

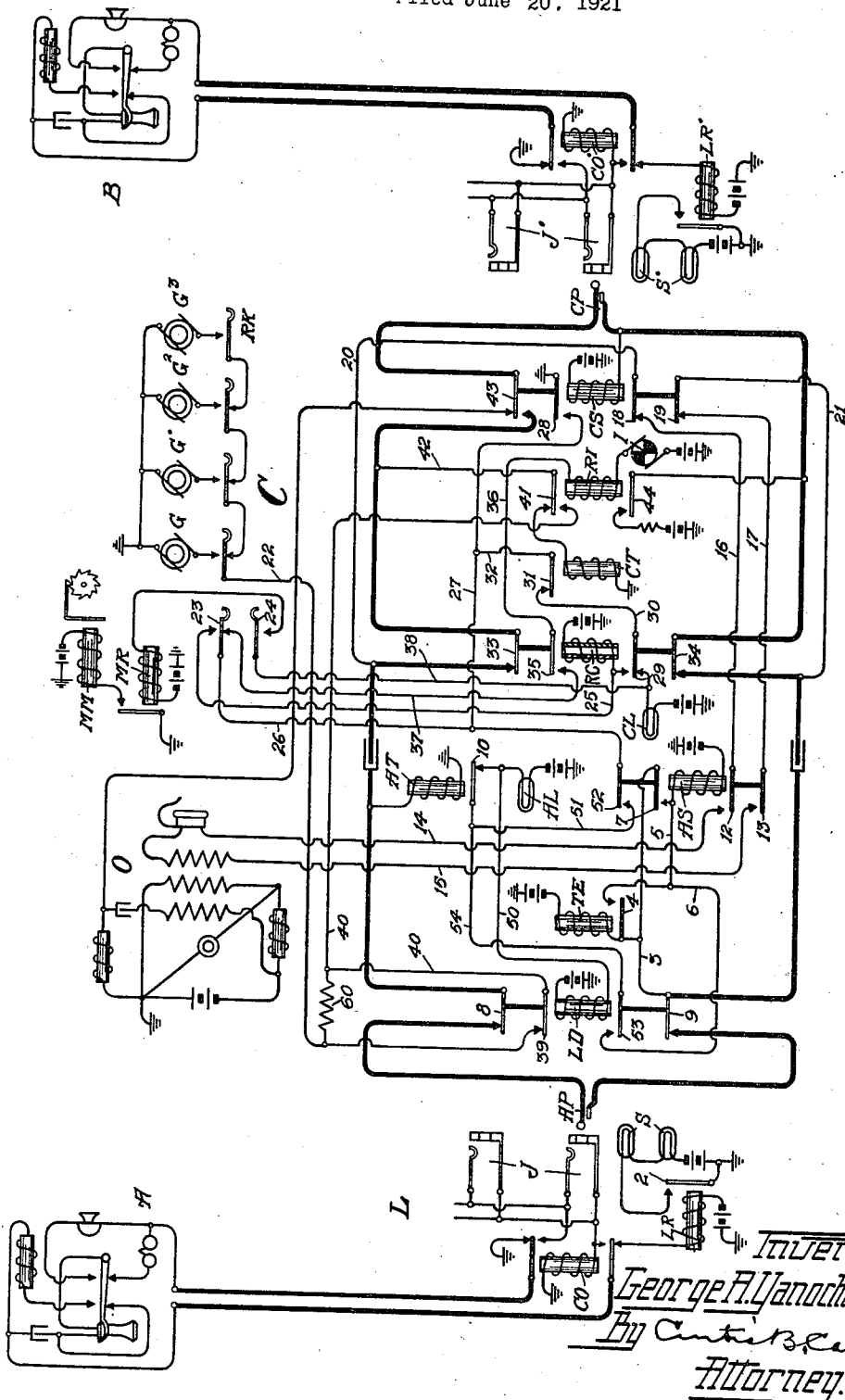
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TELEPHONE SYSTEM

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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that I, GEORGE A. YANOCHOWSKI, a citizen of the United States of America, and a resident of Chicago, 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 automatic ringing systems such as are provided for operators' cord circuits in which an interrupter relay is intermittently energized and de-energized to intermittently apply ringing current to the called line.

