

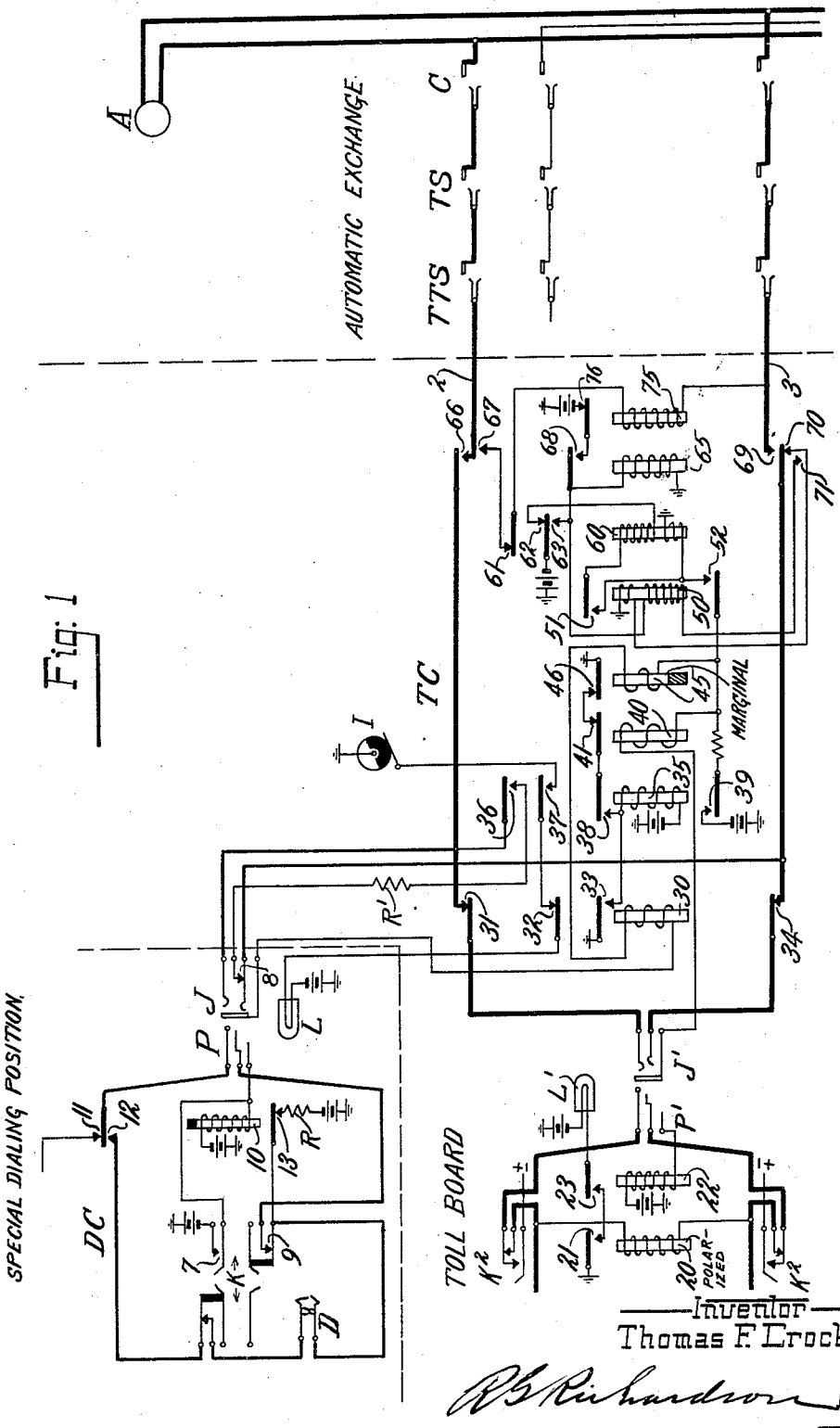
Dec. 30, 1930.

