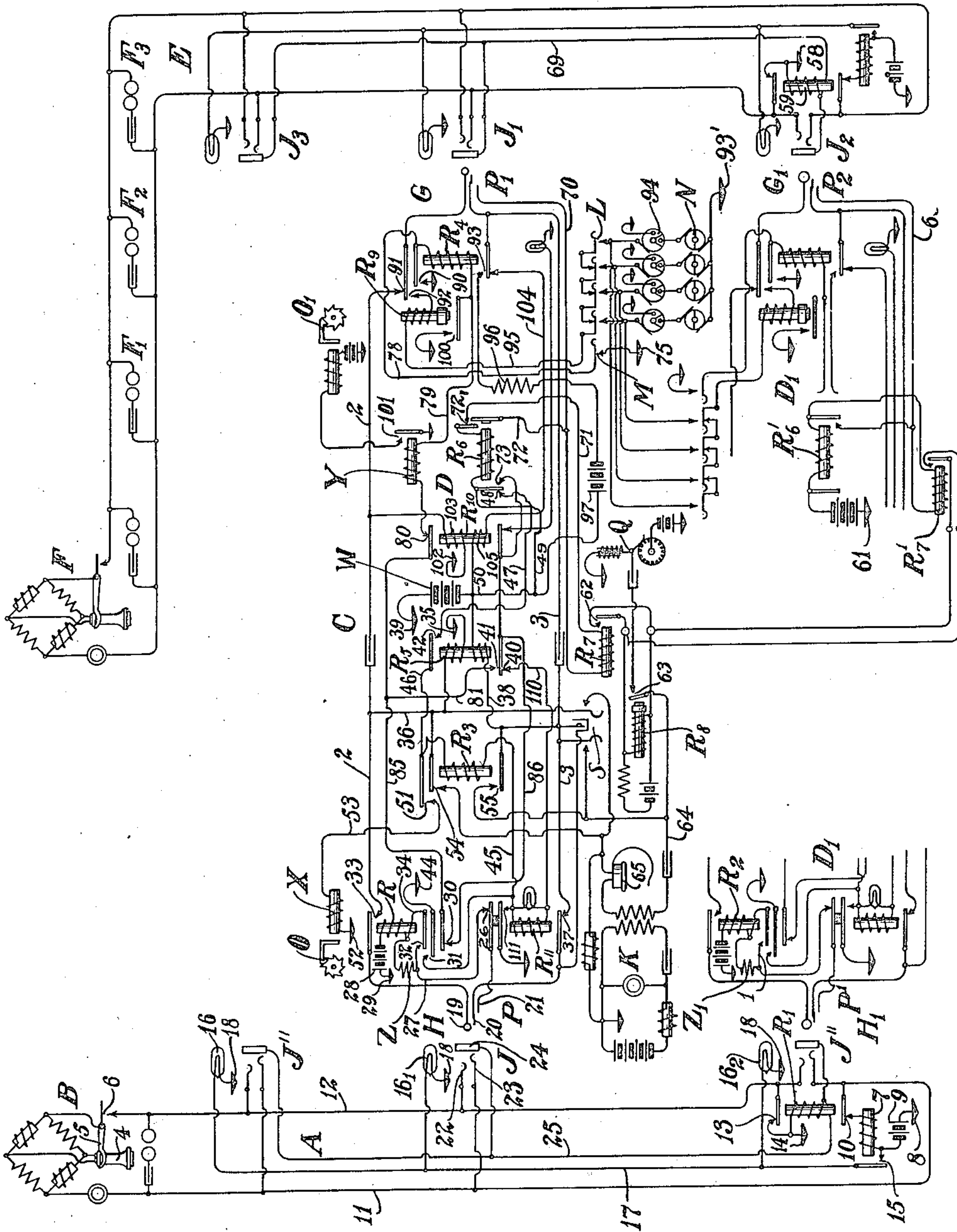


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STROMBERG-CARLSON TELEPHONE MFG. CO., OF ROCHESTER, NEW YORK, A COR-
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TELEPHONE SYSTEM.

1,262,112.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FRANK M. SLOUGH, a citizen of the United States, residing at 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 telephone systems and has for its objects the improvements in a number of ways of the systems now in use, with the general aim of expediting or speeding up the service.

