

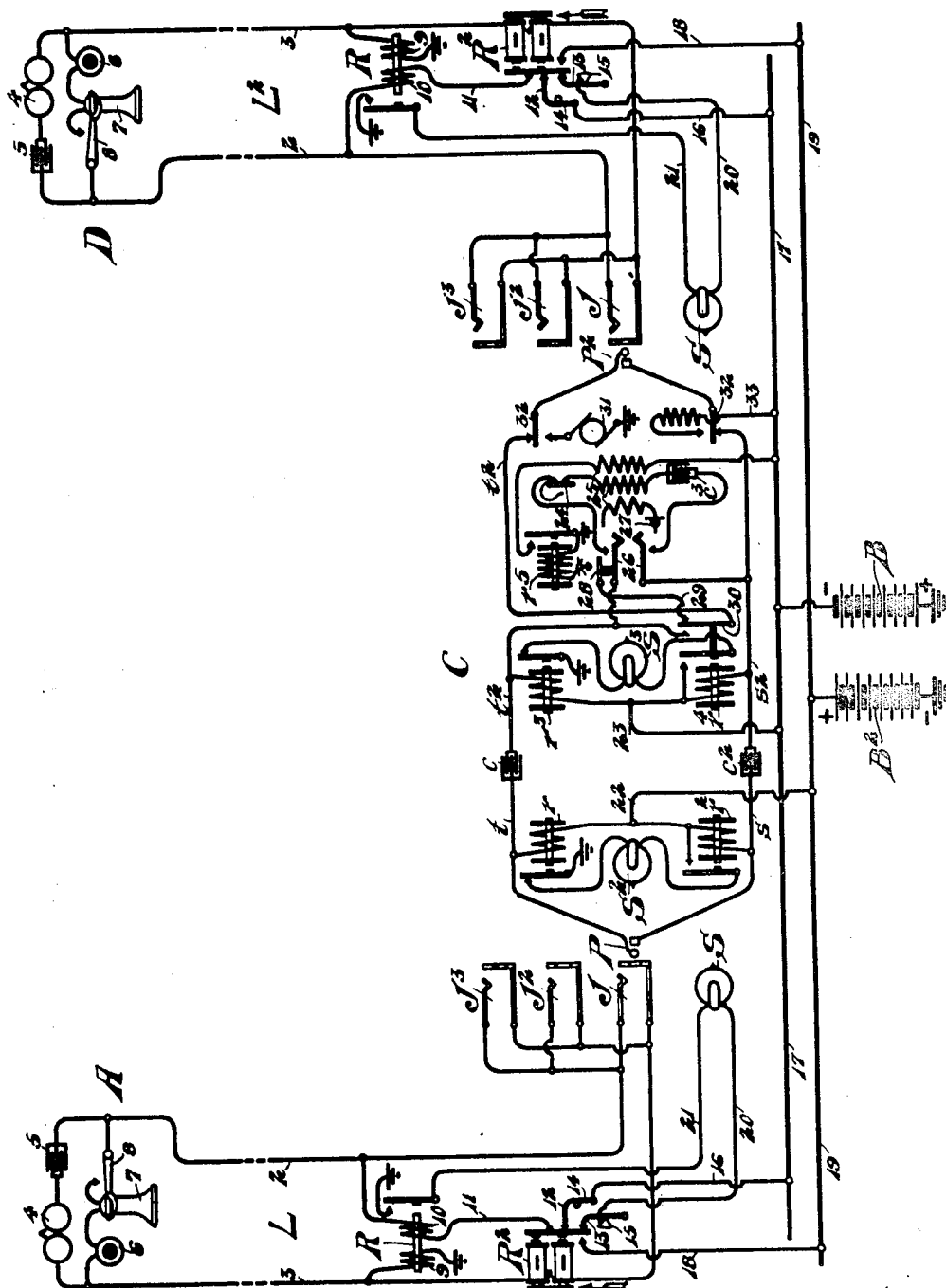
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W. W. DEAN.

TELEPHONE SYSTEM.

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Witnesses.

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[Signature]

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UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

No. 877,058.

Specification of Letters Patent.

Patented Jan. 21, 1908.

