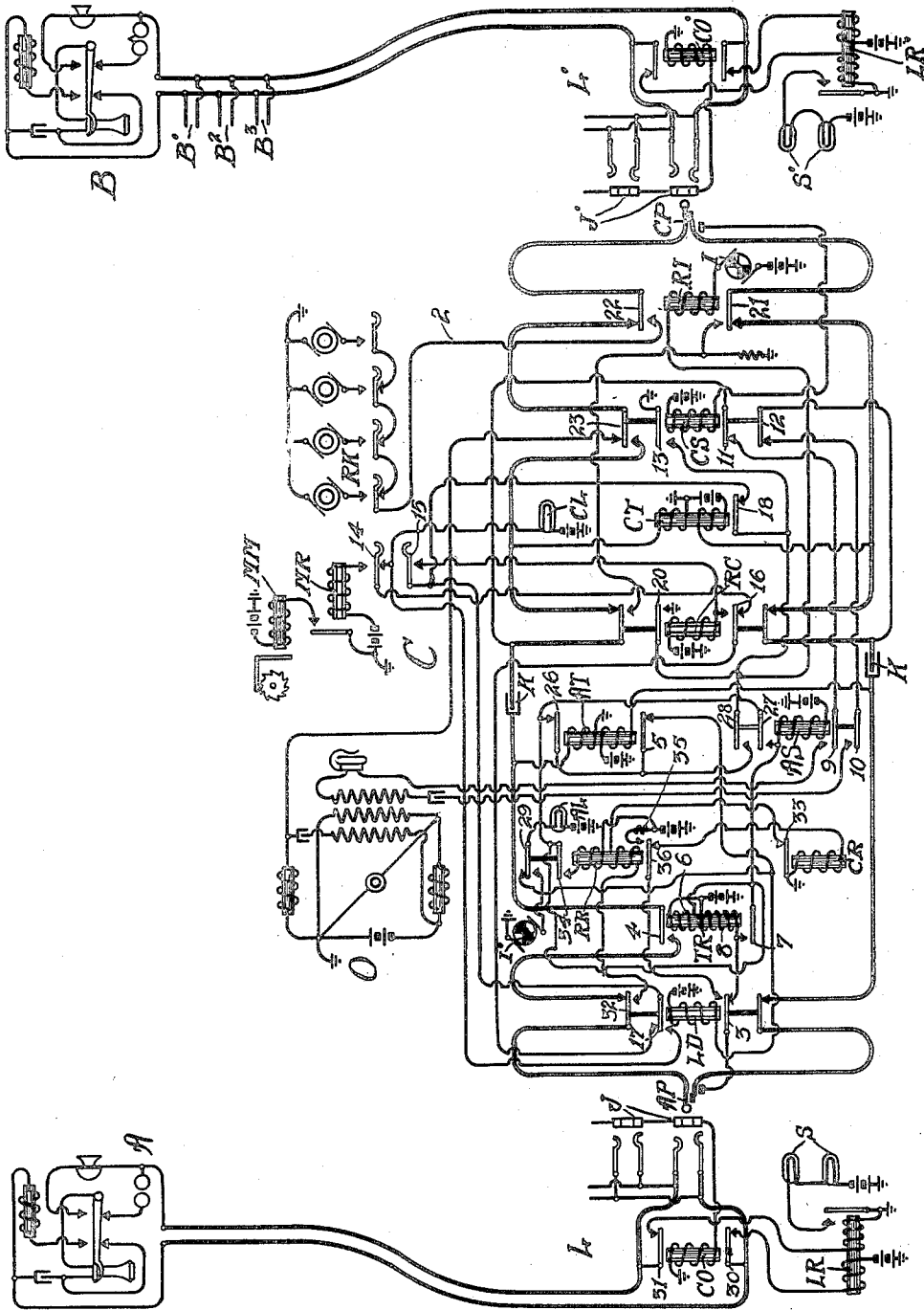


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H. D. CURRIER.
SECRET SERVICE CORD CIRCUITS.
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UNITED STATES PATENT OFFICE.

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SECRET-SERVICE CORD CIRCUITS.

Application filed March 20, 1915, Serial No. 15,935. Renewed March 10, 1920. Serial No. 364,872.

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 Secret-Service Cord Circuits, of which the following is a specification.

My invention relates to telephone systems in which link or cord circuits are employed and has to do more particularly with so-called multiple line lamp systems in which instantaneous disconnect and recall are provided, and has for its object a new and improved system of the above character. In systems heretofore used it has been customary to reoperate the multiple line signals associated with the line circuit of the calling subscriber when the subscriber wished to initiate a recall. In systems of this kind, it is possible for any idle operator to answer the recall. It has been found desirable to have the operator who handled the original call, also handle the recall; she can very often handle it more readily and more intelligently than the other operators. Therefore, I have arranged to segregate the recall to the original operator's position. To accomplish this, I provide means by which when a subscriber recalls, one movement of the switch-hook under the control of the recalling subscriber is sufficient to start in operation certain instrumentalities which convey to the operator an intermittent signal similar to the signal that might be conveyed by the flashing of the switch-hook.

