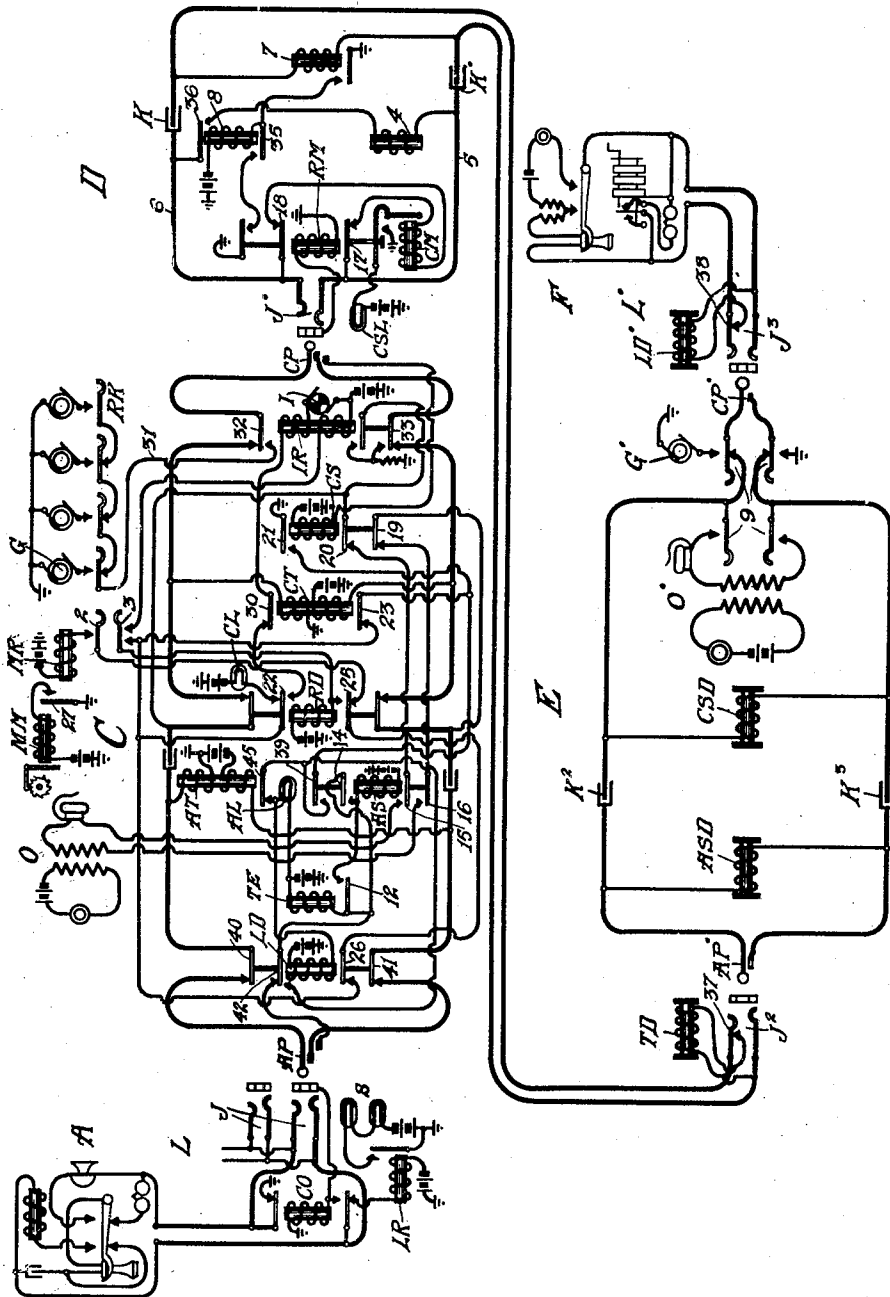


J. E. HILBISH,
TELEPHONE SYSTEM.
APPLICATION FILED APR 12, 1918.

1,337,976.

Patented Apr. 20. 1920.



Inventor:
John E. Hilbish
By Curtis B. Camp.
Attorney

UNITED STATES PATENT OFFICE.

