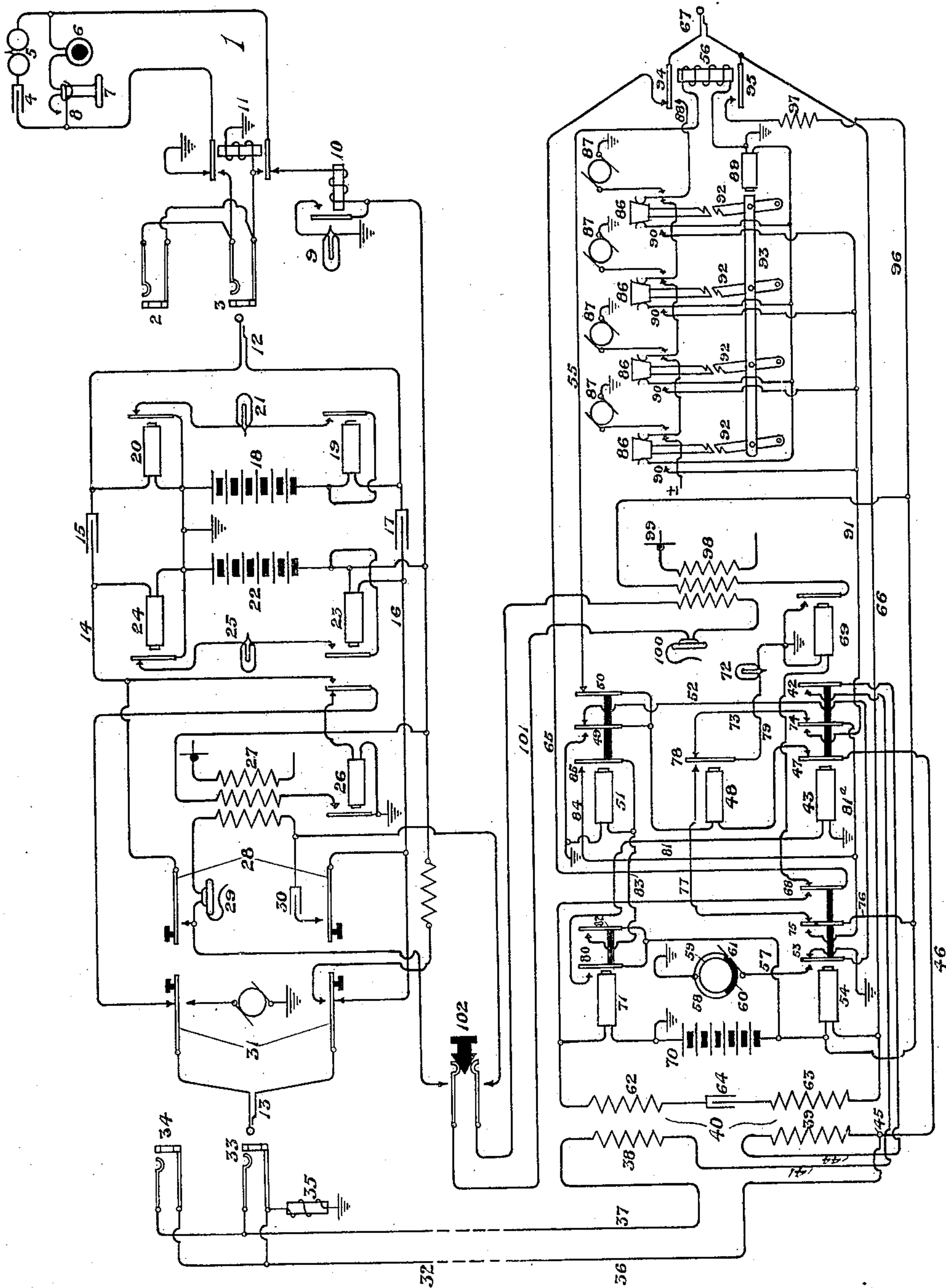


C. S. WINSTON.
TELEPHONE TRUNKING SYSTEM.
APPLICATION FILED NOV. 17, 1906.

976,241.

Patented Nov. 22, 1910.



