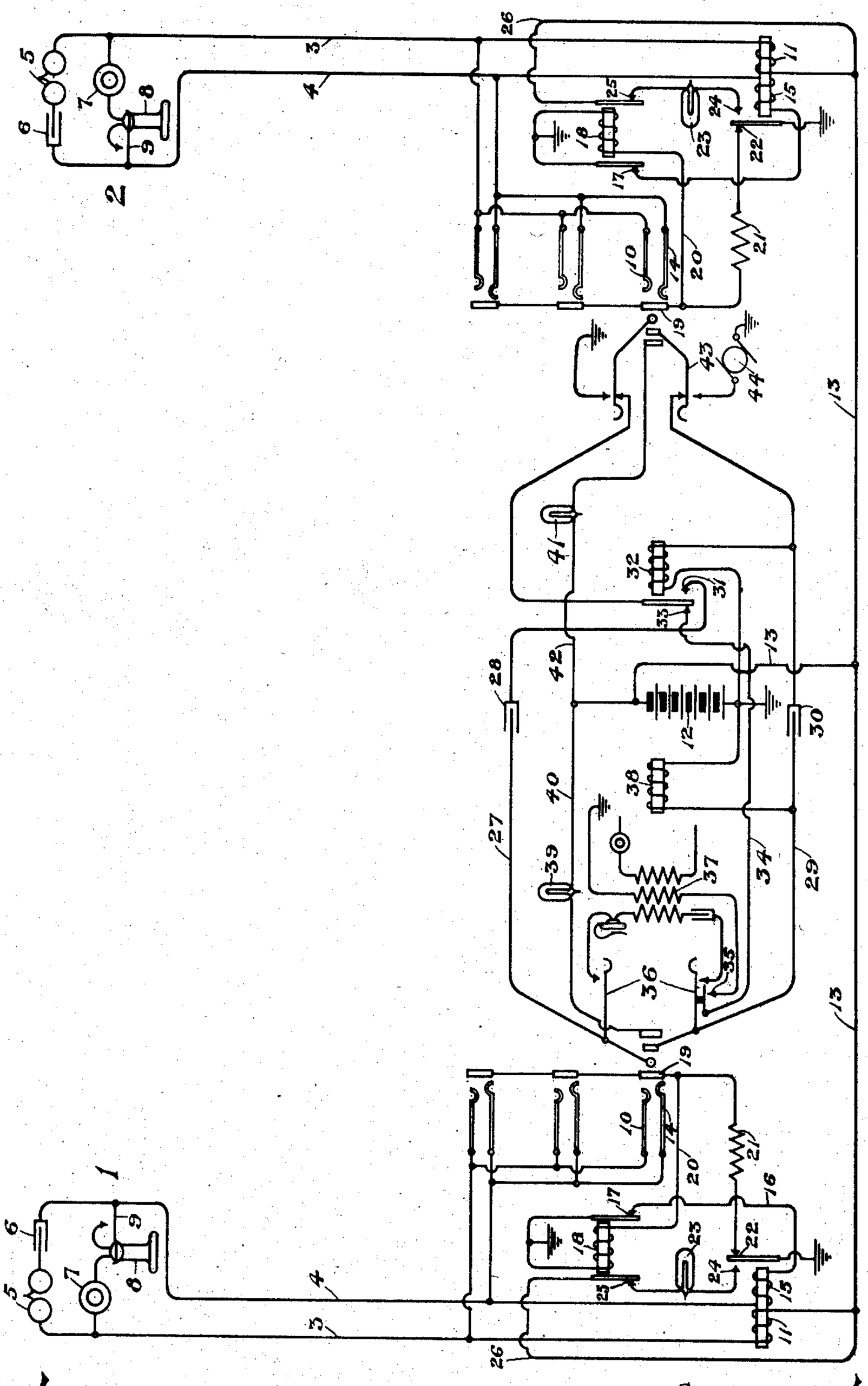
No. 874,147. PATENTED DEC. 17, 1907.

C. S. WINSTON.

THREE WIRE MULTIPLE SYSTEM.

APPLICATION FILED MAR. 12, 1906.



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THREE-WIRE MULTIPLE SYSTEM.

No. 874,147. Specification of Letters Patent. Patented Dec. 17, 1907.

Application filed March 12, 1906. Serial No. 305,512.

To all whom it may concern:

Be it known that I, CHARLES S. WINSTON, 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 Three-Wire Multiple Systems, of which the following is a specification.

My invention relates to a common battery telephone system of the type known as three-wire systems in which two wires extend throughout the multiple of the switchboard section of the lines for talking purposes, and a third wire is provided for testing and signaling purposes.

