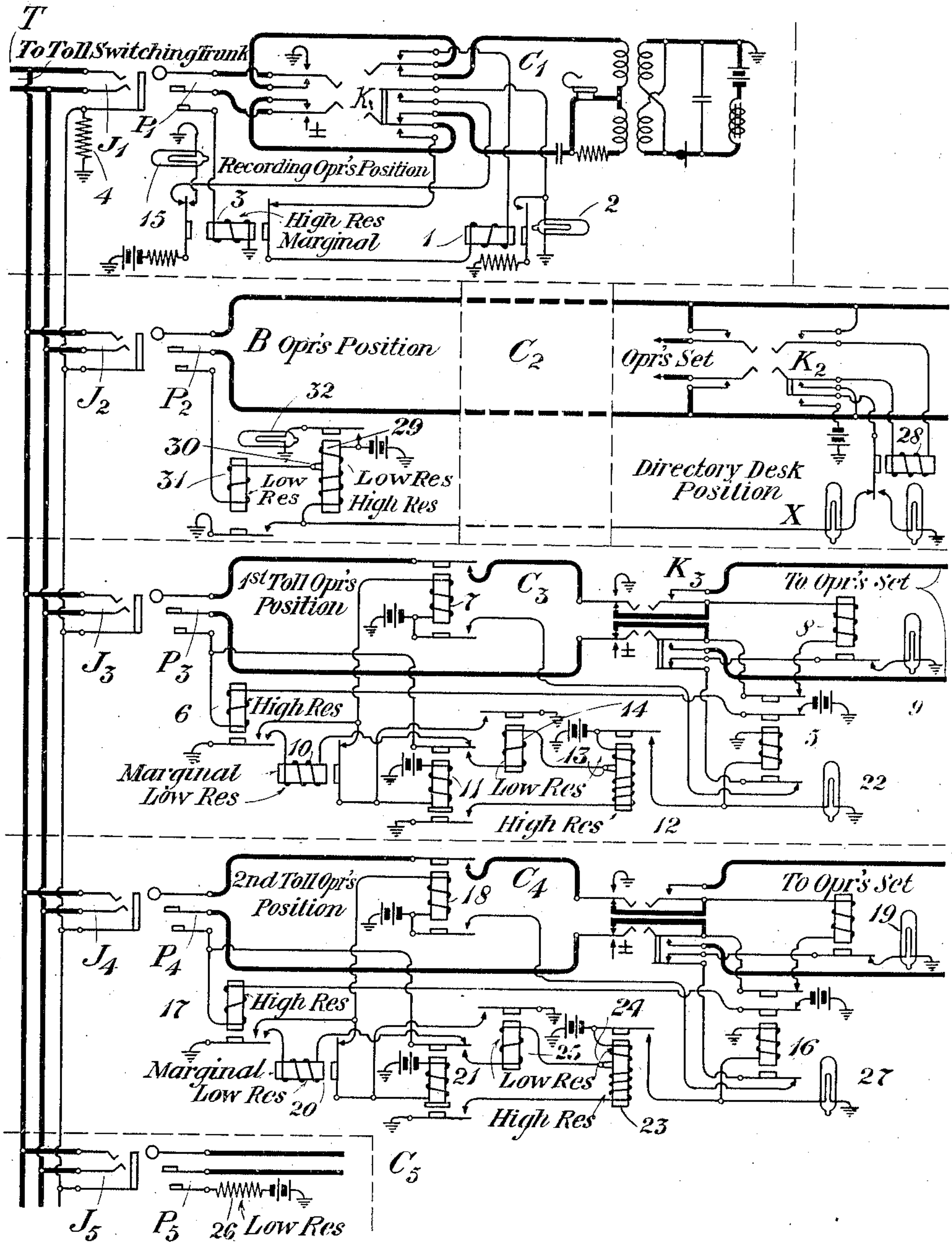


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HOLDING CIRCUITS FOR TOLL SWITCHING TRUNKS.
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HOLDING-CIRCUITS FOR TOLL-SWITCHING TRUNKS.

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To all whom it may concern:

Be it known that I, OWEN H. LOYNES, residing at Woodridge, in the county of Bergen and State of New Jersey, have invented certain Improvements in Holding-Circuits for Toll-Switching Trunks, of which the following is a specification.

This invention relates to telephone circuits and more particularly to circuits employed in connection with the establishment of long distance toll connections.

