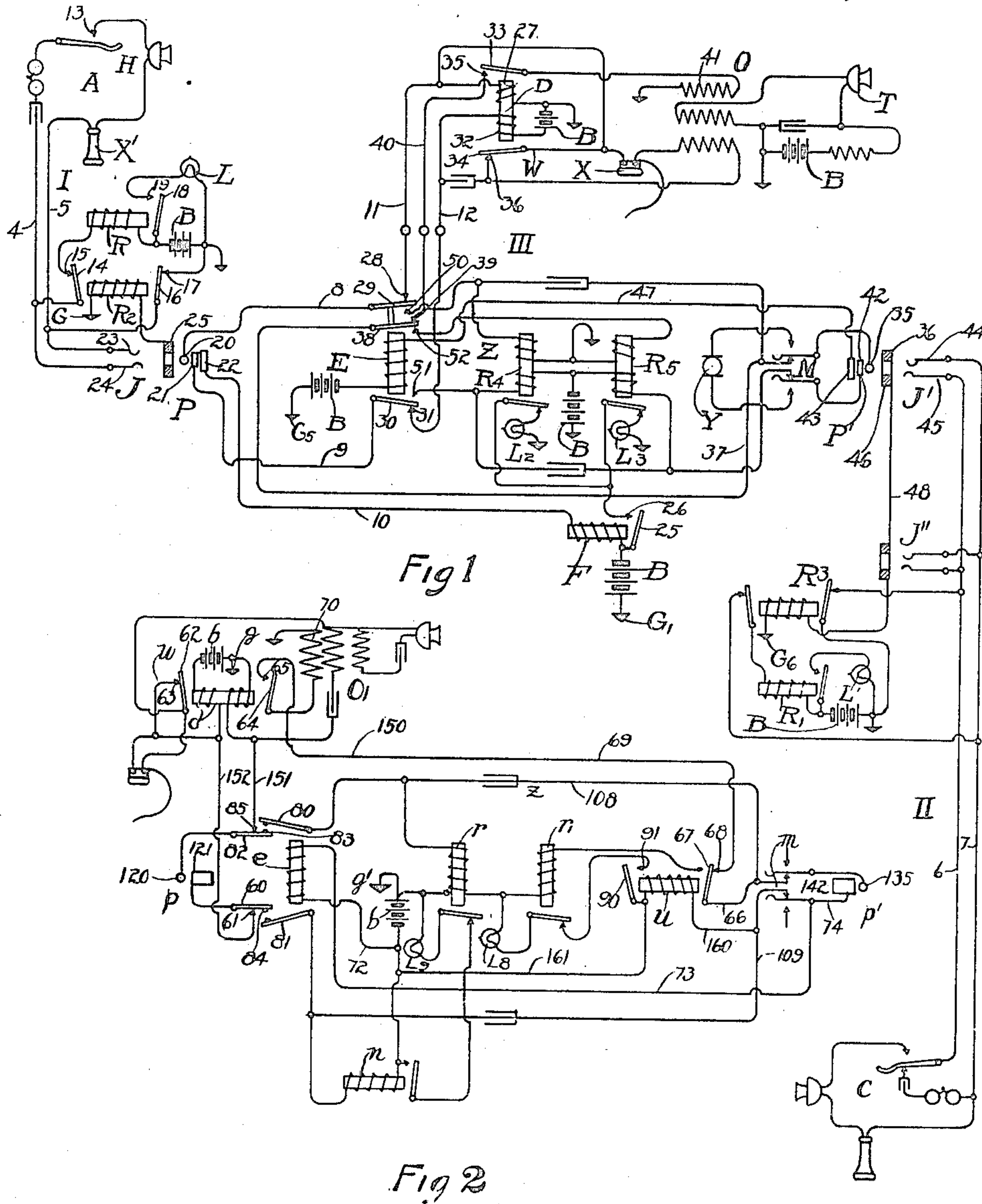


F. M. SLOUGH.
TELEPHONE SYSTEM.
APPLICATION FILED JULY 30, 1914.

1,231,800.

Patented July 3, 1917.
2 SHEETS—SHEET 1.



