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TELEPHONE SYSTEM

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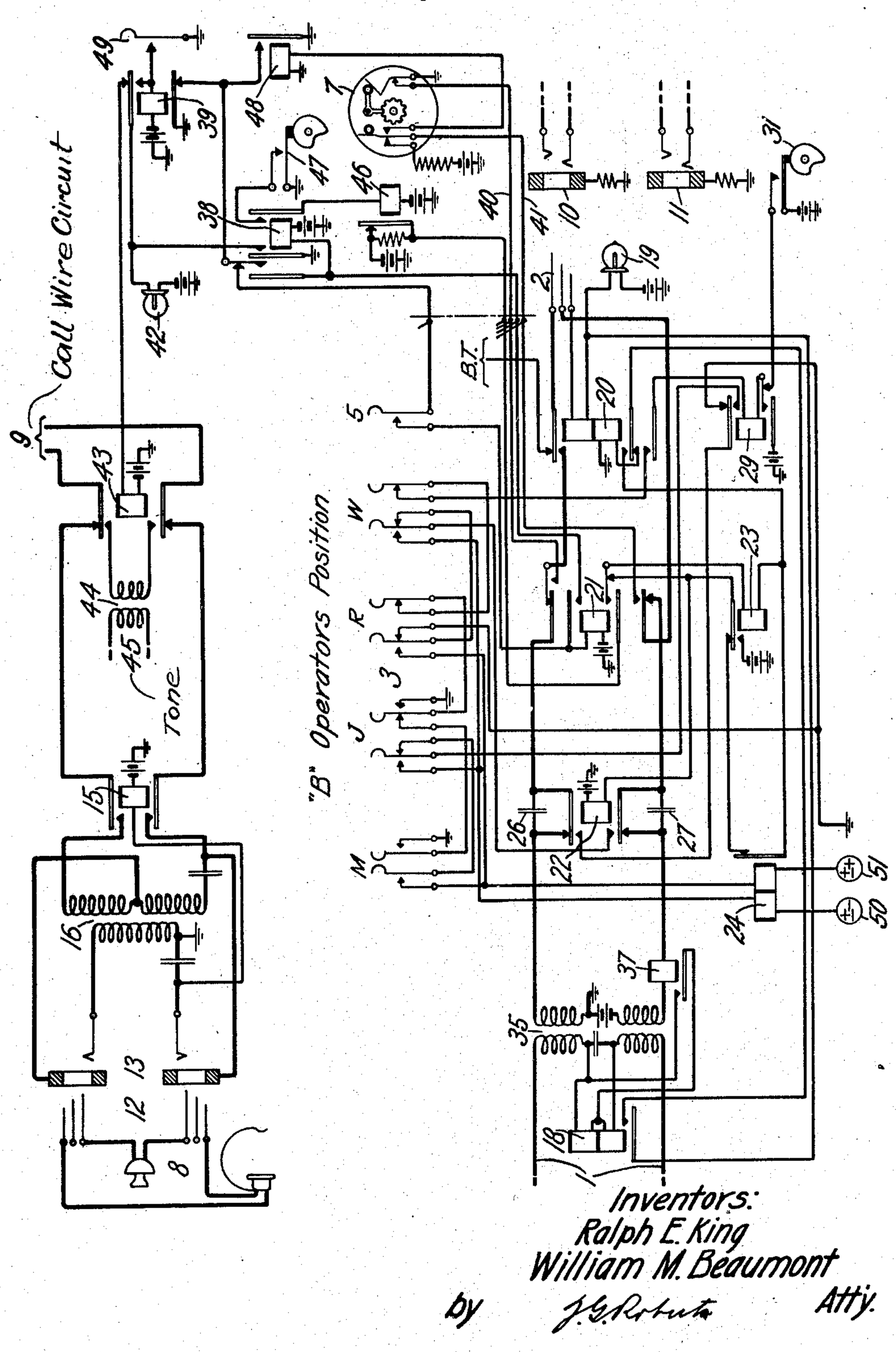

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TELEPHONE SYSTEM.