Another object of my invention is the provision of an absolute secret service system. In systems heretofore in use, in which automatic listening is provided, it has been possible for a second operator to listen in on an established connection by operating her apparatus in a certain manner. I have overcome this objection by providing a system in which it is impossible for a second operator to listen in. These and other objects of my invention will be more particularly pointed out in the following specification and claims.

For a better understanding of my invention, reference may be had to the accompanying drawing in which is shown the common battery substations A and B terminating in the central office in line circuits L and L' respectively. The common battery line circuit A consists of a double wound

line relay LR, cut-off relay CO, the multiple line lamps S and multiple jacks J. The right hand winding of the line relay LR is of a comparatively high resistance while the left hand winding is of a comparatively low resistance, the reasons for having these windings of different resistances will hereinafter appear. The line circuit as illustrated is known as a multiple lamp line circuit in which the lamps S and jacks J appear before a number of operators so that any one operator may answer a call to the exclusion of the other operators. The substation B and the line circuit L' are similar in all respects to the substation A and line circuit L, except that the substation B is one of a plurality of like substations which are connected to the line conductors leading to the central office equipment.

The cord circuit C comprises the answering plug AP and calling plug CP, the two plugs being connected by the heavily marked conductors of the cord circuit and having the condensers K and K' interposed. Associated with the answering end of the cord circuit is the answering sleeve supervisory relay AS and the answering tip supervisory relay AT for controlling the circuit of the answering supervisory lamp AL. I also provide a test relay TR for controlling the circuit of the answering sleeve supervisory relay AS, which relay controls the connection of the operator's telephone set O to the strands of the cord circuit. The test relay TR comprises a pair of windings, one a comparatively high resistance winding 8 and the other a comparatively low resistance winding 6. I also provide a link disconnect relay LD for making possible instantaneous disconnect and recall, and a recall relay RR for segregating a recall to the particular operator that previously answered the original call. Associated with the calling end of the cord circuit I provide a calling tip supervisory relay CT and a calling sleeve supervisory relay CS for controlling the circuit of the calling supervisory lamp CL. The calling sleeve supervisory relay CS also controls the disconnection of the operator's set O from the strands of the cord circuit. A party line ringing key RK is provided for connecting one of a plurality of generators to the common ringing lead 2 and for controlling the ringing control relay RC. The ringing control relay RC controls the ring-

ing interrupter relay RI, which through the medium of the interrupter I applies ringing current from the common lead 2 to the line of the called subscriber. Associated with the cord circuit C is a service registering device comprising a meter magnet MM and a meter control relay MR.

Assuming that the subscriber at the substation A wishes to initiate a call, upon the removal of the receiver thereat, a circuit is closed through the line relay LR, the line relay upon energizing closes a circuit through the multiple line lamps S. An operator upon noting the line lamp S glowing inserts the answering plug AP into a jack J of the calling line. Upon the insertion of the answering plug AP into the jack J, an energizing circuit is closed through cut-off relay CO and through the high resistance winding of the relay TR. This circuit extends from battery through the high winding of said test relay, normal contact 3 of the link disconnect relay LD, through the sleeve contacts of the plug AP and jack J and through the cut-off relay CO to ground. The cut-off relay CO upon energizing, disconnects the subscriber's line circuit from the line relay LR thereby causing the line lamps S to be effaced. The test relay TR, upon energizing, closes the tip strand of the cord circuit at its contact 4 and thereby closes an energizing circuit through the answering tip supervisory relay AT. The answering tip supervisory relay AT, upon energizing, prevents the premature glowing of the answering supervisory lamp AL by opening its normal contact 5 and also prevents the closing of an energizing circuit for link disconnect relay LD. A further result due to the energization of the test relay TR is the closing of a multiple circuit, through its locking winding 6 and through the answering sleeve supervisory relay AS to the sleeve conductor of the answering plug AP. This circuit extends from battery through the windings of the answering sleeve supervisory relay AS and the locking winding 6 of the test relay TR to the contact 7 of the said test relay TR, then through the normal contact 3 of the link disconnect relay LD, through the sleeve conductor of the answering plug AP and jack J, and through the cut-off relay CO to ground. This low resistance path, extending to the sleeve conductor of multiple jacks J, prevents the test relay TR of another cord circuit from operatively energizing and connecting the operator's set of the said second cord circuit to the line circuit of the calling subscriber. Answering sleeve supervisory relay AS, upon energizing, connects the operator's set O to the cord circuit through its alternate contacts 9 and 10 and through the normal contacts 11 and 12 of the calling sleeve supervisory relay CS.