T. F. CROCKER

1,786,480

TOLL SERVICE TRUNKING SYSTEM

Original Filed Nov. 25, 1927 2 Sheets-Sheet 1



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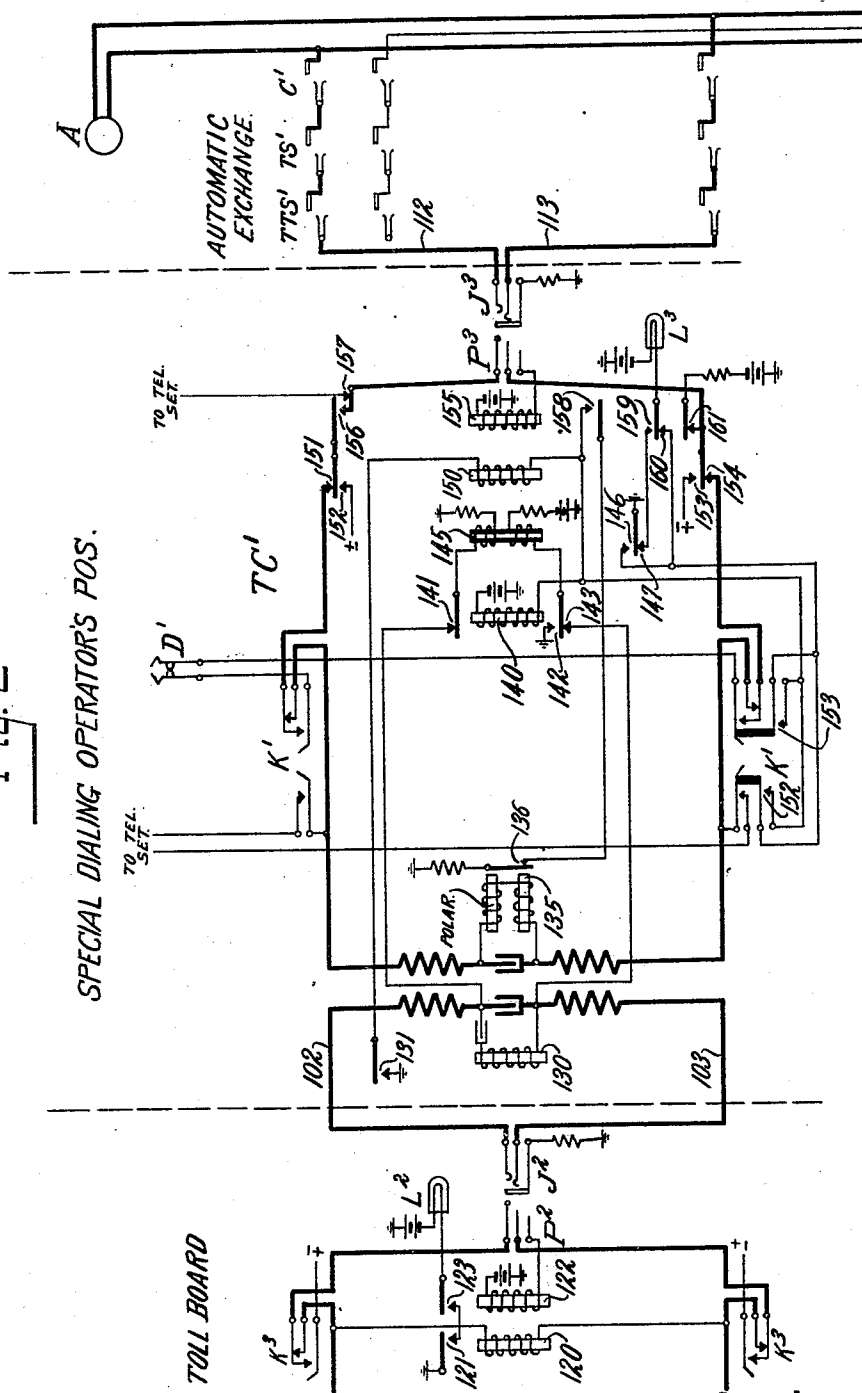
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Fig. 2



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TOLL-SERVICE TRUNKING SYSTEM

Application filed November 25, 1927, Serial No. 235,435, and in Great Britain September 27, 1927.
Renewed April 9, 1930.

This invention relates to telephone systems in general, but is more particularly concerned with toll service trunking systems by which toll calls are extended from a toll board to called subscribers.

operator's cord circuit is shown terminating in the plug P'.

Commonly, in toll service trunking systems, a toll operator sets up a toll connection to an automatic exchange over a trunk line extending from the main toll board to the automatic exchange, controlling the operation of automatic switches at the automatic exchange by dialling the directory number of the called subscriber. It is the object of this invention to provide a toll service trunking system in which the regular toll operators are freed from the necessity of dialling by providing a special dialling operator's position at which dialling operators do the dialling for the toll operators.