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This invention relates to telephone systems and more particularly to systems in which manual lines may be connected to either manual or automatic lines.

In systems of this kind interoffice trunks may be involved that extend from "A" operators' positions in a manual exchange to "B" operators' positions in distant exchanges from which connections may be made to both manual and automatic subscribers. Call wire circuits extending between these two kinds of operators are usually employed for assigning interoffice trunks for use in connections and for communicating the information relating to the establishing of connections thereover. The interoffice trunks are provided at their terminating ends with equipments whereby the "B" operators may dial automatic subscribers' designations.

It is the principal object of this invention to improve the supervision of the establishing of connections over interoffice trunks of this general character.

To attain this and other objects there is provided in accordance with one feature of the invention means whereby a busy tone is applied to the call wire circuit when a "B" operator is engaged in dialing for an automatic subscriber's line, as an indication to the "A" operator that she is so engaged.

The invention further contemplates the provision of means whereby, on the operation of the dial key of the assigned trunk for connecting the dialing circuit to this trunk, a pilot lamp in the dialing circuit is lighted and the usual guard or disconnect lamp in the assigned trunk is flashed. The lighting of the pilot lamp indicates to the "B" operator that the dialing circuit has been connected to a trunk, and the flashing of a guard and disconnect lamp indicates the trunk to which the dialing circuit has been connected.

According to the invention there is also provided a dial lockout arrangement which renders the operation of all dial keys without effect while the dial is actively associated with any one trunk. Thus the accidental operation of a dial key on one trunk will not disturb the dialing operations taking place on another trunk, nor will an established connection on any one trunk be disturbed by the accidental operation of the associated dial key while the dial is thus actively associated with another trunk.

Further, this invention provides improved supervisory signaling means. Ordinarily, when a trunk has been seized at the outgoing end and then extended at its incoming end to an outgoing trunk, the guard lamp will light steadily and when the proper dial key has been depressed, such lamp will flash to indicate to which particular trunk the dialing circuit has been connected and the dial pilot will burn steadily to indicate that the dialing circuit is in order. If, however, a dial key of another trunk is accidentally operated, then the guard lamp will not flash. In this case the dial pilot will light as an indication that the dialing circuit has been taken for use with some trunk, but which trunk is unknown so that it will be necessary to release the dial circuit and depress the proper dial key.

This invention has been illustrated in an accompanying drawing in which is shown the incoming end of an interoffice trunk terminating at a "B" operator's position and a dialing circuit which is common to a plurality of trunks of the kind illustrated.

Referring now to the drawing the invention has been illustrated in connection with an interoffice trunk circuit 1 incoming to a "B" operator's position at one exchange from an "A" operator's position at a distant exchange. This trunk, which is one of a plurality of similar trunks presided over by a "B" operator, terminates in a plug 2 by means of which the trunk may be extended to automatic or manual subscribers. Ringing key unit 3, of the usual type, is provided for ringing connected subscribers, and associated therewith is a dial key 5 for associating this trunk circuit with the dialing crcuit. This dialing circuit is common to all incoming trunks terminating at this "B" operator's position. The dialing circuit is provided with a dial 7 and an operator's telephone set 8. The telephone set is connected to call wire 9 leading to the "A" operator's position at a distant exchange and over which conversation may take place between the "A" and "B" operators relating to the

assignment of interoffice trunks and to the establishing of connections thereover to wanted subscribers' lines.

To more fully set forth the various features of this invention detailed descriptions will now be made of the functions of this trunk circuit when used in establishing a connection to a manual subscriber's line followed by a description of the functioning of this circuit and the dialing circuit when used in establishing a connection to a subscriber whose line terminates in an automatic exchange. In the first case plug 2 will be inserted into the jack 10 and in the second case the plug 2 will be inserted into the jack 11. Jack 10 may be connected through a manual exchange to a manual subscriber's line or directly to a manual subscriber's line, while jack 11 may be connected through the usual automatic switches in an automatic exchange to an automatic subscriber's line in a manner well known in the art.