The operator, now being in connection with the calling subscriber inquires the wants of the said calling subscriber. Assuming that it is the subscriber at the substation B that is wanted, the operator tests the line of the called subscriber and if it is idle she then inserts the calling plug CP into the jack J¹ connected to the line circuit of the called subscriber. If the line of the called subscriber is busy, the operator will receive the usual busy click in her receiver notifying her of the condition of the called line, and will thereupon notify the calling subscriber that the called line is busy. Upon the insertion of the calling plug CP into the jack J¹ an energizing circuit is closed through the calling sleeve supervisory relay CS and the cut-off relay CO¹ of the called line. This circuit extends from battery through the winding of the said calling sleeve supervisory relay CS, sleeve conductor of the calling plug CP and jack J¹, and through the winding of the said cut-off relay CO¹ to ground. The relay CO¹ upon energizing, disconnects the line relay LR¹ from the line circuit of the called subscriber. The calling sleeve supervisory relay, upon energizing, disconnects the operator's set O from the strands of the cord circuit at its contacts 11 and 12 and closes a circuit through the calling supervisory lamp CL at its contact 13. The circuit for lamp CL extends from battery through the said calling lamp CL, end contact 14 of ringing key RK, normal contact 16 of ringing control relay RC, normal contact 17 of link disconnect relay LD, normal contact 18 of calling tip relay CT and through the alternate contact 13 of relay CS to ground. The calling lamp CL is the customary supervisory lamp for indicating to the operator when the called subscriber responds. The operator next depresses one of the ringing key plungers to connect one of the generators to the common ringing lead 2, to initiate the operation of the automatic ringing equipment, and to close a circuit for the meter control relay MR. The circuit for the meter control relay MR, extends from battery through the winding of said relay MR, alternate contact 14 of ringing key RK, normal contact 16 of ringing control relay RC, normal contact 17 of link disconnect relay LD, normal contact 18 of the tip supervisory relay CT and through the alternate contact 13 of the calling sleeve supervisory relay CS to ground. The meter relay MR, upon energizing, closes a circuit through the magnet MM which then operates to register a call upon the service meter. When the operator releases the pressure from the plunger of the ringing key RK, the end springs 14 and 15 return to their normal position. The closing of the alternate contact 15 of the end springs of the ringing key RK closes a cir-

cuit through the ringing control relay RC. This circuit extends from battery through the winding of said relay RC, alternate contact of the end springs 15, normal contact 18 of the
 5 calling tip supervisory relay CT and through the alternate contact 13 of the calling sleeve supervisory relay CS to ground. The ringing control relay RC, upon energizing, closes a locking circuit for itself at its alter-
 10 nate contact 16 independent of the end spring 15, closes a circuit through the interrupter relay RI and separates the talking strands of the calling end of the cord circuit from the strands of the answering end of the
 15 cord circuit. The said locking circuit for ringing control relay RC extends from battery through the winding of said relay, through its alternate contact 16, through normal contact 17 of link disconnect relay LD, normal
 20 contact 18 of calling tip supervisory relay CT and through alternate contact 13 of calling sleeve supervisory relay CS to ground. The circuit for the interrupter relay RI extends from battery through the interrupter
 25 I, through the winding of said relay RI, through alternate contact 20 of the ringing control relay RC to ground. The ringing relay RI, upon energizing, connects ringing current from common ringing lead 2 to the
 30 line of the called subscriber.

Upon the response of the called subscriber, a circuit is closed through the calling tip supervisory relay CT, this circuit extends from battery through the lower winding of
 35 said relay CT, normal contact 21 of ringing relay RI, ring contact of the calling plug CP and jack J¹, through the substation B, tip contacts of the jack J¹ and plug CP, normal contact 22 of ringing relay RI, alter-
 40 nate contact 23 of relay CS, and through the upper winding of the calling tip supervisory relay CT to ground. The relay CT, upon energizing, opens the locking circuit for the ringing control relay RC and for
 45 the supervisory lamp CL at its contact 18. The ringing control relay, upon de-energizing, opens the circuit of the ringing interrupter relay RI at its contact 20 and connects the strands of the calling and called
 50 ends of the cord circuit, so that conversation may now take place between the calling and called subscriber over the heavily marked conductors. The effacement of the calling lamp CL indicates to the operator that the
 55 called party has responded.

Assuming now that conversation has been finished, the subscriber at the substation A, upon replacing the receiver upon its switch-
 60 hook, opens the energizing circuit of the answering tip supervisory relay AT at the switch-hook contacts. The supervisory relay AT, upon de-energizing, closes an energizing circuit for the link disconnect relay LD at
 65 its contact 5 and closes a locking circuit for the test relay TR and for the sleeve super-

