

A. D. T. LIBBY.
TELEPHONE SYSTEM.

APPLICATION FILED NOV. 8, 1909.

Patented May 31, 1910.

959,765.

2 SHEETS—SHEET 1.

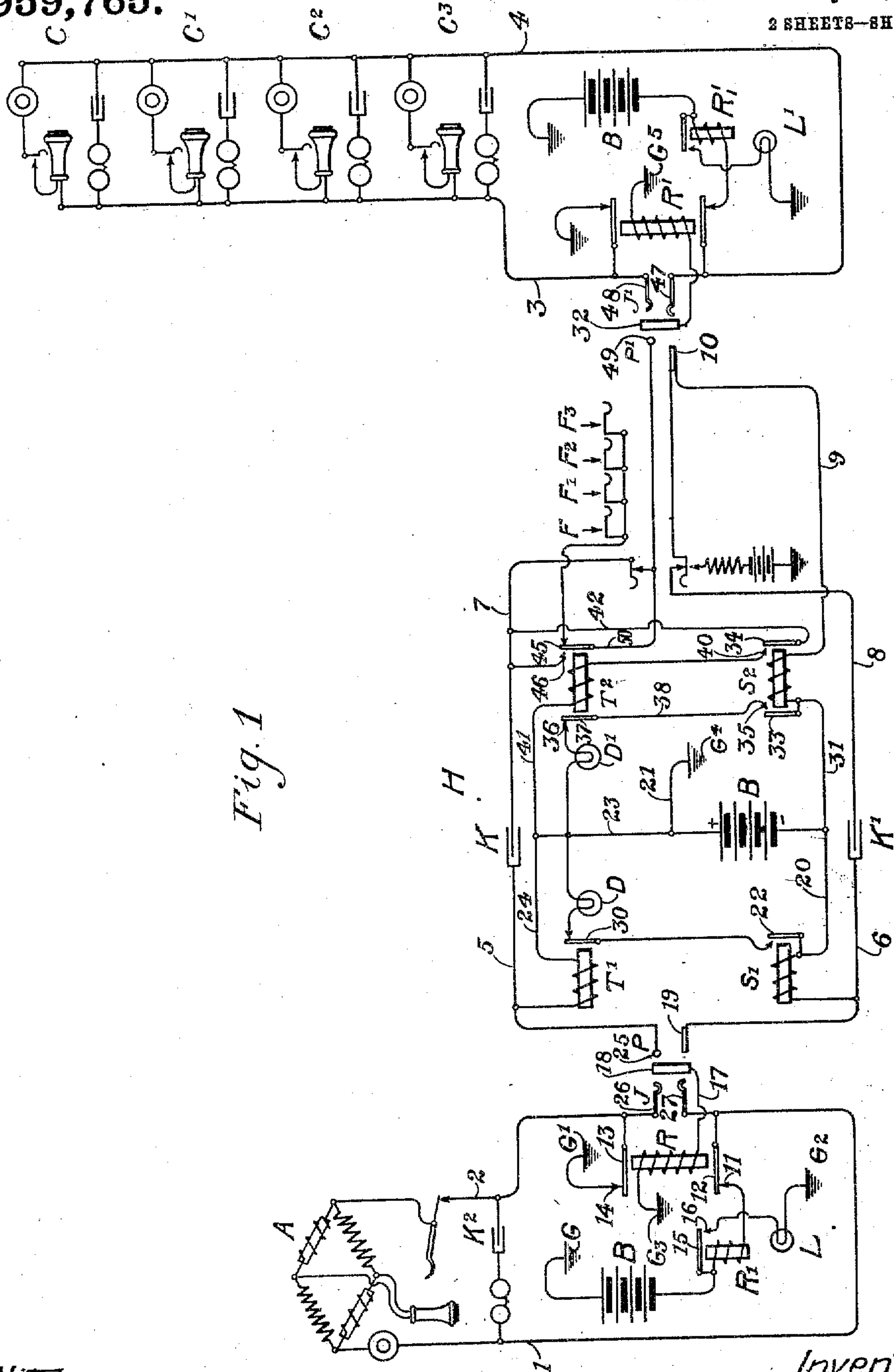


Fig. 1

Witnesses

