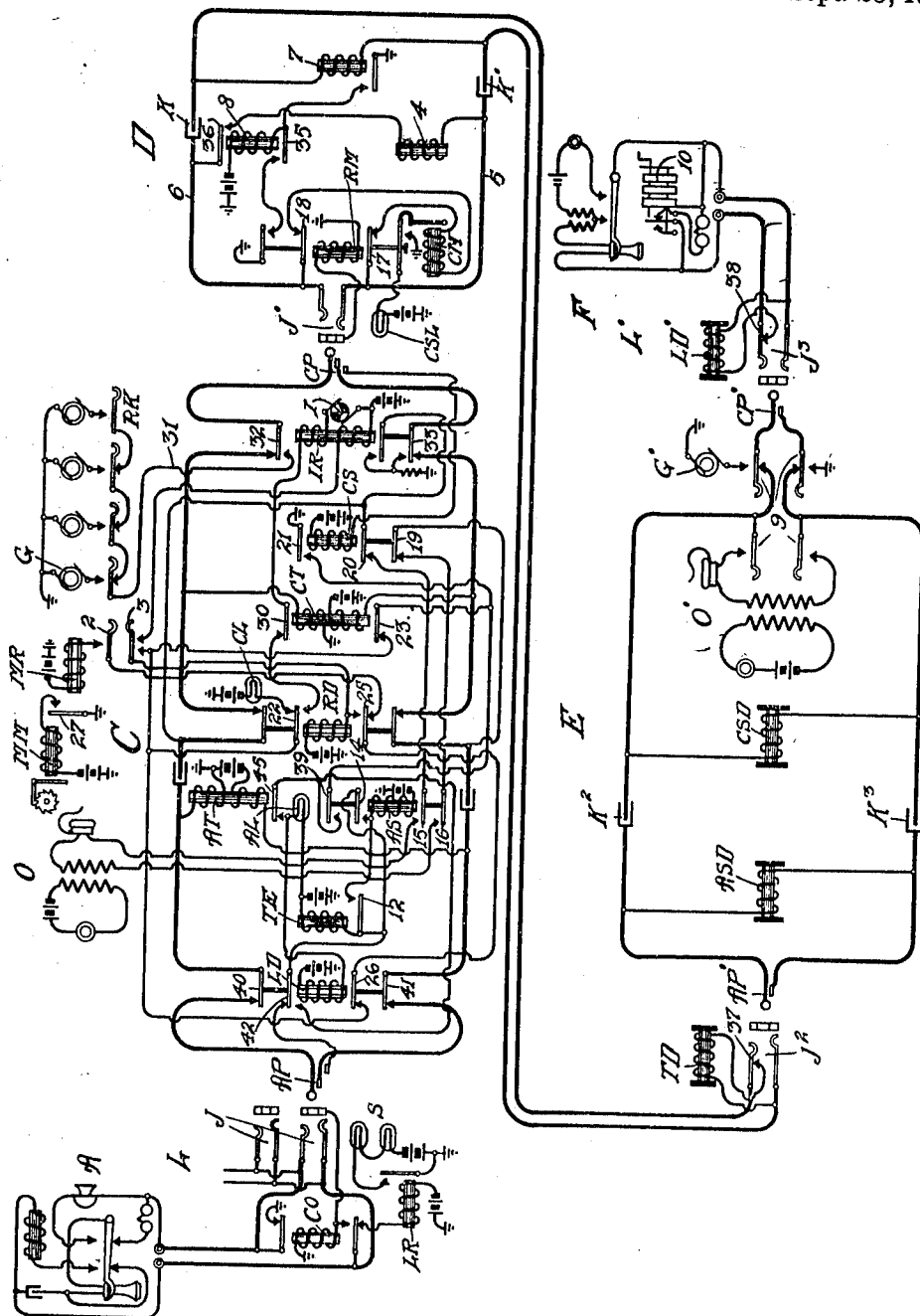


J. E. HILBISH.
TWO-WAY TRUNK CIRCUIT.
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UNITED STATES PATENT OFFICE.

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TWO-WAY TRUNK-CIRCUIT.

1,316,892.

Specification of Letters Patent.

Patented Sept. 23, 1919.

Application filed July 16, 1915. Serial No. 40,181.

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 Two-Way Trunk-Circuits, of which the following is a specification.

My invention relates to telephone systems and has more particularly to do 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 in, which mechanism thereafter operates to intermittently apply ringing current to the said circuit. The feature of providing the above-described so-called preliminary ring 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.

Another feature of my invention is the provision of an improved two-way trunk circuit for use between common battery exchanges and local battery exchanges, which is most simple but yet positive in its operation. Other objects of my invention will be pointed out in the appended claims.

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 L¹ 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 circuit 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 J¹ 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 IR 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 J¹ 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 K¹ 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 AP¹ and a calling plug CP¹ 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 O¹ to the strands of the cord circuit or for associating the generator G¹ with the strands of the calling plug CP¹. The subscriber's substa-

tion F may be of any improved or suitable type and is provided with a generator 10 and the usual talking apparatus. The line equipment L¹ comprises a jack J³ and a line drop LD¹.