One of the objects of my invention is to provide improved means for interrupting the telephone line connecting links when the conversation is completed in order to release certain of the apparatus in the system for immediate use.

Another object of my invention is to provide means for enabling the operator to ring a called subscriber either when the calling subscriber is on the calling line, or when there is no connection to the calling line, at the same time providing means for preventing the ringing of the called subscriber when connection is made to the calling line, but no subscriber is on the calling line.

Another object of my invention is to provide improved means for apprising the called subscriber of the fact that the ringing of the called subscriber is taking place.

These and other objects of my invention will be understood from a description of a particular embodiment of the same.

The drawing shows diagrammatically a particular embodiment of a telephone system involving my invention.

I will first describe in a general way the apparatus shown in the drawing and its operation, and will then give a particular description thereof.

At A is shown a telephone line which will be referred to hereafter as the calling line. At B is shown a substation on the line A, which will hereafter be called the calling subscriber, or the calling subscriber's substation. At C is shown the main or central station of the system which is equipped

with means for connecting telephone lines together, here shown as link conductors, which may be a cord circuit D. At E is shown a second telephone line which will be called hereinafter the called line. A number of substations are connected to the line E, the principal one of which is here shown at F, and others are indicated at F₁, F₂ and F₃. The substation at F will hereinafter be spoken of as the called substation or the called subscriber. It will be understood that any suitable number of stations may be connected to either of the lines A and E.

Means are provided for connecting the link conductors to the telephone lines, here shown as switching means H and G. The switching means H will be spoken of hereafter as the answering switch and the means G as the calling switch. In the form shown the switching means consist of plugs and jacks, the line A being provided with multiple jacks J, J' and J'' and the line E being provided with jacks J₁, J₂ and J₃. The cord is provided with a plug P to cooperate with any one of the jacks of the calling line and with a cord P₁ to cooperate with any of the jacks of the called line. The operator's set is indicated at K, the ringing keys at L, the master key at M and the ringing machine at N. Portions of a second cord are indicated at D₁ provided with plugs P' and P₂. Registers are indicated at O and O₁. A busy tone apparatus is shown at Q.

When the calling subscriber desires a connection, the central station is signaled through the operation of the usual line relay and line lamp placed before the operators, one of whom responds in the usual way, by operating the switching means H by inserting the plug T into one of the jacks, say the jack J. The relay R will be operated over a circuit including the relay R, the resistance Z and the cut-off relay R₁. If, however, prior to the closing of the switching device H, the switching device H₁ shall have been operated by another operator who thus "captures the call", the relay R will not operate because most of the current which would otherwise flow through the relay R will be traversing a circuit in-

cluding the relay R_2 and the shunt 1 of the device Z_1 . Assuming, however, that no other cord is connected to the line A at the time the device H is operated, the relay R will be energized, making capture of the call and shunting the device Z and making it impossible for a connection to be made through any other cord with the line A, as explained. The relay R will also close the strand 2 of the cord circuit and close contacts in the circuit of the secret listening relay R_3 . The relay R will also open contacts in the circuit connections of the magnet R^4 , as will be later explained.

When the strand 2 is completed, the relay R_5 will be operated over a circuit including the line A, in a manner well understood, completing the circuit of the relay R_3 , which will be energized, completing a circuit of the magnet X and causing the operation of the register O. The relay R_3 will also connect the operator's set K to the cord, so that the operator can now communicate with the subscriber at B. Learning that it is the subscriber at F that is desired, the line E may be tested in the usual manner, or the operator may plug in without the usual delay due to such testing. A circuit will be completed through the magnets R_6 and R_7 . If the line E is busy, that is, if the switching device G_1 , for example, has been operated, there will have been completed about the circuit of the relays R_6 and R_7 a shunt including the relays R_6' and R_7' . The relays R_6 and R_7 are so proportioned and arranged that under these circumstances the relay R_7 , which is high wound and very sensitive, will be operated, but the relay R_6 will not. When R_7 is thus operated, the relay R_8 , being short-circuited by the relay R_7 for a sufficient length of time, will complete the special test circuit for the operator. Assuming, however, that the line was idle when the switching device G was operated, the relay R_6 will be operated and the relay R_7 will not be operated sufficiently long to cause the release of the relay R_8 . The relay R_6 will break the circuit of the relay R_3 disconnecting the operator from the cord. The operator then operates a ringing key to connect the source of ringing current to the called line. The closing of the key M completes the circuit through the ringing relay R_4 , which immediately locks itself independently of the key. The closing of the key M also completes a circuit through the relay Y, which is immediately made independent of the master key by the ringing relay. The ringing then takes place over a circuit including the relay R_9 . A branch of this circuit is completed through the strand 3 of the cord circuit and the calling line, through which a fraction of the current will course, indicating to the calling subscriber that the ringing is taking place.