This invention has particular utility in a system in which some of the exchanges are automatic exchanges while others are still manually operated exchanges. The toll operators can then handle all calls in the same manner, and are not hampered by having to determine first whether the call is to a manual or to an automatic exchange and then having to complete the call in one manner if it is to a manual exchange and in a different manner if it is to an automatic exchange.

One arrangement by which the object of this invention is accomplished is disclosed in Fig. 1. In this system, trunk lines extend from the toll board to the various exchanges in the system. The trunk line comprising conductors 2 and 3 is shown extending from the toll board to an automatic exchange. This trunk line having the trunk circuit TC is accessible at the toll board at jack J' and terminates at the automatic exchange in the toll transmission selector TTS which has access through the toll second selector TS and the toll connector C to subscribers' lines, such as the line of substation A. A part of a toll

Each trunk extending to an automatic exchange has a branch extending to the special dialling operator's position located in the same exchange as the toll board. The branch of the trunk comprising conductors 2 and 3 extends to the special dialling operator's position and is accessible thereat at the jack J. The dialling operator is provided with a dialling cord DC terminating in the plug P and having the dial D permanently associated therewith.

To extend a connection, the toll operator calls the dialling operator over an order wire (not shown) and gives the dialling operator the required information. The dialling operator in turn selects an idle trunk to the proper automatic exchange, inserts the plug of her dialling cord into the jack J the selected trunk and informs the toll operator of the trunk selected, then dials up the number of the called subscriber, and then withdraws the plug of her dialling cord from the jack of the selected trunk after which the toll operator has complete supervision of the call.

A second method for accomplishing the object of this invention is disclosed in Fig. 2. In this arrangement, one group of trunks is provided extending from the toll board to the special dialling operator's position, which in this instance may or may not be in the same exchange as the toll board. From the special dialling operator's position, separate groups of trunks are provided extending to the various automatic exchanges in the system. In Fig. 2, a trunk comprising conductors 102 and 103 and extending from the main toll board to the special dialling operator's position and another trunk comprising conductors 112 and 113 and extending from the special dialling operator's position to a main automatic exchange are shown. The former is accessible at the toll board at jack J² and terminates at the special dialling operator's position in

plug P³, with the trunk circuit TC'. The latter trunk is accessible at the special dialling operator's position at jack J³ and terminates at the automatic exchange in the toll transmission selector 'TTS' which has access through the toll second selector TS' and the toll connector C' to subscribers' lines such as the line to substation A'. The automatic toll switches indicated in Fig. 2, as well as those indicated in Fig. 1, may be like those described in the Wick's Patent No. 1,633,149.

According to the second method, to extend a call, the toll operator selects a trunk extending to the special dialling operator's position and converses over this selected trunk with the dialling operator giving her the necessary information. The dialling operator in turn inserts the plug terminating this selected trunk into the jack of a trunk extending to the proper automatic exchange and then dials the called subscriber's number, after which the toll operator has complete supervision of the call.

To describe the invention more in detail, considering first the method disclosed in Fig. 1, let us assume that the toll operator wishes to extend a toll call to the subscriber at substation A. In order to do so, the toll operator first calls the dialling operator over an order wire (not shown) to communicate the wanted subscriber's number to the dialling operator. The dialling operator will then insert the plug P of her dialling cord DC in the jack of an idle trunk extending to the desired automatic exchange, the jack J for example, testing the trunks by touching the tip of the plug P to the sleeves of the jacks of the trunks in the usual manner, and then notifies the toll operator over the order wire of the particular trunk selected. Inserting plug P into jack J closes a circuit which extends from battery through resistance R, contacts 13, key springs 9, ring of the plug P, ring of jack J, contacts 70, through the upper winding of relay 50 to ground. Relay 50 in operating, closes a circuit which extends from ground through the lower winding of relay 60, contacts 52, through the winding of relay 45, through the winding of relay 30, sleeve of jack J, sleeve of plug P, through the winding of sleeve relay 10 to battery. Relays 10, 30, and 60 operate; relay 45, however, is insufficiently energized to be operated. Relay 60, by closing contacts 63, closes a circuit for relay 65. Relay 65, in operating, closes a locking circuit for itself at contacts 68, prepares the dialling circuit by closing contacts 66 and 69, and by permitting contacts 71 to close, completes a locking circuit for relay 50 which extends from battery at contacts 63 and contacts 76 via contacts 68, through the lower winding of relay 50, contacts 71, through the upper winding of relay 50 to ground. Relay 30, in operating, opens a point in the talking circuit extending to the

toll board at contacts 31 and 34, closes a circuit for relay 35 at contacts 33, and opens a point in the circuit of lamp L at contacts 32. Relay 35, in operating, closes a locking circuit for itself at contacts 38, prepares a holding bridge at contacts 36, and closes a holding circuit for relay 60 at contacts 39 independent of the battery supply through sleeve relay 10. Relay 10, in operating, opens the initial energizing circuit of relay 50 by separating contacts 13 and prepares the dialling circuit at contacts 12.

