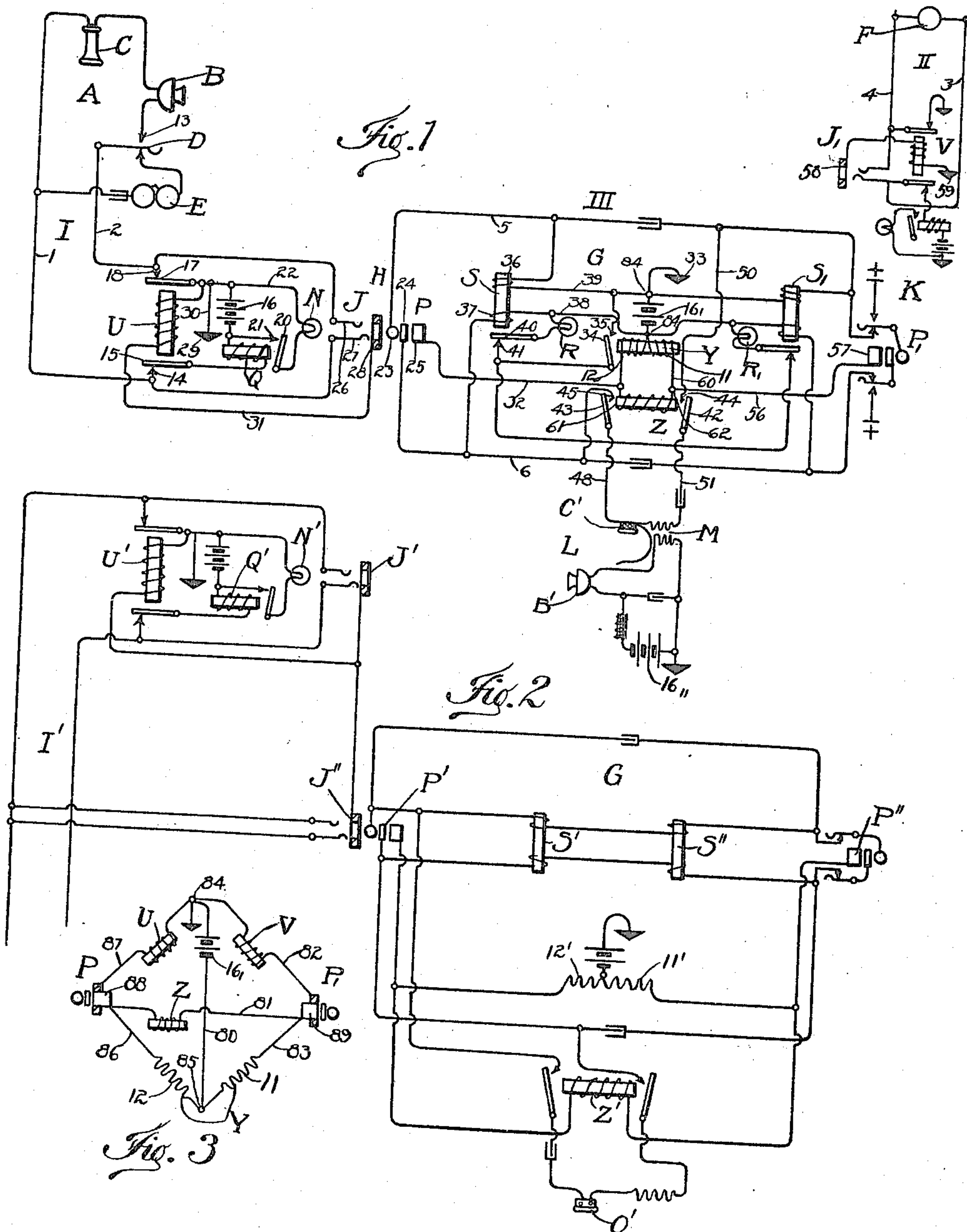


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TELEPHONE SYSTEM.
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1,222,043.

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TELEPHONE SYSTEM.

1,222,043.

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, Lorain county, 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 same, 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 more especially to systems in which secret service is provided; that is, means are provided whereby the operator is excluded during the period when the subscribers are conversing, though permitted to communicate with the calling subscriber for the purpose of learning the connection desired. I aim to accomplish this result with as little complication and with the addition to the system of as little apparatus as possible.

Other objects of my invention and the invention itself will probably be better understood from a description of specific embodiments of the invention.

Figure 1 is a diagrammatic representation of a telephone system embodying my invention.