JOHN E. HILBISH, OF LA GRANGE, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

1,337,976.

Specification of Letters Patent.

Patented Apr. 20, 1920.

Original application filed July 16, 1915, Serial No. 40,181. Divided and this application filed April 12, 1918, Serial No. 228,088.

To all whom it may concern:

Be it known that I, JOHN E. HILBISH, a citizen of the United States of America, residing in La Grange, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems and has to do more particularly with systems using link circuits and trunk circuits for use in completing connection between subscribers in the same exchange and between subscribers in different exchanges, and has for its object a novel and improved system of the above type.

One of the features of my invention is the provision of an improved cord circuit in which the moment a ringing key plunger is depressed, ringing current is automatically connected to the circuit connected with the calling end of the link circuit, no matter in what position the interrupter mechanism may be, which mechanism thereafter operates to intermittently apply ringing current to the said circuit. The feature of providing the above-described so-called preliminary ringing insures the proper operation of the trunk circuit apparatus when the cord circuit is used for extending a call to a distant exchange through the medium of a trunk circuit. This application is a divisional application of my application for two-way trunk circuits, filed July 16, 1915, Serial No. 40,181.

For a more complete understanding of my invention, reference may be had to the accompanying drawing in which only sufficient apparatus is shown for connecting the calling subscriber's line at one exchange with a called subscriber's line at a second exchange. The connection is completed through the medium of the calling subscriber's line circuit L, link circuit C at the first exchange, trunk circuit D extending to the second exchange, link circuit E at the second exchange, and called subscriber's line circuit L' at the said second exchange.

Referring now more in detail to the apparatus illustrated, the substation A may be of any well-known or suitable common battery type. The line circuit L comprises the line relay LR, cut-off relay CO, multiple jack J and multiple line lamps S. The line cir-

cuit illustrated is known as a multiple line lamp circuit in which a line lamp is provided for each line jack so that when a call is initiated a lighted lamp appears before each of the multiple line jacks so that any one of a plurality of operators may seize the calling line to the exclusion of the others.

The cord circuit C comprises an answering plug AP and a calling plug CP connected by the heavily marked talking conductors. Upon the initiation of a call, the operator answers by inserting the answering plug AP into a multiple line jack J, causing the energization of the test relay TE which connects an answering sleeve supervisory relay AS in series circuit with the cut-off relay CO of the line circuit L, the relay AS operating to connect the operator's set O to the cord circuit. The answering tip supervisory relay AT is also energized to prevent answering supervisory lamp AL from glowing prematurely. The operator upon learning the wants of the calling subscriber will plug directly into the jack of the called subscriber's line, if the called subscriber's line terminates in the same exchange, or will plug into the jack J' connected to the trunk circuit D, which extends to a second exchange, if the called subscriber's line terminates in the second exchange. Upon the insertion of the calling plug CP into either of said jacks, the calling supervisory relay CS is energized to disconnect the operator's set O from the cord circuit. One of the ringing key plungers of the ringing key RK is then depressed, which connects one of a plurality of generators to the connected line. The common contacts 2 and 3 of the ringing key are also operated when the plunger is in its fully depressed position to close an energizing circuit for ringing disconnect relay RD which in turn closes an energizing circuit for an interrupter relay IR, which is alternately energized and deenergized to intermittently connect ringing current to the connected line. At the same time that the ringing disconnect relay RD is energized, a preliminary energizing circuit is closed through the interrupter relay IR, thereby connecting ringing current to the connected line the instant that the end contacts 2 and 3 are operated. This preliminary circuit is held closed only during the fully depressed position of the ringing key. A meter relay

MR and meter magnet MM are provided and operated when the common contacts are closed to operate the meter to register. A calling tip supervisory relay CT is also provided, which is energized upon the removal of the receiver at the called substation if connection be direct to a called substation or upon the bridging of the impedance 4 across the trunk conductors 5 and 6 if the connection is extended to a second exchange, to disconnect ringing current from the connected line and to efface the calling supervisory lamp CL.

