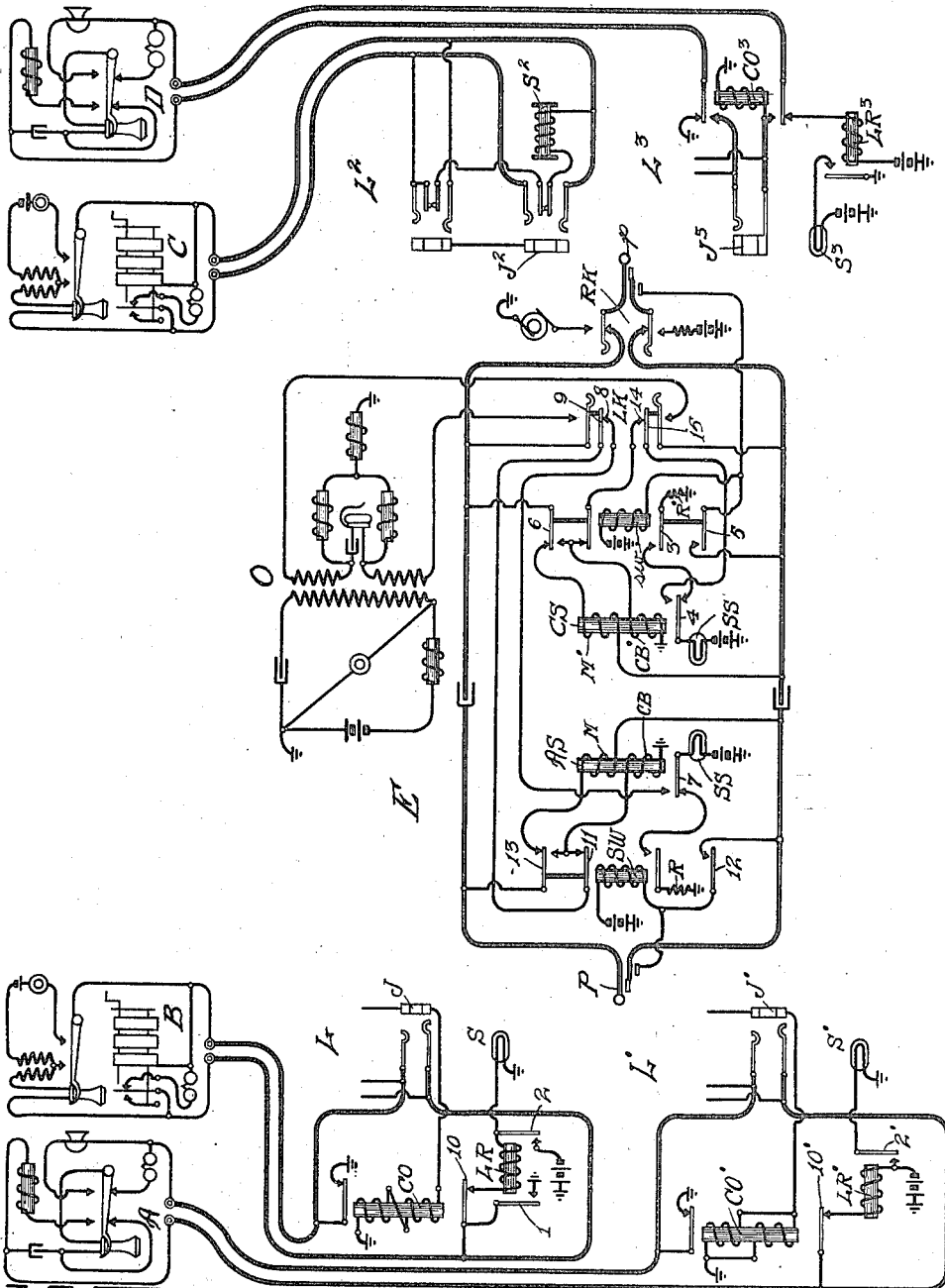


A. J. CARTER.
UNIVERSAL CORD CIRCUITS.
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Witnesses:

George E. Mueller
Wm. Berghahn.

