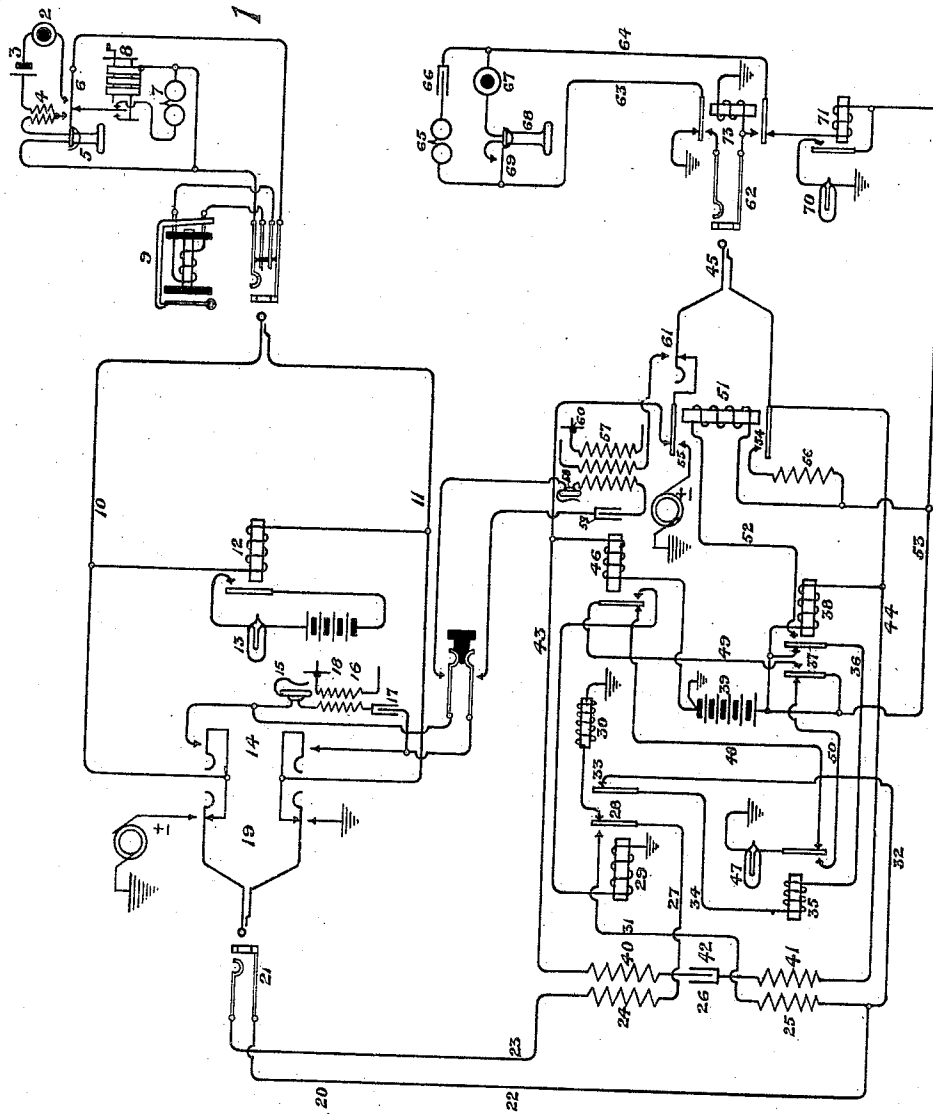


C. S. WINSTON.
 TELEPHONE TRUNKING SYSTEM.
 APPLICATION FILED NOV. 17, 1906.

971,651.

Patented Oct. 4, 1910.



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TELEPHONE TRUNKING SYSTEM.

971,651.

Specification of Letters Patent.

Patented Oct. 4, 1910.

Application filed November 17, 1906. Serial No. 343,801.

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 Trunking Systems, of which the following is a specification.

