

F. M. SLOUGH.
TELEPHONE SYSTEM.

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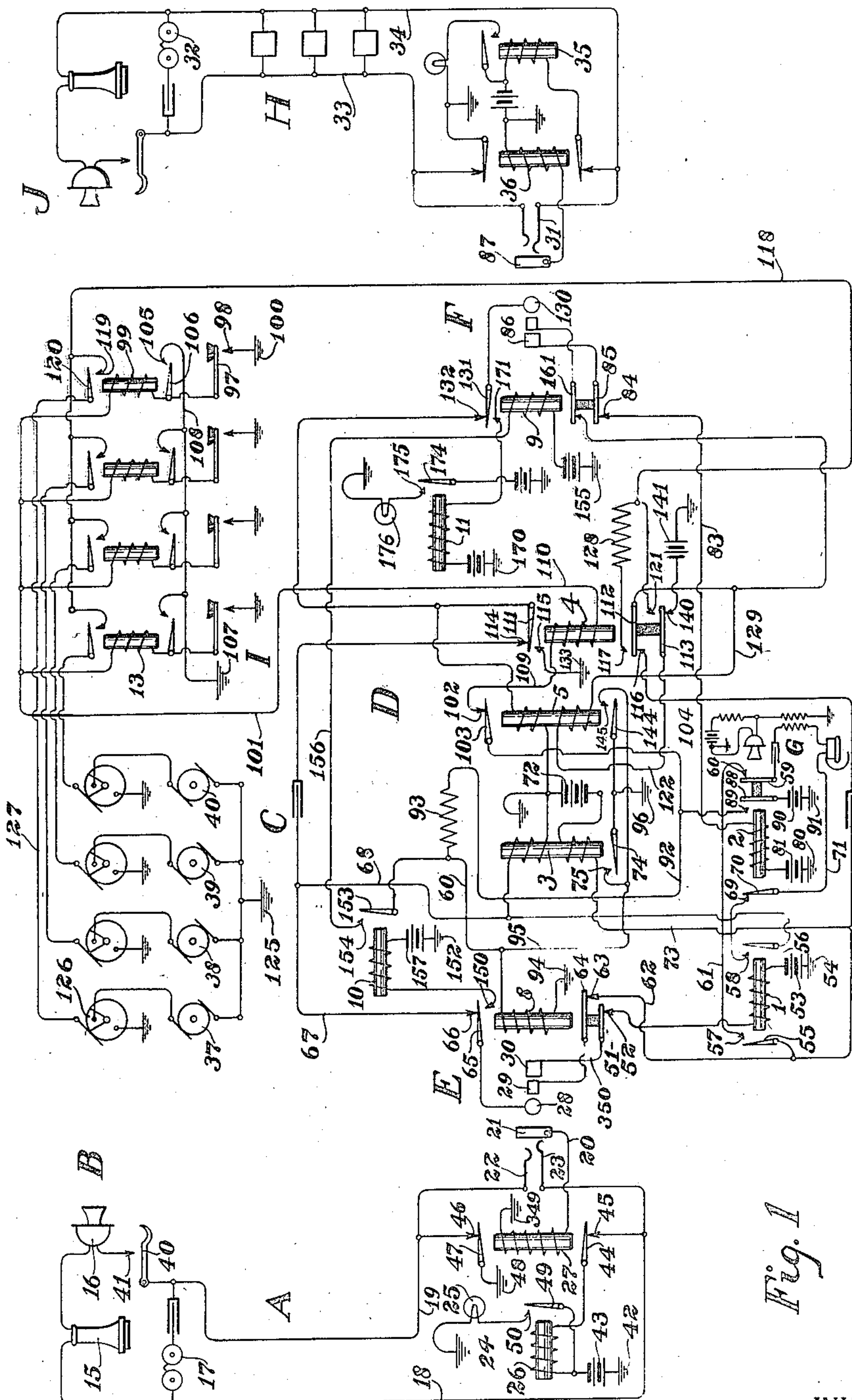


Fig. 1

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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, residing at Rochester, in the county of Monroe and State of New York, 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, in which telephone lines lead to a main or central station where they are connected together by some suitable means.

