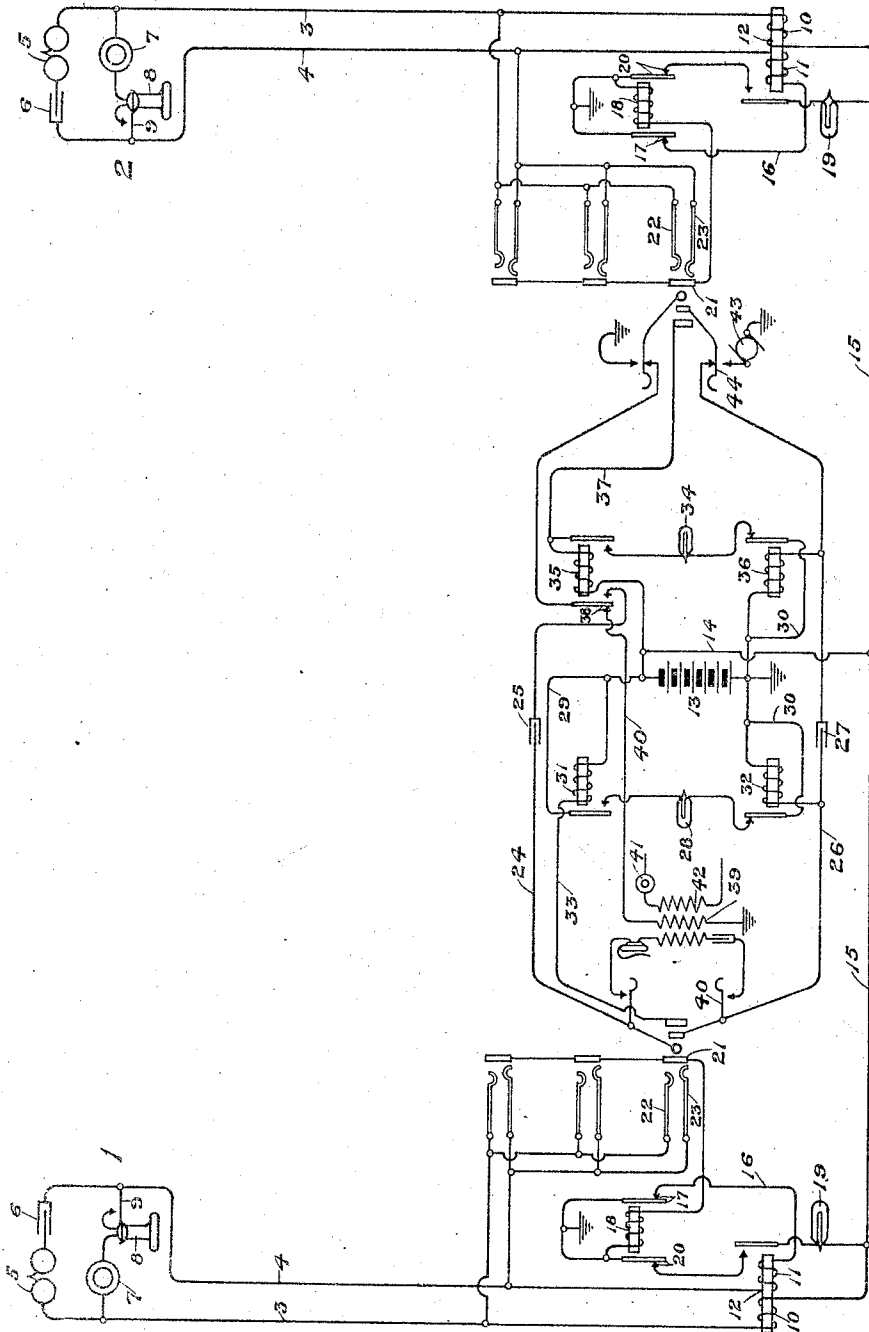


C. S. WINSTON.
THREE WIRE TELEPHONE SYSTEM.
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Patented Jan. 5, 1909.



Witnesses
a. Dahl
C. Bradbury.