Witnesses

A. Dahl

C. C. Bradbury

Charles S. Winston

Inventor

By Curtis Blamp
Attorney

UNITED STATES PATENT OFFICE.

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

TELEPHONE TRUNKING SYSTEM.

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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 at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Telephone Trunking Systems, of which the following is a specification.

My invention relates to telephone trunking systems adapted to connect between two common battery subscribers' lines terminating at different switchboards and is particularly adapted to be used with so-called party-lines where the selective ringing of the annunciators at the different substations is essential.

It has been customary in the past for the operator at the A or main exchange to receive the call from the calling subscriber, to then transmit the desired number to the trunk operator by way of the order wire and for the trunk operator to then make the connection with the desired party, to actuate the proper ringing key to selectively signal the party and to further supervise the connection until the desired party has answered his call.

It is the object of this invention to relieve the trunk operator of unnecessary attention to the connection and to place the supervision entirely in the hands of the A operator after the connection has been established with the desired line.

My improvement particularly relates to the arrangement of the ringing key at the outgoing end of the trunk and to the circuit arrangement necessary in carrying out the functions of the key.

Further objects of my invention will be apparent from the following description and claims, reference being had to the accompanying drawing forming a part of this specification.

In the figure the subscriber's line 1, which may have a plurality of substations upon it, is shown terminating in multiple jacks 2 and 3 before the operator at the main exchange. One of the subscriber's stations is shown on this line and comprises the condenser 4 and annunciator 5 in a permanent bridge of the line conductors, and the transmitter 6 and receiver 7 in a normally open bridge of the line conductors adapted to be closed by the release of the switch hook 8. At the central office the line signal 9 is

adapted to be controlled by the line relay 10, the latter being normally connected with one of the limbs of the telephone line through contacts of the cut-off relay 11. This line is intended to typify any usual or well-known circuit arrangement with any of which my invention is adapted to operate.

The A operator is provided with a number of cord circuits, one of which is here shown terminating in the answering plug 12 and calling plug 13. The tip contacts of these plugs are connected by the talking strand 14 intercepted by condenser 15, and the sleeve contacts of the plugs are connected by the talking strand 16 intercepted by the condenser 17. The answering end of this cord circuit is provided with the source 18 between the live pole of which and the strand 16 of the cord circuit is connected the relay 19, while between the grounded pole of said source and the strand 14 is connected the relay 20. The signal 21 is adapted to be energized over a local circuit controlled by the relays 19 and 20 to furnish supervision for the answering end of said cord circuit. Similarly, the calling end of the cord circuit is provided with source 22 similarly connected through the coil of relay 23 with strand 16, while the coil of relay 24 is connected between ground and the strand 14, the supervisory signal 25 being controlled by contacts of the latter relays. Normally the tip strand of the calling end of the cord circuit connects through contacts of relay 23 to ground through the coil of test relay 26, contacts of which are adapted to close a local circuit through the tertiary of induction coil 27.

The operator is provided with a listening key 28 adapted by its actuation to bridge the receiver 29, the secondary of the induction coil 27 and condenser 30 across the talking strands of the cord circuit. This cord circuit, also being adapted for use between subscribers whose lines terminate in the same exchange, is provided with the usual ringing key 31, which may be of the type here shown or may be provided with a plurality of buttons for connecting selective currents with the desired line.

The trunk line 32 is shown terminating at the A exchange in multiple jacks 33 and 34, the impedance coil 35 being here bridged between ground and the sleeve side of the trunk. This trunk line extending in limbs

36 and 37, terminates at the B exchange in the windings 38 and 39 of the repeating coil 40. The inner terminal of winding 38 is connected through conductor 41 and the normally open contact 42 of relay 43 and conductor 44 with the inner terminal of winding 39.

