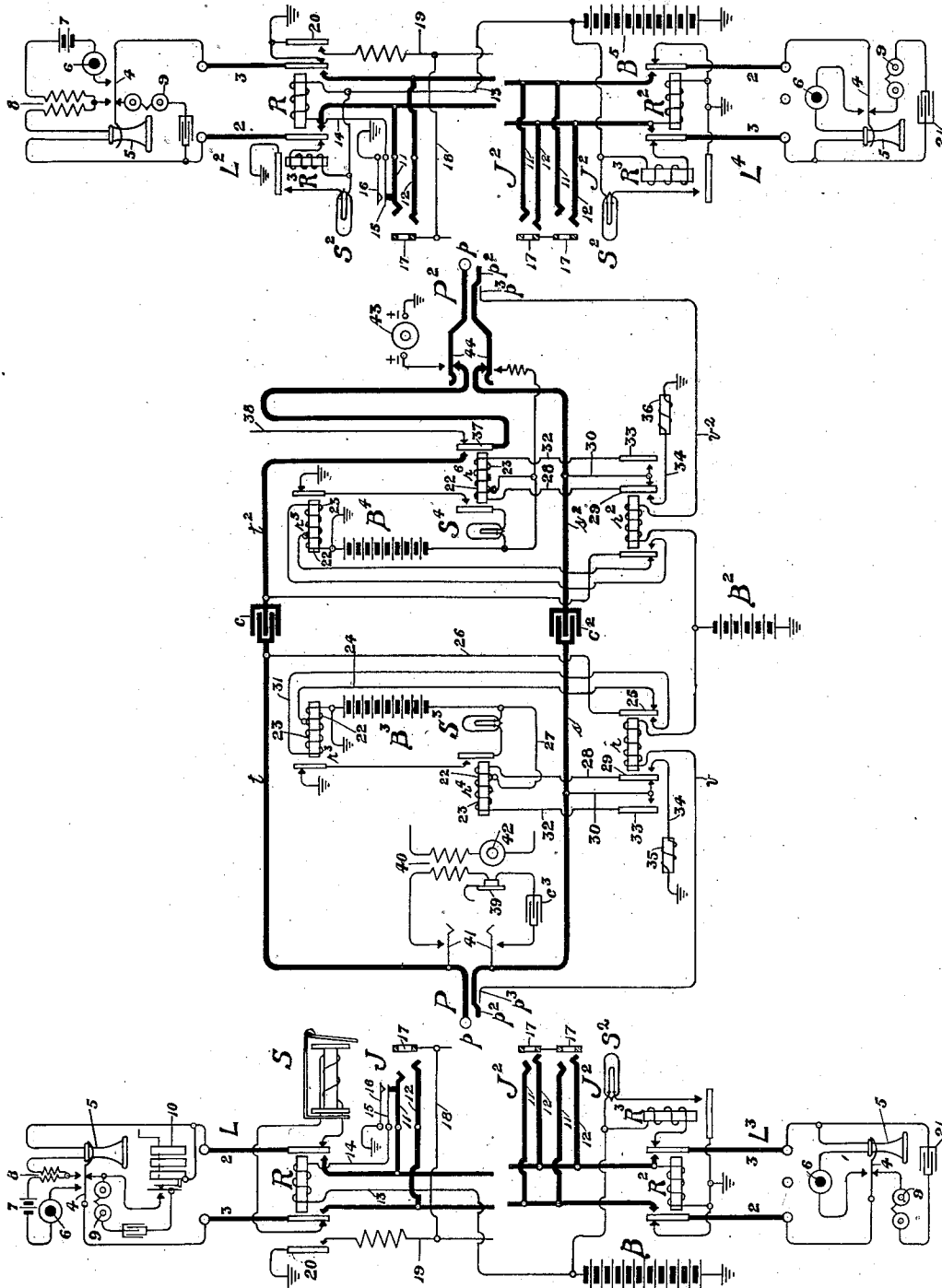


C. S. WINSTON & E. H. RUPE.
TELEPHONE SYSTEM.

APPLICATION FILED DEC. 19, 1904.

1,005,393.

Patented Oct. 10, 1911.



Witnesses.
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TELEPHONE SYSTEM.

1,005,393.

Specification of Letters Patent.

Patented Oct. 10, 1911.

Application filed December 19, 1904. Serial No. 237,363.

