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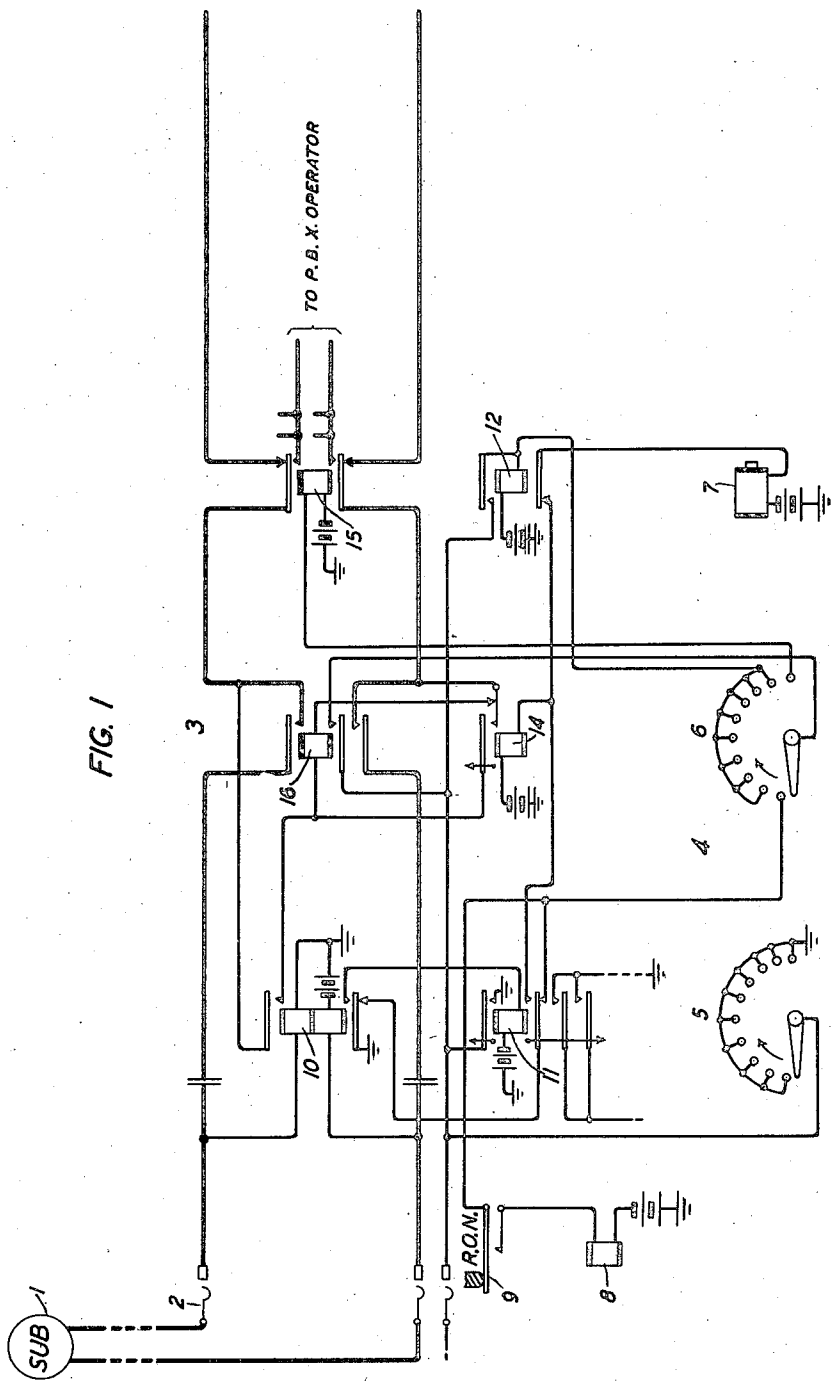
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TELEPHONE SYSTEM

