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M. LANGER ET AL

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TELEPHONE SYSTEM

Filed Feb. 19, 1932

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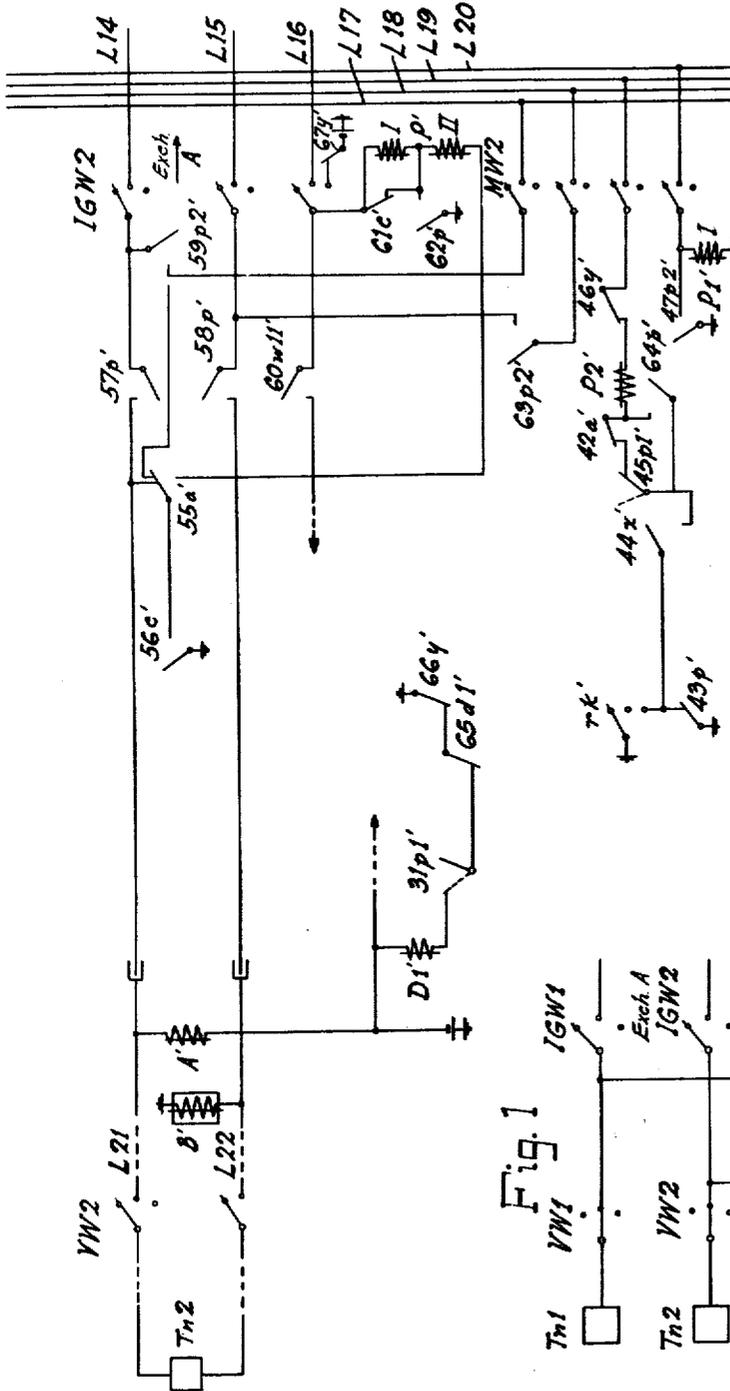
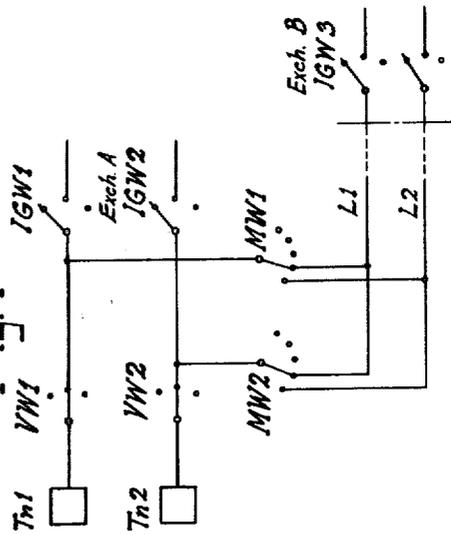