The dialling operator now dials the called subscriber's number, which causes the successive operation of the toll transmission selector TTS, the toll second selector TS and the toll connector C to extend the connection to the line of substation A. Upon the completion thereof, the dialling operator removes the plug P from the jack J. Removing the plug P from the jack J opens the circuit of relay 30 and relay 10. Relay 30, in deenergizing, closes points in the talking circuit by permitting contacts 31 and 34 to close, opens the initial energizing circuit of relay 35 by opening contacts 33, and closes a point in the circuit of lamp L at contacts 32.

The toll operator at the main toll board is expected to insert the plug of her cord into the jack of the trunk selected for the call by the special dialling operator when she is informed of the trunk selected. Inserting plug P' into jack J' completes a circuit including sleeve relay 22 in series with relay 40. Relay 22, in operating, prepares the circuit of the supervisory lamp L at contacts 23; and relay 40, in operating, opens the holding circuit of relay 35 by separating contacts 41.

Thus, if the toll operator has previously inserted the plug of her cord into jack J', the opening of the energizing circuit of relay 35 by the deenergization of relay 30 when the dialling operator removes plug P from jack J after completing the dialling operation causes relay 35 to deenergize. Relay 35, in deenergizing, opens the holding bridge across the trunk conductors by separating contacts 36, opens a point in the circuit of lamp L at contacts 37, and also opens the initial holding circuit of relay 60 at contacts 39, relay 60 being thereafter maintained energized in series with relays 22 and 40 over the sleeve of jack J'.

The toll operator now has complete supervision of the call, and all the succeeding operations are the same as though she had set up the connection herself in an ordinary system. She is signalled whether the called line is busy or idle, initiates the signalling of the called subscriber by momentarily operating her ringing key K², and causes the release of the connection at the termination of the conversation by removing her plug from the jack J' in the regular manner. Removing the plug P' from the jack J' at the termina-

tion of the call opens the holding circuit including relays 22, 40 and 60. Relay 60 in de-energizing, bridges relay 75 across the trunk conductors 2 and 3 by closing contacts 61. Relay 75 energizes (battery and ground being connected to the trunk conductors after the called subscriber replaces his receiver) and opens the locking circuit of relays 50 and 65 by separating contacts 76, contacts 63 having previously been separated when relay 60 deenergized. Relay 75 deenergizes as soon as relay 65 falls back and separates contacts 67.

A special feature of this invention is the provision of means for signalling the dialling operator in case the toll operator fails to insert the plug of her cord into the proper jack. For instance, should the toll operator fail to insert the plug of her cord into the jack J' after the dialling operator has set up the connection to the automatic exchange over this trunk, relay 35 is not released when the dialling operator removes her plug P from the jack J, since relay 35 will be held up over the holding circuit including contacts 41 and 46. With relay 35 energized and relay 30 deenergized, a circuit is closed from the ground interrupter I over contacts 37 and 32 for lamp L at the dialling operator's position. As a result, lamp L flashes, indicating to the dialling operator that the toll operator has failed to plug in the proper jack. The special dialling operator thereupon makes inquiries over the order wire. During this time the connection to the called line is maintained by reason of the holding bridge across the trunk conductors 2 and 3 including contacts 36, resistance R1, and contacts 8 of jack. As soon as the toll operator does plug into the jack J', relay 40 operates as previously described, causing the release of the relay 35, which, in releasing, opens the circuit of lamp L and opens the holding bridge across the trunk conductors 2 and 3.