My object is to produce a system of this general type embodying a simplified circuit arrangement and in which a positive and efficient operation of the signals between the subscribers' stations and the central office is secured.

I have shown one embodiment of my invention in the accompanying drawing in which subscribers' stations 1 and 2 are shown extending to the central office by means of line conductors 3 and 4.

I have indicated the subscribers' apparatus as consisting of a call bell 5 and condenser 6 in a normally-closed bridge of the line conductors and a transmitter 7 and receiver 8 in a bridge of said conductors normally open at the switch hook 9 when the subscriber's telephone is in use.

At the central office the line conductor 3 terminates in the tip jack spring 10 and is permanently secured to one side of the winding 11 of the line relay, the opposite side of said winding being connected with the central office battery 12 by means of conductor 13. Line conductor 4 terminates in the sleeve jack spring 14, said line conductor being also connected with one side of the winding 15 of the line relay, the opposite side of said winding being connected by means of conductor 16 and the normally-closed contacts 17 of the cut-off relay 18 to the grounded side of the central office battery. A third contact or testing terminal 19 of the jacks is connected by means of conductor 20 with one side of the winding of the cut-off relay, the other side of said winding being connected to the grounded side of the central office battery. The jack contacts of each line are multipled at the different sections of the switchboard as shown. A comparatively low resistance coil 21 is connected between the testing terminal 19 of the jacks and the grounded side of the battery through the normally-closed back contacts 22 of the line relay. A line signal 23 has its circuit normally open at the front contact 24 of the line relay and normally closed at the back contact 25 of the cut-off relay, said signal being adapted to receive current over conductor 26 when the line relay is energized.

The operator's cord circuit consists of a tip strand 27 having an interposed condenser 28 and a sleeve strand 29 having an interposed condenser 30. The tip strand is normally open at the front contact 31 of the relay 32, the normally closed contact 33 of said relay connecting the calling end of the tip strand, by means of conductor 34, and the normally open contact 35 carried upon the listening key 36, with a tertiary winding 37 of the operator's induction coil, the opposite side of said coil being connected with ground. The relay 32 is connected between the grounded side of the battery 12 and the sleeve strand of the cord circuit upon one side of the condenser 30 and an impedance coil 38 is connected between the grounded side of the battery and the sleeve strand of the cord circuit upon the opposite side of said condenser.

A supervisory signal 39 is connected between the non-grounded side of the battery 12 and the third contact of the answering plug by conductor 40, and a supervisory signal 41 is similarly connected with the calling side of the cord circuit by means of conductor 42. The operator's head telephone, the secondary of her induction coil and a condenser are adapted to be bridged across the strands of the cord circuit by means of the listening key 36 in the usual manner. A ringing key 43 is adapted to bridge the ringing generator 44 across the limbs of the telephone line for the purpose of signaling the desired subscriber.

In the operation of the system, the removal of the receiver from the telephone hook at station 1 would permit a flow of current from the battery 12 over conductor 13, winding 11 of the line relay, the limbs of the telephone line including the substation apparatus, winding 15 of the line relay, conductor 16, and the normally-closed contacts 17 of the cut-off relay 18 to the grounded side of the battery. The coils 11 and 15

of the line relay are wound in the same direction so that their magnetic influence is added, and the armature of said relay is attracted to close the circuit of the line signal 23 at the front contact 24 of said relay. The line lamp is, therefore, lighted by current over conductors 13 and 26 and contacts 25 and 24 of the cut-off and line relays. Noticing the signal the operator will insert the answering plug of one of her cord circuits in the jack of the calling line. Current will then flow from the battery 12 over conductor 40 through the supervisory signal 39, testing terminal 19, conductor 20 and the winding of the cut-off relay 18 to battery. The cut-off relay is of sufficiently high resistance to prevent the supervisory signal obtaining sufficient current over this path for its illumination. It will be noted that the low resistance shunt 21, is open at the contacts of the line relay and all the current is obliged to pass through the winding of the cut-off relay, which is operated and attracts its armatures, removing the ground connection from the winding 15 of the line relay at its normally-closed contacts 17, and opening the circuit of the line lamp 23 at its normally-closed contacts 25. The line signal is thus effaced, and the impedance 38 is substituted in the sleeve side of the line in place of the coil 15 of the line relay. The balanced condition of the circuit is therefore not disturbed by the operation of the cut-off relay. The coil 11 is, however, sufficient to maintain the line-relay actuated as long as the subscriber's receiver is in use, preventing connection with the low resistance shunt 21, and the supervisory signal 39 remains dark. The current previously flowing through coil 15 of the line relay now flows from line conductor 4, over the sleeve contacts of the plug and jack, sleeve strand 29 of the cord circuit, and the winding of the impedance coil 38 to the grounded side of the battery. The operator may now communicate with the calling subscriber by bridging her telephone set across the line by means of the listening key 36, said operation connecting the tertiary winding 37 of her induction coil with the tip of the calling plug by means of the normally-open contact 35 carried by the listening key. Upon ascertaining the number of the subscriber desired the operator will test the condition of the line in the usual manner by touching the tip of her calling plug to the testing terminal 19 of the desired line. If the line is busy a potential above that of ground will exist upon the sleeve of the line tested, which will produce a flow of current over the tip strand of the cord circuit to conductor 34, contact 35, the listening key being thrown, and the tertiary winding 37 of the operator's induction coil to ground, producing an inductive click in the operator's head receiver and notifying her that the line is busy. If no connection exists with the desired line at any of the other switchboard sections, the testing terminals of said line will be connected to ground through the winding of the cut-off relay, and the operator's testing strand being also connected with ground through the normally-open contacts carried by her listening key, no flow of current will result.