WITNESSES:
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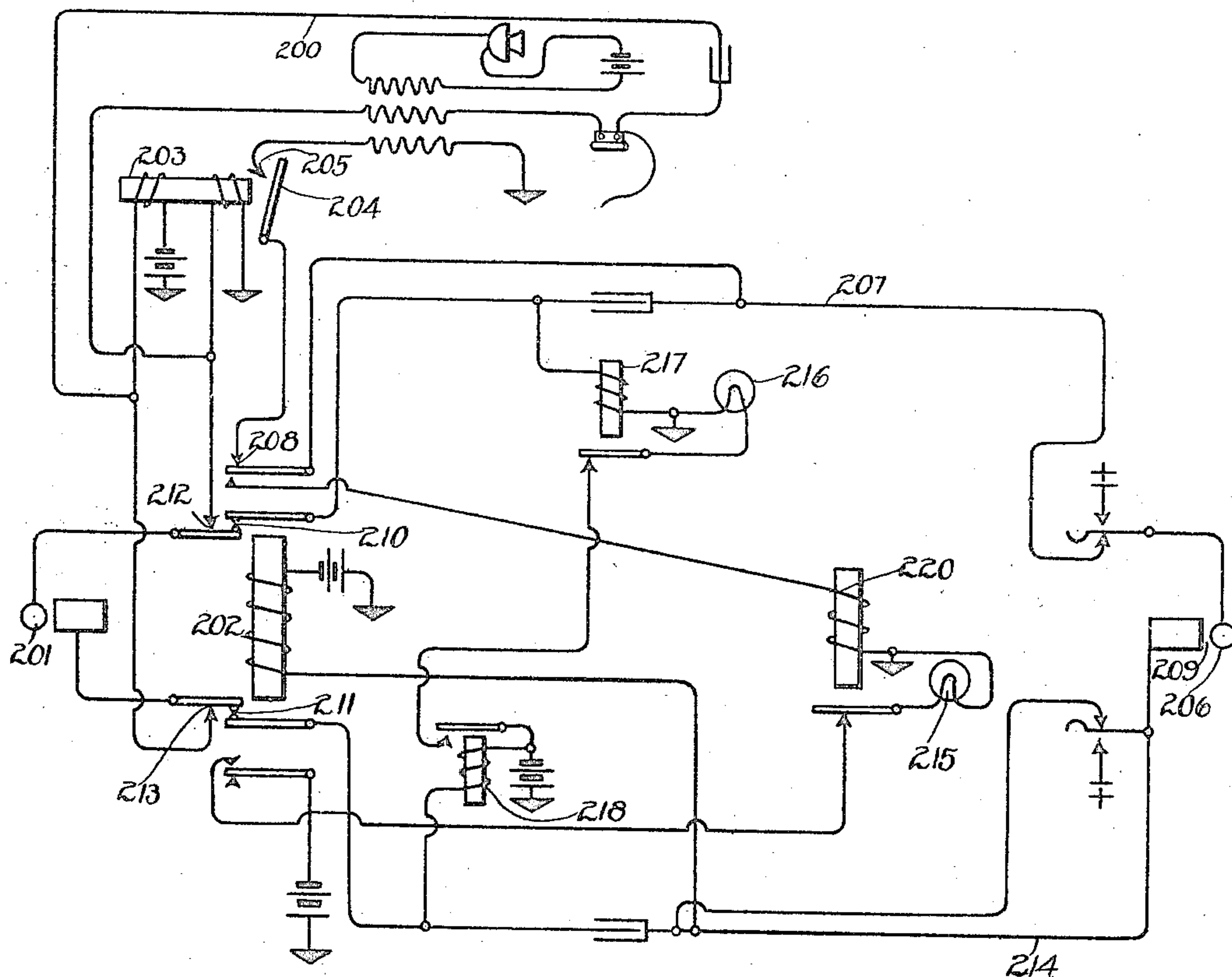


Fig. 3

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TELEPHONE SYSTEM.

1,231,800.

Specification of Letters Patent.

Patented July 3, 1917.

Application filed July 30, 1914. Serial No. 854,025.

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 my invention, such as will enable others skilled in the art to understand the same.

My invention relates to improvements in telephone systems, and more particularly to improvements in what are colloquially known as secret listening circuits, or circuits which are designed to prevent the operator from listening in on the conversation, while at the same time enabling her to listen in to ascertain the desires of the subscriber in order to complete the connection.