My invention relates to trunking systems adapted to be used between toll connecting cords and common battery subscribers' lines, and has, among other objects, the provision of simple means for placing the connection of ringing current with the desired line entirely under the control of the toll operator, and for relieving the trunk operator of all unnecessary attention to, or supervision of the connection. It has been customary in the past for the toll operator to order the connection and for the trunk operator to then test the desired line, insert the trunk plug in the jack, and to operate her ringing key, and to further supervise the connection until the desired party has answered his call.

By the present invention the trunk operator is relieved of all duty further than testing the desired line and inserting and withdrawing the trunk plug.

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

Referring to the drawing, a toll line 1 is shown terminating in a local battery subscriber's station with the usual telephone apparatus, including a transmitter 2, local battery 3 and primary of an induction coil 4, adapted to be included in a local circuit by the removal of the receiver 5 from the hook 6, the annunciator bell 7 being normally bridged across the line and the generator 8 being adapted to send current over the line to the central office, where it actuates the drop 9 or other suitable signal to attract the attention of the toll operator.

The usual toll cord extending in two limbs 10 and 11 is adapted to connect with the toll line and has bridged between its limbs any desired clearing-out signal, here shown as a relay 12, controlling the local circuit of supervisory lamp 13. A listening key 14 is adapted to connect the operator's receiver 15, secondary of the induction coil 16 and condenser 17 in series between the limbs of the

toll cord. A transmitter 18 is connected in series with the primary of induction coil 16, and with any suitable source of exciting current. The ringing key 19 is adapted by its actuation to place ringing current upon one limb of the calling end of the cord and to connect the other limb with ground or another suitable third conductor.

The trunk line 20 extends from the jack 21 at the main office in two limbs 22 and 23 to the windings 24 and 25 of the induction coil 26 at the auxiliary office. From the inner terminal of winding 24 of the induction coil the conductor 27 extends through the normal contacts 28 of relay 29 and through the high resistance and impedance 30 to ground, while from the inner terminal of the winding 25 the conductor 31 extends to the normally open contact of the relay 29. From a point on conductor 22 outside the winding 25 of the induction coil conductor 32 extends through the normal contact 33 of relay 29, thence through conductor 34, coil of relay 35, conductor 36, normal contact 37 of relay 38 to the live pole of battery 39. The other windings 40 and 41 of the repeating coil 26 are inductively connected at their inner ends by the condenser 42, the outer ends being permanently connected with the talking strands 43 and 44 of the incoming end of the trunk which terminates in the contacts of the calling plug 45. The live pole of battery 39 is connected through the coil of relay 38 to conductor 44, while the grounded pole of the battery is connected through the coil of relay 46 to conductor 43. The signal 47 has its circuit controlled by contacts of relays 35, 46 and 38, being normally connected by conductors 48 and 49 to an open contact of relay 38. The conductor 50 is normally connected with the live pole of the battery by contacts of relay 38, and normally disconnected from the signal by contacts of relay 35. The relay 29, controlling the connection between coils 24 and 25 of the induction coil 26, is adapted to be actuated over a local circuit, normally broken by the contacts of relays 46 and 38, and is adapted to be energized by current from the battery 39. The coil of relay 51, which is of comparatively low resistance, has one of its terminals connected through conductor 52 to a normally open contact of relay 38 where it may be connected in series

with conductor 36, which is normally in series with the outgoing end of the trunk. The other terminal of the coil of relay 51 is connected by conductor 53 with the live pole of the battery. A source of ringing current is connected with one limb of the calling end of the trunk circuit by the actuation of armature 55 of relay 51 while current from the live pole of battery 39 is connected to the other limb through the non-inductive resistance 56 by the actuation of armature 54, the normally closed contact with armature 55 being then broken to prevent ringing current from being impressed upon the coil of relay 46.

An operator's set comprising an induction coil 57, receiver 58, condenser 59 and transmitter 60 enables the trunk operator to receive the order from the toll operator and to receive the busy test through the normally open contacts of the key 61.

The plug 45 is adapted to connect with the jack 62 of a common battery telephone line extending in limbs 63 and 64 to the substation where the annunciator bell 65 and condenser 66 are normally bridged across the circuit. The transmitter 67 and receiver 68 are normally in an open bridge, of the line conductors, which is adapted to be closed by the actuation of the switch 69. At the central office the line signal 70 and line relay 71 are normally associated with the line for signaling in the usual manner while the cut-off relay 73 is adapted by its actuation to disconnect the signaling apparatus and connect the limbs of the telephone line directly with the jack.