Should the calling subscriber replace his receiver before the called subscriber answers, the link disconnect relay LD is energized which causes the deenergization of the relays RD and RI to interrupt the ringing current, which is being intermittently connected to the line through the medium of the interrupter I. The energization of the link disconnect relay LD also causes the disconnection of the link conductors from the calling line, which causes the restoration of the connected calling line circuit to permit the calling subscriber to immediately recall without awaiting the removal of the answering plug AP from the connected jack J.

The trunk circuit D is a two-way trunk circuit and is used for extending connections between a common battery exchange and a magneto exchange. It comprises a control magnet CM which is bridged across the trunk conductors 5 and 6 and which responds to ringing current to close a self-locking circuit through the call signal lamp CSL. The release magnet RM responds to the insertion of the calling plug CP into jack J' and operates to open the circuit of the control magnet CM and to mechanically restore its armature. The magnet 7 is bridged across the trunk conductors behind the condensers K and K', which conductively unite the strands of the trunk circuit, and responds to generator current from the distant magneto exchange. The magnet 7, upon energizing, closes a circuit through the relay 8, which in turn energizes and bridges the impedance 4 across the trunk conductors. The trunk circuit D terminates in a jack J² and an associated trunk drop TD, in the magneto exchange. The link circuit E comprises an answering plug AP' and a calling plug CP' conductively connected by a pair of condensers K² and K³ and is provided with an answering supervisory drop ASD and a calling supervisory drop CSD. The usual ringing and listening key 9 is provided for connecting the operator's set O' to the strands of the cord circuit or for associating the generator G' with the strands of the calling plug CP'. The subscriber's substation F may be of any improved or suitable type and is

provided with a generator 10 and the usual talking apparatus. The line equipment L' comprises a jack J³ and a line drop LD'.

Having described in general the apparatus used in the preferred embodiment of my invention as herein illustrated, a connection from the calling substation A located in one exchange to the called substation F located in a second exchange, will now be described more in detail.

Assuming now that the subscriber at substation A initiates a call, the line relay LR is energized, closing a circuit for the line signals S. An operator seizes the call by inserting the answering plug AP into one of the multiple jacks J of the calling line. The test relay TE is energized to close its alternate contact 12 which closes a series energizing circuit including relay AS and the cut-off relay CO. The relay AS is now connected to the sleeve conductors of plug AP independent of the contact 12 of the relay TE by way of its alternate contact 14, and operates to connect the operator's set O through its alternate contacts 15 and 16 to the talking strands of the cord circuit. The relay AT is also energized upon the insertion of the plug AP into the multiple jack J and operates to prevent the premature glowing of the supervisory lamp AL. The cut-off relay CO of the line circuit L, upon energizing, disconnects the line relay LR, which effaces the line lamps S. Should a second operator attempt to answer the initiated call, the low wound answering relay AS of the first cord circuit prevents the high resistance relay TE of the second cord circuit from operating due to the shunting effect of the relay AS of the first cord circuit, and the second operator not being able to communicate with the calling subscriber, knows that the initiated call has been seized by another operator and removes her answering plug AP from the multiple jack J. The connected operator now ascertains the wants of the calling subscriber, and assuming that substation F is wanted, which terminates in line equipment at the second exchange, the operator makes the usual preliminary test, and assuming that trunk circuit D is idle, inserts the calling plug CP into the trunk jack J'. The insertion of the calling plug CP into jack J' closes a series energizing circuit including release magnet RM and the calling sleeve supervisory relay CS. Relay RM, upon energizing, opens the circuit of the controlling magnet CM at its contacts 17 and 18. The relay CS, upon energizing, opens its normal contacts 19 and 20, disconnecting the operator's set O from the cord circuit, and closing a circuit for the calling supervisory lamp CL, traced from battery through the said lamp, through normal contact 22 of relay RD, normal contact 23 of relay CT, and