In systems of the above character the ringing current when applied to a called line may be interrupted by a control exercised by the called substation in answering a call, and a feature of my invention is the provision of a control exercised by the calling substation, should he replace his receiver prior to receiving response from the called substation to introduce a resistance of rather high impedance in the ringing circuit to reduce the amount of flow of ringing current over the called subscriber's line, thus preventing operative actuation of the called subscriber's call bell, thereby preventing the ringing of the called subscriber's call bell.

In the accompanying drawing I have illustrated a preferred embodiment of my invention, and the system as shown includes a calling substation A terminating in a line circuit L having the usual line relay LR, cut-off relay CO, line jacks J and multiple line lamps S. To the right of the drawing I illustrate a called substation B terminating in the line circuit L' having the usual line relay LR', cut-off relay CO' of the line jacks J', and the multiple line lamps S'. The line circuits L and L' shown are what are known as multiple line lamp circuits, in which a line lamp S is provided for each jack J so that when a call is initiated the line signal S lights before each of the calling line jacks J associated with the calling line, and any one of a plurality of operators may seize this call to the exclusion of the other operators.

The cord circuit C as illustrated in the drawing is arranged for interconnecting the telephone lines A and B as calling and called lines, and comprises an answering

plug AP and a calling plug CP connected by the heavily marked conductors. The answering end of the cord circuit C comprises an answering tip supervisory relay AT and an answering sleeve supervisory relay AS, the said answering sleeve supervisory relay AS when energized connects the operator's set O to the cord conductors so that she may be placed in communication with the calling subscriber at the substation A. Relays AT and AS upon energization also prevent the premature lighting of the answering supervisory lamp AL. A high resistance test relay TE is also provided which relay TE is for the purpose of excluding any other operator that may attempt to seize the call after an operator has already established connection to the calling line. A link disconnect relay LD is also provided which is energized when the subscriber at a calling substation replaces his receiver upon the switchhook to disassociate the cord circuit connected with his line from his associated line circuit, which will permit the subscriber at the substation to recall if he wishes to do so.

The calling end of the cord circuit C comprises a calling tip supervisory relay CT and a calling sleeve supervisory relay CS, said relays CT and CS being for the usual supervisory purposes to control the calling supervisory lamp CL. A ringing control relay RC is also provided, which relay is energized upon the depression of the ringing key plunger of the party line ringing key RK, and the said relay RC upon energization connects constantly rotating interrupter I in circuit with a ringing interrupter relay RI to intermittently connect ringing current to one of a plurality of ringing generators G, G', G², or G³ to intermittently connect the call bell at the substation B. A meter relay MR is also provided in association with a meter magnet MM for registering connections.

Having described in general the apparatus embodied in the preferred embodiment of my invention, I will now describe more in detail the operation of the system as illustrated in the accompanying drawing.

Assuming that the subscriber at the substation A initiates a call, the removal of the receiver at the substation A establishes an energizing circuit for the line relay LR of the line circuit L, and the line relay LR