Upon finding the line idle the operator will insert her calling plug into the jack of the desired line, causing a flow of current from the battery 12 over conductor 42, supervisory signal 41, testing terminal 19 of the jack, conductor 20 and the winding of the cut-off relay 18 to ground, which will attract its armature, opening the circuit of the line lamp 23, and removing the ground connection from the winding 15 of the line relay. Due to the fact that the telephone receiver of the called subscriber is upon its hook, no flow of current will result through the winding 11 of the line relay, and the comparatively low resistance path 21 will be connected with ground, in parallel with the winding of the cut-off relay, at the normally closed contact 22 of the line relay. This low resistance path in parallel with the cut-off relay, will permit the supervisory lamp 41 to receive sufficient current for its illumination, thus notifying the operator of the condition of the sub-station apparatus. The operator will now connect the ringing generator with the sleeve side of the line to signal the subscriber, current flowing from said generator to the sleeve contacts of the plug and jack, line conductor 4, substation signaling apparatus, line conductor 3, tip contacts of the jack and plug and back to the generator through the grounded contacts of the ringing key. Upon the response of the called subscriber a path for current is completed from the battery 12 over conductor 13, the winding 11 of the line relay, line conductor 3, the sub-station apparatus, line conductor 4, jack sleeve contact 14, the sleeve strand of the cord circuit, and the winding of the relay 32 to the battery. The flow of current in this path will cause the operation of the line relay, which will open the circuit of the low resistance 21 at the normally-closed back contact of said relay, thus extinguishing the supervisory signal 41, said signal not receiving sufficient current through the winding of the high resistance cut-off relay 18 to cause its illumination. The relay 32 is also operated by current in this path severing the connection between the calling end of the tip strand and conductor 34, and uniting the normally severed parts of said strand for conversation. The subscribers are now in communication for conversation. The impedance of the windings 11 of the line relays, and the coils 32 and 38, prevent shunting of the voice currents, said currents being inductively com-

municated from one side of the cord circuit to the other by means of the condensers 28 and 30. Each subscriber by replacing his receiver upon the hook will interrupt the flow of current through the winding 11 of the line relay, permitting its armature to drop back and inserting the low resistance 21 in parallel with the winding of the cut-off relay, thus permitting sufficient current to flow through the associated supervisory signal to illuminate the same, indicating to the operator that the conversation has terminated. The removal of the plugs from the jacks restores all parts to normal condition.

What I claim is:

