

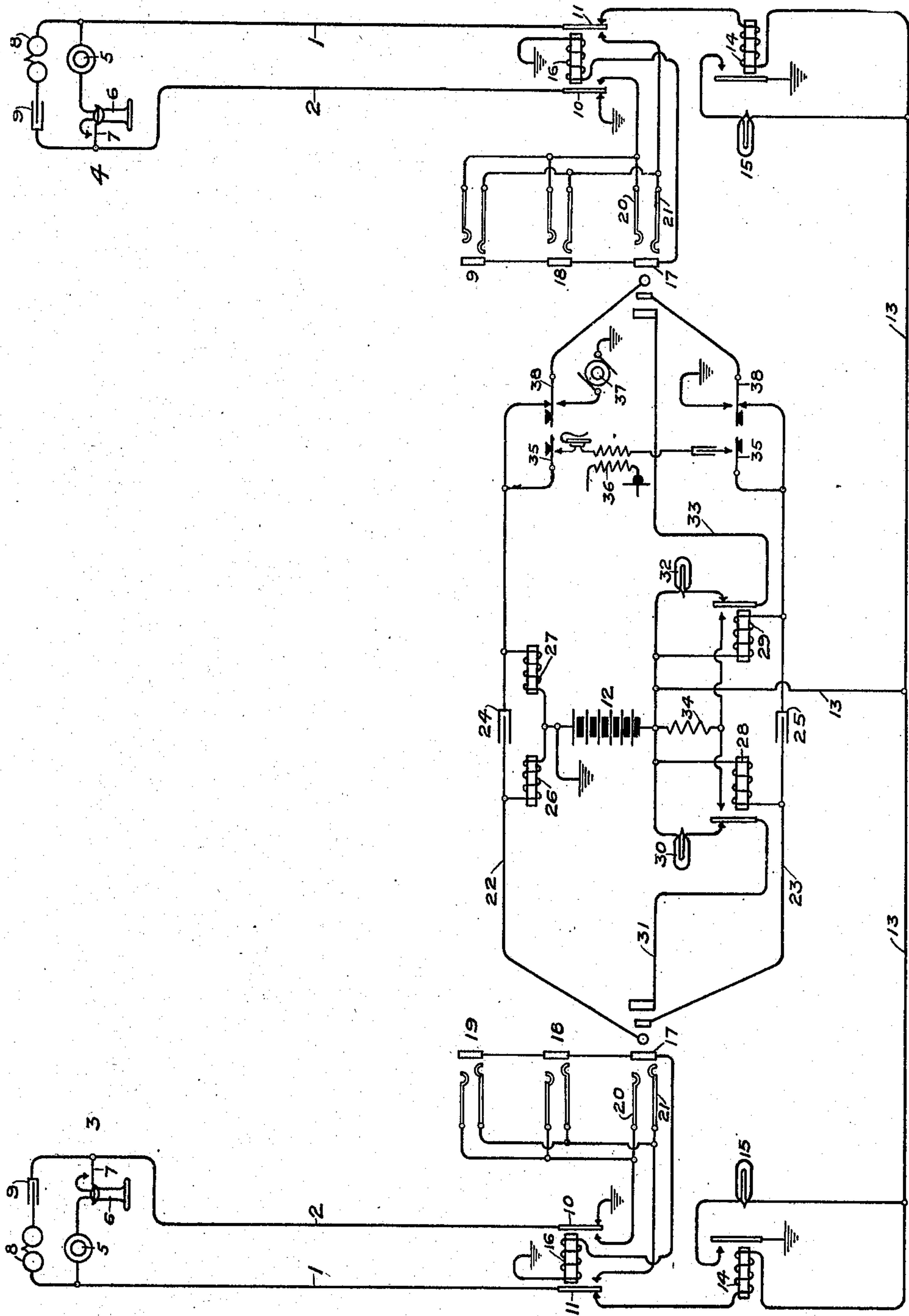
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C. A. SIMPSON.

THREE WIRE CENTRAL ENERGY TELEPHONE SYSTEM.

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THREE-WIRE CENTRAL-ENERGY TELEPHONE SYSTEM.

No. 885,186.

Specification of Letters Patent.

Patented April 21, 1908.

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To all whom it may concern:

Be it known that I, CHARLES A. SIMPSON, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Three-Wire Central-Energy Telephone Systems, of which the following is a specification.

My invention relates to a central energy telephone system of the three-wire type.

It is well known, that in systems usually designated as "two-wire systems", but two contacts are provided in each of the spring-jacks adapted to register with the tip and sleeve strands of the cord circuit when a connection exists with the line. In such systems it is necessary to obtain the busy test over a portion of the talking circuit and to use a portion of the talking circuit for the transmission of signals between the subscribers and the central office during conversation. In three-wire systems an additional contact is provided for the plugs and jacks and an additional wire extends throughout the multiple switchboard section of the lines. In this class of systems the additional or third wire is used for testing purposes and for the transmission of signals, these functions being performed independent of the talking circuit.