When a subscriber indicates to an A operator at a local office that a long distance connection is desired it is customary for the A operator to connect the subscriber with a trunk leading to a toll office at which the trunk terminates before a recording operator's position. The recording operator communicates over the trunk and ascertains from the subscriber the connection desired and then proceeds to enter this information upon a ticket. The recording operator then communicates over an order wire with a B operator at the local office in which the calling subscriber's line terminates and orders the calling subscriber's line connected to a toll switching trunk extending between the local office and the toll office. This connection having been established the recording operator associates a holding circuit with the toll switching trunk to hold the connection thus established in condition for completing the long distance connection when the desired party is available. During the time which elapses while the various operations necessary to completing the call take place the calling subscriber may hang up his receiver.

The recording operator having made out the ticket passes it to a directory operator, in case it is necessary to obtain further information with reference to the called subscriber. If all necessary information was secured by the recording operator, the ticket is passed directly to a toll operator for the purpose of completing the connection. The directory operator, upon receiving the ticket, associates a holding circuit with the toll switching trunk which is connected with the calling subscriber's line, and thereby transmits a disconnect signal to the recording operator's holding circuit so that the recording operator may now disconnect her holding circuit, the toll switching trunk being in the meantime held by the holding circuit of the

directory operator. The directory operator, upon obtaining the necessary information for completing the call, passes the ticket on to a toll operator for the purpose of completing the connection.

It is one of the objects of this invention to provide a holding circuit for a toll operator of such a character that, upon associating the holding circuit with a toll switching trunk, a disconnect signal will be transmitted to the holding circuit of the directory operator or the recording operator as the case may be.

A further object of the invention is to so arrange the holding circuit of the toll operator that when it is associated with a toll switching trunk and thereafter a similar holding circuit is associated with the trunk by another toll operator to whom the ticket for some reason has been passed in order to complete the connection, a disconnect signal will be received by the first holding circuit so that the first toll operator may disconnect the same from the toll switching trunk.

A still further object of the invention is to provide a holding circuit for a toll operator of such character that when, upon the setting up of a connection between the calling subscriber and the wanted subscriber, a toll cord is associated with the toll switching trunk, a disconnect signal will be received by the holding circuit so that the same may be removed from the toll switching trunk.

Other and further objects of the invention will be clear from the following description when read in connection with the accompanying drawing, the figure of which illustrates a preferred embodiment of the invention. It is believed that the apparatus is of such a nature that it may best be understood from the description of the operation which is as follows:

Assuming that a recording operator has obtained from the calling subscriber the necessary information to initiate the establishment of a long distance connection and that in response thereto the recording operator has made out the usual ticket and ordered the calling subscriber's line connected to a toll switching trunk T, the recording operator inserts the plug P₁ of a holding circuit C₁ in the jack J₁, through which the toll switching trunk T terminates

at the recording operator's position. The recording operator then throws the holding key K_1 of the holding circuit, thereby bridging the winding of the holding relay 1 across the holding circuit. As is well understood, the toll switching trunk is so arranged that when a calling subscriber's line is associated therewith and the calling subscriber's receiver is on the switch hook, battery is bridged across the trunk, but when the receiver is removed from the hook, battery is disconnected from the trunk. Assuming that the calling subscriber has hung up his receiver to await the establishment of the desired connection, the relay 1 will be energized by reason of the battery connection bridged across the toll switching trunk I and at its front contact shunts the subscriber's signal lamp 2, thereby preventing it from glowing. The high resistance marginal relay 3 associated with the sleeve circuit of the holding circuit is not operated when the plug P_1 is inserted in the jack J_1 as the sleeve conductor of the trunk is connected to ground through a resistance 4.

Assuming that the recording operator secured from the calling subscriber all of the necessary information for completing the connection and that the recording operator has also in the meantime passed the ticket containing the desired information to the toll operator at the first toll operator's position, for the purpose of completing the connection, the toll operator upon receiving the ticket will at once insert the plug P_2 of the holding circuit C_2 in a multiple jack J_2 of the toll switching trunk. This is done for the purpose of holding the toll switching trunk T while the connection is being established. The hold-circuit C_2 may be used as a link circuit, but in practice is merely a one-ended circuit adapted to associate the talking set of the operator with the trunk. A circuit is now completed from battery over the middle back contact of relay 5, through the winding of high resistance relay 6, over the sleeve contacts of plug P_2 and jack J_2 , over the sleeve circuit of the trunk T and thence to ground over the sleeve contacts of the jack J_1 and the plug P_1 and through the winding of the high resistance marginal relay 3 in parallel with resistance 4. The high resistance relay 6 is energized over the circuit above traced but owing to its high resistance the current flow is insufficient to operate the marginal relay 3.

