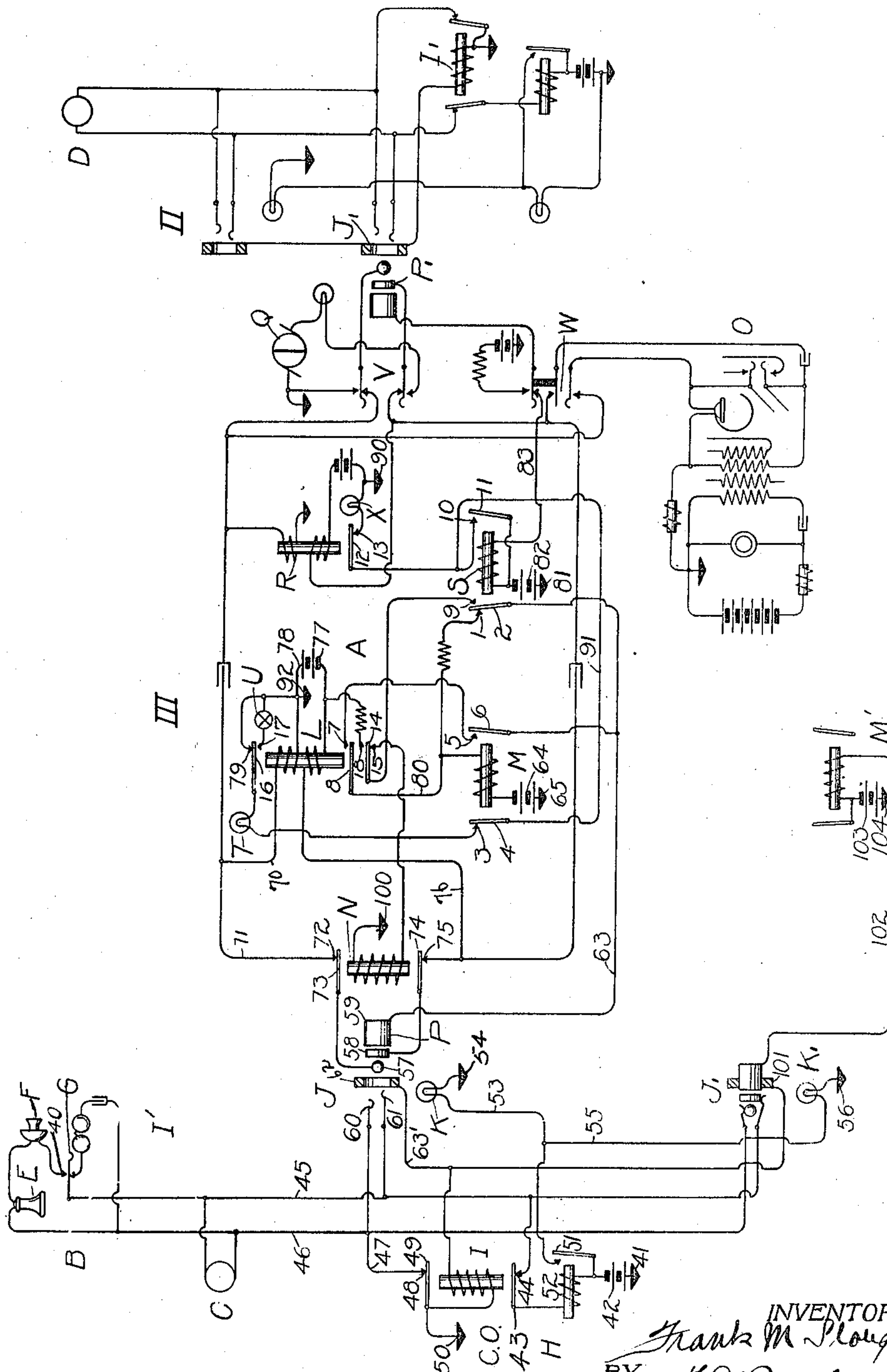


F. M. SLOUGH.
TELEPHONE SYSTEM.
APPLICATION FILED JAN. 8, 1916.

1,320,715.

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TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that I, FRANK M. SLOUGH, a citizen of the United States, and a resident of Elyria, in the county of Lorain and State of Ohio, have invented certain new and useful Improvements in Telephone Systems; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in telephone systems, and more particularly central energy systems. There is a certain type of central energy system which has come to be known as the automatic disconnect system and in which means are provided for disconnecting the terminals of the link conductors from the main portions of the link conductors at the time the conversation is terminated or between that time and the time when another conversation is initiated. In systems of this type in use hitherto, so far as I am aware, recalls have been effected by operating the line lamp through the raising or lowering of the switch-hook at the subscriber's station.

