May 16, 1933. W. C. OAKES 1,909,419

TELEPHONE SYSTEM

Filed July 1, 1932 2 Sheets-Sheet 1

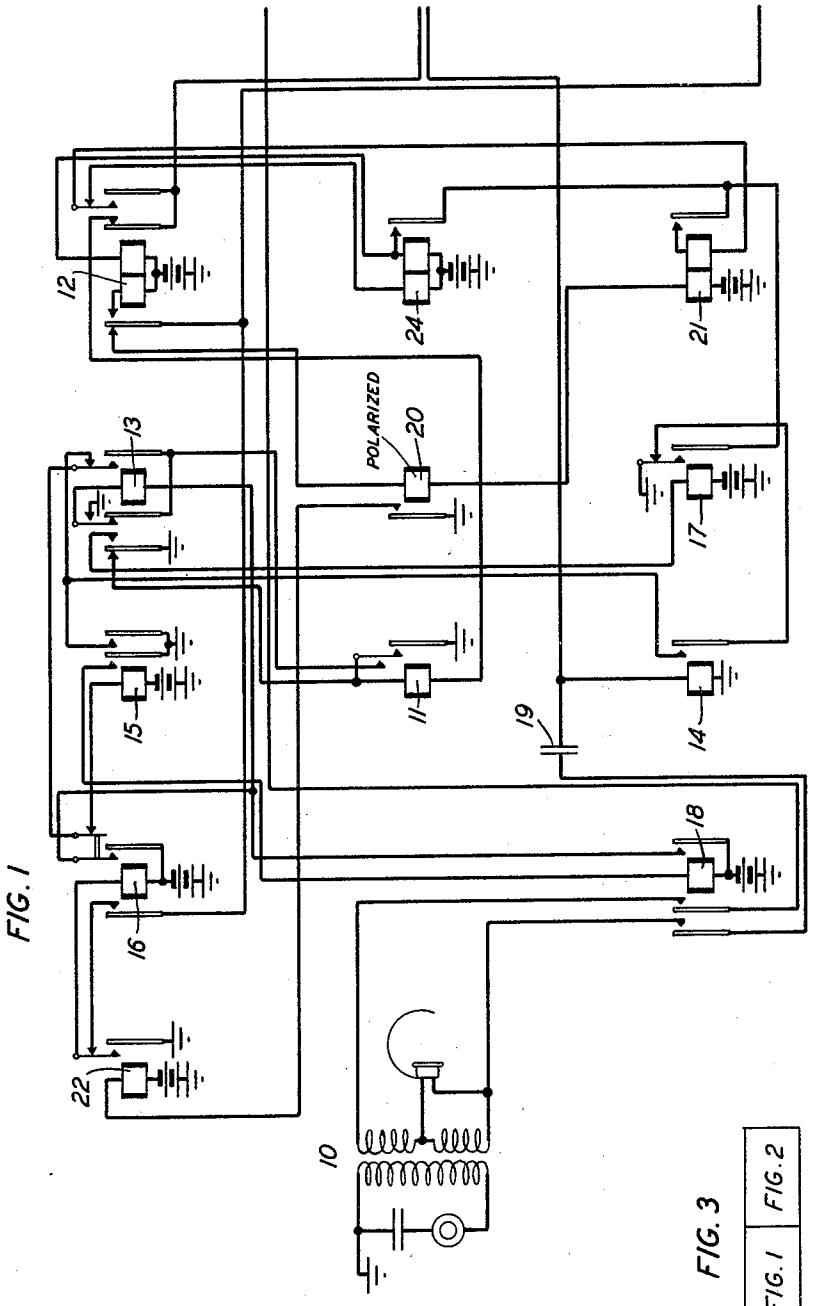

FIG. 1

FIG. 3

FIG. 2
FIG. 1

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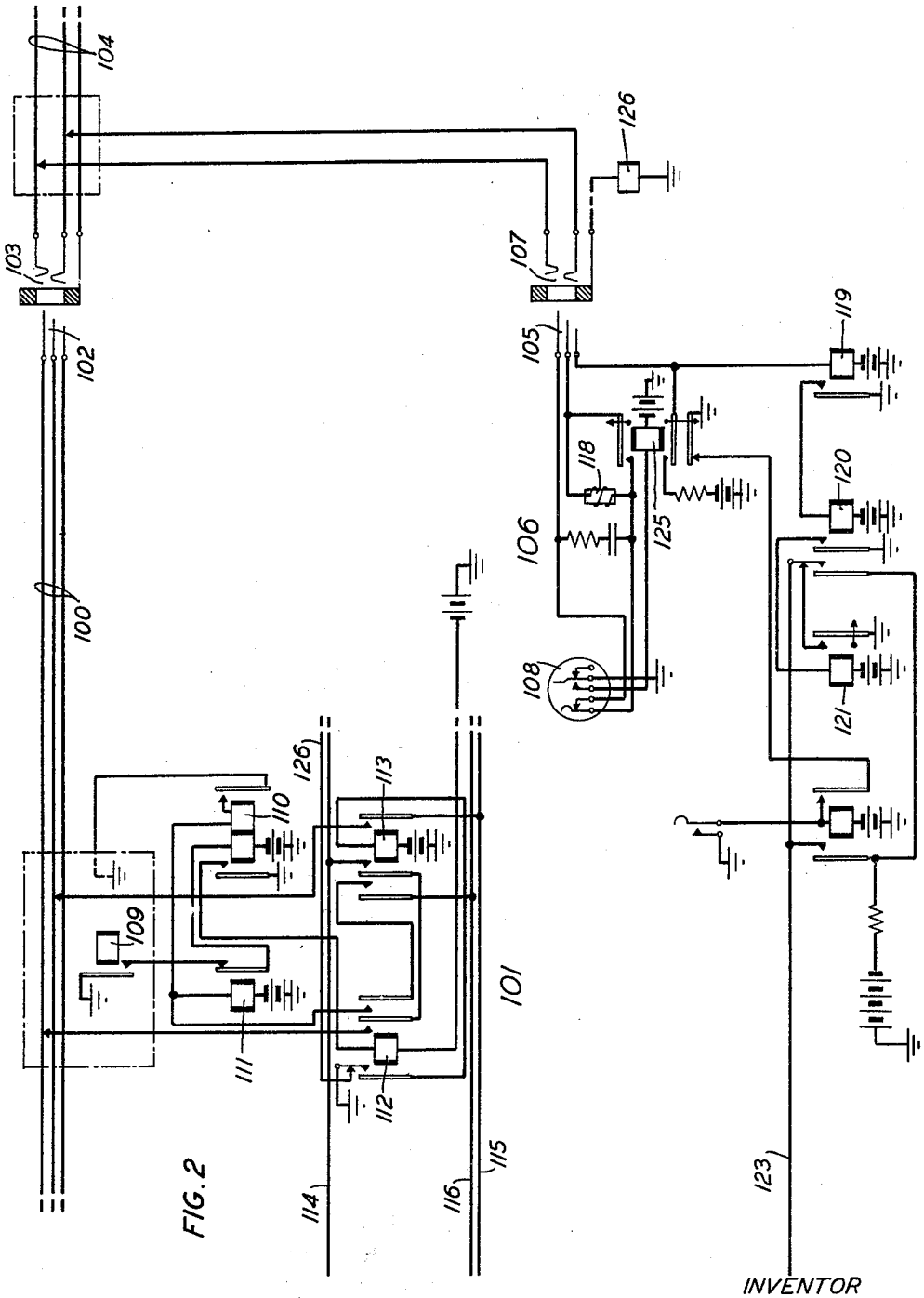

FIG. 2

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UNITED STATES PATENT OFFICE

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TELEPHONE SYSTEM

Application filed July 1, 1932. Serial No. 620,417.

This invention relates to telephone systems and particularly to trunking systems.

An object of the invention is to improve the traffic arrangements over trunk connections involving the use of an operator's telephone set and dialing equipment.