The particular objects of my invention and the invention itself will probably be better understood from a detailed description of certain embodiments of the invention which have been illustrated in the annexed drawing.

Figure 1 is a diagrammatic illustration of an embodiment of my invention in connection with a three-conductor cord.

Fig. 2 is an illustration of an embodiment of my invention in connection with a two-conductor cord.

Fig. 3 is a modification of the embodiment shown in Fig. 2.

Referring now to the drawing, and first to Fig. 1, at I is shown a telephone line leading from a substation at A through conductors 4 and 5 to a main station at III. At II is shown a second telephone line leading from a substation C through limbs 6 and 7 to the main station. I have illustrated single party lines, though any number of parties may be connected thereon.

At the main station suitable means are provided for connecting the telephone lines together, here shown as link conductors which are preferably in the form of a cord circuit Z. In the form shown in Fig. 1, the cord circuit consists of three strands 8, 9 and 10. 8 and 9 are what are known as the talking strands, as it is over these that the conversation takes place. Suitable means are provided for connecting the link con-

ductors to the telephone lines, here shown as switching devices comprising plugs and jacks. The line I terminates at the switch-board in a jack J and the line II in jacks J' and J''. The cord circuit terminates in an answering plug P and a calling plug P'. When the plugs are inserted into the jacks, connection is made in the well known manner. The line signals are shown at L and L', the line relays at R and R¹, the cut-off relays at R² and R³. Supervisory signals are shown at L² and L³, and relays controlling the same at R⁴ and R⁵. The calling generator is shown at Y. The source of talking current is shown at B. Although I have illustrated this at a number of places for the sake of convenience, it may be, and preferably is, a single source. The operator's set is shown at O and consists of a transmitter T and a receiver X. The operator's set is normally connected through conductors 11 and 12 to the answering end of the cord circuit, though such connection is rendered ineffective by a shunt W. The shunt W is retired by a relay D when connection is made with the calling line, placing the operator in connection with the calling line. The operator's set is disconnected from the cord circuit by a relay E when connection is made with the called line, making it impossible for the operator to listen in upon a conversation, and insuring a secret communication between the subscribers.

Although the operator is disconnected from the calling end of the cord, I enable her by my invention to make the busy test after the relay D has been energized. The talking strands of the cord circuit are also normally interrupted, and I provide means for completing the cord circuit at the same time that the operator is disconnected therefrom.

Perhaps my invention and the object thereof will be better understood from a description of the operation of the embodiments shown. The operation of that shown in Fig. 1 is as follows:

Assume that the subscriber at A desires to communicate with the subscriber at C—she removes her receiver X' from the receiver hook H, closing a switch H¹³ and energizing the relay R over the limbs 4, 5

of the line, the switches 14—16 and 16—17 and battery B. When energized, the relay R attracts its armatures 18, closing the circuit of the line lamp at 18—19. The line lamp is energized and attracts the attention of the operator who inserts the plug P into the jack J, the tip contact 20, the sleeve contact 21 and the shank contact 22 of the plug registering respectively with the tip spring 23, the sleeve spring 24 and the ring 25 of the jack, and completing the following circuits: first, a circuit from ground at G—through the cut-off relay R²—25—22—10—relay F—battery B to ground at G¹. This energizes the cut-off relay and cuts off the line lamp and signal from ground, extinguishing the line signal. The energization of the relay F causes the attraction of the armature 25, closing a switch 25—26 and completing a circuit through each of the supervisory signals L² and L³.