Fig. 1

Fig. 3



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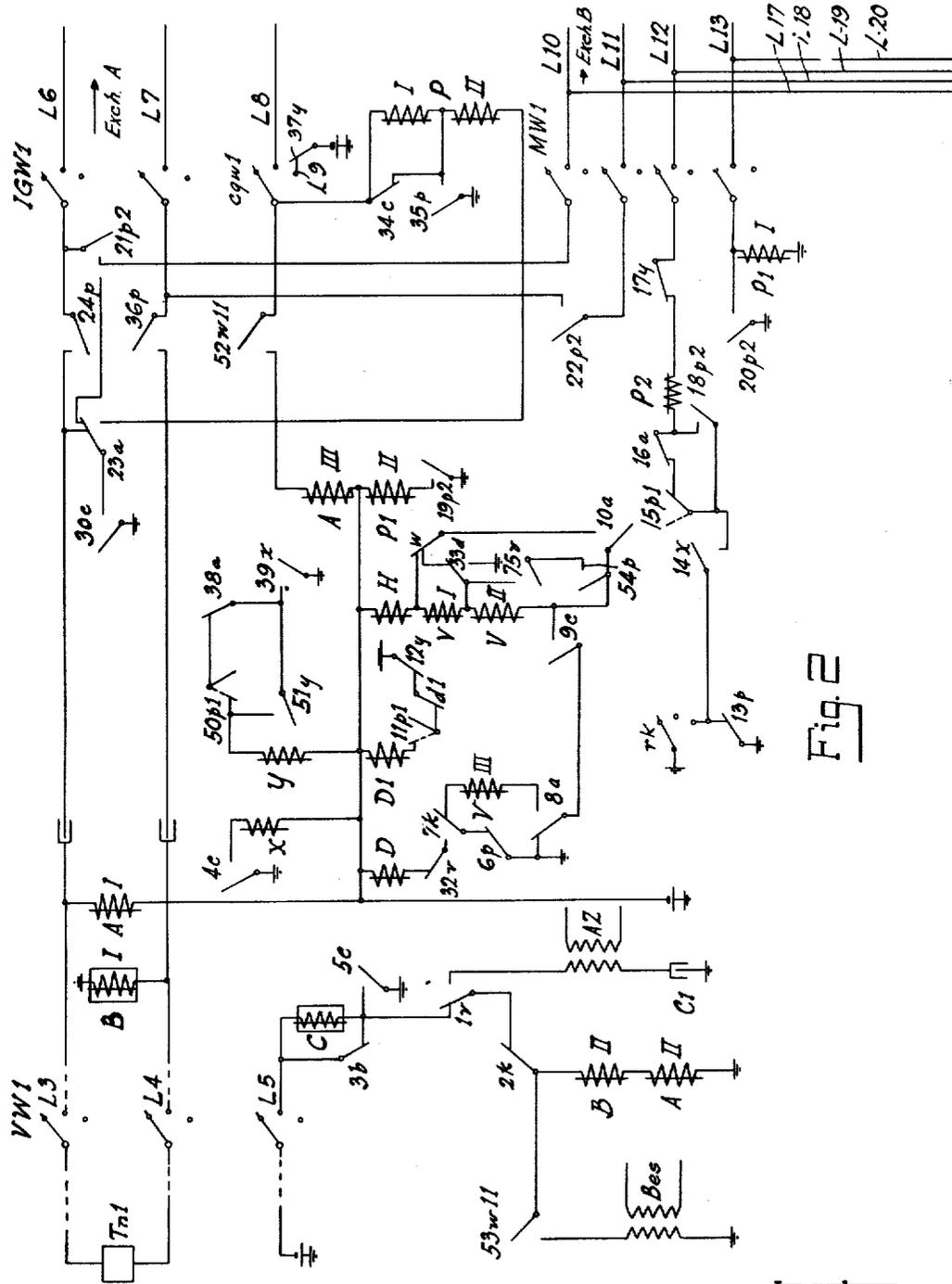


Fig. 2

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# UNITED STATES PATENT OFFICE

1,925,261

## TELEPHONE SYSTEM

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12 Claims. (Cl. 179—18)

The invention relates to telephone systems in which lines, reached over free hunting switches, may be reached by additional free hunting switches. In such systems, when a line, reached over a free hunting switch, is taken into use, it is essential to make this line inaccessible to the other switches. This, according to the invention, is achieved by switching means which make this line inaccessible to the remaining free hunting switches only when a station, connected to the reached line, dials.