Fig. 2 is a second diagrammatic illustration of a telephone system embodying my invention.

Fig. 3 is a theoretical diagram for the purpose of illustrating the principle of my invention.

Referring first to the embodiment illustrated in Fig. 1, at I and II are illustrated telephone lines, line I being here called the calling line and line II the called line. Substation apparatus is connected to each of the lines. At the station A upon line I this apparatus is illustrated as consisting of a transmitter B, a receiver C, a switch hook D and a signal bell E. The station at F upon line II is illustrated merely as a symbol, the apparatus thereat being substantially the same as that shown at station A. Of course, either of these lines may be a multi-party line. The main station is represented as at III.

The line I extends by limbs 1 and 2 to the main station III and the line II, by limbs 3 and 4 to the main station. Means are provided at the main station for connecting the lines together, which consists of suitable link conductors 5 and 6, in the embodiments illus-

trated shown in the form of a cord circuit G. Switching mechanism is provided for connecting the cord circuit to the telephone lines—an answering switching mechanism H and a calling switching mechanism K. In the form shown, the switching mechanism H is shown as consisting of a plug P connected to the strands of the cord circuit and a jack J connected to the telephone line I. The calling switching mechanism is shown as consisting of a plug P₁ connected to the cord G and a jack J₁ connected to the line II. An operator's set is provided at the main station illustrated at L and including a transmitter B', a receiver C' and an induction coil M and other apparatus constituting the essentials of such a set. The substation set, the switching means and the operator's set are all apparatus well known in the art, and the sub-combinations constituting the same are no part of my invention.

Line I is provided with a line signal N, a line relay Q and a cut-off relay U. The line II is provided with similar apparatus, the cut-off relay being shown at V. The cord circuit is provided with supervisory lamps R, R₁ and supervisory relays S and S₁. The cord circuit is provided also with a supervisory signaling and controlling relay Y, sometimes known as the supervisory relay. This relay is provided with two coils 11 and 12. A relay Z is also provided, which controls the connection of the operator's set to the cord circuit.

The apparatus itself and the purposes will be clear from the following description of the operation of the system.

Assuming the subscriber at A desires to communicate with the subscriber at F, the receiver C is removed from the hook D in the well known manner, and the hook D being spring pressed upward, rises and engages the contact 13, completing a circuit through the relay Q, as follows: 13—transmitter B—receiver C—conductor 1—switch 14—15—relay Q—battery 16—switch 17—18—conductor 2—hook switch D. The relay Q will be energized, attracting its armature 20 and closing a switch 20—21 in the circuit of the lamp N, which includes the battery 16 and the conductor 22. The lamp N will receive current and be lighted. This lamp being in a position where its illumination attracts the attention of the operator, the operator will insert the plug P into the

jack J, the tip contact 23, the ring contact 24 and the sleeve contact 25 engaging respectively with the tip spring 26, sleeve spring 27 and thimble 28 of the jack.

5 The engagement of the contact 25 with the contact 28 completes a circuit through the relays U, Z and Y, as follows: ground at 29—conductor 30—relay U—conductor 31—contact 28—contact 25—conductor 32, the

10 relay Z and the windings 11 and 12 of the relay Y in multiple, battery 16' to ground at 33. The relay U will be energized, attracting its armatures 15 and 17 and severing the line signal and lamp from the line. The re-

15 lay Y will be energized, attracting its armature 34 and closing a switch 34—35 in the circuit of the lamp R. The lamp R would also be energized, except that when the plug is inserted, the relay S will also be energized,

20 over a circuit as follows: winding 36 of S—5—both sides of line and the substation set—6—winding 37 of S—conductor 38—battery 16₁—conductor 39. The relay S will attract its armature 40 and open the

25 switch 40—41, so that the lamp R will not be energized. The completing of the circuit through the relays U, Z and Y also causes the energization of the relay Z, as stated. This relay will attract its armatures 42 and

30 43, closing the switches 42—44, 43—45 and connecting the operator's set to the talking strands 5 and 6 of the cord circuit. The operator will then communicate with the subscriber at A over the following circuit:

35 C'—48—43—45—6—24—27—1—C—B—13—D—2—26—23—5—50—44—42—51—back to C'. Having learned that it is the subscriber at F that is desired, and assuming that line II is idle,

40 the plug P₁ is inserted into the jack J₁, the tip, ring and sleeve contacts of the plug engaging with the tip spring, sleeve spring and thimble of the jack J₁. A circuit will be completed as follows: 33—bat-

45 tery 16₁, coil 11 of relay Y in multiple with coil 12 of relay Y and relay Z—conductor 60—conductor 56—contact 57—58—V—to ground 59. The relay V will be energized, cutting off the line signal lamp of the line II

50 in the manner described in connection with line I, and the relay Z will be deenergized, owing to the fact that the completion of the circuit through the relay V placed the points 61 and 62 at the same potential.

