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PREMATURE DISCONNECT SIGNAL FOR TELEPHONE CIRCUITS

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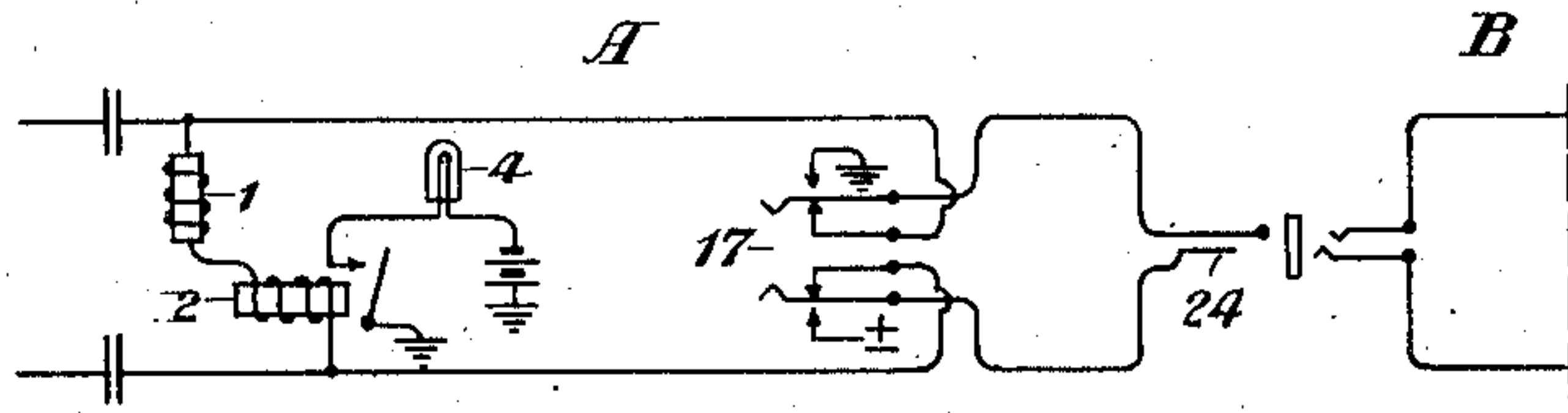