To all whom it may concern:

Be it known that we, CHARLES S. WINSTON and EDWIN H. RUPE, citizens of the United States, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

Our invention relates to telephone systems and particularly to the cord circuits of such systems whereby the same cord circuit is adapted for use with various types of telephone lines, and particularly with magneto common battery signaling and common battery talking lines.

In small installations it is often desired to terminate upon the same board lines of the magneto and common battery type and possibly still other types, this most often occurring in connection with old installations to which new and improved additions have been made, the additions being of the later and improved types. In order to enable any of the operators, before either the old or the new parts of the board to connect with any of such lines, it is necessary that the multiple sections of the lines be extended through both the old and the new portions of the board. Heretofore it has been most common to provide all operators with the different types of cord circuits necessary to be used with the different lines, or to provide additional apparatus of some type in connection with the operators' outfits so that additional labor was imposed upon them to make the connections between the two or more kinds of lines.

Our invention has for its object the simplification of the operator's cord circuit by means of which the same cord circuit having only the usual answering and calling plugs may be used interchangeably with any of the different lines and without any difference in the mode of establishing and completing such connections, thus rendering it unnecessary for the operator to know and keep in mind the different types of lines that appear before her. It is obvious that the invention results in more efficient service than heretofore and as will appear hereinafter, saves considerable complication of relays and other apparatus ordinarily associated with such circuits.

Our invention is illustrated in the accompanying drawing in which the figure is

a diagram of a telephone system provided with magneto common battery signaling but local battery talking and common battery talking lines and with cord circuits of our improved type which are adapted for use with such lines.

In the figure L is a telephone line of the magneto type, L² is of the common battery signaling type, while L³ and L⁴ are telephone lines of the common battery talking type.

In the case of line L the line wires 2 and 3 terminate at the sub-stations in the usual devices, comprising a switch hook 4 upon which the receiver 5 is adapted to be suspended when not in use, and which, when the receiver is taken up suitably connects the transmitter 6, the local battery 7 and the primary of the subscriber's induction coil 8 in a local circuit, and the said receiver and secondary of said induction coil in the circuit of the telephone line. Normally said hook connects the line wire 3 through the signaling bell 9, a condenser, and normal contacts of the hand magneto generator 10 to the other side of the circuit.

At the central office the line conductors 2 and 3 are normally connected through the contacts of the cut-off relay R with the line signal S, the forward or alternate contacts of said cut-off relays being connected with the tip and sleeve springs 11 and 12 of the springjack J of the line. The said cut-off relay is connected upon one side by conductor 13 with the live pole of the central common battery B while its opposite terminal is joined through the medium of conductor 14 with the normally-open spring 15 of the jack J which is insulated from spring 11 and is adapted to be thrown into contact with the grounded spring or contact 16 of said jack when the connecting plug is inserted therein. The third or test contact 17 of the jack is connected by conductors 18 and 19 with the forward contact of an auxiliary grounded spring 20 of the said cut-off relay R.

The line L² is the same as line L except that it is equipped for common battery signaling instead of magneto generator signaling, a line relay R³ being connected between line conductor 2 and the battery wire 13 leading from battery B⁵, while line conductor 3 is normally grounded. The line relay controls the local circuit of the line

signal S^2 which is preferably a small incandescent lamp.

The line conductors 2 and 3 of the common battery lines L^3 and L^4 terminate at the substation in the usual devices adapted for common battery transmission, including the switch hook 4, which normally completes a path for ringing current through the call bell or ringer 9 and a suitable condenser 21, and which when the receiver 5 is lifted therefrom completes a path for battery current through the transmitter 6 and said receiver. It will be understood that this arrangement is intended merely to typify any usual or desired common battery arrangement. At the central office the line wires 2 and 3 are normally extended through contacts of the cut-off relay R^2 to opposite poles of the battery B, and include in circuit therewith the line relay R^3 which controls the local circuit of the line signal S^2 , which is preferably in the form of a small incandescent lamp. The switchboard section of the line is extended from the forward contacts of the cut-off relay R^2 of the springjack contacts 11 and 12 of jacks J^2 . The winding of the cut-off relay is legged to ground from the sleeve side of the switchboard section of the line.

The multiple jacks of the lines L and L^2 are not completely shown in the drawing, but are indicated by the branching lines extending beyond the answering jacks, and it is understood they are of the same type as the said answering jacks.

