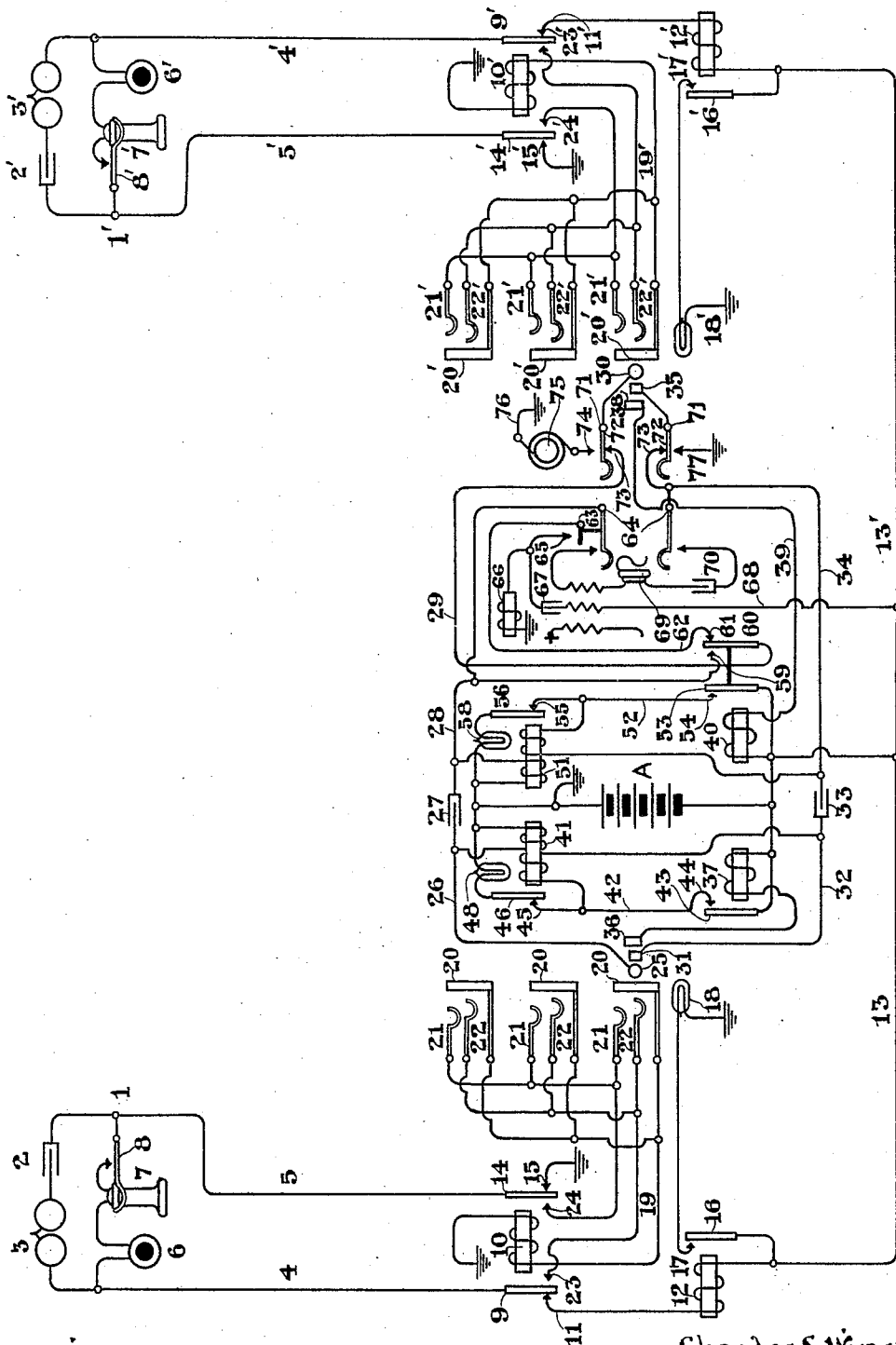


C. S. WINSTON.
TELEPHONE SYSTEM.
APPLICATION FILED NOV. 29, 1907.

933,150.

Patented Sept. 7, 1909.



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TELEPHONE SYSTEM.

933,150.

Specification of Letters Patent.

Patented Sept. 7, 1909.

Application filed November 29, 1907. Serial No. 404,221.

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 Telephone Systems, of which the following is a specification.

My invention relates to telephone systems, and particularly to that class having three conductor multiple jacks at the central office and having cord circuits with three conductor plugs to register with the conductors of the line jacks.

