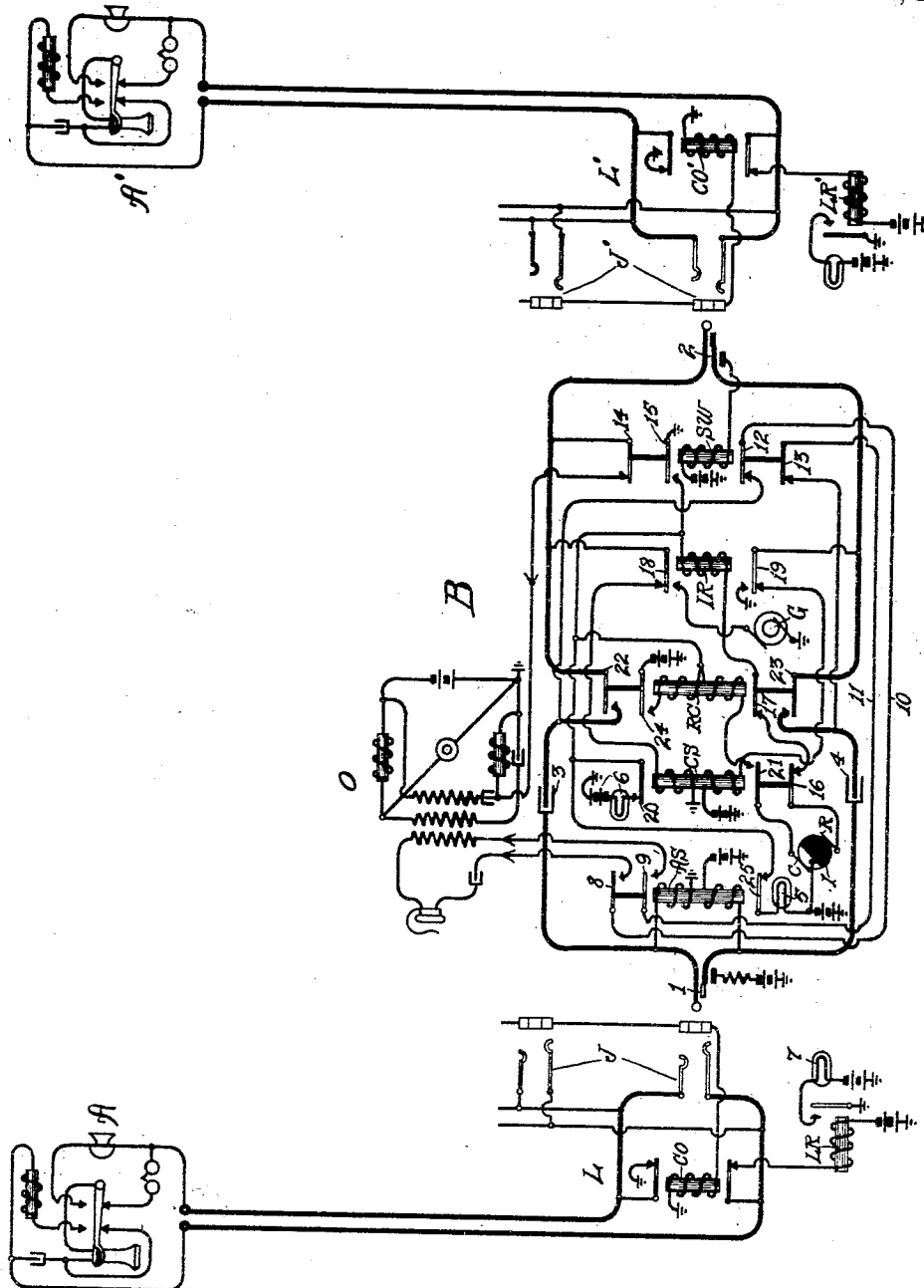


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 TELEPHONE SYSTEM WITH AUTOMATIC RINGING.
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TELEPHONE SYSTEM WITH AUTOMATIC RINGING.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, RICHARD I. UTTER, a citizen of the United States of America, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Systems with Automatic Ringing, of which the following is a specification.