1. In a telephone system, the combination with a pair of telephone lines, of a cord circuit for making connection therewith for conversation, a line relay permanently connected with the line, a third conductor at the central office, a cut-off relay permanently connected with said third conductor and controlling contacts normally in the circuit of the line, a supervisory signal in said third conductor associated with the cord circuit, and a low resistance path in parallel with the portion of said conductor associated with the line, said supervisory signal receiving insufficient current for its operation when said low resistance path is open, said path being closed at the contacts of said line relay when the subscriber's telephone is not in use and a connection exists with the line, whereby said signal is operated, 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 line relay permanently connected with the line, a third conductor at the central office, a cut-off relay permanently connected with said third conductor and controlling contacts in the circuit of the line, a signal for the line having its circuit jointly controlled by the contacts of said relays, a supervisory signal in said third conductor associated with the cord circuit, and a low resistance path in parallel with the portion of said conductor associated with the line, said supervisory signal receiving insufficient current for its operation when said low resistance path is open, said path being closed at the contacts of said line relay when the subscriber's telephone is not in use and a connection exists with the line, whereby said signal is operated, 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 line relay permanently connected with the line, two windings for said relay, one in the circuit of each line conductor, a central source of current at the central office, an impedance coil between said source and one strand of the cord circuit, a third conductor at the central office, a cut-off relay permanently connected with said third conductor, a supervisory signal in said third conductor associated with the cord circuit, and a low resistance path in parallel with the said conductor associated with the line, said supervisory signal receiving insufficient current for its operation when said low resistance path is open, said path being closed by the contacts of said line relay when the subscriber's telephone is not in use, said impedance coil being substituted in the line for one of the windings of said line relay when a connection is established with the line, 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 line relay permanently connected in the path of current to the substation, a source of current associated with the cord circuit, a third conductor in the cord circuit containing a supervisory signal permanently connected with said source, a coöperating third conductor associated with the line having two parallel branches, a cut-off relay in one of said branches of sufficiently high resistance to prevent the operation of said signal and controlling contacts in the circuit of the line, the other of said branches being of sufficiently low resistance to permit the operation of the supervisory signal, and means associated with said line relay for closing said low resistance branch when the subscriber's receiver is not 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 line relay permanently connected in the path of current to the substation, and having one winding in the circuit of each line conductor, a source of current associated with the cord circuit, an impedance coil connected between one side of said source and one strand of the cord circuit, a third conductor in the cord circuit containing a supervisory signal permanently connected with said source, a coöperating third conductor associated with the line having two parallel branches, a cut-off relay in one of said branches of sufficiently high resistance to prevent the operation of said signal, the other of said branches being of sufficiently low resistance to permit the operation thereof, said impedance coil being substituted in the line circuit for one winding of said line relay during conversation, and means associated with said relay for closing said low resistance branch when the conversation has terminated, substantially as described.

6. In a telephone system, the combination with a pair of telephone lines, of a cord circuit for making connection therewith for con-

versation, a line relay permanently connected in the path of current to the substation, and having one winding in the circuit of each line conductor, a source of current associated with the cord circuit, an impedance coil connected between one side of said source and one strand of the cord circuit, a third conductor in the cord circuit containing a supervisory signal permanently connected with said source, a coöperating third conductor associated with the line having two parallel branches, a cut-off relay in one of said branches of sufficiently high resistance to prevent the operation of said signal, the other of said branches being of sufficiently low resistance to permit the operation thereof, a line signal for the line having its circuit normally closed at the contacts of said cut-off relay and normally open at the contacts of said line relay; said impedance coil being substituted in the line circuit for one winding of said line relay during conversation, and means associated with said relay for closing said low resistance branch when the conversation has terminated, substantially as described.

7. In a telephone system, the combination with a pair of telephone lines, of a cord circuit for making connection therewith for conversation, a line relay permanently connected in the path of current to the substation, and having one winding in the circuit of each line conductor, the circuit of said windings being completed through the normally-closed contacts of the said cut-off relay, a source of current associated with the cord circuit, an impedance coil connected between one side of said source and one strand of the cord circuit, a third conductor in the cord circuit containing a supervisory signal permanently connected with said source, a coöperating third conductor associated with the line having two parallel branches, a cut-off relay in one of said branches of sufficiently high resistance to prevent the operation of said signal, the other of said branches being of sufficiently low resistance to permit the operation thereof, a line signal for the line having its circuit normally closed at the contacts of said cut-off relay and normally open at the contacts of said line relay, said impedance coil being substituted in the line circuit for one winding of said line relay during conversation, and means associated with said relay for closing said low resistance branch when the conversation has terminated, substantially as described.

8. In a telephone system, the combination with a telephone line, of a line relay, a cord circuit for making connection with the line for conversation, a source of current associated with the cord circuit, an impedance connected between said source and a strand of the cord circuit, a supervisory signal in a local circuit of said source, a cut-off relay in the path of current through said supervisory signal, and means associated with said line relay for rendering said signal inert during conversation, subtantially as described.

9. In a telephone system, the combination with a telephone line, of a central source of current, a line relay permanently connected between a pole of said source and a limb of said line, a cut-off relay controlling normally closed contacts in the circuit of the other limb of said line, a cord circuit, a third conductor, a supervisory signal for the cord circuit, said signal and the coil of said cut-off relay being connected in said third conductor, a path in parallel with the winding of said cut-off relay, said supervisory signal receiving insufficient current for its operation when the parallel path is open, said path being closed by contacts of said line relay when the subscriber's telephone is not in use, substantially as described.

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

CHARLES S. WINSTON.

Witnesses:
C. C. BRADBURY,
E. F. GRIER.