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SWITCHBOARD CORD CIRCUIT

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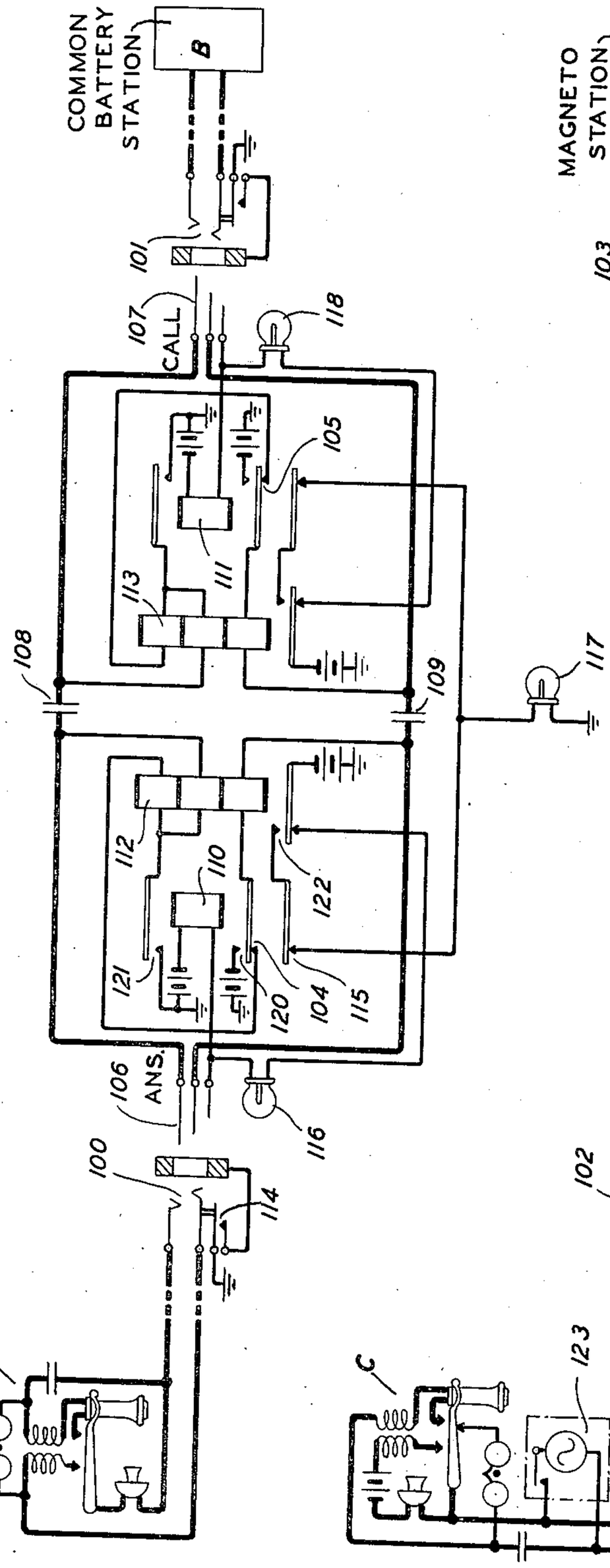

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SWITCHBOARD CORD CIRCUIT

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6 Claims. (Cl. 179—51)

This invention relates to telephone systems and more particularly to universal cord circuits for indiscriminately connecting telephone lines of like or unlike character, as for example, two common battery lines, two magneto lines, or a common battery and a magneto line.

An object of the invention is to control cord circuit supervisory signals in accordance with supervisory signal current incoming over any line, of either type, with which the cord circuit is connected.

A feature of the invention in accordance with the foregoing object resides in the employment of a supervisory relay having three windings. When the cord is idle, or connected to a magneto line, all three windings are connected in series across the cord circuit talking conductor and when the cord is connected to a common battery line one of these windings is disconnected and the cord circuit battery is connected in series with the remaining two windings bridged across the cord.

Figure 2 of Patent 1,931,603, issued October 24, 1933 to W. E. Darrow, the present applicant, discloses a somewhat similar universal cord circuit in which supervisory relays 212 and 213, each having two windings, are normally bridged across the cord circuit. This condition is unchanged when the cord is connected to a magneto line but when a common battery line is connected to a cord circuit battery is serially included in the bridge.