55 The operation of this portion of apparatus will probably be better understood from a reference to Fig. 3, where I have illustrated the apparatus in the form of a Wheatstone bridge with the relay Z in the bridge. If the branch including the coil of the relay

60 Y is open, current will flow in two paths, as follows: (first path), 16', conductor 80—winding 12 and winding of relay U back to 16'; (second path), 16'—80—winding 11 of relay Y—81—Z—winding of U—back to

65 16', the relay Z receiving current. If, however, the limb 82, including the winding of relay V is closed, the bridge will be balanced and current will flow in two paths as follows: 16'—80—11—83—82—V back to the point 84. The second path will be 16,—80—12—86—87—U—back to the point 84. The resistances of the devices U, V, 11 and 12 are so proportioned that the potentials at the points 88 and 89 are the same, so that no current will flow through the bridge 81. Consequently, the relay Z will be deenergized, releasing its armatures 42 and 43 and automatically disconnecting the operator's set from the cord circuit. After the

70 called subscriber is signaled by the ringing of his bell, and after he replies, the conversation takes place over the conductors 1, 2, 5, 6, 3 and 4, the operator being disconnected during this period. When the conversation

75 is terminated, the restoration of the receivers to the hooks causes the deenergization of the relays S and S₁, whereupon the circuits of the lamps R and R₁ are closed, indicating to the operator that the conversa-

80 tion is completed, whereupon she withdraws the plugs from the jacks and the system is restored to normal.

In the modification shown in Fig. 2, instead of using inductive resistances, or wind-

85 ings of a relay, as for example at Y in Fig. 1 I have employed special non-inductive resistances 11' and 12'. The operation of this system would be the same as that described in connection with the modification shown

90 in Fig. 1. The operator's set is illustrated at O', the relay controlling the same at Z', the calling line at I', the cut-off relay at U', line lamp at N', line relay at Q', multiple jacks of the calling line at J' and J'', an-

95 swering plug at P', calling plug at P'' and the supervisory relays at S' and S''.

It will, of course, be understood that any suitable resistance devices may be employed, though it will be seen that in the modifica-

100 tion shown in Fig. 1 I have utilized the resistance of the sleeve supervisory relays for the purpose of accomplishing the desired functions, and have in fact provided a cord circuit with secret listening service with

105 only four relays, the number ordinarily employed in an ordinary cord circuit which does not furnish secret listening service.

I have illustrated these forms and these details for the purpose of clearly illustrat-

110 ing the invention, and not that I desire to be limited to the same. I contemplate many modifications and departures from these forms and details without departing from the spirit of the invention.

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I claim:

1. In a telephone system, the combination of a main station, a plurality of substations, telephone lines connecting the main station and the substations, link conductors at the

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main station for connecting the telephone lines together, supervisory apparatus associated with said link conductors, an operator's set at the main station, means for controlling the connection of the operator's set to the link conductors including a relay provided with a winding, means including a portion of said supervisory apparatus to create at the terminals of said relay winding different electrical potentials when the link conductors are connected to one line, and means to create at the terminals of said relay winding the same electrical potential when the link conductors are connected to a plurality of telephone lines.

2. 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 at the main station adapted to be connected to one or more lines, supervisory apparatus associated with said cord, an operator's set at the main station, means for connecting the operator's set to the talking strands of the cord circuit, a relay controlling the connection of the operator's set to the cord circuit, means for energizing said relay when the cord circuit is connected to one telephone line and means including a portion of said supervisory apparatus for shunting the flow of electrical current from said relay when the cord circuit is connected to a plurality of telephone lines.

3. 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 at the main station adapted to be connected at each end to a telephone line, supervisory apparatus associated with said cord circuit, an operator's set at the main station, means to connect the operator's set to the cord circuit, a relay controlling the connection of the operator's set to the cord circuit, means for completing a circuit through said relay and a portion of said supervisory apparatus when one end of the cord circuit is connected to a telephone line and means for creating a shunt about said relay when each end of the cord circuit is connected to a telephone line.