The object of my invention is to improve the telephone systems at present in use, so as to shorten the time and lessen the trouble of operation. I aim to do this with the use of as little apparatus as possible and to so arrange the same that a marginal operation is practically eliminated.

The specific objects of my invention, as well as the other general objects and uses thereof will probably be better understood from a description of particular apparatus embodied in the invention.

The figure illustrates diagrammatically a telephone system embodying my invention.

Referring now to the embodiment of the invention illustrated in the drawing, at A I show a subscriber's line leading from a sub-station B to a main or central station C. For the sake of convenience, I will designate the line A the calling line or line of the calling party, because in the description of the operation of the system I will assume that the subscriber at B is the calling subscriber.

The subscriber at B is provided with sub-station talking apparatus, including a receiver 15, a transmitter 16 and a signaling apparatus, such as a bell 17. This line extends by conductors 18 and 19 to the main station C, where it terminates in an element of a switching mechanism, such as a jack 20, here shown as consisting of a thimble contact 21, a tip contact spring 22 and a sleeve contact spring 23. Line signaling apparatus 24 may be employed, here consisting of a lamp 25 and a line relay 26. A cut-off relay 27 may be employed for severing the connection between the apparatus 24 and the line A.

At the main station I provide means for connecting the lines together. This apparatus is adapted to be connected to the line by the switching mechanism, to which I have previously referred. In the embodiment illustrated the connecting apparatus consists of a cord circuit D, here shown as terminating in an element of the above mentioned switching mechanism, and such element here consists of a plug E at one end and a plug F at the other. The plug E includes a plurality of contacts, such as a tip 28, sleeve 29 and ring 30, which register with the contacts of the jack 20 when the plug is inserted therein. An operator's set G may be used for communication with the calling subscriber. This set is adapted to be connected to the cord through any suitable means, such as electrical conductors. These conductors are controlled by relays 1 and 2, which condition the conductors to permit the operator to listen in during a part of the operation and to exclude her during another part. The plug F is provided with elements adapted to register with the elements of the jack 31 of the called line H. The apparatus used in connection with the called line is so similar to that used in connection with the calling line, that it will be useless to describe it here, except that it is shown as a party line; that a signal device, such as a bell, is employed at each station; that the line extends by conductors 33 and 34 from subscribers' stations to the main station; and that line signal apparatus 35 and a cut-off relay 36 are employed in connection therewith.

Suitable means is provided for supplying energy to operate the signal devices illustrated at 17 and 32. In the form shown this consists of generators 37, 38, 39 and 40. Any of these generators are adapted to be connected in circuit with the signaling devices on the called line and I provide conductors and suitable means controlling said conductors for performing such function. In the form shown this is done by depressing one of the series of ringing keys I which causes the connection of such source to the called line. Means are provided for continuing at intervals the application of energy for the actuation of the signal at the subscriber's station until the subscriber responds, whereupon it is automatically dis-

connected. I also provide means for automatically disconnecting the plugs E and F from the cord circuit after the subscribers have retired their substation apparatus. A
 5 signal is also provided which is operated to warn a desired party that the conversation is completed and that the connections are to be restored to normal.

The objects of my invention and the particular embodiment will probably be better understood from a description of the operation of the system, which is as follows:—
 Assuming that the subscriber at B desires to communicate with the subscriber at J
 15 upon the called line, the receiver 15 is removed from the receiver hook 40, which is spring pressed upward and automatically rises, closing a switch 40—41 in a circuit of the line relay 26, which is traced as follows: 42—battery 43—winding 26—armature 44—contact 45—side 18 of line—15—
 20 16—41—40—19—46—47—to ground at 48. The relay 26 pulls up the armature 49, closing a switch 49—50 in the circuit of the
 25 lamp 25, which is in such a position as to attract the attention of the operator, who inserts the plug E into the jack 20, completing a circuit from ground 349—through 27—21—30—350—51—52—relay 1—battery—53—ground 54—actuating the cut-off
 30 relay which attracts its armatures 44 and 47, disconnecting the line signaling apparatus of the called line from the conductors 18 and 19. The relay 1 is energized, attracting its armatures 55 and 56, closing switches
 35 55—57 and 56—58, and connecting the operator's set G to the cord circuit and in circuit with the subscriber's apparatus at B over the following circuit: G—59—60—61—57—
 40 55—62—63—64—29—23—18—15—16—41—40—19—22—28—65—66—67—68—56—58—69—70—71—back to G. Current will be supplied to this circuit from the battery 72, which courses through the relay 3 and the
 45 conductors 68 and 73 to the cord circuit and over the conductors just traced through the substation apparatus at B, energizing the relay 3, which attracts its armature 74, closing a switch 74—75 for a purpose to be described. The operator then talks with the
 50 subscriber, learning that it is the station at J that is wanted. The plug F is inserted into the jack 31, completing a circuit through the relay 2 as follows: ground 80—battery
 55 81—relay 2—conductor 83—contacts 84—85—86—87 to ground through the relay 36. 36 will be energized, attracting its armatures and severing the called line signaling apparatus from the called line. The relay 2 will
 60 be energized, attracting the armatures 70 and 59, disconnecting the operator's set from the cord circuit and making it impossible to listen in to the conversation which takes place between the subscribers at B and J.
 65 The armature 88 will be attracted, closing a