My invention relates in general to telephone systems and has to do more particularly with automatic ringing systems adapted for use with operators' cord or link circuits, an object of my invention being to provide an improved and simplified circuit arrangement embodying certain features as will be hereinafter more particularly pointed out in the following specification and claims.

In the accompanying drawing I have illustrated a preferred embodiment of my invention which comprises calling and called substations A and A¹ connected to centrally located line circuits L and L¹ respectively adapted to be connected by means of an operator's cord or link circuit B. Although but two telephone lines are shown it is to be understood that there are a number of such lines provided and also a plurality of cord circuits for interconnecting them.

I have preferably embodied my invention in a so-called three-conductor or three-wire multiple circuit and therefore the line circuits L comprise three-contact jacks J, a line relay LR and cut-off relay CO also being provided. The substations A may be of any common battery type and I have shown the well-known Kellogg form of substation. The line circuit L¹ is similar to that of L, the parts thereof being indicated by reference characters corresponding to the reference characters of the line circuit L.

The operator's link circuit B includes the usual answering terminal 1 and calling terminal 2 connected by the heavily marked tip and sleeve conductors having interposed condensers 3, 4. The third contact of the answering plug 1 is connected to battery so as to provide an energizing circuit for the cut-off relay CO of the calling line, but at the calling terminal 2, I have preferably connected the third contact through a switching relay SW to battery whereby said relay and the cut-off relay CO¹ of the called line are energized over the connected series circuit. At the answering end of the cord

circuit I provide an answering supervisory relay AS preferably connected in bridge of the tip and sleeve conductors and arranged to automatically connect the operator's telephone O in bridge of the cord circuit when a call is answered. Upon extending the calling line to a called line, the switching relay SW is energized to automatically disconnect the operator's telephone O.

In connection with the calling end of the cord circuit I provide a calling supervisory relay CS and a ringing generator G which are adapted to be alternately connected in bridge of the called line through contacts of an interrupter relay IR, which relay IR is periodically energized over a circuit including an interrupter I. A ringing control relay RC is also provided which relay serves to control the application of ringing current by interrupter relay IR, also serving as a closing relay to close the tip and sleeve talking conductors of the cord, when the called subscriber responds.

Relays RC and IR are adapted to be energized by a circuit including the battery segment of the interrupter I which interrupter is arranged to alternately connect battery to the ringing control brush C or the interrupter brush R, with a dead period between each alternate connection. That is, after the battery segment leaves one brush there is a short period before it connects with the opposite brush. One of the reasons for this dead period is to prevent an incidental kick of the armature of the calling supervisory relay CS from a ringing current discharge, to effect a premature energization of the ringing control relay RC. That is, due to this short dead period, although a discharge of ringing current may effect a momentary kick of the armature of relay CS, said relay armature will again drop back before the lower winding of relay RC is connected to the live segment of the interrupter I.

In general, the operation of the system is as follows: The operator having inserted the answering plug 1 into a jack J of a calling line, relay AS automatically connects the operator's telephone O to the calling line. After ascertaining the number of the wanted line, the operator tests in the usual manner by placing the tip of plug 2 against the jack J¹ of the called line. Assuming the line is idle the calling plug 2 is inserted into

a jack J¹ whereby the switching relay SW disconnects the operator's telephone O and connects ground to the interrupter relay IR whereby it is periodically energized by the interrupter I to alternately bridge generator G and supervisory relay CS across the called line. When the subscriber responds relay CS energizes closing the circuit of the lower winding of relay RC whereby upon the following closure of the control relay brush C of the interrupter I, relay RC energizes to close the talking strands of the link circuit. The operation of relays CS and RC also interrupts the circuit for relay IR thus preventing any further application of ringing current. The answering and calling supervisory lamps 5 and 6 respectively are controlled by the answering and calling supervisory relays in the usual manner.