An unnecessarily lengthy seizure of the junction lines, reached over free hunting switches, is prevented by means of the arrangement according to the invention with the result that, due to the shorter period during which the junction lines are engaged, the total number of junction lines to be erected for a telephone system is reduced. This results in greater economy in the system, although its operation is equally reliable.

This switching arrangement is particularly advantageous in exchanges having a plurality of traffic directions, especially in systems in which several impulse receivers are simultaneously set by the calling station, as the line selection of the distant exchange is carried out over switches of the above mentioned type. The greatest advantage gained by the invention is to be found in a very much greater utilization of the junction lines connecting the exchanges.

An embodiment of the invention is shown in Figs. 1, 2, and 3, but the invention, however, is not limited to this embodiment only. Fig. 1 is a general plan. Tn1 and Tn2 represent two subscribers' stations which have access to the first group selectors (IGW1, IGW2) in their exchange A over their preselectors VW1 and VW2. Each first group selector is associated with a preselecting secondary lineswitch. The lineswitches MW1 and MW2 have both been set to the same line L1 leading to a group selector IGW3 in the exchange B. It will now be assumed, as an example, that the levels 1—5, in the group selector, are reserved for traffic within the exchange A, and the identification digits 6—0 for traffic with the exchange B. Conversations within the exchange A are guarded by the first line loop breaking, for example, for Tn1 the line L1, to which the lineswitch associated with the group selector IGW1, in this case for example MW1, has been set, the other lineswitch, for example, MW2, which is connected to the same line in the meantime having been set to the succeeding free line, for example, L2. The group selector IGW1 in exchange A, and the group selector IGW3 in

exchange B, are operated simultaneously upon dialling, the group selector IGW3 in exchange B being released when the identification digit of the exchange A is dialled, releasing the line L1 at the same time. Connections are completed in the same manner for conversations with the exchange B, although in this case the group selector IGW1 in exchange A is not released. It should be mentioned in this connection that devices are provided, which, when impulses are transmitted over still operating free hunting switches or over a switch still guarding a line, prevent the setting up of a connection over such a switch. The manner in which a connection is completed will be described below in conjunction with Figs. 2 and 3 of the drawings.

The circuits for completing the connection indicated in Fig. 1 are clearly shown in Figs. 2 and 3. Only the wipers of the preselectors VW1 and VW2 are shown in these figures. The test circuit in the group selector IGW2, for the preselector VS2, and the circuits for the setting of the switch, have not been illustrated in Fig. 3, since they are exactly the same as those in the group selector IGW1, shown in Fig. 2.

If, for example, the subscriber Tn1 wishes to set up a connection to his own exchange A, the following switching operations take place: The lifting of the receiver at Tn1 causes the associated preselector VW1 to hunt for a line leading to a free group selector, for example, the group selector IGW1. When this group selector IGW1 is seized, windings I of relays A and B are energized over: earth, battery, relay A, line L3, subscriber's line loop, line L4, relay B, earth. By means of contact 3b, relay B removes the short circuit for relay C so that this is energized over: earth, windings II of relays A and B, contacts 2k, 1v, relay C, line L5, battery, earth in the preselector VW1. Relay C actuates its contacts 4c, 5c, 9c, 30c, 34c. Relay X is energized over contact 4c and actuates its contacts 14x and 39x. Relay C is maintained energized over contact 5c until released. Earth is preparatorily applied, at contact 30c, to the impulse line leading to exchange B, over the lineswitch MW1. When contacts 8a, 10a are actuated, winding III of relay V is energized over: earth, contacts 6p, 7k, winding III of relay V, contacts 8a, 9c, 10a, w, vertical magnet H, battery, earth. The current in this circuit being too weak, the vertical magnet is unable to operate. The exchange signal AZ is connected up by contact 1v in the following circuit: earth, condenser C1, repeater winding of AZ, contacts 1v, 2k, windings II of relays B

and A, earth. The secondary line-switch MW1, associated with the group selector IGW1, is of the preselecting type. Therefore, it has selected a free junction line leading to the exchange B.