At the point 45, on limb 36, outside the winding 39, a path may be normally traced to ground by way of conductor 46, normal contacts 47 of relay 43, the coil of relay 48, springs 49 and 50 of relay 51, where the path divides reaching ground directly through conductor 52, and normal contacts 53 of relay 54, the other branch from spring 50 of relay 51 reaching ground through conductor 55 and the coil of relay 56. It will be seen that by the actuation of relay 54, conductor 52 will be connected with conductor 57 and through the interrupter 58 to ground. This interrupter comprises a rotating portion having the conducting ring 59 and insulating ring 60, the brush 61 being adapted to be grounded whenever it is in contact with the conducting portion and to be severed from its connection with ground whenever it is in connection with the insulating portion 60. The other windings 62 and 63 of repeating coil 40 have their inner terminals inductively connected through condenser 64, while their outer terminals are permanently connected with the talking strand 65 and 66 leading to the contacts of the calling plug 67. The strand 65 is seen to be broken at contacts 68 of relay 54, the tip conductor being carried through the normal contacts at 68 to the coil of test relay 69. The source 70 has its live pole connected through the coil of relay 54 with the sleeve conductor 66, and its grounded pole connected through the coil of relay 71 with the tip conductor 65. The signal 72 has one of its terminals connected with ground while its other terminal connects through the normal contacts of relay 48, conductor 73, normal contacts 74, of relay 43, with the open contact 75 of relay 54, where the circuit is adapted to be completed through conductor 76 to the live pole of source 70. The live pole of source 70 is normally connected through conductor 76, contacts 75 of relay 54, and conductor 77 with the normally open contacts 78 of relay 48, where it is adapted to be connected through conductor 79 with the signal 72. The tip supervisory relay 71 through its normally open contacts 80 and conductor 81, controls the circuit through the coil of relay 43, while through the normally-open contacts 82 the relay 71 normally controls the circuit of relay 51 through conductor 83. Relay 51, however, is adapted to be maintained actuated after once being energized by current over conductor 84 and through the normally open contact 85 of relay 51, conductor 84 being adapted to be connected

through conductor 76 with the live pole of source 70 by the actuation of relay 54.

In order to connect selective ringing currents upon the desired subscriber's line the B operator is provided with the selective ringing keys 86, each adapted by its actuation to connect one of the sources 87 with the inside contact 88 of relay 56 and also to close the circuit of relay 89 through one of the contacts 90 and conductor 91 to the normally-open contacts at 74 of relay 43. The catches 92 are adapted to register with any one of the plungers of buttons 86 which may be depressed and to hold the plunger in its depressed position until the bar 93 is moved by the energization of relay 89. The armature 94 of relay 56 is adapted to register with contact 88 and thus to connect ringing current with the tip of the plug, while the armature 95 is adapted by the actuation of relay 56 to connect the live pole of source 70 through conductor 96 and non-inductive resistance 97 with the sleeve of plug 67. The operator's induction coil 98 has its tertiary connected with the spring of relay 69 and its primary connected in series with the transmitter 99 and any suitable source of energizing current, while its secondary is connected in series with the receiver 100 and the order wires 101 which lead back to the order button 102 at the A office. No telephone line is shown with which the calling plug 67 is adapted to connect but it is to be understood that a line similar to 1 may be used, though it should preferably be a party line having annunciators at the different substations adapted to be rung by selective currents from the four generators 87.

In the operation of this system the call originates from the substation of telephone line 1 and the signal 8 is displayed in the usual manner before the A operator. Upon observing the signal the operator inserts her plug 12 in the jack 3 thus closing a local circuit which actuates the relays 19 and 11. The actuation of relay 11 connects the limbs of the telephone line with the tip and sleeve of jack 3 and a circuit is thereby completed over the telephone line and through the tip supervisory relay 20. The line signal 9 is simultaneously effaced, the circuit of line relay 10 being broken at the contacts of the cut-off relay 11. The supervisory signal 21 has its circuit closed by the actuation of relay 19 but immediately opened again by the actuation of relay 20 and thereby remains effaced. The operator now throws her listening key 28 and receives the desired number from the calling party. She then depresses the order button 102, which connects the secondary of her repeating coil 27 and her receiver in series with the receiver 100 and secondary of induction coil 98 belonging to the trunk operator, before whom the desired line terminates. The A operator

now indicates the desired line and the B operator responds by designating which of the plurality of trunks which lead between the two offices is to be used. The B operator
 5 now takes up the plug 67 and tests the desired line by touching the tip of her calling plug to the test ring of the desired line in the usual manner. If the line is busy the
 10 test ring will be at a potential higher than that of ground and current will flow over strand 65 to ground through the coil of test relay 69, actuating the same to close a local circuit through the tertiary of the induction
 15 coil 98. If no click is heard in the operator's receiver the plug 67 is inserted in the jack, thus closing a local circuit from the source
 20 70, through the coil of relay 54, over conductor 66, and through the coil of the cut-off relay of the desired line. Current in this
 25 path actuates supervisory relay 54 and closes a local circuit through the contacts 75 of relay 54, conductor 81^a, contacts 74 of relay 43, conductor 73, contacts 78 of relay 48 and through the signal 72 to ground, thus displaying the signal.