The cord circuit which is adapted for use of these various lines is provided with an answering plug P and a calling plug P^2 provided with tip, sleeve and third contacts adapted to register respectively with the corresponding contacts of the springjacks, such as J and J^2 , of both types of lines. The tip contacts p of said plugs are connected together through the medium of flexible strands t and t^2 and the interposed condenser c , while their sleeve contacts p^2 are similarly joined by the strands s and s^2 , and the interposed condenser c^2 . The third contacts p^3 of said plugs are connected by the similar strands v and v^2 to the live pole of the battery B^2 , these strands containing respectively the relays r and r^2 . A pair of supervisory relays, r^3 and r^4 are associated with the answering end of the cord circuit, and suitably control the local circuit of the supervisory signal S^3 , while a similar pair of relays— r^5 and r^6 —connected with the calling end of the cord circuit likewise control the local circuit of the supervisory signal S^4 . Each of these relays is provided with a comparatively low resistance winding 22—say of one hundred ohms—and a high resistance winding 23 of from 400 to 500 ohms. The low resistance winding of relay r^3 is connected on one side to the grounded pole of the battery B^3 and upon the other side by con-

ductor 24, the normal contact and spring 25 of relay r , and conductor 26 with the strand t of the cord circuit. Similarly the low resistance winding 22 of relay r^4 is connected on one side by conductor 27 with the live pole of the battery B^3 , while on the other side it is connected by conductor 28, spring 29 and normal contact of relay r , and conductor 30, with the sleeve strand s of said cord circuit. With this arrangement it will be seen that when the relay r remains unoperated, the said two low resistance windings of the two relays r^3 and r^4 are connected on opposite sides of the battery B^3 in a bridge of the answering end of the cord circuit. The high resistance windings of said relays are connected with one end of the low resistance windings, and in the case of relay r^3 has its other terminal connected by conductor 31 with the forward contact of spring 25 of said relay r , whereby upon the energization of the latter the conductor 26 is connected with conductor 31, and the conductor 24 is disconnected therefrom, so that the whole winding of the said relay r^3 is in circuit between the adjacent pole of the battery B^3 and the strand t of the cord circuit. Similarly the high resistance winding 23 of relay r^4 is connected by conductor 32 with an extra spring 33 of said relay r , the forward contact of which spring is joined to the conductor 30 so that upon the attraction of the armatures of the relay r , conductor 28 is disconnected from the conductor 30 and the conductor 32 is connected therewith, thus connecting the high resistance winding 23 of the relay r^4 between the battery B^3 and the strand s . The forward contact of the spring 29 of this relay r is connected to ground by conductor 34 through a suitable retardation coil 35, so that the relay r^4 remains operated as long as relay r is operated. In a similar manner the windings of the relays r^5 and r^6 are connected with the strands t^2 and s^2 , another retardation coil 36 being supplied in connection with this end of the cord circuit. The relay r^6 at this end of the cord circuit is provided with an additional spring 37, connected as shown to the forward portion of strand t^2 for busy testing purposes, its normal contact being joined by conductor 38 with a suitable test relay or other testing device and its alternate contact being connected with the rear portion of the strand t^2 . The operator's set comprising the usual receiver 39, the secondary of her induction coil 40, and a suitable condenser c^3 , are adapted to be bridged across the answering end of the cord circuit by the springs 41 of any suitable listening key, while her transmitter 42 and the primary winding of her induction coil are arranged to be charged from any suitable source of current. A ringing generator 43 is adapted to be con-

nected with the calling plug P² by the operation of the ringing key springs 44.