John J. Mayes.
C. A. Severcool

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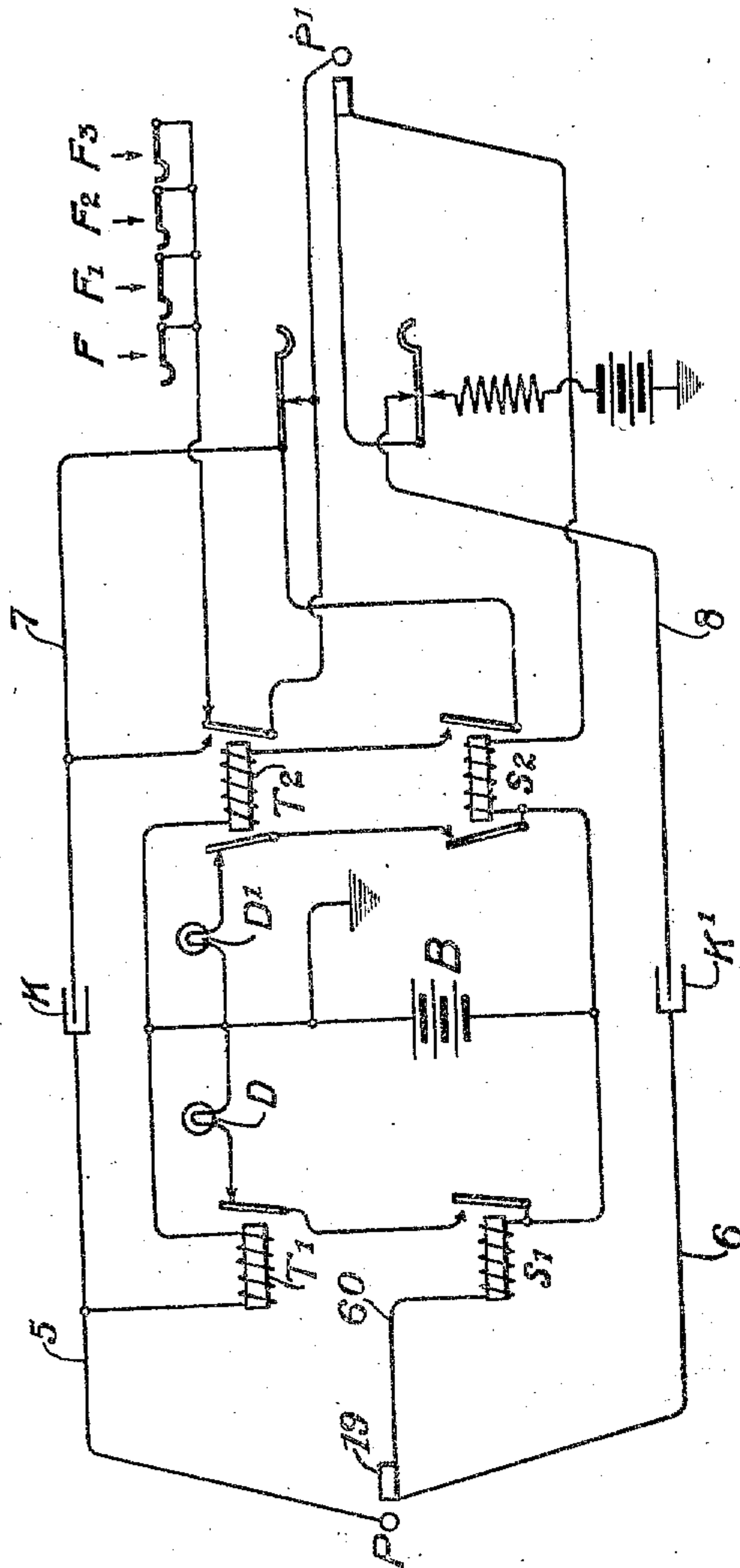
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2 SHEETS—SHEET 2.