Filed Nov. 25, 1932

2 Sheets-Sheet 1



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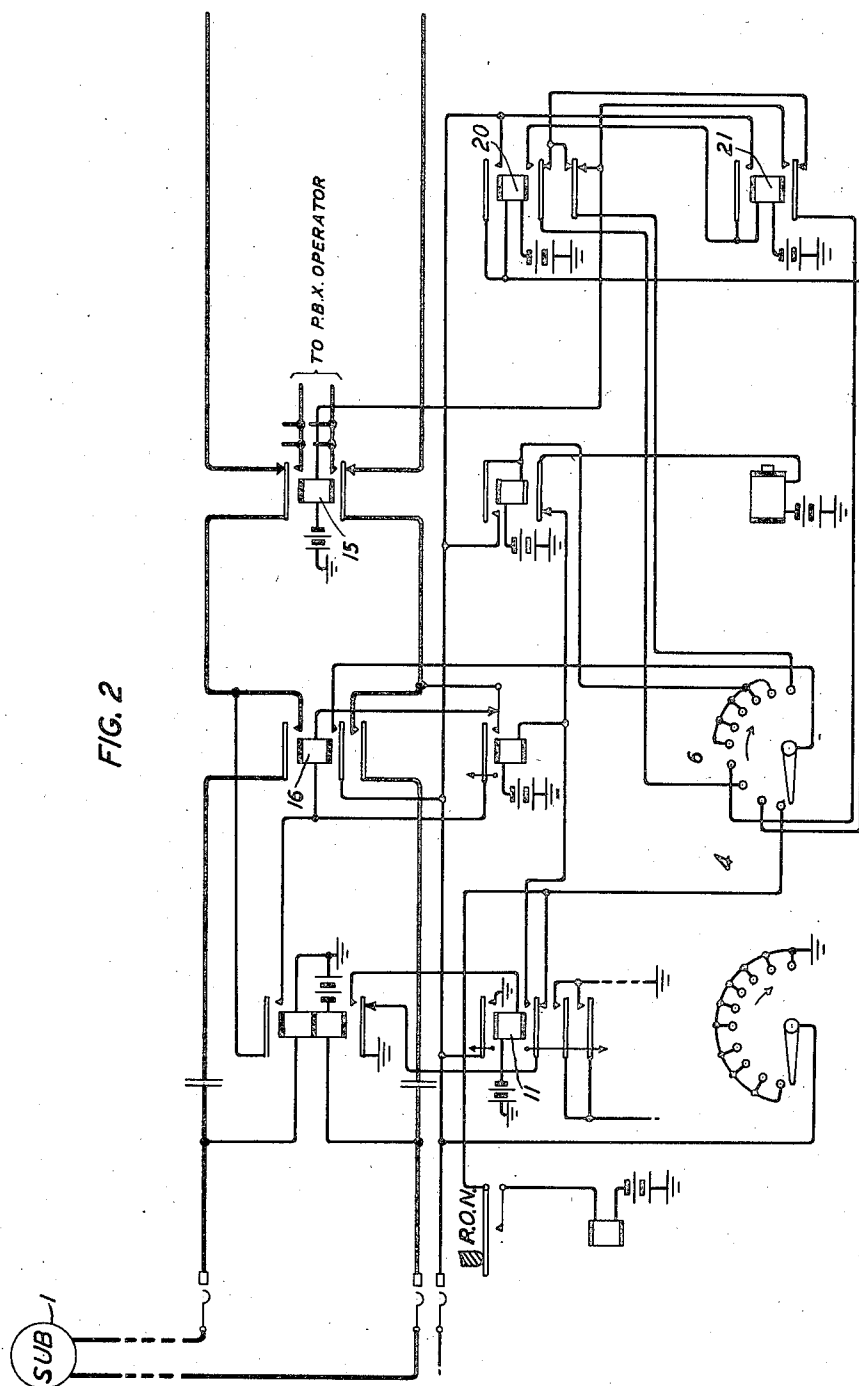
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TELEPHONE SYSTEM

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Application November 25, 1932, Serial No. 644,252

3 Claims. (Cl. 179—27)

This invention relates to telephone systems and particularly to improvements in private branch exchange systems.

The object of this invention is to simplify the arrangement at a private branch exchange for preventing unauthorized connections to distant exchanges from being made by private branch exchange subscribers.

In a copending application by F. A. Bonomi, Serial No. 644,235, filed Nov. 25, 1932, a system has been disclosed for preventing subscribers in private branch exchange systems from establishing connections to distant offices such as toll offices if such calls are attempted over trunks leading to local offices. If such a connection is dialed, the call is answered at the toll office to which it is extended. Current of a certain polarity is thereby sent back over the local office trunk incoming to the private branch exchange. This current causes the operation of means to release the toll connection and to transfer the calling subscriber's line from the local office trunk to a branch line terminating at a private branch exchange operator's position.

Systems have also been provided whereby a line extended to a trunk over one switch may be transferred to another trunk over another switch, if the number dialed over the first trunk connection is of a certain combination. To this end a special stepping switch was associated with the line and actuated by the special combination to cause circuit changes to take place to switch the line from one trunk connection to another. If succeeding digits of this call indicate that still another trunk connection is desired, this second extension will be disconnected and a third trunk or a fourth trunk connection established as desired by means of this auxiliary switch.

A feature of this invention relates to means for preventing subscribers in private branch exchange systems from establishing connections to distant offices, such as toll offices, when such calls are attempted over trunks leading to local offices. This means comprises an auxiliary switch and circuit arrangements therefor at the private branch exchange which, when a certain code is dialed, namely, a number of a toll office to which a call is prohibited, operate to cause the subscriber's line to be disconnected from the local office trunk over which the toll call was attempted and to be connected to a special line terminating at a private branch exchange operator's position. If the subscriber dials a local office number, the auxiliary switch does not effect a transfer.