Inventor:

Alva J. Carter.
By Curtis K. Camp
Attorney.

UNITED STATES PATENT OFFICE.

ALVA J. CARTER, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG-SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

UNIVERSAL CORD-CIRCUITS.

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To all whom it may concern:

Be it known that I, ALVA J. CARTER, a citizen of the United States of America, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Universal Cord-Circuits, of which the following is a specification.

My invention relates to telephone systems in which universal cord circuits are provided for interconnecting telephone lines of different characters such as magneto and common battery lines, one of the principal objects being to provide an improved circuit arrangement in the cord circuit whereby the connecting plugs may be inserted interchangeably into line jacks of the two or three-contact type of common battery lines, or to three-contact jacks of common battery or magneto lines, and provide the proper supervision and talking current supply where needed. My invention is also particularly useful in connection with universal cord circuits for interchangeably connecting common battery and magneto telephone lines provided with three-contact jacks having the thimble connected to cut-off relays and the other two contacts extending in line conductors, the cord circuit being provided with a three-contact plug having its third contact connected to a switching relay adapted to be connected in series with the cut-off relay and provided with circuit connections whereby the resulting energization of the switching relay will connect its winding to a talking contact of the plug and thus supply talking current to the connected line, providing it is a common battery line. If the plug is inserted in a magneto line the cut-off relay thereof will energize although the switching relay will not, and therefore the switching relay is not operated to supply talking current.

In the preferred embodiment of my invention, I provide a distinctive signaling means whereby an operator can distinguish calls between a magneto and common battery line so that in case a magneto line wishes to recall prior to the removal of the plug from the answering jack, the supervisory signal will flash in a distinctive manner so that the operator can readily distinguish when a connected magneto line is signaling, whether it is a disconnect or recall signal.

Referring now more in detail to one form of my invention as illustrated in the accompanying drawing, I show two common battery substations A and D terminating in the line circuits L' and L² and two magneto substations B and C terminating in line circuits L and L² respectively. A cord circuit E is provided which is adapted for interconnecting the different lines as shown, the said cord circuit E being used in establishing connection between substations A and B, and C and D, or connections may be established between A and C, or B and D, or likewise, connection may be established between two telephones of like character. At the left of the drawing, I have shown convertible line circuits L and L' for magneto and common battery lines, these line circuits comprising similar apparatus but differing only in connections.

The magneto line comprises a well-known magneto substation B terminating in a line circuit L, the said line circuit L comprising a cut-off relay CO, a line relay LR, a line signal S, and the multiple jack J. The line circuit L is so arranged that when the hand generator at the substation B is operated the line relay LR is energized and then establishes a locking circuit for itself to maintain the signal S lighted until an answering plug is inserted into the jack, whereby the cut-off relay CO is energized. The line circuit L is arranged so that it may be changed into a common battery line circuit such as L' by simply changing the connections of the relays LR and CO as shown.

The common battery line comprises a well-known common battery substation A terminating in a line circuit L' which comprises a cut-off relay CO', a line relay LR', a line signal S', and the multiple jack J'. The relay CO when used with a magneto line circuit such as L has its windings connected in series so as to provide a high resistance path for the sleeve of the jack to ground, but when used in connection with a common battery line circuit such as L' the relay CO' has its windings connected in multiple so as to provide a low resistance path from the sleeve of the jack to ground. The difference in resistance of the relays CO and CO' is for the purpose of either effecting the operation or non-operation of the switching relays SW and SW of the cord circuit E when connection is made with a line so as to con-

nect the common battery winding CB of the relay AS in circuit with the connected line.

At the right of the drawing I have illustrated a magneto substation C and a common battery substation D terminating in line circuits L² and L³. The line circuit L² has the usual line signal S² and jacks J² which are shown multiply connected. The line circuit L³ is a two-wire line circuit comprising the cut-off relay CO³, line relay LR³, line signal S³ and the multiple jack J³.

