

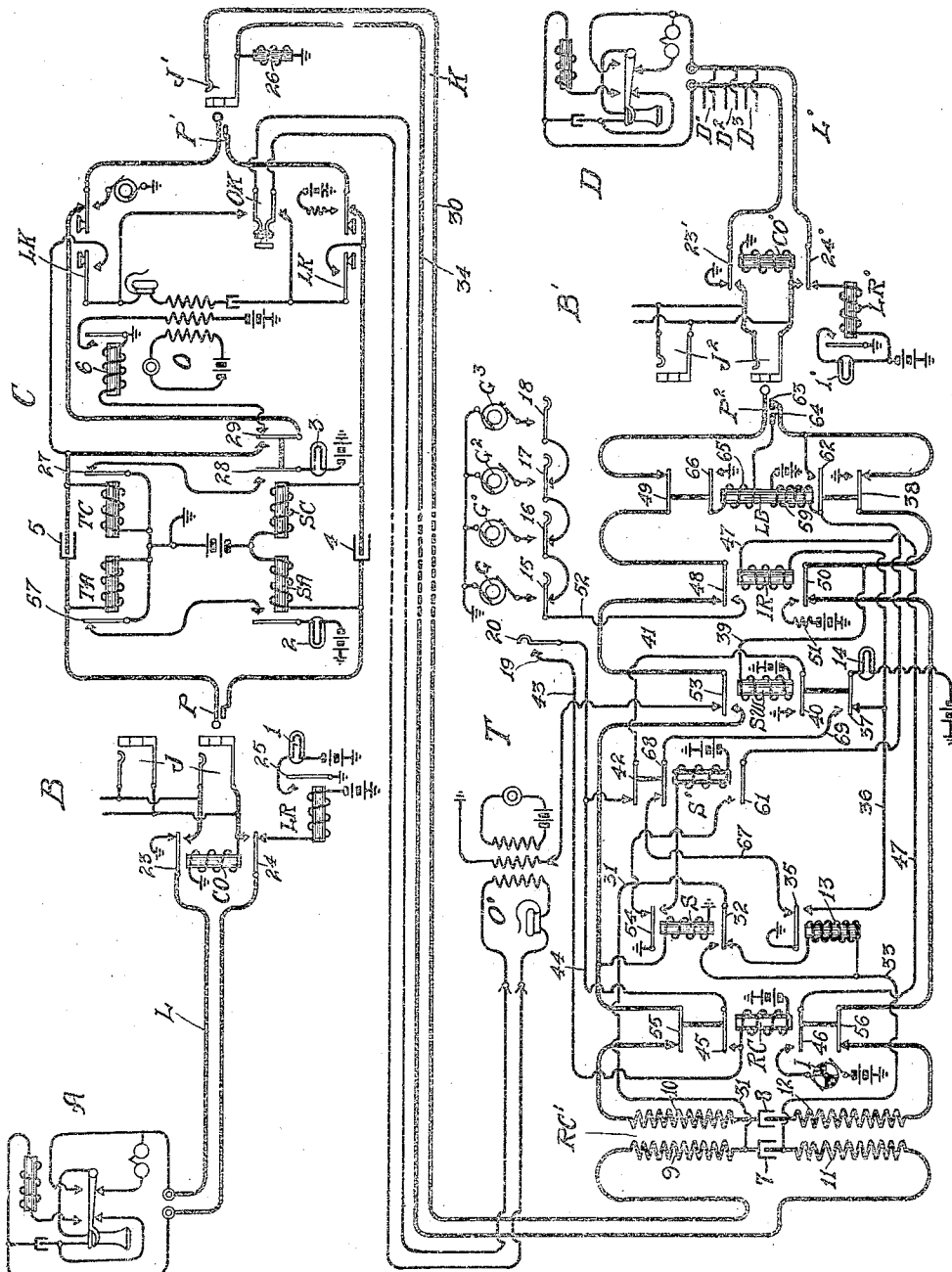
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TRUNK CIRCUIT WITH INSTANTANEOUS DISCONNECT AND RECALL.

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UNITED STATES PATENT OFFICE.

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TRUNK CIRCUIT WITH INSTANTANEOUS DISCONNECT AND RECALL.