switch 88—89 and completing a circuit through the relay 8 as follows: ground 91—90—88—89—92—93—8 to 94. The relay 8, however, will not be actuated, because when the magnet 3 was energized, a shunt about
 70 said relay 8 was completed as follows: 95—75—74—to ground at 96. The operator then selects from the set of ringing keys I the key controlling the source of energy which is adapted to actuate the signal device 32. 75
 Assuming that this is the device 37, the key 97 will be actuated, closing the switch 97—98 and completing a circuit for the magnets 99 and 4 as follows: ground 100—98—97—99—
 80 101—110—4—109—102—103—104—89—88—90 and 91. The magnet 99 will be energized, attracting its armature 106, closing a switch 105—106 and locking the relay from ground 107 through conductor 108, switch 106—105 and over the circuit just
 85 traced.

Also the magnet 4 will be energized, attracting its armatures 111, 112 and 113, interrupting the tip strand of the cord at 111—114 and grounding the tip at 111—115. 90
 The sleeve strand is interrupted at 112—116 and connected at 112—117 to a conductor 118 leading to a contact 119 which is connected to a second contact 120 when the magnet 99 is energized. A second path is
 95 created for current through the switch 113—121, the conductor 122 and one of the windings of the magnet 5 on to the sleeve side of the cord.

Thus, after the magnetization of the relays 4 and 99, which has been described, a circuit will be completed for the application of the energy of the source 37 to the signal 32 as follows: from ground 125—through 37, the interrupter 126—conductor 127—contacts 120—119—conductor 118—and in parallel through 128—117—112—to the sleeve and 121—113—122—magnet 5 and conductor 129 to the sleeve, from the sleeve to the side 34 of line, through the signal device 32
 100 back over the side 33 of line to the tip 130, through contacts 131—132—111—115—to ground at 133. The ringing continues at intervals, whose length is determined by the character of the segment upon the interrupter 126 and the rate of its rotation. 105
 Owing to the resistance of the bell bridge at the substation, the current through this circuit will not be sufficient to actuate the relay 5. When the called subscriber at J
 120 responds, the substation talking set is placed in bridge of the line and this being of lower resistance than the bell bridge, the energy through the circuit just described has increased, so that the relay 5 will now be actuated. The magnet 5 attracts its armature 103, opening the switch 102—103 in the circuits of the relays 4 and 99, which are de-
 125 energized, restoring their armatures and the apparatus controlled thereby to the position
 130

shown in the drawing, disconnecting the ringing current from the line, renewing the continuity of the cord circuit and connecting the magnet 5 through a switch 113—140 to a source 141 and over a circuit just traced in connection with the ringing circuit through the subscriber's line and the magnet 5, keeping the same energized and placing it under control of the subscriber's set, so that it remains actuated as long as the subscriber is on the line.

The relay 5 also attracted an armature 144 and closed a switch 144—145, completing a second shunt 146 about the magnet 8 for a purpose to be described.

