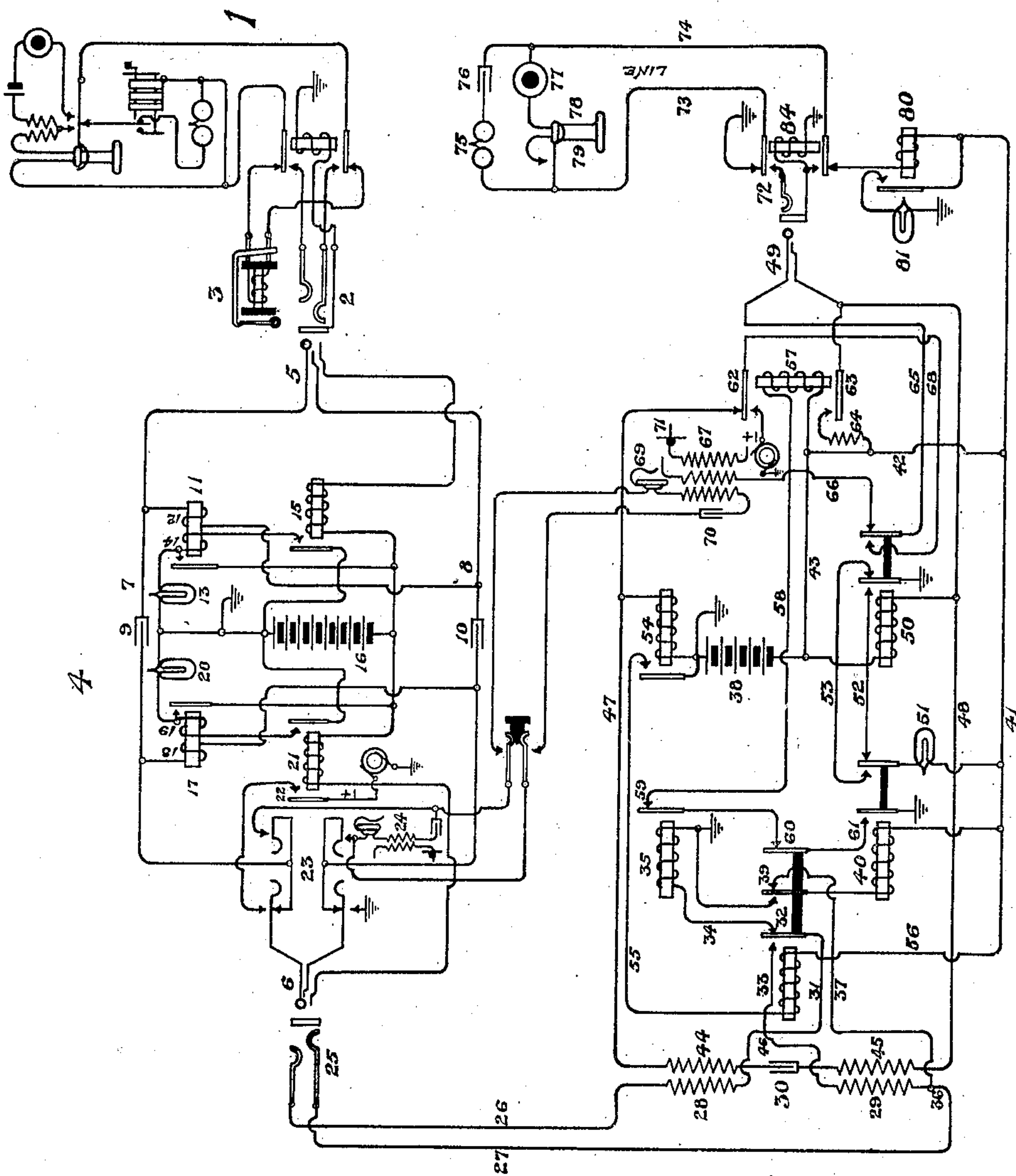


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E. H. RUPE.
TELEPHONE TRUNKING SYSTEM.
APPLICATION FILED NOV. 15, 1906.



Witnesses

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TELEPHONE TRUNKING SYSTEM.