Application filed January 29, 1914. Serial No. 815,122.

To all whom it may concern:

Be it known that I, HIRAM D. CURRIER, 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 Trunk Circuits with Instantaneous Disconnect and Recall, of which the following is a specification.

My invention relates to telephone systems in which link or trunk circuits are employed and has to do more particularly with manually operated link circuits for interconnecting telephone lines, one of the features of my invention being the provision of means whereby when connection has been made with a telephone line by a link circuit, another call may be extended to a central office switchboard from such line prior to disconnecting the link circuit thereof. Where manually operated link circuits are employed for interconnecting lines, there are times when an operator will fail to take down a connection immediately upon receiving a disconnect signal and this delays extending another call from such a connected line. Therefore I have provided means whereby a subscriber may initiate a call without waiting for the operator to disconnect an associated link circuit, and to this end I have provided a so-called link disconnect relay which is adapted to be operated when the receiver is replaced at the connected substation, said relay thereby operatively disassociating the link circuit from the line and restoring the line circuit to such condition that the immediate removal of the said receiver will extend a call to the central office even though the terminal of the link circuit is still connected with said line. In my copending application filed of even date, the disconnect feature is shown in connection with the cord circuit.

Referring now in general to the preferred embodiment of my invention as illustrated in the accompanying drawing, it comprises a calling substation A of the well-known Kellogg common battery type connected by the line limbs L to a common battery line circuit B, comprising multiple jacks J, a line relay LR energized upon initiation of a call to light a line lamp 1, and a cut-off relay CO which is energized to interrupt the circuit of the relay LR to efface the lamp signal.

A cord circuit C is associated with the line circuit B comprising an answering plug P and a calling plug P¹ the condensers 4 and 5 being interposed in the heavily marked conductors connecting the plugs P and P¹. The calling plug P¹ is adapted for connection with multiple jacks of other telephone lines terminating in the same switchboard or can be connected to jacks leading to trunk circuits extending to distant exchanges or switchboards. The answering end of the cord circuit C comprises a tip answering supervisory relay TA and a sleeve answering supervisory relay SA, the two relays TA and SA controlling a supervisory lamp 2. The calling end of the cord circuit C comprises a tip calling supervisory relay TC and a sleeve calling supervisory relay SC, the two relays TC and SC controlling a supervisory signal 3. A listening key LK is provided which when actuated connects the operator's set O with the cord circuit and a test relay 6 is associated with the operator's set O. An order wire key OK is provided for connecting the operator's set O with the trunk operator's set O¹ at a distant exchange. Trunk jacks J¹ are located at the A operators' positions and are connected by the heavily marked conductors K to trunk circuits T.

The trunk circuit T comprises a calling plug P², connected through talking conductors to a repeating coil RC¹ and having the condensers 7 and 8 interposed between the windings 9, 11 and 10, 12. A relay 13 of high resistance is associated with the incoming end and energizes when the plug P¹ is inserted into the jack J¹. A guard lamp 14 is lighted upon energization of the relay 13 and acts as a check for the B operator at O¹ and informs her whether the operator at O has plugged into the trunk jack assigned to her. A switching relay SW is provided which is energized in series with the cut-off relay CO¹ when the plug P² of the trunk circuit T is inserted into a multiple jack J². Ringing generators G, G¹, G² and G³ are provided being of different frequencies and associated with the key plungers 15, 16, 17 and 18. End springs 19 and 20 of the ringing keys are actuated when one of the ringing plungers is depressed to its fully actuated position thereby energizing a slow-acting ringing control relay RC which connects the interrupter I through one of its contacts to energize and de-energize an interrupter

relay IR to connect ringing current to the called line. A tip supervisory relay S is also associated with the trunk circuit T and is energized when the called subscriber removes his receiver from its switch-hook, thus opening the circuit of the high resistance relay 13 which allows the relay TC of the cord circuit C to energize and to efface the lamp 3. A slow-acting relay S¹ is also energized when the supervisory relay S is operated, thus interrupting the circuit of the relay RC to disconnect the interrupter I. A double wound link disconnect relay LD is provided which is operated when the subscriber at the called substation replaces his receiver upon the switch-hook, thereby operatively disassociating the trunk from the line and allowing the called station to light its line lamp for recall before the trunk plug is removed. This operation will be more fully described.

