapable of operation by the locking relay when the latter is energized by the operation of the supervisory relay which is in turn energized by current over the line when connection is made with the line and the latter is in use.

5. A metallic telephone line extending to a connection terminal at a central station, a relay associated with the line for controlling a signal, a suitable signal to be controlled, a connecting circuit for the line, said connecting circuit having a metallic talking circuit extending therethrough and adapted to be connected in circuit with the metallic line, a source of ringing current associated with the connecting circuit, a ringing relay associated with the connecting circuit for connecting the said source of ringing current in circuit with a portion of the said metallic talking circuit and the metallic line when connection is made with the line, a supervisory relay connected to a strand of the said metallic talking circuit and adapted to be operated by current over the line when connection is made with the line and the latter is in use, a locking relay under control of the supervisory relay, a contact in circuit with the ringing relay and controlled by the locking relay, a third strand in the connecting circuit connected in circuit with the said contact of the locking relay and the ringing relay, and a third contact-member associated with the line connection terminal whereby the ringing relay is supplied with current through the first mentioned relay, the said third strand of the connecting circuit and the said contact of the locking relay, to operate the first mentioned relay and the ringing relay, when connection is made with the line, the ringing relay being rendered incapable of operation by the locking relay when the latter is energized by the operation of the supervisory relay which is in turn operated by current over the line when connection is made with the line and the latter is in use.

6. A metallic telephone line extending to a plurality of connection terminals at a central station, a relay associated with the line for controlling a signal, a suitable signal to be controlled, a connecting circuit for the line, said connecting circuit having a metallic talking circuit extending therethrough and adapted to be connected in circuit with the metallic line, a source of ringing current associated with the connecting

circuit, a ringing relay associated with the connecting circuit for connecting the said source of ringing current in circuit with a portion of the said metallic talking circuit and the metallic line when connection is made with the line, a supervisory relay connected to a strand of the said metallic talking circuit and adapted to be operated by current over the line when connection is made with the line and the latter is in use, a locking relay under control of the supervisory relay, a contact in circuit with the ringing relay and controlled by the locking relay, a third strand in the connecting circuit connected in circuit with the said contact of the locking relay and the ringing relay, and a third contact-member associated with each of the said line connection terminals whereby the ringing relay is supplied with current through the first mentioned relay, the said third strand of the connecting circuit and the said contact of the locking relay, to operate the first mentioned relay and the ringing relay, when connection is made with any one of the said line connection terminals, the ringing relay being rendered incapable of operation by the locking relay when the latter is energized by the operation of the supervisory relay which is in turn operated by current over the line when connection is made with the line and the latter is in use.

7. A metallic telephone line extending to a connection terminal at a central station, a relay associated with the line for controlling a signal, a suitable signal to be controlled, a connecting circuit for the line, said connecting circuit having a metallic talking circuit extending therethrough and adapted to be connected in circuit with the metallic line, a source of ringing current associated with the connecting circuit, a ringing relay associated with the connecting circuit for connecting the said source of ringing current in circuit with a portion of the said metallic talking circuit and the line when connection is made with the line, a source of direct current and an intermittent circuit-closer connected in circuit with the ringing relay, a supervisory relay connected to a strand of the said metallic talking circuit and adapted to be operated by current over the line when connection is made with the line and the latter is in use, a locking relay under control of the supervisory relay, a contact in circuit with the ringing relay and controlled by the locking relay, a third strand in the connecting circuit connected in circuit with the said contact of the locking relay, the ringing relay, the intermittent circuit-closer, and the said source of direct current, and a third contact-member associated with the line connection terminal whereby the ringing relay is supplied with current through the said contact of the

locking relay, the said third strand of the connecting circuit, and a line connection including the first mentioned relay, for operating the ringing relay, when connection is made with the line, the intermittent circuit-closer operating the ringing relay intermittently, the ringing relay being rendered incapable of operation by the operation of the locking relay when the latter is energized by the operation of the supervisory relay which is in turn operated by current over the line when connection is made with the line and the latter is in use.