energizing closes its alternate contact 2, whereby the line signals S for the different associated jacks J are lighted. The first operator to seize the call by the insertion of an answering plug AP into one of the jacks J connects the high resistance, test relay TE and cut-off relay CO in series from battery through the winding of the relay TE, conductor 3, sleeve contact of the connected plug AP and jack J to ground through the winding of the cut-off relay CO. The relay TE is energized over this circuit and the closing of its alternate contact 4 connects the low resistance answering sleeve supervisory relay AS in series with the cut-off relay CO, circuit being traced from battery through the winding of the relay AS, conductors 5 and 6, alternate contact 4 of the relay TE, conductor 3 to ground through the winding of the cut-off relay CO, over the previously described path. The closing of alternate contact 7 of the relay AS connects the winding of relay AS directly to the sleeve conductor of the cord circuit C independent of the contact 4 of the relay TE, and relay AS remains energized until disconnection takes place. Due to the flow of current to the windings of the relays AS and TE over the calling line, the answering tip supervisory relay AT is also energized over a circuit traced from ground through the winding of the relay AT, tip conductor of cord circuit C, tip contact of the connected plug AP and jack J, through the closed contacts of the substation switchhook and back through the sleeve contacts of the connected jack J and plug AP, normal contact 9 of the relay LD, conductor 3, alternate contact 7 of relay AS, to battery through the winding of the relay AS. The relay AT energizes over this circuit, and the opening of its normal contact 10 prevents the premature lighting of the answering supervisory lamp AL. The closing of alternate contacts 12 and 13 of the answering sleeve supervisory relay AS connects the operator's set O in bridge of the talking conductors of the cord circuit C, through conductors 14 and 15, alternate contacts 12 and 13 of the relay AS, conductors 16 and 17, normal contacts 18 and 19 of the calling sleeve supervisory relay AT and conductors 20 and 21 to the tip and sleeve, conductors of the cord circuit.

Should a second operator insert an answering plug AP into another jack J of the calling line subsequent to the insertion of the plug AP of the cord circuit C, that is not connected to the calling line, the test relay TE of the second cord does not energize due to the shunting of its winding by the low resistance relay AS of the cord circuit C, so that the second operator is not free to communicate with the calling subscriber because her operator's set is not connected, due to the failure of the answering

sleeve supervisory relay AS of the second cord to energize, and the second operator receiving no response again withdraws the answering plug AP of the second cord from the connected jack.

The first operator having connected with the calling subscriber at the substation A as just described now inquires the want of the calling subscriber thereat. Assuming that it is the subscriber at the substation B that is wanted, the operator tests the jack J' of the calling line in the usual manner, and if busy she will receive the customary busy click in her head set. Assuming that the line is idle, the operator inserts the calling plug CP into the jack J' of the called line, thus establishing a series energizing circuit for the calling sleeve supervisory relay CS and the cut-off relay CO' from battery through the winding of the relay CS, sleeve contacts of the connected plug CP and jack J' to ground, through the winding of the cut-off relay CO'. The relay CS energizing opens its normal contacts 18 and 19 to disconnect the operator's set O from the cord conductors. The operator now depresses the proper key plunger of the ringing key RK, whereby the selected generator, which we will assume is G, is now connected to the common ringing conductor 22. The actuation of the ringing key plunger to its fully depressed position also momentarily actuates the end spring contacts 23 and 24. The closing of alternate contact 23 of the end spring contacts established an energizing circuit for the ringing control relay RC, traced from battery through the winding of the relay RC, conductor 25, alternate contact 23 of the end spring contacts, conductors 26 and 27 to ground at alternate contact 28 of the calling sleeve supervisory relay CS. The relay RC energizing closes its alternate contact 29, establishing a locking circuit for itself, traced from battery through its winding, its alternate contact 29, conductor 30, normal contact 31 of the calling tip supervisory relay CT, conductors 32 and 27 to ground at alternate contact 28 of the relay CS. The relay RC energizing interrupts its normal contacts 33 and 34 to interrupt the tip and sleeve conductors of the cord circuit and the closing of alternate contact 35 of the relay RC establishes an energizing circuit for the ringing interrupter relay RI, traced from battery through the constantly rotating interrupter I, through the winding of the interrupter relay RI, conductor 36, alternate contact 35 of the relay RC, conductor 37, normal contact 23 of the end spring contacts, conductors 26 and 27 to ground at alternate contact 28 of the relay CS. The momentary closure of alternate contact 24 of the end spring contacts upon the depression of a plunger of the ringing key RK closes an energizing circuit for the meter re-