In the operation of this system a call is sent in from the generator 8 over the toll line 1 and actuates the drop 9 before the toll operator. Upon observing the signal the operator connects the answering plug of one of her toll cords with the calling line and throws her listening key 14 to obtain the number of the desired subscriber's station. Upon learning the desired number the operator presses her order button and notifies the trunk operator of the desired line. The trunk operator then responds by telling the toll operator to connect with one of her idle trunk lines which may be connected with jack 21 and at the same time throws her test key 61 and tests the jack 62 of the desired line which may be multiplied before a plurality of operators' positions. If the line is busy the sleeve or test contact of the jack will be at a potential higher than that of ground, and a current will then flow through the tertiary of the induction coil 57, thus causing an inductive click in the operator's receiver.

Finding the line idle the trunk operator inserts plug 45 in the jack 62, thus closing a local circuit from the battery 39 through the coil of relay 38, conductor 44, sleeve contacts

of the plug and jack, and through the coil of the cut-off relay 73. The current in this path actuates the relays 38 and 73, the former closing a local circuit from the battery 39 over conductors 49 and 48 and through the signal 47 to display said signal, and the latter disconnecting the line relay 71 and placing the line in condition to be called. In the meantime the trunk operator has inserted her calling plug in the jack 21, thus closing a circuit which may now be traced from the live pole of battery 39 over conductor 53, through the coil of relay 51, conductors 52 and 36, the coil of relay 35, conductors 34, 32 and 22, the sleeve of jack 21, limb 11 of the toll cord, the coil of relay 12, limb 10 of the toll cord, tip of jack 21, conductor 23, winding 24 of the induction coil 26, conductor 27, contacts 28 and the high resistance and impedance 30 back to the ground pole of battery 39. The current in this path is sufficient to actuate the relays 35 and 12 which are of comparatively high resistance, but owing to the extremely high resistance of coil 30 the current is not sufficient to actuate the relay 51 which is of low resistance. The actuation of relay 35 now opens the circuit of signal 47, thus extinguishing it. If, however, the toll operator inserts her plug before the trunk operator the relay 35 is actuated over the same path as previously described except that its circuit excludes the relay 51. The actuation of relay 35 connects the signal 47 in a local circuit with the battery 39 including conductor 50 and normal contacts of relay 38. Thus the signal 47 is displayed when connection exists at either end of the trunk, but is effaced when connection exists at both ends. The toll operator now throws her ringing key 19, placing a ground upon the sleeve side of the trunk line which decreases the resistance of the described path, including the coil of relay 51 by removing the high resistance 30, the winding 24 of the induction coil 26 and the coil of relay 12 from the previously described circuit. Current now flows from battery through conductor 53, the coil of relay 51, conductors 52 and 36, the coil of relay 35, conductors 34, 32 and 22, the sleeve of jack 21 and to ground through the spring of key 19. The current in this path is sufficient to actuate the relay 51, placing ringing current on the spring and battery upon the spring 54.

It will be noted that the toll operator may insert her plug in the outgoing end of the trunk and throw her ringing key before the trunk operator has connected with the desired line. To provide against placing the ringing current upon a plug which may be in the trunk operator's hand under these conditions, the circuit of relay 51 is maintained broken at contacts of the sleeve super-

visory relay 38 until after the plug has been inserted in the jack of the desired line.

The actuation of relay 51 places the non-inductive resistance 56 in parallel with the
5 coil of relay 38, between the live pole of battery and the sleeve strand 44 of the trunk cord. The resistance of the coil 56 is adjusted so as not to shunt the relay 38 sufficiently to allow it to fall back, but at the
10 same time to furnish a path of low impedance for the returning ringing current, thus preventing the deenergization or rattling of relays 73 and 38. The cut-off relay being maintained actuated the ringing current
15 now flows over one limb of the called line through the annunciator 65 and condenser 66, back over the outer limb of the called line and through battery to the generator by way of the non-inductive resistance 56. When the ringing key 19 is again
20 released the path for current through the relay 51 again includes the high resistance coil 30, winding 24 of the induction coil 26 and the coil of relay 12, which reduces the
25 current enough to allow the low resistance relay 51 to fall back and remove the ringing current from the called line.