visory relay AS at its contact 26. The locking circuit for the sleeve supervisory relay AS extends from battery through the winding of said relay, its alternate contact 27,
 70 normal contact 26 of relay AT, alternate contact 28 of relay AS and alternate contact 13 of relay CS to ground. The locking circuit for the test relay TR extends from battery through the windings of said relay,
 75 alternate contact 27 of relay AS, normal contact 26 of relay AT, alternate contact 28 of relay AS and alternate contact 13 of relay CS to ground. A further result due to the de-energization of the answering tip super-
 80 visory relay AT is the closing of a circuit through the answering supervisory lamp AL. This circuit extends from battery through the said lamp AL, normal contact 29 of relay RR, normal contact 5 of relay
 85 AT, alternate contact 28 of relay AS and alternate contact 13 of relay CS to ground. The circuit for the link disconnect relay LD extends from battery through the winding of said relay, normal contact 5 of relay AT,
 90 alternate contact 28 of relay AS and alternate contact 13 of relay CS to ground. The link disconnect relay LD, upon energizing, disassociates the talking strands of the link circuit from the line circuit, opens the circuit of the cut-off relay CO at its normal con-
 95 tact 3 and connects the control relay CR to the sleeve of the answering plug AP. The called subscriber B, upon replacing his receiver upon the receiver hook, opens the circuit of the calling tip supervisory relay CT
 100 at the switch-hook contacts. The supervisory relay CT, upon de-energizing, closes a circuit for the calling supervisory lamp CL. The circuit for the calling supervisory lamp extends from battery through the said lamp,
 105 alternate contact 17 of link disconnect relay LD, normal contact 18 of relay CT and alternate contact 13 of relay CS to ground. The operator, upon noting the glowing of the answering supervisory lamp AL and the
 110 calling supervisory lamp CL, removes the answering plug AP and the calling plug CP from their respective jacks J and J¹. The removal of the calling plug CP from the jack J¹ allows the cut-off relay CO¹ and
 115 the calling sleeve supervisory relay CS to de-energize. The relays CS upon de-energizing, opens the locking circuit for the link disconnect relay LD, answering sleeve supervisory relay AS, test relay TR and for
 120 the supervisory lamps CL and AL. The relays, upon de-energizing permit the apparatus of the cord circuit to return to normal as soon as the answering plug AP is removed from the jack J.
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Should the calling subscriber wish to recall before the answering plug AP is removed from the jack of the line circuit L, he may do so. The subscriber, upon removing his receiver for a recall, closes a circuit
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through the recall relay RR extending from battery through the left hand winding of the line relay LR, normal contact 30 of cut-off relay CO through the calling subscriber's substation, tip contact of the jack J and plug AP, alternate contact 32 of relay LD through the lower winding of said recall relay RR and the normal contact 33 of control relay CR to ground. The subscriber upon removing his receiver also closes a circuit through the high resistance winding of the line relay LR, this circuit extending from battery through the left hand winding of the relay LR, normal contact 30 of the cut-off relay CO, through the calling subscriber's substation, normal contact 31 of relay CO and through the high resistance right hand winding of the relay LR to ground. The line relay LR does not energize at this time owing to the low resistance path extending through the recall relay RR and owing to the special adjustment of contact 34 of relay RR. The relay RR is so adjusted that upon the first slight movement of its armature its contact 34 is closed before its other contacts are moved. The relay RR, upon energizing, closes a locking circuit for itself extending from battery through its upper winding, its alternate contact 34, normal contact 26 of relay AT, alternate contact 28 of relay AS and alternate contact 13 of relay CS to ground. The relay RR also closes an energizing circuit for the cut-off relay CO of the recalling subscriber's line. This circuit extends from ground through the winding of said cut-off relay, sleeve conductor of jack J and plug AP, alternate contact 3 of relay LD, alternate contact 36 of recall relay RR and through the resistance 35 to battery. The cut-off relay, upon energizing, disconnects the line relay LR from the subscriber's line circuit L before it has had time to energize and cause the line signals S to be operated. A further result due to the energizing of the recall relay RR is to flash the supervisory lamp AL. The flash circuit for the supervisory lamp AL extends from battery through the said lamp AL, alternate contact 29 of the recall relay RR and through the interrupter I¹ to ground. The operator, upon noting the flashing of the answering supervisory lamp AL, removes the calling plug CP from the jack J¹ thereby allowing the calling sleeve supervisory relay CS to de-energize. The relay CS, upon de-energizing opens the locking circuits for answering sleeve supervisory relay AS, testing relay TR, recall relay RR and link disconnect relay LD. The link disconnect relay LD is made slightly slow-acting to allow relays AS, TR and RR to de-energize before it de-energizes. The recall relay RR, upon de-energizing, opens the circuit of the supervisory lamp AL at its alternate contact 29. Link disconnect relay LD,

upon de-energizing, immediately closes a circuit through the high resistance winding of the test relay TR at its normal contact 3 before the cut-off relay CO has had time to allow the line relay LR to energize and cause the line signals S to glow. The test relay TR, upon again energizing, closes a multiple circuit through its winding 6 and through the answering sleeve supervisory relay AS to the sleeve conductor of the answering plug AP in the same manner as hereinbefore described. The link disconnect relay LD upon de-energizing, also connects the talking conductors of the answering plug AP to the strands of the link circuit C. The recall is then handled by the operator in the same manner as previously described for handling an original call.