Application filed November 11, 1903. Serial No. 180,687.

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States of America, and resident of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems and particularly to systems of a common battery type in which two sources of current are supplied at the central office, said sources being employed for each conversation.

One object of the invention is to provide means in connection with such systems whereby when connection is established with a calling subscriber's line the potential upon the line is not greatly varied so that practically no noise is caused in the waiting subscriber's receiver, and other objects are to provide a simplified circuit arrangement and apparatus which is convenient and inexpensive.

My invention is illustrated in the accompanying drawing in which the figure is a diagram of a telephone system embodying my improvements and in which L and L' indicate subscribers' lines extending in two limbs 2 and 3 from their respective substations A and D to the central office C where they are fitted with the usual line signals S, answering jacks and multiple jacks such as J² and J³ in any number, according to the size of the switchboard. The substation outfit is diagrammatically represented by the ordinary signaling bell 4 and condenser 5 in a permanent bridge of the line conductors, and a transmitter 6 and receiver 7 in a second bridge, whose normal discontinuity is maintained by the switch hook 8. Any other substation device adapted for common battery actuation may be employed. At the central office the line relay R is provided with a pair of windings 9 and 10, the former legged to ground from the sleeve line conductor 3 and the latter included in a conductor 11 extending from the tip line conductor to the armature of a polarized cut-off relay R², whose winding is included in said sleeve line conductor 3 between the line relay and the jacks. The normal contacts of the said cut-off relay consists of the springs 12 and 13 normally resting against suitable stops 14 and 15, the latter being employed as a normal contact for its spring 13. The spring 14

is connected by conductor 16 with the common battery lead 17 connected with the live pole of the central common battery B, while the forward contact of the said cut-off relay is joined by conductor 18 with the battery lead 19 connected with the live pole of the second common battery B². The said contact 15 of said spring 13 is connected by a conductor 20 with one side of the line signal S, while the other side of the signal S is connected by a wire 21 with the spring of the line relay R, the forward contact of which is grounded. The armature of said cut-off relay is shown in its normal position, but the relay is so polarized that when current flows through it in one direction, the armature will be tipped to one side, and when current flows through it in the other direction said armature will be tipped in the opposite direction. With the arrangement and connections as shown in the diagram, said relay is polarized to respond to negative current flowing therethrough in the direction of the arrow so as to move its armature away from the springs 12 and 13 and bring it into engagement with the contact of conductor 18; when current flows through it in the opposite direction the armature is moved in the opposite direction to lift said springs 12 and 13 and separate spring 13 from its normal contact 15.

The operators are provided with a plurality of cord circuits, each having an answering plug P and a calling plug P² provided with tip and sleeve contacts adapted to register with the corresponding contacts of the jacks, the tip contacts of said plugs being connected by the flexible strands t and t' and the interposed condenser c, while the sleeve contacts are joined by similar strands s and s' and the interposed condenser c'. A pair of supervisory relays r and r' are bridged across the answering end of the cord circuit and together control the local circuit of the supervisory signal S² associated with the answering plug, the former relay serving when energized to open said circuit and the latter to close the same. An intermediate point of the bridge of these relays is joined by a conductor 22 with the battery lead 19. A similar pair of relays r² and r'² are bridged across the calling end of the cord circuit and control in like manner the local circuit of the supervisory signal S² associated with the calling plug, the intermediate point of said

supervisory bridge being joined by a suitable conductor 23 with the live pole of the said battery B. The operator's head telephone 24, the secondary of her induction coil 25, and a suitable condenser c^a are adapted to be bridged across the calling end of the cord circuit by the operation of any suitable listening key, such as 26, her transmitter 27 and the primary of her induction coil being charged from any suitable source of current and which may be either the battery B or B^2 . A suitable high resistance and high impedance test relay r^2 is adapted to be connected by the spring 28 of the listening key and through conductor 29 with the forward portion of the strand t^2 of the cord circuit by means of the extra spring 30 upon the supervisory relay r^4 , said spring serving when the said relay is energized to complete the strand t^2 for conversation. The ringing generator 31 is adapted to be connected with the tip side of the cord circuit when the ringing key 32 is operated, the sleeve side of the cord circuit being simultaneously connected with battery lead 17 by the conductor 33.