The substation D shown at the called end is similar to the substation A and its associated line circuit B¹ is similar to the line circuit B. There are four substations located on the line limbs L¹ the terminals D¹, D² and D³ of the three substations being shown.

Having described in general the apparatus used in the system as illustrated, the operation of the system will now be more fully described.

Assuming a subscriber at substation A wishes connection with a substation D terminating at a different switchboard, he removes his receiver from its switch-hook establishing a circuit through the line relay LR traced from ground at normal contact 23 of cut-off relay CO over line limbs L, substation A, normal contact 24, and the winding of relay LR to battery, energizing the relay LR and lighting the line lamp 1 by the closing of the alternate contact 25. The operator in response to the said signal inserts an answering plug P into the jack J establishing an energizing circuit for the relays SA and CO traced from battery through the winding of relay SA, the sleeve contacts of the plug P and jack J and through the winding of cut-off relay CO to ground. The relays SA and CO are energized, the cut-off relay CO interrupting the circuit of the line relay LR thereby effacing the line signal 1. A circuit for relay TA is also established from battery through the previously described path to alternate contact 24 of relay CO, over the line limbs L through the substation A, alternate contact 23, tip contacts of the jack J and plug P and through the winding TA to ground energizing the relay TA. The operator then actuates key LK to connect operator's telephone O to ascertain the wants of the calling subscriber.

Assuming that the calling subscriber at

A desires connection with the substation D which terminates at a distant switchboard or exchange, the operator then presses the order-wire key OK leading to the exchange in which the line of substation D terminates. The A operator at the originating exchange, after having a trunk assigned by the B operator inserts the calling plug P¹ into the trunk jack J¹ thereof. When the plug P¹ is inserted into the jack J¹ the circuit for sleeve calling supervisory relay SC is closed, traced from battery through the winding of relay SC, the sleeve contacts of the plug P¹ and jack J¹, and through the impedance coil 26 to ground energizing the relay SC. The energization of relay SC lights the supervisory lamp 3, the circuit being traced from ground at normal contact 27 of relay TC, alternate contact 28, through the lamp 3 to battery. The alternate contact 29 of relay SC in closing establishes a circuit for the high resistance signal relay 13 of trunk circuit T, traced from ground through the winding of relay TC, alternate contact 29, tip contacts of the plug P¹ and jack J¹, conductor 30, winding 9 of repeating coil RC¹, conductor 31 to normal contact 32, the winding of relay 13, conductor 33, winding 11 of repeating coil RC¹, conductor 34, sleeve contacts of the jack J¹ and plug P¹, the winding of relay SC to battery energizing the relay 13, but the relay 13 being wound to a comparatively high resistance, sufficient current does not flow through the relay TC to energize it thus allowing the supervisory lamp 3 to remain lighted.

Assuming now that the trunk operator has as yet not plugged into the jack of the called substation, upon the said energization of relay 13, guard lamp 14 is lighted, its circuit being traced from ground at alternate contact 35 of relay 13, conductor 36, normal contact 37, and through the lamp 14 to battery. The lamp is lighted and indicates to the trunk operator in the usual manner that the operator at the originating exchange has plugged into the trunk assigned to her. Now if the operator at the originating exchange has plugged into a trunk jack other than the jack J¹, the lamp 14 does not light and the trunk operator will know that the first operator has not plugged into the jack J¹ due to the relay 13 not energizing.

The B or trunk operator having had the called number repeated to her, tests the jack J² of the called substation by placing the tip of the plug P² to the sleeve of the jack J². If the called line is busy the operator receives the customary click in her head receiver.

