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# UNITED STATES PATENT OFFICE

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## TELEPHONE SYSTEM.

1,040,629.

Specification of Letters Patent.

Patented Oct. 8, 1912.

Application filed February 3, 1908, Serial No. 414,078. Renewed August 14, 1911. Serial No. 644,042.

*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 telephone systems; to provide improved means for operating 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, an operator's disconnecting relay, and a supervisory signal, all 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 line jack, for operating the said devices 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. I also provide a supervisory relay for controlling the supervisory signal, and an impedance coil, both associated with the said plug of the plug-cord circuit, through which 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 cir-

cuit 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.

Attention is called to my two co-pending applications Serial No. 590,384, filed November 2, 1910 and Serial No. 625,088, filed May 4, 1911.

In the drawings the lines A and B are each provided with a substation in 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.

The limbs 1 and 2 of each line extend to terminals 3 and 4, respectively, of a spring-jack C. When a plug D or E is inserted into a jack C the spring contact-members 3 and 4 are disengaged from contacts 5 and 6, respectively. Each contact 6 is connected through a line lamp 7 and a common line pilot relay 8 to pole 9 of a common source of electricity F, the opposite pole 10 of source F being grounded. Each spring-contact 5 is connected to ground.

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 contacts 16—17 and 18—19 in the respective talking strands 11 and 12, the said contacts being normally closed. When either of the relays 15 is energized, spring members 16 and 18 are caused to disengage contacts 17 and 19, respectively, and to engage contacts 20 and 21, respectively, contacts 20 and 21 being connected through conductors 22 and 23, respectively, to a ringing generator G.

Each of the plugs D and E is provided with a third strand or conductor 24 adapted to furnish a ground connection through a jack-spring 5 when the plug is connected with a line-jack, to furnish current supply

for operating the several relays and the supervisory signals in the plug-cord circuit. A pair of operator's disconnect relays 25 and 26 are connected from the respective strands 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 of an operator's induction coil, an operator's receiver, and a condenser, are bridged from talking strand 11, on one side of condenser 13, to talking strand 12, on the other side of condenser 14, 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.

The arrangement of the operator's relays 25 and 26, and their function, are the same as in my copending application for Letters Patent on telephone system, Serial No. 349,374, but the means for supplying these relays with current for energizing same is new in this invention.

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, ringing pilot relay 38, and conductor 39, to pole 9 of battery F. Each supervisory lamp 40 is also connected to the corresponding strand 24, through a normally-closed contact 41—42 of a corresponding supervisory relay 43, the circuit from each lamp 40 extending through a supervisory pilot relay 44 to pole 9 of battery F.

From talking strand 11, on opposite sides of condenser 13, are connected a pair of impedance coils 45 to ground. From talking strand 12, on opposite sides of condenser 14, are connected a pair of supervisory relays 43, to pole 9 of battery F. When either of the supervisory relays 43 is energized it causes spring 42 thereof to disengage contact 41 and to engage contact 46 which leads to the winding of the corresponding locking relay 36. When either of the locking relays 36 is energized it causes spring 35 thereof to disengage contact 34 and to engage contact 47, spring 35 being connected to the corresponding strand 24.

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 causes current to flow from pole 9 of battery F, through line pilot relay 8, line lamp 7, contact 6—4, line A, and contact 3—5 to ground. The current