The operation of our invention is as follows: Assuming the subscriber upon the line L³ to have taken up his receiver, a path for current is provided over the telephone from the battery B, thereby energizing the line relay R³, and lighting the line signal S². Upon observing this signal the operator inserts the answering plug P of her cord circuit into the jack J² of the calling line, thereby permitting current to flow from the live pole of the battery B³ over conductor 27, winding 22 of relay r⁴, conductor 28, spring 29 and back contact of relay r, conductor 30, strand s, sleeve contacts of the plug and jack, and then through the cut-off relay R² to the ground, thereby energizing said cut-off relay and cutting off the line relay to retire the line signal and to connect the two portions of the telephone line together for conversation. It will be noticed that the third or test contacts 17 of the jacks J² are insulated from other parts of the system so that no circuit is completed through the strand v of the cord circuit and the relay r, therefore, remains deenergized, thus permitting the current from battery B³ to continue to flow in the path just above traced. At the same time the supervisory relay r⁴ is energized and closes the local circuit of the supervisory signal S³, but on account of the subscriber's telephone being off its hook said signal is prevented from operation by the actuation of the companion relay r³, the circuit for the low resistance winding 22 of which is now completed through the conductors 24 and 26 from the grounded pole of the battery B³ to the strand t. Under these conditions of use therefore, the battery B³ furnishes current to the subscriber's station for the operation of the transmitter through the low resistance windings 22 of the supervisory relays r³ and r⁴. The operator is therefore enabled to receive the order for the wanted subscriber.

Assuming the subscriber upon the line L⁴ to be the one desired, the said line is tested in the usual manner, and if found idle the calling plug P² is inserted therein and the ringing key 44 depressed. On account of the fact that the contacts 17 of the jack are isolated, the relay r² associated with this end of the cord circuit remains in its normal condition and the path for current is completed from battery B⁴ through the low resistance winding 22 of the supervisory relay r⁶, the normal contact 29 of the relay r², and thence through the cut-off relay R² of the line L⁴, which is operated to prevent the lighting of the line signal of the called line and to place the said line in condition for conversation. The operation of the relay r⁶ completes the strand t² of the cord circuit through its spring 37, thereby cutting off

the test relay, and also completes the local circuit of the supervisory signal S⁴ through another spring, and since the subscriber has not yet responded, and relay r⁵ is not yet operated said supervisory signal S⁴ is now lighted, indicating to the operator the condition of the subscriber's telephone. The testing operation is apparent, that is, if idle, no click is received by the operator when she touches the tip of the plug P² to one of the test rings 17, since a complete circuit is not established; but if busy, a complete circuit is established through the third strand v or v² to the live pole of battery B², and a click would be received, it being understood that the test relay or other device would be grounded. As soon as the plug is inserted in the called line the ringing key 44 is depressed, the calling current passing out over the tip side of the telephone to the substation and back to the central office over the sleeve side of the line and through the battery B⁴ to ground. During this operation current from the battery B⁴ is holding up the cut-off relay R² in the usual manner. Upon the response of the called subscriber a path for current from the battery B⁴ is now completed over the telephone line as in the case of line L³ and the relay r⁵ is energized to open the local circuit and thereby to retire the supervisory signal S⁴. The operator is now informed that the subscribers are in communication. Current for the two substation transmitters is now fed out through the 100 ohm windings of the supervisory relays in the common manner, while the voice currents are transmitted from one circuit to the other by the condensers c and c². Upon the return of the subscribers' receivers to their hooks the line circuits are opened and the tip relays r³ and r⁵ are deenergized, thus closing the circuits of the supervisory lamps S³ and S⁴. The supervisory relays r⁴ and r⁶ as well as the cut-off relays of the lines remain operated, however, over the local paths before described and the supervisory lamps are lighted. Upon observing these the operator takes down the connection and restores all parts to normal condition.

Assuming the calling subscriber to have been located upon the line L the operation of his hand generator 10 sends a calling current through the drop signal S, thereby indicating to the operator that a connection is desired. The operator inserts the plug P of the same cord circuit into the jack J, thereby closing the local circuit of the cut-off relay R from the battery B, which is energized to cut off the signal S and to connect the line conductors 2 and 3 with the spring-jacks of the line. The operation of the cut-off relay R connects ground with the third contacts 17 of the jacks through conductors 18 and 19 and spring 20 of said relay, which