My invention consists of a simplified form of telephone system of the three-wire type, the arrangement being such as to produce a system that is economical to install and highly efficient in operation.

In the accompanying drawing I have illustrated an embodiment of my invention in which I have shown two subscribers' stations and a central office equipment, the parts being shown in their inoperative or normal condition.

Referring to the drawing, in which like reference numerals have been used so far as applicable, two telephone lines consisting of limbs 1 and 2 extend from the central office to the sub-stations 3 and 4. The sub-station apparatus is represented as consisting of a transmitter 5 and receiver 6 in a bridge of the line conductors normally open at the switch hook 7. A call bell 8 and condenser 9 are connected in a permanently closed bridge of the line conductors. This apparatus is only intended to typify any common battery subscriber's equipment.

The telephone lines terminate in contact

springs 10 and 11, contact spring 10 being normally connected with ground, and contact spring 11 being connected with the non-grounded pole of the central office battery 12 by means of conductor 13 and the winding of a line relay 14. The line relay is adapted to control through its normally-open contacts the circuit of a supervisory signal 15. The winding of the cut-off relay is connected between ground and the third contact or testing terminal 17 of the spring-jack of the line. Multiple jacks 18 and 19 are provided at the different sections of the switchboard as shown. The tip spring 20 and sleeve spring 21 of the jacks are connected with the front contact anvils of the cut-off relay, and are normally disconnected from the respective limbs of the telephone line.

The operator's cord circuit consists of the tip strand 22, and a sleeve strand 23 having interposed condensers 24 and 25 conductively separating said strands but inductively uniting them for the purpose of conversation. The central battery 12 is permanently connected in a bridge of the cord circuit, said bridge containing the windings of impedance coils 26 and 27 connected with the tip strand of the cord circuit, either side of the condenser 24, and the windings of supervisory relays 28 and 29 similarly connected with the sleeve strand thereof upon either side of the condenser 25. A supervisory lamp 30 has its circuit normally closed at the front contacts of the supervisory relay 28, the armature of said relay being connected with the third contact of the answering plug by means of conductor 31. A supervisory lamp 32 has its circuit normally closed at the front contacts of the supervisory relay 29, the armature of said relay being similarly connected with the third contact of the calling plug by conductor 33. A suitable resistance 34 is connected between the battery 12 and the front contact anvils of the relays 28 and 29, said resistance providing a path for current to maintain the cut-off relay 16 energized, when the circuits of the supervisory lamps are opened by the operation of the relays 28 and 29.

The operator's head telephone, the secondary of her induction coil and a condenser are adapted to be bridged between the strands of the cord circuit by means of a listening key 35. The primary of her induction coil 36 and a transmitter are indicated associated

therewith. A ringing generator 37 is adapted to be connected with the line by a suitable ringing key 38.

The operation of the system is as follows:

5 The subscriber at station 3 desiring to communicate with the subscriber at station 4, will remove his receiver from the switch hook, closing the limbs of the telephone line through his talking apparatus and energizing
10 the line relay 14 by current from the battery 12, over conductor 13, through the winding of said relay, the limbs of the telephone line, contact spring 10 of the cut-off relay 16 to ground, and back to the battery. The line
15 lamp 15 will be lighted, due to the operation of the line relay, to attract the attention of the operator. When a plug is inserted in the jack of the calling line, current will flow from battery 12 through the supervisory sig-
20 nal 30, the front contacts of the supervisory relay 28, conductor 31, testing contact 17 of the jack, and through the winding of the cut-off relay to ground. The cut-off relay will attract its armatures 10 and 11, remov-
25 ing the ground from the line conductor 2 and breaking the flow of current through the line relay 14 at contact spring 11, thus retiring the line signal 15. The operation of the cut-off relay also serves to connect the external
30 limbs of the telephone line with the jack springs 20 and 21, at the forward contacts of said relay. The supervisory signal 30 is not lighted however by current in this path, due to the fact that the subscriber's telephone is
35 off its hook and the path for current is at once closed through the supervisory relay 28. Current in this path flows from the battery 12 through the supervisory relay 28, sleeve strand 23, contact spring 21 of the jack, line conductor
40 1, through the substation apparatus, line conductor 2, jack spring 20 and the tip strand of the cord circuit to battery through the winding of the impedance coil 26. The winding of the supervisory relay 28 is thus
45 substituted in the tip side of the telephone line for the winding of the line relay 14. The operation of the relay 28 opens the circuit of the lamp 30 and connects the resistance 34 in the path of current to the cut-off relay. The operator will now connect her
50 telephone set with the line by means of the listening key 35 and communicate with the calling subscriber, to ascertain the number of the desired line. If the line wanted is busy,
55 that is, if a connection exists with the line at some other section of the switchboard, a potential above that of earth will exist at the sleeves of the multiple jacks of the line, due to a flow of current through the sleeve at the
60 switchboard section where the connection exists, as above described. Upon touching the tip of her plug to the test terminal of the line, therefore, a flow of current will result from the testing terminal, through the tip
65 strand of the cord and through the winding

of the impedance coil 27 to ground. This flow of current will vary the potential across terminals of the bridge containing the operator's telephone, and an inductive click will be produced therein to notify her that the
70 line is busy.