If a connection is to be completed to a manual subscriber's line the "A" operator at the distant exchange notifies the "B" operator over the order wire 9 of the number of the wanted subscriber and assigns a trunk such as 1 over which the connection is to be extended. It should be understood that the "B" operator's telephone set 8 is connected through plugs 12 and jacks 13 to the dialing circuit when the "B" operator is in attendance at the position and removed from the dialing circuit when the "B" operator is absent from the position. Relay 15 is therefore normally actuated over an obvious circuit through the transmitter and the secondary of induction coil 16 so that the conductors of the order wire are connected through the contacts of relay 15 to the primary of the induction coil 16. If it is assumed that the "B" operator has received the number of the wanted manual subscriber and the "B" operator has assigned the trunk 1 for use in this connection, relay 18 will operate. The operation of relay 18 is due to it being connected across the tip and ring conductors of trunk 1 through battery at the "A" operator's position in a manner well known in the art. The operation of relay 18 closes a circuit for the operation of the guard and disconnect lamp 19 over a circuit as follows: battery, lamp 19, armature and front contact of relay 18, inner lower armature and back contact of relay 20, lower winding of relay 20 to ground. Relay 20 does not operate in this circuit. The lighting of lamp 19 indicates to the "B" operator that the connection is to be extended over trunk 1. She will thereupon test jack 10 of the wanted subscriber's line in the usual manner by touching the tip of plug 2 to the sleeve of jack 10. If this subscriber's line is found to be idle she will insert plug 2 into jack 10 and relay 20 will operate over the sleeve circuit. Relay 20 in operating disconnects the busy test lead from the tip conductor of trunk 1 and connects this conductor to contacts of relay 21. This relay 20 also in operating connects relay 22 in parallel with lamp 19 and thereby shunts and extinguishes the lamp and causes the operation of relay 22 over a circuit as follows: battery, winding of relay 22, armature and back contact of relay 23, armature and back contact of relay 24, inner lower armature and front contact of relay 20, armature and front contact of relay 18, upper winding of relay 20, sleeve terminals of plug 2 and jack 10 to ground.

The operation of relay 22 connects the ringing key set 3 to the wanted subscriber's line and removes the short-circuit from across the condensers 26 and 27. As indicated this circuit is arranged for four-party ringing and one of the keys of the ringing key set 3, for example W, is actuated as the ringing key set 3 is self-locking. The key W applies the ringing for the first party of a four-party line, or for the single party of a single party line. The application of ringing current in this case would then be over circuits as follows: ground will be applied through the upper armature and back contact of relay 29 to the upper armature and front contact of relay 22 through the tip conductor of the trunk 1 while negative superimposed ringing will be applied from source 50 through the left-hand winding of ringing relay 24, left-hand operated contacts of key W, the lower armature and front contact of relay 22 to the ring conductor of the trunk. If the jack 10 is connected with a four-party line and party M is wanted, the key having this designation will be operated and relay 29 will operate over the following circuit: from battery through the interrupter 31, make-before-break contacts of relay 29, winding of relay 29, lower outer armature and front contact of relay 20, right-hand normal contacts of keys W, R and J to ground at the right-hand operated contacts of key M. Relay 29 locks through its lower armature and front contact to battery and the ringing current applied to the line in this case will be as follows: from ground through the left-hand normal contacts of keys R and W, lower armature and front contact of relay 22 to ring conductor of trunk 1, while positive superimposed ringing current from source 51 through the right-hand winding of ringing relay 24 will be applied through the left-hand operated contacts of key M, left-hand normal contact of key J, upper armature and front contact of relay 29, the upper armature and front contact of relay 22 to the tip conductor of trunk 1. If party J is to be rung the operation of key J will also cause the operation of