establishes a path for current over the strand v of the cord circuit through the relay r from the live pole of the battery B^2 . This relay is therefore energized and results in cutting in both windings of the supervisory relay r^3 and the high resistance winding 23 of relay r^4 . Current from the battery B^3 therefore flows over the metallic telephone line through said high resistance windings of relays r^3 and r^4 to suitably control the said relays and thereby the supervisory signal S^3 , and at the same time a large current is prevented from flowing in the line which is not only now unnecessary because a local battery 7 is provided to operate the substation transmitter, but would also interfere with the operation of the receiver at the substation and would consume undue amount of current. A path for current through the low resistance winding of relay r^4 is also now established through conductors 28 and 34, which it is evident, maintains the same operated as long as the relay r is energized or until the plug P is withdrawn from the jack. The operator is now enabled to talk with the subscriber to learn his order. Assuming that the subscriber upon the line L^2 is the one desired, the said line is tested in the ordinary manner, and if found idle, plug P^2 is inserted in one of the multiple jacks thereof, and the ringing key operated. The relay R of the called line is now operated to cut off the line signal and to connect ground with the jack rings and relay r^2 is energized to complete a path for current through the winding 22 of the relay r^6 through conductor 28, spring 29 and its forward contact and conductor 34 and through the retardation coil 36 to ground. This relay r^6 is therefore operated and closes the local circuit of the signal S^4 , which is now lighted owing to the fact that the relay r^5 is not yet operated, and indicates to the operator that the subscriber has not yet responded. As explained in connection with line L this relay r^6 remains energized as long as the plug is connected with the telephone line. The strand t^2 is also placed in condition for conversation by the attraction of the spring 37. When the subscriber responds current flows over the metallic line through the two windings of the relay r^5 which energizes said relay and retires the supervisory signal S^4 . The current flowing upon the line is small in quantity, due to the high resistance windings 23 of the relays r^5 and r^6 . During conversation the local batteries of the substations are furnishing the current for the operation of the transmitters. At the termination of the conversation the return of the subscribers' receivers to their hooks de-energizes the relays r^3 and r^6 , thereby closing the local circuits of the supervisory signals S^3 and S^4 which become lighted and indicate to the operator that the conversation

has terminated, when she takes down the cord circuit and restores all parts to normal condition.

The operation of the devices at the two ends of the cord circuit are independent and it is obvious that any of the types of lines may be connected together for conversation. The connection of either end of the cord circuit with a common battery line results in feeding current to said line through the low resistance windings of the supervisory relays at that end of the cord circuit due to the fact that the relay in the third strand does not operate, and the connection of the other end of the cord circuit with a magneto line results in feeding current thereover through the high resistance windings, due to the fact that the relay in the corresponding third strand of that cord is operated. The voice currents in each instance are transmitted from one end of the cord circuit to the other and from one line to the other through the condensers c and c^2 .

The several batteries may be one and the same and in practice not more than the two batteries B^3 and B^4 would be employed, although for testing purposes the battery B^2 may be of less electromotive force. The retardation coils 35 and 36 may be of 500 ohm resistance and the other parts of the usual or desired electrical dimensions. Our improvements may be applied to one end only of a cord or trunk where that would be desirable.

It is thus apparent that we have provided a cord circuit for the purposes desired, which is comparatively simple, efficient and economical to install, operate and maintain; and while but one specific form, which has been worked out for commercial purposes, has been shown and described, we do not desire to be limited thereto in all respects as it is obvious that various alterations may be made therein without departing from the scope or principle thereof.

We claim:

1. In a telephone system, the combination with common battery and local battery telephone lines, of a cord circuit to establish connections therewith for conversation, a central source of current associated with the cord circuit and connected through the limbs thereof with the common battery line to furnish current to the substation of said line for the operation of the transmitter when the cord is connected therewith, supervisory signals associated with said cord circuit and adapted to be operated by current from said source, and means whereby said cord circuit may be used interchangeably with the local and common battery lines without in any way altering the operation of the supervisory signals, substantially as described.

2. In a telephone system, the combina-

tion with common battery and local battery lines normally open to direct currents at the substations, of a cord circuit adapted for interchangeable use with lines of both types, a source of direct current associated with the cord circuit and adapted to furnish current for the transmitters of the common battery lines; and a supervisory signaling system associated with the cord circuit controlled over the limbs of the talking circuit in series and having the same manifestation when the cord circuit is used with the different kinds of lines, substantially as described.

3. In a telephone system, the combination with telephone lines of different kinds, of a cord circuit adapted for use with the different kinds of lines, a supervisory signal associated with the cord circuit controlled over the limbs of the talking circuit of the telephone line in series and effaced when direct current flows therein during a connection and having the same method of operation when the cord is connected with the different kinds of lines, substantially as described.