Assuming now that the line is idle, the operator inserts the plug P² into the jack J² and an energizing circuit for the switching

relay SW of the trunk circuit T and the cut-off relay CO¹ of the line circuit B¹ will be established, traced from ground through the winding of relay CO¹, the sleeve contacts of the jack J² and plug P², normal contact 38 conductor 39, and the winding of relay SW to battery energizing the relay CO¹ and SW in series. The relay SW energizing effaces the guard lamp 14. The trunk operator after having plugged into the wanted line, actuates one of the ringing plungers 15, 16, 17 or 18 to connect the proper ringing generator G, G¹, G² or G³ to the line of the called substation. Assuming now that the plunger 15 is depressed to its fully depressed position, when in this position the end springs 19 and 20 are closed to establish an energizing circuit for the ringing control relay RC, the circuit being traced from ground at alternate contact 40 of relay SW, conductor 41, normal contact 42, closed springs 19 and 20, conductor 43, and winding of relay RC to battery. When the plunger is released it remains in its ringing position, the end springs 19 and 20 assuming their normal position and opening the initial energizing circuit for relay RC, but a locking circuit therefor was established traced from ground at alternate contact 40 of relay SW, conductor 41, normal contact 42, conductor 44, alternate contact 45, and the winding of relay RC to battery. When the relay RC energized, its alternate contact 46 closed establishing a circuit for relay IR traced from ground at alternate contact 35 of relay 13, conductor 36, winding of relay IR, conductor 47, alternate contact 46, and interrupter I to battery. The interrupter opens and closes the circuit of the relay IR to intermittently connect ringing current to the line of the called for substation. The ringing circuit may be traced from the ungrounded pole of the generator G, alternate contact 15, conductor 52, alternate contact 48, normal contact 49, tip contacts of the plug P² and jack J², alternate contact 23¹, line limbs L¹, condenser and call bell of the substation D, alternate contact 24¹, sleeve contacts of the jack J² and plug P², normal contact 38, alternate contact 50, through the protective resistance 51 to battery and ground.

Upon the response of the called-for subscriber at substation D an energizing circuit for supervisory relay S is established, the circuit being traced from ground through the winding of relay S, the heavily marked conductor to alternate contact 53 of relay SW, normal contact 48, normal contact 49, tip contacts of the plug P² and jack J², alternate contact 23¹, line limb L¹, substation B, alternate contact 24¹, sleeve contacts of the jack J² and plug P², normal contact 38, conductor 39 and through the winding of relay SW to battery. The ener-

gization of relay S opens the circuit of the high resistance relay 13, and closes a low resistance circuit for the relay TC of cord circuit C from ground through the winding of relay TC, alternate contact 29, tip contacts of the plug P¹ and jack J¹, conductor 30, winding of repeating coil RC¹, conductor 31 alternate contact 32, conductor 33, winding 11 of repeating coil RC¹, conductor 34, sleeve contacts of the jack J¹ and plug P¹ and winding of relay SC to battery. The relay TC energizes and opens its normal contact 27 effacing the supervisory lamp 3 notifying the A operator that the two substations are in conversational circuit.

The energization of relay S closes an energizing circuit for the relay S¹ traced from ground at alternate contact 54 of relay S, the winding of relay S¹ to battery, energizing the relay S¹ to open the locking circuit of the relay RC at its normal contact 42. Upon de-energization of relay RC, the interrupter I is disconnected at alternate contact 46, opening the circuit of relay IR allowing it to restore to normal and disconnecting the ringing current from the line. The relay RC in restoring closes its contacts 55 and 56 establishing the continuity of the talking conductors. The substations are now connected in conversational circuit, said talking circuit being traced over the heavily marked conductors.

The subscribers having finished conversation replace their receivers upon their respective switch-hooks and upon replacing of the receiver at substation A, the tip answering supervisory relay TA is de-energized, closing its normal contact 57 and lighting the supervisory lamp 2. The replacing of the receiver at substation D opens the energizing circuit of the relay S which de-energizes substituting the high resistance path through relay 13, so that relay TC de-energizes closing its normal contact 27 and again lighting the supervisory lamp 3. The supervisory lamps 2 and 3 being lighted, the A operator removes the plugs P¹ and P¹ from the jacks J and J¹ whereupon the relays SA and SC restore, effacing lamps 2, 3. The apparatus of the cord circuit C is at normal and is now available for other connections.