8. A metallic telephone line extending to a plurality of connection terminals at a central station, a relay associated with the line for controlling a signal, a suitable signal to be controlled, a connecting circuit for the line, said connecting circuit having a metallic talking circuit extending there-through and adapted to be connected in circuit with the metallic line, a source of ringing current associated with the connecting circuit, a ringing relay associated with the connecting circuit for connecting the said source of ringing current in circuit with a portion of the said metallic talking circuit and the line when connection is made with the line, a source of direct current and an intermittent circuit-closer connected in circuit with the ringing relay, a supervisory relay connected to a strand of the said metallic talking circuit and adapted to be operated by current over the line when connection is made with the line and the latter is in use, a locking relay under control of the supervisory relay, a contact in circuit with the ringing relay and controlled by the locking relay, a third strand in the connecting circuit connected in circuit with the said contact of the locking relay, the ringing relay, the intermittent circuit-closer, and the said source of direct current, and a third contact-member associated with each of the said line connection terminals whereby the ringing relay is supplied with current through the said contact of the locking relay, the said third strand of the connecting circuit, and a line connection including the first mentioned relay, for operating the ringing relay, when connection is made with any one of the said line connection terminals, the intermittent circuit-closer operating the ringing relay intermittently, the ringing relay being rendered incapable of operation by the operation of the locking relay when the latter is energized by the operation of the supervisory relay which is in turn operated by current over the line when connection is made with the line and the latter is in use.

9. A metallic telephone line extending to a plurality of connection terminals at a central station, a relay associated with the line for controlling a signal, a suitable signal to be controlled, a metallic connecting circuit

for the line, a source of ringing current associated with the connecting circuit, a ringing relay for connecting the source of ringing current in circuit with the metallic connecting circuit when connection is made with the line, a third conductor in the connecting circuit and a third contact-member in each of the said line connection terminals co-operating to supply the ringing relay with current over a line connection through the first mentioned relay when connection is made with any one of the said line connection terminals, an intermittent circuit-closer in circuit with the ringing relay for operating the latter intermittently, a supervisory relay connected with the metallic connecting circuit to be operated by current over the metallic line, a locking relay controlling the circuit of the ringing relay, a supervisory signal under control of the supervisory relay, means whereby the locking relay is initially under control of the supervisory relay so that the latter when operated energizes the locking relay with current over the said third line connection, for operating the locking relay, the latter being provided with means for closing its own circuit through the said third line connection, when operated, whereby it locks itself in operated position until the connecting circuit is disconnected from the line.

10. In a telephone system having lines, a connecting circuit for the lines, a source of ringing current associated with the connecting circuit, a ringing relay associated with the connecting circuit and operated over a circuit including a line connection for connecting the said source of ringing current with the line when connection is made therewith, a locking relay controlling the circuit of the said ringing relay, a supervisory signal, an operator's circuit, a pair of relays controlling the circuit of the supervisory signal, means whereby one of the relays of the pair controls the circuit of the said locking relay, and means whereby the other said relay of the pair controls the operator's circuit.

11. In a telephone system having a plurality of lines, a relay associated with each of the lines for controlling respective signals, suitable signals to be controlled, a connecting circuit for the lines, said connecting circuit terminating in a pair of connecting plugs adapted to be connected with the lines, an operator's telephone set normally connected with the connecting circuit, an operator's disconnect relay for each connecting plug through which the operator's telephone set is connected, in multiple, with the connecting circuit, and means whereby the said operator's disconnect relays are supplied with current over respective line connections through respective relays which are associated with the lines, for operating all of the

said relays, when connection is made between the corresponding connecting plugs and the lines, whereby the operator's telephone set is entirely disconnected from the connecting circuit when both of the said operator's disconnect relays are operated.

12. In a telephone system having a plurality of lines each terminating in a number of connection terminals in multiple, a relay associated with each of the lines for controlling respective signals, suitable signals to be controlled, a connecting circuit for the lines, said connecting circuit terminating in a pair of connecting plugs adapted to be connected with the lines, an operator's telephone set normally connected with the connecting circuit, an operator's disconnect relay for each of the connecting plugs through which the operator's telephone set is connected, in multiple, with the connecting circuit, and means whereby the said operator's disconnect relays are supplied with current over respective line connections through respective relays which are associated with the lines, when connection is made between the corresponding connecting plugs and any of the said line connection terminals of the respective lines, for operating all of the said relays, whereby the operator's telephone set is entirely disconnected from the connecting circuit when both of the said operator's disconnect relays are operated.