relay 29, in this case ground will be supplied at the operated right-hand contact of key J for relay 29, while ringing ground will be supplied through the normal left-hand contacts of keys R and W, the lower armature and front contact of relay 22 to the ring side of trunk 1, and negative superimposed ringing current from source 50 through the left-hand winding of relay 24 and left-hand operated contacts of key J and upper armature and front contact of relay 29, the upper armature and front contact of relay 22 to the tip conductor of trunk 1. If party R is the party wanted, key R will be operated and ground in this case will be supplied to the tip conductor of trunk 1 through the upper armature and back contact of relay 29 and upper armature and front contact of relay 22, while positive superimposed ringing current from source 51 will be connected through the right-hand winding of relay 24, left-hand operated contacts of key R, left-hand normal contacts of key W, lower armature and front contact of relay 22 to the ring conductor of trunk 1. It will be noted that ringing current is started under control of a pick-up interrupter 31 in the case of parties M and J and is started immediately and not under control of such interrupter in the case of parties R and W. The function of the pick-up interrupter is to cause the energization of the reversing relay 29 so that in the case of parties M and J, the ringing current is connected to the tip conductor with a return path to ground over the ringing conductor, whereas in the case of parties R and W, the ringing current is connected to the ring conductor with a return path to ground over the tip conductor. The pick-up interrupter is arranged to cause the operation of relay 29 during the silent interval, the sources 50 and 51 being associated with the usual interrupter, so that ringing current is supplied for a short interval and then battery current for a short interval and so on. Since the operators sometimes depress the ringing keys before inserting the plug in the jack of the called line, it is desirable to keep ringing current off the tip of the plug while it is passing over the ring spring of the jack in order to prevent false ringing of the R or W party. Therefore, should relay 29 operate at such a time under control of pick-up interrupter and the lower armature of relay 20, ringing current will not flow from the tip of the plug 2 to the ring spring of jack 10 and falsely ring party R or party W. During the ringing of a wanted subscriber's line part of the ringing current will flow through the condensers 26 and 27 through the right-hand windings of repeating coil 35 and ringing tone is thereby induced in the left-hand windings of this repeating coil over the trunk 1 to the "A" operator and subscriber at the distant exchange. This serves as an indication to the "A" operator and subscriber that ringing current is being applied to the line of the wanted subscriber.

When the subscriber at the called station answers by removing the receiver from the switchhook, ringing relay 24 operates in a manner well known in the art. The operation of this relay removes the short-circuit for the winding of relay 23 and this relay operates in series with relay 22 over a circuit as follows: battery winding of relay 22, lower and normal make-before-break contacts of relay 21, winding of relay 23, inner lower armature and front contact of relay 20, armature and front contact of relay 18, upper winding of relay 20, sleeve terminals of plug 2 and jack 10 to ground. Relay 23 in operating short-circuits and releases the relay 22 and the winding of relay 23 now acts as a shunt across the guard and disconnect lamp 19, keeping it extinguished. Relay 22 in releasing opens the circuits for relay 24 which also releases. Relay 22 also in releasing short-circuits the condensers 26 and 27 and connects the tip and ring conductor in trunk 1 through to the repeating coil 35. Relay 37 is thereby operated and this relay now short-circuits the high resistance winding of relay 18 which will have the effect at the distant "A" operator's position of extinguishing a supervisory lamp, as is well known in the art, to indicate that the wanted subscriber has been connected to the trunk and that conversation between the calling and called subscriber may now take place over this connection.

When the conversation ceases and the called subscriber hangs up the receiver, relay 37 is released and removes the short-circuit from the high resistance winding of relay 18 thus causing the supervisory lamp at the "A" operator's position at the distant exchange to be lighted as a disconnect signal. The "A" operator now removes the plug of the connected cord from the jack of this trunk line and this causes the release of relay 18 which in turn causes the release of relay 23. The release of these relays permits the guard and disconnect lamp 19 to be lighted as a disconnect signal for the "B" operator. The "B" operator now removes plug 2 from jack 10 and thus causes the release of all associated relays and the extinguishing of the lamp 19, thus restoring the circuits of trunk 1 to normal condition.