through alternate contact 21 of said relay CS to ground. The operator now depresses a ringing plunger of the ringing key RK to connect ringing current to the strands of the trunk circuit D, thereby throwing the trunk drop in the distant exchange. The ringing plunger, upon being depressed to its fully operated position, also closes the common contacts 2 and 3, but when the plunger assumes its indicating position the same common contacts restore to normal. The closure of alternate contact 2 closes a circuit through meter relay MR traced from battery through the winding of said relay, alternate contact 2, normal contact 25 of relay RD, normal contact 26 of relay LD, normal contact 23 of relay CT, and through alternate contact 21 of relay CS to ground. The meter relay MR, upon energizing, closes its alternate contact 27, thereby closing a circuit through meter magnet MM to step the meter mechanism to register the call. The closure of the common contact 3 closes an energizing circuit through the ringing disconnect relay RD and through the interrupter relay IR, the latter circuit extending from battery through the lower winding of said relay IR, alternate contact 3, normal contact 23 of relay CT, and alternate contact 21 of relay CS to battery, thus causing the relay IR to energize and connect ringing current to the trunk conductors 5 and 6 as long as the ringing plunger is held depressed. The circuit for the ringing disconnect relay RD extends from battery through winding of said relay, alternate contact 3, normal contact 23 of relay CT and alternate contact 21 of relay CS to ground. The ringing disconnect relay, upon energizing, closes a locking circuit for itself through its alternate contact 25 independent of the common contact 3, said circuit extending from battery through said relay RD, its alternate contact 25, normal contact 26 of relay LD, normal contact 23 of relay CT and alternate contact 21 of relay CS to ground. The ringing disconnect relay RD, upon energizing, also disconnects the talking strands of the cord circuit, connecting the plugs AP and CP, and closes an energizing circuit through the interrupter relay IR traced from battery through the interrupter I, upper winding of said relay IR, normal contact 30 of relay CT, alternate contact 22 of relay RD, normal contact 23 of relay CT and alternate contact 21 of relays CS to ground. However, this circuit is only operative to energize the interrupter relay IR when connection is extended directly to the jack of the called subscriber's line. The interrupter relay, upon its first energization, due to the direct closure of alternate contact 3, closed a circuit extending from the selected generator over the common ringing conductor 31, alternate contact 32 of interrupter relay IR, tip conductors of plug CP and jack J', and condenser K. Here the circuit divides, part of the current passing through magnet 7, the rest extending through the trunk drop TD back over the opposite trunk conductor where the circuits again join and extend through the condenser K', sleeve conductors of jack J' and plug CP, alternate contact 33 of relay IR to ground and back to the generator. The relay 7, upon energizing, closes an energizing circuit through the relay 8, which, upon energizing, closes a locking circuit for itself through its alternate contact 35 and bridges impedance 4 across the trunk conductors 5 and 6 through its alternate contact 36. The bridging of the impedance 4 across the trunk conductors closes an energizing circuit through the calling tip supervisory relay CT. This circuit extends from ground through the upper winding of relay CT, normal contact 32 of relay IR, tip conductors of plug CP and jack J', alternate contact 36 of relay 8, impedance 4, ring contacts of jack J' and plug CP, normal contact 33 of relay IR, through the lower winding of said relay CT to battery. The relay CT upon energizing, opens the circuit of the ringing disconnect relay RD at its normal contact 23 and opens the circuit of interrupter relay at its normal contact 30. The closure of the circuit through trunk drop TD causes the said drop to be operated to signal the operator at the second exchange. It has been found essential to close the above-traced preliminary circuit through the interrupter relay IR, before waiting for the interrupter circuit to be closed therethrough, otherwise if the ringing disconnect relay RD should be energized just as the interrupter I is turning from its conductive path to its insulated path, the interrupter relay IR will be energized momentarily and not supply sufficient ringing current to operate the trunk drop at the distant exchange before the relay 7 operates to cause relay 8 to bridge the impedance 4 across the trunk conductors and cause the calling tip supervisory relay to permanently open the circuit of the interrupter relay IR. The preliminary ringing circuit is also a great help when ringing called subscribers direct, as it causes the bell of the called subscriber to be signaled the instant that the plug is inserted into the jack of the said called line and the ringing plunger depressed. The operator at the distant exchange, noting that the trunk drop TD is operated, inserts the answering plug AP' of cord circuit E into the jack J², opening the circuit of the trunk drop TD at contact 37. She then operates the ringing and listening key 9 to connect her telephone set O' across the conductors of the cord circuit E so that she may inquire the

wants of the calling subscriber. Upon learning that the subscriber at substation F is desired, she inserts calling plug CP' into jack J³, thereby disconnecting the line drop LD' by opening normal contact 38. The operator next operates the ringing and listening key in the opposite direction to connect the generator G' across the line of the called subscriber. The called subscriber upon answering may now carry on conversation with the calling subscriber over the heavily marked conductors.