Fig. 1

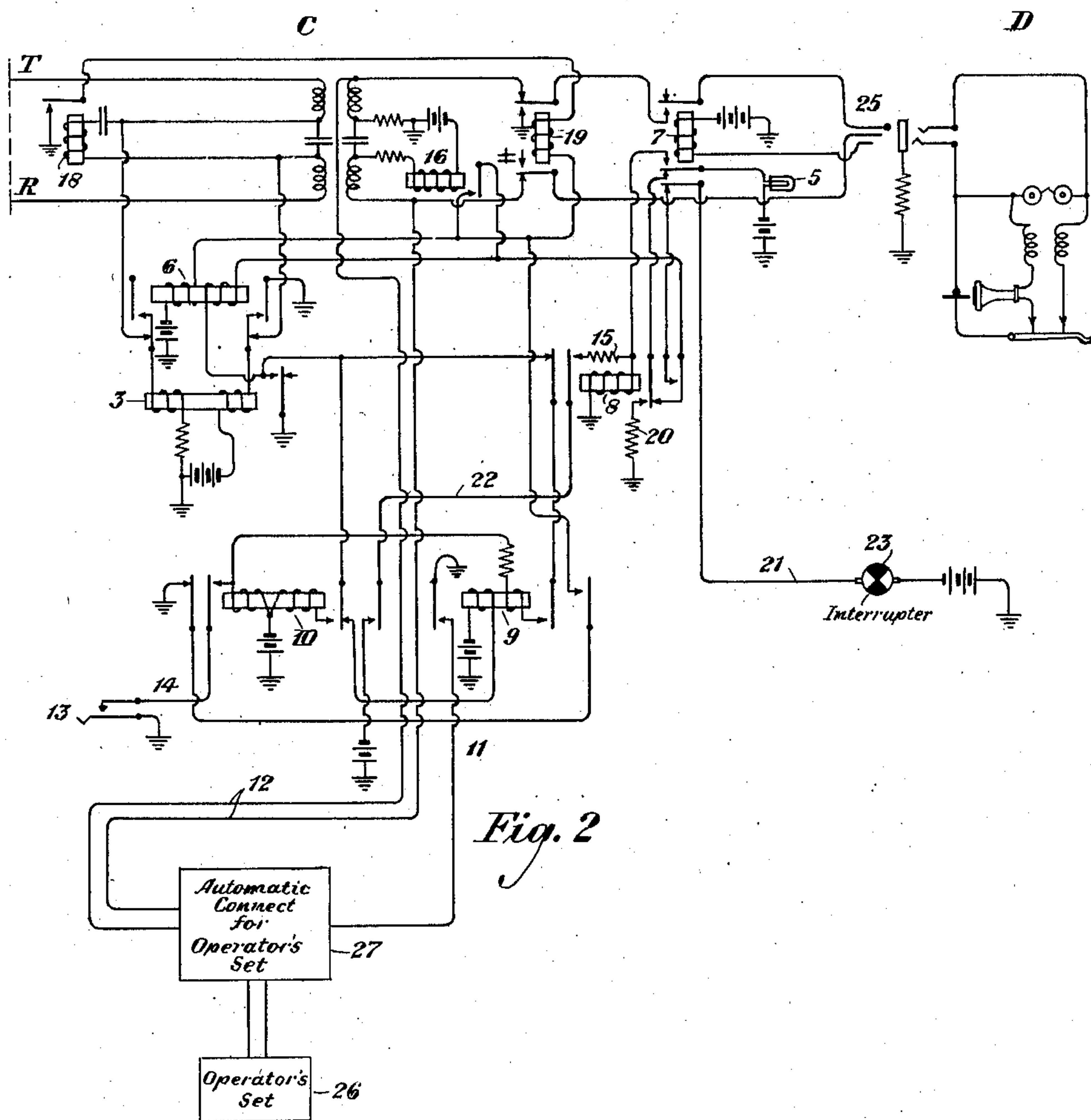


Fig. 2

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PREMATURE-DISCONNECT SIGNAL FOR TELEPHONE CIRCUITS

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This invention relates to signaling systems for telephone circuits and more particularly to improvements in the supervision of such long distance calls as necessitate the use of toll switching trunks in the establishment of telephone connections.

The novel feature of the invention consists in an automatic reorder signal to the toll operator where the toll switching or "B" operator has disconnected the switching trunk from the subscriber's line before the call is complete, as would be the case in a premature disconnect. After a connection has been established between the toll operator and a subscriber if the "B" operator disconnects prematurely, that is, prior to a disconnect by the toll operator, the toll operator will automatically and almost instantly receive a reorder signal evidenced by a periodic and intermittent flashing of the supervisory lamp associated with the toll operator's cord circuit connected to the toll switching trunk in question. The toll operator, upon noting the flashing lamp will have the connection reestablished.

The circuit operations by means of which this result is obtained are best made clear by reference to the attached drawings, of which:

In Figure 1, A shows the circuit diagram of a portion of a toll operator's cord circuit including the toll supervisory guard lamp, the ringing key, and the plug for insertion into a toll switching trunk. The other portion of the toll cord circuit, not shown, is connected to a toll line which in turn is connected by well known means, through intermediate apparatus to the distant subscriber's circuit. B shows the outgoing end of a toll switching trunk, the distant end of which terminates in a "B" office.

