May 12, 1936. F. A. BONOMI 2,040,291

TELEPHONE SYSTEM

Filed Nov. 25, 1932 2 Sheets-Sheet 1

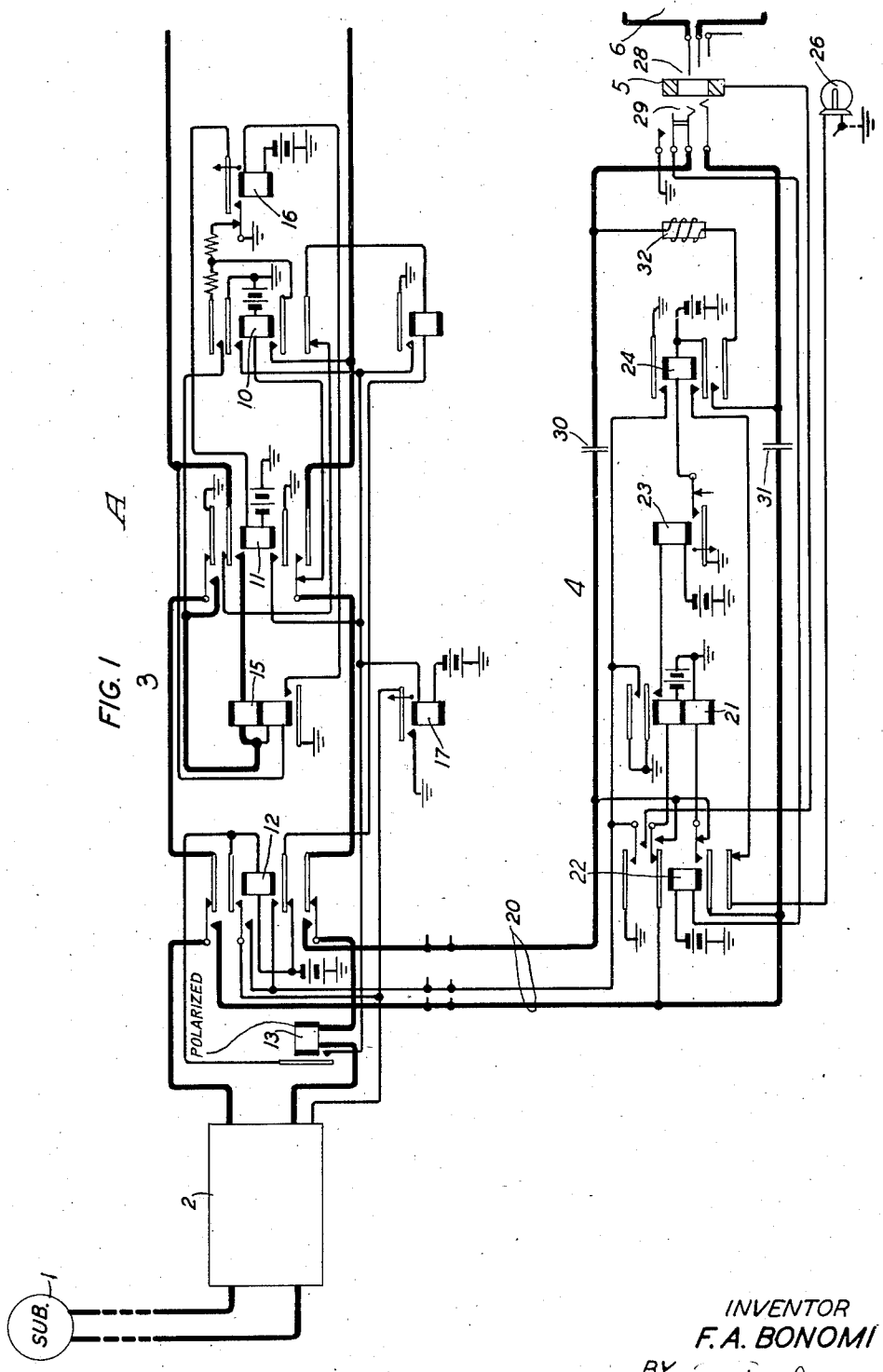

FIG. 1

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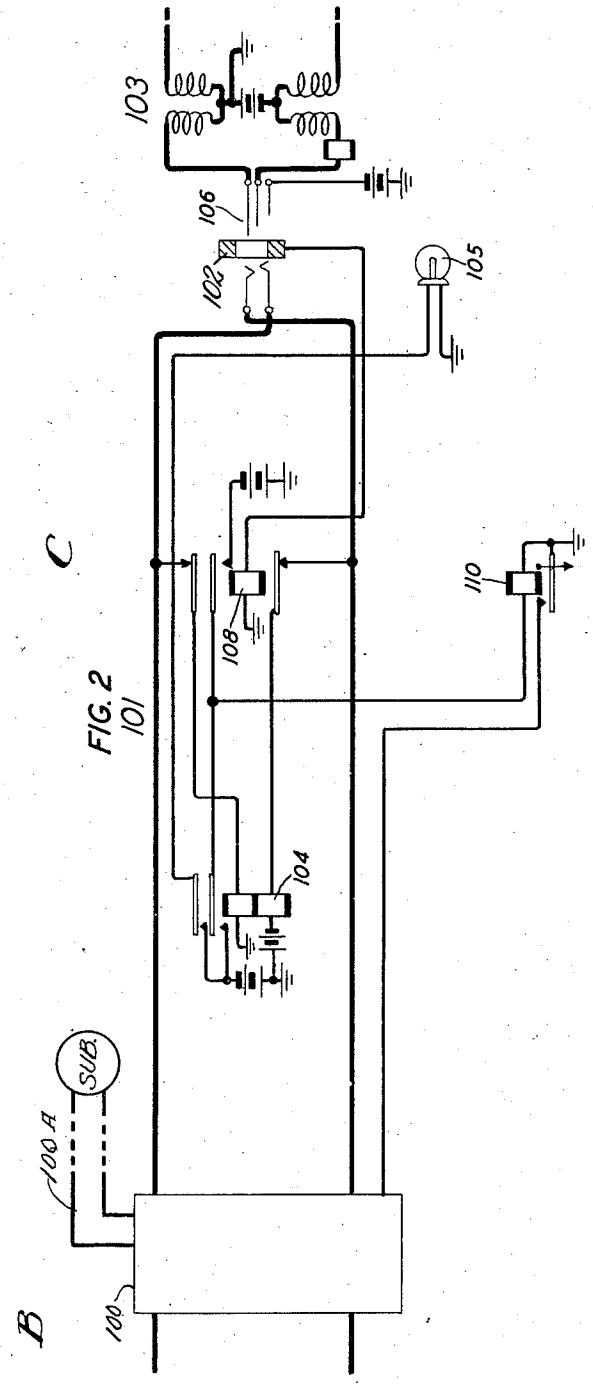

FIG. 2

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TELEPHONE SYSTEM

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Application November 25, 1932, Serial No. 644,235

6 Claims. (Cl. 179—27)

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

The object of the 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.

Heretofore systems have been provided whereby if a connection is attempted by a subscriber to a zone to which he is not entitled to make connection the subscriber's line is disconnected from the attempted connection and transferred to a tone source which sends a tone to the subscriber to remind him that the attempted call is non-permissible. Other systems have been provided in which when connections are extended to a central office over a trunk and this call requires separate supervision by the private branch exchange operator a lamp is lighted at the operator's position to permit the operator to supervise the connection. Other systems have also been provided in which if all the trunks to a certain office are busy the call is routed through other trunks and offices to the desired office.

It is a feature of this invention to prevent subscribers in a private branch exchange system from establishing connections to certain distant offices such as toll offices. If such a connection is dialed by a private branch exchange subscriber the call is answered at the toll office to which it is extended. Current of a certain polarity is thereby sent back over the trunk incoming to the private branch exchange. This current causes a relay to operate at the exchange to release the toll connection and to transfer the calling subscriber's line to a branch line terminating at a private branch exchange operator's position.