Heretofore in establishing a connection for calls incoming over one trunk to another trunk outgoing to another office an operator's telephone set has been automatically associated with the incoming trunk when seized and when this trunk was connected to the outgoing trunk the operator's telephone set was automatically disconnected for use with other incoming trunks.

In systems of this kind when the outgoing trunk terminates in an automatic office and it is necessary for the operator to dial a number over the outgoing trunk, the operator's telephone set would be automatically connected to another seized incoming trunk through a sequencing circuit. The operator would under such circumstances be disturbed during the dialing operations by the requests for another connection incoming over this second trunk to which her set is connected.

According to one feature of this invention, improvements are secured in this respect by means whereby the operator's telephone set is totally disabled until the dialing is completed. The arrangement is such that when a trunk is seized, the operator's telephone set is automatically connected to this trunk through a sequence circuit if the trunk is the next in sequence and the information is received for the establishing of a connection. Then, when the operator inserts a dial cord into a jack of an outgoing automatic trunk the operator's telephone set is automatically disabled although it is still maintained associated with this incoming trunk through the sequence circuit. When the dialing is finished the operator removes the dial cord from the jack of the outgoing trunk and the operator's telephone set is thereby automatically released from the incoming trunk through the sequence circuit to permit it to be connected to the next incoming trunk awaiting attention.

Referring now to the drawings, the invention has been illustrated in Figs. 1 and 2, which may be arranged as shown in Fig. 3. Fig. 1 shows an operator's telephone set and a relay arrangement for connecting it to and disconnecting it from a trunk circuit, while Fig. 2 shows an incoming trunk circuit and an outgoing trunk circuit in diagrammatic form, an operator's dialing equipment and part of the sequence circuit for connecting the operator's telephone set shown in Fig. 1 to incoming trunks as they are seized.

The invention will be described in connection with these circuits under circumstances which will disclose the various features thereof. In general, the procedure is as follows: A call incoming over the trunk 100 causes the operator's telephone set 10 to be connected through the sequence switch relays 101 to this trunk. Then after the operator receives the information as to the desired number, she inserts a plug 102 of the trunk 100 into jack 103 of the outgoing trunk 104 leading to a desired distant automatic office. The operator will then proceed to dial after inserting plug 105 of her dialing equipment 106 into dialing jack 107. The effect of this will be, as is well known in trunks of the type having a special dialing jack, that dial 108 will be connected to the trunk 104. The operator will then dial the desired number and after dialing is completed remove plug 105 from the dialing jack 107, when the connection from the calling party over trunk 100 will be established through trunk 104 to the called party. The arrangement in regard to the operator's telephone set 10 is such that when the operator inserts plug 105 into the dialing jack 107, the telephone set 10 is disconnected or disabled as far as trunk 100 is concerned although the sequence circuit 101 still maintains the con-

nection to the trunk to prevent the set from being connected to another calling trunk similar to 100. When the operator has finished dialing and removes plug 105 from jack 107, the operator's telephone set 10 is completely removed from trunk 100 through the sequence circuit which then operates to connect the operator's telephone set to the next calling trunk. Thus, it will be seen that the operator's telephone set will be held ineffective during dialing over the trunk 104 so that in the case a call comes in over another trunk during the dialing period the set will not be connected thereto until the dialing has been completed and the operator will therefore not be disturbed during dialing by requests from other calling parties incoming over other trunks.