The setting of the secondary lineswitch to a free line takes place as follows:

In an unoperated condition relay P1 is at normal and the rotary magnet D1 is connected to battery over: earth, battery, rotary magnet D1, contacts 11p1, d1, 12y, earth. When the secondary lineswitch MW1 finds a free line, for example, the line L10—L13, winding I of relay P1 is energized over: earth, relay P1, winding I line L13, battery in the group selector IGW3 (not shown), earth. By means of contact 11p1, relay P1 opens the rotary magnet circuit, causing the switch to be brought to rest. The test circuit over line L12 is prepared by contact 15p1. It is assumed, in the present example, that not only the secondary lineswitch MW1 but also the lineswitch MW2, which is associated with the group selector IGW2, has been set to the lines L10—L13. The setting of these two secondary lineswitches is effected in the same manner. Relay P', of the secondary lineswitch MW2, is connected to the line L13 over line L20 and is energized in parallel with relay P1 of the secondary lineswitch MW1. In Figs. 2 and 3 the secondary lineswitches MW1 and MW2 are shown in a set condition, that is to say, their test relays P1 and P1' have been energized. The normal positions of their contacts are indicated by dotted lines.

The subscriber Tn1 may now commence dialling. The identification digits 1—5 being allocated to the traffic with the exchange A, he dials, for example, the digit 5. Relay A, during the dialling, releases in accordance with the line loop interruptions, whereas relay B, in the form of a slow acting relay, remains energized during the impulse output. The vertical magnet H is intermittently energized over: earth, contacts 8a, 9c, winding II of relay V, contacts 33d, w, vertical magnet H, battery, earth. Relay V remains energized during the impulse series. The off-normal contacts 2k and 7k are thrown over at the first vertical step. The exchange signal is disconnected by contact 2k, whereas contact 7k prepares the circuit for the rotary magnet. Relay V releases with slow action after the end of the impulse series and closes the circuit for the rotary magnet D, which is energized in the following circuit: earth, contacts 6p, 7k, 32v, rotary magnet D, battery, earth. The magnet operates, thereby actuating its contact 33d. This causes relay V to be energized afresh over earth, contact 33d, winding I of relay V, vertical magnet H, earth. By means of its contact 32v, relay V opens the circuit for the rotary magnet D, which thereupon is released, causing its contact 33d to be re-opened. This disconnects relay V which closes its contact 32v with the result that the rotary magnet D is reenergized, causing the switch to execute a further step. This interaction continues until the switch encounters a free line. The circuit for relay P2 is closed by contact 16a at the first release of relay A. Relay P2 is then energized over: earth, contacts 13p, 14x, 15p1, 16a, relay P2, contact 17y, line L12, to the group selector IGW3 in exchange B, battery, earth (not shown), and remains energized over its contact 18p2. Relay P2, by means of its contact 20p2, applies earth to the line L13, with the result that winding I of relay P1 is short-circuited. Winding II of relay P1, however, is connected up by contact 19p2, thus preventing this relay from being de-

energized. Earth having been applied to the line L13, and consequently also line L20, all the test relays of the secondary line switches which had been set to the same line leading to exchange B are short-circuited. Relay P1', in the present embodiment, is released, thereby closing its contact 31p1'. Battery is thereby applied to the rotary magnet D1', and the secondary lineswitch MW2 continues to hunt until it encounters a free line. The lines L10 and L11, leading to exchange B, are switched through to the group selector IGW1 by contacts 21p2 and 22p2. The closing of contact 21p2 causes earth to be applied over contacts 30c and 23a to the line L10 which leads to exchange B. The line loop interruptions, set up when subscriber Tn1 dials, are thus transmitted to exchange B over contact 23a, the group selector IGW1 in exchange A as well as the group selector IGW3 in exchange B being set in accordance with the said line loop interruptions. Relay P is energized in the following circuit when the free line L6—L8 is connected up: earth, contacts 30c, 23a, relay P, wiper cgw1, line L8, battery, earth in the succeeding switch (not shown). Relay P short circuits its high resistance winding II and remains energized over its contact 35p. The lines L3 and L4 are switched through to the lines L6 and L7, by means of contacts 24p and 36p. The opening of contact 13p opens the circuit for relay P2, causing this relay to release. This disengages the line leading to the exchange B, and at the same time releases the already set group selector IGW3 in exchange B.