in this circuit causes line lamp 7 to light and also energizes the line pilot relay 8 and thereby causes same to light the line pilot lamp 48 as well understood. The line lamp 7 now signals the operator at the central station for a connection and the operator inserts one of the plugs D or E into the jack C of line A to answer the call. The plug contacts 11, 12 and 24 now engage jack springs 3, 4 and 5, respectively, thereby opening jack contacts 3—5 and 4—6, extinguishing the line lamp 7, deenergizing the line pilot relay 8 and allowing its armature to release, and 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 supervisory relay 43 on the connected-plug side of the cord-circuit, contact 19—18, strand 12, jack-spring 4, line A, jack-spring 3, strand 11, contact 16—17, and impedance coil 45 to ground. 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 from displaying a signal. Contact 42—46 being closed closes a circuit from pole 9 of battery F, through locking relay 36, contact 46—42, strand 24, and jack-spring 5 to ground. Current from battery F flowing through this latter circuit energizes relay 36 and thereby causes its armature to be attracted and open contact 34—35 and close contact 35—47. Contact 34—35 now being open prevents ringing relay 15 from becoming energized. Contacts 35—47 being closed closes a circuit from pole 9 of battery F, through relay 36, contact 47—35, strand 24, and jack-spring 5 to ground. Current from battery F flowing through this latter circuit will keep relay 36 energized and its armature attracted, even if contact 46—42 is opened, contacts 47—35 and 46—42 being in multiple in the circuit of relay 36. Thus the armature of relay 36 is locked in attracted position until the connecting plug is removed from the line jack C.

Second: From pole 9 of battery F, through one of the operator's disconnect relays 25 or 26, (say 25) strand 24 of the connected plug, and jack-spring 5 to ground. Current from battery F flowing through this circuit energizes relay 25 and thereby causes its armatures to be attracted and to open contacts 30—31 and 32—33. 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.

The operator now receives from the party at substation A, instructions to connect his

line for conversation with substation B, whereupon the operator inserts the idle connecting plug of the pair into the line jack C of line B. This insertion of the plug into the jack C of line B closes 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 the operator's disconnect relay 26, strand 24 of the calling plug, and jack-spring 5 of line B, to ground. 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. Now the operator's telephone set is entirely cut off from the talking strands 11 and 12 of the plug-cord circuit.

Second: From pole 9 of battery F through conductor 39, ringing pilot relay 38, intermittent circuit-closer H, conductor 37, ringing relay 15 associated with the calling plug, contact 34—35 of locking relay 36, strand 24 of the calling plug, and jack-spring 5 of line B, to ground. Current from battery F flowing through this circuit when the circuit-closer H closes the circuit, energizes ringing relay 15 intermittently and thereby causes its armatures to be attracted and to open contacts 16—17 and 18—19, respectively, and close contacts 16—20 and 18—21, respectively. 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, jack-spring 4, strand 12, contact 18—21, 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. At the time the ringing relay 15 is energized, the ringing pilot relay 38, being in the same circuit, is also energized and the armature thereof attracted to light the ringing pilot lamp 49 as well understood. It will be seen that the ringing relay 15 connects the source of ringing current G direct with 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.

Third: From pole 9 of battery F through the supervisory pilot relay 44, supervisory lamp 40 which is associated with the calling plug, contact 41—42, strand 24, and jack-spring 5 of line B, to ground. Current from battery F flowing through this circuit light the supervisor lamp 40 which shows to the operator that the circuit of line B is open, and also energizes relay 44 which lights the supervisory pilot lamp 50 in a manner well understood.

When connection is made with line B, jack contacts 3—5 and 4—6 are opened, thereby rendering the line lamp 7 incapable of displaying a signal.

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 9 of battery F, through supervisory relay 43 which is associated with the calling plug, contact 19—18, strand 12, jack-spring 4, line B, jack-spring 3, strand 11, contact 16—17, and impedance coil 45 to ground, when the circuit of ringing relay 15 is opened at the intermittent circuit-closer H. Current from battery F flowing through this circuit, including strands 11 and 12 and line B, 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 opened extinguishes lamp 40 which indicates to the operator that the party at substation B has answered his call, and also de-energizes relay 44 and thereby causes same to extinguish the supervisory pilot lamp 50. Contact 42—46 being closed closes a circuit from pole 9 of battery F, through locking relay 36, contact 46—42, strand 24 of the calling plug, and jack-spring 5 to ground. Current from battery F flowing through this circuit energizes relay 36 and thereby causes its armature to be attracted and to open contact 34—35 and close contact 35—47. Contact 34—35 being opened renders ringing relay 15 incapable of further operation and thereby stops the ringing over line B. Contact 35—47 being closed closes a circuit from pole 9 of battery F, through locking relay 36, contact 47—35, strand 24 of the calling plug, and jack-spring 5 to ground. Current from battery F flowing through this latter circuit will keep relay 36 energized and its armature attracted, even if contact 46—42 is opened, contacts 47—35 and 46—42 being in multiple in the circuit of relay 36. Thus the armature of relay 36 is 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 41—42 which closes a circuit from pole 9 of battery F, through supervisory pilot relay 44, the supervisory lamp 40 which is associated with line A, contact 41—42, strand 24, and spring-contact 5 of the connection terminal of line A, to ground. 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, and also energizes relay 44 and thereby causes same to light the supervisory pilot lamp 50.