It is another feature of this invention to provide means whereby in the establishing of a plurality of toll connections the transfer from such toll connections of the associated subscriber's lines may be made to a common branch line leading to a single operator's position.

The invention has been shown in the accompanying drawings in which Fig. 1 shows the equipment at a private branch exchange embodying features of the invention, while Fig. 2 shows the equipment partly in diagrammatic form at a main office and at a toll office. A trunk between the main office and the toll office is illustrated to which connections are not permitted by subscribers at the private branch exchange.

Referring now to the drawings a private branch exchange subscriber's set has been illustrated at 1 connected through automatic switching mechanisms, illustrated by box 2, and terminating in the trunk circuit 3 incoming to the private branch exchange A. This trunk circuit 3 in turn terminates at the main office B in automatic connecting means, illustrated by box 100, having access to subscriber's lines in the main office B such as line 100A and to trunk circuits such as 101 ending in a jack 102 at a toll operator's position in the toll office C where a toll operator's cord 103 has been shown in diagrammatic form. The incoming trunk circuit 3 is also connected with a branch circuit 4 terminating in a jack 5 at a private branch exchange operator's position, where a cord circuit 6 is shown in diagrammatic form. If a connection is attempted by the subscriber at 1 for extension to the toll office over a trunk 101, the automatic equipment at 2 is actuated to select an incoming trunk circuit such as 3, and then by a series of dial impulses the equipment at 100 is operated to select a trunk such as 101. When the toll operator at 103 answers this call battery is reversed over the trunk line towards the private branch exchange, and the connection from the calling subscriber at 1 is transferred to the branch circuit 4 for answering by the private branch exchange operator. Description will now be made of such a call.

When the subscriber at 1 has operated the automatic equipment 2 to select the trunk circuit 3 a circuit is completed from battery through the winding of relay 10, make-before-break contacts of relay 11, lower outer armature and back contact of relay 12, winding of the polarized relay 13 over the ring conductors through the calling subscriber's loop back over the tip conductor, upper outer armatures and back contacts of relays 12 and 11 to ground. This causes the operation of relay 10. Relay 10 in operating closes a short circuit for the tip and ring conductors leading to the equipment 100 from the tip conductor, lower winding of relay 15, upper outer armature and front contact of relay 10, lower inner armature and front contact of relay 10 to the ring conductor. As soon as the equipment at 100 has been seized, battery and ground is connected to the ring and tip conductors respectively through the usual line relay in this equipment. This causes the operation of relay 15. This relay in turn closes an obvious circuit for the operation of relay 16. This latter relay closes an obvious circuit for the operation of relay 11. Relay 11 completes the connection between the tip and ring conductors from the calling subscriber to

equipment 100. The tip connection is now extended through the upper inner armature and front contact of relay 11, upper winding of relay 15, upper make-before-break contacts of relay 10, while the ring connection is extended through the lower outer armature and front contact of relay 11. The operation of relay 11 disconnects the winding of relay 10 from the calling subscriber's loop causing this relay to release, while relay 15 is maintained operated to maintain relays 16 and 11 operated. Relay 11 in operating also closes an obvious circuit for the operation of relay 17 which closes a connection to ground at its armature and front contact for the sleeve lead leading to the automatic equipment at 2, to maintain preceding switches operated.