lay MR, from battery through the winding of relay MR, the closed contact 24 of the end spring contacts, conductor 38, normal contact 29 of the relay RC, conductor 30, normal contact 31 of the relay CT, conductors 32 and 27 to ground at alternate contact 28 of the relay CS. The meter relay MR energizing closes its alternate contact to energize the meter magnet MM, which meter magnet MM actuates the meter mechanism to register a connection. The ringing interrupter relay RI is intermittently energized and de-energized over the circuit just described and the ringing current at the called substation B may be traced from the generator G, through the now closed ringing key plunger contact, ringing conductor 22, normal contacts 39 of the link disconnect relay LD, conductor 40, alternate contact 41 of relay RI, conductor 42, alternate contact 43 of the relay CS, the tip contacts of the connected plug CP and jack J', through the call bell and condenser of the called substation B and back through the sleeve contact of the connected jack J' and plug CP to battery and ground through alternate contact 44 of relay RI. The call bell at the substation B is thus intermittently actuated and upon the response of the called subscriber at the substation B, and following the de-energization of the relay RI a circuit is established for the calling tip supervisory relay CT, traced from ground through the winding of the relay CT, normal contact 41 of the relay RI, conductor 42, alternate contact 43 of the relay CS, tip contact of the connected plug CP and jack J', through the now closed contacts of the substation switch-hook, back through the sleeve contacts of the connected jack J' and plug CP to battery, through the winding of the relay CS. The relay CT energizing opens its normal contact 31, which interrupts the locking circuit of the ringing control relay RC, and the said relay now de-energizes and the opening of its alternate contact 35 disconnects the constantly rotating interrupter I from the ringing interrupter relay RI, thus preventing further application of ringing current to the called substation B.

The closing of the normal contacts 33 and 34 of the now de-energized relay RC re-establishes the continuity of the talking conductors, and the calling subscriber at the substation A and the called subscriber at the substation B are now in conversational circuit, which may be traced over the heavily marked conductors.

Assuming now that a connection has been extended to the called substation B, as just described, and that the call bell at the substation is being actuated, but that the calling subscriber at the substation A replaces his receiver prior to receiving a response from the subscriber at the called substation

B. The replacing of the receiver at the calling substation A by the subscriber thereat opens the energizing circuit of the answering tip supervisory relay AT at the switch-hook contacts, and the closing of its normal contact 10 establishes an energizing circuit for the link disconnect relay LD, traced from battery through the winding of the relay LD, conductor 50, normal contact 10 of the relay AT, conductor 51, alternate contact 52 of the relay AS, conductors 26 and 27 to ground at alternate contact 28 of the relay CS. The relay LD energizes over this circuit and opens its normal contact 9, interrupting the energizing circuit of the answering sleeve supervisory relay AS, but a substitute circuit is established for the said relay AS, traced from battery through the winding of the relay AS, its alternate contact 7, conductor 3, alternate contact 4 of the relay TE, conductor 6, alternate contact 53 of the relay LD, conductors 54 and 51, alternate contact 52 of the relay AS, conductors 26 and 27 to ground at alternate contact 28 of the relay CS. The energizing circuit of the relay TE is also interrupted at normal contact 9, but the relay TE has a substitute circuit established for it from battery through the winding of the relay TE, its alternate contact 4, to ground at alternate contact 28 of the relay CS over the path as just described.

The closing of normal contact 10 of the relay AT also closes a circuit for the answering supervisory lamp AL, traced from battery through the winding of the lamp AL, normal contact 10, of the relay AT, conductor 51, alternate contact 52 of relay AS, conductors 26 and 27 to ground at alternate contact 28 of the relay CS. In this instance the relay RC remains energized as the called subscriber has not answered and, therefore, the calling tip supervisory relay CT is still at normal and the locking circuit of the relay RC is maintained.