Assuming now that the conversation has been terminated, that the calling subscriber A and called subscriber B have replaced their receivers, and that a second operator has received a call for the calling subscriber A, the operator first tests the line of the subscriber A and finding it idle inserts the calling plug of a cord circuit in to a jack J connected to the line circuit of subscriber A. Upon inserting the calling plug of the second operator's link circuit into the jack J, an energizing circuit is closed through the control relay CR of the cord circuit C. This circuit extends from battery through the calling sleeve supervisory relay of the second operator's cord circuit, the sleeve of the calling plug, the sleeve of the jack J, sleeve of the answering plug AP of cord circuit C, alternate contact 3 of the link disconnect relay LD, normal contact 36 of recall relay RR and through the winding of control relay CR to ground. The control relay CR energizes over this circuit and removes ground from the lower winding of the recall relay RR so that when the second operator applies ringing current to the tip conductor of the calling plug CP, it will not cause the recall relay RR to be operated to cause the answering supervisory lamp AL to signal a false recall.

Assuming now that a connection has been established, if an operator should attempt to listen in upon a busy line by inserting the answering plug of an idle link circuit into a multiple jack of the busy line and then touch the tip of another answering or calling plug to the sleeve of the busy line in an attempt to energize the answering sleeve supervisory relay AS to connect the operator's set O with the strands of the cord circuit that she has connected to the busy line, she will find that she will be unable to energize the supervisory relay AS to connect her set O, as ground is normally disconnected from the tip conductors of both the answering and calling plugs.

In working out my invention I have em-

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ployed preferred circuit arrangements, all of which go to make an efficient operating system but it is to be understood that changes and modifications may be readily made without departing from the spirit and scope of my invention. Therefore, I do not desire to be limited to the exact arrangement shown and described but aim to cover all such changes and modifications as come 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. In a telephone system, a calling subscriber's line circuit, a plurality of line signals for said line circuit, a link circuit adapted to be connected to said line circuit, a supervisory signal for said link circuit, means for operating said multiple signals when the calling subscriber initiates a call, automatic means for operating said supervisory signal and for placing the subscriber's line in condition to be called when the subscriber signals for disconnection, and means controlled by a single actuation of the call initiating apparatus at the subscriber's substation for intermittently operating the said supervisory signal.

2. A telephone system including a subscriber's telephone line, a link circuit for connection to said line to extend a call therefrom, a signal individual to said link circuit adapted to be operated to denote a recall, and means responsive to the connection of a second link circuit to said line as a called line for removing the substation control of said signal.

3. A telephone system including a subscriber's telephone line, a link circuit for connection to said line to extend a call therefrom, recall apparatus individual to said link circuit for denoting recalls, and means for rendering said apparatus unresponsive to substation control when a second link circuit is connected to said line as a called line prior to the disconnection of said first link circuit from said line.

4. In a telephone system a subscriber's line, a plurality of terminals for said line, a link circuit adapted to be connected to said line for extending a call, recall apparatus individual to said link circuit and controllable by the subscriber, means for making said line busy when said link circuit is connected to the said line, means for removing the busy potential when disconnection is desired, and a relay for removing the substation control of said recall apparatus so that the line may be connected with as a called line.

5. A telephone system including a subscriber's telephone line, a plurality of terminals for said line, a link circuit for extending a connection from said line and for placing a busy potential upon said termi-

nals, recall apparatus individual to said link circuit, subscriber controlled means for removing the busy potential from said terminals, and means responsive to the connection of a second link circuit to one of said terminals for rendering said recall apparatus ineffective.

6. A telephone system including a subscriber's telephone line, a plurality of terminals for said line, a link circuit for extending a connection from said line, recall apparatus individual to said link circuit, and means responsive to the connection of a second link circuit to one of said terminals for removing the substation control of said recall apparatus.

7. A telephone system including a subscriber's telephone line provided with a plurality of multiple terminals, a link circuit provided with a connection terminal for connection to one of said terminals for extending a call from said line, subscriber-controlled means for removing the busy potential from said line when said subscriber signals for disconnection, and a supervisory signal for said link circuit adapted to be intermittently operated to denote recall responsive to a single actuation of the subscriber's substation equipment.

8. A telephone system including a subscriber's telephone line, multiple line terminals and line signals for said line, a link circuit for connection to said line and for placing a busy potential upon said multiple terminals, subscriber controlled means for removing said busy potential, a signal associated with said link circuit, and means for automatically intermittently operating said signal when a recall is initiated.

9. A telephone system including a subscriber's telephone line, multiple line terminals and line signals for said line, a link circuit for connection to said line and for placing a busy potential upon said multiple terminals, subscriber controlled means for removing said busy potential, a signal associated with said link circuit, and means for intermittently operating said signal responsive to a single actuation of the call initiating apparatus at the subscriber's substation when a recall is initiated.

10. A telephone system including a subscriber's telephone line, multiple line terminals for said line, a link circuit for connection to said line, a signal associated with said link circuit, subscriber controlled means for disconnecting the answering plug of said link circuit from the talking strands of said link circuit, and automatic means for intermittently operating said signal when a call is initiated.