Fig. 2



Witnesses

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UNITED STATES PATENT OFFICE.

ALBION D. T. LIBBY, OF ELYRIA, OHIO, ASSIGNOR TO THE DEAN ELECTRIC COMPANY,
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TELEPHONE SYSTEM.

959,765.

Specification of Letters Patent.

Patented May 31, 1910.

Original application filed May 28, 1909, Serial No. 498,911. Divided and this application filed November 8, 1909. Serial No. 526,814.

To all whom it may concern:

Be it known that I, ALBION D. T. LIBBY, 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 make and use the same.

This application is a division of my application, Serial No. 498,911, filed May 28, 1909.

My invention relates to telephone systems, and more particularly to that class of telephone systems in which a plurality of telephone lines lead to a central station where they may be connected together for conversational purposes by means of cord or other arrangements. Central station circuits of the general character which mine represents, heretofore in use, have been divided into two general classes known as three and two-conductor cords. The former consists of two strands, one of which is common to the talking and supervisory signal arrangements, and utilizes a two-conductor plug, thereby realizing the advantages of simplicity and cheapness in manufacture, a greater certainty in operation, and longer life. Against these merits there exists in this former circuit the faults of a common conductor for the talking and signaling currents, both of which necessarily operate over the same strand. The other form of cord circuit, namely, the three-conductor cord, provides a different circuit for these two classes of current, thus liberating the talking circuit from the objectionable burden of transmitting the supervisory currents. On the other hand, the three-conductor plugs, which have been invariably used and inalienably associated with these circuits, require more trouble and expense in their production, are less efficient, require more care in operating, and are shorter lived than the two-conductor plug.

By my invention I propose to produce a central station circuit adapted to connect the subscribers' lines together in which I combine the use and advantages of a two-conductor plug with a three-conductor cord, thus being enabled to realize the cheapness and simplicity of the former and superior

service of the latter. I remove the burden of transmitting the supervisory signaling currents from the talking strands, having, in fact, produced a cord circuit in which the signaling is performed over conductors independent of the talking circuit. To do this, I produce a system in which I may connect two cord strands to the sleeve of the plug, making the said sleeve large enough to engage both the sleeve spring and the ring of the jack when the plug is inserted therein. The talking current passes through the sleeve of the jack to the forward part of the plug without passing to the third strand from which it is excluded by the reactance of the supervisory relay and through reacting means which may be provided without departing from the spirit of my invention. On the other hand, the continuous current which controls the signals being excluded from the talking circuit by the cord condenser, traverses the ring of the jack and the rear of the plug sleeve and passes on to the battery. Thus, it will be seen that I produce a cord circuit using the two-conductor plug in which the talking circuit is independent of and distinct from the circuit of the supervisory apparatus.

In this preliminary description I have endeavored to explain the main purpose of my invention, and in so doing have described a particular form of apparatus and a particular mode of operation. This has been done to elucidate the purpose, the means and a method of realizing such purpose, and not with the intention of limiting my invention or my objects thereto. On the contrary, I intend to realize any and all the benefits of any modifications and methods which are included within the scope of my claims, as well as the functions of such modifications or methods.

My invention will be better understood by reference to the following description when taken in connection with the accompanying illustrations showing specific embodiments thereof, while its scope will be more particularly pointed out in the appended claims.

Figure 1 shows a cord circuit constructed in accordance with my invention. Fig. 2 shows a modification of Fig. 1.