The cord circuit E comprises the answering and calling plugs P and p which are connected by the heavily marked conductors, the third contact of each plug having a switching relay as SW or *sw* connected to it. These switching relays are energized when connection is made with a common battery line so as to bridge the supervisory relays AS and CS across the connected line. The switching relays SW and *sw* have a normally open contact which is closed when the switching relays SW or *sw* are energized by reason of connection with a common battery line to cross the ring and sleeve contacts of the connected plug to connect the ring and sleeve conductors so as to form a second or sleeve conductor and also for the purpose of supplying battery for talking purposes. When connection is made with a magneto line these switching relays are not energized and thus maintain the magneto windings M or M' bridged across the line. The relays CO and CO' of magneto and common battery line circuits L and L' are of different resistances, relay CO being sufficiently high to prevent the operation of the relay SW and relay CO' of the common battery line being of a low enough resistance to permit the energization of the switching relay SW, but in either case these relays CO or CO' operate.

I arrange the supervisory signals as SS so that an operator can readily distinguish what kind of a line is connected with the corresponding end of the cord circuit. When a common battery line is connected a switching relay as SW is operated, the supervisory signal as SS being then controlled through the resistance R. This resistance R being of low enough resistance allows the signal SS to glow brightly. When a magneto line is connected the switching relay is not energized, and the supervisory signal SS is included in series circuit with its associated winding CB which is of a higher resistance than its associated resistance R so that the signal SS glows less brightly.

Now if a subscriber on a common battery line wishes to recall, the relay AS or CS as the case may be, is operated to flash the signal SS or SS', when the switchhook is operated or winked at the calling substation. Now if the subscriber on a magneto line wishes to recall, the relay AS or CS as the

case may be, is operated by current from the hand generator at the magneto substation and then locks its armature with its associated signal connected in series with its associated winding CB. Upon further actuation of the hand generator at the substation, a flow of alternating current passes through the winding M of the associated supervisory relay producing an induced current flow in its associated winding CB and causes a flickering of the signal SS or SS', as the case may be. Even though the supervisory relay is locked, when a disconnect signal on the magneto line is received, a subscriber is still able to cause a distinctive operation of the signal when he wishes to recall or attract the operator's attention.

In regard to the various resistance values used in the control of the switching and signaling circuits, I have found in practice that with the following values successful operation is secured. Relay CO, 1000 ohms, each winding 500 ohms, relay CO' 250 ohms, and relays SW and *sw*, 100 ohms. By using a 70 ohm resistance R and 100 ohms for resistance of the winding CB of the supervisory relays lamps SS and SS' will operate as described. The supervisory lamps are 6 v. and I preferably employ a battery of 24 volts. I do not wish to be limited to these exact values as the resistance and voltage may be of course varied.

When connection is made with the magneto line circuit L² the line signal S² is disconnected and the sleeve contact being an open circuit, the switching relay does not operate, but when connection is made with the common battery line circuit L³, both switching relay *sw* and cut-off relay CO³ operate.

Having described in general the apparatus as illustrated in the drawing, the operation of the system will now be described.

Assuming that a call is initiated at the magneto substation B, the substation generator is operated, current flowing over a circuit including the line relay LR which energizes closing a locking circuit for itself through its contacts 1 and 2 and contact 10 of the relay CO. The closing of contact 2 of relay LR lights the signal S which remains lighted due to the locking circuit of relay LR. The operator noting the signal inserts the answering plug P into the jack J of the calling line, this operation connecting the switching relay SW and cut-off relay CO in series. This permits the operation of the cut-off relay CO from battery through the winding of the switching relay SW, through contacts of the plug P and jack J, the winding of cut-off relay CO to ground. But due to the high resistance of relay CO, as previously described, the relay SW does not operate. The energization of relay CO opens the locking circuit of the relay LR which deenergizes and effaces the signal S and due to the