When a plug was inserted into the jack, a circuit was also completed through the relay D as follows: the coil 27 of D—conductor 11, switch 28—29—conductor 8, 20—23—5—X—13—H—4—24—21—9—30—31—12—winding 32 of relay D and battery B. The relay D will be energized, attracting its armatures 33 and 34, closing a switch 33—35 and breaking the shunt W at 34—36. The interruption of the shunt enables the operator to communicate with the calling subscriber, from whom she learns the number of the station desired, which I have assumed to be the station C upon the line II. One of the objects of normally shunting the receiver is to enable the use of one set with a plurality of cords, and to prevent stray currents which pass over the idle cord circuits from going through the operator's receiver. Having learned that it is the subscriber C that is wanted, the operator first tests the line C by making a testing connection, which in this case consists of applying the tip 35 of the plug P' to the ring 36 of the jack J'. If the line is busy, there will be a potential upon the member 36 and an impulse of current will pass from 36 through the receiver over the circuit completed by the relay D, as follows: 36—35—37—38—39—40—35—33—the winding 41 of the operator's set. This will induce a flow of current in the receiver, and she will know that the line is busy. If, however, line II is idle there will be no such flow of current and the operator will insert the plug P' into the jack J', the tip contact 35, the sleeve contact 42 and the shank contact 43 of the plug registering respectively with the tip spring 44, sleeve spring 45 and the ring 46 of the jack. A circuit will be completed through the cut-off relay R³ and the relay E as follows: ground at G⁵—battery B—relay E—conductor 47, 43—46—48—R³—ground at G⁶. The cut-off relay R³ will be energized, cutting off the line signal

lamp of the line II. The relay E will be energized, disconnecting the operator's set at 28—29, 30—31 and the testing circuit at 38—39. The armature 29 will engage a contact 50, completing the tip strand of the cord. The armature 30 will engage a contact 51, completing the sleeve side of the cord, and a switch 38—52 will be closed for a purpose to be described. The circuit of relay R⁴ will now be completed over the talking strands of the cord circuit through the contacts therein controlled by the relay E, and both sides of line, interrupting the circuit of the supervisory lamp L², and retiring the same. The circuit of relay R⁵, however, will not be completed as there is an interruption in the circuit of the calling line at the subscriber's switch hook.

It will be apparent that the operator is now disconnected from the cord, and that she has no means of reëntering upon the same. The operator now operates the ringing switch M connecting ringing current to the called line. When the called subscriber responds, the circuit of the relay R⁵ is completed and the lamp L³ is retired. When the conversation is completed, the subscribers hang up their receivers, interrupting the circuits of the relays R⁴ and R⁵, whereupon the lamps L² and L³ are operated. Upon observing these lamps burning, the operator withdraws the plugs from the jacks and the system will be automatically restored to normal.

Referring now to the embodiment shown in Fig. 2, I have shown my invention in connection with a two-conductor cord circuit. The operator's set is shown at O', the answering plug at p and the calling plug at p'. The cord circuit is shown at z and here consists of two conductors 108 and 109. The plugs are provided with two contacts, shown at 120 and 121 for the plug p and 135 and 142 for the plug p'. The ringing switch is shown at m. When the plug p is inserted into a jack, the contact 121 engages with both the thimble and sleeve spring of the jack, such as are shown at 24 and 25. The cut-off relay R² would be energized over a circuit from ground at G—R²—25—121—60—61—conductor 152—relay d—battery b—to ground at g. A circuit will also be completed through the relay d through conductors 152 and 151, the plug and jack and the calling line. The energization of the relay d will cause the interruption of the shunt w when the relay attracts its armature 62, opening the switch 62—63. The attraction of the armature 64 closes a switch 64—65, and completes the test circuit which will be described.

The operator is now connected to the calling line and communicates with the calling subscriber, learning that it is the subscriber at C that is desired. The called line is tested

by applying the tip 135 to the thimble 36. If the called line is busy, there will be a battery potential upon the thimble 36 and an impulse of current will flow from 135—66—67—68—69—65—64 and the winding 70 of the operator's induction coil, causing a click in her receiver. If, however, the called line is idle, the plug p' is inserted into the jack J' , the contact 142 engaging the contacts 45 and 46. A circuit will be completed through the relay e , as follows: ground g^1 —battery b —conductor 72—relay e —conductor 73—the portion 74 of the talking strand—142—46—relay R^s —ground G^c . The relay R^s will be energized, cutting off the line signal and lamp. The relay e will be energized, attracting its armatures 80 and 81, which will make contacts at 80—83 and 81—84 before the contacts at 82—85 and 60—61 are broken. The making of the contacts at 81—84 and 80—83 completes the cord circuit, which was hitherto interrupted at these points and connects battery b into the system before the battery leads 151 and 152 were taken off. The breaking of the contacts 82—85 and 60—61 cuts the operator off from the cord and the relay e remaining energized during the conversation, it will be impossible for her to come on again until the conversation is terminated, insuring a secret communication between the subscribers. When the calling plug was inserted into the jack of the called line, a circuit was completed for the relay u through the cut-off relay of the called line, the thimble of the jack, the sleeve of the plug, the portion of the talking strand 74—the conductor 160—relay u —conductor 161—battery b —and to ground g^1 . The relay u being energized interrupts the testing circuit at 67—78 and closes a switch 90—91 in the circuit of the supervisory lamp L^s . The operation of the supervisory lamps L^s , L^p and of the supervisory relays n , r and r' will be apparent from the description hitherto made in connection with the system of Fig. 1, and need not be repeated here.