Should the toll operator not care to complete the connection for some reason or other after the dialling operator has extended the connection to the called subscriber's line, she may so inform the special dialling operator and the latter may release the connection to the called line by reinserting the plug P into the jack J and operating the key K to the right. Operating the key K to the right opens the loop across the trunk conductors by separating contacts 9, which causes the release of the automatic switches in the automatic exchange. By the closure of contacts 7 direct battery potential is connected to the sleeve of jack J which increases the current flow through relay 45 sufficiently to cause this relay to operate. Relay 45, in operating, opens the holding circuit of relay 35. With the key K operated, the dialling operator removes the plug P from jack J. Relay 30 immediately deenergizes, whereupon relay

35 deenergizes, and a moment later relay 45 also falls back. Relay 35, in deenergizing, opens the circuit of relay 60 whereupon the remaining relays of the trunk circuit TC are restored to normal as previously described.

Should the dialling operator make a mistake in dialling, she may release the switches at the automatic exchange by operating the key K to the left thereby opening the bridge across the trunk conductors 2 and 3 without effecting any relay operations in the trunk conductor TC.

To describe the operation of the arrangement shown in Fig. 2 in detail, let us assume that the toll operator at the toll board receives a toll call for the subscriber at sub-station A'. To extend this connection, the toll operator inserts the plug of her cord, into the jack of an idle trunk extending to the dialling operator's position, the jack J² for example. Inserting the plug P² into the jack J² causes the operation of sleeve relay 122 which prepares the circuit of supervisory lamp L² at contacts 123. A bridge is also placed across the trunk conductors 102 and 103 including the supervisory relay 120 thereby closing the circuit for relay 145 at the dialling operator's position. Relay 120 operates and lights lamp L². Relay 145 operates and closes a circuit for the call lamp L³ at contacts 146.

Upon noting the lighted condition of the lamp L², the dialling operator operates her listening and dialling key K' to the listening position (to the left) which in addition to bridging her headset across the trunk conductors, closes a circuit for relay 140 at contacts 152, this circuit including contacts 146. Relay 140 energizes and by separating contacts 143 and 141 disconnects relay 145 from in bridge of the trunk conductors 102 and 103. A holding circuit is established for the lower winding of relay 145 at contacts 142. The disconnection of relay 145 from the trunk conductors 102 and 103 opens the circuit of the supervisory relay 120 in the toll operator's cord circuit, thereby causing relay 120 to deenergize and extinguish lamp L². The extinguishing of the lamp L² notifies the toll operator that the dialling operator is waiting to be informed of the name or number of the subscriber being called.

The toll operator then converses with the dialling operator. After receiving the required information, the dialling operator inserts the plug P³ into the jack of an idle trunk extending to the proper automatic exchange, the jack J³ for example, then throws the key K' to the dialling position (to the right), and then dials the called subscriber's number. Inserting the plug P³ into the jack J³ causes sleeve relay 155 to operate. Relay 155, in operating, closes a point in the talking circuit at contacts 156, prepares

a circuit for the ringing relay 150, and closes another circuit for relay 140 at contacts 158, opens the initial circuit for lamp L³ by separating contacts 160 and prepares another circuit therefor at contacts 159. The dialling of the called subscriber's number by the dialling operator causes the successive operation of the toll transmission selector TTS', the toll second selector TS', and the toll connector C' to extend the connection to the line of substation A'. During the dialling of the called subscriber's number, relay 140 is maintained energized over the circuit including contacts 153 of key K' as well as over the circuit including contacts 158 and 136.

At the completion of the dialling operation, the dialling operator restores the key K' to normal. If the called subscriber's line is busy, an intermittent current flow is produced over trunk conductors 112 and 113 in the proper direction to cause the polarized relay 135 to actuate and deactuate correspondingly. Relay 135, in so operating, intermittently opens the circuit of relay 140 at contacts 136 key K' being at normal. Each time relay 140 operates, it disconnects relay 145 from in bridge of the trunk conductors 102 and 103, and causes the supervisory relay 120 in the operator's cord circuit O' to deenergize, as a result lamp L² flashes, which indicates to the operator that the called line is busy.

If the called line is idle, a continuous flow of current is produced over trunk conductors 112 and 113 in the proper direction to cause polarized relay 165 to operate. As a result, the circuit for relay 140 is maintained open and relay 140 remains deenergized. Thus relay 145 is maintained connected across the trunk conductors 102 and 103 and supervisory relay 120 in the toll operator's cord circuit O' is maintained operated. As a result lamp L² lights steadily. This signal, as usual, indicates to the toll operator that the called line is idle.