In Fig. 2, C shows the circuit diagram for the "B" office end of a toll switching trunk with associated signaling apparatus arranged for the automatic listening straightforward method of operation. With the straightforward method of operation, the toll operator passes instructions to the "B" operator directly over the switching trunk to be used in completing a call, while

the automatic listening consists in a circuit arrangement for automatically connecting the "B" operator's set to a switching trunk which has been seized by the toll operator. The signaling apparatus shown at C in Fig. 2, contains the novel features of the present invention.

The detailed operation of the circuit will become apparent from the following explanation. When the toll operator plugs her cord circuit A into the jack of the toll switching trunk B, a direct current bridge is placed across the tip and ring causing relay 3 of Fig. 2 to operate from ground through the left winding of 3, out over the tip side of the switching trunk, through retard coil 1 of Fig. 1, and relay 2, back over the ring side of the switching trunk, through the right winding of 3 to battery and ground. Relay 3 operates and lights the switching trunk supervisory lamp 5 over a circuit from battery through lamp 5, lower inner back contact of relay 7, right inner back contact of relay 8, through the right winding of relay 6 to ground at the front contact of 3. Relay 6 operates over this circuit and closes a locking circuit for 3 from battery through the right winding of 3 to ground at the front right contact of 6. At the same time the operation of 6 cuts off battery and ground from the ring and tip conductors of the switching trunk, thus preventing the operation of relay 2 and the consequent lighting of toll supervisory lamp 4 at this time. The operation of 3 also furnishes ground to operate relay 9 from battery through the left winding of 9, right inner back contact of 10, to ground at the front contact of 3. The operation of 9 connects ground to lead 11 which by means of switching device 27 causes the operator's telephone set 26 to be automatically connected to the switching trunk through leads 12. The operation of 9 also operates 10 from battery, through the left winding of 10, right winding and right inner front contact of 9, left outer back contact of 8, to ground at the front contact of 3. 10 locks to ground under control of 3 from battery, through the right winding, and right inner front con-

tact of 10 to ground at 3. At the same time the operation of 10 opens the operating circuit at 9 at the right inner back contact of 10, but 9 is still held operated through its right winding.

5 If the operator, after receiving the call, operates her release key 13, a ground is placed on lead 14 which short-circuits the right winding of 9, thus releasing it. The release
10 of 9 removes the ground from lead 11 which causes the operator's set to be disconnected from leads 12. When the "B" operator plugs into the called subscriber's line D, relay 7
15 operates from battery through 7 to ground in the sleeve of D. The operation of 7, by opening its lower inner back contact, removes battery from the right winding of 6, causing it to release. The release of 6 again connects
20 3 across the trunk, through the back contacts of 6 and thus supplies battery and ground to the ring and tip causing the operation of relay 2 at the toll board thus lighting toll supervisory lamp 4, which furnishes a signal
25 for the toll operator to ring on the circuit. Meantime, the operation of 7 has closed the tip conductor of the trunk through the upper front contact of 7, and by closure of the lower inner front contact, has completed a circuit
30 from battery through the "B" board guard lamp 5 to ground through relay 8 which operates. The operation of 8 closes a circuit from battery at the outer right front contact of 10, through resistance 15, through 8 to
35 ground. Relay 8 is thus locked up under control of relays 10 and 7. Resistance 15 being now shunted across lamp 5, extinguishes the latter. The operation of 8, by opening its left outer back contact, opens the holding circuit of 9 and releases it if it has
40 not already been released in the manner described above by operation of release key 13. Relay 6 will now follow the operation of relay 16, which, in turn, will follow the operation of the subscriber's switchhook.

45 With the connection in its present condition, the toll operator rings the subscriber's line D by operating ringing key 17, which in turn, causes the operation of relay 18 at the incoming end of the trunk. The operation
50 of 18 supplies ground to operate relay 19 from battery through the left winding of 6, winding of 19 to ground at 18. The operation of 19 supplies ringing current through its front contacts to the subscriber's line circuit.
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When the called subscriber answers, the removal of the receiver from the switchhook places a direct current bridge across the tip and ring conductors of D, thus causing the
60 operation of relay 16. The operation of 16 closes a circuit to operate 6, from battery through the left winding of 6, front contact of 16, right winding of 6 to ground at the front contact of 3. The operation of 6 re-
65 moves battery and ground from the tip and

ring of the trunk extinguishing toll supervisory lamp 4 which furnishes a signal to the toll operator that the subscriber has answered.