Charles S. Winston
Inventor
By Curtis B. Camp.
Attorney

UNITED STATES PATENT OFFICE.

CHARLES S. WINSTON, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD & SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

THREE-WIRE TELEPHONE SYSTEM.

No. 908,926.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES S. WINSTON, a citizen of the United States, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Three-Wire Telephone Systems, of which the following is a specification.

My invention relates to central energy telephone systems of the three-wire type as distinguished from systems employing only two conductors in the multiple switchboard section of the lines. In such two-wire systems it is necessary to use a part of the talking circuit for the purpose of testing the idle or busy condition of the lines, and for signaling purposes between the substations and the central office. In three-wire systems an additional conductor is provided for testing and signaling purposes, so that these functions may be performed entirely independent of the talking circuit.

The objects of my invention are to provide a system of the latter class that will be simple in operation and inexpensive to install and one that will be free from possible voice current shunts other than those necessary to furnish the energy to the lines for conversation, and from impedance in the talking circuit, whereby a high degree of efficiency is obtained.

My invention is illustrated in the accompanying drawing in which the figure is a diagram showing two subscribers' lines and a central office equipment for connecting the lines for conversation.

Referring to the drawing, two subscribers' stations 1 and 2 are shown connected with the central office by means of line conductors 3 and 4. I have indicated a common battery substation outfit at the subscribers' stations consisting of the call bell 5 and condenser 6 in a permanent 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.

At the central office the limbs of the telephone lines terminate in the windings 10 and 11 of a line relay 12, the winding 10 being connected with the non-grounded pole of the central office battery 13 by means of conductors 14 and 15, and the coil 11 being connected to ground through the conductor 16 and the normally-closed contacts 17 of the

cut-off relay 18. A line lamp 19 is connected between the conductor 15 and ground through normally-open contacts of the line relay 12 and the normally-closed contacts 20 of the cut-off relay 18. The winding of the cut-off relay is connected between ground and the testing terminal 21 of the answering jack, said terminal and the tip and sleeve springs 22 and 23 of the jacks being multipled at the different sections of the switchboard.

The operator's cord circuit consists of a tip strand 24 having an interposed condenser 25 and a sleeve strand 26 having an interposed condenser 27. A supervisory signal 28 is provided for the answering side of the cord circuit, said signal being connected with the opposite poles of the battery 13 by means of conductors 29 and 30, and having the continuity of its circuit normally open at the front contact of supervisory relay 31 and normally closed at the back contact of the supervisory relay 32. The relay 31 is connected between the non-grounded side of the battery 13 and the third contact of the plug by means of a conductor 33 and relay 32 is connected between the grounded pole of said battery and the sleeve strand of the cord circuit. A supervisory signal 34 is similarly connected with reference to battery 13 upon the opposite side of the cord circuit and has the continuity of its circuit similarly controlled by the normally-open contacts of a supervisory relay 35, and the normally-closed contacts of a supervisory relay 36. The relay 35 has one side of its winding connected with the non-grounded pole of battery 13, the other side thereof being connected to the third contact of the calling plug by conductor 37, and the relay 36 is connected between the grounded side of the battery 13 and the sleeve strand of the cord circuit. A second pair of normally-closed contacts 38 are provided for the supervisory relay 35, the contact anvil of said pair being connected with the tertiary winding 39 of the operator's induction coil by means of conductor 40. The operation of the supervisory relay 35 severs the connection between the tip strand and the tertiary winding, and unites the normally-severed tip strand of the cord circuit at the front contacts of said relay for conversation.

A listening key 40 is provided adapted to

bridge the operator's telephone across the cord circuit in the usual manner; the transmitter 41 and the primary of the operator's induction coil 42 may be supplied with current by the battery 13 or from any suitable source. A ringing generator 43 is adapted to be connected with the limbs of the telephone line by means of a ringing key 44 for the purpose of signaling the desired subscriber.