The removal of the calling plug P¹ from the jack J¹ opens the energizing circuit of the relay 13 and when the subscriber at D replaces his receiver upon its switch-hook relay S restores interrupting the circuit of relay S¹ but relay S¹ being slow to release, an energizing circuit for link disconnect relay LD is established through its high resistance winding 59, alternate contact 61 and normal contact 54 to ground. The relay LD then establishes a locking circuit for itself traced from battery through its lower winding 59, alternate contact 62, the ring contact

63 of the plug P², sleeve contact of the jack, sleeve contact 64, of the plug P² and the low resistance winding 65 to ground at alternate contact 66. The opening of its alternate
 5 contacts 38, 49 operatively disassociates the link talking conductors from the connected line of D, and the closing of alternate contact 38 maintains an energizing circuit for relay SW. The high resistance winding 59
 10 of relay LD assisted by the shunting effect of low winding 65 does not allow sufficient current to flow through the cut-off relay CO¹ which deenergizes so as to permit a call to come in from the connected line of D. In
 15 practice I have found that with 24 volts, winding 65, 200 ohms, winding 59, 1000 ohms, and winding CO¹, 500 ohms, satisfactory operation is secured although it is to be understood that other values may be
 20 employed. The de-energization of relay S¹ closes a circuit for the lamp 14 traced from ground at normal contact 35 of relay 13, conductor 67, normal contact 68, conductor 69, alternate contact 37 and through the lamp
 25 14 to battery, the lamp 14 again lighting and acting as a disconnect signal for the trunk operator.

We now have the trunk circuit T with its plug P² still in the jack of the called line, disconnect signal 14 lighted, and with the
 30 cut-off relay CO¹ restored. Now if the subscriber at the called substation desires to initiate a call prior to the removal of the trunk plug P² from the jack, the receiver at
 35 substation D is again removed and due to the fact that relay CO¹ is at normal, line relay LR¹ is energized by current over the calling line thereby operating the line signal 1¹. The A operator at whose position
 40 the answering jack J² of the called line terminates, therefore inserts an answering plug P of a cord circuit C into the answering jack associated with the line lamp 1¹ connecting relays SA and CO¹ in series to cause
 45 the energization of both of these relays, and also the energization of tip relay TA as already described. The connection is then extended in the usual manner. It will be remembered that the trunk plug P² was still
 50 in one of the jacks J² of the called line at the time the answering plug of the cord circuit C was inserted but with a resistance of 100 ohms for relay SA sufficient current will flow to energize relays SA, TA and
 55 CO¹. The B operator upon removing the plug P² in response to the disconnect signal 14 does not affect the last connection established.

From the above it will be apparent that
 60 a subscriber whose line has been connected with by a link circuit, as a called line, need not wait for the removal of the trunk plug from the line jack before initiating a call, but by simply replacing his receiver upon
 65 its switch-hook circuit changes are effected

whereby the immediate removal of the telephone will initiate a call at the answering jack of this line.

Upon removal of the trunk plug P², the energizing circuit for link disconnect relay 70 LD is interrupted at the contacts of the plug whereby said relay de-energizes followed by the de-energization of relay SW so that the trunk circuit is available for use in establishing other connections.

It will be also apparent from the above that in the case of connecting to called party lines, as soon as a called party upon such party line replaces his receiver, the line is available for calling by other telephones on
 80 the line without waiting for the trunk operator to remove the trunk plug.

In working out my invention I have applied it so as to work in connection with certain standard forms of link circuits but I
 85 contemplate using it in other ways than that shown and therefore do not desire to be limited to the exact system as shown and described but aim to cover all that which comes within the spirit and scope of the
 90 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 call- 95 ing subscriber's line and a called subscriber's line, an operator controlled link circuit having a pair of normally connected terminals for connecting the said lines in conversational circuit, and means controlled at the
 100 substation of said called line independent of the control of the calling line for operatively disassociating said link circuit from said called line prior to the disconnection of the terminals of the link circuit from the jacks
 105 of the calling and called lines.

2. A telephone system comprising a calling subscriber's line and a called subscriber's line, operator controlled link circuit provided with a pair of normally connected
 110 terminals for connecting said lines in conversational circuit, a link disconnect relay for said circuit, and a supervisory relay for said link circuit controlled at the substation of said called line for operating said link
 115 disconnect relay, said disconnect relay controlled independently of the calling line.