The subscribers at substations A and F, having finished conversation, replace their receivers upon their respective switch hooks, and the subscriber at substation F operates the generator 10 to bridge the ringing current across the called subscriber's line. The replacing of the receiver at substation A opens the energizing circuit of the answering tip supervisory relay AT. The said relay upon deenergizing, closes its normal contact 45, thereby closing a circuit through the answering supervisory lamp AL and link disconnect relay LD, the latter circuit extending from battery through said relay LD, said normal contact 45 of relay AT, alternate contact 39 of relay AS, and alternate contact 21 of relay CS to ground. The relay LD, upon energizing, opens the cord circuit conductors at contacts 40 and 41, and opens the series energizing circuit for the relay CO and AS at its contact 42. However, a substitute circuit is closed for the relay AS before it has had time to deenergize, said circuit extending from battery through the said relays, its alternate contact 14, the alternate contact 42 of relay LD, alternate contact 39 of said relay AS and through the alternate contact 21 of relay CS to ground. Relay CO deenergizing restores the line circuit of the calling line to normal, placing it in condition for an immediate recall so that if the subscriber at substation A again removes his receiver, the line relay LR is energized to light the multiple line signals S so that the same operator or another operator may seize a recall without awaiting the removal of the plug AP. The operator at the link circuit C, noting the glowing of the supervisory lamp AL, removes the calling plug CP from the pack J' and thereby allows the apparatus of the trunk circuit D and of the cord circuit C to return to normal. The operation of the generator 10 at the called substation F operates the calling supervisory drop CSD to notify the operator at the trunk circuit E that conversation has terminated. The operator then removes the calling plug CP' and the answering plug AP' from their respective jacks J³ and J², thereby permitting the remaining apparatus used in the trunking connection to restore to normal.

Now, assuming that a subscriber at the

magneto exchange, for example, a subscriber at substation F, desires a connection with a subscriber at the common battery exchange, the said subscriber F first removes his receiver and then operates the generator 10 to throw the line drop LD'. The operator, upon noting this signal, inserts the answering plug AP' of the link circuit D into jack J³ of the subscriber's line equipment L'. The operator next throws the listening key 9 to connect her telephone O' across the line of the calling subscriber and inquires his wants. The operator, upon learning that a subscriber at the common battery exchange is desired, inserts the calling plug CP' into the jack J² connected to the trunk circuit D and operates the key 9 to bridge the ringing generator G' across the trunk circuit. The relay 7, located at the common battery exchange, in response to this connection of ringing current to the trunk conductors operates to close a circuit through the relay 8. The relay 8 energizes, but its operation is functionless at this time. At the same time that relay 7 is operated, the control magnet CM is also operated due to the bridged ringing current at the magneto exchange. The control magnet, upon operating, closes a circuit through the signal lamp CSL. The operator at the common battery exchange, noting the glowing of the lamp CSL, inserts the answering plug of a cord circuit into the jack J' and inquires the wants of the calling subscriber. This cord circuit may be of any suitable or approved type of three-conductor cord circuit. Upon the insertion of the answering plug into the jack J', the magnet RM is energized and operates to restore the armature of the magnet CM, thereby effacing lamp CSL and removes the winding of the same from across conductors 5 and 6 of the trunk circuit D. The operator then inserts the calling plug into the jack of the called line and signals the called subscriber in the usual manner. After the conversation is finished, the subscriber at substation F operates generator 10 to cause the answering supervisory drop ASD to be operated. The operator at the magneto exchange, upon noting the position of the drop ASD, removes the plugs of the cord circuit E from the jack of the calling line and from the jack J² of the trunk circuit D. The operator at the common battery exchange, upon noting the disconnect signal caused by the called subscriber replacing his receiver, removes the plugs of the cord circuit used in establishing the connection and thereby permits the apparatus of the trunk circuit D and at the called subscriber's line circuit to return to normal.