The apparatus is now in condition for conversation and the same takes place, its length being determined by the desire of the subscribers. At the end of the conversation, the receivers are restored to the hooks, interrupting the line circuits and the circuits of the relays 3 and 5, which release their armatures 74 and 144, interrupting the shunts about the relay 8 which will become energized over the circuit previously traced. When this relay is energized, it attracts the armatures 65, 64 and 51, interrupting the circuits of the relays 27 and 1, and restoring the switches 46—47 and 44—45 to the condition illustrated in the drawing. The attraction of the armatures 64 and 65 automatically disconnects the switching mechanism shown at E—20 from the connecting apparatus D and releases the line A from the connection so that the line can be used for other calls immediately upon the termination of the conversation.

When the armature 65 was attracted, a switch 65—150 was closed, completing a circuit through the magnet 10 as follows: 48—47—46—22—28—65—150—10—battery 157 to ground at 152. The relay magnet 10 is wound with a great many turns of very fine wire, so that it will be of very high resistance and on account of the great number of turns of wire, can be energized with a very small amount of current. This relay when the foregoing circuit is completed, attracted the armature 153, completing a circuit for the magnet 9 as follows: ground 155—battery—magnet 9—conductor 156—154—153—magnet 8 to ground at 94 and energizing the magnet 9. This magnet would likewise be shunted through the shunts controlled by the relays 3 and 5 when either of these relays is energized, so that in the form of my invention illustrated the magnet 9 is controlled by the subscriber's apparatus. The magnet 9 when energized attracted the armatures 131 and 161, cutting off the plug F from the cord D and releasing the line H. The armature 85 was also attracted when the magnet 9 was energized, interrupting the circuit of the cut-off relay 36 and the relay 2, the magnets 8 and 9 now

being energized over the following circuit: 94—8—153—154—156—9—battery to ground at 155. The interruption of the circuits of the magnets 1 and 2, restores the armatures to the condition illustrated in the drawing. The attraction of the armature 131 closes a circuit through the relay 11 as follows: ground at 170—battery—magnet 11—contact 171—131—130—through the tip and contacts of the relay 36—to ground. The relay magnet 11 is wound with very fine wire in a manner similar to the magnet 10. The magnet 11 is energized, attracting its armature 174 and closing a circuit 174—175 through battery and a disconnect signal 176 which becomes energized, indicating to the operator that the conversation is terminated. This signal continues to burn until such time as the operator finds it convenient to withdraw the plugs E and F, disconnecting the cord from the line. This withdrawal interrupts the circuits of the magnets 10 and 11, which in turn interrupt the circuits of the magnets 8 and 9 and the signal 12, restoring the apparatus to the normal condition illustrated in the drawing.

I claim:

1. In a telephone system, the combination of a main station, a plurality of substations, switches at the substations, telephone lines connecting the substations to the main station, connecting apparatus at the main station for connecting telephone lines together, switching mechanism for connecting the connecting apparatus to the telephone lines, an operator's telephone set at the main station adapted to be connected to the connecting apparatus, electromagnetic means for operating contacts in the connection of the operator's set to the connecting apparatus and means controlled by said first named means for automatically disconnecting the switching mechanism from the connecting apparatus.

2. In a telephone system, the combination of a main station, a plurality of substations, switches at the substations, telephone lines connecting the substations to the main station, connecting apparatus at the main station for connecting telephone lines together, switching mechanism for connecting the connecting apparatus to the telephone lines, an operator's telephone set at the main station, means for connecting said set to such connecting apparatus, a relay operating contacts in said connecting means, and electromagnetic means controlled by said relay for automatically disconnecting the switching mechanism from the connecting apparatus.

3. In a telephone system, the combination of a main station, a calling telephone line, substation apparatus on said line, a called telephone line, substation apparatus on said line, a cord circuit at the main station for connecting said lines together, plug and jack

switching mechanism for connecting the cord circuit to the calling line and plug and jack switching apparatus for connecting the cord to the called line, an operator's telephone set, electromagnetic means for connecting the set to the cord, means controlling said connecting means and means operable by the calling substation apparatus for automatically disconnecting the calling line plug and jack switching mechanism from the cord, said last named means being controlled by the means which controls the connection of the operator's set to the cord circuit.

4. In a telephone system, the combination of a main station, a calling telephone line, substation apparatus on said line; a called telephone line, substation apparatus on said line, a cord circuit at the main station for connecting said lines together, plug and jack switching means for connecting the cord circuit to the calling line and plug and jack switching apparatus for connecting the cord to the called line, an operator's telephone set, means including relay contacts for connecting the set to the cord, means for operating said relay contacts associated with said connecting means and means for automatically disconnecting the called line plug and jack switching means from the cord, said last named means being controlled by the means for operating said relay contacts.