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 connecting plugs from the line terminals or 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 circuits of ringing relays 15 15, but these 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. The withdrawal of the connecting plugs from the line terminals also opens the circuits of the supervisory lamps 40 40, and of the supervisory pilot relay 44, over the line connections, and thereby extinguishes the supervisory lamps 40 40 and deenergizes the relay 44 which extinguishes the supervisory pilot lamp 50. 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 relay 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 contacts 42—46 42—46 in the first closed paths through the locking relays 36 36, while connection is still made with the lines.

It will be seen that I have provided a telephone exchange system including telephone lines extending from sub-stations to

an exchange, a cord circuit having two plugs, each of which may be used as an answering plug and each of which may be used as a connecting plug, an operator's telephone, two magnets, one associated with each plug and each, when inert, serving independently of the other to connect the operator's telephone with the cord circuit, and means operated by each plug when taken for use, for effecting the energization of its associate magnet, whereby when both plugs are taken for use, the operator's telephone is cut out of circuit, and when only one plug is taken for use, the operator's telephone remains in circuit.

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.

What I claim as my invention is:

1. A telephone line, a connecting circuit therefor, a source of ringing current, a ringing relay for connecting the source of ringing current with the connecting circuit, a second relay associated with the connecting circuit to be operated by current over the line when connection is made therewith, a single wound locking relay controlling the circuit of the ringing relay and being under control of the said second relay, means whereby the said second relay energizes the locking relay with current over a line connection when the said second relay is operated, and means whereby the said locking relay closes its own circuit when operated and thereby locks itself in operated position until the connecting circuit is disconnected from the line.

2. A telephone line, a connecting circuit therefor, a source of ringing current associated with the connecting circuit, a ringing relay for connecting the source of ringing current with the connecting circuit, a single wound locking relay controlling the circuit of the ringing relay, means for energizing the locking relay with current over a line connection when connection is made with the line, to operate the locking relay, and means whereby the locking relay closes its own circuit through a line connection, when operated, whereby it locks itself in operated position until the connecting circuit is disconnected from the line.

3. A metallic telephone line extending to a connection terminal at a central station, 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, a third conductor in the connecting circuit and a third contact-member in the line connection terminal cooperating to supply

the ringing relay with current over a line connection to operate the said relay, 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 single wound 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 the control of the supervisory relay, means whereby the supervisory relay when operated energizes the locking relay with current over the said third line connection for operating the locking relay, the latter said relay 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.

4. A plurality of telephone lines, 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 relays are supplied with current over respective line connections, for operating the said relays, when connection is made between the corresponding connecting plugs and the lines, whereby the operator's telephone set is disconnected from the connecting circuit when both of the said relays are operated.

5. A plurality of telephone lines, 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 co-operating 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 said relays are supplied with current over the respective said third-conductor connections between the corresponding connecting plugs and the lines, when connection is made with the lines, for operating the said relays whereby the op-

erator'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.

6. The combination with a plurality of telephone lines and a connecting circuit therefor terminating in a pair of connecting plugs, of an operator's telephone set associated with the connecting circuit, a relay associated with each connecting plug, and means independent of the telephone line circuits for energizing each relay through a line jack terminal and a line connection leading to battery, during the time connection is made with the line, the said relays connecting the operator's telephone set with the connecting circuit when at least one of them is deenergized, and disconnecting the operator's telephone set from the connecting circuit when both are energized.