Referring now more particularly to the operation of the system, in initiating a call, a calling subscriber removes his receiver to operate his line relay LR and line lamp 7 whereby the operator inserts an answering plug 1 into the jack J of the calling line thus energizing the cut-off relay CO and effacing signal 7. The answering supervisory relay AS is thus connected in bridge of the calling line whereby current flows through the winding thereof causing the energization thereof and the closing of its alternate contacts 8, 9. Operator's telephone O is thus connected by means of strands 10, 11, and through normal contacts 12, 13 to the link circuit. The operator finding that connection is desired with another line tests said line to determine its idle or busy condition by placing the tip of the calling plug 2 against the test contact of the called line jack J¹. If said line is busy there will be a battery connection to said line from the connected plug but if said line is idle there is no such connection but instead ground potential. With a battery connection a busy click is transmitted in a well-known manner and if idle no such signal is transmitted. Assuming the wanted line is idle the operator inserts the plug 2 in the jack J¹ thereof whereby relays SW and CO¹ are connected in series causing the energization of both, the energization of CO¹ removing the control of the line signal and the energization of SW disconnecting the operator's telephone at contacts 12, 13. The interruption of normal contact 14 of SW disconnects the test conductor and the closing of alternate contact 15 provides an operating path for relays IR and RC and calling supervisory signal 6. Thus alternate contact 15 having closed, upon the following closure of battery to the interrupter brush R of interrupter I, a circuit for interrupter or ringing relay IR is established traced from battery through said brush R, normal contacts 16,

17, and the winding of IR to ground at alternate contact 15. Relay IR therefore closes its alternate contacts 18, 19, connecting generator G in bridge of the called line to signal the call-bell at a substitution thereon. The continued rotation of interrupter IR causes an interruption of the circuit of IR to bring about the disconnection of ringing current and the bridging of relay CS. A short dead period of interrupter I then ensues after which battery is connected to the control relay brush C but if the subscriber has not as yet responded the supervisory relay CS is still inert and therefore no disconnect circuit is provided. The continued operation of interrupter I thus alternately connects the ringing generator and the calling supervisory relay in bridge of the called line, but due to the condenser interposed in the called line circuit while the receiver is on the switch-hook, no path for direct current is provided for the relay CS. Upon response of the called subscriber by the removal of the receiver of his substitution, and assuming that this occurs during a silent interval and while battery is connected to brush C, relay CS is energized by current flowing over the called line whereby its normal contact 20 is interrupted to efface signal 6. The interruption of normal contact 16 of CS prevents any further applications of ringing current and the closing of alternate contact 21 provides an energizing circuit for ringing control relay RC established from battery through brush C, alternate contact 21, and the lower winding of RC to ground at alternate contact 15. Upon energization of relay RC alternate contacts 22, 23, close the tip and sleeve talking strands and the closing of alternate contact 24 establishes a locking circuit for RC through the upper winding thereof. The interruption of normal contact 17 of RC prevents a subsequent operation of the interrupter relay IR and the application of ringing current when the called subscriber replaces his receiver and causes the restoration of CS. It will be apparent from the foregoing that the application of ringing current and disconnection thereof is controlled by alternately closed interrupter contacts. Assuming again that ringing current is being applied to the called line as before, but that a response is made just before the battery segment of the interrupter I advances into engagement with the brush R, that is with the interrupter wheel I in a dead period. In such case the removal of the receiver causes the energization of CS as before, and upon the battery segment connecting with brush R, interrupter relay IR would again energize to again cause the restoration of CS, if it was not for the interruption of the circuit of IR at normal contact 16 of CS. Therefore as the battery

segment continues in its rotation and connects with the brush C, relay RC is energized as before locking itself and establishing the continuity of the talking conductors. After the subscribers have finished conversation they will replace their receivers upon their respective switch-hooks to cause the restoration of the supervisory relays AS and CS. Responsive to the closing of normal contact 25 of AS, signal 5 is lighted and upon the closing of normal contact 20 of CS signal 6 is lighted. The operator noting these signals will remove the connecting plugs 1 and 2 from their respective spring jacks whereby relays AS and SW are restored to normal. Upon the restoration of SW the circuit for RC is interrupted causing its restoration, the interruption of alternate contact 15 of SW also effecting signals 5, 6. The apparatus is thus at normal and available for use in establishing other connections. Again assuming that calling plug 2 is in connection with the jack of a called line and ringing current is being applied as described, upon each restoration of relay IR a discharge of ringing current through the windings of relay CS is brought about causing said relay to momentarily kick up its armature at times. Such incidental operation of relay CS does not cause the operation of ringing control relay RC because of the dead period on the interrupter wheel. That is when relay CS kicks up its armature, although the alternate contact 21 thereof may be closed, circuit for RC is not established because at this time the brush C is resting upon the dead segment of the interrupter wheel and the armature of CS retracts before the battery segment reaches the brush C.