5. In a telephone system, the combination of a main station, a plurality of telephone lines including a calling line, substation apparatus on said calling line, a cord circuit at the main station for connecting telephone lines together, plug and jack switching mechanism for connecting the cord to the calling line, an operator's set adapted to be connected to the cord circuit, a relay having contacts in the connections of the operator's set to the cord circuit, electromagnetic means for automatically disconnecting said switching mechanism from the cord circuit, said electromagnetic means being controlled by said relay.

6. In a telephone system, the combination of a main station, a plurality of substations, telephone lines connecting the substations to the main station, a cord circuit for connecting telephone lines together, an operator's set at the main station, conductors for connecting the set to the cord circuit, normally open switches in said conductors, a magnet for closing said switches when the cord circuit is connected to a calling line and a magnet for opening said conductors, said last named magnet being operated by the act of connecting the cord to a called line, said last named magnet controlling said first named magnet.

7. In a telephone system, the combination of a main station, a called telephone line, a calling telephone line, substation apparatus

on each line, a cord circuit at the main station, an answering plug for said cord circuit and a calling plug for said cord circuit, said plugs adapted to connect the cord to the jacks of said lines, said cord including talking strands, means for automatically disconnecting the answering plug from the cord circuit and interrupting the strands of the cord circuit, said means including a relay under the control of the calling subscriber and a circuit for said relay, a second relay controlling the circuit of the first-named relay and a circuit for said second named relay local to the main station and including a portion of one of the talking strands of the cord circuit.

8. In a telephone system, the combination of a main station, a plurality of subscriber's lines leading to the main station, substation apparatus on the subscribers' lines, connecting apparatus at the main station for connecting telephone lines together, switching mechanism for connecting said apparatus to the telephone lines, means associated with said connecting apparatus controlled by substation apparatus, means for disconnecting the switching mechanism from the connecting apparatus, a source of energy for supplying energy to said disconnecting means, said disconnecting means being included with the source of energy in a circuit local to said connecting apparatus and means governed by said subscriber controlled means for shunting the energy of said source from said disconnecting means.

9. In a telephone system, the combination of a main station, a plurality of subscribers' lines leading to the main station, substation apparatus on said lines, connecting apparatus at the main station for connecting telephone lines together, switching mechanism for connecting said apparatus to the telephone lines, a device associated with said connecting apparatus controlled by substation apparatus, electromagnetic means for disconnecting the switching mechanism from the connecting apparatus, a circuit for said electromagnetic means local to said connecting apparatus and a shunt for said electromagnetic means governed by said subscriber controlled device.

10. In a telephone system, the combination of a main station, a calling telephone line leading to said main station, substation apparatus on said calling line, a called line leading to the main station, substation apparatus on the called line, a cord circuit for connecting said lines together, plug and jack switching mechanism for connecting the cord to the lines, a relay for disconnecting the cord from the plug and jack switching mechanism of the calling line, a second relay for disconnecting the plug and jack switching mechanism of the called line from the cord, circuits for said relays, shunts

about said relays and means governed by said substation apparatus controlling said shunts.

11. In a telephone system, the combination of a main station, a plurality of telephone lines, including a called line, leading to the main station, substation apparatus on said lines, a cord circuit at the main station, plug and jack switching mechanism for connecting the cord to the lines, means for disconnecting said plug and jack switching mechanism from the cord, electromagnetic means for actuating the same, a circuit for said electromagnetic means local to said cord circuit, and a shunt about said electromagnetic means controlled by the substation apparatus of a subscriber on the called line.

12. In a telephone system, the combination of a main station, a plurality of substations, telephone lines leading from the substations to the main station, a cord circuit at the main station for connecting telephone lines together, switching mechanism at each end of the cord for connecting the cord to a telephone line, means for disconnecting the switching mechanism at one end of the cord from the cord and means for disconnecting the switching mechanism at the other end from the cord, one of said means controlling the other.