No. 885,180.

Specification of Letters Patent.

Patented April 21, 1908.

Application filed November 15, 1906. Serial No. 343,540.

To all whom it may concern:

Be it known that I, EDWIN H. RUPE, a citizen of the United States, residing at Chicago, 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 improvements in telephone trunking systems employed in establishing conversational connection between toll and common battery lines. It is usual for toll lines to terminate before toll operators at a main or central exchange, these operators being provided with connecting circuits known as "toll cords" by which they are enabled to connect the different toll lines together for conversation. It often occurs, however, that local subscribers whose lines terminate at other exchanges are desired, and in order to connect with these subscribers a trunk circuit extending from this main or toll board to an auxiliary exchange is used to further the connection.

My invention contemplates the simplifying of the apparatus necessary in furthering this connection through the trunk line, and particularly in means for placing the connection of ringing current with the desired line entirely under the control of the toll operator.

Other objects of the invention will be hereinafter described and claimed, reference being had to the accompanying drawing forming a part of this specification.

In the drawing, in which all apparatus is shown in its normal or unactuated condition, the toll line 1 terminates at the main exchange in the connection terminal 2 which may be multiplied before a number of operators' positions. The signal 3 is adapted to be actuated over the toll line which may terminate before another toll operator at a distant station or in a local battery station as shown.

The toll operator is provided with a plurality of connecting circuits such as the one shown at 4, each circuit being provided with an answering plug 5 and calling plug 6. The tip contacts of the plugs are normally connected for talking purposes by the strand 7, while the ring contacts are connected for talking purposes by the strand 8, the condensers 9 and 10 being placed in each strand

for the purpose of conductively separating the two ends of the connecting circuit in order to furnish double supervision for the toll operator. A relay 11, having a high resistance and impedance coil 12, is bridged across the answering end of the cord circuit and is adapted to control the circuit of signal 13 which is associated with that end of the connector. A locking coil 14 is also provided on relay 11 so that the signal when displayed by currents from a temporary or intermittent source will be maintained actuated. This locking circuit is controlled by contacts of relay 15 which is actuated from the source 16 over the sleeve of the answering plug 5 whenever a connection is established with a toll line. The calling end of the toll connector is similarly provided with relay 17 having a similarly connected high impedance coil 18, and locking coil 19, signal 20 being controlled by the actuation of relay 17. The relay 21 has its coil connected with the sleeve contact of the calling plug and has, in addition to the contact controlling the locking circuit of relay 17, the normally open contacts 22 controlling the circuit of the ringing current. The calling end of this toll connector is also provided with the usual ringing and listening-key 23, the operator's set 24 being adapted to be connected with any one of the toll connecting circuits under the control of this particular toll operator.

The three-point jack 25 which may be multiplied before a number of toll operators has its tip and ring contacts connected with the strands 26 and 27 of the trunk line, while its sleeve contact is normally free from any connection.

In the auxiliary exchange the limbs 26 and 27 are connected with the windings 28 and 29 of the repeating coil 30, the inner terminal of winding 28 being normally connected with ground by way of conductor 31, normal contacts 32 of relay 33, conductor 34 and the coil of relay 35, while the inner terminal of coil 29 extends to the normally open contact of relay 33 where it is adapted to be connected with conductor 31 by the actuation of relay 33. From the point 36 on conductor 27 just outside the winding 29 the conductor 37 extends to the live pole of battery 38 by way of the normal contacts 39 of relay 33, the coil of relay 40 and conductors 41, 42 and