One of the objects of my invention is to provide means for initiating a recall in an automatic disconnect telephone system, which, can be effected by the operation of the subscriber's apparatus in the same manner as it is operated to initiate a call, thereby eliminating the jiggling of the hook-switch. Other objects of my invention and the invention will probably be better understood from a description of an embodiment of the invention.

The drawing shows a diagrammatic representation of an embodiment of my invention.

Referring now to the drawing and to the embodiment illustrated therein at I' is shown a telephone line which, for convenience, will here be referred to as the calling line. At II is shown a second telephone line, which, for convenience, will be here referred to as the called line. At III is shown a main station. At this main station there is shown means for connecting the telephone lines together, such as link conductors, shown in this embodiment as a cord circuit and which will, for convenience, be referred to as a cord circuit. Any desired number of stations may be connected to the line I'.

In the form shown I have shown two stations connected thereto, one at B and another at C. The subscribers' apparatus is illustrated at B, but at C the station has been represented merely by a circle. A single station is shown at D upon the called line, though any desired number of stations may be connected to this line.

At the station B the receiver is shown at E, the transmitter at F and the hook-switch at G. The line leads to the main station, where it terminates in switching terminals, here illustrated as jacks J and J₁. The line relay is shown at H, the cut-off relay at I and line lamps at K and K₁. The link conductor switching terminals, here shown as plugs, are shown at P—the answering plug, and at P₁, the calling plug. A subscriber-controlled relay is shown at L which is also known among some engineers as a supervisory relay. The sleeve relay is shown at M; the automatic disconnect relay is shown at N; the operator's set is shown at O; the ringing machine at Q; the called subscriber-controlled or supervisory relay is shown at R; a second sleeve relay is shown at S; a signal lamp is shown at T and a commutator is shown at U. The ringing key is shown at V and the listening key at W.

Briefly, the operation of the system is as follows: The subscriber at B initiates a call, causing the energization of the line relay H, which in turn causes the energization of the line lamps K and K₁, which are located so as to attract the attention of different operators. Assuming that the operator controlling the cord A inserts the plug P into the jack J, the cut-off relay I and the sleeve relay M will be actuated over a circuit including the switch 1—2. The cut-off relay I will disconnect the line lamp and relay from the line, extinguishing the line lamps, in a well known manner. The relay M opens a switch 3—4 in the circuit of the lamp T, preventing the present actuation of the same and closes a switch 5—6 in a branch of its circuit which passes through the switch 1—2. At the time the plug P was inserted into the jack J, the subscriber-controlled relay L was actuated, closing a switch 7—8 and completing a circuit for the relay M through the switches 5—6 and 7—8, independently of the branch through the switch 1—2. The operator then actuates

the listening key W and learns that it is the subscriber at D that is wanted. The plug P₁ is then connected to the called line, whereupon the relay S is actuated, opening the switch 1—2 and closing the switch 2—9, for a purpose later to be described. The switch 10—11 will also be closed, completing a circuit for the lamp X. The ringing key V is then operated, connecting the ringing machine Q to the line and calling the subscriber at D.

When the subscriber at D responds, the relay R is actuated, opening the switch 12—13 and extinguishing the lamp at X. With the apparatus in this condition, the conversation takes place, and at the termination of the conversation, the subscribers restore their substation sets to normal, interrupting the circuits of the relays L and R. The deenergization of the relay R will cause a reenergization of the lamp X. The deenergization of the relay L restores the apparatus to the condition in which it is shown in the drawing, opening the switch 7—8 and causing the deenergization of the relays M and I, closing the switch 14—15 in the circuit of the disconnect relay N.

Now, should the subscriber at B initiate a recall, it will only be necessary to take the receiver from the hook, which rises and completes the circuit of the relay L which closes a switch 16—17, which completes a circuit for the lamp T through the commutator U and the switches 3—4 and 10—11. This will cause a flashing or intermittent action of the lamp T in the presence of the operator who controls the cord A and attract her attention.

When the subscriber at B initiates a recall, a circuit will be completed through the relay I, reenergizing the same. Such circuit will include the switches 2—9 and 14—18. The energization of the relay I will prevent the line lamps K and K₁ being lighted, so that there will be no cause for any other operator plugging in to answer the recall, thereby limiting the recall signal to the operator whose cord is already connected to the line desiring the recall. This is especially convenient and saves time, especially when the subscriber at B desires a reconnection with the subscriber at D, which very frequently happens.

However, should there be no recall and a second operator desires a connection with the line I, the insertion of a plug of her cord into a multiple jack of this line will cause the automatic actuation of the relay N and the disconnection of the cord A from the line I. This is effected by completing a circuit for the relay N through the switches 14—15, 2—9 and the relay M' of the cord of the second operator.