When the called subscriber answers his call current from the battery 39 flows
30 through the coil of relay 38, over the line and back to the ground side of battery 39 through the coil of relay 46. This current actuates relay 46, which in turn actuates relay 29 over a local circuit including conductor 49. The actuation of relay 29 removes the coil of relay 35 from its connection with the outgoing end of the trunk, and at the same time short-circuits the inner terminals of windings 24 and 25 of the repeating coil 26. The connection of battery 39
40 is thus removed from the outgoing end of the trunk and relay 12 falls back and extinguishes the signal 13, thus indicating to the toll operator that the call has been
45 answered. The deenergization of relay 35 would now again close the circuit of signal 47 but that the actuation of relay 46 opened the circuit of conductors 48 and 49 at the contacts of relay 46. The lines are now in
50 condition for conversation, currents being fed to the common battery line through the coils of relays 38 and 46, and the signals before both operators are effaced. When the called subscriber again places his receiver upon its hook and opens the circuit of relay 46 relay 29 is simultaneously deenergized and current from battery 39 is again sent over the line and through the
55 coil of relay 12 as before described. This actuates the signal 13 before the toll operator and the connection of the toll cord is severed from the trunk. Relay 35 now falls back and again closes the circuit of signal 47 notifying the trunk operator that
60 the conversation has terminated. She then

removes her plug 45 from its connection with the called line and all parts assume their normal condition ready for another call.

While I have shown and described my
70 improvements in connection with only one form of telephone systems I do not wish to limit the scope of my invention to this specific arrangement, the improvements here disclosed being applicable to many other
75 circuit arrangements.

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

1. In a telephone system, the combination
80 with a trunk line, of a cord circuit adapted to be connected with it at its outgoing end, and a telephone line with which its incoming end may be connected, a source of direct current associated with the incoming end of the
85 trunk, means to complete a path for current from said source by the connection of the cord circuit with the trunk, a ringing key associated with the cord circuit, means to vary the direct current flow from said source by
90 the actuation of the ringing key, and a ringing relay at the incoming end of the trunk actuated by such change in the current flow, substantially as described.

2. In a telephone system, the combination
95 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 may be connected, a source of direct current, and a relay associated with
100 the incoming end, an auxiliary circuit controlled by said relay, a signal associated with the cord circuit, a circuit completed through said relay by the connection of the cord circuit with the trunk, whereby said signal is
105 displayed, but whereby said relay is not actuated, a ringing key associated with the cord circuit, and means for increasing the current in said circuit, whereby said relay is actuated by the operation of said ringing
110 key, substantially as described.

3. 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
115 end may be connected, a source of direct current associated with the incoming end of the trunk, a ringing relay and a signaling relay connected in series between said source and the outgoing end of the trunk when a
120 connection is established between the incoming end of the trunk and a subscriber's line, a circuit completed by the connection of the cord circuit with the outgoing end of the trunk, whereby the signaling relay is actuated,
125 a ringing key associated with the cord circuit, and means to increase the current in said circuit by the actuation of said ringing key, whereby the ringing relay is actuated, and a source of ringing current associated
130

with the contacts of said ringing relay, substantially as described.

4. 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 may be connected, a source of direct current associated with the incoming end of the trunk, a relay and a high resistance normally in series with said source and with the outgoing end of the trunk when connection has been established with the trunk at each end, and means associated with the cord circuit for shunting the high resistance, whereby the relay becomes operative, and an auxiliary circuit controlled by said relay, substantially as described.

5. In a telephone system, the combination with a trunk line, of a cord circuit adapted to be connected with it at its outgoing end, and a telephone line with which its incoming end may be connected, a source of direct current, a ringing relay and a high resistance adapted to be placed in series when connection is established with each end of the trunk, and means associated with the cord circuit for shunting the high resistance, whereby the ringing relay becomes operative, and a source of ringing current connected with the called line by the actuation of said ringing relay, substantially as described.