4. In a telephone system, the combination of a telephone line and a cord circuit, switching means for connecting the telephone lines to the cord circuit, supervisory apparatus including a pair of supervisory relay windings, an operator's set, means to connect the operator's set to the cord circuit, a relay controlling said means, a pair of circuits having a source of current in common, each of said circuits including one of said supervisory relay windings leading through one of the switching means for connecting the cord to a telephone line and a bridge of said circuits including said relay.

5. In a telephone system, the combination of telephone lines and a cord circuit, switching means for connecting each end of the cord to a telephone line, a pair of supervisory relay windings associated with said cord circuit, an operator's set, means to connect the operator's set to a telephone line, a relay controlling said means, a pair of circuits, each of which includes a supervisory relay winding and contacts of one of said switching means, and a bridge of said circuits including said relay.

6. In a telephone system, the combination of telephone lines, link conductors for connecting said lines together, switching means for connecting the link conductors to two telephone lines, an operator's set and means to connect the operator's set to the link conductors, supervisory means including resistance devices, a pair of electric circuits each of which includes one of said resistance devices and contacts of the switching means for connecting the link conductors to telephone lines, a bridge of said circuits and a relay in said bridge controlling the means for connecting the operator's set to the link conductors.

7. In a telephone system, the combination of telephone lines, and link conductors for connecting said telephone lines together, cut-off mechanism for each of said lines including a resistance device, an operator's set and means for connecting the operator's set to the link conductors, a pair of circuits, each of which includes one of said resistance devices of the line cut-off mechanism and contacts of one of said switching means, a bridge of said conductor and a relay in said bridge controlling the means for connecting the operator's set to the link conductors.

8. In a telephone system, the combination of telephone lines and link conductors for connecting the telephone lines together, switching means for connecting the link conductors to telephone lines, an operator's set, means for connecting the operator's set to said link conductors, cut-off mechanism for each telephone line including a resistance device, additional resistance devices in said system, a pair of circuits each of which includes one of said cut-off resistance devices and one of said other resistance devices and contacts of one of said switching means, a bridge of said circuits connected to each bridge between the resistance devices therein, and a relay in said bridge controlling the means for connecting the operator's set to the link conductors.

9. In a telephone system, the combination of telephone lines and link conductors for connecting the telephone lines together, switching means for connecting the link conductors to each telephone line, an operator's set and means for connecting the operator's

set to the link conductors, supervisory mechanism associated with the link conductors including resistance devices, cut-off mechanism associated with each telephone line, including a cut-off resistance device, two circuits each of which includes a cut-off resistance device, a supervisory resistance device and contacts of one of said switching means and a bridge of said circuits between the resistance devices included therein, and a relay in said bridge controlling the means for connecting the operator's set to the link conductors.

10. In a telephone system, the combination of telephone lines and link conductors for connecting the same together; a line circuit associated with each telephone line, switching means for connecting the link conductors to telephone lines, a resistance in each line circuit, an operator's set and means to connect the operator's set to the link conductors, a pair of circuits each of which includes one of said resistances in a line circuit and contacts of one of said switching means and a relay in bridge of said conductors controlling the means for connecting the operator's set to the link conductors.

11. In a telephone system, the combination of telephone lines and link conductors for connecting the telephone lines together, switching means for connecting the link conductors to the telephone lines, an operator's set and means for connecting the operator's set to the link conductors, a cut-off relay in each line circuit, a pair of supervisory windings and a pair of circuits each of which includes one of said supervisory windings, the

winding of a cut-off relay and contacts of one of said switching means, a bridge of said circuits connected thereto between the supervisory winding and the cut-off relay and a relay in said bridge controlling the means for connecting the operator's set to the link conductors.

12. In a telephone system, the combination of telephone lines and a cord circuit, supervisory apparatus associated with said cord circuit, an operator's set and means controlling the connection of the operator's set to the cord circuit including a relay, a Wheatstone bridge circuit including supervisory apparatus, portions of the cord and line circuits, and a relay in the neutral conductor of said bridge controlling the connection of the operator's set to the cord circuit.

13. In a telephone system, the combination of telephone lines, means to connect the telephone lines together, supervisory apparatus associated with said cord circuit, an operator's set, means controlling the connection of the operator's set to said first named means including a relay, a Wheatstone bridge circuit associated with said lines and said first named means, said bridge including supervisory apparatus and a neutral conductor in which the winding of said relay is connected.

In witness whereof, I have signed my name in the presence of two witnesses this 8th day of August, 1914.

FRANK M. SLOUGH.

Witnesses:

GEO. E. ROBERTS,
JOHN PEHRSSON.

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