7. A metallic telephone line, 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 metallic line when connection is made therewith, an interrupter for primarily controlling the circuit of the ringing relay when connection is made with the line, 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.

8. The combination with telephone lines, of a connecting circuit for the lines, a source of ringing current, a ringing relay operated over a circuit including a line connection and adapted and arranged to primarily connect the source of ringing current direct with a portion of the connecting circuit and a line, when connection is made with a 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.

9. The combination with telephone lines, of a connecting circuit for the lines, a source of ringing current, means operated over a circuit including a line connection for automatically connecting the source of ringing current direct with a line when connection is made therewith, whereby all other apparatus is eliminated from the ringing circuit, locking mechanism for controlling the said automatic connecting means, and means for operating said locking mechanism when the line is taken for use while connection is made therewith.

10. A telephone system having metallic

lines, a connecting circuit for the lines, a source of ringing current associated with the connecting circuit, ringing mechanism operated over a circuit including a line connection and automatically controlling the application of ringing current direct to both limbs of a metallic line when connection is made therewith, locking mechanism for controlling the said ringing mechanism, and means for operating said locking mechanism when the line is taken for use while connection is made therewith.

11. A telephone exchange system including a plurality of telephone lines, a connecting circuit for the lines terminating in a pair of connecting plugs, an operator's telephone set associated with the connecting circuit, an operator's relay associated with each connecting plug, means independent of the telephone line circuits for energizing each relay through a line jack terminal and a line connection leading to battery, during the time connection is made with the line, the said relays connecting the operator's telephone set with the connecting circuit when at least one of them is deenergized, and disconnecting the operator's telephone set from the connecting circuit when both are energized, a source of signaling current, means for automatically including the source of signaling current in circuit with the signal receiver at the called station, and mechanism for removing the source of signaling current from connection with the line and intermittently brought into association with the line for the purpose.

12. A telephone system having metallic lines, 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, means whereby the said relays are supplied with current over respective line connections, for operating the said relays, when connection is made between the corresponding connecting plugs and the lines, whereby the operator's telephone set is disconnected from the connecting circuit when both of the said relays are operated, a source of ringing current associated with the connecting circuit, ringing mechanism automatically controlling the application of ringing current direct to both limbs of a metallic line when connection is made therewith, locking mechanism for controlling the said ringing mechanism, and

means for operating the said locking mechanism when the line is taken for use while connection is made therewith.

13. A telephone system having metallic lines, a connecting circuit for the lines, a source of ringing current associated with the connecting circuit, a ringing relay operated over a circuit including a line connection and automatically controlling the application of ringing current direct to both limbs of a metallic line when connection is made therewith, a locking relay for controlling the said ringing relay, and means for operating the said locking relay when the line is taken for use while connection is made therewith.

14. A telephone exchange system including telephone lines extending from substations to an exchange, a cord circuit having two plugs, each of which may be used as an answering plug and each of which may be used as a connecting plug, an operator's telephone, two magnets, one associated with each plug and each, when inert, serving independently of the other to connect the operator's telephone with the cord circuit, and means operated by each plug when taken for use, for effecting the energization of its associate magnet, whereby when both plugs are taken for use, the operator's telephone is cut out of circuit, and when only one plug is taken for use, the operator's telephone remains in circuit.

15. A telephone exchange system including telephone lines extending from substations to an exchange, a cord circuit having two plugs, each of which may be used as an answering plug and each of which may be used as a connecting plug, an operator's telephone, two magnets, one associated with each plug and each, when inert, serving independently of the other to connect the operator's telephone with the cord circuit, and means jointly operated by each plug and the line jack with which such plug is engaged, for effecting the energization of its associate magnet, whereby when both plugs are taken for use, the operator's telephone is cut out of circuit, and when only one plug is taken for use, the operator's telephone remains in circuit.

As inventor of the foregoing I hereunto subscribe my name in the presence of two subscribing witnesses, this 30th day of January, 1908.

ELMER R. CORWIN.

Witnesses:

FREDERICK R. PARKER,  
C. C. NEWBURN.