13. In a telephone system, the combination of a main station, a calling subscriber's line leading to said main station, a called subscriber's line leading to said main station, a cord circuit for connecting said lines together, a switching device for connecting the cord to the calling line, a second switching device for connecting the cord to the called line, means for disconnecting the cord from said second switching device and means controlling said first named means for disconnecting the cord from the first named switching device.

14. In a telephone system, the combination of a main station, a plurality of telephone lines leading to the main station, substation apparatus on said telephone lines, a cord circuit at the main station, switching mechanism provided with contacting terminals for connecting the cord circuit to the telephone lines, apparatus for disconnecting the switching mechanism from the cord circuit, a disconnect signal associated with the cord controlled by said apparatus, and a circuit for maintaining the disconnect signal, including contacting terminals of the switching mechanism.

15. In a telephone system, the combination of a main station, a plurality of telephone lines leading to the main station, substation apparatus at the main station, a cord circuit for connecting the lines together, a switching device provided with contacting terminals for connecting one end of the cord to

a telephone line, electromagnetic apparatus for disconnecting said switching device from the cord, a disconnect signal associated with the cord controlled by said electromagnetic apparatus, and a circuit for maintaining the disconnect signal, including contacting terminals of the switching device.

16. In a telephone system, the combination of a main station, a calling subscriber's line leading to the main station, a cut-off relay for said calling line, a cord circuit, a switching device for connecting the cord to the calling telephone line, a called telephone line leading to the main station, a switching device for connecting the cord to the called line, means for automatically disconnecting the cord from said second named switching device, a circuit for said means, a relay controlling said circuit and a circuit for said relay controlled by the cut-off relay in the calling subscriber's line.

17. In a telephone system, the combination of a main station, telephone lines leading to the main station, substation apparatus on the telephone lines, cut-off relays for said lines, a cord circuit, switching mechanism for connecting the cord to telephone lines, means for disconnecting the cord from the switching apparatus, a relay controlling said means and a circuit for said relay controlled by the cut-off relay of one of the subscriber's lines.

18. In a telephone system, the combination of a main station, a called telephone line leading to the main station, a cord circuit, a switching device provided with contacting terminals for connecting the cord to the telephone line, a disconnect signal associated with the cord circuit, means controlling said disconnect signal for automatically disconnecting the switching device from the cord circuit, and a circuit for maintaining said disconnect signal, including contacting terminals of said switching device.

19. In a telephone system, the combination of a main station, a plurality of substations, telephone lines leading from the substations to the main station, a cord circuit for connecting the lines together, switching mechanism for connecting the cord to the lines, means for automatically disconnecting the cord from the switching mechanism, an operator's telephone set, electromagnetic means to connect the telephone set to the cord and means controlling the operator's connecting means controlled by said disconnecting means.

20. In a telephone system, the combination of a main station, telephone lines leading to the main station, substation apparatus on the telephone lines, a cord circuit at the main station including talking strands, jacks for the telephone lines, an answering and a calling plug for connecting the cord circuit

to such jacks, a source of current associated with the cord circuit, means including a relay, the magnet of which is in a circuit local to the main station controlled by sub-
 5 station apparatus for automatically disconnecting the answering end of the plug from the cord circuit, and mechanism for retiring said means and restoring the cord circuit, said mechanism including a circuit which
 10 includes a portion of one of the talking strands of the cord circuit.

21. In a telephone system, the combination of a main station, a plurality of subscribers' lines leading to the main station, sub-
 15 station apparatus on said lines, connecting apparatus at the main station for connecting telephone lines together, switching mechanism for connecting said apparatus to the telephone lines, a device associated with
 20 said connecting apparatus controlled by substation apparatus, electromagnetic means for automatically disconnecting the switching mechanism from the connecting apparatus when a connected subscriber retires
 25 his substation apparatus, a circuit for said electromagnetic means, said circuit being local to said connecting apparatus and a shunt for said electromagnetic means governed by said subscriber controlled device.

22. In a telephone system, the combination of a main station, a plurality of telephone lines, including a called line, leading to the main station, substation apparatus on said lines, a cord circuit at the main station, plug and jack switching mechanism for connecting the cord to the line, means for disconnecting said plug and jack switching mechanism from the cord, electromagnetic means in a circuit local to said cord
 40 circuit for automatically actuating the same when connected substation apparatus is retired and a shunt about said electromagnetic means controlled by the substation apparatus of a subscriber on the called line.