4. In a telephone system, the combination with a local battery telephone line having a hand generator at the substation adapted to be connected in series with the limbs of the telephone line while in use, of a common battery line having a switch hook adapted to open the circuit of the telephone line when the receiver is on the hook, a cord circuit adapted to connect said lines together for conversation, each end of said cord being adapted to connect with each of said lines depending upon whether the line is a called or a calling line, a signal associated with each end of said cord circuit and adapted to be displayed when the conversation is terminated, the signal of the end of the cord circuit connected with the local battery line being displayed independent of the operation of said hand generator, the signal associated with the end of the cord circuit connected with the common battery telephone line being adapted to be controlled by current in the telephone line, whereby said signal is displayed when the receiver of the common battery substation is placed upon the hook and the circuit of the common battery line is open at the substation, substantially as described.

5. In a telephone system, the combination with common battery and local battery telephone lines, of a cord circuit to be used with both kinds of lines, a common battery associated with the cord and adapted to be suitably connected with the first type of lines to furnish current thereover for the operation of the substation transmitters, supervisory signals associated with said cord circuit and adapted to be displayed by current from said common battery, and means

whereby when the cord is connected with the local battery lines the current from said source does not flow upon the line to an objectionable degree but does flow on the line sufficiently to operate the supervisory signals, substantially as described.

6. In a telephone system, the combination with common battery and local battery telephone lines, of a cord circuit adapted for connection between either different or like lines, a central source of current adapted to be suitably connected with the common battery lines to furnish current thereover for the operation of the substation transmitters, a supervisory signal associated with the cord and controlled during conversation with a local battery line by a relay actuated over the telephone line by current from said source flowing over the telephone line, and means whereby when the cord is connected with the local battery lines the said supervisory signal is operated in the same manner as with the common battery lines and current from the said source flows on the line sufficiently to control said signal but does not flow to an objectionable degree.

7. In a telephone system, the combination with common battery and local battery telephone lines, of a cord circuit adapted for connection between either different or like lines, a central source of current adapted to be suitably connected with the common battery lines to furnish current thereover for the operation of the substation transmitters, a supervisory signal associated with the cord and controlled during connections by current from said source flowing over the telephone line, and means whereby when the cord is connected with the local battery lines the supervisory signal is operated in the same manner as with the common battery lines and the current flowing in the line from said source is reduced but still flows sufficiently for the control of said signal, substantially as described.

8. In a telephone system, the combination with common battery and local battery telephone lines, of a cord circuit and a source of current associated therewith, to furnish current to the substation transmitters, supervisory-signal-controlling electromagnets associated with the cord circuit through which current is fed to the substations, and means for cutting down the current through said magnets when the cord is connected with the local battery lines whereby the current from the latter is reduced and the said magnets are still suitably operated for supervisory purposes, substantially as described.

9. In a telephone system, the combination with common battery and local battery telephone lines, of a cord circuit and a source of current associated therewith, to furnish current to the substation transmitters, supervisory-signal-controlling electromagnets as-

sociated with the cord circuit through which current is fed to the substations, and means for including a resistance in the circuit of said magnets when connection is established with local battery lines to cut down the current on such lines, the said magnets being still operated in the same manner for supervisory purposes, substantially as described.

10. In a telephone system, the combination with common battery and local battery telephone lines, of a cord circuit and a source of current associated therewith, to furnish current to the substation transmitters, supervisory-signal-controlling electromagnets associated with the cord circuit through which current is fed to the substations, means for including a resistance in the circuit of said magnets when connection is established with local battery lines to cut down the current on such lines, the said magnets being still operated in the same manner for supervisory purposes, and a high resistance coil on the said magnets cut into the circuit thereof when connection is established with local battery lines, substantially as described.

11. In a telephone system, the combination with common and local battery telephone lines, of a cord circuit to connect said lines together for conversation, relays associated with said cord circuit, supervisory

signals associated with said relays, and means whereby said relays will cooperate in a different manner to control said supervisory signals when the cord is connected to a local battery line from that in which they cooperate when the cord is connected to a common battery line, substantially as described.

12. In a telephone system, the combination with common and local battery telephone lines normally open to direct currents at the substations, of a cord circuit to connect said lines together for conversation, relays associated with said cord circuit, supervisory signals associated with said relays, and similarly displayed when the cord is connected either to a common or a local battery line, the signal for each end of the cord circuit being controlled over the talking strands in series of the line connected with that end of the cord circuit, substantially as described.

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

CHARLES S. WINSTON.
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Witnesses:

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