If the line is not in use the operator will insert the plug in the jack of the desired line. Current will then flow through the supervisory lamp 32, over conductor 33, the testing
75 contact 17 of the jack and through the cut-off relay as described with reference to the other side of the cord circuit, said relay attracting its armatures and connecting the external limbs of the telephone line with the
80 contacts 20 and 21 of the jack section thereof. The supervisory lamp 32 will respond to current in this path, due to the fact that the subscriber's telephone is upon its hook, and no flow of current results through the winding of
85 the supervisory relay 29. The supervisory lamp 32 will therefore remain lighted until the subscriber responds. The operator will then throw her ringing key to signal the desired subscriber, the ringing current flowing
90 from the generator 37 over the tip contacts of the inserted plug and jack, line conductor 2, through the substation ringing apparatus, line conductor 1, back to the generator, through the sleeve contacts of the plug and
95 jack and the grounded contact of the ringing key.

When the called subscriber responds by removing his receiver from its hook current will flow through the supervisory relay 29,
100 the sleeve contacts of the plug and jack, line conductor 1 through the substation apparatus, line conductor 2, tip contacts of the plug and jack, the tip strand of the cord circuit, to battery through the winding of the
105 impedance coil 27. The supervisory relay 29 will attract its armature extinguishing the lamp 32 and substituting the resistance 34 therefor. When either subscriber replaces his telephone at the conclusion of the conver-
110 sation the circuit through the corresponding supervisory relay will be broken, allowing the armature of said relay to drop back and close the circuit of the associated signal, thus indicating to the operator that the conversa-
115 tion has terminated. The removal of the plugs from the jacks restores all parts to normal condition.

What I claim as new and desire to secure by Letters Patent is: 120

1. In a telephone system, the combination with a pair of telephone lines, of a cord circuit for making connection therewith for conversation, a pair of terminals in the talking circuit of the line normally disconnected
125 therefrom, a signaling apparatus normally connected therewith, a third conductor isolated from the talking circuit, a supervisory signal in said third conductor, and means associated with said third conductor for dis- 130

connecting said signaling apparatus from the line, and connecting said terminals with the talking circuit, and further means for opening the circuit of said supervisory signal, substantially as described.

2. In a telephone system, the combination with a pair of telephone lines, of a cord circuit for making connection therewith for conversation, a third conductor at the central office isolated from the talking circuit, a cut-off relay in said conductor, a pair of terminals in the talking circuit normally disconnected from the line at the front contacts of said relay, a signaling apparatus for the line normally connected therewith at the back contacts of said relay, a supervisory signal and a source of current associated with the cord circuit, said signal being adapted to be actuated in series with said relay when the cord is connected with the line, a single supervisory relay for controlling the circuit of said signal, connected between said source and one strand of the cord circuit, and means operative in making a connection with the line for completing the talking circuit through said terminals, the circuit of said supervisory signal being controlled through the contacts of said supervisory relay, substantially as described.

3. In a telephone system, the combination with a pair of telephone lines, of a cord circuit for making connection therewith for conversation, a third conductor at the central office isolated from the talking circuit, a cut-off relay in said conductor associated with the line, a supervisory signal in a normally-closed branch of said third conductor associated with the cord circuit, a central source of current, a supervisory relay connected between said source and one strand of the cord circuit, a low resistance branch from said battery about said signal, adapted to be controlled by the contacts of said supervisory relay, a pair of terminals in the talking circuit normally disconnected from the line at the contacts of said cut-off relay, means operative in making connection with the line for completing the talking circuit through said terminals at the contacts of said cut-off relay, and opening the circuit of said signal at the contacts of said supervisory relay when the subscriber's telephone is off its hook, substantially as described.

4. In a telephone system, the combination with a pair of telephone lines, of a cord circuit for making connection therewith for conversation, a third conductor at the central office isolated from the talking circuit, a cut-off relay in said conductor associated with the line, a supervisory signal in said conductor associated with the cord circuit, a pair of terminals in the talking circuit normally disconnected from the line at the contacts of said cut-off relay, an impedance coil, a central source of current and a supervisory relay in a bridge of the cord circuit, a

normally-open low resistance branch circuit about said signal, and means operative in making connection with the line for completing the talking circuit through said terminals at the contacts of said cut-off relay, said supervisory relay being energized over the telephone line and said impedance coil, and being adapted to open the circuit of said signal and close said low resistance branch when the subscriber's telephone is in use, substantially as described.