In the operation of my invention the subscriber A taking up his receiver completes a path for current from the battery B, over conductors 17 and 16, spring 12, the armature of cut-off relay R^2 , conductor 11, winding 10 of line relay R, line conductor 2, through the substation devices and back to the central office over line conductor 3 and through the winding 9 of the line relay R to ground. The current in this path actuates the line relay R to close the local circuit of the line signal S, said circuit being traced from the battery lead 17 over conductor 16, spring 14 of cut-off relay R^2 , armature of said relay, spring 13, contact 15 and conductor 20 of one terminal of the lamp, and thence over conductor 21 to the spring and forward contact of the line relay R to ground. Upon observing this signal the operator inserts the answering plug P of her cord circuit, thereby completing a path for current from the battery B^2 , over conductors 19 and 22, through the sleeve supervisory relay, sleeve strand s of the cord circuit and over conductor 3, through the polarized cut-off relay R^2 and the winding 9 of the line relay to ground. The current in this path is of such direction that the springs 12 and 13 of the same are lifted from the stop 14 and contact 15, thereby opening at the latter contact the local circuit of the line signal S and retiring the same. The connection with the battery B, however, is maintained between the spring 12 and the armature of the cut-off relay, so that during the connection such battery continues to furnish current over the telephone line. The actuation of the sleeve supervisory relay r^2 closes the circuit of the supervisory signal S^2 but the simultaneous operation of the supervisory relay r over the tip

side of the telephone line opens said circuit and prevents the signal glowing. Upon learning the order of the calling subscriber the line is tested in the usual manner by touching the tip of the calling plug to one of the test rings of the jacks of said line. Said test rings are normally grounded through the winding 9 of the line relay R and since the operator's key is now actuated and the supervisory relay r^4 is not yet actuated the tip of the calling plug P^2 is likewise grounded so that no flow of current takes place and the operator knows that the line is idle. In case the line is engaged, the sleeve rings are connected through the sleeve strand of the inserted plug with the live pole of either the battery B or B^2 and the application of the grounded tip of the plug thereto results in a flow of current through the test relay r^2 which closes the local circuit through the operator's induction coil and causes a click in her receiver, thus notifying her that the line is busy.

Assuming that the line is idle, the calling plug P^2 is inserted and the ringing key 32 depressed. The insertion of the calling plug in the first place closes a path for current from the negative pole of the battery B over conductors 17 and 23, through the sleeve supervisory relay r^4 , sleeve strand s^2 of the cord circuit and the sleeve conductor 3 of the telephone line and thence through the winding 9 of the cut-off relay to ground. This current, it will be observed, is of the proper direction to tip the armature of said cut-off relay in the opposite direction from that of the line L, thereby opening at spring 13 the local circuit of the line signal S and disconnecting at spring 12 the battery B, and connecting said armature through conductors 18 and 19 with the battery B^2 . The operation of the ringing key serves to connect the generator 31 in the metallic line and to connect the sleeve side of the line around a supervisory relay r^4 by means of conductor 33 with said battery lead 17. Thus the said cut-off relay is now maintained actuated in the same direction during ringing. After the subscriber has been called but before his response the supervisory relay r^4 is actuated to close the local circuit of the supervisory signal S^2 , thereby lighting the same, as well as to disconnect the conductor 29 leading to the test relay and completing the strand t^2 of the cord circuit for conversation. Upon the subscriber's response, the tip supervisory relay r^2 receives current in the manner described for the similar relay r and serves to open the local circuit of the supervisory signal S^2 to retire the same, thus indicating to the operator that the subscribers are connected for conversation. During conversation the battery B is furnishing current to the line L and the battery B^2 is furnishing current to the line L². The lines are thus independently supplied by

current from the two batteries, and the calling subscriber, whose line remains connected with the battery B during the process of making the connection, remains undisturbed by changes of potential on the line.