6. 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 may be connected, a source of direct current associated with the incoming end of the trunk, a low resistance relay, a signaling device and a high resistance adapted to be placed in series with said source when a connection is established with each end of the trunk, the current in said circuit being of sufficient strength to actuate the signaling device, and means associated with the cord circuit for increasing the current, whereby the relay becomes actuated, and apparatus affected by the actuation of said relay, substantially as described.

7. 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 may be connected, a high resistance and a relay associated with the incoming end of the trunk, a path for current from said source through said relay and high resistance over the limbs of the outgoing end of the trunk in series, completed by the connection of the cord circuit with the trunk, whereby said relay becomes operative, a ringing relay adapted to have its coil included in said path when a connection is established with the incoming end of the trunk, the current in said path being nor-

mally insufficient for the operation of said ringing relay, and means associated with the cord circuit for increasing the current through said ringing relay, whereby said relay becomes operative, and a source of ringing current connected with the line by the actuation of said ringing relay, substantially as described.

8. 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 may be connected, a high resistance and a relay associated with the incoming end of the trunk, a path for current from said source through said relay and high resistance over the limbs of the outgoing end of the trunk in series, completed by the connection of the cord circuit with the trunk, whereby said relay becomes operative, a ringing relay adapted to have its coil included in said path when a connection is established with the incoming end of the trunk, the current in said path being normally insufficient for the operation of said ringing relay, and means for excluding said high resistance from said path for current, whereby the current in said path is increased, and said ringing relay becomes operative, and a source of ringing current connected with the line by the operation of said ringing relay, substantially as described.

9. 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 may be connected, a high resistance and a relay associated with the incoming end of the trunk, a source of current a path for current from said source through said relay and high resistance over the limbs of the outgoing end of the trunk in series, completed by the connection of the cord circuit with the trunk, whereby said relay becomes operative, a source of ringing current a ringing relay adapted to have its coil included in said direct current path when a connection is established with the incoming end of the trunk, the current in said path being normally insufficient for the operation of said ringing relay, and means for decreasing the resistance of said path for current, whereby said ringing relay becomes operative, to connect said ringing current source with the desired line, substantially as described.

10. 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 may be connected, a high resistance and a relay associated with the incoming end of the trunk, a path for current from said source through said relay and

high resistance over the limbs of the outgoing end of the trunk in series, completed by the connection of the cord circuit with the trunk, whereby said relay becomes operative, 5 a ringing relay adapted to have its coil included in said path when a connection is established with the incoming end of the trunk, the current in said path being normally insufficient for the operation of said 10 ringing relay, and means for closing a circuit over one limb only of the outgoing end of the trunk, whereby the current in said path is increased and said ringing relay is operated and a source of ringing current 15 connected with the desired line by the actuation of said ringing relay, substantially as described.

11. In a telephone system, the combination with a trunk line, of a cord circuit adapted 20 to be connected therewith at its outgoing end, and a telephone line with which its incoming end may be connected, a source of direct current at the incoming end of the trunk, said source and a relay in series 25 with the outgoing end of the trunk, and means for varying the current through said relay, whereby it may become operative and telephone apparatus affected by the

operation of said relay, substantially as described.

12. In a telephone system, the combination with a telephone line, of a connective circuit therefor, a source of direct current, a low resistance relay winding, a high resistance relay winding and a high resistance in a circuit of said source, the current from said source through said path being sufficient to actuate said high resistance relay but not sufficient to actuate said low resistance relay, telephone apparatus controlled by the 30 actuation of said high resistance relay, means to exclude said high resistance from said path, whereby the current is increased sufficiently to actuate said low resistance relay, and a source of ringing current connected with the calling end of the trunk circuit by the actuation of said low resistance relay, substantially as described. 35 40 45

Signed by me at Chicago, county of Cook, and State of Illinois, in the presence of two 50 witnesses.

CHARLES S. WINSTON.

Witnesses:

CLIFFORD C. BRADBURY,
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