At A I show a substation upon a line 1—2 which extends to the jack J at the central station H. At C, C¹, C², and C³, I show a

plurality of stations upon line 3—4 which extends therefrom to a jack J' at the same central station H. The line relay of the line 1—2 is shown at R¹, the line lamp at L and the cut-off relay at R. The corresponding parts of the line 3—4 are shown at R², L' and R'. Between these stations is shown a cord circuit terminating in the answering plug P and the calling plug P'. The answering tip supervisory relay is shown at T¹. The answering sleeve supervisory relay at S¹. The answering supervisory signal at D. The calling tip supervisory relay at T² and the corresponding sleeve relay at S². The answering supervisory signal at D'. The cord strands are divided into sections by condensers K and K'. The condenser K divides the tip strands into the sections 5 and 7. The condenser K' divides the sleeve strand into the sections 6 and 8. At F, F¹, F², F³ I show empirically contacts which lead to the sources of signaling current. The plug P and the answering end of the cord do not differ from that of the common two-conductor cord. The calling end, however, is shown, according to my invention, and the third strand 9 leading to the sleeve 10 which is common to said third strand and to the sleeve talking strand 8.

The particular description of my invention can be best described by the operation which is as follows: Assuming that the subscriber at A desires to communicate with the subscriber C on the line 3—4, subscriber A removes his receiver from the hook which closes the substation circuit in bridge of the line, permitting the flow of direct current which, previous to this operation, was prevented by the condenser K². A circuit is thus completed through the line relay R¹ as follows: ground at G—battery B—R¹—11—1—station A—the contacts of the switch hook thereat—2—13—14—ground at G'. The relay R¹ is energized pulling up its armature 15, closing a circuit through the line lamp L—through ground G—battery B—15—16—L—G². This vitalizes the lamp L, attracting the attention of the central station operator who inserts the plug P into the line jack J, completing a circuit through the cut-off relay R as follows: ground at G³—R—17—ring 18—sleeve 19—6—S¹—20—battery B—21—ground at G⁴. This energizes relay R which pulls up its armatures 12 and 13 cutting off the line from the ground and the line relay, causing the extinction of the lamp L. The supervisory relay S¹ is also energized by current flowing over this circuit, pulling up its armature 22 which would complete the circuit of the supervisory lamp D were not a second circuit simultaneously completed through the tip relay T¹. This circuit is as follows: positive pole of battery B—23—24—T¹—5—tip 25—tip spring 26—2—substation circuit A—1—

27—19—6—S¹—20—to the negative pole of battery B. The tip relay T¹ being thus energized, pulls up its armature 30 interrupting the circuit of the signal D and preventing its operation. The central station operator now connects her listening set (not shown) into the cord circuit ascertaining the desired connection. Being informed that the substation C is desired, she next tests the line, and, finding it not busy—which assumption is made in this operation—she inserts the plug P' into the jack J'. A circuit is immediately completed through the relays R¹ and S² as follows: from ground at G⁴—21—battery B—31—S²—9—10—ring 32—R'—to ground at G⁵. This energizes relay R¹ cutting off the line signaling apparatus of the line 3—4. The relay S² is energized pulling up its armatures 33 and 34. The armature 33 completes a circuit through the lamp D' as follows: positive pole of battery B—23—D'—36—37—38—35—33—31—negative pole of battery B. This vitalizes the lamp D'. The armature 34 closes the switch 34—40, placing the battery B in bridge of the calling end of the cord as follows: from 10—9—S²—31—B—23—41—T²—40—34—42—to the tip side 7. The operator now places ringing current on the line, selecting the station C, who, upon answering, removes his receiver from the hook closing a substation bridge thereat. The tip relay T² is immediately energized over the bridge just described, the tip side of the cord circuit and the line of the now closed substation circuit. The armature 37 is attracted interrupting the circuit of the signal D'. The armature 45 is attracted, closing the switch 45—46 and completing the cord circuit there-through. The parties now converse through the following circuit: from the substation A—1—27—19—6—K'—8—10—47—4—C—3—48—49—50—45—46—K—5—25—26—2—back to substation A. It will thus be seen that the talking circuit of the calling end of the cord is independent of and distinct from the circuit of the sleeve supervisory and cut-off relay. Upon the termination of the conversation the subscribers return their receivers to the hooks which action interrupts the previously described circuits of the tip relays T¹ and T² which are deenergized, permitting their armatures to fall back and close the circuits of the supervisory lamps which are operated to indicate the desire for disconnection. The operator then pulls out the plugs, restoring the system to normal.