In systems of this character it is the common practice to furnish current for the operation of the substation transmitters from a source which is permanently associated with the cord circuit, the opposite poles of this source being connected through impedances with the two talking strands of the cord circuit. The third conductor of the cord circuit is usually connected either directly or through relays or other signaling devices with one of the poles of this same source. It has been found with this arrangement that when the operator inserts the answering plug into the jack of the calling line the middle or ring contact of the plug often touches the sleeve contact of the jack as the plug is being inserted. This causes the cut-off relay to be actuated and it is usually allowed to fall back to its normal position and be again actuated when the ring contact of the plug is separated from the sleeve contact of the jack and the sleeve contact of the plug is connected with the sleeve contact of the jack. This making and breaking of the circuit through the cut-off relay causes it to chatter its contacts and thereby to open and close the circuit through the substation receiver in such manner that the calling subscriber receives a sharp and objectionable noise in his ear.

It is the object of the present invention to obviate this objectionable interruption of the receiver circuit of the calling subscriber. In order to accomplish this result the system of my invention is provided with normally open contacts in the circuit between the ring of the plug and the source of current associated with the cord circuit, this contact not being closed until the plug is inserted far enough for the sleeve of the plug to make good connection with the sleeve of the jack.

Other objects of my invention will be dis-

tinctly brought out in the following description and claims.

My invention is illustrated in the accompanying drawing in which all apparatus is shown in its normal and unactuated condition.

The subscriber's station 1 is equipped with the condenser 2 and annunciator 3 in a permanent bridge between the line conductors 4 and 5 and with the transmitter 6 and receiver 7 in a bridge maintained normally open by the contacts of the switch hook 8. At the central office the line conductor 4 is connected with the spring contact 9 of the cut-off relay 10 and thence through the normally closed contact 11 and the coil of line relay 12 over conductor 13 to the live pole of battery A, and line conductor 5 is connected through the contacts 14 and 15 of the cut-off relay 10 with earth. Line relay 12 controls the normally open contacts 16 and 17 in the circuit of the line lamp 18. The coil of cut-off relay 10 is connected through conductor 19 with the sleeve contact 20 of the answering and multiple jacks, the tip and ring contacts 21 and 22 of said jacks being connected with the normally open contacts 24 and 23 of the cut-off relay 10. The called telephone line 1' is similarly equipped with apparatus of a character identical with that of the calling line, such corresponding apparatus being designated by like figures with the suffix "2". The cord circuit for connecting these lines for conversation is composed of tip, ring and sleeve strands, the tip strand extending from the tip contact 25 of the answering plug through conductor 26, condenser 27, conductors 28 and 29 to the tip contact 30 of the calling plug. The ring strand extends from the ring contact 31 of the answering plug through the conductor 32, condenser 33 and conductor 34 to the ring contact 35 of the calling plug. The sleeve contact 36 of the answering plug is connected through the coil of supervisory relay 37 with the live pole of battery A and the sleeve contact 38 of the calling plug is connected through conductor 39 and the coil of supervisory relay 40 with the live pole of battery A. The answering end of the cord circuit is also provided with the supervisory relay 41, which has two coils, one coil being connected between the tip strand 26 and the ground pole of battery A, and the other coil being con-

5 nected between the sleeve strand 32 and conductor 42, this conductor being adapted to be connected with the live pole of battery A by the closing of contacts 43 and 44 of supervisory relay 37. Conductor 42 is also connected through the normally closed contacts 45 and 46 of the supervisory relay 41 with the supervisory signal 48 and thence to the ground pole of battery A. The calling end of the cord circuit is similarly provided with the supervisory relay 51 having one of its coils similarly connected between the tip conductor 28 and the ground pole of battery A, and its other coil connected between the ring conductor 34 and the conductor 52 which is adapted to be connected with the live pole of battery A by the closing of contacts 53 and 54 of supervisory relay 40. Conductor 52 is likewise normally connected through contacts 55 and 56 with the supervisory signal 58 and thence to the ground pole of battery A. Supervisory relay 40 also has the contacts 59 and 60 which normally maintain a break between the tip conductors 29 and 28. The contact 60 of relay 40 is normally connected with contact 61 which is connected through conductor 62 with the auxiliary contact 63 of the operator's listening key 64. This contact is adapted when the key is actuated to connect with contact 65 which is connected with the impedance coil 66 and with one terminal of the condenser 67. The impedance coil 66 has its other terminal connected with earth, and the condenser 67 has its other terminal connected through the tertiary winding of the operator's induction coil and conductors 68 and 13' with the live pole of battery A. The operator's head receiver 69 is adapted to be placed in a bridge between the talking strands 28 and 34 by the actuation of the listening key 64. This bridge contains the secondary of the operator's induction coil and the condenser 70 which prevents the flow of direct current through the operator's receiver.

The operator's ringing key 71 is provided with series contacts 72 and 73 in circuit with the tip and ring cord conductors. The actuation of this key is adapted to connect the tip spring with the contact 74 which is connected with the generator 75 and thence through conductor 76 with earth. The ring contact of the key 71 is adapted by its actuation to connect with the contact 77 and thence to earth.