When the conversation terminates, the restoration of the receivers to the hooks will cause the operation of these supervisory signals, the plugs will be withdrawn and the system will be restored to normal.

In the modification shown in Fig. 3 the operator's set is shown at 200, which is normally connected to the answering plug 201 through normally closed contacts of a relay 202. The operator is called in the usual way through the line lamp and signal, and when she plugs in she is immediately in communication with the calling subscriber. At the same time, the relay 203 which controls the test circuit is energized, closing the test circuit at 204—205, the busy test, if any were given, would be from the tip 206—through the portion 207 of the talking strand—the

switch 208 controlled by the relay 202 and the switch 204—205. When the plug 209 is inserted into the jack of the called line, the relay 202 will be energized, closing the switches 210 and 211 before the switches 212 and 213 are broken, insuring that battery will at all times remain upon the line, preventing any unnecessary impulses of current flowing through the calling line. The opening of the switches 212 and 213 permanently disconnects the operator from the line. As will be apparent, the circuit of relay 202 includes a portion 214 of one of the talking strands. The answering supervisory lamp 216 is controlled through the relays 217 and 218, one of which is controlled through the sleeve of the answering plug and the cut-off relay, and the other over the talking strands and the calling line. The supervisory signal 215 is controlled by the relay 202, which is operated over a portion of one of the talking strands and the cut-off relay of the called line, and the relay 220, which is controlled over the calling end of the cord and the called line. In the modification shown in Fig. 3, the relay 202 serves both as an operator disconnect relay and as a supervisory relay.

While I have illustrated only these embodiments of my invention, I do not wish to be limited to these embodiments, or the details thereof, as it will be apparent, from the scope of the claims, that many departures may be made from such details and embodiments without departing from the spirit of my invention.

I claim:

1. In a telephone system, the combination of a plurality of substations and a main station, telephone lines connecting the substations and the main station, a cord circuit at the main station for connecting the telephone lines together, an operator's set at the main station and circuit connections for connecting said set to the answering end of the cord circuit, means to prevent current from flowing over said connections and through the operator's set, means for retiring said preventing means when the answering plug is inserted into the jack of a line, and means to disconnect the operator's set from the cord circuit when the calling plug is inserted into the jack of a line.

2. In a telephone system, the combination of a main station and a plurality of substations, telephone lines connecting the substations to the main station, a cord circuit at the main station for connecting telephone lines together, an operator's set at the main station, means to connect said set to a portion of the talking strands of the cord circuit, means to prevent current flowing from said cord circuit through the operator's set when the cord is disconnected from a telephone line, a relay controlling said means

operated when the answering plug is inserted into the jack of a line, and a relay for disconnecting the operator's set from the cord circuit controlled through a contact of the calling plug.

3. In a telephone system, the combination of a main station, a plurality of substations, telephone lines connecting the substations and the main station, a cord circuit at the main station, an operator's set at the main station, conductors normally connecting the operator's set to a portion of the talking strand of the cord circuit, means to prevent current from passing from the cord circuit over said conductors to the operator's set, a relay controlling said preventing means and adapted to retire the same when the answering plug is inserted into the jack of a line, a relay controlling the connection of the operator's set to the cord circuit controlled through the contacts of the calling plug and adapted when the calling plug is inserted into the jack of a line to disconnect the operator's set from the cord circuit.