The detailed operations of the circuits under these circumstances are as follows: When the trunk 100 is seized by a calling subscriber a relay such as 109 may be operated in any well known manner by circuit arrangements acting due to the seizing of the trunk. The operation of relay 109 closes an obvious circuit for the operation of relay 110 and this relay in turn causes the operation of relay 111 over a circuit from battery, winding of relay 111, right-hand winding of relay 110 and right-hand contacts to a holding ground supplied in the trunk circuit. Relay 110 in operating causes the operation of relay 112 over an obvious circuit and relay 112 closes an obvious circuit for relay 113. The immediate effect of the operation of relays 112 and 113 will be to extend the tip and ring connections from the tip and ring conductors of trunk 100 over leads 114 and 115 towards the tip and ring conductors of the operator's telephone set 10. Another circuit closed by the operation of relays 112 and 113 causes the operation of relay 11 from battery winding of relay 111, armatures and front contacts of relays 112 and 113, lead 116, contacts of relay 12, winding of relay 11, to ground at contact of relay 13. Relay 11 in operating does not perform any useful function immediately. It should be noted that relay 14 is connected from ground through the winding of this relay to conductor 115 and this relay will therefore operate as soon as this ring conductor has been connected through the sequence circuit 101 to battery not shown but that may be supplied over the ring conductor in trunk 100. The operation of relay 14 closes a circuit for the operation of relay 15 from battery winding of relay 15, contacts of relays 16, 13 and 14 to ground at contacts of relay 17. Relay 15 in operating closes an obvious circuit for the operation of relay 18 and this latter relay, by closing connections at its left-hand armatures and front contacts, connects the operator's telephone set 10 with the conductors 114 and 115, the connection through conductor 115 extending through the condenser 19 so that the operator's telephone set 10 will now be connected to the calling subscriber's line over trunk 100.

The operator now receives the necessary information to establish a connection over trunk 104 to an automatic office. The information will include office information so that the operator will be able to choose an idle trunk to the desired office. If it is assumed that trunk 104 is the one chosen the operator will insert plug 102 into jack 103. The next step on the part of the operator is to proceed to dial the desired subscriber's number. To this end she will insert plug 105 into the dialing jack 107 of trunk 104 and dial the number. It should be noted that on the insertion of plug 105 into jack 107 a bridge is completed over the tip and ring conductors through the retardation coil 118 and the pulsing contacts of dial 108 to cause the operation of the usual pulsing relay at the automatic office. Relay 119 will now operate over the sleeve circuit. Relay 119 in operating causes the operation of relay 120 which in turn causes the operation of relay 121 over obvious circuits. Relay 120 in operating closes a circuit from battery, outer left-hand armature of front contact of relay 120, lead 123, contact of relay 12, winding of polarized relay 20, winding of relay 21 to battery. The battery connected to the contact of relay 20 is of such a polarity and potential in relation to the battery connected at the opposite side of the winding of relay 21 that relay 21 will not operate in this circuit while relay 20, which is polarized, will operate. Relay 20 in operating closes an obvious circuit for relay 22 and this relay in turn closes an obvious circuit for the operation of relay 16. Relay 16, in operating opens the circuit for relay 15 and relay 15 in releasing causes the release of relay 18 thereby disabling the operator's telephone set 10 by disconnecting it from the leads 114 and 115.

The circuits now remain in this position during dialing. The operator may operate dial 108 in accordance with the desired number. When the dial is operated from normal a circuit is closed for relay 125 and this relay being slow in releasing will remain operated during the pulsing which takes place through its upper armature and front contact that short-circuit the retardation coil 118. Relay 125 in operating also closes a circuit from battery through a resistance over the sleeve terminals of plug 105 and jack 107 to a relay 126 to ground. This relay in operating may cause the disconnection of the tip and ring conductors from trunk 100 during dialing to prevent the impulses from being repeated over the trunk 100. Any well known arrangement may be provided for this purpose. Relay 119, however, remains operated over

the sleeve circuit regardless of whether relay 125 is operated or not.