43. The other windings 44 and 45 of repeating coil 30 have their inner ends inductively connected by condenser 46 and their outer ends permanently connected with the tip and sleeve talking conductors 47 and 48 which during conversation connect with contacts of the plug 49. Bridged between the live pole of battery 38 and conductor 48 is the coil of relay 50. The contacts of this relay and of relay 40 together control the local circuit containing signal 51, the armature of relay 40 being normally connected with conductor 52 which is normally broken at the armature of relay 50, while the grounded armature of relay 50 is normally connected with conductor 53 which is normally broken by the contacts of relay 40. The coil of relay 54 is connected between the ground pole of battery 38 and talking conductor 47, contacts of this relay controlling the circuit of relay 33 through conductors 55 and 56, 41, 42 and 43. The relay 57 has one of its terminals connected with the live pole of battery 38 and its other terminal connected through conductor 58, the normally closed contacts 59 and 60 of relays 35 and 33 to the normally open contact 61 of relay 40, the armature of relay 40 being connected with the ground pole of battery 38. The armature 62 of relay 57 is normally connected with conductor 47 but is adapted to be connected with any desirable source of ringing current through its normally open contact, while the armature 63 is adapted by its actuation to connect the sleeve strand of the talking circuit with the live pole of battery 38 through the non-inductive resistance 64.

In order to provide an automatically disconnected testing circuit the tip of the plug is normally connected by conductor 65 through contacts of relay 50 and conductor 66 to the tertiary of the operator's induction coil 67, the actuation of relay 50 being adapted to disconnect the tertiary of the induction coil 67 and to connect the conductor 65 with conductor 68 which is a portion of the tip strand of the talking circuit.

The operator's listening set which comprises the usual receiver 69, induction coil 67, condenser 70 and transmitter 71 is connected through order wires with the toll operator's set and may be used with a plurality of trunks such as the one shown in the drawing.

The plug 49 is adapted to connect with any one of a plurality of common battery telephone lines, one of which is here shown terminating at the central office in spring jack 72 and extending in limbs 73 and 74 to the substation where the annunciator 75 and condenser 76 are bridged between the two line conductors. The transmitter 77 and receiver 78 are normally in an open bridge of the line conductors adapted to be closed by the actuation of the hook-switch 79. At the

central office the line relay 80 is normally connected with the limb 74 of the telephone line and controls the local circuit of signal 81, while the limb 73 is normally grounded. The cut-off relay 84 is adapted to be actuated over a portion of the talking circuit to disconnect the line signaling apparatus and ground from the limbs 74 and 73 and to connect the tip and sleeve contacts of the jack 72 directly with the line.

In the operation of this system the call is sent in over the toll line 1 and the signal 3 is displayed before the toll operator. Upon observing this signal the plug 5 is inserted in the jack 2 thus completing a circuit from battery 16 over the sleeve of the plug 5 which actuates the relay 15 and the cut-off relay of the calling toll line. The actuation of relay 15 places the locking circuit of relay 11 in condition to be closed by the actuation of the latter relay. The toll operator now throws her listening key and obtains the number of the desired subscriber. Finding that the desired subscriber's line terminates before a certain trunk operator the toll operator presses the order button which connects her own operator's set directly with the set of the operator before whom the desired line terminates. The toll operator then orders the connection and the trunk operator designates which of her trunks she will use. Picking up the plug of the trunk she has designated the trunk operator tests the desired line to ascertain whether or not it is in use. If the line is busy the sleeve of the jack will be at a potential higher than that of ground and a current will flow over the tip of the plug through conductors 65 and 66 and the tertiary of the operator's induction coil 67 causing a click which notifies the operator that the line is busy.

Assuming the line to be idle the trunk operator inserts the plug 49 into the jack 72 thus closing a local circuit from the battery 38 through the coil of relay 50 over the sleeve strand of the trunk and through the coil of cut-off relay 84 to ground. This actuates relay 84 to place the desired line in condition to be called, and relay 50 to close the circuit of signal 51 through the normal contact of relay 40 and conductor 52. This testing and connecting with the desired line requires a little time on the part of the trunk operator and it is supposed that in the meantime the toll operator will have inserted her calling plug 6 in the designated trunk line which terminates at her board in the jack 25. Upon the connection of the toll cord with the outgoing end of the trunk a circuit is completed which may be traced from the live pole of battery 38 through conductors 43, 42 and 41, the coil of relay 40, contacts 39 of relay 33, conductor 37, limb 27 of the trunk line, the rings of jack 25 and the plug 6, talking strand 8 of the toll

cord, coil 18 of supervisory relay 17, tip strand 7, the tip contacts of plug 6 and jack 25, conductor 26, the winding 28 of repeating coil 30, conductors 31 and 34 and through the coil 35 to the ground pole of battery 38. The relays 17, 35 and 40 in the path just traced, each being of high resistance, will be actuated, the actuation of relay 40 serving to efface the signal 51 if it has been previously displayed by the actuation of relay 50, or to display said signal by current over conductor 53 and the normal contacts of relay 50 if the latter has not yet been actuated by the insertion of the calling plug 49.