If the subscriber Tn1 dials one of the digits denoting the traffic with the exchange B, the seizing and setting of the group selectors IGW1 and IGW3 takes place in the same manner. In the levels reserved for traffic with exchange B, however, the lines L6 and L7 are not to be found. Battery is applied to the first level contact of the switch wiper cgw1 over contact 37y, with the result that, when the switch is operated to this level, relay P will be energized over: earth, battery, contact 37y, line L9, wiper cgw1, windings I and II of relay P, contacts 23a, 30c, earth. Relay P remains energized over contact 35p and opens contact 13p. At the same time, however, contact 7k is closed when the switch operates, with the consequence that the circuit for relay P2 is not cut off. The subscriber Tn1, therefore, is switched through to the exchange B over contacts 24p, 36p, 21p2, and 22p2 and the lines L10 and L11.

Should it occur that two subscribers Tn1 and Tn2 start dialling at exactly the same time, it being assumed that the secondary lineswitches MW1 and MW2 allocated to their respective first group selectors IGW1 and IGW2 have been set to the same outgoing line L10—L13, devices will have to be provided, which, upon transmission of impulses over a secondary lineswitch, set to a guarded line, or over still operating lineswitches, prevent the setting up of a connection over such a switch. The subscriber Tn2 is connected to the group selector IGW2 over his preselector VW2. The connection is set up in the manner referred to above. Subscriber Tn1 is connected to the group selector IGW1 over his preselector VS1. When the subscriber Tn2 commences to dial his line, relay A' is intermittently deenergized, which causes the test relay P2' to be energized over: earth, contacts 43p', 44x', 45p1', 42a', relay P2', contact 46y, lines L19, L12, to the group selector IGW3 in exchange B, battery, earth (not shown). Relay P2' actuates

its contacts, applying earth to the lines L20 and L12 by means of contact 47p2'. This causes relay P1, which is associated with the group selector IGW1 and line L13, to be short-circuited, with the result that it releases. Voltage is applied to the rotary magnet of the secondary lineswitch MW1 over: earth, battery, rotary magnet D1, contacts 11p1, d1, 12y, earth, so that the lineswitch is advanced. But the subscriber T71 started dialling at the same time as subscriber T72. When battery is cut off for the first time from the line relay A, allocated to the subscriber T71, the secondary lineswitch MW1 has not yet encountered a free line leading to exchange B, with the result that contact 50p1, therefore, is still closed. Relay Y is then energized over: earth, battery, relay Y, contacts 50p1, 38a, 39x, earth, remaining energized over its contact 51y. At contact 12y, relay Y breaks the circuit for the rotary magnet, of the secondary lineswitch, preventing this from operating, and opens contact 37y to the line L9. If the subscriber T71 wishes to get into communication with the exchange A, the switch is set to the level which corresponds to the selected digit and hunts freely until it finds a free line. The operations in conjunction therewith have already been described. But if this subscriber T71 requires exchange B, the group selector IGW1 will receive no potential when encountering the selected level as contact 37y has been opened. The switch, therefore, is set to the eleventh step, whereupon relay P will be energized over: earth, battery, relay A, winding III, rotary off-normal contact 52w11, relay P, contacts 23a, 30c, earth. Relay P is energized and brings the switch to rest by opening its contact 6p. Contact 17y was opened, upon the energization of relay Y, thus opening the circuit for relay P2 which consequently released. Relay P2 opened its contacts 22p2 and 21p2, which prevented transmission of impulses over contact 23a for the setting of the switch in exchange B, succeeding the secondary lineswitch MW1. Therefore, the group selector IGW3 in exchange B does not receive impulses from two different group selectors, for example, IGW1 and IGW2, when the associated secondary lineswitches MW1 and MW2 have been set to the same line leading to the group selector IGW3 and two subscribers start dialling at exactly the same time. The busy signal is transmitted to the subscriber T71 over contact 53w11, indicating that the connection cannot be set up, and that he will have to make the attempt later. The setting of the succeeding switches, as well as the release at the end of the conversation, takes place in known manner. When the subscriber T71 hangs up his receiver, relays A and B are deenergized and released. Relay C is short-circuited by contact 3b, causing this relay to open its contacts. Contact 34c short-circuits relay P, which in turn causes the switches, which succeed the group selector IGW1, to be released.

What is claimed is:

1. In an automatic telephone system, a selector repeater and an associated lineswitch in a local exchange, a trunk line extending to a selector in a distant exchange accessible to said lineswitch, means responsive only when a calling subscriber starts to dial for marking the trunk line to the distant exchange busy to all other lineswitches having access thereto, and means responsive to the digit dialled for simultaneously

setting said selector repeater and said selector in the distant exchange.