When the called subscriber responds, the relay R_9 will cause the disconnection of the ringing current from the line, in a manner which will be explained in detail later, and the relay R_{10} will be energized. The breaking of the ringing circuit and the circuit of the ringing relay also interrupts the circuit of the relay Y. With the apparatus in this condition, the conversation takes place and at the close of the conversation, the subscriber at B hangs up, breaking the circuit of the relay R_5 and causing the energization of the relay R_{11} , which interrupts the circuit of the relay R at 26, which then interrupts the strand 2, disconnecting the switching device H from the cord circuit. When the operator withdraws the plugs, the system is restored to normal.

A detailed description of the operation is as follows: When the subscriber at B takes the receiver 4 off of the hook 5, the latter being spring pressed upward, will close a switch 6 in the line A. This will complete a circuit through the relay 7, as follows: ground 8, battery 9—relay 7—switch 10—conductor 11—switch 6—conductor 12—switch 13—to ground at 14, causing the actuation of the relay 7 which closes a switch 15 in the circuit of the line lamps 16, 16₁ and 16₂, which will be lighted in multiple over the following circuits: 8—9—15—17—to ground at 18. The lamps will be at various positions at the main station, and one of the operators will answer the call. In this case, we will assume that the operator who has charge of the cord D inserts the plug P into the jack J, thereby connecting the cord to the line. The contacts 19, 20 and 21 of the cord will register respectively with the contacts 22, 23 and 24 of the jack. The following circuit will immediately be completed: ground 14—cut-off relay R_1 —conductor 25—contact 24—contact 21—switch device 26—conductor 27—resistance Z—relay R—battery 28—to ground 29. The relay R_1 will be energized, disconnecting the line lamp and line relay from the line by opening the switches 10 and 13. The relay R will be energized opening a switch 30 for a purpose to be described, closing a switch 31 in the circuit of the relay R_3 and closing a switch 32, thereby completing a shunt 34 about the resistance device Z, and making the circuit of the relay R independent of said device.

Now, if a second operator were to plug into a jack of the line A; for example, suppose the operator controlling the cord D_1 were to operate the switching device H_1 , then the current which flowed through the relay R_2 would not be sufficient to operate the said relay because of the presence of the lower resistance circuit of the relay R including the shunt through 32. The relay R also closes a switch 33 in the strand 2, com-

pleting that strand. As soon as the switch 33 is closed, a circuit is closed for the relay R_5 as follows: ground 35—upper winding of R_5 —conductor 36—2—33—19—22—12—6—
 5 11—23—20—37—3—38—lower winding of relay R_5 —battery W—to ground 39. The relay R_5 opens the switch 40 and closes the switches 41 and 42. A circuit is now completed for the relay R_3 , as follows: ground
 10 44—switch 31—conductor 45— R_3 —conductor 46—switch 42—conductor 47—switch 48—conductor 49—conductor 50—W—39. The relay R_3 closes a switch 51, completing a circuit through the device X as follows:
 15 ground 52—X—conductor 53—switch 51—46—42—47—48—49—50—W—39. The device X operates the register O. The relay R_3 also closes the switches 54 and 55, connecting the operator's set K to the strand of the cord
 20 circuit and enabling the operator to learn from the subscriber, the subscriber desired.