A more particular description of the operation of the embodiment of my invention

shown in the drawing is as follows: When the receiver is removed from the hook-switch G, the hook rises and engages with the contact, 40 completing a circuit through the relay H, as follows: ground 41—battery 42—H—switch 43—44—conductor 45—G—40—F—E—46—47—switch 48—49—to ground 50. The relay H is energized, attracting its armature 51 and closing a switch 51—52 and completing circuits through the lamps K and K₁ as follows: for K, 41—42—51—52—53—K—ground at 54, and for K₁, 41—42—51—52—53—55—K₁—to ground at 56. The lamps K and K₁ burn in the presence of the operators, one of whom answers the call. Assuming that it is the operator who controls the cord A,—she answers by inserting the plug P into the jack J, the tip contact 57, the sleeve contact 58 and ring contact 59 of the plug engaging respectively with the tip spring 60, sleeve spring 61 and ring 62 of the jack. The operation of the device P—J completes the following circuits: 50—I—63'—62—59—conductor 63—2—1—relay M—battery 64—to ground 65. Both the relays I and M will be energized. The relay I will attract its armatures 49 and 43, opening the switches 48—49 and 43—44, disconnecting the line relay and lamps from the line and causing the lamps to cease to burn. The relay M is actuated, opening the switch 3—4 in the circuit of the lamp T and preventing the same from being actuated at this stage of the operation. The relay M also attracts its armature 6, closing the switch 5—6 for a purpose presently to be described.

The actuation of the device J—P when the hook-switch at the substation is closed will also complete a circuit for the relay L as follows: L—70—71—switch 72—73—57—60—46—E—F—G—45—61—58—74—75—76—L—battery 77—conductor 78. The relay L will attract its armature 16, opening the switch 79—16 and closing the switch 16—17. This operation, however, will be without result at this stage, because the switch 3—4 is now open. The relay L will also attract its armature 14, opening the switch 14—15, which will also be without result at this stage of the operation. The attraction of 14 will also close the switch 14—18, which will be without result at this stage of the operation. The relay L will also attract the armature 8, closing the switch 7—8 and completing a circuit through the relay M, independent of the switch 1—2. This circuit will be as follows: 65—64—M—conductor 80—8—7—5—6—63—to ground through the relay I. The operator now operates the switch W, connects her set with the cord circuit and learns the subscriber that is desired. We will assume that D is wanted. The plug P₁ is inserted into the jack J₁, the respective contacts of the jack and plug engaging in the same

manner as explained in connection with the plug P and jack J. A circuit is completed for the relay S as follows: ground 81—battery 82—S—conductor 83—through the plug P₁ and jack J₁—the called line cut-off relay I₁—to ground. The relay S attracts its armature 2, opening the switch 1—2 and closing a switch 2—9, neither of which has any effect at this stage of the operation, except to open the contacts in the old and now unimportant circuit of the relay M, which as has been explained, is now energized through the circuit containing the switch 5—6. The relay S closes the switch 10—11 in the circuit of the lamp X, which is as follows: 81—82—11—10—12—13—X—to ground at 90. The ringing key V is then operated and the subscriber at D is called.

The response of the subscriber at D completes the circuit of the relay R in the same manner as was described for the relay L, except that the circuit will be over the called line and through the called subscriber's set, instead of over the calling line and the set of the calling subscriber, as in the case of the relay L.

The actuation of R opens a switch 12—13 in the circuit of X and causes this lamp to go out. Conversation then takes place, and at the termination of the conversation, the receivers are restored to the hooks, opening the hook-switches at the respective stations and opening the circuits of the relays L and R, whereupon the armatures controlled by these relays are restored to the condition in which they are shown in the drawing. The lamps X and T will then burn,—the lamp X over the circuit previously described, and the lamp T over the following circuit: 81—82—11—10—91—4—3—T—16—79—to ground at 92. Assuming now that the subscriber at B desires to make a recall before the plugs are withdrawn from the jacks,—(it should here be explained that the operators do not always withdraw the plugs immediately upon the termination of conversation, because, for one reason, they may be busy with other matters. It also frequently happens, especially in the case of one of the subscribers being a private branch exchange, that the subscriber desires another connection with the same called subscriber)—assuming now that the subscriber at G again removes his receiver from the hook-switch, the hook-switch will be closed and the relay L energized, as previously described, and as previously described, the armatures 16, 8 and 14 will be attracted, opening the switches 16—79 and 14—15 and closing the switches 16—17, 7—8 and 14—18. The relay I will be energized over the following circuit: 50—I—63'—62—59—63—2—9—14—18—77—78—92. The relay I will prevent the actuation of the lamps K and K₁, thereby avoiding the recall signal being given to

other operators than the one whose plug is already inserted into the jack of the line I. The circuit of the lamp T will now include the interrupter U, which will cause the intermittent flashing of this lamp to advise the operator controlling the cord A that a recall is desired, whereupon she connects her set with the cord and proceeds to set up a connection as before.