In Fig. 2 I show a modification conforming in every particular to the circuit shown in Fig. 1, except that both plugs are constructed in accordance with my invention, the sleeve 19 of the plug P serving both for the talking strand and an additional strand 60 which leads to the supervisory relay S¹

independently of the talking strand. The operation is the same as that described, except that the cut-off relay R and the relay S' are operated over the third strand 60 instead of over the talking strand 6 described in the operation *supra*. The talking now takes place through the cord strand independently of the supervisory relays.

While I have shown these embodiments of my invention, which are the preferred arrangements, it will be obvious to those skilled in the art to which this invention appertains, that numerous and extensive departures from the form and details of the circuits here shown may be made without departing from the spirit of this invention, the same being herein shown solely for the purpose of clearly illustrating my preferred arrangements.

I claim:

1. In a telephone system, a plurality of telephone lines leading from substations to a central exchange, a three-strand cord at said central exchange for connecting two of said lines for conversation, switching means by which said central circuit is connected to said lines, two of said strands connected directly to a common contact of said switching means to complete two independent circuits in said cord.

2. In a telephone system the combination of a plurality of subscribers' lines extending from sub-stations to an exchange, a three conductor link at the exchange for connecting said lines together, said lines terminating in spring jacks, a two conductor plug for said link, two of said strands being connected directly to the same contact of said plug, a cut-off relay, a source of current in said link, a circuit for said relay completed when said plug is inserted into a jack of a line, a talking circuit completed when two of said lines are linked together, said talking circuit and said cut-off relay circuit having but one common point, said source supplying current to said talking circuit through a part of said cut-off relay circuit to said common point.

3. In a telephone system, the combination of a plurality of telephone lines, sub-stations on said lines, an exchange to which said lines lead, spring jacks in which said lines terminate, a three conductor link at said exchange for connecting said lines together, a two contact plug connected to said link to be inserted in one of said jacks, a source of current at the exchange, a supervisory relay, a conductor leading from said source

through said supervisory relay to one of the contacts of said plug, a talking strand connected to said same contact, said source supplying current to said talking strand through said contact, said supervisory relay conductor being independent of said talking strand, except for said common contact.

4. In a telephone system, the combination of a plurality of telephone lines, sub-stations on said lines, an exchange to which said lines lead, spring jacks in which said lines terminate, a three conductor link at said exchange for connecting said lines together, a two contact plug connected to said link to be inserted in one of said jacks, a supervisory signal in said link, means for controlling said signal associated with said link, a circuit for said means connected to one of the contacts of said plug, a talking circuit through said plug, the talking circuit being free from the current through the circuit of said supervisory signal controlling means.

5. In a telephone system, the combination of a plurality of telephone lines, sub-stations on said lines, an exchange to which said lines lead, spring jacks, in which said lines terminate, a three conductor link at said exchange for connecting said lines together, a two contact plug connected to said link to be inserted in one of said jacks, a supervisory relay, a circuit therefor leading through a contact of said plug, a talking circuit through said contact, said talking circuit being free from the current through said relay circuit.

6. In a telephone system the combination of a plurality of telephone lines, sub-stations on said lines, an exchange to which said lines lead, a link at said exchange for connecting said lines together, a source of current, switching means for connecting a line to said link, a pair of talking strands in said link, a third strand leading to said source, a switch contact to which said third strand and one of said talking strands is connected, two line contacts with which said first named contact engages when said link and line are united and a separate circuit through said third conductor, said talking circuit being free from current through said separate circuit.

In testimony whereof I affix my signature in presence of two witnesses.

ALBION D. T. LIBBY.

Witnesses:

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C. A. SEVERCOOL.