If the wanted subscriber is one that may be reached through switches of an automatic exchange the "B" operator will insert plug 2 into jack 11 which may be connected in any well known manner to an automatic exchange. This connection causes the op-

eration of relay 20 in the same manner as previously described. The "B" operator now operates the dial key 5 to associate the dial circuit with the trunk 1 so that the operations of dial 7 for the selection of the wanted subscriber's line in the automatic exchange may take place. The operation of the dial key closes a circuit for the operation of relay 21 as follows: battery winding of relay 21, operated contacts of dial key 5, make-before-break contacts of relay 38, lower armature and back contact of relay 39 to ground. Relay 21 in operating connects the tip and ring conductors of trunk 1 to the dial circuit through leads 40 and 41 extending to the dial 7 and causes the operation of relay 38 over the circuit as follows: battery winding of relay 38, inner upper armature and front contact of relay 21, contacts of dial key 5, make-before-break contacts of relay 38, lower armature and back contact of relay 39 to ground. Relay 38 in operating provides a locking circuit for itself through its outer left-hand armature and front contact to the ground at the lower armature of relay 39. The operation of relay 38 also provides a locking circuit for relay 21 to the same ground at relay 39. The operation of relay 38 further closes obvious circuits for the actuation of pilot lamp 42 and for the operation of relay 43.

Pilot lamp 42 is lighted to indicate to the "B" operator that the dialing circuit has been connected to a trunk and the operation of relay 43 disconnects the operator's telephone set 8 from the call wire circuit 9 and connects instead thereto the secondary winding of a repeating coil 44, the primary of which is connected to a tone source 45. Thus the fact that the dialing circuit has been connected to a trunk is indicated to the "A" operator at the distant exchange by a tone applied to the call wire circuit. In other words this tone on the call wire circuit will indicate to the "A" operator at the distant exchange that the "B" operator is engaged in establishing a connection with an automatic subscriber involving the dialing circuit.

Another circuit closed by the operation of relay 38 is that for relay 46 as follows: battery winding of relay 46, right-hand armature and front contact of relay 38 to interrupter 47. This circuit for relay 46 is alternately opened and closed through the operation of interrupter 47 so that this relay will alternately open and close a circuit for alternate operation and release of relay 23 which thus causes the flashing of the guard and disconnect lamp 19 by the alternate short-circuiting of the circuit thereof. The flashing of the guard and disconnect signal 19 indicates to the "B" operator that the dialing circuit has been connected to this particular trunk and that the circuits for the dialing of the number of the wanted subscriber are now completed and that dialing may be begun.

When dial 7 is operated relay 48 will operate over a circuit as follows: from ground, winding of relay 48, off normal contacts of dial 7, lead 41, lower outer armature and front contact of relay 21, the ring conductor of trunk 1, ring terminals of plug 2 and jack 11 to battery through a relay (not shown) in the outgoing trunk circuit. When the dial is returned to normal ground impulses are passed over lead 40, tip conductor of trunk 1, the tip terminals of plug 2 and jack 11 through a pulsing relay in the trunk circuit to battery thereby causing this relay to be actuated to operate switching mechanisms in the automatic telephone system to select the desired subscriber's number in a manner well known in the art. An outgoing trunk circuit adapted to function with applicants' arrangement is shown in Fig. 3 of Patent No. 1,567,256, issued December 29, 1925, to C. B. Fowler. When dial 7 returns to normal relay 48 is released and lead 41 is connected through a resistance and battery to ground. It is, of course, understood that the dial 7 is operated once for each digit of the wanted subscriber's number. When the dialing is completed the "B" operator operates the master release key 49 causing the operation of relay 39 over an obvious circuit. Relay 39 in operating locks temporarily under the control of relay 38 and removes the ground from the winding of relay 38 thus causing the release of relay 38. Relay 39 also by operating its upper armature opens the circuit for relay 43 so that the tone from source 45 is disconnected from the call wire circuit 9 and the operator's telephone set 8 is reconnected to the call wire circuit. The release of relay 38 extinguishes the pilot lamp 42 and releases relay 46. The release of this relay also causes the release of relay 21 so that the flashing of lamp 19 will be discontinued and relay 23 locked in operated position to the tip terminals of plug 2 and jack 11 and lamp 19 extinguished. The release of relay 21 also connects the tip and ring conductors of trunk 1 to the repeating coil 35. When the wanted subscriber answers in response to the usual automatic ringing by removing his receiver from the hook, relay 37 operates and short-circuits the high resistance winding of relay 18, whereby a signal is received as previously stated at the "A" operator's position indicating that the connection is now completed through to the wanted subscriber's line and that conversation between the calling and called subscribers may take place.