fact that the switching relay SW does not operate the supervisory relay AS has its winding M in bridge of the called line. The operator throws the listening key and finding that connection is wanted and assuming that it is the common battery substation D, the jack J³ of the wanted line is tested and if busy, the operator receives the customary click in her head receiver. Assuming that the line is idle, the operator inserts the calling plug *p* into the jack J³ closing a circuit for the cut-off relay CO³ and the switching relay *sw* in series causing the operation of both of these relays. The operation of cut-off relay CO³ extends the talking conductors of the cord circuit E to the called line. The operation of the switching relay *sw* closes a circuit for the supervisory signal SS' from battery through the signal SS', normal contact 4 of the supervisory relay CS, alternate contact 3 of the relay *sw* through resistance R' to ground causing a bright glow of the supervisory signal SS'. The operator then throws her ringing key RK to ring the called-for subscriber, and due to the crossing of the sleeve and ring contacts of the plug *p* by the closing of alternate contact 5 of the switching relay *sw*, battery is supplied to the called line through the relay *sw* and when the subscriber answers due to the signal caused by the actuation of the ringing key RK, current flows over the called line returning over the tip conductor, alternate contact 6 of the switching relay *sw* and the winding CB' of the relay CS to ground. This energizes the relay CS and opens the circuit of the signal SS' at normal contact 4, effacing the signal. The substations B and D are now connected in conversational circuit, said circuit being traced over the heavily marked conductors. When conversation is completed the subscriber at the calling magneto substation B operates his hand generator causing the flow of current through the bridged winding M of the relay AS closing its alternate contact 7, thus establishing a locking circuit for relay AS traced from battery through the signal SS, alternate contact 7, the normal contacts 8 and 9 of the listening key LK, normal contact 11 of relay SW and the winding CB of relay AS to ground. The signal SS is included in circuit with the winding CB of the relay AS so that a dull glow of the lamp SS is obtained which notifies the operator that this signal is received from a magneto substation. The disconnect signal from the common battery substation D is obtained by the subscriber at substation D replacing his receiver, which act interrupts the flow of current through the winding CB' of relay CS, but relays *sw* and CO³ are still maintained energized over the previously traced circuit and upon deenergization of relay CS its normal contact 4 is again closed connecting the sig-

nal SS', and resistance R' in series thus lighting the lamp brightly and indicating to the operator that a disconnect signal has been received from a common battery subscriber. The operator now withdraws the 70 answering and calling plugs *p* and P from the jacks J and J³. The withdrawal of the plug *p* effects the restoration of the relay *sw*, restoring said relay and effacing the signal SS'. The relay AS was energized and 75 locked up over the local circuit including normal contacts 8 and 9 of the listening key LK and in order to effect the restoration of the relay AS the operator actuates the listening key LK to interrupt the circuit of re- 80 lay AS at the normal contacts 8 and 9 and said relay AS restores effacing the signal SS.

Now if the subscriber at substation B wishes to recall or converse with the operator before the removal of the answering plug 85 P from the jack J, a continued operation of the hand generator at substation B transmits an alternating current through the magneto winding M of the supervisory relay AS. An induced current is set up in the winding CB of supervisory relay AS and this winding being included in circuit with the supervisory signal SS a flickering effect of the lamp is produced, notifying the operator that a recall is being sent from a magneto 90 substation. Without this distinctive feature of the signal upon recall, the operator would disconnect when a recall was desired. The operator after having conversed with the subscriber that sent the recall, throws her 95 listening key LK interrupting the circuit of the relay AS, said relay restoring and effacing the signal SS as before described. The recall of the common battery subscriber at substation D is caused by the subscriber's 100 switch-hook being operated, causing the signal SS' to flash, notifying the operator that subscriber D wishes to recall.

Now if a call is initiated from the common battery subscriber A, upon removal of 110 the switch-hook at substation A, the line relay LR' is energized closing its alternate contact 2' to light the line signal S'. The operator noting the lighted signal S' inserts the answering plug P into the jack J' of the 115 calling line. This insertion of the plug P into the jack J' energizes the cut-off relay CO' and the switching relay SW in series. Responsive to the energization of the switching relay SW its alternate contact 12 is 120 closed thereby connecting the sleeve and ring contacts of the plug P so that the battery through the relay SW will flow over the calling line returning over the tip conductor and through alternate contact 13 of relay 125 SW through the common battery winding CB of relay AS to ground, causing the energization of the supervisory relay AS. When the switching relay SW is energized the closing of its alternate contact 13 disconnects 130