10 In the operation of the system the subscriber at station 1, desiring to attract the attention of the operator, will remove his receiver from the switch hook and close a path for current from the battery 13 over conductors 14 and 15, the winding 10 of the line relay 12, limbs 3 and 4 of the telephone line including the substation apparatus, winding 11 of the line relay, conductor 16 and contact 17 of the cut-off relay 18 to ground. The line relay will attract its armature, closing the circuit of the line signal 19 from conductor 15 to ground through the normally-closed contacts 20 of the cut-off relay. Upon noticing the signal the operator will raise the plug of the cord circuit and insert the same in the answering jack of the calling line. Upon the insertion of the plug a path for current will be closed through the winding of the supervisory relay 31, conductor 33, testing terminal 21, and the winding of the cut-off relay to ground. Both relays in this path will be energized, the cut-off relay opening the circuit of the line lamp 19 at its normally-closed contacts 20 and removing the ground connection from the sleeve side of the line at its normally-closed contacts 17. The relay 31 will close the circuit of the supervisory signal 28 at the normally-open contacts of said relay. The supervisory signal 28 would not be lighted, however, due to the energization of the supervisory relay 32 in response to a flow of current over the telephone line; this flow of current may be traced from the battery 13 over conductors 14 and 15, winding 10 of the line relay, line conductor 3, the substation apparatus, line conductor 4, sleeve spring 23 of the jack and the corresponding plug contact, sleeve strand 26 of the cord circuit, and the winding of said relay to battery. It will be seen, therefore, that the signal 28 will remain dark during conversation, due to the fact that the circuit of said signal is jointly controlled by the relays 31 and 32, the former over a path local to the central office, and the latter over a path including the substation apparatus and depending for its operation upon the position of the subscriber's telephone receiver. Upon moving her listening key 40 and bridging her telephone set across the cord circuit the operator would be in communication with the calling subscriber. Upon learning the number of the line wanted its condition would be tested in the usual manner by touching the tip of the plug to the testing terminal of the line wanted. If a connection existed with the line at another position of the switchboard the testing terminals throughout the multiple of that line would be raised to a potential above that of ground, due to the flow of current through the terminal at said position, to operate the cut-off relay. Upon touching the tip of her plug to a multiple testing terminal of a busy line a flow of current would result from the test ring over the tip strand of the cord circuit, conductor 40, through the tertiary winding 39 of the operator's induction coil to ground. This flow of current would produce an inductive click in the operator's head receiver, notifying her of the busy condition of the line. Finding the line idle the operator would insert the plug in the jack of the line wanted. On the insertion of the plug current would flow through the supervisory relay 35, and the cut-off relay 18, as described with reference to the answering side of the cord circuit. The operation of the cut-off relay would open the circuit of the line signal 19 at the normally-closed contacts 20 of said relay and remove the ground from the sleeve side of the telephone line at its normally-closed contacts 17, preventing the operation of the line relay 12. The operation of the supervisory relay 35 closes the circuit of the supervisory lamp 34 at the normally-open contacts of said relay and severs the connection between the tip strand of the cord circuit and the tertiary winding of the operator's induction coil at its normally-closed contacts, uniting the normally-severed parts of said strand for conversation. Due to the fact that the called subscriber's telephone was upon its hook no flow of current would result through the supervisory relay 36 and the supervisory lamp 34 would be lighted to indicate this fact to the operator. The operator would then throw her ringing key 44 to signal the subscriber, the path for ringing current being from the generator 43 over the sleeve contacts of the plug and jack, line conductor 4, substation ringing apparatus, line conductor 3, tip strand of the plug and jack, and back to the generator through the grounded contact of the ringing key. Upon the response of the called subscriber supervisory relay 36 would be energized to extinguish the lamp 34 over a path including conductors 14 and 15, winding 10 of the line relay, line conductors 3 and 4 including the substation apparatus, the sleeve strand of the cord circuit and the winding of the supervisory relay 36 to battery. The subscribers would then be in communication, the talking currents being propagated from one line to the other through the interposed condensers 25 and 27 in the strands of the cord circuit. Either subscriber placing his receiver upon the hook at the termination of the conversation would deenergize the corresponding supervisory re-

lay 32 or 36, permitting the armatures of said relays to drop back and light the associated supervisory signal to inform the operator that the conversation had terminated.
 5 Upon withdrawing the plugs from the jacks all parts of the system would be restored to normal condition.