When the toll operator is ready to signal the called subscriber, she momentarily operates her ringing key K³ to apply ringing current to the trunk conductors 102 and 103 which causes the operation of the alternating current relay 130 at the dialling operator's position. Relay 130, in operating, closes the circuit of ringing relay 130 in series with relay 140 at contacts 131. Relay 150, in operating, applies ringing current to the trunk conductors 112 and 113 which in the usual manner starts the signalling of the called subscriber.

When the called subscriber answers, the current over the trunk conductors 112 and 113 from the automatic exchange is reversed, causing the deenergization of polarized relay 135. Relay 140 is again operated and by dis-

connecting relay 145 from the trunk conductors, causes the extinguishment of the lamp L². This indicates to the toll operator that the called subscriber has answered.

At the termination of the conversation, the toll operator receives the disconnect signal when the called subscriber replaces his receiver by the lighting of the lamp L² by reason of the current flow over the trunk conductors 112 and 113 again being reversed back to normal.

Upon receiving the disconnect signal, the toll operator removes the plug P² from the jack J², causing the sleeve relay 122 to deenergize and also causing relay 145 to deenergize. Relay 145, in deenergizing, closes a circuit for lamp L³ at contacts 47. The lighting of lamp L³ at this time indicates to the dialling operator that the call is terminated. The dialling operator then removes the plug P³ from the jack J³ causing the deenergization of relay 155 and also initiating the release of the automatic switches at the automatic exchange.

The inventor is aware that his invention lends itself to many modifications, and he does not wish to be limited to the specific arrangements shown herein. What he considers new and desires to have protected by Letters Patent is pointed out in the appended claims.

What is claimed is:

1. In a telephone system, a toll board at which incoming toll calls are received, an automatic exchange, a toll switching train comprising automatic toll switches at said exchange, a dialling operator's switchboard, a trunk extending from said toll board to said automatic exchange, a branch of said trunk line extending to said switchboard, means at said switchboard whereby the operator thereat may control the operation of said automatic toll switches over said trunk and said branch in accordance with the number of a called line as communicated to her by the toll operator at the toll board, and means at said toll board whereby the toll operator may complete the toll call over said trunk exclusive of said branch.

2. In a telephone system, a trunk accessible at two separate jacks, an automatic switch terminating said trunk, two plug ending cords, means operable providing the plug of the first cord is inserted into the first of said jacks for operating said switch to extend a connection, a signal, means effective when the plug of the first cord is removed for maintaining said switch operated and for operating said signal, and means operative when the plug of the second cord is inserted into the second of said jacks for disabling said last means.

3. In a telephone system, a trunk accessible at two separate jacks, an automatic switch terminating said trunk, two plug

ending cords, means operative when the plug of the first cord is inserted into the first of said jacks for operating said switch to extend a connection, means effective when the plug of the first cord is removed from the first of said jacks for maintaining said switch operated, and means operative when the plug of the second cord is inserted into the second of said jacks for disabling said last means.

4. In a telephone system, an automatic switch, a trunk having two branches at one end and terminating in said switch at the other, two link circuits and means for connecting the first to the first of said branches and the second to the second of said branches, means effective when the first link circuit is connected to the first of said branches for operating said switch, means effective when the first link circuit is disconnected from the first of said branches for maintaining said switch operated, and means operative when the second link circuit is connected to the second of said branches for disabling said last means.

5. In a telephone system, a trunk, a link circuit and means for connecting it to said trunk, a calling device and means for connecting it to said trunk, an automatic switch terminating said trunk and responsive to the actuation of said calling device, means for maintaining said switch operated after said calling device is disconnected from said trunk, and means responsive to the connection of said link circuit to said trunk for disabling said last means.

6. In a telephone system, a trunk line, a link circuit and means for connecting it to said trunk, a calling device and means for connecting it to said trunk to control the operation of automatic switches, a signal, and means responsive to the disconnection of said calling device from said trunk, providing said link circuit is not connected to said trunk for operating said signal.

7. In a telephone system, a trunk, an automatic switch terminating said trunk, a calling device and means for connecting it to said trunk for controlling the operation of said switch, means effective when said calling device is disconnected from said trunk line after said switch is operated for maintaining said switch operated, and means operable upon the reconnection of said calling device to said trunk for releasing said switch.

8. In a telephone system, a trunk accessible at a jack, an automatic switch terminating said trunk, a link circuit terminating in a plug, means operable after said plug is inserted into said jack for operating said switch, means effective when said plug is removed from said jack for maintaining said switch operated, and means operable upon the reinsertion of said plug into said jack for releasing said switch.