Having thus described my invention, what I claim is:

1. In a telephone system, the combination with a plurality of telephone lines, of a pair of sources of current at the central office with one of which said lines are normally connected, a cut-off relay for each line, means for operating said relay in one direction when a connection is established with a calling telephone line to thereby render the line signal inoperative, the connection with said source of current remaining undisturbed at this time, and further means for operating said relay in the reverse direction when a connection is established with a called telephone line to render the line signal inoperative and to disconnect said source of current, substantially as described.

2. In a telephone system, the combination with a plurality of telephone lines, of a pair of sources of current at the central office with one of which said lines are normally connected, a cut-off relay for each line, means for operating said relay in one direction when a connection is established with a calling telephone line to thereby render the line signal inoperative, the connection with said source of current remaining undisturbed at this time, and further means for operating said relay in the reverse direction when a connection is established with a called telephone line to render the said line signal inoperative to disconnect said normal current source and to connect said second source therewith, substantially as described.

3. In a telephone system, the combination with a plurality of telephone lines, of a pair of sources of current at the central office, one of said sources being normally connected with the lines to permit the subscribers to call the central office, a polarized cut-off relay for each line, and means controlled by said cut-off relays when connections are established with the lines so that the normal connection of the calling subscriber with said current source remains undisturbed but the called subscriber's line is disconnected therefrom, substantially as described.

4. In a telephone system, the combination with a plurality of telephone lines, of a pair of sources of current at the central office, one of said sources being normally connected with the lines to enable the subscribers to call the central office, a polarized cut-off relay for each line, and means controlled by said relay and when connections are established with the lines so that the normal connection of the calling subscriber with said current source remains undisturbed but when connection is established with the called line the said

source is disconnected therefrom and the other source is connected therewith, substantially as described.

5. In a telephone system, the combination with a plurality of telephone lines, of a pair of sources of current at the central office with one of which said lines are normally connected, a polarized cut-off relay for each line, a cord circuit to establish connections between the lines for conversation, one end of said cord circuit being connected with one pole of one source and the other end with the other pole of the other source, and means whereby when connection is established by the cord circuit with the lines the cut-off relays of the calling lines permit said first named source to remain in connection with such lines while with the called-for lines the cut-off relays are operated to disconnect said source, substantially as described.

6. In a telephone system, the combination with a plurality of telephone lines, of a pair of sources of current at the central office with one of which said lines are normally connected a polarized cut-off relay for each line, a cord circuit to establish connections between the lines for conversation one end of said cord circuit being connected with one pole of one source and the other end with the other pole of the other source, and means whereby when connection is established by the cord circuit with the lines, the cut-off relays of the calling lines permit said first named source to remain in connection with such lines while with the called-for lines the cut-off relays are operated to disconnect said source and to connect said other source.

7. In a telephone system, the combination with a pair of telephone lines, of switching mechanism for each line at the central office, a cord circuit to connect the lines together for conversation, means for sending current through said switching mechanism in one direction when the line is a calling line and in the opposite direction when the line is a called line, whereby said line switching mechanism is differently affected to differently control the circuits of the calling and called telephone lines, substantially as described.

8. In a telephone system, the combination with a cord circuit adapted to connect lines together for conversation, of two sources of current for said cord circuit, switching mechanism associated with the lines, and means to differently affect said switching mechanism, whereby current is sent over like branches of said lines in opposite directions, substantially as described.

9. In a telephone system, the combination with a cord circuit adapted to connect lines together for conversation, of two sources of current for said cord circuit, switching mechanism associated with the lines and means to differently affect said line switching mechanism, whereby current is sent over like

branches of said lines in opposite directions from said two sources, substantially as described.

10. In a telephone system, the combination with a plurality of telephone lines, a central source of current to which said lines are normally connected for signaling purposes, a polarized line switching device associated with each line and controlling the connection of the lines with said source, a cord circuit, means to send current through said polarized switching device in the proper direction to maintain the connection of the line with said source when the answering end of said cord circuit is connected with said line, a second

source of current, and means to send current through said line switching device in the proper direction to actuate said device to connect the line with said second source of current when the calling end of said cord circuit is connected with the line, substantially as described.

Signed by me at Chicago, county of Cook, State of Illinois, this fifth day of November 1903.

WILLIAM W. DEAN.

Witnesses:

GAZELLE BEDER,
E. A. GASLOCK.