Assuming that the subscriber desired is the subscriber at F, the operator operates the device G by inserting the plug P_1 into the
 25 jack J_1 . Assuming that the line E is busy; that is, that a cord is already connected thereto, for example, that the cord at D_1 , is connected to the line E by the presence of the plug P_2 in the jack J_2 , a circuit will
 30 then be completed as follows: 58—59—60— R_6 '—ground 61. Now, if the switching device G is operated, the current flow through the relay R_6 will not be sufficient to cause the actuation of the same, owing to the shunt
 35 thereof through the relay R_6 '. The characteristics of the relay R_7 , however, are such that it will be operated by the slight flow of current passing through the branch containing the relay R_6 , even when the branch
 40 containing the relay R_6 ' diverts most of the current therefrom. Relay R_7 , being energized, closes a switch 62 shunting the relay R_8 , which lets go its armature, closing a switch 63. The operator will then get a
 45 special busy tone from the device Q through the conductor 64 and her receiver 65, which will indicate to her that the line is busy, when she will withdraw her plug P_1 . Assuming, however, that the line E is idle, the
 50 operation of the device G will complete a circuit for the relay R_6 as follows: ground 58—59—69—conductor 70— R_7 —conductor 71—switch 72—relay R_6 —49—50—W—39. R_6 will be energized, completing an alternate
 55 circuit for itself and excluding therefrom the relay R_7 . This alternate circuit will be as follows: 58—59—69—70—72— R_6 , and as before. Relay R_6 opens the switch 48 in the circuit of the relays X and R_3 , completing
 -60 the operation of the register, and causing the disconnection of the operator's set from the cord. A switch 73 is also closed for a purpose to be described.

The subscriber at F is now rung, by op-
 65 erating one of the ringing keys, say the keys

L and M. When the key M is operated, the following circuit is completed: 75—M—78—
 R_4 —79—Y—switch 80—conductor 81—41—
 73—49—50—W and 39. This is the circuit
 that is completed when the plug P is in the 70
 jack J and the subscriber is on the line. If, however, the plug P is in the jack J and the subscriber is not on the line, this circuit
 will not be completed, because the circuit
 of the relay R_5 would have been interrupted 75
 at the substation B, and the said relay de-energized, causing an interruption of the circuit of the relay R_4 , which has been de-
 scribed. This is of especial use, because fre-
 quently the subscriber F does not respond, 80
 and after waiting a reasonable length of time, the subscriber at B suspects that F will not respond, and retires. Under these cir-
 cumstances the automatic ringing will be in-
 85 interrupted. An alternate path is provided for this circuit to enable the operator to ring
 the subscriber F independently of any con-
 nection to a calling line, for example, when
 it is desired to call F in the morning, or call
 him to communicate with him for some other 90
 reason. Assuming, therefore, that the plug P has not been inserted into the jack J, the circuit of the relay R_4 will be as follows:
 75—M—78— R_4 —79—Y—80—85—switch
 30—conductor 86—switch 73—49—50—W— 95
 39. When relay R_4 has been energized, a switch 90 is operated, completing a locking circuit for the relay R_4 , which is independ-
 ent of the key M, so that no matter how often
 the key M is now operated, neither the relays 100
 R_4 nor Y will be affected, thus enabling the operator to use the key M for other pur-
 poses. The relay R_4 will interrupt the
 strand 2 by opening a switch 91 therein, and
 close switches 92 and 93 in the ringing cir- 105
 cuit, which will be as follows: ground 93'—
 source of ringing current N—off and on
 through the commutator 94—L—conductor
 95—switch 92—through the switching device
 G—over the line E—back through the 110
 switching device G, the main part of the current through the switch 93—resistance
 device 96—booster 97—50—W—to ground
 39. If the link is connected to a calling line,
 a portion of this circuit will pass through a 115
 multiple of the device 96, 97 and W as fol-
 lows: conductor 3—the switching device H—
 the calling line—the subscriber's set B—to
 ground at 35—through conductor 36—and
 the upper coil of the relay R_5 . The flow of 120
 current through this multiple will indicate
 to the calling subscriber that the ringing is
 going on and appease his impatience during
 the time necessary to secure the attention of
 the subscriber F. As soon as subscriber F 125
 responds, the flow of current through the
 relay R_5 will be such that this relay will be
 operated, closing a switch 100 and complet-
 ing a shunt of the relay R_4 , thereby divert-
 ing the current from the relay R_4 , which will 130

be deenergized, releasing its armatures and restoring the switches controlled thereby to the condition illustrated in the drawing.