Systems employing the two-winding scheme, of Patent 1,931,603, are subject to limitations, particularly as regards length of magneto lines, which it is not practicable to overcome with a two-winding relay. For the condition of a cord connected to a common battery line the relay must be given a release adjustment that will insure proper functioning of the relay during subscriber flashing, release against leakage current, and other circuit conditions. The spring tensions that are set up by this release requirement play an important part in determining the current on which the relay will operate satisfactorily. The current in the long common battery lines is much greater than this release requirement, so that there will be no difficulty in adjusting the relay for operation over common battery lines. The signaling current over long magneto lines, however, is less than that for common battery lines and the relay must therefore be given a weaker adjustment. The weakening of the operate adjustment can be carried only to a certain point because if the operate current is made too low, the relay may fail to release when it should on common battery connections. An operate current must therefore be selected sufficiently higher than the release current to permit maintaining the relay so that it will function over both common battery and magneto connections. The operate current thus determined limits the length of magneto loops.

As contemplated by the present invention, the provision of a third winding on the relay which is connected in series with the two original windings on magneto connections increases the turns so that the relay is more sensitive to weak magneto signals. This will increase the length of magneto lines over which the relay will operate. When the cord circuit is connected to a common battery line, the third winding is disconnected and the cord circuit battery substituted therefore, hence, the relay can be given a release and operate adjustment on the two common battery windings and it will still operate satisfactorily over long magneto lines.

The invention will be understood from the following description together with the accompanying drawing which illustrates one embodiment of the invention.

In the drawing, A and B are common battery subscribers' stations, C and D are magneto subscribers' stations and E is a universal cord circuit at a switchboard in which are located line jacks 100 and 101 for the common battery stations A and B, respectively, and line jacks 102 and 103 for the magneto stations C and D, respectively.

Cord circuit E consists of answering and calling cords terminating in plugs 106 and 107, respectively, in which condensers 108 and 109 are inserted in the tip and ring conductors thereby insulating the two ends of the cord from each other with respect to direct current.

Answering and calling sleeve relays 110 and 111 are associated with their respective ends of the cord and operate responsive to the connection of the associated plug sleeve with the grounded sleeve of either one of the common battery line jack 100 or 101. The sleeves of the magneto line jacks 102 and 103 are not grounded when a plug is inserted and consequently the cord sleeve relays remain unoperated.

112 and 113 are answering and calling supervisory relays each provided with three windings normally connected in series across the tip and ring conductors of the respective ends of the cord over normal contacts 104 and 105 of the respective sleeve relays 110 and 111.

116 and 118 are answering and calling super-

visory lamps, respectively, adapted to be controlled by the respective supervisory relays 112 and 113 when their respective ends of the cord are connected to common battery lines.

117 is a magneto supervisory lamp, common to both ends of the cord, adapted to be lighted when a magneto station connected to either end of the cord rings on the line and operates the associated supervisory relay, the corresponding sleeve relay being in its normal or unoperated position at the time due to the absence of ground on the sleeve of the magneto line jack.

The operation is as follows: In response to a call from common battery station A, the operator inserts plug 106 in jack 100 thereby closing local contacts 114 of the jack and grounding the sleeve which thereby causes the cord sleeve relay 110 to operate. Operation of relay 110 opens its contacts 104 and 115 and closes contacts 120 and 121.

Opening of contact 104 disconnects the top winding of relay 112 and the closure of contacts 120 and 121 connects battery and ground respectively to the ring and tip conductors of the cord through the respective lower and middle windings of relay 112 thereby establishing a "wet" or battery bridge, including two windings of relay 112, across the cord. If the receiver at station A is off the hook at this time the loop will be closed and relay 112 operates in the usual manner thereby removing battery at its lower contacts from the lamp 116 and preventing it from lighting.

Upon ascertaining the number of the desired station which we will first assume to be common battery station B, the operator inserts calling plug 107 in jack 101 whereupon sleeve relay 111 operates to ground on the sleeve. As it is assumed that the called station receiver is on the hook, supervisory relay 113 will not operate at this time and consequently supervisory lamp 118 will light in a circuit traced from ground, sleeve contacts of jack 101 and plug 107, lamp 118 and lower contacts of relay 113 to battery. It is, of course, obvious that the arrangement of relays are the same at both ends of the cord and that the operation of relay 111 disconnected the top winding of relay 113 and connected battery and ground through the lower and middle windings of relay 113 to the ring and tip of the calling end of the cord.