Another feature of this invention is a system of this kind in which each local office trunk is provided with an individual auxiliary switch and associated circuit arrangement.

The invention has been illustrated in the accompanying drawings in which:

Fig. 1 shows it applied to one type of automatic telephone system; and

Fig. 2 shows it applied to another type of automatic telephone system.

Referring now to the drawings, Fig. 1 shows a subscriber's station 1 in a private branch exchange connected through switches shown in diagrammatic form at 2 to a trunk circuit 3 embodying the features of this invention. This trunk circuit may extend to a central office. If the subscriber at 1 attempts to extend a connection through this central office, to a toll office, he dials a toll number. The first numeral dialed, after the trunk 3 has been seized automatically, will represent such a toll call at the central office. The arrangement may be such that the toll number to be dialed is zero or ten impulses, and also so that the preliminary digit 1 will be lost, that is, if the subscriber dials 1 no permanent effect is produced at the central office. A local switch 4 is associated with trunk 3 having two banks 5 and 6, an operating or stepping magnet 7, a release magnet 8 and off-normal contacts 9. If the numeral 1 should be dialed this switch will be actuated one step but will return to normal. This impulse will release relay 10 momentarily as it should be understood that relay 10 becomes operated on the seizure of the trunk 3. On the original operation of relay 10 the slow-to-release relay 11 will operate and remain operated during the sending of the dial pulses in each series. On the first release of relay 10, if it is supposed that one impulse only is sent, the magnet 7 will receive one impulse and advance the brushes of switch 4 one step. The circuit for this magnet extends from battery, winding of the magnet, lower armature and back contact of relay 12, lower inner armature and front contact of relay 11, lower armature and back contact of relay 10 to ground. On the original operation of relay 10 a circuit was closed from battery and ground at the central office over the tip and ring conductors, armatures and back contacts of relay 15, upper armature and front contact of relay 10, winding of relay 16 and make-before-break contacts of relay 14, to cause relay 16 to operate. However, as relay 14 operates on the first impulse on the release of relay 10 the circuit for relay 16 is opened by the armature and front

contact of this relay and releases. However, when relay 10 again operates relay 14 is released if no further impulses are received. Relay 14 is slow in releasing so in case more than one impulse is sent relay 14 will be maintained operated during pulsing to prevent relay 16 from operating during the dialing of a digit. This release of relay 14 at the end of a series permits the reoperation of relay 16. Consequently, on the release of relay 14 and reoperation of relay 16, at the end of the first impulse in this case, and considering that the brushes of the banks 5 and 6 have advanced one step a circuit will be completed for the release magnet from battery through the release magnet 8, off-normal contacts 9, first terminal and brush of bank 6, lower inner armature and front contact of relay 16 to ground at the upper armature and front contact of relay 11 thus causing the switch 4 to return to normal. On the next series of impulses if it is the digit that is intended for a toll call, that is, the zero digit, the operations described are repeated, that is, relay 14 is operated and remains operated during the pulsing to maintain relay 16 released and the rotary magnet in this case advances the brushes of switch 4 to the tenth position. In this position, when the last impulse has been sent relay 14 releases and relay 16 reoperates and consequently a circuit is then completed for the operation of relay 15 from battery, the winding of this relay, the tenth terminal and brush of bank 6, lower inner armature and front contact of relay 16 to ground at the upper armature and front contact of relay 11. Relay 15 in operating switches the tip and ring connection from the trunk leading to the central office to leads extending to the private branch exchange operator's circuit. Relay 16 is now maintained operated through the operator's circuit and completes the talking connection between the calling subscriber at 1 and this private branch exchange operator. The talking battery for the calling subscriber is supplied through the windings of relay 10 and the talking battery for the private branch exchange operator is supplied at her set in the usual manner.

When the conversation is finished between the calling subscriber at 1 and the operator, relay 10 releases when the calling subscriber hangs up his receiver and thus causes the release of relays 11 and 16. Relay 11 closes a circuit for the release magnet 8 from battery, off-normal contacts 9, lower inner armature and back contact of relay 11 and lower armature and back contact of relay 10 to ground. The switch at 2 is held operated by ground on the sleeve supplied by the terminals and brushes of bank 5 until the switch 4 is returned to normal when this ground is removed, thus permitting switches at 2 to release as is well known in the art. This is to prevent the seizure of trunk circuit 3 until the auxiliary switch 4 has actually returned to normal.