11. A telephone system including a subscriber's telephone line, multiple terminals for said lines appearing at a plurality of operators' positions at a central office switch-

- board, operators' link circuits for connection to said line, automatic means for preventing the operative connection of more than one of said link circuits to said line at one time in
 5 answering a call, a signal for said link circuit, and apparatus associated with said link circuit for causing said signal to be intermittently operated responsive to a unitary actuation of the call initiating apparatus at
 10 the substation.
12. A telephone system including a calling subscriber's line, a link circuit for connection to said line, a signal individual to said link circuit, automatic means for disconnecting
 15 said line from the talking strands of said link circuit, and means for intermittently operating said signal when a recall is signaled for.
13. A telephone system including a calling
 20 ing subscriber's line, a link circuit for connection to said line, a signal for said link circuit, automatic means for disconnecting said line from the talking strands of said link circuit when disconnection is signaled
 25 for, and means responsive to a unitary actuation of the subscriber's substation equipment for intermittently operating said signal when a recall is signaled for.
14. A telephone system including a calling
 30 ing subscriber's telephone line, a link circuit for connection to said line for extending a call therefrom, a signal for said link circuit, means responsive to a removal of the receiver at the subscriber's substation for causing an
 35 intermittent operation of said signal to denote a recall, and automatic means for disassociating the subscriber's line and the talking strands of said link circuit.
15. A telephone system including a subscriber's telephone line, a link circuit for
 40 connection to said line for extending a call therefrom, a signal for said link circuit adapted to be intermittently operated by a unitary actuation of the call initiating apparatus at the subscriber's substation to denote
 45 a recall, and means responsive to the connection of a second link circuit to said subscriber's line as a called line for rendering ineffective the substation control of said
 50 signal.
16. A telephone system including a subscriber's telephone line, a link circuit for connection to said line, a supervisory signal for said link circuit, a supervisory relay for
 55 actuating said supervisory signal adapted to be controlled from the subscriber's substation, electromagnetic disconnect means for removing the substation control of said supervisory relay, and a second relay responsive
 60 to the removal of the receiver at the substation for causing the intermittent operation of said supervisory signal.
17. A telephone system including a subscriber's telephone line, a link circuit for
 65 connection to said line, a supervisory signal for said link circuit, a supervisory relay adapted to be controlled over the subscriber's line for controlling the said supervisory signal, electromagnetic disconnect means for removing the substation control of said supervisory relay, a relay responsive to the removal of the receiver at the subscriber's substation for causing the intermittent operation of said supervisory signal, and means responsive to the connection of a second link
 75 circuit to the said telephone line for removing the substation control of said second relay.
18. A telephone system including a subscriber's line, a link circuit for extending a
 80 call from said line, a signal individual to said link circuit under substation control, and means for permitting a second link circuit to connect to said line and for removing the substation control of said signal.
19. A telephone system including a subscriber's telephone line, a link circuit for connection to said line to extend a call therefrom, a supervisory signal individual to
 85 said link circuit, substation controlled means for operatively disassociating said link circuit from said subscriber's line, and substation controlled means for causing an intermittent operation of said supervisory signal.
20. A telephone system including a subscriber's telephone line provided with multiple answering terminals, groups of operators' link circuits, a supervisory signal for
 90 each of said link circuits, means for preventing the operative connection of more than one of said link circuits to said subscriber's line when answering a call, and automatic means controlled over the calling subscriber's line for intermittently operating the supervisory signal of the link circuit connected to the subscriber's line.
21. A telephone system including a subscriber's telephone line, a link circuit for connection to said line to extend a call therefrom, a supervisory signal individual to said
 110 link circuit, substation controlled means for operatively disassociating said link circuit from said subscriber's line, and substation controlled means for operating said supervisory signal to denote a recall.
22. In a telephone system, the combination of a main station, a plurality of telephone lines leading to the main station, substation apparatus on each telephone line, line signalling mechanism for each telephone
 120 line, cut-off relays for disassociating said mechanism from its associate telephone line, one of said cut-off relays being associated with each telephone line, a cord circuit at the main station and mechanism to connect
 125 said cord circuit to a telephone line, a circuit for the cut-off relay associated with the telephone line to which the cord is connected completed to cause the energization of said cut-off relay when the cord is connected
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connected to the line, means controlled by the subscriber for causing the de-energization of said cut-off relay when the subscriber re-
 5 tires and for causing the re-energization of said cut-off relay when the subscriber initiates a recall.

23. A telephone system including a subscriber's telephone line terminating in a jack at the central exchange, a cut-off relay
 10 for said line, a link circuit provided with a plug for insertion in said jack, a circuit for the cut-off relay completed in response to the insertion of said plug in said jack, subscriber controlled means for de-energiz-
 15 ing said cut-off relay when the subscriber signals for disconnection and for causing the re-energization of said cut-off relay when the subscriber signals for a recall.

24. A telephone system including a subscriber's telephone line terminating in a jack at the central exchange, a cut-off relay for
 20 said line, a link circuit provided with a plug for insertion in said jack, a circuit for the cut-off relay completed in response to the insertion of said plug in said jack, sub-
 25 scriber-controlled means for de-energizing said cut-off relay when the subscriber signals for disconnection and for causing the re-energization of said cut-off relay when
 30 the subscriber signals for a recall, and a signal for said cord circuit adapted to be intermittently operated when the subscriber signals for a recall.