The link disconnect relay LD energizing opens its normal contact 39, and the impedance coil 60, which is normally in shunt of the normally closed contact 39 of the relay LD before it has energized, is now placed in circuit with the ringing current due to the opening of normal contact 39 and the ringing current which normally flows through the contact 39 of the relay LD before the subscriber at the calling substation A has replaced his receiver now flows through the coil 60 and the ringing circuit may now be traced from the ungrounded pole of the generator G, conductor 22 to the resistance 60, conductor 40, alternate contact 41 of the ringing interrupter relay RI and over the previously described path to battery and ground through alternate contact 44 of the relay RI. The ringing interrupter relay RI is intermittently energized and de-

energized over a path as previously described, due to the fact that the ringing control relay RC is maintained energized over its locking circuit due to the fact that the
 5 relay CT is still at normal as the calling subscriber has not as yet removed his receiver from the switchhook.

The ringing current passing through the impedance coil 60 reduces the current flow
 10 to the call bell of the called substation B to such an extent as to prevent operative actuation of the call bell thereat, thereby preventing the ringing of the called subscriber's bell at the substation B. The operator having
 15 received the disconnect signal from the calling subscriber due to the lighting of the answering supervisory lamp AL, as before described, now withdraws the calling plug CP from the jack J' of the called line B to
 20 open the series energizing circuit of the calling sleeve supervisory relay CS and the cut-off relay CO' of the line circuit L'. The opening of alternate contact 28 of the relay CS opens the locking circuit of the ringing
 25 control relay RC and the energizing circuits of the link disconnect relay LD, high resistance test relay TE and the answering sleeve supervisory relay AS. The operator now
 30 withdraws the answering plug AP from the connected jack J of the calling line and the apparatus used in establishing the connection is now at normal and available for use in establishing other connections.

It will be observed that when the subscriber A replaces his receiver upon the
 35 switchhook prior to receiving a response from the called substation, the relay LD was energized to open its normal contacts 8 and 9 to disconnect the cord conductors from the calling line. The cut-off relay CO, therefore,
 40 restores so that the subscriber at the substation A is available for immediate recall.

Now, if the subscriber at the substation
 45 A desires to initiate a recall immediately after replacing his receiver upon the switchhook and before the removal of the plugs AP and CP from their respective jacks, the removal of the receiver at the calling substation A again establishes a circuit for the
 50 line relay LR of the line circuit L, and the line relay LR is energized to light its associated line signals S, so that the same or another operator may take the call.

When a connection has been established
 55 between two subscribers at the substations A and B in the manner as before described and both receivers are off their switchhooks, the conversational circuit may be traced over the heavily marked conductors.

At the termination of conversation the replacing of the receiver at the substation A opens the energizing circuit of the answering
 60 tip supervisory relay AT, and the relay AT now restores to close its normal contact

10. The closing of normal contact 10 of the relay AT establishes an energizing circuit for the link disconnect relay LD over a circuit as previously described, and the relay LD upon energization opens its normal
 70 contacts 8 and 9 to interrupt the tip and sleeve cord conductors, and the opening of normal contact 9 opens the series energizing circuit of the cut-off relay CO and answering sleeve supervisory relay AS, but a substitute energizing circuit is established for
 75 the said relay AS due to the closure of alternate contact 53 of the relay LD. The relay LD is also held energized through the alternate contact 53 and thus the answering sleeve supervisory relay AS and the relay
 80 TE remain energized.

The closing of normal contact 10 of the relay AT also establishes an energizing circuit for the answering supervisory lamp AL
 85 from battery through the lamp AL, normal contact 10, conductor 51, alternate contact 52 of the relay AS, to ground at alternate contact 28 of the relay CS. The said answering supervisory lamp AL thus lights over
 90 this circuit.

The replacing of the receiver at the called substation B opens the energizing circuit of the calling tip supervisory relay CT at the
 95 switchhook contacts, and the relay CT de-energizing closes its normal contact 31, establishing an energizing circuit for the calling supervisory lamp CL, traced from battery through the lamp CL, normal contact
 100 29, conductor 30, normal contact 31 of the relay CT, conductors 32 and 27 to ground at alternate contact 28 of the relay CS.

The operator noting the two lighted signals AL and CL now withdraws the answering
 105 plugs AP and CP from their respective jacks J and J'. The withdrawal of the plug CP from the jack J' opens the energizing circuit for the relay CS, and the relay CS restoring opens the energizing circuits of the relays LD, TE and AS. The
 110 removal of the plug AP from the jack J now places the apparatus that was used in establishing the connection at normal, which may now be used for establishing other connections.