5. In a telephone system, the combination with a pair of telephone lines, of a cord circuit for making connection therewith for conversation, a third conductor at the central office isolated from the talking circuit, a cut-off relay in said conductor associated with the line, a supervisory signal in said conductor associated with the cord circuit, a normally-open low resistance branch circuit about said signal, a pair of terminals in the talking circuit normally disconnected from the line at the contacts of said cut-off relay, an impedance coil, a central source of current and a supervisory relay in a bridge of the cord circuit, means operative in making connection with the line for completing the talking circuit through said terminals at the contacts of said cut-off relay, said supervisory relay being energized over the telephone line and said impedance coil, and being adapted to open the circuit of said signal and close said low resistance shunt when the subscriber's telephone is in use, a second impedance coil, and a second supervisory relay, said impedance coil and said supervisory relay being individual to the opposite side of the cord circuit and being in the bridge with said source, and a condenser in each strand of the cord circuit disposed between said impedance coils and said relays, substantially as described.

6. In a telephone system, the combination with a pair of telephone lines, of a cord circuit for making connection with the lines for conversation, a pair of talking strands and a third strand for the cord circuit, a cut-off relay for the line, a supervisory signal in said third strand adapted to be actuated in series with said cut-off relay when the cord is connected with the line over a path independent of the talking circuit, a source of current, a supervisory relay having its coil connected between one of the talking strands of the cord circuit and a pole of said source, the coil of said relay being out of the path of voice currents, said relay being under the control of the subscriber and controlling contacts in the circuit of said supervisory signal, substantially as described.

7. In a telephone system, the combination with a telephone line, of a cord circuit for making connection therewith, a pair of talking strands and a third conductor for the cord circuit, a source of current, an impe-

dance coil and a relay bridged between the talking strands of said cord circuit, a cut-off relay for the line, a supervisory signal for the cord circuit, means to complete the circuit of said cut-off relay and said supervisory signal over a path independent of the talking circuit when the cord is connected with the line, whereby the cut-off relay is actuated and the supervisory signal displayed, contacts of said cord relay controlling the circuit of said supervisory signal, said relay being actuated to efface said signal when the cord is connected with a line closed at the substation, substantially as described.

8. In a telephone system, the combination with a telephone line, of a cord circuit to connect therewith for conversation, a pair of talking strands and a third conductor for said cord circuit, a supervisory signal in said third conductor, a resistance coil normally in an open circuit, a source of current an impedance coil and a relay bridged between the talking strands of the cord circuit, said relay being under the control of the subscriber when the cord is connected with the line, contacts of said relay adapted by their actuation to sever said supervisory signal from said third conductor and to include said resistance coil in said third conductor, a cut-off relay for the line adapted to be connected in series with said third conductor when the cord is connected with the line, whereby said relay is actuated and the supervisory signal is displayed when the cord relay is unactuated, said cut-off relay being adapted to be actuated over said third conductor and said resistance coil when the cord relay is actuated, substantially as described.

9. In a telephone system, the combination with a telephone line, of a cord circuit for making connection therewith for conversation, a source of current and a third conductor for the cord circuit, a supervisory signal included between said source and said third conductor, a cut-off relay for the line actuated over a path independent of the talking circuit and including said third conductor, a relay connected between said source and one

of the strands of the cord circuit, said relay being out of the path of voice currents and under the control of the subscriber when the cord is connected with the line, said relay controlling contacts in the circuit of said supervisory signal, substantially as described.

10. In a telephone system, the combination with a telephone line, of a cord circuit to connect therewith for conversation, a source of current and a third conductor associated with the cord circuit, a pair of parallel paths between said source and said third conductor, a supervisory signal in one of said paths, a cut-off relay for the line actuated by current over a path independent of the talking circuit and including said third conductor when the cord is connected with the line, and a relay in a bridge of the talking strands of the cord circuit and under the control of the subscriber having contacts for including either of said parallel paths in said third conductor, whereby said supervisory signal may be either displayed or effaced, substantially as described.

11. In a telephone system, the combination with a telephone line, of a cord circuit to connect therewith for conversation, a cut-off relay for the line having its coil connected with the test contacts of the line, a source of current, a supervisory signal for the cord circuit normally connected between said source and the sleeve contact of the cord circuit, whereby said signal and said cut-off relay are actuated in series over a path independent of the talking circuit when the cord is connected with the line, and a relay for the cord circuit in a bridge of the talking strands thereof for controlling the circuit of said signal when the cord is connected with a line, substantially as described.

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

CHARLES A. SIMPSON.

Witnesses:

CURTIS B. CAMP,
E. F. GRIER.