In the operation of the system here shown the call arises at station 1, the subscriber at that station removing his receiver 7 from the switch hook 8 and completing a path for current from the live pole of battery A over conductor 13 through the coil of line relay 12, contacts 11 and 9 of cut-off relay 10, line conductor 4, transmitter 6, receiver 7, contacts of switch hook 8, line conductor 5 and

contacts 14 and 15 of the cut-off relay 10 to earth. The current in this path actuates the line relay 12 closing its contacts 16 and 17 and thereby completing the circuit of the line lamp 18 and displaying that signal. Upon observing the display of the line signal 18 the operator inserts her answering plug in the answering jack designated by the display of the lamp and thereby completes a circuit from the live pole of battery A through the coil of supervisory relay 37, sleeve contacts 36 and 20 of the plug and jack, conductor 19 and the coil of cut-off relay 10 to earth. Current in this path actuates relays 10 and 37. The actuation of relay 10 opens the circuit of the line relay 12 allowing that relay to fall back to efface the line signal 18. The actuation of relay 10 also connects the line conductors 4 and 5 respectively with the ring and tip contacts 22 and 21 of the answering jack. The actuation of relay 37 closes its contacts 43 and 44, thus connecting the live pole of battery A through a coil of relay 41 with the sleeve conductor 32 of the cord circuit. Current therefore is permitted to flow over the ring contacts of the plug and jack, contacts 23 and 9 of the cut-off relay 10, line conductor 4, transmitter 6, receiver 7, switch hook 8, line conductor 5, contacts 14 and 24 of the cut-off relay 10, the tip contacts 21 and 25 of the jack and plug, conductor 26 and the other coil of relay 41 to earth. The current in this path actuates relay 41 and prevents the display of supervisory signal 48 which would otherwise have been displayed by the actuation of relay 37. The operator now throws her listening key 64 and receives the desired number. She then raises her calling plug and touches its tip contact 30 with the sleeve or test contact 20' of the desired line. If the line is busy the sleeve contact of the jack will be connected with the sleeve contact of some other cord circuit and will therefore be maintained at a potential higher than that of earth. Current will therefore flow from the sleeve of the busy line over the tip contact 30 through contacts 72 and 73 of the ringing key, over conductor 29, through contacts 60 and 61, the supervisory relay 40, over conductor 62, through the now closed contacts 63 and 65 of the operator's listening key 64, and through the impedance coil 66 to earth. The current in this path will slightly change the potential of the terminal of the impedance coil 66 and of the condenser 67. This will partially discharge the condenser 67 and will cause a sudden rush of current through the tertiary of the operator's induction coil which is connected in series with that condenser. This sudden flow of current will inductively produce a similar flow in the secondary of the operator's induction coil and will therefore cause a click to be pro-

duced in the operator's head receiver 69. If, however, the line is idle no sound will be produced in the operator's receiver and she will insert her calling plug completely into the jack of the desired line, completing the connection between the tip ring and sleeve contacts of the plug and the jack.

Upon the insertion of the plug a circuit is completed from the live pole of battery A through the coil of the supervisory relay 40, conductor 39, sleeve contacts 38 and 20' of the plug and jack, conductor 19' and the coil of cut-off relay 10'. This actuates relays 40 and 10'. The actuation of relay 10' connects the line conductors 4' and 5' with the contacts 22' and 21' of the jack. The actuation of relay 40 completes the circuit of supervisory signal 58 and also by the opening of contacts 60 and 61 and the closing of contacts 59 and 60 disconnects the testing apparatus from the tip strand of the cord circuit and completes the continuity of the tip strand between conductors 29 and 28. The operator now throws her ringing key 71 and thereby completes the circuit from the ringing generator 75 over the tip contact of the plug and jack and over the telephone line through the condenser 2', annunciator 3' at the substation and thence back over the ring contacts of the jack and plug to earth through contact 77. The ringing key is then released such that when the desired subscriber answers his call and removes his receiver 7' from the switch hook 8' a circuit is completed from the live pole of battery A through contacts 53 and 54 of relay 40 through the coil of supervisory relay 51, over the ring conductor 34 of the cord circuit, the ring contacts 35 and 22' of the plug and jack, contacts 23' and 9' of cut-off relay 10', line conductor 4', transmitter 6', receiver 7', switch hook 8', line conductor 5', contacts 14' and 24' of cut-off relay 10', the tip contacts 21' and 30 of the jack and plug, tip conductor 29, contacts 60 and 59 of relay 40, tip conductor 28 and the other coil of supervisory relay 51 to earth. This actuates relay 51 and opens its contacts 55 and 56 in the circuit of the supervisory signal 58. The calling and called subscribers' stations are now connected for conversation and all signals at the central office are effaced. When the conversation is terminated and the subscribers again hang up their receivers the circuits of relays 41 and 51 are again severed allowing those relays to fall back to their normal positions and again complete the circuits of supervisory signals 48 and 58. The operator observing these signals is informed that the conversation has been completed and removes her answering and calling plugs from their respective jacks. This interrupts the circuits of relays 10 and 108 and relays 37 and 40, allowing the contacts of those relays to again assume their normal positions,

the contacts of relays 37 and 40 again opening the circuits of supervisory signals 48 and 58 and allowing all of the apparatus to resume its normal unactuated condition.