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

10 1. In a telephone system, the combination with a telephone line, 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
 15 relay and a supervisory relay in said third conductor, a line relay permanently connected with the line, a source of current, a second supervisory relay connected between said source and the sleeve strand of the cord
 20 circuit, and a supervisory signal having its circuit jointly controlled by the contacts of said supervisory relays, substantially as described.

2. In a telephone system, the combination
 25 with a telephone line, 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 and a supervisory relay in said third
 30 conductor, a line relay permanently connected with the line, a source of current, a second supervisory relay connected between said source and the sleeve strand of the cord circuit, and a supervisory signal having its
 35 circuit normally open at the contacts of said supervisory relay associated with said third conductor and normally closed at the contacts of said last mentioned supervisory relay, substantially as described.

40 3. In a telephone system, the combination with a telephone line, 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
 45 relay and a supervisory relay in said third conductor, a line relay having two windings, one permanently connected with each line conductor, and a line signal having its circuit completed through the contacts of said line
 50 and cut-off relays, a source of current, a second supervisory relay connected between said source and the sleeve strand of the cord circuit, and a supervisory signal having its circuit normally open at the contacts of said
 55 supervisory relay associated with said third conductor, said relay being in a circuit local to the central office, and normally closed at the contacts of said last mentioned relay, said relay being in the path of current to the
 60 substation, substantially as described.

4. In a telephone system, the combination with a telephone line, of a cord circuit for making connection therewith for conversation, a third conductor at the central office
 65 isolated from the talking circuit, a cut-off

relay and a supervisory relay in said third conductor, a line relay having two windings, one permanently connected with each line conductor, a line signal having its circuit completed through the contacts of both said
 70 relays, a source of current, a second supervisory relay connected between said source and the sleeve strand of the cord circuit, said second supervisory relay being substituted in the line for one of the windings of said
 75 line relay when a connection is established for conversation, and a supervisory signal having its circuit normally open at the contacts of said supervisory relay associated with said third conductor, and normally
 80 closed at the contacts of said last-mentioned supervisory relay, substantially as described.

5. In a telephone system, the combination with a telephone line, of a cord circuit for connecting therewith, a third conductor at
 85 the central office, a cut-off relay and a supervisory relay in said third conductor, a line relay permanently connected with the line, a source of current, a second supervisory relay connected between said source and a
 90 strand of the cord circuit, and a supervisory signal in a circuit having series contacts therein, one pair being controlled by each of said supervisory relays, substantially as described.

6. In a telephone system, the combination with a telephone line, of a cord circuit for making connection therewith, a third conductor at the central office isolated from the talking circuit, a cut-off relay and a super-
 100 visory relay in said third conductor, a line relay connected with the line during conversation, a second supervisory relay connected between said source and a strand of the cord circuit, and a supervisory signal having its
 105 circuit jointly controlled by the contacts of said supervisory relays, substantially as described.

7. In a telephone system, the combination with a telephone line, of a cord circuit con-
 110 nected therewith, a third conductor isolated from the talking circuit, a cut-off relay and a supervisory relay in said third conductor, a source of current, a line relay with its winding permanently connected between a limb
 115 of the line and a pole of said source, a second supervisory relay connected between the other pole of said source and a strand of the cord circuit, and a supervisory signal having its circuit jointly controlled by the contacts
 120 of said supervisory relays, substantially as described.

8. In a telephone system, the combination with a telephone line, of a cord circuit con-
 125 nected therewith, a third conductor isolated from the cord circuit, a supervisory relay in said third conductor, a source of current, a line relay connected between a pole of said source and a limb of the telephone line, a
 130 second supervisory relay connected between

the other pole of said source and the strand of said cord circuit connecting with the other limb of the telephone line, and a supervisory signal having its circuit jointly controlled by the contacts of said supervisory relays, 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. B. CAMP,

C. C. BRADBURY.