

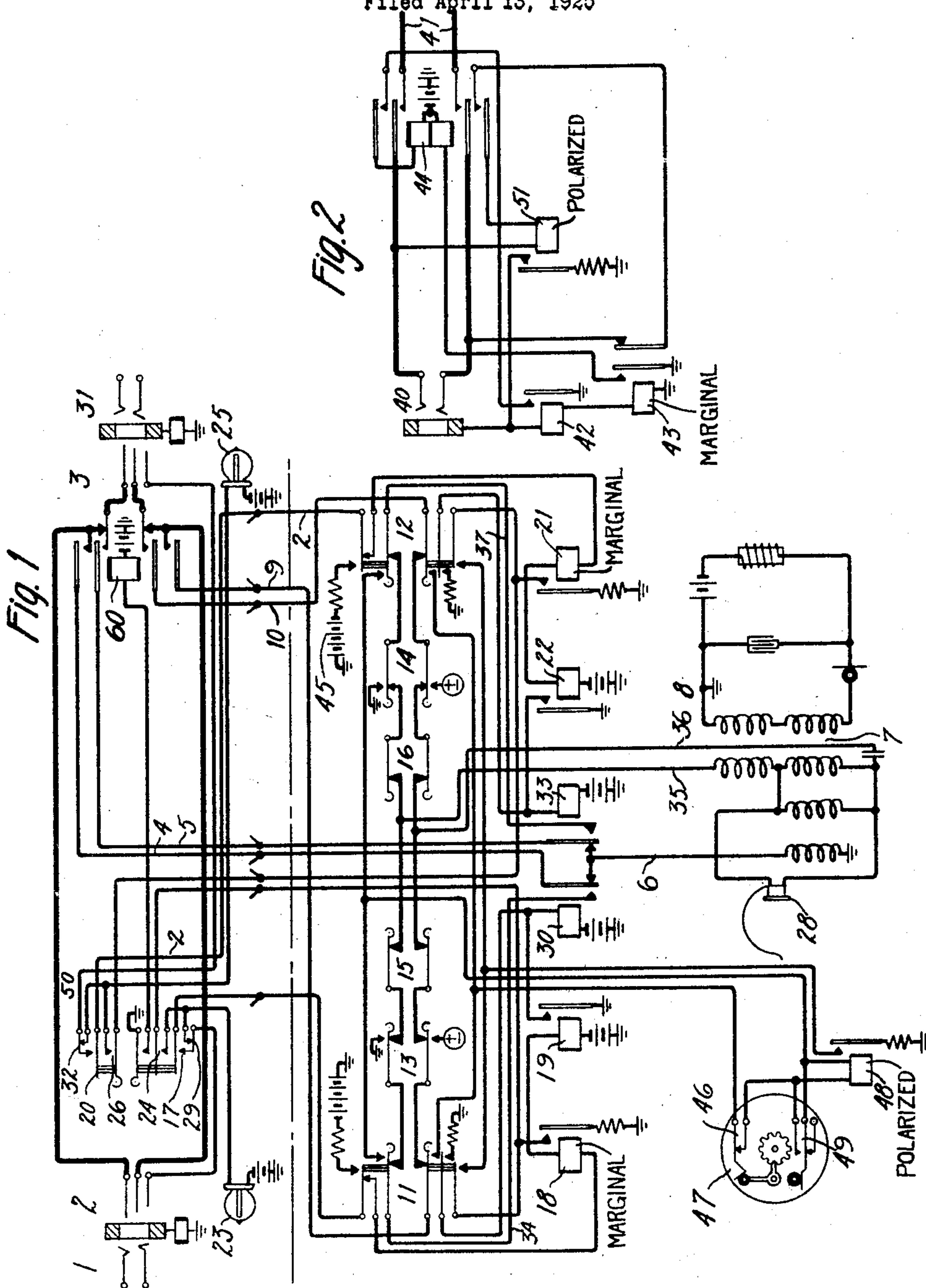
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TELEPHONE SIGNAL SYSTEM

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TELEPHONE SIGNAL SYSTEM.