Should another operator desire to use the line I', a plug of one of her cords may be inserted into a multiple jack, for example, into the jack J₁, and if the plug P has not been withdrawn from the jack J and the line I' is idle, a circuit will be completed for the automatic disconnect relay N as follows: ground at 100—N—15—14—9—2—63—59—62—63'—101—102—M'—battery 103—ground 104. The relay N will be energized, disconnecting the cord A from the plug P by opening the switches 72—73 and 74—75 and leaving the line I' free of the cord A. When the plugs are withdrawn from the jacks, the apparatus will be restored to normal.

I have shown this particular form and these particular details for the purpose of better explaining my invention, it being obvious that numerous and extensive departures may be made from the form and details illustrated without departing from the spirit of the invention.

I claim:

1. 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 deenergization of the cut-off relay when the subscriber retires and re-completing such circuit when the subscriber initiates a recall to cause a second energization of said cut-off relay.

2. In a telephone system, the combination of a calling line, a link circuit for uniting said calling with a called line, link conductors comprising talking and operating strands for said link circuit, an operator's listening key and contacts controlled thereby associated with the link conductors; supervisory relays connected in said talking strands, a controlling relay in the operating

strand associated with the calling line, means independent of the calling subscriber's relay and the operator's key and contacts controlled thereby to cause an initial
 5 operation of said controlling relay when connection is made between the link circuit and calling line, and means under the control of the calling subscriber's supervisory relay to restore said controlling relay to
 10 normal.

3. In a telephone system, the combination of a calling line, a called line, a link circuit, link conductors for said link circuit comprising talking and operating strands, a
 15 supervisory relay in the talking strand leading to the calling line, a controlling relay in the operating strand associated with the calling line, a cut-off relay for said calling line, a circuit for said controlling relay
 20 including said cut-off relay, said circuit including contacts of said supervisory relay and contacts of said controlling relay.

4. In a telephone system, the combination of a calling line, a called line, a link circuit,
 25 link conductors for said link circuit comprising talking and operating strands, a supervisory relay in the talking strand leading to the calling line, a controlling relay in the operating strand associated with the
 30 calling line, a cut-off relay for said calling line and a circuit for said controlling relay including said cut-off relay, said circuit including contacts of said supervisory relay and contacts of said controlling relay, said
 35 circuit being established when connection is made with a calling line and disestablished when said supervisory relay is restored to normal to give a disconnect signal.

5. In a telephone system, the combination
 40 of a calling line, a called line, a link circuit, link conductors for said link circuit comprising talking and operating strands, a supervisory relay in the talking strand leading to the calling line, a controlling re-
 45 lay in the operating strand associated with the calling line, a cut-off relay for said calling line, and a circuit for said controlling

relay including said cut-off relay, said circuit including contacts of said supervisory relay and contacts of said controlling relay, 50
 switching means to establish said circuit when connection is made with a calling line, a controlling relay in the operating strand associated with the called line, switching
 means to operate said controlling relay when 55
 connection is made with a called line, a switch of said last named controlling relay to initially establish the circuit of said first named controlling relay, said switch preventing said circuit from being reestab- 60
 lished after said supervisory relay is restored to normal to give a disconnect signal.

6. In a telephone system, the combination of a calling line, a called line, a link circuit,
 link conductors for said link circuit com- 65
 prising talking and operating strands, a supervisory relay in the talking strand leading to the calling line, a controlling relay in the operating strand associated with the
 calling line, a cut-off relay for said calling 70
 line, and a circuit for said controlling relay including said cut-off relay, said circuit including contacts of said supervisory relay and contacts of said controlling relay,
 switching means to establish said circuit 75
 when connection is made with a calling line, a controlling relay in the operating strand associated with the called line, switching means to operate said controlling relay when
 connection is made with a called line, a 80
 switch of said last named controlling relay to initially establish the circuit of said first named controlling relay, said switch preventing said circuit from being reestab- 85
 lished after said supervisory relay is restored to normal to give a disconnect signal,
 and an alternate circuit for said cut-off relay including switch contacts operated by
 said supervisory relay when said supervisory 90
 relay is subsequently operated.

In witness whereof, I have signed my name this 29th day of December, 1915.

FRANK M. SLOUGH.