4. In a telephone system, the combination of a plurality of substations and a main station, telephone lines connecting the substations and the main station, a cord circuit at the main station including normally open contacts in the talking strands, an operator's set at the main station normally connected to a portion of a plurality of said talking strands, and means controlled by the connection of the cord to a called line for closing the open contacts in the talking strands of the cord circuit, and interrupting the connection of the operator to the cord circuit.

5. In a telephone system, the combination of a main station, a plurality of substations, telephone lines connecting the substations and the main station, a cord circuit at the main station including normally open contacts in the talking strands, an operator's set normally connected to the answering end of the cord circuit, a relay controlling the connection of the operator to the cord and for operating said contacts to complete the talking strands, a circuit for said relay controlled by the calling plug and adapted when the calling plug is inserted into the jack of a called line to disconnect the operator's set from the talking strands and to complete the talking strands.

6. In a telephone system, the combination of a main station and a plurality of substations, telephone lines connecting the substations to the main station, a cord circuit at the main station normally interrupted, an operator's set at the main station, a source of talking current, means to normally connect the operator's set and the source of talking current with the answering end of the cord, a second set of connections for said source of talking current, and means made operative when a connection is completed

with the called line to interrupt the connection between the answering end of the cord and the operator's set and the first named connections between the source of current and the cord, and to complete the cord and the second set of connections to the source of talking current.

7. In a telephone system, the combination of a main station and a plurality of substations, telephone lines to connect the substations to the main station, a cord circuit at the main station, an operator's set, a source of direct current, conductors normally connecting said source of current and said operator's set with the answering end of the cord, a second set of conductors for connecting said source of current to the answering end of the cord circuit, and means to interrupt said first named set of connections between the answering end of the cord and the source of direct current, and to complete said second named set of connections.

8. In a telephone system, the combination of a main station and a plurality of substations, telephone lines connecting the substations and the main station, a cord circuit and an operator's set at the main station, switching means for connecting the cord to telephone lines, a relay normally connected to the answering end of the cord, a busy test circuit associated with the cord circuit including a portion of the operator's set and normally open contacts of said relay, and a circuit for said relay including contacts of said switching means.

9. In a telephone system, the combination of a calling telephone line and a called telephone line, a cord circuit for connecting such lines together, switching means for connecting said cord to the calling line, an operator's set normally connected to the answering end of said cord, a relay associated with said cord, a circuit for said relay, including contacts of said switching means and a busy test circuit including a portion of said operator's set and normally open contacts of said relay.

10. In a telephone system, the combination of calling and called telephone lines, a cord circuit for connecting said lines together, an operator's set and a relay associated with said cord circuit and a circuit including said relay and a part of the calling line and a busy test circuit including a portion of the operator's set and normally open contacts of said relay.

11. In a telephone system, an operator's set normally connected to a portion of the talking strands of the cord circuit and means at the main station controlled by the calling subscriber to prevent current flowing from said cord circuit through the operator's set.

12. In a telephone system, a calling telephone line including subscriber controlled contacts, a cord circuit, an operator's set and

a relay associated with the cord circuit, a circuit including said relay and parts of the calling line and said subscriber controlled contacts, and a busy test circuit including a portion of the operator's set and normally open contacts of said relay.

13. In a telephone system, the combination of a link circuit, a relay having normally open contacts in said circuit, an operator's receiver normally connected to said link circuit, a second relay having a circuit including contacts of the first named relay and a shunt of the operator's receiver controlled by said second relay.

14. In a telephone system, the combination of telephone lines, a telephone line interconnecting link circuit provided with a pair of talking strands, an operator's receiver normally connected to one of said strands, a relay having normally open contacts in said link circuit, a second relay provided with a circuit including contacts of the first

relay and a shunt of the operator's receiver including contacts of the second relay.

15. In a telephone system, the combination of telephone lines, a telephone line interconnecting link circuit, a relay having normally open contacts in said circuit, a circuit for said relay, an operator's receiver normally connected to said link circuit, a second relay having a circuit including contacts of the first named relay, a shunt of the operator's receiver including contacts of the second relay and an operator-controlled switch having contacts in the circuit of the first named relay.

In witness whereof, I have signed my name at Elyria, in the county of Lorain and State of Ohio, in the presence of two witnesses.

FRANK M. SLOUGH.

Witnesses:

JOHN S. RICHEY,
META M. SMITHBERGER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."