3. A telephone system comprising a party telephone line, an operator controlled link circuit having a manual connection terminal
 120 for connecting with said line, means whereby when a party on said line hangs up for disconnection the line is available for extending a calling signal before said connection
 125 terminal is withdrawn, and a busy potential maintained for said line while so recalling.

4. A telephone system comprising a party telephone line, an operator controlled link circuit having a manual connection terminal
 130 connected to said line, means for signaling

a called substation on said line, means whereby when a subscriber at the called substation hangs up for disconnection said line is available for extending a calling signal from any of the other substations before said connection terminal is withdrawn, and a busy potential maintained for said line when so recalling.

5. A telephone system comprising telephone lines, A and B operators' link and trunk circuits respectively connecting a pair of said lines by a conversational circuit, and means controlled over the line connected to the trunk whereby a call can be effected from the substation thereof irrespective of whether said circuit is or is not connected to its said line, said means including a disconnect magnet energizable to permit the subscriber to recall.

6. A telephone system comprising telephone lines, an operator controlled link circuit provided with terminals for connecting a pair of said lines in conversational circuit, means controlled at the substation of one of said lines independent of the other connected line for operatively disassociating said first line from said link circuit, and means operative upon disconnection of one of said terminals from said first line for restoring to normal said disassociating means.

7. A telephone system comprising a telephone line, line and cut-off relays for said line, an operator controlled link circuit having a manual connection terminal normally connected with the conductors of said link circuit for connecting with said line as a called line, said cut-off relay being operated responsive to the connection of said terminal with said line whereby said line relay is disconnected from the line, means for signaling the substation on said line, and means under sole control of such substation for restoring said cut-off relay and rendering the line relay operative while said manual connection terminal is connected with the line.

8. A telephone system comprising a telephone line, an operator controlled link circuit having a manual connection terminal for connecting with said line, and means responsive to a control exercised at the substation of said line for operatively disassociating said link circuit and line and maintaining a busy potential on the line terminal.

9. A telephone system comprising a telephone line, an operator controlled link circuit having a manual connection terminal for connecting with said line, a link disconnect relay, a supervisory relay controlled at the substation of said line for operating said link disconnect relay, and means for maintaining a busy potential upon the terminal of said line while said link disconnect relay is operated.

10. A telephone system comprising a party telephone line, an operator controlled link circuit having a manual connection terminal normally connected with the conductors of said link circuit for connecting with said line as a called line and means whereby when a receiver is replaced for disconnection the line is available for extending a calling signal before said connection terminal is withdrawn, said means being initially under sole control of the connected line and independent of the connection of the other connection terminal of said link circuit to a line.

11. A telephone system comprising a telephone line, an operator controlled link circuit having a manual connection terminal for connecting with said line, a link disconnect relay, a supervisory relay controlled at the substation of said line for operating said link disconnect relay, and means for maintaining said link disconnect relay operated and a busy potential upon the line terminal while said connection terminal is connected with the line.

12. A telephone system comprising a telephone line, a cut-off relay connected to a jack terminal of said line, an operator controlled link circuit having a manual connection terminal for connecting with the line terminal, means for energizing said cut-off relay responsive to such connection, and means controlled over said line for operatively disassociating said link and line without removal of the connecting terminal and for maintaining a busy potential upon the jack terminal but insufficient to effect the energization of the cut-off relay.

13. A telephone system comprising a telephone line, a cut-off relay connected to a jack terminal of said line, an operator controlled link circuit having a manual connection terminal for connecting with the line terminal, a switching relay for the link circuit, said switching relay and cut-off relay being energized over a series circuit upon such connection, a link disconnect relay, said disconnect relay being controlled over the connected line for disconnecting said line and link, maintaining said switching relay energized and a busy potential upon the jack terminal.

14. A telephone system comprising a telephone line, an operator controlled link circuit having a manual connection terminal for connecting with a terminal of said line, tip and sleeve supervisory relays for the link circuit, a cut-off relay for the line and said sleeve relay being energized responsive to the connection of the link and line, a link disconnect relay responsive to the tip supervisory relay for operatively disconnecting said link and line, and connections controlled by the disconnect relay for maintaining the sleeve relay energized and a busy po-

tential upon the line terminal insufficient to energize the cut-off relay, until said connection terminal is withdrawn.