It is seen that the signal 51 thus acts as a guard signal to indicate to the trunk operator that the toll operator is connected with the proper trunk line, the signal being effaced as soon as connection exists at both ends of the trunk. Relay 17, associated with the toll connector, now being actuated the signal 20 is displayed. The toll operator now throws her ringing key 23 placing ground upon the ring side of the toll line but not placing ringing current upon the tip side, since when the plug 6 is connected with a trunk line having the sleeve contact disconnected no current will flow from battery 16 through the relay 21, and consequently contacts 22 will not be closed to place ringing current upon the normally disconnected contact of the ringing key. Ground being placed upon the ring side of the calling end of the toll connector and the normal circuit being broken in the tip side of the toll cord, the relay 35 which was actuated over the outgoing end of the trunk will now be deprived of current and its armature will fall back to complete the local circuit of relay 57, relay 40 being maintained actuated by current from the live pole of battery 38 over conductors 43, 42 and 41, its own coil, conductors 37 and 27 and the ring contacts of jack 25 and plug 6 to ground through the contact of the ringing key 23. By the actuation of relay 57 signaling current is connected with the tip side of the line through the armature 62 while battery is connected with the sleeve side of the line through the non-inductive resistance 64 and the armature 63. The ringing current thus sent upon the line passes through conductors 68 and 65 and out over the tip side of the line actuating the annunciator 75 and returning over the line conductor 74 to the generator through the non-inductive resistance 64 and the battery 38. This non-inductive resistance 64 is so adjusted in resistance that it will not shunt the relay 50 sufficiently to allow it to fall back but will offer a path for the returning ringing current of sufficiently low impedance to prevent the demagnetization or rattling of either relays 84 or 50. It will be noted that if the toll operator should throw her ringing

key before the trunk operator had inserted her calling plug, that while the relay 57 will be actuated under these conditions, no ringing current will be placed on the contacts of the plug due to the fact that the tip strand is normally open at contacts of relay 50.

When the called subscriber answers his call a path for current from battery 38 is completed through the coil of relay 50, the sleeve strand of the called line, the called subscriber's switch-hook and back to the ground pole of battery 38 actuating the relay 54, transmitter current thus being fed to the common battery line through the coils of relays 50 and 54. The actuation of relay 54 closes the local circuit of relay 33, the actuation of which serves to short-circuit the inner terminals of windings 28 and 29 of induction coil 30 and to disconnect the coils of both relays 35 and 40 from the outgoing end of the trunk line, thus severing connection for current from battery 38 over the outgoing end of the trunk and depriving relay 17, associated with the toll cord, of actuating current, whereby the signal 20 will now be effaced to indicate to the toll operator that the desired party has answered his call.

The actuation of relay 33 deprives relay 35 of actuating current, and at the same time maintains the actuation of relay 40 over a local circuit instead of the previous circuit which included the outgoing end of the trunk. The deenergization of relay 35 would now again close the circuit of relay 57, replacing ringing current upon the called line but that the separation of the contacts 60 of relay 33 simultaneously opens the circuit of relay 57.

The system is now in complete talking condition, the signals before both operators being effaced. The disconnect signal may now be sent in, either from the common battery station or over the toll line. When the disconnect signal is sent in over the toll line the current which is usually alternating or intermittent passes through the high resistance coil of relay 11 actuating that relay to close the local circuit of the signal 13, and at the same time to close the locking circuit through its own coil 14. When the common battery subscriber replaces his receiver upon the hook the relay 54 will be deprived of actuating current and will fall back opening the circuit of relay 33, the deenergization of which again connects the poles of the battery with the limbs of the outgoing end of the trunk through the coils of relays 35 and 40 and consequently through the coil 18 of the bridged relay 17 associated with the toll cord. The actuation of this relay closes the local circuit of signal 20 displaying it to indicate to the toll operator that the conversation has terminated. When both signals 13 and 20 are thus displayed the toll operator removes the plugs 5 and 6 from their respective jacks