The purpose of relay 48 is to prevent the dialing circuit from being disconnected from the trunk during a dialing period which

would ordinarily take place if master key 49 was operated before the dialing is finished. Relay 48 is maintained operated as stated while the dial is off normal and thus provides at its armature and front contact a ground for the maintaining of relays 38 and 21 operated until the dial has returned to normal, even though key 49 may have been operated before this time and removed the normal ground for these relays.

If the "B" operator should actuate dialing key 5 before plug 2 is inserted in jack 11 the guard and disconnect lamp 19 will not flash as relay 23 will not be alternately operated and released due to the fact that relay 20 will not be operated to provide a circuit for relay 23 on the operation of relay 21. It therefore follows that if a dial key of another trunk is operated while the dialing circuit is connected to trunk 1 the functions of the dialing circuit will not be disturbed. This is evident because the relay corresponding to relay 20 in this other trunk would not ordinarily be operated. Even if it was operated, that is, if the plug of this trunk was inserted in a jack, no disturbance could take place as the relay 38 would be operated and consequently there would be no connection for the dial key to ground in the dialing circuit for the operation of the relay corresponding to relay 21 in this trunk.

What is claimed is:

1. A telephone system comprising a line, a dialing circuit, a signal associated with said line, means responsive to the seizure of the line for actuating said signal, means for connecting said dialing circuit with said line, another line, means for connecting said lines together, and means responsive to said connections for actuating said signal in a manner different from its actuation on the seizure of the first line.

2. A telephone system comprising a line, a dialing circuit, a signal associated with said line, another signal associated with the dialing circuit, means for connecting said line and dialing circuit together, another line, means for connecting said lines together, and means responsive to said connections for actuating said signals.

3. A telephone system comprising a line, a dialing circuit, a signal associated with said line, another signal associated with the dialing circuit, means for connecting said line and dialing circuit together, another line, means for connecting said lines together, and means responsive to said connections for actuating said signals in different manners.

4. A telephone system comprising a line, a dialing circuit, a signal associated with the line, a signal associated with the dialing circuit, means responsive to the seizure of the line for actuating said first associated signal, means for connecting said line and dialing circuit together, another line, means for connecting said lines together, means responsive to the first mentioned connection for actuating the dialing signal, and means responsive to both of said connections for actuating the line signal in a manner different from its actuation at the seizure of the line.

5. A telephone system comprising a line, a dialing circuit, a signal associated with the dialing circuit, a call wire circuit, a tone source, means for connecting the line and the dialing circuit together, and means responsive to said connection for actuating said signal and for connecting the tone source to the call wire circuit.

6. A telephone system comprising a line, a dialing circuit, a signal associated with the line, a signal associated with the dialing circuit, an operator's telephone set, a call wire circuit connected to said operator's telephone set, a tone source, means for connecting said line and dialing circuit together, another line, means for connecting said lines together, means responsive to the seizure of the line for actuating the line signal, means responsive to the connection of the dialing circuit and the first mentioned line together for actuating the signal associated with the dialing circuit and for disconnecting the operator's telephone set from the call wire circuit and connecting the tone source to the call wire circuit, and means responsive to the connection of the dialing circuit and the two lines together for actuating the line signal in a manner different from its actuation on the seizure of the line.

In witness whereof, we hereunto subscribe our names this 27th day of April, A. D. 1926.

RALPH E. KING.
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