Some time is required for the B operator to test the desired line and insert her plug and it is presumed that in the meantime the A operator will have inserted her plug
 30 13 in the designated jack 33 of the trunk line 32. Upon the insertion of the plug 13 a local circuit is closed from the live pole of source 22 through the coil of relay 23, sleeve conductor 16, and the impedance coil
 35 35 to ground, thus actuating the relay 23 to close the local circuit of supervisory signal 25 to display it. The impedance coil 35 being of high resistance, a portion of the current through supervisory relay 23 will
 40 pass over the trunk line and will reach ground through point 45, conductor 46, contacts 47 of relay 43, coil of relay 48, conductor 52, and either by way of the normal contacts 53 of relay 54 or else through the
 45 conducting portion 59 and the brush 61 of the interrupter 58. Current in this path actuates the relay 48 which will efface the signal 72 if it has been previously displayed by the actuation of relay 54, or if the B
 50 operator has not yet inserted her plug 67 and the relay 54 has not yet been actuated, will display the signal 72 by completing a path for current from the source 70 over conductor 76, through the normal contacts
 55 at 75, conductor 77, and the then-closed contacts 78 of relay 48. It is thus seen that the signal 72 is displayed when a connection is established with either end of the trunk line and effaced when connection exists at
 60 both ends and thus may be used to indicate to the B operator whether or not the A operator has connected with the correct trunk line.

The B operator now presses one of her
 65 keys 86 to connect the desired selective cur-

rent with the open contact 88 of relay 56 and at the same time operates one of the catches 92, which maintains the actuation of the depressed key until the relay 89 is energized. As previously described, there are
 70 branch paths from the springs 49 and 50, one path including conductor 55 and the coil of relay 56, while the other path, after the actuation of relay 54, includes conductors 52 and 57 and the conducting portion of
 75 the interrupter 58, the latter path being of very low resistance, will carry enough of the current which passes from the source 22 at the A exchange through the coil of relay 23 and over the trunk line to shunt the re-
 80 lay 56 and prevent its actuation but when the interrupter, which is slowly driven, has rotated so that the brush 61 is resting upon the insulating portion 60, current, which before passed through the conducting por-
 85 tion of the interrupter to ground, must now take the path through the coil of relay 56 to ground. Relay 56 is thus periodically actuated and released, periodically bringing the spring 94 in contact with the point 88 to
 90 which selective ringing current is applied and the spring 95 in contact with the live pole of the battery through the non-inductive resistance 97. It is to be understood that the resistance of the coil 97 is to be so
 95 adjusted that when the coil is placed in parallel with the coil of relay 54 it will not shunt the relay sufficiently to allow it to fall back but at the same time, due to its low impedance, the coil 97 will sufficiently
 100 shunt the returning ringing current away from the coil of relay 54 and the coil of the cut-off relay associated with the called line, to prevent deenergization or rattling in those relays.
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It is now seen that the B operator has completed her duties and that the selective current will continue to be automatically applied to the desired line until the party answers his call, when the circuit will
 110 be completed through the coil of relay 71, actuating it to close the local circuits of both relays 43 and 51. The actuation of relay 51 closes a locking circuit for itself through its normally-open contact 85 and at the same
 115 time permanently interrupts the circuit of relay 56 by severing the connection between the spring 50 and conductor 55 and also places a permanent ground upon spring 49, severing same from its connection with the
 120 interrupter 58. The actuation of relay 43 closes the connection between the inner terminals of coils 38 and 39 of repeating coil 40 by the closure of contacts 42, thus completing the circuit for current from the live pole
 125 of battery 22 through the coil of relay 23, sleeve strand 16, the limb 36 of the trunk line, winding 39 of the repeating coil 40, conductor 44, contacts 42, conductor 41, winding 38 of repeating coil 40, limb 37 of
 130