Should the calling subscriber at 1 dial any other intermediate number the relay 12 will be operated as soon as the brush of bank 6 stops at any of the intermediate positions, as determined by the digit dialed, by a circuit from battery, winding of relay 12, any of the intermediate terminals and the brush of bank 6 to ground at relay 11 as hereinbefore traced when the pulsing ceases. Relay 12 is locked at its upper armature and front contact of relay 11 to prevent the rotary magnet 7 from operating on subsequent series of impulses transmitted to the central offices by pulsing relay 10. The actual pulsing in this

case is now done by the upper armature and front contact of relay 10 which connects the tip and ring conductors of the trunk through the connection established at the armature and front contact of relay 14. In this case the pulsing is done on the operation of relay 10 instead of the release of relay 10. At the end of each series relay 14 is released and relay 16 is reoperated to complete the talking connection.

Referring now to the modified form of the embodiment of the invention as shown in Fig. 2, the function of this circuit is identical with that shown in Fig. 1 with the exception of the arrangement for calling a trunk. In this case if the subscriber at 1 attempts a toll call he may employ two different kinds of code. It will be remembered that in the circuit of Fig. 1 he had to dial the zero digit when making an attempt to get the trunk connection. In this case in addition to being able to call the zero digit he may also attempt to call a trunk by dialing the code number 211, this number being chosen merely to illustrate how different types of trunk connections may be attempted having different code numbers. Assuming that all the functions of the circuit arrangement shown in Fig. 2 are the same as in Fig. 1, as far as calling the code number 1 which releases the switch 4, the calling of the numbers 5 to 9 will cut through the connection to the private branch exchange operator while the numbers 2, 3, and 4 are reserved for calling on bank 6 the code number 211 and the tenth position for the code number zero. If the code number 211 is called the brush of bank 6 will be advanced to the second position. When this position is reached relay 20 is operated from battery, winding of this relay, second terminal and the brush of bank 6, lower inner armature and front contacts of relay 16, to ground at the upper armature and front contact of relay 11. Relay 20 is locked through its upper armature and front contact to the same ground on relay 11, then when the next numeral is called, that is 1, a connection is established for the operation of relay 21 from battery, winding of this relay, lower inner armature and front contact of relay 20, third terminals and brush of bank 6, to ground at relay 11. Relay 21 locks through its upper armature and front contact to ground at relay 11. When the third digit 1 of the code number 211 is called the brush of bank 6 will make a connection through the fourth terminal. In this case, therefore, a circuit will be closed for relay 15 from battery, winding of this relay, lower armature and front contact of relay 21, terminal 4 and brush of bank 6 to the ground at relay 11. The connection is thereby transferred from the tip and ring conductors leading to the central office to the connection leading to the private branch exchange operator's position. From this point on, the operation of the two circuits is the same, relays 20 and 21 releasing on the release of relay 11 when the connection is released by the calling subscriber.

It should be understood that while the invention has only been illustrated in connection with two systems it could readily be applied to other embodiments without departing from the spirit thereof.

What is claimed is:

1. In a telephone system, subscribers' lines, trunks, a branch line, a switch associated with each trunk, means for seizing a trunk from a calling subscriber's line, dial pulse producing means, means responsive to dial pulses from said means

for actuating the switch associated with said seized trunk, a relay associated with said seized trunk for disconnecting the subscriber's line from said trunk and for connecting it to said branch line, another relay associated with said seized trunk for preventing further control of said switch by dial pulses, and means responsive to certain settings of said associated switch by dial pulses for operating said first relay, and means responsive to certain other settings of said switch by dial pulses for operating said second relay.

2. In a telephone system, an exchange, subscribers' lines terminating in said exchange, trunks terminating in said exchange and having conductors extending outside said exchange, a branch line, means for seizing the outgoing end of a trunk from a subscriber's line, a switch associated with each trunk, means operative over said calling subscriber's line for setting the switch associated with said seized trunk in various positions, means responsive to the setting of said switch in certain positions for disconnecting the outgoing end of said trunk from the conductors thereof extending outside of said

exchange and for connecting said outgoing end to said branch line, and means responsive to the setting of said switch in other positions for thereafter disabling said means for setting the switch.

3. In a telephone system, an exchange, subscribers' lines terminating in said exchange, trunks terminating in said exchange and having conductors extending outside of the exchange, a branch line, means for seizing the outgoing end of a trunk from a subscriber's line, a switch associated with each trunk, means operative over said calling subscriber's line for setting the switch associated with the seized trunk in various positions, means responsive to the setting of said switch in a certain position for releasing said switch, means responsive to the setting of said switch in other positions for disconnecting the outgoing end of said trunk from the conductors thereof extending outside the exchange and for connecting said outgoing end to the branch line, and means responsive to the setting of said switch in still other positions for thereafter preventing said means for setting said switch from further control over said switch.

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