While I have illustrated and described my invention in connection with a preferred
 115 form of cord circuit, it is to be understood that it is applicable for use with other circuits than that shown. It will also be apparent that changes and modifications will readily suggest themselves to those skilled
 120 in the art, and I, therefore, do not wish to be limited to the exact structure shown, but aim to cover all such changes and modifications as come within the spirit and scope
 125 of the appended claims.

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

1. A telephone system including a calling 130

subscriber's line and a called subscriber's line, an operator's link circuit for use in interconnecting said lines, a source of ringing current, operator controlled means for connecting said ringing current to the said called subscriber's line, a relay controlled over the calling line, and means including a link disconnect relay controlled by said relay for cutting down the flow of ringing current to the called subscriber's line by directing the ringing current through a high resistance circuit which is normally shunted prior to the operation of said disconnect relay.

2. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for connecting said lines, a source of ringing current, means for intermittently applying said ringing current to the called subscriber's line, and means including a link disconnect relay controlled by the replacement of the receiver at the calling substation to introduce impedance means in the ringing circuit to cut down the current flow to prevent further operative actuation of the call bell at the called substation, said impedance being normally shunted by a circuit including a normally closed contact of said disconnect relay through which ringing current normally flows.

3. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for interconnecting said lines, a source of ringing current and operator-controlled means for connecting said ringing current to the said called subscriber's line, a supervisory relay controlled over the calling line, a disconnect relay under the control of said supervisory relay, means controlled by the said supervisory relay by the replacement of the receiver at the calling substation to energize said disconnect relay to introduce impedance means normally shunted through a normally closed contact of said disconnect relay in said ringing circuit to cut down the amount of current flowing over the called line so as to prevent further actuation of the call bell at the called subscriber's substation.

4. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for interconnecting said lines, a source of ringing current, interrupter means for intermittently applying ringing current to the called line, and operator controlled means for initiating the applying of said ringing current, a supervisory relay controlled by the calling subscriber and a disconnect relay controlled by said supervisory relay, means under the control of said supervisory relay by the replacement of the receiver at the calling substation to energize said disconnect relay to introduce impedance means normally shunt-

ed by normally closed contacts of said disconnect relay to cut down the flow of ringing current to prevent further operative actuation of the call bell at the called substation prior to the response of said called substation.

5. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for interconnecting said lines, a source of ringing current, and operator-controlled means for applying said source of ringing current, a supervisory relay controlled over the calling line, a disconnect relay controlled by said supervisory relay, an impedance normally bridged across contacts of said relay through which said ringing current passes to permit the full value of ringing current to flow through the call bell at said called substation, and supervisory relay controlled means for energizing said disconnect relay to remove said shunt from about said impedance prior to the response of the called substation.

6. A telephone system comprising telephone lines, an operator's link circuit for interconnecting said lines, a source of ringing current and operator-controlled means for applying said ringing current to a called line, means controlled at the substation of the calling line for disassociating his line from the said link circuit, and means responsive to such disassociation for introducing impedance means in the ringing current to cut down the current flow of the same, thereby preventing the operative actuation of the called subscriber's call bell, said impedance means normally shunted during the ringing period when said second last means is in its normal position to permit the full value of ringing current to flow through said call bell.

7. A telephone system comprising telephone lines, an operator's link circuit for interconnecting said lines, a source of ringing current and operator-controlled means for applying said ringing current to a called line, means in said link circuit controllable at the substation of the calling line for disassociating his line from the connected link circuit, and means including a normally closed contact of said second means responsive to the disassociation of said line from said link to connect impedance means in the ringing circuit to cut down the amount of current flowing thereover, thereby preventing the operative actuation of said called subscriber's bell when said calling line and link circuit are disassociated by the operation of said second means prior to the response of said called subscriber.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 17 day of June, 1921.

GEORGE A. YANOCHOWSKI.