When the relay Y was operated, it closed
 5 a switch 101 in the circuit of the register O₁. The response of the calling subscriber and the closing of the switch 91 will complete a circuit through the relay R₁₀ as follows:
 10 ground 102—winding 103—conductor 2—91—through the switching device G and over the line E and the substation circuit at F—through the switch 93—conductor 104—winding 105—battery W—ground 39. The relay R₁₀ opens the switch 80 in the cir-
 15 cuit of the relay Y and causes the completion of the actuation of the register. With the apparatus in this condition, the conversation takes place, and at the termination of the conversation, or as soon as the subscriber
 20 B hangs up, the circuit of the relay R₅ will be broken, thereby completing a circuit for the relay R₁₁ as follows: 44—31—R₁₁—110—40—73—49—50—W—39. The relay R₁₁ interrupts the strand 3 at 37, completes a lock-
 25 ing circuit for itself by closing a switch 111, and interrupts the circuit of the relay R at 26. The relay R will then release the switches controlled by it, interrupting the strand 2 at 33. The operator may then with-
 30 draw the plugs from the jacks and the system will then be restored to normal.

In connection with the system as before described, I provide a key S, which in addition to enabling the operator to manually
 35 connect her telephone set to the cord circuit at any desired time, also contains inner contacts which are closed when the key is operated and which are in the circuit including the calling subscriber's telephone set
 40 and a winding of the relay R₅, and therefore, when the key is operated, provided the calling subscriber is on the line, the relay R₅ will also be operated, closing the circuit of the disconnect relay R₁₁, in case the discon-
 45 nection of the answering end of the cord has previously occurred, and re-connecting the subscriber's line wires to the talking strands 2 and 3 of the cord circuit. Thus, the subscriber at B having completed one
 50 conversation over the cord circuit and desiring another connection, after having replaced his receiver 4 upon the hook 5, can initiate another call by again removing the receiver from the hook, causing a second
 55 lighting of the line lamps 16 and 16₁. The attendant operator noticing the lamp 16₁ light above the jack J, into which the plug P is inserted, and noticing that the disconnect lamp associated with the disconnect re-
 60 lay R₁₁ is lighted, can thus restore the connection with the cord circuit by the operating of the key S, which brings the cord circuit into the same condition as in answering the previous call. If the subscriber de-
 65 sires a connection with the same line as be-

fore, all that will be necessary will be for the operator to again depress the proper ringing key as before and to restore her listening key S. If connection with another line is desired, the plug P₁ will be withdrawn from 70 the jack J₁ and connected to a jack of the line desired, whereupon the ringing will take place upon the depressal of the proper ringing key, as before described.

I have illustrated this embodiment of my 75 invention and the details shown therein for the purpose of describing the invention, and not that I wish to be limited to this particular form or to the details shown, since it will be apparent to those skilled in the art 80 that many departures may be made from such form and details, without departing from the spirit of the invention.

I claim:—

1. In a telephone system, the combination 85 of a calling line, a substation on said line, a called line, a substation on said line, a signal at the substation, a main station, means at the main station including link conductors for connecting said lines together, 90 switching means for connecting the link conductors to the called line and switching means for connecting the link conductors to the calling line, ringing apparatus at the main station for operating the signal at the 95 substation, controlling means for said ringing apparatus controlling the connection of the same to the signal, including a circuit, mechanism under the control of the calling subscriber and said switching means 100 for connecting the link conductors to the calling line governing said circuit, means independent of said calling subscriber and said switching means controlling said circuit, and apparatus to supersede said last 105 named means and deprive said last named means of such control of said circuit.

2. In a telephone system, the combination of a calling line, a substation on said line including a talking bridge, a called line, 110 a substation on said line including a signal, a main station, means at the main station for connecting said lines together including link conductors and switching means for connecting the link conductors to the call- 115 ing line, apparatus for operating the signal at the station on the called line, mechanism for rendering said apparatus automatically operative when said switching means is un- 120 operated, mechanism for rendering said apparatus operative when said switching means is operated and the substation bridge is closed, said apparatus being inoperative when the switching means is operated and the substation bridge is open. 125

3. In a telephone system, the combination of a calling line, a substation on said line including a talking bridge, a called line, substation apparatus on said line including a signal, means at the main station includ- 130

ing link conductors and a switch for connecting said lines together, said switch when operated connecting the link conductors to the calling line, apparatus for operating the signal at the station on the called line, a relay controlling the connection of said apparatus to the called line, a circuit for said relay, means to close said circuit when said switch is operated and the substation bridge is closed, means to open said circuit and render inoperative the signaling apparatus when said switch is closed and the substation bridge is open, a normally closed branch of said circuit and means for closing said branch and rendering said signaling apparatus operative when said switch is open.