the magneto winding M of the supervisory relay AS from the cord circuit and connects the common battery winding CB of the relay AS to the said cord. The operator now
 5 actuates her listening key and inquires the wants of the calling subscriber, and assuming it is the magneto substation C, the operator tests the magneto line as to its idle or busy condition. Assuming now that the line
 10 is idle, the operator inserts the calling plug *p* into the jack J² of the magneto line, and the insertion of the plug disconnects the line signal S², and as the sleeve of the jack J² is on open circuit, no circuit is established for
 15 the switching relay *sw*, this relay remains deenergized and maintains its magneto winding M' of the calling supervisory relay CS in bridge of the called line. The operator now actuates her ringing key RK to
 20 ring the bell of the called-for subscriber at magneto substation C, and upon the removal of the receiver at substation C, the lines are connected in conversational circuit, which may be traced over the heavily marked con-
 25 ductors. When conversation is completed the subscriber at magneto substation C operates the hand generator at the substation C, causing the signal SS' to light with a dull glow for the same reason as previously de-
 30 scribed and the restoration of the receiver at substation A causes the signal SS to light and glow brightly. The disconnection and restoration of the apparatus to normal is the same as before described, the operator actu-
 35 ates her listening key LK to interrupt the normal contacts 14 and 15 to interrupt the circuit of relay CS and efface signal SS'. In case of either subscriber wishing to recall
 40 before the plugs are withdrawn the operation of the signals SS and SS' are the same as previously described.

Should connection be established between the substations A and B, the operation of the circuit can be readily followed from the
 45 previous description, and likewise if connection be established between substations C and B or to substations of like character such as to common battery or two magneto sub-
 50 stations, the operation can also be readily followed from the description already given.

While I have described my invention in one specific form and have given certain values for a successful operation, I do not wish to be limited to the same as I con-
 55 template changes which will readily suggest themselves to those skilled in the art, and I aim to cover all such modifications in the appended claims.

Having described my invention, what I
 60 claim as new and desire to secure by United States Letters Patent is:

1. A telephone system comprising tele-
 65 phone lines provided with two and three contact jacks, a cord circuit for intercon-
 necting said lines provided with a plug hav-

ing three contacts, a switching relay con-
 nected to the third contact of said plug and operated responsive to a connection of said
 plug to said jack for electrically connecting
 said third contact and a talking contact of
 the associated plug to supply talking cur-
 rent through the winding of said switching
 relay to a connected line.

2. A telephone system comprising tele-
 75 phone lines having three contact jacks, a cut-off relay connected to one of the jack
 contacts, line conductors for said lines ex-
 tending from the other two contacts of the
 jacks, a cord circuit having a three contact
 plug for registering with said jacks, talk-
 80 ing conductors extending from two of the
 plug contacts and a switching relay connect-
 ed to the third contact of the plug, said
 switching and cut-off relays being energized
 responsive to a connection of the plug and
 85 jack, said switching relay having contacts
 closed responsive to its energization for
 electrically connecting one of said plug talk-
 ing contacts to the said third contact there-
 of to supply current through the winding of
 90 the switching relay to the connected line.

3. A telephone system comprising tele-
 phone lines having three contact jacks, a
 cut-off relay connected to one of the jack
 contacts and line conductors extending from
 95 the other two contacts thereof, a cord circuit
 having a three-contact plug for registering
 with said jacks, talking conductors extend-
 ing from two of the plug contacts and a
 switching electromagnet connected to the
 100 third contact of the plug, a source of current
 connected to the winding of said switching
 electromagnet whereby said switching mag-
 net and cut-off relay are energized respon-
 sive to a connection of the plug and jack,
 105 and contacts controlled by said switching
 magnet for electrically connecting one of
 said plug talking contacts and the third
 contact thereof whereby talking current is
 supplied to the connected line through the
 110 winding of said switching electromagnet.