15. A telephone system comprising a telephone line, multiple jack terminals for said line, an operator controlled link circuit having a manual connection terminal for connecting with said jacks, a busy potential placed upon said jacks responsive to such connection, and means controlled over the connected line for operatively disassociating said line and link but maintaining a busy potential upon the jack terminals until the connecting terminal is withdrawn.

16. A telephone system including a telephone line, an operator controlled link circuit having a manual connection terminal, normally connected with the conductors of said link circuit for connecting with said line, a link disconnect relay controlled over the connected line and having a maintaining circuit including a talking contact of the said manual terminal.

17. A telephone system including an operator controlled link circuit having a manual connection terminal for connecting to telephone lines, and means included in said link circuit for operatively disassociating said link and a connected line but maintaining the connected line busy.

18. A telephone system including a telephone line, an operator controlled link circuit having a manual connection terminal for connecting with said line, a link disconnect relay controllable over said connected line and adapted upon energizing to disconnect said line from said link circuit, and a maintaining circuit for said relay including the test contact of the manual connection terminal.

19. A telephone system including telephone lines, an A operator's link and a B operator's trunk circuit for connecting a pair of said lines in a conversational circuit, and means controlled over the line connected to the trunk circuit whereby a call may be extended from the substation thereof irrespective of whether said link circuit is or is not operatively connected to said line, said means including a disconnect magnet energizable to disconnect the said line from said trunk circuit.

20. A telephone system comprising a calling telephone line and a called telephone line, a B operator's trunk circuit having a plug terminal for connection to said called telephone line, a jack terminal for said trunk circuit, an A operator's link circuit having a pair of plug terminals for connection to said calling telephone line and to the jack of said operator's trunk circuit, a line relay, a cut-off relay and a line signal individual to said called line, a supervisory relay for the said trunk circuit controlled over the said

line, relay coil for said trunk circuit, called subscriber's controlled means for de-energizing said supervisory relay to connect said relay coil in circuit with said cut-off relay to restore same whereby the line relay and line signal may be operated from the substation of said called line irrespective of whether said link circuit is operatively connected to said calling line or not.

21. A telephone system including a telephone line, an operator controlled link circuit having a manual connection terminal for connecting to said telephone line, and means associated with said link circuit for operatively disassociating said line and said link circuit and maintaining the said connected line busy.

22. A telephone system including a called subscriber's telephone line provided with a jack, an operator-controlled link circuit provided with a normally connected terminal for connecting with said jack, and means under the absolute control of the substation on said called line to operatively disconnect said link circuit from said line prior to the disconnection of said link circuit from a calling subscriber's line.

23. A telephone system including a telephone line, an operator's trunk circuit for extending connections provided with a manual connection terminal normally connected with the conductors of the trunk circuit for connecting to said line, and a double wound trunk disconnect relay controlled solely over the connected line and having a maintaining circuit including a contact of said manual terminal and its two windings in series.

24. A telephone system comprising a telephone line terminating at a central office, a line signal for the line, a link circuit, a cutoff relay associated with the line for controlling the line signal and actuated upon connection of the link circuit with the line, a resistance coil, and means controlled solely over the said telephone line for including the resistance coil in circuit with the cut-off relay to cause the release thereof.

25. A telephone system comprising a telephone line terminating at a central office, a line signal for the line, a link circuit, a cut-off relay associated with the line for controlling the line signal and actuated upon connection of the link circuit with the line, a supervisory relay in the link circuit responsive to the opening of the telephone line, and a resistance coil included in circuit with the cut-off relay upon the response of the supervisory relay to cause the release of the cut-off relay, the control of the placing of the resistance coil in the cut-off relay circuit being entirely under the control of the substation on said telephone line.

26. A telephone system including a telephone line terminating at a central office, a

line signal for said line, a cut-off relay for said line for controlling the line signal, a link circuit for connection with said line, a relay for said link circuit adapted to be included in circuit with said cut-off relay when said link circuit is connected to said line, and means for substituting a resistance for the link circuit relay thereby reducing the flow of current through said cut-off relay causing the same to de-energize and place the line signal under the control of the substation on said line.