Relay 6 upon being energized completes a circuit from ground over the front contact of said relay and through the winding of relay 7 to battery. Relay 7 upon being energized, at its upper front contact completes the talking circuit so that battery from the toll switching trunk flows through the winding of holding relay 8. Holding relay 8

opens the circuit of the subscriber's signal lamp 9 which otherwise would have been completed by the energization of relay 7, said circuit extending from battery over the lower front contact of relay 7, lower back contact of relay 5, lower normal contact of holding key K_2 , back contact of relay 8 and through the lamp 9 to ground. The relay 6 also completes a circuit from ground over its front contact, through the winding of low resistance marginal relay 10, over the upper back contact of slow acting relay 11, through the winding of high resistance relay 6 and over the middle back contact of relay 5 to battery. Owing to the high resistance of relay 6, marginal relay 10 does not receive sufficient current to attract its armature. Accordingly a further circuit is completed by relay 6 from ground over the front contact of said relay, over the back contact of marginal relay 10 and through the winding of slow acting relay 11 to battery.

Relay 11 upon being energized opens the circuit of relay 10 and completes circuits for the differential relay 12 as follows:

From battery through the low resistance winding of relay 12 to point 13 where the circuit divides one path continuing through the lower high resistance winding of relay 12 and over the lower front contact of relay 11 to ground. Another path extends from point 13 through the low resistance winding of relay 14, over the upper front contact of relay 11, over the sleeve contacts of plug P_2 and jack J_2 , over the sleeve circuit of the trunk T, sleeve contacts of jack J_1 and plug P_1 and through the winding of marginal relay 3 to ground. The marginal relay 3 now has in series with its winding only the low resistance winding of relay 12 and the winding of relay 14 which is also of low resistance. Consequently the current flow through relay 3 is sufficient to energize said relay, which at its left hand front contact completes a circuit for the disconnect lamp 15. The windings of relay 12 are differentially arranged and are so proportioned that with the circuits as above described said relay 12 will not be energized. Relay 14 will be energized, however, and at its upper front contact completes a locking circuit for the relay 11.

The recording operator upon observing the glowing of the disconnect lamp 15 withdraws the plug P_1 from the jack J_1 of the toll switching trunk, thereby restoring the holding circuit C_1 to normal. The disconnection of the high resistance relay 3 from the sleeve circuit of the trunk does not sufficiently vary the current flow through the windings of the relay 12 to operate said relay, as ground is still connected to the sleeve of the trunk through the resistance 4.

Consequently the relay 14 of the holding circuit C_3 remains energized but the differential relay 12 remains deenergized.

In the normal course of events the first toll operator now proceeds to complete the connection. If, however, the first operator should be overloaded the ticket of the connection here under consideration might be passed to a second operator who upon receiving the same would insert the plug P_4 of the holding circuit C_4 , (which is similar to holding circuit C_3), in the jack J_4 of the toll switching trunk T. A circuit is thereby completed from battery over the middle back contact of relay 16, through the winding of high resistance relay 17, over the sleeve contacts of plug P_4 and jack J_4 and over the sleeve circuit of the trunk T through resistance 4 to ground. Relay 17 is now energized and at its lower front contact completes the circuit of relay 18, which upon being energized completes a talking circuit and prepares a circuit of the lamp 19 in a manner similar to that described in connection with the lamp of the holding circuit C_3 .

Relay 17 also completes a circuit from ground over its front contact through the winding of the low resistance marginal relay 20, over the upper back contact of slow acting relay 21, over the sleeve contacts of plug P_4 and jack J_4 , over the sleeve contacts of jack J_3 and plug P_3 , over the upper front contact of relay 11, through the winding of relay 14 and through the upper low resistance winding of relay 12 to battery. As the circuit just traced includes only three low resistance windings, sufficient current flows through the winding of relay 20 to energize the same, and said relay upon attracting its armature opens the circuit of the slow acting relay 21 before said relay has had time to pull up. The current flowing through the upper low resistance winding of relay 12 is also increased to such an extent that the differential relay 12 is energized and completes the circuit of the disconnect lamp 22 of the holding circuit C_3 , thereby indicating to the operator at the first position that the plug P_3 should be withdrawn. Relay 12 upon being energized also completes the circuit of relay 5, which at its middle contact opens the battery connection through the high resistance relay 6. Relay 6 is thereupon deenergized and opens the circuits of relay 7 and 10. Relay 11, however, remains energized as it is locked up over the front contact of relay 14.