the trunk line, the tip strand 14 of the cord circuit, and back to the grounded pole of battery through the coil of supervisory relay 24. Current in this path now actuates relay 24, effacing the signal 25 and indicating to the A operator that the desired party has answered his call. The actuation of spring 74 of relay 43 closes a circuit from the source 70 through conductor 76, the now-closed contacts 75 of relay 54, conductor 81^a, contacts 74, conductor 91, contacts 90 of the depressed key 86, and through the coil of relay 89 to ground. Current in this path actuates the relay 89 to release the depressed key and sever the connection of selective ringing current from the open contact 88 of relay 56. The actuation of spring 47 of relay 43 severs the connection of the outgoing end of the trunk with ground at the B exchange and opens the circuit of relay 48. The release of relay 48 would again actuate the signal 72 but that the circuit is now maintained open by the actuation of spring 74 of relay 43.

The system is now in condition for conversation throughout and the signals before both operators are effaced. When the called party replaces his receiver upon its hook he severs the circuit for current through relay 71 at the B exchange and this relay falls back, opening its contacts 80 and 82. The opening of contacts 82 does not affect the relay 51, since it is maintained actuated through its locking circuit, but the opening of contacts 80 severs the circuit of relay 43 and allows it to fall back. When this relay falls back it opens the circuit of supervisory relay 24 associated with the cord circuit at the A exchange by severing the connection between the inner terminals of windings 38 and 39 of coil 40 at contacts 42. The closure of contacts 47 of relay 43 now again completes the circuit of relay 48 which actuates but does not affect the signal 72, due to the actuation of relay 54. The actuation of contacts 74 does not now affect the signal 72, due to the simultaneous action of relay 48. It is thus seen that while no signal appears for the B operator the signal 25 is displayed before the A operator, indicating to her that the conversation has terminated. When the calling party hangs up his receiver the signal 21 is displayed by the deenergization of relay 20 and the A operator removes both her plugs from their connections. Upon the removal of the calling plug 13 the circuit from source 22, which was previously completed by way of the limb 36 of the trunk line 32, point 45, conductor 46, contact 47 of relay 43, coil of relay 48 and the now-closed contacts of spring 49 to ground, is broken, allowing relay 48 to become deenergized, falling back to complete the circuit of signal 72 through the back contact 78 of relay 48, the back contact 74 of relay 43, conductor 81^a, the forward contact 75 of relay 54, con-

ductor 76 to the live pole of source 70. The signal 72 now being displayed, the B operator knows that the connection has been severed with the outgoing end of the trunk and that the conversation has terminated; she therefore removes plug 67 from its connection with the called line and thereby severs the path for current from the live pole of source 70 through the coil of relay 54 which had been completed over the sleeve strand of the talking circuit and through the coil of the cut-off relay of the called line. The release of relay 54 now opens the circuit of signal 72 by interrupting it at the forward contact 75 of relay 54, thus allowing the signal to become effected, at the same time the locking circuit of relay 51 which was energized through the same contacts 75 of the relay 54 is severed, allowing relay 51 to fall back.

The apparatus is thus in its normal condition throughout the entire system and ready for another call which may be carried out in the manner just described.

It is to be understood that many features of this invention are applicable to other circuit arrangements than those shown here and I do not wish the scope of this invention to be limited to the specific arrangement here shown.

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

1. In a telephone system, the combination with a trunk line, of a cord circuit adapted to be connected with one end thereof, and a connecting circuit permanently connected with the other end thereof, a manually operated ringing key associated with the incoming end of the trunk, a catch for maintaining said key actuated, a source of direct current, an electromagnet for said key, a relay permanently in bridge of the talking strands of said connecting circuit, and means controlled by said relay in response to current over a called line for directing current from said source to energize said magnet for releasing said key, substantially as described.