When the dialing has been completed relay 125 releases. It is slow in releasing in order to prevent the pulsing relay at the distant exchange from being momentarily released which may occur due to the impedance of the coil 118. The operator now removes plug 105 from jack 107, which causes the release of relays 119, 120 and 121 in succession. However, relay 121 is slow in releasing so that when relay 120 is releasing a momentary connection will be established from ground at the armature and front contact of relay 121 to connect over make-before-break contacts of relay 120 to conductor 123. The removal of the battery connection from conductor 123 causes the release of relay 20 and the momentary connection to ground causes a momentary operation of relay 21. The release of relay 20 causes the release of relay 22. Relay 16, however, is maintained operated until the connection to ground over lead 123 is removed when it releases. Relay 21 in operating locks over a circuit from ground, armatures and front contacts of relays 17 and 21, right-hand winding of relay 21, make-before-break contacts of relay 12, left-hand winding of relay 24 to battery. Relay 24 operates and locks to ground at relay 17. The ground from relay 17 is extended by the operation of relay 24 to the right-hand winding of relay 12 to battery causing relay 12 to operate and through its left-hand winding to ground on lead 123. Relay 12 in operating opens the circuit from conductor 116 to relay 11 to cause this relay to release. The operation of relay 12 also closes a connection for lead 116 at its outer right-hand armature and front contact through the right-hand winding and armature and front contact to ground at relay 17. As the resistance of this winding of relay 21 is less than the resistance of the right-hand winding of relay 110, relay 110 will release due to the shunting of the battery through the winding of relay 111 by the ground at relay 17. Relay 110 in releasing releases relay 112 which in turn releases relay 113 and the release of these two relays release relay 111. The sequence circuit 101 is thus restored for use with other incoming calls to connect the operator's telephone set to seized trunks such as 100. In the meantime, relay 109 of trunk 100 has released so that the sequence circuit will not be seized by this trunk. When the ground on lead 123 is removed by the release of relay 121, relays 16, 13 and 17 are released in succession and relay 17 releases in turn relays 21, 24 and 72.

What is claimed is:

1. In a telephone system, a calling line, an operator's telephone set, means for automatically connecting said telephone to said calling line, a trunk, a dialing means, means for connecting said dialing means to said trunk for dialing, means responsive to said last mentioned connection for disabling said telephone set, and means responsive to the disconnection of the dialing means from the trunk for disconnecting the telephone set from the line.

2. In a telephone system, a calling line, an operator's telephone set, means for automatically connecting said telephone to said calling line, a trunk, a dialing means, means for connecting said dialing means to said trunk for dialing, means responsive to said last mentioned connection for disconnecting said telephone set from said line, and means responsive to the disconnection of the dialing means from the trunk for preventing the telephone set from being reconnected to the line.

3. In a telephone system, a calling trunk, a called trunk, means for seizing said calling trunk, means for connecting the calling trunk to a called trunk, an operator's telephone set, means for connecting said operator's set to the calling trunk when seized, means for dialing, means for connecting said dialing means to said called trunk, means responsive to the connection of the dialing means to the called trunk for disabling the operator's telephone set, and means responsive to the disconnection of the dialing means from the called trunk for disconnecting the operator's telephone set from the calling trunk.

4. In a telephone system, calling lines, an operator's telephone set, means for automatically connecting said telephone set to said calling lines in sequence, a trunk, a dialing means, means for connecting said dialing means to said trunk, means responsive to said last mentioned connection for disabling the telephone set but maintain it associated with the particular calling line to which it was connected, and means responsive to the disconnection of the dialing means from the trunk for disconnecting the telephone set from this calling line to permit it to be connected to the next calling line in the sequence.

5. In a telephone system, a plurality of calling lines, an operator's telephone set, a sequence circuit for connecting the operator's telephone set to calling lines in a certain sequence in response to the seizure of said lines, a trunk, a dialing means, means for connecting said dialing means to said trunk, means responsive to said last mentioned connection for disabling the telephone set but maintain it associated through the sequence circuit with a calling line, and means responsive to the disconnection of the dialing means from the trunk for releasing said telephone set from said calling line for connection through the sequence circuit to another calling line.

6. In a telephone system, calling lines, an operator's telephone set, a sequence circuit for connecting the operator's telephone set to seize calling lines in a certain sequence, a

trunk, means for connecting a line to which an operator's telephone set has been connected to said trunk, dialing means, means for connecting said dialing means to said trunk, means responsive to the last mentioned connection for disabling the telephone set but preventing it from being connected to another calling line, and means responsive to the disconnection of the dialing means from the trunk for releasing the telephone set for connection to the next calling line in the sequence.

In witness whereof, I hereunto subscribe my name this 28th day of June, 1932.

WILLIAM C. OAKES.