The first toll operator upon observing the glowing of signal lamp 22 withdraws the plug P_3 from the jack J_3 , thereupon disconnecting battery from the sleeve contact of the jack J_3 and releasing relays 14 and 12. This operation also results in the deenergization of the marginal relay 20 of the

holding circuit C_4 since the only circuit now existing for the relay 20 includes the high resistance winding of relay 17. Relay 20 upon being deenergized completes the circuit of the slow acting relay 21, which at its upper and lower front contacts completes circuits as follows:

From battery through the upper low resistance winding of relay 23 to point 24 from which point one path extends through the lower high resistance winding of relay 23 and over the lower front contact of relay 21 to ground. Another path extends from point 24 through the low resistance winding of relay 25, upper front contact of relay 21, sleeve contacts of plug P_4 and jack J_4 , over the sleeve circuit of the trunk T and through the resistance 4 to ground. Relay 25 is energized and locks up relay 21 but relay 24 is differential and does not attract its armature.

Should the toll connection be completed between the calling and called subscribers by inserting the plug P_5 of a toll cord C_5 in a multiple jack such as J_5 of the toll switching trunk T with which the calling subscriber's line is associated, a circuit would be completed from battery through resistance 26 in the sleeve of the toll cord, over the sleeve contacts of plug P_5 and jack J_5 , sleeve contacts of jack J_4 and plug P_4 , upper front contact of relay 21, winding of relay 25, through lower winding of relay 23 and over the lower front contact of relay 21 to ground. The current flow through the lower winding of relay 23 is now sufficiently increased to cause relay 23 to attract its armature and cause the glowing of the disconnect lamp 27. The second toll operator therefore withdraws the plug P_4 from the jack J_4 , thereby restoring the holding circuit C_4 to normal.

In case the recording operator had been unable to secure sufficient information for completing the connection, she would have passed the ticket containing such information as she had obtained to a directory desk position X, at which position an operator is provided with directories of various cities from which the necessary information concerning the called subscriber may be obtained. Since the directory operator's position will have calls for information arising from a very large number of trunks, it is not practicable to provide a multiple for each trunk at the directory operator's position. Consequently, the directory operator will be connected with the trunk through a B operator's position. The directory operator upon receiving the ticket communicates with a B operator over an order wire and requests the B operator to insert the plug P_2 of a holding circuit C_2 extending to the directory desk position in the jack J_2 of the toll switching trunk T. The directory oper-

ator then throws the holding key K_2 to bridge the holding relay 28 across the holding circuit terminating at the B operator's position. A circuit is completed from battery through the low resistance winding of relay 29 to point 30 and thence through the low resistance relay 31, over the sleeve contacts of plug P_2 and jack J_2 and over the sleeve contacts of jack J_1 and plug P_1 , through the winding of marginal relay 3 to ground. As only the low resistance windings of relays 29 and 31 are included in series with the relay 3, the latter relay is energized and actuates the disconnect signal 15 of the holding circuit C_1 in a manner already described. Relay 31 is energized over the circuit above traced and at its lower front contact completes a circuit through the high resistance winding of the differential relay 29, so that said relay is maintained deenergized to prevent the actuation of the disconnect lamp 32.

The directory operator upon securing such additional information as is necessary to complete the call passes the ticket to a toll operator, such as, for instance, the operator provided with the holding circuit C_3 . Said toll operator then inserts the plug P_3 in the jack J_3 so that the relay 6 is energized over a circuit from battery, middle back contact of relay 5, winding of relay 6, sleeve contacts of plug P_3 and jack J_3 , over the sleeve conductor of the toll switching trunk T and through resistance 4 to ground.