4. A telephone system comprising tele-
 phone lines having two and three contact
 jacks, a cut-off relay normally connected to
 a contact of each jack, a cord circuit having
 115 a three contact plug adapted for connection
 with any of said jacks, a switching electro-
 magnet connected to one of said contacts of
 the plug adapted to register with the jack
 contacts to which the cut-off relays are con-
 120 nected, talking conductors leading from the
 other two plug contacts, and contacts con-
 trolled by said switching electromagnet for
 electrically connecting the first said plug
 contact to one of its associated talking con-
 125 tacts.

5. A telephone system comprising tele-
 phone lines having two and three contact
 jacks, a source of current having one of its
 terminals normally connected to a contact
 130

of each jack, a universal cord circuit for interconnecting said lines having three contact plugs adapted for connection with any of said jacks, one of the contacts of each plug being adapted to register with the said jack contents to which the source of current is connected, a switching electromagnet connected to each such contact of the plug and connected to the other pole of said source whereby it is energized responsive to the connection of its plug with one of said jacks, and means controlled by each electromagnet when so energized for directly electrically connecting the said connected plug contact to one of its associated contacts and for closing a supervisory circuit.

6. A telephone system including telephone lines having three contact jacks, a cut-off relay connected to one of the jack contacts, a cord circuit having a three-contact plug for registering with said jacks, a switching relay connected to a contact of the plug, a supervisory relay provided with a winding having its terminals connected to the other two contacts of said plug, a circuit including said switching relay and said cut-off relay adapted to be closed responsive to a connection of the plug and jack, and contacts controlled by said switching relay for interrupting a circuit through the supervisory relay and for connecting one of said plug contacts to the said third plug contact whereby current is supplied to the connected line through a winding of the switching relay.

7. A telephone system including telephone lines having three contact jacks, a cut-off relay connected to one of the jack contacts, a cord circuit having a three-contact plug for registering with said jack, a switching electromagnet connected to a third contact of said plug, a double-wound supervisory relay having one winding bridged across the talking contacts of said plug, a circuit including said cut-off relay and said switching relay adapted to be closed responsive to a connection of the plug to the jack, and contacts controlled by said switching relay for interrupting the bridging circuit of said supervisory relay and for connecting one of the plug contacts to a terminal of the other winding of said supervisory relay and for connecting the other of the talking contacts of the plug with said switching electromagnet.

8. A telephone system including a telephone line terminating in a jack at the central exchange, a cord circuit provided with a three-contact plug for registering with

said jack, a switching relay connected to the sleeve contact of said plug, an energizing circuit for said switching relay closed responsive to the insertion of said plug in said jack, and contacts controlled by said switching relay for connecting said switching relay in multiple with another contact of said plug.

9. A telephone system including a telephone line terminating at the central exchange in a jack, a cord circuit provided with a three-contact plug for registering with said jack, a switching relay connected to the third contact of said plug, an energizing circuit for said switching relay closed responsive to the insertion of said plug in said jack, a supervisory relay, and contacts controlled by said switching relay for connecting one terminal of said supervisory relay to one of the talking contacts of said plug and for connecting said switching relay to the remaining contact of said plug.

10. A telephone system including a subscriber's telephone line terminating in a jack, an operator's link circuit provided with a three-contact plug for registering with said jack, a battery, a switching relay having one of its terminals connected to said battery and its other terminal connected to the third contact of said plug, and contacts controlled by said switching relay for connecting battery through said switching relay to one of the other contacts of said plug.

11. A telephone system including a subscriber's telephone line terminating in a jack, a link circuit provided with a three-contact plug for registering with said jack, a battery, a switching relay, and means individual to the link circuit for connecting said battery through said switching relay to two of the contacts of said plug.

12. A telephone system including a subscriber's telephone line terminating in a jack at the central exchange, an operator's link circuit provided with a plug for registering with said jack, a battery, a relay winding, and means individual to the link circuit responsive to the connection of the said plug to the said jack for connecting said battery through said relay winding to a plurality of said contacts of the plug.

Signed by me at Chicago, in the county of Cook and State of Illinois, in the presence of two witnesses.

ALVA J. CARTER.

Witnesses:

GEORGE E. MUELLER,
M. R. ROCHFORD.