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, 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 J¹. The insertion of the calling plug CP into jack J¹ 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 said 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 relay 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 J¹, 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 K¹, sleeve conductors of jack J¹ 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 J¹, alternate contact 36 of relay 8, impedance 4, ring contacts of jack J¹ 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 AP¹ 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 O¹ 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 CP¹ into jack J³, thereby disconnecting the line drop LD¹ by opening normal contact 38. The operator next operates the ringing and listening key in the opposite direction to connect the generator G¹ 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 extends 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 relay, 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 jack J¹ 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 CP¹ and the answering plug AP¹ 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, 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 LD¹. The operator, upon noting this signal inserts the answering plug AP¹ of the link circuit D into jack J³ of the subscriber's line equipment L¹. The operator next throws the listening key 9 to connect her telephone O¹ 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 CP¹ into the jack J² connected to the trunk circuit D and operates the key 9 to bridge the ringing generator G¹ 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 J¹ 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 J¹, 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.

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

1. A telephone system comprising a common battery subscriber's line and a local battery subscriber's line, a link circuit and a trunk circuit for connecting said lines, means controlled from said link circuit for operating a signal at the distant end of said trunk circuit, automatic means for disassociating said operating means, and means individual to said link circuit for insuring the operation of said signal.

2. A telephone system including a calling subscriber's line and a called subscriber's line, a trunk circuit for connecting said lines, a ringing current generator associated with said trunk circuit, a signal device associated with said trunk circuit, automatic means for connecting current from said generator to said trunk circuit, a manually controlled device independent of said trunk circuit for initiating an operation of said automatic means, automatic means associated with said trunk circuit for disconnecting the said ringing current generator from the trunk circuit, said manually controlled means operating said automatic ringing means in such a manner as to insure the operation of said signaling device.

3. A telephone system including a trunk circuit, means bridged across one end of said trunk circuit for displaying a signal, signaling means associated with the opposite end of said trunk circuit to cause such display, and a coil bridged across said trunk circuit for disconnecting said signaling means, and means to insure the operation of said first means.

4. A telephone system comprising a common battery line and a local battery line, a link circuit and a trunk circuit for connecting said lines, means controlled from the link circuit for operating a signal device associated with said trunk circuit, automatic means associated with said trunk circuit for automatically discontinuing said first means, and means individual to said link circuit for insuring that said signal will be operated before said automatic means operates.

5. A telephone system including common battery and local battery subscribers' telephone lines, a manually controlled link circuit and a manually controlled trunk circuit for interconnecting said lines in conversational circuits, means responsive to the connection of said link circuit to said trunk circuit for operating a signal at the distant end of said trunk circuit, automatic means for disassociating said first means, and means individual to said link circuit for insuring the operation of said signal be-

fore said disassociating means disassociates said operating means.

6. A telephone system including a link circuit and a trunk circuit, a visual signal for said trunk circuit, automatic ringing means for said link circuit for operating said visual signal, trunk circuit means for disconnecting said automatic ringing means from said trunk circuit, and key controlled means individual to said link circuit for operating said automatic ringing means to connect it with said trunk circuit for a period of time sufficient in duration to operate said trunk signal before said trunk means operates to disconnect said automatic ringing means.

7. A telephone system including subscribers' telephone lines, link circuit and a trunk circuit for connecting two of said lines in conversational circuit, a signal device associated with the distant end of said trunk circuit, automatic ringing means for said link circuit for operating said signal device, means associated with said trunk circuit for disconnecting said automatic ringing means, and manual means individual to said link circuit for connecting said ringing current to said trunk circuit for a period of time sufficient to insure that said trunk signal will be operated before said disconnect means operates to disassociate said automatic ringing means.

8. A telephone system including a link circuit, automatic ringing means for said link circuit, a called subscriber's line, a trunk circuit provided with a signal, said link circuit adapted to be connected to either said subscriber's line of said trunk circuit, and means for causing a preliminary operation of said automatic ringing means to either signal said called subscriber or to operate said signal.

9. A telephone system including subscribers' telephone lines, a link circuit and a trunk circuit for connecting two of said lines in conversational circuit, a signal device associated with one end of said trunk circuit, automatic ringing means for said link circuit for operating said signal device, means associated with said trunk circuit for disconnecting said automatic ringing means, and means individual to said link circuit for connecting said ringing current to said trunk circuit for a period of time sufficient to insure that said trunk signal will be operated before said disconnect means operates to disassociate said automatic ringing means.

10. In a telephone system, the combination of a link circuit connected to a trunk circuit, a signal for said trunk circuit, signaling means for said link circuit for operating said trunk circuit signal, means associated with said trunk circuit for disconnecting said signaling means from said

trunk circuit, and means individual to said link circuit for insuring that said signaling means will be connected to said trunk circuit for a period of time sufficient to operate said trunk circuit signal.

11. In a telephone system, the combination of a plug-ended link circuit connected to a jack-ended trunk circuit, signaling means associated with said link circuit, a signal associated with said trunk circuit, a manually controlled ringing key for associating said signaling means with said trunk circuit to operate said trunk signal, automatic means associated with the trunk circuit for disconnecting said signaling means, and means individual to said link circuit for insuring the operation of said trunk circuit signal.

12. A telephone system including a subscriber's line terminating in a three-conductor jack and a second subscriber's line terminating in a two-conductor jack, a link circuit and a trunk circuit for connecting said jacks, signaling means associated with

said link circuit, a signal associated with said trunk circuit, means for associating said signaling means with said signal, automatic means for disassociating said signaling means, and means individual to said link circuit for insuring the operation of said signal.

13. A telephone system including subscribers' lines of different character, a link circuit and a trunk circuit for connecting said lines, means associated with said link circuit for operating the signal associated with said trunk circuit, automatic means for disassociating said operating means, and means individual to said link circuit for insuring the operation of said signal.

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

JOHN E. HILBISH.

Witnesses:

P. H. MALLINCKRODT.

B. O'BRIEN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."