When the called subscriber answers relay 113 operates in the usual manner thereby opening its lower contacts and extinguishing lamp 118. When either or both of the common battery subscribers hang up, their respective supervisory relays release thereby connecting battery to the corresponding supervisory lamps which light as an indication to the operator that she may disconnect.

It will now be assumed that magneto station C originates a call in the usual manner by the operation of a hand generator 123 in response to which the operator inserts plug 106 in jack 102. As this jack is not arranged to connect ground to the sleeve the cord sleeve relay 110 does not operate and consequently all three windings of relay 112 remain connected in series in the dry bridge across the tip and ring of the cord.

If common battery station B is called the operation of relays 111 and 113 is the same as previously described.

In case magneto station D is called insertion of plug 107 in jack 103 will not operate relay 111 as no ground is present on the sleeve and consequently all three windings of relay 113 remain connected in series across the tip and ring of the calling end of the cord.

When the conversation is completed it is general practice for the calling station to "ring off" by giving the magneto generator a short turn which transmits a pulse of ringing current over the line which passess through the serially connected windings of relay 112 causing that relay to operate momentarily thereby closing its contact 122. Due to the fact that relay 110 is not operated, contacts 115 are closed and a circuit is thereby established to light the magneto supervisory lamp 117 in an obvious circuit. Lamp 117 remains lighted only during the duration of the ring and is extinguished immediately upon its cessation.

A re-ring or ring-off signal initiated by the called station causes operation of relay 113 in a similar manner to that described for relay 112 and the consequent lighting of the common lamp 117.

Lighting of lamp 117, for any duration, is an indication to the operator that she must challenge on the line to determine whether the conversation is finished or another connection is desired by one of the stations.

What is claimed is:

1. In a universal cord circuit for indiscriminately connecting magneto and common battery lines, supervisory relays, one for each end of said cord and connected in bridge thereto, a battery, and means responsive to conection of either end of the cord to a common battery line for connecting said battery in series with said respective relay and for reducing the effective winding turns thereof.

2. In a universal cord circuit for indiscriminately connecting magneto and common battery lines, supervisory relays, one for each end of the cord, each of said relays having three windings serially connected in bridge of the respective ends of the cord when the respective ends are disengaged or connected to a magneto line, a battery, and means responsive to connection of either end of the cord to a common battery line for disconnecting one winding of the respective relay from the bridge and substituting said battery therefor.

3. In a universal cord circuit for indiscriminately connecting magneto and common battery lines, plural winding supervisory relays one for each end of the cord, each of said relays having its plurality of windings serially connected in bridge of the respective end of the cord when the respective end is connected to a magneto line, a battery, sleeve relays, one for each end of the cord, and means controlled by the respective sleeve relay when one end of the cord is connected to a common battery line for disconnecting one of the windings of the corresponding supervisory relays and for substituting said battery therefor in series with the remaining windings.

4. In a universal cord circuit for indiscriminately connecting magneto and common battery lines, supervisory relays, one for each end of the cord, said relays having a relatively high impedance and being connected in bridge of the respective ends of the cords when the corresponding ends are connected to magneto lines, a battery, and switching means responsive to conection of either end of the cord with a common battery line for reducing the impedance of the respective relays and for connecting said battery in series therewith.

5. In a universal cord circuit for indiscrim-

inately connecting magneto and common battery lines, a supervisory relay having a relatively large number of turns connected in bridge to one end of the cord, a source of direct current, and means including a sleeve relay responsive to the connection of said end of the cord to a common battery line for reducing the effective turns of said supervisory relay and for serially connecting said source of current at the mid-point of the remaining effective turns.

6. In a universal cord circuit for indiscriminately connecting magneto and common battery lines, a sleeve relay associated with one end of the cord and arranged to operate when the cord is connected to a common battery line and to remain non-operated when the cord is connected to a magneto line, a supervisory relay having a relatively large number of turns connected in a bridge circuit across the same end of the cord, said circuit including a normal contact of said sleeve relay, and a battery, said sleeve relay being so arranged that when operated a substantial number of turns will be effectively removed from said supervisory relay and said battery will be serially connected in said bridge in substitution for the turns removed.

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