The calling subscriber may now control the line relay in equipment 100 to pulse for the selection in the usual manner of a subscriber such as the one connected to line 100A in the main office B or as in the case assumed to pulse for the selection in the same manner for a trunk 101 leading to the toll office C. When this trunk is seized battery and ground are connected to the ring and tip conductors back over the calling subscriber's loop through the windings of relay 104. This relay operates and closes an obvious circuit for the lighting of lamp 105 to indicate that a call is present on this trunk. The operator now inserts her plug 106 of a cord 103 into jack 102 thereby closing a circuit from battery, sleeve terminals of plug 106 and jack 102 to ground through the winding of relay 108. This relay in operating opens the connections from the tip and ring conductors through the windings of relay 104, causing this relay to release and thereby extinguishes lamp 105. Relay 104 when originally operated closed an obvious circuit for the operation of relay 110 which in turn closes a connection to ground for the sleeve lead to maintain the switches in equipment 100 operated. Relay 110 is now maintained operated under control of relay 108. It will be noted that the battery connections through the cord 103 are reversed for the tip and ring conductors over trunk 102 leading towards the incoming end of the trunk. Relay 13 inserted in series with the ring conductor will now operate as it is polarized. Relay 13 in operating closes a circuit for the operation of relay 12 from battery, winding of this relay, armature and front contact of relay 13, lower inner armature and front contact of relay 11 to ground. Relay 12 closes a locking circuit for itself through its upper inner armature and front contact to the ground on the sleeve leads supplied by relay 17. The tip and ring conductors leading to the toll office are now opened at the upper and lower outer armatures and back contacts of relay 12 so as to signal to the toll operator that this connection is not permitted through the release of the usual supervisory relay in the cord circuit. The tip and ring conductors and sleeve conductor from the calling subscriber at 1 through the equipment at 2 are then transferred to the tip and ring and sleeve conductors 20 leading to the branch circuit 4.

A connection is now completed from battery and ground through the windings of relay 21 in the branch circuit 4 over the upper inner armature and back contact of relay 22 for the tip conductor, while the ring conductor is extended through the lower make-before-break contacts of relay 22. Relay 21 in operating closes a connection at its upper outer armature and front contact to ground for the sleeve lead to maintain the switches in the equipment 2 operated. Another obvious circuit is closed by relay 21 for the operation of relay 23. Relay 23 in operating closes an obvious circuit for relay 24. This latter relay in operating closes a connection to ground at its upper armature and front contact for the sleeve lead and a circuit for the lighting of lamp 26 from battery, lower inner armature and front contact of relay 24, the lower outer armature and back contact of relay 22, lamp 26 to ground. The lighted lamp 26 notifies the private branch exchange operator that a call is waiting on this line. She will then insert plug 28 of a cord 6 into the jack 29 of the branch circuit 4. This closes an obvious circuit for the operation of relay 22. Relay 22 in operating opens the circuit for lamp 26 to extinguish it and reverses connection from battery and ground from relay 21 to the tip and ring conductors to maintain the battery connections over the line to the calling subscriber in the usual direction for talking. Relays 21, 23 and 24 are maintained operated as long as the connection remains established. It should be noted that on the operation of relay 12 the relays 15, 16, 11 and 17 were released and on the operation of relay 22 relay 13 was released. Talking battery for the calling subscribed is supplied through the windings of relay 21 while the talking battery for the private branch exchange operator is supplied through the usual battery in the cord 6, condensers 30 and 31 supplying the talking connection between the two parties.

When the calling subscriber releases the connection, relay 21 is released causing the release of the switching equipment 2 and the release of the remaining relays 22, 23 and 24, while relay 24 when released opens the non-conducting shunt established on its operation at its lower outer armature and front contact through repeating coil 32, thereby signaling the private branch exchange operator in the usual manner in the cord circuit that the calling subscriber has disconnected.

What is claimed is:

1. In a telephone system, a first office, a second office, a calling subscriber's line terminating in said first office, an operator's position in said first office, a subscriber's line terminating in said second office, a first trunk connecting said first and second offices, a third office, a second trunk connecting the second and third offices, a source of current at said third office, means for establishing a connection from the calling subscriber to the subscriber in the second office over said first trunk, means for establishing a connection from the subscriber in the first office to said third office over said trunks, means for connecting said source of current to said second trunk, and means reponsive to the establishing of a connection from the subscriber in said first office to said third office and to the connection of said source of current to the second trunk for disconnecting said first trunk from said calling subscriber's line and for connecting said calling subscriber's line to said operator's position.