2. In an automatic telephone system, a selector repeater and an associated lineswitch in a local exchange, a trunk line extending to a selector in a distant exchange accessible to said lineswitch, means responsive only when a calling subscriber starts to dial for marking the trunk line to the distant exchange busy to all other lineswitches having access thereto, means responsive to the digit dialled for simultaneously setting said selector repeater and said selector in the distant exchange, and means responsive when the digit dialled determines that the call is not for a subscriber in said distant exchange for removing the busy marking from said trunk and for releasing the selector operated thereover.

3. In an automatic telephone system, a selector repeater and an associated lineswitch in a local exchange, a trunk line extending to a selector in a distant exchange accessible to said lineswitch, means responsive only when a calling subscriber starts to dial for marking the trunk line to the distant exchange busy to all other lineswitches having access thereto, means responsive to the digit dialled for simultaneously setting said selector repeater and said selector in the distant exchange, and means responsive when the call is for a subscriber in said distant exchange for maintaining said selector repeater and associated lineswitch in an operated position and for repeating the impulses of the remaining digits of the wanted subscriber's number over said trunk line to set the remaining switches in the distant exchange to complete the call.

4. In an automatic telephone system, a selector repeater for use in a branch exchange, a preselecting lineswitch associated with said selector repeater for selecting a trunk to a main exchange without making the selected trunk busy, and means responsive when a calling subscriber starts to dial for marking the selected trunk line busy.

5. In an automatic telephone system, a selector repeater for use in a branch exchange, a preselecting lineswitch associated with said selector repeater for selecting a trunk to a main exchange without making the selected trunk busy, means responsive when a calling subscriber starts to dial for marking the selected trunk line busy, and means for removing the busy condition from the main exchange trunk when the value of the digit dialled determines that the call is for a branch exchange subscriber.

6. In an automatic telephone system, a trunk line extending to a selector repeater, a preselecting lineswitch associated with said selector repeater, a trunk line extending to a selector in a distant exchange preselected by said lineswitch, means at a calling subscriber's station for transmitting impulses to simultaneously set said selector repeater and said selector, and means responsive only when said subscriber starts to transmit impulses for marking the trunk line to the distant exchange busy to all other preselecting lineswitches that are connected or that have access thereto.

7. In an automatic telephone system, a trunk line extending to a selector repeater, a preselecting lineswitch associated with said selector repeater, a trunk line extending to a selector in a distant exchange preselected by said lineswitch, means at a calling subscriber's station for transmitting impulses to simultaneously set said selector repeater and said selector, means responsive

only when said subscriber starts to transmit impulses for marking the trunk line to the distant exchange busy to all other preselecting lineswitches that are connected or that have access thereto, said preselecting lineswitches arranged to automatically rotate to select an idle trunk when said busy marking is encountered.

8. In an automatic telephone system, a trunk line extending to a selector repeater, a preselecting lineswitch associated with said selector repeater, a trunk line extending to a selector in a distant exchange preselected by said lineswitch, means at a calling subscriber's station for transmitting impulses to simultaneously set said selector repeater and said selector, means responsive only when said subscriber starts to transmit impulses for marking the trunk line to the distant exchange busy to all other preselecting lineswitches that are connected or that have access thereto, and means for preventing the setting of the selector in said distant exchange when impulses are transmitted over a hunting lineswitch.

9. In a system as claimed in claim 8 in which means are provided for disconnecting the conductor over which impulses are transmitted to set the selector in said distant exchange to prevent the setting up of a connection.

10. In a system as set forth in claim 8 in which means are provided for giving the calling subscriber a busy signal when the connection to the distant exchange is prevented.

11. In an automatic telephone system, a trunk line accessible to calling subscribers, a repeater in said trunk line, a lineswitch for extending the trunk line responsive to a call, there being a plurality of other trunk lines accessible to said lineswitch which may be used, means in said repeater for transmitting impulses over the trunk extension, and means responsive to the initiation of the impulse transmission for making the other trunk line involved busy.

12. In an automatic telephone system, a group of trunk lines, a second trunk line, means responsive to a call for linking a connection through a trunk line of said group and said second trunk line, means for transmitting impulses over the linked connection, and means responsive to the initiation of impulse transmission for making said second trunk line busy.

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