2. In a telephone system, the combination with a trunk line, of a cord circuit adapted to be connected with one end thereof, and a connecting circuit permanently connected with the other end thereof, a source of steady current associated with the cord circuit, relays associated with the incoming end of the trunk line, and means operative upon the connection of the cord circuit with the trunk for actuating said relays by current from said direct current source to place said connecting circuit in condition to have ringing current supplied thereto, and means operative upon the connection of the trunk with the line for accomplishing the application of the ringing current to the incoming end of the trunk, substantially as described.

3. In a telephone system, the combination with a trunk line, of a cord circuit adapted to be connected with one end thereof, and a connecting circuit permanently connected
5 with the other end thereof, a source of direct current associated with the cord circuit, an interrupter associated with the connecting circuit, a relay associated with the connecting circuit and adapted when actuated to
10 place ringing current upon the called subscriber's line, means operative upon the connection of the cord with the trunk to direct current from said source alternately through said interrupter and through said relay,
15 whereby intermittent ringing will be secured upon the called subscriber's line, substantially as described.

4. In a telephone system, the combination with a trunk line, of a cord circuit adapted to
20 be connected with one end thereof, and a connecting circuit permanently connected with the other end thereof, a source of current associated with the cord circuit, an interrupter associated with the connecting circuit, a relay associated with the connecting
25 circuit, means operative upon the connection of the cord with the trunk for directing current from said source through said relay, and means for shunting the current from
30 said relay by the rotation of said interrupter, substantially as described.

5. In a telephone system, the combination with a telephone trunk circuit, a source of ringing current associated therewith, a periodically actuated relay for connecting said
35 source with the talking strands of said trunk circuit, means for primarily controlling said relay from the outgoing end of the trunk, and means depending upon the
40 condition of the called subscriber's telephone for automatically rendering said relay inoperative, substantially as described.

6. In a telephone system, the combination with a connecting circuit, of a source of
45 ringing current associated therewith, a relay adapted by its actuation to connect said source of current with the talking strands of said connecting circuit, an interrupter for periodically operating said relay, the
50 circuit of said relay being completed independently of said interrupter, and means depending upon the condition of the called subscriber's telephone for severing the circuit of said relay during the remainder of
55 the connection, substantially as described.

7. In a telephone system, the combination with a connecting circuit, of a source of ringing current associated with said connecting circuit, a relay for connecting said
60 source with the talking strands of said connecting circuit, a shunt for said relay causing

ing it to be periodically actuated and means operative upon the response of the called subscriber for severing the circuit of said relay, substantially as described. 65

8. In a telephone system, the combination with a telephone line, of a cord circuit adapted to be connected therewith, a source of direct current, a supervisory relay, and a cut-off relay adapted to be actuated in
70 series over a portion of the telephone line when connection is established, a source of ringing current, a non-inductive resistance normally in open circuit about the supervisory relay, means for connecting the ringing current source with the telephone line,
75 and for simultaneously closing the circuit of said non-inductive resistance, whereby the supervisory and cut-off relays will be maintained actuated during ringing, substantially as described. 80

9. In a telephone system, the combination with a telephone line, of a cut-off relay therefor actuated over a portion of the talking circuit, a cord circuit, a supervisory relay therefor actuated over a portion of the
85 talking circuit, a source of direct current, and a source of ringing current, means operative during the connection of the ringing current with the telephone line for placing
90 a non-inductive resistance about the supervisory relay, whereby the ringing current will be shunted away from the coils of the supervisory and cut-off relays, and whereby sufficient direct current will pass through
95 the coils of said relays to maintain their actuation during ringing, substantially as described.

10. In a telephone system, the combination with a telephone line, of a source of direct
100 current and a source of alternating current associated therewith, a pair of relays at the central office connected respectively between one of the limbs of said line and the opposite poles of said direct current source whereby
105 said relays are actuated, means to complete a circuit from said alternating current source over the other limb of said telephone line with return over the first limb, and a non-inductive resistance connected in parallel with one of said relays to afford a
110 ready path for the alternating current, whereby neither of said relays will be deenergized, substantially as described.

Signed by me at Chicago, county of Cook, 115 and State of Illinois, in the presence of two witnesses.

CHARLES S. WINSTON.

Witnesses:

CLIFFORD C. BRADBURY,
EDITH F. GRIER.