2. In a telephone system, a first office, a second office, a calling subscriber's line terminating in said first office, a trunk connecting said offices, a subscriber's line terminating in said second office, a second trunk terminating in said second office, an operator's position in said first office, means for establishing connection from the calling subscriber to the subscriber in the second office over the first mentioned trunk, means for establishing

a connection from the calling subscriber to the second trunk over the first trunk, a source of current, means for establishing a connection between said source of current and said second trunk, and means responsive to current from said source connected to said second trunk for disconnecting said first trunk from the calling subscriber's line and for connecting said calling subscriber's line to said operator's position.

3. In a telephone system, a first office, a second office, a calling subscriber's line terminating in said first office, an operator's position in said first office, a subscriber's line terminating in said second office, a first trunk connecting said first and second offices, a third office, a second trunk connecting the second and third offices, a source of current at said third office, means for establishing a connection from the calling subscriber to the subscriber in the second office over said first trunk, means for establishing a connection from the subscriber in the first office to said third office over said trunks, a signal at said third office associated with said second trunk, means responsive to the connection from the subscriber at the first office to said third office over said trunks for actuating said signal, means for connecting said source of current to said second trunk, and means responsive to the establishing of a connection from the subscriber in said first office to said third office and to the connection of said source of current to the second trunk for disabling said signal and for disconnecting said first trunk from said calling subscriber's line and for connecting said calling subscriber's line to said operator's position.

4. In a telephone system, a first office, a second office, a calling subscriber's line terminating in said first office, an operator's position in said first office, a signal at said operator's position, a subscriber's line terminating in said second office, a first trunk connecting said first and second offices, a third office, a second trunk connecting the second and third offices, a source of current at said third office, means for establishing a connection from the calling subscriber to the subscriber at the second office over said first trunk, means for establishing a connection from the subscriber at the first office to said third office over said trunks, means for connecting said source of current to said second trunk, and means responsive to the establishing of a connection from the subscriber in said first office to said third office and to the connection of said source of current to the second trunk for disconnecting said first trunk from said calling subscriber's line and for connecting said calling subscriber's line to said operator's position and actuating said signal.

5. In a telephone system, a first office, a second office, a calling subscriber's line terminating in said first office, an operator's position in said first office, a subscriber's line terminating in said second office, a plurality of trunks in said first office having conductors outgoing to said second office, a branch line terminating at said operator's position and connectable to any one of said trunks at said first office, a third office, another trunk connecting the second and third offices, a source of current at said third office, means for establishing a connection from the calling subscriber to the subscriber in said second office over the outgoing conductors of any one of said first-mentioned trunks, means for establishing a connection from the subscriber in the first office to said third office over the outgoing conductors of any one of said first-mentioned trunks and over said second-mentioned trunk, means for connecting said source of current to said second-mentioned trunk and means responsive to the establishing of a connection from the subscriber in said first office to said third office and to the connection of said source of current to said second-mentioned trunk for disconnecting the calling subscriber's line from the outgoing conductors of the trunk used in the connection and for connecting the calling subscriber's line through the branch line to the operator's position.

6. In a telephone system, a first office, a second office, a calling subscriber's line terminating in said first office, a plurality of trunks in said first office having outgoing conductors terminating in said second office, a branch line connectable to any one of said trunks at said first office, a subscriber's line terminating at said second office, another trunk outgoing from said second office, means for establishing a connection from the calling subscriber's line to the subscriber in the second office over the outgoing conductors of any one of said first-mentioned trunks, means for establishing a connection from the calling subscriber's line to the second-mentioned trunk over the outgoing conductors of any one of said first-mentioned trunks, a source of current, means for establishing a connection between said source of current and said second-mentioned trunk, and means responsive to current from said source connected to said second-mentioned trunk for disconnecting the calling subscriber's line from the outgoing conductors of the trunk used in the connection between the two offices and for connecting said subscriber's line to the branch line.

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