25. A telephone system including a subscriber's telephone line terminating in a jack at the central exchange, a cut-off relay for
 35 said line, a link circuit provided with a plug for insertion in said jack, a circuit for the cut-off relay completed in response to the insertion of said plug in said jack, sub-
 40 scriber-controlled means for de-energizing said cut-off relay when the subscriber signals for disconnection and for causing the re-energization of said cut-off relay when the
 45 subscriber signals for a recall, and operator-controlled means for preventing a subscriber from re-energizing said cut-off relay.

26. A telephone system including a subscriber's telephone line terminating in a jack at the central exchange, a cut-off relay for
 50 said line, a link circuit provided with a plug for insertion in said jack, a circuit for the cut-off relay completed in response to the insertion of said plug in said jack, sub-
 55 scriber-controlled means for de-energizing said cut-off relay when the subscriber signals for disconnection, a supervisory signal individual to said link circuit, and sub-
 60 scriber-controlled means for automatically flashing said supervisory signal when a recall is signaled for.

27. A telephone system including a subscriber's telephone line terminating in a jack at the central exchange, a cut-off relay for
 65 said line, a link circuit provided with a plug

for insertion in said jack, a circuit for the cut-off relay completed in response to the insertion of said plug in said jack, sub-
 scriber-controlled means for de-energizing said cut-off relay when the subscriber sig-
 70 nals for disconnection, a supervisory signal individual to said link circuit, subscriber-controlled means for automatically flashing said supervisory signal when a recall is sig-
 75 naled for, and operator-controlled means responsive to the connection of a second link circuit to said subscriber's line for preventing a subscriber from intermittently oper-
 ating said supervisory signal.

28. A telephone system including a sub-
 80 scriber's telephone line, a link circuit for connection to said line, a supervisory signal for said link circuit, a supervisory relay for actuating said supervisory signal adapted to be controlled from the subscriber's sub-
 85 station, substation-controlled disconnect means for removing the substation control of said supervisory relay, a second relay responsive to the removal of the receiver at the substation for causing the intermittent oper-
 90 ation of said supervisory signal, and operator-controlled means for preventing the subscriber from operating said second relay.

29. A telephone system including a subscriber's telephone line terminating in a jack
 95 at the central exchange, a cut-off relay for said line, a link circuit provided with a plug for insertion in said jack, a circuit for the cut-off relay completed in response to the insertion of said plug in said jack, sub-
 100 scriber-controlled means for de-energizing said cut-off relay when the subscriber signals for disconnection and for causing the re-energization of said cut-off relay when the subscriber signals for a recall, and
 105 means responsive to the connection of a second link circuit to said telephone line for re-energizing said cut-off relay and for thereafter preventing the subscriber from de-energizing said cut-off relay.

30. A telephone system including a sub-
 110 scriber's telephone line provided with multiple answering terminals, groups of operators' link circuits, a supervisory signal for each of said link circuits, means for pre-
 115 venting the operative connection of more than one of said link circuits to said subscriber's line when answering a call, automatic means controlled over the calling sub-
 120 scriber's line for intermittently operating the supervisory signal of the link circuit connected to the subscriber's line, and means responsive to the connection of a second
 125 link circuit to said telephone line for removing the control of the supervisory sig-
 nal from the subscriber.

31. A telephone system including a sub-
 scriber's telephone line provided with multi-
 ple answering terminals, groups of oper-
 130 ators' link circuits, a supervisory signal for

each of said link circuits, means for preventing the operative connection of more than one of said link circuits to said subscriber's line when answering a call, subscriber-controlled means for operatively disassociating the subscriber's line from the connected link circuit, and automatic means controlled over the calling subscriber's line for intermittently operating the supervisory signal of the link circuit connected to the subscriber's line.

32. A telephone system including a subscriber's telephone line provided with multiple answering terminals, groups of operators' link circuits, a supervisory signal for each of said link circuits, means for preventing the operative connection of more than one of said link circuits to said subscriber's line when answering a call, automatic means controlled over the calling subscriber's line for intermittently operating the supervisory signal of the link circuit connected to the subscriber's line, and automatic means for connecting and disconnecting an operator's telephone set and the said link circuit.

33. In a telephone system, the combination of a main station, a calling telephone line, substation apparatus including a switch on the calling line, line signaling mechanism for said telephone line, a cut-off relay for said telephone line adapted when energized to disassociate said line signaling mechanism from the line, a cord circuit at the main station, a switch for connecting the cord circuit to the telephone line, a circuit for said cut-off relay controlled by said switch and completed when said switch is operated, to cause the energization of the cut-off relay, a second relay controlled by the switch at the subscriber's station and contacts in the circuit of the cut-off relay controlled by said subscriber-controlled relay, said second relay causing the opening of the circuit and the de-energization of the cut-off relay when the subscriber retires, and means for re-completing such circuit when the subscriber initiates a recall to cause a second energization of said cut-off relay.

34. A telephone system including a subscriber's telephone line terminating in a jack, a cut-off relay for said line, a connecting circuit provided with a plug for insertion in said jack, a circuit for the cut-off relay responsive to the insertion of a plug in the jack, subscriber-controlled means for de-energizing said cut-off relay, and subscriber-controlled means for re-energizing said cut-off relay.