and her apparatus immediately assumes its normal unactuated condition. The removal of the plug 6 from the jack 25 severs the circuit of relays 35 and 40 allowing them both to fall back. The deenergization of the relay 40 displays the signal 51 through conductor 52 and the contact of the now actuated relay 50. Upon observing this signal the trunk operator removes her plug 49 from its connection with the called line thus severing the circuit of relay 50, effacing the signal 51 and allowing all of her apparatus to assume its normal unactuated condition.

While I have thus described my improvements in connection with a specific telephone system I do not wish to so limit the scope of my invention, certain features of which may be applied to many different specific arrangements.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a telephone system, the combination with a cord circuit, of a ringing key associated with the cord circuit, a plurality of jacks of different character with which the cord may be connected, and means depending upon the character of the jack with which the cord circuit is connected for governing the connection with said key, substantially as described.

2. In a telephone system, the combination with a cord circuit, of a source of ringing current, a ringing key, a plurality of jacks of different character with which the cord may be connected, and means depending upon the character of the jack with which the cord circuit is connected for governing the connection of the ringing current source with the ringing key, substantially as described.

3. In a telephone system, the combination with a cord circuit, of a ringing key, and a relay, the actuation of which depends upon the character of the jack with which the cord is connected, for governing the connection with said key, and jacks of different character with which the cord may be connected substantially as described.

4. In a telephone system, the combination with a cord circuit, adapted to connect either with a subscriber's line or a trunk line, of a source of ringing current, a ringing key, and a relay controlling the connection of said source with said key, the actuation of said relay depending upon the character of line with which the cord is connected, substantially as described.

5. In a telephone system, the combination with a cord circuit, of jacks of different character with which the cord may be connected, a source of ringing current, a ringing key, a relay for controlling the connection of the ringing current with the key, and means depending upon the character of the jack

with which the cord circuit is connected for controlling said relay, substantially as described.

6. In a telephone system, the combination with a cord circuit terminating in a three-point connecting plug, of a ringing key having contacts normally connected with two of such plug contacts, a source of ringing current, a third contact for said ringing key, a relay having contacts normally separating the third contact of the ringing key from said source, and having its coil connected with the third contact of the connecting plug, a plurality of jacks having differently connected sleeve contacts with which said connecting plug may be connected, the actuation of said relay depending upon the connection of the sleeve contact of said jacks, substantially as described.

7. In a telephone system, the combination with a telephone line, of a cord circuit to connect therewith for conversation, a source of ringing current for the cord circuit, a ringing key adapted when actuated to connect said source with said line when the calling end of the cord circuit is connected therewith, a trunk line with which the calling end of said cord may also be connected, and means to prevent said source from being connected with the trunk line when the calling end of the cord is connected therewith and the key is actuated, substantially as described.

8. In a telephone system, the combination with a trunk circuit, of a cord circuit adapted to be connected with the outgoing end, and a connecting circuit permanently connected with the incoming end thereof, a source of direct current and a relay associated with the incoming end of the trunk circuit, a source of ringing current adapted to be connected with the incoming end of the trunk circuit by the actuation of said relay, and means to actuate said relay by current from said direct current source upon the actuation of said ringing key, substantially as described.

9. In a telephone system, the combination with a trunk line and a subscriber's line, of a cord circuit adapted to connect with either, a ringing current source, a ringing key, and means whereby said source will be connected with the subscriber's line when the calling end of the cord is connected therewith and the key is actuated, and whereby said source will not be connected with the trunk line when the calling end of the cord is connected therewith and the key is actuated, substantially as described.

10. In a telephone system, the combination with a trunk line and a subscriber's line, of a cord circuit adapted to connect with either, a ringing current source adapted to be connected with the subscriber's line for calling purposes when the calling end of the cord

is connected therewith, and means whereby said source cannot be connected with the trunk line when the calling end of said cord is connected with the trunk line, substantially as described.