It will be apparent from the foregoing that although the supervisory relay CS may have its armature kicked up incidentally, due to the dead period of the interrupter wheel the control circuits are not affected.

Although I have embodied my invention in a simple operator's cord circuit, I contemplate using it in other ways. I am also aware that changes and modifications thereof will occur to those skilled in the art and I aim to cover all such changes and modifications by the appended claims.

Having described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. A telephone system comprising telephone lines, a link circuit for connection therewith, a calling supervisory relay and source of ringing current, an interrupter relay and means for operation thereof to alternately bridge said relay and current across a connected called line, a ringing control relay and energizing circuit therefor responsive to said supervisory relay, an interrupter included in said energizing circuit, said

interrupter being adapted to prevent a premature operation of said control relay by an incidental momentary operation of the supervisory relay.

2. A telephone system comprising telephone lines, a link circuit for connection therewith, a calling supervisory relay and source of ringing current, means for alternately connecting said relay and current in bridge of a connected called line, a ringing control relay and energizing circuit therefor responsive to said supervisory relay, an interrupter included in the circuit of the control relay, said interrupter being adapted to prevent a premature operation of the control relay by an incidental momentary operation of the supervisory relay.

3. A telephone system comprising telephone lines, an operator controlled link circuit for connection therewith, a calling supervisory relay and source of ringing current, means responsive to the connection of said link circuit to a called one of said lines for alternately connecting said relay and current in bridge of a connected called line, a ringing control relay and energizing circuit therefor responsive to said supervisory relay, an interrupter included in the circuit of the control relay, and means whereby said interrupter will prevent a premature operation of the control relay by an incidental momentary operation of the supervisory relay.

4. A telephone system comprising telephone lines, an operator's link circuit for connection therewith, a ringing or interrupter relay a ringing control relay and a calling supervisory relay for said link circuit, an energizing circuit for each of said interrupter and control relays, an interrupter having alternate contacts included in said circuits, means responsive to the connection of said link circuit to a called one of said lines whereby said circuit of the interrupter relay is effective to periodically apply ringing current to said line, and means for energizing said supervisory relay upon response of the called line to establish said energizing circuit for the control relay to prevent further application of ringing current.

5. A telephone system comprising an operator's link circuit, telephone lines adapted for connection therewith, an interrupter relay a ringing control relay and a calling supervisory relay for said link circuit, an interrupter having alternate contacts adapted to be alternately connected in energizing circuits for the ringing and interrupter relays, means responsive to the connection of said link circuit to one of said lines whereby one of the alternate contacts of said interrupter causes the operation of said interrupter relay to periodically apply ringing current to the connected line, means whereby said supervisory relay is energized upon re-

sponse from the connected line to close an energizing circuit for the ringing control relay through the other alternate contact of the interrupter to prevent further application of ringing current to the connected line.

5 6. A telephone system comprising telephone lines, a link circuit for connection therewith, interrupter, ringing control and calling supervisory relays for said link circuit, energizing circuits for said interrupter and control relays, an interrupter having alternate contacts one included in each of said circuits, means for causing the operation of said interrupter relay over its said circuit to periodically apply ringing current to a connected called line, and means for energizing said supervisory relay upon response of the called line to establish said energizing circuit for the control relay to prevent further application of ringing current.

7. A telephone system comprising telephone lines, a link circuit for connection therewith, interrupter, ringing control, and calling supervisory relays for said link circuit, an interrupter having alternate contacts, an energizing circuit for said interrupter relay including one of said interrupter contacts and normally closed contacts of said control relay, and an energizing circuit for said control relay including the other contact of said interrupter and normally open contacts of said supervisory relay.

Signed by me at Chicago, county of Cook and State of Illinois, in the presence of two witnesses.

RICHARD I. UTTER.

Witnesses:

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