While the trunk is in its present condition and is still held at the toll board, if the "B" operator should disconnect first, as would be the case with a premature disconnect, relay 7 will release also relay 16 if it is operated at the time of the cut-off releases and opens the
70 operating circuit of relay 6. Relay 8 remains locked through the outer right front contact of 10, 10 of course remains locked through its right front contact and ground at 3, 3 being held operative by the D. C. bridge at A. The release of 7 relights lamp
75 5, through the lower back contact of 7, front right contact of 8, to ground through resistance 20. At the same time the release of 7 connects intermittent battery to 6 over a circuit from battery through interrupter 23 to
80 lead 21, lower outer back contact of 7, outer right front contact of 8 through the right winding of 6 to ground at front contact of 3. The operation of 6 follows the battery pulses received through 23 and thus each operation of 6 interrupts the battery and ground
85 supplied to the tip and ring conductors of the trunk. The interrupted pulses thus arriving at A causes the intermittent operation of 2 which in turn causes a flashing toll supervisory lamp 4. The toll operator, noting the
90 flash, can again obtain connection with the "B" operator by removing an reinserting plug 24. The act of removing 24 will release relays 3, 10, and 8, thus returning the trunk to its initial condition. Upon reinserting 24, the trunk will function as in the case of a new call reconnecting the "B" operator's set to the switching trunk in the manner previously described.
95 100 105

It was pointed out above that when the toll switching operator disconnected prematurely the guard lamp 5 was relighted and off-hand, it might appear that this would be a sufficient signal to the "B" operator to have the connection reestablished. There are several reasons why this is not the case. In the first place, the relighting of lamp 5 on a premature disconnect, causes the trunk to appear in the same condition as a trunk on which a new call is waiting to be answered. Consequently if calls were waiting to be answered on several trunks, the "B" operator might not notice that her operator's set was not connected to the prematurely disconnected circuit in regular sequence as would be the case for trunks on which new calls were waiting. This is due to the fact that on a premature disconnect relay 9 does not reoperate to
110 115 120 125 130

ond place, even assuming that the "B" operator did note the premature disconnect promptly, it would, nevertheless, be necessary for her to plug the disconnected switching trunk into a reorder jack in order to notify the toll operator of the disconnect which procedure would also introduce undesirable delay. This second objection also applies in offices where the "B" operator manually connects her operator's set to the toll switching trunk.

In the case of a normal call, the toll operator will disconnect first. Assume that the call has progressed in the manner described above to the point at which the called subscriber answers and that the circuit is undisturbed until the call is complete. When the called subscriber hangs up, relay 16 will release, thus releasing 6. The release of 6 again connects battery and ground to the tip and ring of the trunk causing the operation of 2 in the toll cord circuit. The operation of 2 lights the toll supervisory lamp 4 giving the signal to the toll operator to disconnect. The toll operator, in disconnecting, removes the D. C. bridge across the tip and ring conductors of the switching trunk thus releasing 3. The release of 3, by removing ground from its front contact breaks the holding circuit for 10 which releases and in so doing, removes battery from lead 22 thus removing the shunting resistance 15 from around lamp 5. Lamp 5 thus relights and furnishes a signal to the "B" operator to disconnect. When the "B" operator disconnects, 7 releases, extinguishing lamp 5 and releasing 8. The circuit is now in its normal condition.