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This invention relates to telephone systems, and more particularly to improvements in ringing, splitting, dialing and line busy test circuits or other circuits for operator's cords, as used in manual telephone exchange switchboards.

An object of this invention is to simplify and decrease the cost of individual cord circuit equipments by providing an equipment common to a plurality of cord circuits for performing the testing of lines to which connections are desired, the dialing of subscribers' lines if connections are made with trunks leading to automatic exchanges, and the ringing of the wanted subscriber's lines, as well as the splitting of any cord circuit connected to the common equipment or for extending the cord circuits through the common equipment to monitoring or other circuits which are used for various control or supervisory functions in modern telephone systems.

Another object of the invention is to increase the utility of the individual cord circuits by providing facilities for utilizing this common equipment for testing, dialing and ringing from either plug.

As is well known in the present practice of dialing and ringing through cords, individual keys have to be provided for each cord for associating the dial and the ringing source with the cord in use, while in the case of testing, when cords are equipped with facilities for testing from either plug individual relays would be required for each plug to cut off the test lead when a plug is inserted in a jack. The cost of equipping both plugs of every cord with such testing facilities is excessive and the cost of the individual keys is considerable.

A feature of this invention is an arrangement of the testing circuits for the cords whereby only a single group of test relays for cutting off the test leads is required for all cords at a position.

Another feature consists in arranging the common equipment so that it controls the supervisory lamp of any cord circuit connected therewith. This feature is of particular importance and dialing where the operation of the supervisory signals in different systems may be involved.

Another feature of the invention is the provision of circuits whereby when the usual talking key in a cord for connecting the

operator's telephone set thereto is operated, the set is not immediately connected, but the group of common test relays is instead associated with the tips of both plugs of the cord and when the busy test has been performed and the plugs inserted in the desired jacks, the test leads are disconnected and the tip and ring conductors of the cord are completed through to the operator's set and common dialing and ringing keys, by means of which a dial may be connected for the transmission of directive impulses and whereby ringing signals may be transmitted to the connected lines over either one of the plugs. When the operator desires to disconnect her set and this common equipment, the release of the talking key simply disconnects them and completes the continuity of the cord circuit between the two plugs.

It is readily seen that such an invention as this is of the utmost utility, as it not only saves a considerable amount of equipment such as the usual individual dialing, ringing and splitting keys, but also increases the facilities for testing and the speed at which tests may be performed. The usual practice of employing the set plug of a second cord to test the jack with which the plug not equipped with testing facilities is to be connected, is entirely avoided.

Referring now to the drawings, Figure 1 illustrates a cord circuit equipped in accordance with this invention above the dash-dotted line and below it the circuits of the equipment common to a number of cords, and Fig. 2 illustrates the outgoing end of a trunk line leading to an automatic exchange.

In case connections are desired between subscribers' lines terminating at manual exchanges, the operation of this circuit arrangement is as follows: Assume for example, that the operator, whose position is equipped with this particular type of cords, desires to test the jack 1 which might be assumed to lead to a manual exchange for its idle or busy condition, she will first of all actuate the talking key 50. As indicated, this operation causes the energization of relay 60 over an obvious circuit. This relay in operating, splits the tip conductor between the plugs 2 and 3 and connects each part thereof through leads 4 and 5 to the common test lead 6 which is connected through the usual busy test winding of induction coil 7 of the operator's telephone set

8 to ground. This relay also connects the ring conductors of these two plugs 2 and 3 to the common leads 9 and 10 connected through the common dialing keys 11 and 12, ringing keys 13 and 14, and splitting keys 15 and 16 to one side of induction coil 6 at the operator's telephone set. The key 50 also connects at its contacts 17 the sleeve lead of plug 2 to the common test relays 18 and 19, through normally closed contacts of key 11, and by means of its contacts 20 connects the sleeve lead of plug 3 to the common test relays 21 and 22. Other connections made by this key 50 are those of the supervisory lamp 23 associated with plug 2 through contacts 24 to the front contact of relay 18 and the supervisory lamp 25 through the contacts 26 to the front contact of relay 21.