Relay 6 upon being energized completes a circuit from ground over its lower front contact, through the winding of relay 10, over the upper back contact of relay 11, over the sleeve contacts of plug P_2 and jack J_3 , over the sleeve contacts of jack J_2 and plug P_2 , through the winding of low resistance relay 31 and through the low resistance winding of relay 29 to battery. The current flow through the upper winding of relay 29 is now sufficiently increased to cause relay 29 to attract its armature and complete the circuit of the disconnect lamp 32. The B operator upon observing the glowing of this lamp withdraws the plug P_2 from the jack J_2 , whereupon the marginal relay 10 is deenergized and at its back contact completes a circuit of the relay 11 in a manner already described. Relay 11 upon being energized completes circuits for relays 12 and 14 similar to those already described so that the relay 14 is energized and locks up relay 11, but relay 12 being differential does not attract its armature.

Should another holding circuit such as C_4 be associated with the trunk T, or should a toll cord such as C_5 be connected to the toll switching trunk, the differential relay 12 will be actuated in a manner similar to that already described and will cause the

disconnect lamp 22 to glow so that the toll operator will take down the holding cord.

By means of the arrangement above described a holding circuit for a toll switching trunk is provided, said holding circuit being of such character that disconnect signals will be transmitted to holding circuits previously associated with the trunk and the holding circuit will in turn receive a disconnect signal upon the subsequent association of any other holding circuit with the trunk.

Furthermore, while the invention has been illustrated in what is believed to be its preferred form, it will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. The combination with a toll switching trunk, of a holding circuit adapted to be associated therewith, means associated with said holding circuit whereby when it is connected with a trunk a disconnect signal will be given for any other holding circuit which may at that time be associated with the trunk, and signaling means associated with said holding circuit and adapted to be actuated when another circuit is thereafter connected with the trunk.

2. The combination with a toll switching trunk, of a holding circuit adapted to be associated therewith, means associated with said holding circuit whereby when it is connected with a trunk a disconnect signal will be transmitted over the sleeve conductor of the trunk to any other holding circuit which may at that time be associated with the trunk, and signaling means associated with said holding circuit and adapted to be actuated when another circuit is thereafter connected with the trunk.

3. The combination with a toll switching trunk, of a holding circuit adapted to be associated therewith, means associated with said holding circuit whereby when it is connected with a trunk a disconnect signal will be transmitted over the sleeve conductor of the trunk to any other holding circuit which may at that time be associated with the trunk, and signaling means associated with said holding circuit and adapted to be actuated over the sleeve circuit of the trunk when another circuit is thereafter connected with the trunk.

4. The combination with a toll switching trunk, of a holding circuit adapted to be associated therewith, means associated with said holding circuit whereby when it is connected with a trunk a disconnect signal will be given for any other holding circuit which may at that time be associated with the trunk, and signaling means associated with

said holding circuit and adapted to be actuated over the sleeve conductor of the trunk when another circuit is thereafter connected with the trunk.

5 5. The combination with a toll switching trunk, of a holding circuit adapted to be associated therewith, means whereby when said holding circuit is associated with a trunk a low resistance path is connected to the sleeve
10 conductor of the trunk to operate a marginal signal controlling relay associated with another holding circuit which may at that time be connected with the trunk, and means to connect a disconnect signal controlling relay
15 with the sleeve conductor of the holding circuit, said relay being arranged to be operated only when another circuit is thereafter associated with the trunk.

20 6. The combination with a toll switching trunk, of a holding circuit adapted to be associated therewith, means whereby when said holding circuit is associated with a trunk a low resistance path is connected to the sleeve conductor of the trunk to operate a marginal
25 signal controlling relay associated with another holding circuit which may at that time

be connected with the trunk, and means to connect one winding of a differential signal controlling relay with the sleeve conductor of the holding circuit, said relay being ar- 30 ranged so that it is unbalanced and operates due to an increase in current flow over the sleeve conductor of the trunk when another circuit is connected with the trunk.

7. The combination with a toll switching 35 trunk, of a recording operator's holding circuit adapted to be associated with the trunk, a toll operator's holding circuit adapted to be associated with the trunk at a toll operator's position, means associated with said toll op- 40 erator's holding circuit to transmit a disconnect signal to the recording operator's holding circuit, and means whereby when a second toll operator's holding circuit is connected with the trunk a disconnect signal is 45 transmitted to said first mentioned toll operator's holding circuit.

In testimony whereof, I have signed my name to this specification this twenty-first day of December 1918.

OWEN H. LOYNES.