While I have illustrated the preferred embodiment of my invention in certain specific circuit arrangements, yet it is to be

understood that I do not wish to be limited to the same as many changes and modifications will readily suggest themselves to one skilled in the art. Therefore, I wish to cover all that which comes within the spirit and scope of the appended claims.

What I claim as new, and desire to secure by United States Letters Patent is:

1. A telephone system including subscribers' lines, a link circuit provided with a pair of plug terminals for connecting a calling and a called one of said lines, a ringing control relay provided with a pair of windings, an interrupter device adapted to be included in circuit with one of said windings, a key switch adapted to be included in circuit with the other of said windings, and means controlled by said key switch for first closing a circuit through the second of said windings and for then closing a circuit through the first of said windings.

2. A telephone system including subscribers' telephone lines, a link circuit provided with a pair of plug terminals for connecting a calling and a called one of said lines, a ringing control relay provided with a pair of windings, an interrupter device adapted to be included in circuit with one of said windings, a key switch adapted to be included in circuit with the other of said windings, and means controlled by said key switch for first closing a circuit through the second of said windings and for then closing a circuit through the first of said windings whereby said substation is signaled the instant said key switch is operated and is thereafter intermittently signaled.

3. A telephone system including a called subscriber's line, a link circuit provided with a three-conductor terminal plug for connection to said called line, a ringing control relay for said link circuit provided with a pair of windings, an interrupter device adapted to be included in circuit with one of said windings, a switch device for closing a circuit through the other said windings, and means controlled by said switch device for closing said last circuit and for thereafter including said interrupter device in said first circuit.

4. A telephone system including a called subscriber's line, connecting means including a pair of line contacts and a test contact for connecting said link circuit to said subscriber's line, a ringing control relay provided with a pair of windings, an interrupter device, a switching device, and means controlled by said switching device for closing a circuit through one of said windings, thereby energizing said relay and for subsequently including said interrupter device in circuit with the other of said windings.

5. A telephone system including a called subscriber's line, connecting means including a pair of line contacts and a test contact for connecting said link circuit to said subscriber's line, a ringing control relay provided with a pair of windings, an interrupter device, a switching device, means controlled by said switching device for closing a circuit through one of said windings, thereby energizing said relay and for subsequently including said interrupter device in circuit with the other of said windings, and a source of ringing current adapted to be connected to the called subscriber's line by said ringing control relay to operate the call bell at the called substation.

6. A telephone system including a pair of subscribers' lines, a link circuit for connecting said subscribers' lines, a double wound relay for applying ringing current to one of said subscriber's lines, an initial energizing circuit for said relay including one of its windings, an interrupter, a supervisory relay, and a circuit for the other winding of said first relay including said interrupter and a contact of said supervisory relay.

7. A telephone system including a pair of subscribers' lines, a link circuit for connecting said lines in conversational circuit, ringing means for applying ringing current to one of said subscriber's lines, an operator's switch for initiating the operation of said ringing means and for thereafter connecting intermittently operating means in circuit with said ringing means to intermittently apply ringing current to said subscriber's line, and a supervisory relay controlled over the subscriber's line having a contact in the circuit of said intermittently operating means.

8. A system of the character described, including a pair of subscribers' lines, a link circuit for connecting said lines, a ringer relay for said link circuit, an operator controlled switch for initiating the operation of said ringer relay, an interrupter adapted to thereafter be included in the circuit of said ringer relay, a relay controlled directly over a subscriber's line having a contact in said latter circuit, and subscriber controlled means for energizing said relay to open said circuit.

9. A telephone system including a pair of subscribers' lines, a link circuit for connecting said subscribers' lines, a ringer relay, an operator's switch for closing a circuit for said ringer relay, an interrupter adapted to be afterward included in the circuit of said ringer relay, and a relay controlled directly over the subscriber's line having a contact in said latter circuit.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 10th day of April, 1918.

JOHN E. HILBISH.