23. In a telephone system, the combination of a main station, a plurality of substations, telephone lines leading from the substations to the main station, a cord circuit at the main station for connecting telephone lines together, switching mechanism at each end of the cord for connecting the cord to a telephone line, means for automatically disconnecting the switching mechanism at one end of the cord from the cord and
 55 means for automatically disconnecting the switching mechanism at the other end from the cord, one of said means controlling the other and each of said means being automatically actuated when connected subscribers' substation apparatus is retired.

24. In a telephone system, the combination of a main station, a calling subscriber's line leading to said main station, a called subscriber's line leading to the main station,
 65 a cord circuit for connecting said lines to-

gether, a switching device for connecting the cord to the calling line, a second switching device for connecting the cord to the called line, means for automatically disconnecting the cord from said second switching
 70 device when the called substation apparatus is retired and means controlling said first named means for automatically disconnecting the cord from the first named switching device when the calling substation apparatus
 75 is retired.

25. In a telephone system, the combination of a main station, a plurality of telephone lines leading to the main station, sub-
 80 station apparatus on said telephone lines, a cord circuit at the main station, switching mechanism provided with contacting terminals for connecting the cord circuit to the telephone lines, apparatus for automatically disconnecting the switching mechanism from the cord circuit when connected
 85 substation talking apparatus is retired, a disconnect signal associated with the cord controlled by said apparatus, and means for maintaining the disconnect signal, said
 90 means being included in circuit together with contacting terminals of said switching mechanism.

26. In a telephone system, the combination of a main station, a plurality of telephone lines leading to the main station, sub-
 95 station apparatus at the main station, a cord circuit for connecting the lines together, a switching device for connecting one end of the cord to the telephone line, electromagnetic apparatus for automatically disconnecting said switching device from the cord when
 100 connected subscribers' talking apparatus is retired and a disconnect signal associated with the cord circuit controlled by said electromagnetic apparatus, said disconnect signal and electromagnetic apparatus being maintained in an operative state over a circuit including a portion of a talking strand
 105 of said cord circuit and contacting terminals of said switching device.

27. In a telephone system, the combination of a main station, a calling subscriber's line leading to the main station, a cut-off relay for said calling line, a cord circuit, a
 115 switching device for connecting the cord to the calling telephone line, a called telephone line leading to the main station, a switching device for connecting the cord to the called line, means for automatically disconnecting
 120 the cord from said second named switching device when connected subscribers' talking apparatus is retired, a circuit for said means, a relay controlling said circuit and a circuit for said relay controlled by the cut-off relay
 125 in the calling subscriber's line.

28. In a telephone system, the combination of a main station, telephone lines leading to the main station, substation apparatus on the telephone lines, cut-off relays for said
 130

lines, a cord circuit, switching mechanism for connecting the cord to telephone lines, means for automatically disconnecting the cord from the switching apparatus when
 5 connected subscribers' substation talking apparatus is retired, a relay controlling said means, and a circuit for said relay controlled by the cut-off relay of one of the subscriber's lines.

10 29. In a telephone system, the combination of a main station, a called telephone line leading to the main station, a cord circuit, a switching device for connecting the cord to the telephone line, a disconnect signal
 15 associated with the cord circuit and means including a relay having its magnet in a circuit local to the main station, controlling said disconnect signal and for automatically disconnecting the switching device from the cord circuit when connected
 20 subscribers' substation talking apparatus is retired, said relay being operatively maintained over a circuit including a portion of a talking strand of said cord circuit.

25 30. In a telephone system, the combination of a main station, a plurality of substations, telephone lines leading from the substations to the main station, a cord circuit for connecting the lines together, switching mechanism for connecting the cord to the lines,
 30 means without the talking circuit for automatically disconnecting the cord from the switching mechanism when connected subscribers' talking apparatus is retired, an operator's telephone set adapted to be connected
 35 to the cord and means controlling the connection of the operator's set to the cord and controlled by said disconnecting means.

31. In a telephone system, the combination
 40 of a main station, a calling telephone line, substation apparatus on said line, a called telephone line, substation apparatus on said line, connecting apparatus at the main station for connecting the calling telephone
 45 line to the called telephone line, plug and jack switches for connecting said connecting apparatus to the telephone lines, two electromagnetic devices for disassociating the plug and jack switches from the connecting ap-
 50 paratus, one of which is under the control of the substation apparatus, the second being controlled by the first electromagnetic device.