35. A telephone system including a subscriber's telephone line terminating in a jack, a cut-off relay for said line, a connecting circuit provided with a plug for insertion in said jack, a circuit for the cut-off relay responsive to the insertion of a plug in

the jack, subscriber-controlled means for de-energizing said cut-off relay, subscriber-controlled means for re-energizing said cut-off relay, and a supervisory device for the connecting circuit adapted to be intermittently operated.

36. A telephone system including subscribers' telephone lines, an operator's link circuit for use in interconnecting said lines, a disconnect relay in said circuit for disconnecting one of said subscriber's lines from the link circuit, subscriber controlled means for operating the said relay, and subscriber controlled means for again seizing said connecting circuit.

37. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for use in connecting said subscribers' lines, electromagnetic means in said link circuit for connecting one of said subscriber's lines from the link circuit, subscriber controlled means for operating said electromagnetic means, and subscriber controlled means for again seizing said link circuit.

38. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for use in connecting said subscribers' lines, subscriber controlled means for disconnecting one of said lines from said link circuit, and subscriber controlled means for again seizing said link circuit.

39. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for use in connecting said subscribers' lines, and subscriber controlled means for operatively disassociating one of the subscriber's lines from the said link circuit and for again seizing said link circuit.

40. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for use in establishing connection between said lines, and subscriber controlled means for operatively freeing one of said subscriber's lines from said link circuit when he signals for disconnection and for again operatively associating said subscriber's line with the link circuit when he signals for a recall.

41. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for use in establishing connection between said lines, subscriber controlled means for operatively freeing one of said lines from said link circuit when he signals for disconnection, and subscriber controlled means for again seizing said link circuit when the subscriber attempts to initiate a recall and extend another connection.

42. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for use in es-

establishing connection between said subscribers' lines, a relay for rendering a circuit inoperative, means controlled over a subscriber's line for effecting said relay and for operatively freeing one of the subscriber's lines from the link circuit when said subscriber signals for disconnection, and means controlled over the said subscriber's line for again affecting said relay when the subscriber signals for a recall.

43. A telephone system including a calling subscriber's line, a called subscriber's line, an operator's link circuit for use in establishing a connection between said subscribers' lines, a relay controlling a circuit, and means controlled over one of the subscriber's lines for affecting said relay and for operatively disconnecting the subscriber's line from the link circuit when the subscriber signals for a disconnection, and for again affecting said relay when the subscriber signals for a recall.

44. A telephone system including subscribers' telephone lines, an operator's circuit for use in interconnecting said lines, a disconnect relay in said circuit for disconnecting one of said subscriber's lines from the other of said subscriber's lines, subscriber controlled means for operating said relay, and subscriber controlled means for again seizing said connecting circuit.

45. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for use in connecting said subscribers' lines, electromagnetic means in said link circuit for disconnecting one of said subscriber's lines from the other of said subscriber's lines, subscriber controlled means for operating said electromagnetic means, and subscriber controlled means for again seizing said link circuit.

46. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for use in connecting said subscribers' lines, subscriber controlled means for disconnecting one of said lines from the other of said lines, and subscriber controlled means for again seizing said link circuit and for affecting a signal.

47. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for use in connecting said subscribers' lines, and subscriber controlled means for operatively disconnecting one of the subscriber's lines from the other of said subscriber's lines, and for

again seizing said link circuit and operating a signal.

48. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for use in establishing connection between said lines, subscriber controlled means for operatively freeing one of said lines from the other of said subscriber's lines when he signals for disconnection, and subscriber controlled means for again seizing said link circuit when the subscriber attempts to initiate a recall and extend another connection and for affecting a signal to said link circuit.

49. A telephone system including a calling subscriber's line and a called subscriber's line, an operator's link circuit for use in establishing connection between said subscriber's line, a relay for rendering a circuit inoperative, means controlled over a subscriber's line for affecting said relay and for operatively freeing one of said subscriber's lines from the other of said subscriber's lines when said subscriber signals for disconnection, and means controlled over the said subscriber's line for again affecting said relay when the subscriber signals for a recall.

50. In a telephone system, the combination of a main station, a calling telephone line, substation apparatus including a switch on the calling line, line signaling mechanism for said telephone line, a cut-off relay for said telephone line adapted when energized to disassociate said line signaling mechanism from the line, a cord circuit at the main station, a switch for connecting the cord circuit to the telephone line, a circuit for said cut-off relay controlled by said switch and completed when said switch is operated, to cause the energization of the cut-off relay, means including a second relay controlled by the switch at the subscriber's station and contacts in the circuit of the cut-off relay controlled by said subscriber-controlled relay for causing the opening of the circuit and the de-energization of the cut-off relay when the subscriber retires and recompleting such circuit when the subscriber initiates a recall to cause a second energization of said cut-off relay.

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

HIRAM D. CURRIER.

Witnesses:

G. A. YANOSCHOWSKI,
B. O'BRIEN.