9. In a telephone system, a trunk, a link circuit and means for connecting it to said trunk, means for establishing a normal current flow over one conductor of said trunk and for increasing the same, a relay for controlling a bridge across conductors of said trunk, means for operating said relay, when said link circuit is connected to said trunk, means for maintaining said relay operated after said link circuit is disconnected from said trunk, and means responsive to said increase of current over said one conductor for disabling said last means.

10. In a telephone system, a trunk, a link circuit and means for connecting it to said trunk, a relay for controlling a bridge across the conductors of said trunk, means responsive to the connection of said link circuit to said trunk for operating said relay, a key in said link circuit, means for maintaining said relay operated after said link circuit is disconnected from said trunk, and means responsive to the actuation of said key when said link circuit is again connected to said trunk for disabling said last means.

11. In a telephone system, a first switchboard, a second switchboard, a trunk extending from said first switchboard to said second switchboard means at said first switchboard for extending a connection over said trunk, a listening key at said second switchboard for answering a call extended over said trunk, a line, means at said second switchboard for further extending the connection to said line, a signal at the first switchboard and means for operating said signal when said key is actuated, when the connection to said line is completed, when the call is answered, and when the call is terminated.

12. In a telephone system, a first switchboard, a second switchboard, a trunk extending from said first switchboard to said second switchboard, means at said first switchboard for extending a connection over said trunk, a listening key at said second switchboard, a line, means at said second switchboard for further extending the connection to said line, means for establishing a flow of current over said trunk, and means at said first switchboard responsive to the actuation of said key and to the answering of the call for interrupting said current flow.

13. In a toll service trunking system, a toll switchboard, a dialling switchboard, talking and dialling jacks at said switchboards, respectively, a toll service trunk having two branches connected to said two jacks, respectively, a toll selector in which said toll service trunk terminates, other toll switches cooperating with said toll selector for extending said trunk to subscribers' lines, apparatus at said dialling switchboard for controlling said switches through said dialling jack, and apparatus at said toll switchboard

for completing talking connections through said talking jack.

14. In a toll service trunking system, a toll switchboard, toll selectors, toll service trunks extending from jacks at said switchboard to said toll selectors, other toll switches cooperating with said toll selectors for extending said toll service trunks to subscribers' lines, a dialling operator's switchboard, a dialling jack at said second switchboard individual to each toll service trunk, a dialling cord at said second switchboard and a calling device by means of which the dialling operator can operate the switches to extend any toll service trunk to a desired subscriber's line, and toll cords at said first switchboard for connecting a toll line with any toll service trunk.

15. In a toll-service trunking system, a toll board at which incoming toll calls are received, a dialling operator's switchboard, an automatic exchange, a toll-switching train comprising automatic switches at said exchange, a trunk line extending from the toll board to said exchange, a branch of the trunk line extending to said switchboard, a dialling cord at the switchboard for controlling the operation of said automatic switches over the trunk line and said branch, and a toll cord at the toll board for establishing a talking connection over the trunk line and said automatic switches exclusive of said branch.

16. In a toll-service trunking system, a toll switchboard and a dialling switchboard, talking and dialling jacks at said switchboards respectively, a toll-service trunk having two branches connected to said two jacks respectively, an automatic switch terminating said trunk, other automatic switches cooperating with said first switch for extending connections to subscriber's lines, a dialling cord at said dialling switchboard for controlling said switches through said dialling jack, a toll cord at said toll switchboard for completing talking connections through said talking jack, a signal at said dialling switchboard operated responsive to the disconnection of the dialling cord from said dialling jack, and means for disabling said signal responsive to the connection of the toll cord to said talking jack.

17. In a toll-service trunking system, a toll switchboard and a dialling switchboard, talking and dialling jacks at said switchboards respectively, a toll-service trunk having two branches connected to said two jacks respectively, an automatic switch terminating said trunk, other automatic switches cooperating with said first switch for extending connections to subscribers' lines, a dialling cord at said dialling switchboard for controlling the operation of said switches through said dialling jack, a toll cord at said toll switchboard for completing talking connections through said talking jack, a holding

circuit for maintaining said automatic switches operated after the disconnection of the dialling cord from said dialling jack, and means responsive to the connection of the toll cord to said talking jack for disabling said circuit and for maintaining said switches operated over a holding circuit in the toll cord.

In witness whereof, I hereunto subscribe my name this 21st day of November, A. D. 1927.

THOMAS F. CROCKER.

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