27. A telephone system comprising a telephone line, a cut-off relay for said line, a link circuit for connection with said line, a link relay adapted to be included in circuit with said cut-off relay when said link circuit is connected to said line, and means for substituting a resistance coil for said link circuit relay thereby causing the said cut-off relay to de-energize.

28. A telephone system comprising a telephone line, a cut-off relay for said line, a link circuit for connection with said line, a link relay adapted to be included in circuit with said cut-off relay when said link circuit is connected to said line, a resistance, and means for substituting said resistance for said link circuit relay thereby decreasing the flow of current through said cut-off relay and causing the same to de-energize.

29. A telephone system including a calling telephone line and a called telephone line, a line signal for said called line, a link circuit and a trunk circuit for connecting said calling line to said called line, a cut-off relay for said called line for controlling the line signal and actuated upon connection of the trunk circuit with the called line, a resistance coil, and means controlled solely by the called subscriber and by an operator for including the resistance coil in circuit with the cut-off relay to cause the release thereof.

30. A telephone system including a calling telephone line and a called telephone line, a line signal for said called line, a link circuit and a trunk circuit for connecting said calling line to said called line, a cut-off relay for said called line for controlling the line signal and actuated upon connection of the trunk circuit with the called line, a resistance coil, and means associated with the trunk circuit controlled over said called telephone line independent of any control exercised over the calling line for including the resistance coil in circuit with the cut-off relay to cause the release thereof.

31. A telephone system including a calling telephone line and a called telephone line, a link circuit and a trunk circuit connecting said lines in conversational circuit, trunk circuit disconnect means for disconnecting said called line from said trunk circuit, and a relay solely under the control of the called subscriber and an operator for

controlling said trunk circuit disconnect means.

32. A telephone system including a calling telephone line and a called telephone line, a link circuit and a trunk circuit connecting said lines in conversational circuit, trunk circuit disconnect means for disconnecting said called line from said trunk circuit, said trunk disconnect means including a magnet having an operating circuit local to the trunk circuit, and a relay under the control of the called subscriber independent of any control of the calling subscriber for controlling the said local circuit of said magnet.

33. A telephone system including a calling telephone line and a called telephone line, a link circuit and a trunk circuit connecting said lines in conversational circuit, trunk circuit disconnect means for disconnecting said called line from said trunk circuit, said trunk disconnect means including a disconnect magnet having a local operating circuit, and electromagnetic means under the control of the called subscriber and independent of any control of the calling subscriber, or of the connection of said link circuit to said trunk circuit for actuating said disconnect magnet.

34. A telephone system including a calling telephone line and a called telephone line, a link circuit and a trunk circuit for connecting said lines in conversational circuit, and trunk circuit disconnect means solely under the control of the called subscriber and an operator for freeing the called line whereby the called subscriber may initiate a recall prior to the disconnection of the trunk circuit terminal from the called subscriber's line, said trunk circuit disconnect means including a disconnect magnet energizable when the called subscriber replaces his receiver.

35. A telephone system including a trunk circuit, a relay normally bridged across the conductors of said trunk circuit, an operator's link circuit, connection means for connecting said operator's link circuit to said trunk circuit, a called subscriber's line, connection means for connecting said trunk circuit to said called subscriber's line, signaling means for signaling the called subscriber, trunk circuit means for associating said signaling means with the called line, the operative association of said signaling means with the called line being dependent upon the energization of said trunk relay, and means controlled by the called subscriber to de-energize said trunk relay.

36. A telephone system comprising a telephone line terminating at a central office, a line signal for the line, a link circuit, a cut-off relay associated with the line for controlling the line signal and actuated upon connection of the link circuit with

the line, a supervisory relay in the link circuit de-energized upon the opening of the telephone line, a resistance coil, and a relay responsive to the de-energization of
5 the supervisory relay for including the resistance coil in circuit with the cut-off relay to cause the release thereof.

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

HIRAM D. CURRIER.

Witnesses:

GEORGE E. MUELLER,
M. R. ROCHFORD.