11. In a telephone system, the combination with a trunk line, of a cord circuit adapted to be connected therewith at its outgoing end, and a telephone line with which its incoming end is adapted to be connected, a source of direct current associated with the incoming end of the trunk, a ringing relay having its coil connected with said source, a ringing key associated with the cord circuit, means operative upon the actuation of such ringing key for closing the circuit of said source through the ringing relay, means actuated upon the connection of the incoming end of the trunk with the telephone line for placing ringing current upon the telephone line, and means operative upon the response of the called subscriber for de-energizing the ringing relay, substantially as described.

12. In a telephone system, the combination with a trunk line, of a cord circuit adapted to be connected with the outgoing end thereof, and a telephone line with which the incoming end may be connected, a source of direct current associated with the incoming end of the trunk, a relay having its coil normally connected between such source and the outgoing end of the trunk, a ringing key associated with the cord circuit, the actuation of which completes the circuit of said source through said relay, a source of ringing current, a ringing relay, and means actuated by the energization of said first relay for actuating the ringing relay to place ringing current upon the incoming end of the trunk, substantially as described.

13. In a telephone system, the combination with a trunk line, of a cord circuit adapted to be connected with the outgoing end thereof, and a telephone line with which the incoming end may be connected, a source of direct current associated with the incoming end of the trunk, a relay having its coil normally connected between such source and the outgoing end of the trunk, a ringing key associated with the cord circuit and adapted by its actuation to complete the circuit of said source through said relay, a source of ringing current, a ringing relay for connecting said ringing source with the incoming end of the trunk having its circuit controlled by the contacts of said first relay, and means for severing the circuit of said ringing relay upon the response of the called subscriber, substantially as described.

14. In a telephone system, the combination with a trunk line, of a cord circuit adapted to be connected with the outgoing end thereof, and a telephone line with which

the incoming end may be connected, a source of direct current associated with the incoming end of the trunk, a relay having its coil normally connected between such source and the outgoing end of the trunk, a ringing key associated with the cord circuit and adapted by its actuation to complete the circuit of said source through said relay, a source of ringing current, a ringing relay for connecting said ringing source with the incoming end of the trunk having its circuit controlled by contacts of said first relay, and means for severing the circuit of said first relay upon the response of the called subscriber, substantially as described.

15. In a telephone system, the combination with a trunk line, of a cord circuit adapted to be connected with the outgoing end thereof, and a telephone line with which the incoming end may be connected, a source of direct current associated with the incoming end of the trunk, a relay having its coil normally connected between such source and the outgoing end of the trunk, a ringing key associated with the cord circuit adapted by its actuation to complete the circuit of said source through said relay, a source of ringing current, a ringing relay for connecting said ringing source with the incoming end of the trunk having its circuit controlled by the contacts of said first relay, and means for disconnecting said first relay from the outgoing end of the trunk upon the response of the called subscriber, substantially as described.

16. In a telephone system, the combination with a trunk line, of a cord circuit adapted to be connected with its outgoing end, and a telephone line with which its incoming end may be connected, a three-point jack forming a terminal at the outgoing end, the sleeve contact of said jack being normally disconnected, a ringing key associated with the cord circuit, and adapted by its actuation to place ringing current upon a telephone line when the sleeve contact of the line jack is properly connected, means operative when the cord circuit is connected with the trunk jack for preventing ringing current from being connected with the trunk line by the actuation of the ringing key, and a circuit completed by the actuation of said ringing key for causing ringing current to be placed upon the incoming end of the trunk line, substantially as described.

17. In a telephone system, the combination with a trunk line and a subscriber's line, of a cord circuit, the calling end of which is adapted to connect with either of said lines, a ringing key, a source of ringing current adapted to be connected with the calling end of said cord circuit by the actuation of said key when the calling end of the cord is connected with said subscriber's line, and means

whereby said ringing current source will not be connected with the calling end of said cord by the actuation of said ringing key when the calling end of said cord is connected with the trunk line, substantially as described.

Signed by me at Chicago, county of Cook,

and State of Illinois, in the presence of two witnesses.

EDWIN H. RUPE.

Witnesses:

CLIFFORD C. BRADBURY,
EDITH E. GRIER.