Assume now that the toll operator has disconnected as described in the preceding paragraph but that the "B" operator fails to disconnect upon getting a signal by the relighting of lamp 5 and with the switching trunk thus still connected to D, the toll operator plugs into B to place a new call. Relay 3 again operates, furnishing a ground for the operation of 9 through its left winding and the right inner back contact of 10. The operation of 9, by connecting ground to lead 11, again connects the "B" operator's set to the switching trunk. Relay 10 does not operate at this time since its operating circuit is open at the outer left back contact of 8, which is still held operative due to the fact that the switching trunk is still plugged into D. Relay 6 operates over a circuit from battery through the left winding of 6, outer right front contact of 9, outer left back contact of 10, to ground. The operation of 6 removes battery and ground from the tip and ring conductors of the switching trunk thus extinguishing lamp 4 at the toll board. The toll operator thus supposing the trunk to be in its normal condition at the "B" board, waits on the circuit for the "B" operator to answer. The "B" operator, after taking the new call, will start to insert

plug 25 into the jack of some different called station E, not shown, and will notice for the first time that the plug of the switching trunk has no been removed from the jack of the station last called, namely D. The "B" operator will thus remove plug 25 from D and insert it in E. Upon removal of the plug from D, relays 7 and 8 will release, thus allowing 10 to operate. The circuit is now in the same condition it would be in had the call started with the switching trunk in its normal condition, hence upon the insertion of the plug in E the call proceeds as described above.

A toll switching trunk which is equipped with the automatic reorder circuit discussed above differs from one which does not contain this feature in that the former trunk has an additional relay 8, resistance 15, and source of interrupted battery 23, which the latter does not contain. In addition, of course, the wiring of the signaling system on the switching trunk is changed somewhat to cause the apparatus to function as a unit.

What is claimed is:

1. In a telephone system, in combination, a toll switching trunk extending from a toll office to a "B" office, a toll cord containing a toll supervisory lamp circuit at the toll office, a subscriber's line circuit terminating at the "B" office, and means for causing an intermittent flashing of the toll supervisory lamp upon disconnection of the toll switching trunk from the subscriber's circuit prior to disconnection of the toll cord from the toll switching trunk.

2. In a telephone system, in combination, a toll switching trunk extending from a toll office to a "B" office, a toll cord containing a supervisory lamp circuit at the toll office, a subscriber's line circuit terminating at the "B" office, means for supervising the establishment, talking period, and completion of a connection from the toll office to the subscriber by furnishing characteristic signals to the toll and "B" operators during this period, and in addition, means for causing an intermittent operation of the toll supervisory lamp upon disconnection of the toll switching trunk from the subscriber's circuit prior to a disconnection of the toll cord from the toll switching trunk.

3. In a telephone system, in combination, a telephone trunk circuit extending between two offices, a link circuit containing a signaling device at one office, a subscriber's circuit terminating at the other office, a system of relays and a signaling device associated with the trunk circuit, which, operating in conjunction with the signaling device of the link circuit, is adapted to furnish supervision by means of characteristic signals at both offices during the establishment of a talking period and disconnection of a connection from the toll office to the subscriber, and an additional

relay and a source of interrupted battery supply adapted to cause a periodic and intermittent operation of the signaling device in the link circuit upon disconnection of the trunk circuit from the subscriber's circuit prior to a disconnection of the link circuit from the trunk circuit.

4. In a telephone system, in combination, a toll switching trunk extending from a toll office to a "B" office, a toll cord containing a supervisory lamp circuit at the toll office, a subscriber's circuit terminating at the "B" office, signaling apparatus consisting of a system of relays and a supervisory lamp circuit associated with the toll switching trunk at the "B" office adapted to supervise, by means of characteristic signals to the toll and "B" operators, the establishment and completion of a connection from the toll office to the subscriber by means of the toll cord switching trunk and subscriber's loop, an additional relay, and a source of interrupted battery supply adapted to cause an intermittent and periodic flashing of the toll supervisory lamp upon disconnection of the toll switching trunk from the subscriber's loop prior to disconnection of the toll cord from the toll switching trunk.