13. In a telephone system having a plurality of metallic lines, a relay associated with each of the lines for controlling respective signals, suitable signals to be controlled, a connecting circuit for the lines, said connecting circuit having a metallic talking circuit extending therethrough and terminating in a pair of connecting plugs adapted to be connected with the lines, an operator's telephone set normally bridged across the metallic talking circuit of the connecting circuit, a pair of operator's disconnect relays associated with the respective connecting plugs and through which the operator's telephone set is bridged, in multiple, across the metallic talking circuit of the connecting circuit, a third conductor in each connecting plug, and a third contact-member for each line coöperating with the said third conductors of the connecting plugs, the said operator's relays being connected in circuit with the respective third conductors of the connecting plugs whereby the latter said relays are supplied with current over the respective said third-conductor connections between the corresponding connecting plugs and the lines, through respective relays which are associated with the lines, when connection is made with the lines, for operating all of the said relays, whereby the operator's telephone set is entirely disconnected from both strands of the metallic talking circuit of the connecting

circuit when both of the connecting plugs are connected with respective lines.

14. In a telephone system having a plurality of lines each terminating in a number of connection terminals in multiple, a relay associated with each of the lines for controlling respective signals, suitable signals to be controlled, a connecting circuit for the lines, said connecting circuit having a metallic talking circuit extending therethrough and terminating in a pair of connecting plugs adapted to be connected with the lines, an operator's telephone set normally bridged across the metallic talking circuit of the connecting circuit, a pair of operator's disconnect relays associated with the respective connecting plugs and through which the operator's telephone set is bridged, in multiple, across the metallic talking circuit of the connecting circuit, a third conductor in each connecting plug, and a third contact-member in each of the said connection terminals of the respective lines coöperating with the said third conductors of the connecting plugs, the said operator's relays being connected in circuit with the respective third conductors of the connecting plugs whereby the latter said relays are supplied with current over the respective said third-conductor connections between the corresponding connecting plugs and the lines, through respective relays which are associated with the lines, when connection is made with any of the said connection terminals of the respective lines, for operating all of the said relays, whereby the operator's telephone set is entirely disconnected from both strands of the metallic talking circuit of the connecting circuit when both of the connecting plugs are connected with respective lines.

15. A metallic telephone line extending from a substation to a source of electricity at a central station, a line signal, a line relay included in the said line for operating the line signal, a plurality of connection terminals for the line, having respective contact-members connected in multiple to one limb of the metallic line, and respective sleeve contact members connected together and normally disconnected from the other limb of the metallic line, and a cut-off relay connected with a third contact member of each of the said connection terminals and adapted to render the line signal inoperative without deenergizing the line relay, and to disconnect a limb of the metallic line from the said source and connect the said limb with the said sleeve contact members of the said connection terminals, when connection is made with the line.

16. In a telephone system having lines, a connecting circuit for the lines terminating in a pair of connecting plugs, a supervisory signal for each of the connecting plugs, an

operator's circuit, a pair of relays for each of the supervisory signals for controlling the operation thereof, and means whereby a relay of each pair controls respective multiple connections of the operator's circuit with the connecting circuit, the last mentioned relays being always operated at the time their respective connecting plugs are connected with lines.

17. The combination with a metallic telephone line having a plurality of connection terminals and a relay associated therewith, of a connecting circuit for the line, a source of ringing current associated with the connecting circuit, a ringing relay associated with the connecting circuit whereby the source of ringing current is connected direct with both limbs of the line when connection is made therewith, an interrupter for primarily controlling the circuit of the ringing relay through the first mentioned relay when connection is made with any one of the said line connection terminals, whereby the ringing relay is operated intermittently, a locking relay for controlling the circuit of the ringing relay, and means for operating the locking relay when connection is made with the line and the latter is taken for use.

18. The combination with telephone lines and relays associated therewith, of a connecting circuit for the lines, a source of ringing current, a ringing relay in circuit with a line relay when connection is made with a

line and adapted and arranged to primarily connect the source of ringing current direct with a portion of the connecting circuit and the line whereby all other apparatus is eliminated from the ringing circuit, a locking relay for controlling the circuit of the ringing relay, and means for operating the locking relay when connection is made with a line and the latter is taken for use.

19. The combination with a telephone line having a relay associated therewith, of a connecting circuit therefor, a source of ringing current associated with the connecting circuit, a ringing relay for applying the ringing current to the line when connection is made therewith, means for rendering the ringing relay inactive when connection is made with the line and the latter is taken for use, the ringing relay being operated through the line relay and being arranged to apply the ringing current direct to the line whereby all marginal line resistances employed for operating such systems are done away with.

As inventor of the foregoing I hereunto subscribe my name in the presence of two subscribing witnesses this 17th day of February, 1908.

ELMER R. CORWIN.

Witnesses:

FREDERICK R. PARKER,
FRANK J. RYAN.