The next action on the part of the operator is to touch the tip of plug 2 to the sleeve of jack 1, and if the line associated with this jack is idle no busy indication will be received by the operator, through the test winding of induction coil 7. On the other hand, if the line associated with this jack 1 is busy, battery potential will be present at the sleeve and a click indication will be noticed in the operator's receiver 28 by current from the battery associated with the supervisory lamp such as 23 of another cord, through contacts such as 29 of the corresponding key 50 of that cord, through the sleeve of the plug of said cord, to the sleeve of jack 1, thence to the tip of plug 2, upper outer armature and front contact of relay 60, common lead 4, armature and back contact of test relay 30, common lead 6, test winding of induction coil 7 to ground.

A similar indication will be received if the operator desires to test jack 31 with plug 3 and this jack is found busy. That is, if this jack is associated with a manual exchange subscriber. The circuit in this instance would be from the corresponding battery of a supervisory lamp such as 25 of the cord associated with that jack, through such as contacts 32 of the corresponding talking key 50, through the sleeve of the plug of that cord, the sleeve contact of jack 31, tip contact of plug 3, upper inner armature and front contact of relay 60, common lead 5, armature and back contact of test relay 33, common lead 6, and test winding of induction coil 7 to ground.

On the other hand if either of these jacks are idle the operator will in the case of jack 1, insert the plug therein and thus complete a circuit for cutting off the common test lead 6 from the cord and complete the connection from the cord to the operator's set 8 over circuits as follows: First, battery, windings of relays 19 and 18, upper and normal contacts of key 11, contacts 17 of key 50, sleeve contacts of plug 2 and jack

1 to the ground normally connected to the jack sleeve, causing relays 18 and 19 to operate. The operation of relay 18 completes the circuit for the supervisory lamp 23 as follows: battery, lamp 23, contacts 24, armature and front contact of relay 18 to ground. The operation of relay 19 closes an obvious circuit for relay 30 which removes the common lead 6 from the common lead 4 and connects this lead and the tip conductor of plug 2 through to the middle winding of the induction coil 7, the other end of which is connected through to the ring conductor of plug 2. The circuit may be traced as follows: tip conductor of plug 2, outer upper armature and front contact of relay 60, conductor 4, armature and front contact of relay 30, conductor 34 through contacts of keys 11, 13 and 15, conductor 35 and middle windings of induction coil 7, conductor 36, lower contacts of keys 15, 13 and 11, common lead 9, lower outer armature and front contacts of relay 60, to ring conductor of plug 2. The operator's set 8 is thus connected through to the line associated with jack 1.

A similar operation takes place when the operator inserts plug 3 in jack 31 when it is idle, that is, the insertion of this plug in jack 31 completes a circuit for relays 21 and 22 from battery, through the windings of these relays, upper normal contacts of key 12, contacts 20 of key 50, through sleeve contacts of plug 3 and jack 31 to ground. The operation of relay 21 closes a circuit for the supervisory lamp 25 from battery, lamp 25, contacts 26 of key 50, armature and front contact of relay 21 to ground. The operation of relay 22 closes an obvious circuit for relay 33 which disconnects the common lead 5 associated with the tip contact of plug 3, from the common test lead 6 and connects it to the middle winding of induction coil 7, the other end of which is connected to the ring conductor of plug 3. This circuit may be traced as follows: tip conductor of plug 3, inner upper armature and front contact relay 60, lead 5, armature and front contact of relay 33, conductor 27, upper contacts of keys 12, 14 and 16, lead 35, middle winding of induction cord 7, lead 36, lower contacts of keys 16, 14 and 12, conductor 8, inner lower armature and front contact of relay 60 and ring conductor of plug 3. The operator's set 8 is thus connected also through to the line associated with jack 31, and conversation may take place between the operator and the subscribers connected to lines associated with jacks 1 and 31. If the operator desires to talk to one subscriber without having the other subscriber overhear the conversation, she may depress the corresponding splitting key 15 or 16, as is well known in the art.