5. In a telephone system, in combination, a toll switching trunk extending from a toll office to a "B" office, a toll cord containing a supervisory lamp circuit at the toll office, a subscriber's circuit terminating at the "B" office, means for causing an intermittent flashing of the toll supervisory lamp, if, after the toll cord is connected to the switching trunk and the switching trunk connected to the subscriber's circuit, the switching trunk is then disconnected from the subscriber's circuit before the toll cord is disconnected from the switching trunk.

6. In a telephone system, in combination, a toll switching trunk extending from a toll office to a "B" office, a toll cord containing a supervisory lamp circuit at the toll office, a subscriber's circuit terminating at the "B" office, means for supervising, by means of characteristic signals to the toll and "B" operators, the establishment and completion of a connection from the toll office to the subscriber, and means adapted to cause an intermittent and periodic flashing of the toll supervisory lamp if, after the toll cord has been connected to the switching trunk and the switching trunk connected to the subscriber's circuit, the switching trunk is then disconnected from the subscriber's circuit before the toll cord is disconnected from the switching trunk.

7. In a telephone system, in combination, a toll switching trunk extending from a toll office to a "B" office, a toll cord containing a supervisory lamp circuit at the toll office, a subscriber's circuit terminating at the "B" office, a system of relays operating in con-

junction with the toll cord and adapted to cause a periodic and intermittent flashing of the toll supervisory lamp upon disconnection of the switching trunk from the subscriber's circuit prior to a disconnection of the toll cord from the switching trunk.

8. In a telephone system, in combination, a toll switching trunk extending from a toll office to a "B" office, a toll cord containing a supervisory lamp circuit at the toll office, a subscriber's circuit terminating at the "B" office, a system of relays and a supervisory lamp associated with the switching trunk at the "B" office operating in conjunction with the toll supervisory lamp circuit for supervising the establishment and completion of a connection from the toll office to the subscriber by means of the toll cord switching trunk and subscriber's circuit, and also adapted to automatically connect the operator's set to the switching trunk upon connection of the toll cord to the switching trunk, and also adapted to cause a periodic and intermittent flashing of the toll supervisory lamp upon disconnection of the toll switching trunk from the subscriber's circuit prior to a disconnection of the toll cord from the switching trunk.

9. In a telephone system, in combination, a toll switching trunk extending from a toll office to a "B" office, a toll cord containing a supervisory lamp circuit at the toll office, a subscriber's circuit terminating at the "B" office, a system of relays and a supervisory lamp associated with the switching trunk at the "B" office operating in conjunction with the toll supervisory lamp and adapted to furnish supervision to the toll and "B" operators by well known methods during the establishment and completion of a connection from the toll office to the subscriber by means of the toll cord switching trunk and subscriber's circuit, and, as a new and improved feature, an additional relay and a source of periodic battery supply operating in conjunction with the aforementioned system of relays and signaling apparatus and adapted to cause a periodic and intermittent flashing of the toll supervisory lamp if, after a connection has been established from the toll cord to the switching trunk and from the switching trunk to the subscriber's circuit, the switching trunk is then disconnected from the subscriber's circuit before the toll cord is disconnected from the switching trunk.

10. In a telephone system in combination, a toll switching trunk extending from a toll office to a "B" office, a toll cord circuit containing a toll supervisory lamp circuit at the toll office, a subscriber's line circuit terminating at the "B" office, and means adapted to furnish characteristic signals at both said offices during the establishment, holding period and completion of a connec-

tion from the toll cord circuit to the trunk circuit and from the trunk circuit to the subscriber's circuit, and in addition, means adapted to cause an intermittent operation of the supervisory lamp in the toll cord circuit upon disconnection of the trunk circuit from the subscriber's circuit prior to a disconnection of the toll cord circuit from the trunk circuit.

10 In testimony whereof, we have signed our names to this specification this 11th day of January, 1928.

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