32. In a telephone system, the combination
 55 of a main station, telephone lines, substation apparatus on the telephone lines, switchboard jacks in which the lines terminate, a cord circuit at the main station including talking strands, and an answering and a calling plug in which the cord terminates, means
 60 under the control of the calling subscriber for automatically disconnecting the answering plug from the cord circuit, said last named means including a relay and a circuit
 65 therefor, means to complete said circuit and

maintain the disconnection of the answering plug from the cord circuit, said last named means including a relay and a circuit therefor, which last named circuit includes a portion of a talking strand of the cord circuit. 70

33. In a telephone exchange system, including telephone lines extending from substations to an exchange, line signaling apparatus at the exchange for said telephone lines, connecting apparatus at the exchange
 75 for uniting lines in conversation, a cut-off relay governed by said connecting apparatus for preventing the presentation of the line signal of a calling line, and means, operable under the joint control of the connected
 80 stations for removing the control of the cut-off relay over the line signal of the calling line, thereby permitting the calling station to regain control of the line signal of the calling line and means including a circuit
 5 for withholding the control of said line signal from said cut-off relay.

34. In a telephone system, the combination of telephone lines, each provided with a line circuit, telephone line interconnecting mechanisms for connecting telephone lines together including talking strands adapted to be automatically interrupted at the termination of a conversation thereover, supervisory relay means associated with said mechanisms, a high resistance relay controlling the interruption of said talking strands, a circuit for said relay, including portions of one of said talking strands and a line circuit of a connected line, and means to close said
 90 circuit at the termination of a conversation and maintain such circuit closed until the connection is taken down. 95

35. In a telephone system, the combination of a telephone line provided with a subscriber's set and a line circuit, telephone line interconnecting mechanism including a subscriber controlled relay and talking strands adapted to be interrupted at the termination
 105 of a conversation over said strands, a high resistance relay controlling such interruption of such strands, a circuit for said relay including portions of a talking strand and such line circuit and means for closing said
 110 circuit upon the retirement of a subscriber and maintaining such circuit closed until the connection is taken down. 115

36. In a telephone system, the combination of telephone lines, each provided with a line circuit, telephone line interconnecting mechanisms for connecting telephone lines together, including talking strands adapted to be automatically interrupted at the termination of a conversation thereover, supervisory relay means associated with said mechanisms, a high resistance relay controlling the interruption of said talking strands, a circuit for said relay including portions of one of said talking strands and a line circuit of a connected line, means to close said cir- 120
 125
 130

cuit at the termination of a conversation and maintain such circuit closed until the connection is taken down, and a disconnect signal controlled by said high resistance relay.

5 37. In a telephone system, the combination of a telephone line provided with a subscribers' set and a line circuit, telephone line interconnecting mechanism including a subscriber controlled relay and talking strands
10 adapted to be interrupted at the termination of a conversation over said strands, a high resistance relay controlling such interruption of such strands, a circuit for said relay including portions of a talking strand and
15 such line circuit, means for closing said circuit upon the retirement of a subscriber and maintaining such circuit closed until the connection is taken down and a disconnect signal controlled by said high resistance
20 relay.

38. In a telephone system, the combination of telephone lines, link conductors including talking strands for connecting said
25 lines together, a first connection switch for connecting said link conductors to a tele-

phone line, a second connection switch for connecting said conductors to another telephone line, a disconnect relay adapted to cause the disconnection of said talking strands from a switch when the conversation
30 is completed, a circuit for said relay including contacts of the first switch, and disconnect signal apparatus including a disconnect signal relay and a circuit therefor which includes contacts of the other switch. 35

39. In a telephone system, the combination of telephone line interconnecting means including talking strands adapted to be interrupted at the termination of a conversation, a relay controlling such interruption, a disconnect signal and a disconnect signal relay
40 and circuits for said relays, each including a portion of a talking strand.

In witness whereof, I have signed my name in the presence of two witnesses this
15th day of October, 1913. 45

FRANK M. SLOUGH.

Witnesses:

GEO. E. ROBERT,
R. G. SANDS.