While I have shown and described my invention in combination with certain specific apparatus and connections it is to be understood that many alterations may be made without departing from the spirit or scope of my invention.

I claim:

1. In a telephone system, the combination with a telephone line having jack contacts at the central office, a cord circuit having an answering plug to connect with said line, a pair of relays and a source of current for the cord circuit, one of said relays and said source being connected in a bridge between the talking strands of the cord circuit during conversation, and the other of said relays being permanently connected between the sleeve strand of the cord circuit and a pole of said source, the latter relay having contacts in the bridge circuit of the first relay, and a supervisory signal controlled by the conjoint action of said relays, substantially as described.

2. In a telephone system, the combination with a telephone line terminating at the central office in a three-conductor jack, a cut-off relay for the line having its coil connected with the sleeve contact of said jack, a cord circuit, a source of current and a relay adapted to be bridged between the talking strands of the cord circuit during conversation to furnish transmitter current to the line, a second relay connected between a pole of said source and the sleeve strand of the cord circuit, said relay having contacts maintaining a normal interruption in the circuit of the first cord relay, whereby the circuit of the cut-off relay will not be completed when the talking contacts of the plug are connected with the sleeve contact of the jack in the insertion of the plug, and a supervisory signal controlled by the conjoint action of said cord relays, substantially as described.

3. In a telephone system, the combination with a telephone line having a three-conductor jack at the central office, of a cord circuit to connect therewith having a three-conductor plug, a source of current, a supervisory relay having its coil permanently connected between the sleeve of said plug and a pole of said source, a second supervisory relay having a coil adapted to be connected between the same pole of said source and the ring contact of said plug by the actuation of the first supervisory relay, substantially as described.

4. In a telephone system, the combination with a telephone line having a three-conductor jack at the central office, of a cord circuit to connect therewith having a three-

conductor plug, a source of current associated with the cord circuit, a supervisory relay having two coils adapted to be connected in a bridge between the tip and ring strands of the cord circuit, said bridge containing said source, and means maintaining the normal interruption of said bridge, substantially as described.

5. In a telephone system, the combination with a telephone line having tip, ring and sleeve jack contacts at the central office, of a cord circuit to connect therewith having tip, ring, sleeve and plug contacts, a source of current adapted to be placed in a bridge between the tip and ring conductors of the cord circuit during conversation to furnish current for the substation transmitter, said source being also connected with the sleeve conductor of the cord circuit during conversation, and means maintaining said source disconnected from the ring conductor of the cord circuit until the sleeve contact of the plug is connected with the sleeve contact of the jack, a pair of relays for the cord circuit, and a supervisory signal controlled by the conjoint action of said relays, substantially as described.

6. In a telephone system, the combination with a telephone line having contacts at the central office, of a cut-off relay for said line connected with one of said contacts, a cord circuit to connect with the line having contacts to register with the contacts of the line, a source of current, a supervisory relay for the cord circuit having two coils—one connected on each side of said source in a bridge between the talking strands of the cord circuit during conversation, a second supervisory relay having its coil connected between a pole of said source and a contact of the cord circuit, said latter relay having normally-open contacts in the bridge containing the coils of the first relay and said source, substantially as described.

7. In a telephone system, the combination with a telephone line having a three-conductor jack at the central office, of a cut-off relay for the line connected with one of the contacts of said jack, a cord circuit to connect therewith having a three-contact plug to register with the contacts of the line jack, a source of current, and a relay in a bridge between the talking strands of said cord circuit, and means to prevent the flow of said source over the ring contact of the plug and the sleeve contact of the jack during the insertion of the plug, whereby the circuit of the cut-off relay will be completed before the sleeve contact of the plug connects with the sleeve contact of the jack, substantially as described.

8. In a telephone system, the combination with a telephone line, of a three-conductor jack therefor at the central office, a source of current, a cut-off relay connected between the sleeve contact of said jack, and a pole of said source, a cord circuit having a three-conductor answering plug to connect with said jack, a relay connected between the sleeve of said plug and the other pole of said source, a second relay and said source of current adapted to be connected in a bridge between the talking strands of the cord circuit by the actuation of the first cord relay, whereby said source is not connected with the ring contact of the plug until the sleeve contact of the plug is connected with the sleeve contact of the jack, and a supervisory signal controlled by the joint action of said 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:

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MARJORIE E. GRIER.