4. In a telephone system, the combination of a calling line, a substation on said line including a talking bridge, a called line, a substation on said line including a signal, a main station, means at the main station for connecting said lines together including link conductors and a switch for connecting the link conductors to the calling line, apparatus at the main station for operating the signal at the substation on the called line, means for connecting said apparatus to said signal, including a relay, circuit connections for said relay, means controlling said connections for completing a circuit for said relay when said switch is operated and the substation bridge on the calling line is completed, means to interrupt the circuit of said relay when the switch is operated and the substation bridge is broken, and normally closed means controlling said circuit connections for completing a circuit through said relay when said switch is unoperated.

5. In a telephone system, the combination of a calling line, substation apparatus on said line, a called line, a substation on said line including a signal, apparatus for operating said signal, link conductors for connecting said lines together, means for rendering said signal operating apparatus operative when the link conductors are connected to the calling line and the substation apparatus on the calling line is connected thereto, means for incapacitating said signaling apparatus when the link conductors are connected to the calling line and the substation apparatus is disconnected therefrom and normally closed mechanism for rendering said signal apparatus operative when the link conductors are disconnected from the calling line.

6. In a telephone system, a calling line, substation apparatus on said line including a talking bridge, a called line, substation apparatus on said line including a signal, a main station, a cord circuit at the main station for connecting the lines together, an answering switch for connecting the cord to the calling line, a calling switch for connecting the cord circuit to the called line, a

source of ringing current at the main station, conductors for connecting the source to the called line, a relay controlling said conductors, a circuit for said relay, means for completing said circuit including the answering switch and the substation bridge on the calling line, means for breaking said circuit, including the substation bridge on the calling line, a branch of said circuit and a relay for completing said branch when the answering switch is open.

7. In a telephone system, the combination of a calling line, substation apparatus including a hook-switch on the calling line, a called line, substation apparatus including a signal on the called line, a main station, a cord circuit at the main station, an answering switch for connecting the cord to the calling line, a calling switch for connecting the cord to a called line, a source of signaling current for causing the actuation of the signal on the called line, conductors for connecting said source to the called line, a relay controlling said conductors, a circuit for said relay, contacts in said circuit, a second relay controlling said contacts, a circuit for said second relay including the contacts of the answering switch and of the hook-switch, a branch of the circuit of the first named relay and electromagnetic means for closing said branch when said answering switch is in open position.

8. In a telephone system, the combination of telephone lines, a three-strand link connector for connecting the lines together, including two talking strands, a pair of relays, one controlling one of said talking strands and the other controlling the other of said talking strands, a circuit for one of said relays including a part of the third strand and means including a portion of the third strand for causing the actuation of said relays to interrupt the talking strands.

9. In a telephone system, the combination of telephone lines, means for connecting said lines together, including plugs and jacks and a pair of talking strands, apparatus for automatically interrupting said strands when the conversation is completed, including a pair of relays, each of said relays controlling one of said talking strands only and means including one of said relays controlling the other of said relays.

10. In a telephone system, the combination of telephone lines, means for connecting said lines together, including plugs and jacks and a pair of talking strands, means for automatically interrupting said strands when the conversation is completed, including a pair of relays, each of said relays controlling a talking strand and each of said relays controlling the other of said relays.

11. In a telephone system, the combination of a called line and a calling line, means

for connecting said lines together, including plugs and jacks and a pair of talking strands, a relay controlling each of said strands, and a circuit for each of said relays
5 controlled by the other of said relays.

12. In a telephone system, the combination of a called line, substation apparatus on said line, a main station, a telephone jack at said main station associated with said
10 called line, a cord circuit, a calling plug connected to said cord circuit and adapted for insertion into the jack of the called line,

a sensitive relay and a less sensitive relay in a circuit including a source of current, contacting terminals of said plug and jack, 15 and a relay associated with said line circuit, said sensitive relay adapted when operated to cause the operation of a busy signal, said less sensitive relay when operated, adapted to prevent the operation of said sensitive 20 relay.

I have signed my name hereunto this 10th day of May, 1915.

FRANK M. SLOUGH.