If the operator now desires to disconnect

her set from the cord circuit she releases the talking key 50. This will release relay 60 and restore the continuity between the plugs of the tip and ring conductors and the group of testing relays will all be restored to normal. It should be noted that on the release of key 50 the make-before-break contacts 29 and 22 are made before contacts 17 and 20 are open so that the supervisory signals 23 and 25 will be continuously connected to the sleeve of plugs 2 and 3 respectively. The operator is now free to use this common equipment for testing with other cords and connect her telephone set in the same manner thereto.

If instead of connecting with jack 31 leading to a manual exchange or subscriber connection is desired to a subscriber that may be reached through a machine switching exchange, the operator may, after performing the test as described in connection with insertion of plug 3 into jack 31, insert plug 3 into jack 40 of a trunk, the outgoing end of which is shown in Fig. 2.

The operation for the association of the common equipment with a cord under this condition will now be described. The first circuit closed is the sleeve circuit for plug 3 and jack 40, which in this instance is completed to ground through the winding of relay 42 and the winding of the marginal relay 43. This circuit caused the operation of relays 42 and 22 and the operation of relay 22 caused the operation of relay 33, which now completes the circuit for the operator's telephone set 8, as previously described. The resistance of this circuit is such that relay 21 will not operate and consequently lamp 25 will not be lighted and as the operator's set is not needed in this type of connection, the operator may operate her splitting key 16 to prevent the set from being connected with the trunk 41.

However, the circuits are now ready for the association of the dial with the trunk 41 and the extension of the trunk through relay 44 to the incoming end of the automatic exchange. It should be understood that any type of automatic exchange apparatus well known in the art may be connected at the incoming end of the trunk 41 and as such equipment does not form any part of this invention it has not been illustrated. If the operator now depresses her dialing key 12, the sleeve circuit will be opened at the upper outer contacts of this key 12 for relays 21 and 22, and completed instead through the corresponding alternate contacts of this key through a resistance to a high voltage battery 45. Current from this battery is sufficient to cause the operation of the marginal relay 43 in series with relay 42. The operation of relay 43 closes an obvious circuit for relay 44, which now locks up through its upper winding over an obvious circuit to

ground at the armature and front contact of relay 42. Relay 44 in operating extends at its inner upper and lower armatures and front contact the tip and ring leads of jack 40 to the corresponding leads of trunk 41 extending to the usual circuits at the incoming end of the trunk. To preserve the continuity of the tip lead from plug 3 between leads 5 and 37 to key 12, relay 33 is maintained operated over an obvious circuit from the middle lower contacts of key 12, when this key is operated. The connection from the pulsing contacts 46 of dial 47 are now completed through the inner upper and lower springs and alternate contacts of key 12. It will be observed that polarized relay 48 is connected in series with the pulsing contact 46 in this dialing circuit. As is well known in the art the various stages in the progress of establishing a connection may be indicated by the operation of the supervisory lamp 25 and a circuit therefor may now be controlled from contacts of relay 48. This circuit is as follows: battery of lamp 25, contacts 26 of key 50, outer lower spring and alternate contact of key 12, armature and front contact of relay 48 through a resistance to ground. If the operator now manipulates the dial 47, the switches at the automatic exchange respond to the dialed number, as is well known in the art, to extend the connection to the wanted subscriber's line. If a trunk connection in the automatic exchange or if the wanted subscriber's line is busy, relay 48 will be operated either between the series of impulses, or at the end of the last series of impulses in different manners to cause the lamp 25 to indicate by flashing signals the conditions encountered, as is well known in the art. If, however, the wanted subscriber's line is idle lamp 25 will be steadily lighted at the end of the last digit and return of the dial to normal. This signal now serves as an indication to the operator that the subscriber's line has been reached and that ringing may begin.

The operator may now release her dialing key 12 and in so doing the tip and ring leads will be extended to the ringing key 14 and it should be noted that in releasing key 12 the sleeve circuit is again completed through relays 21 and 22 and that relay 33 is maintained operated to preserve the continuity of the tip lead through to the ringing key 14. The release of the dialing key 12 also causes the release of relay 43 as the high voltage battery 45 is removed when the sleeve circuit is restored through relays 21 and 22. Thus, the bridge for polarized relay 51 is completed across the tip and ring leads of the trunk, as is well known in the art, and this relay will then be operated the moment the wanted subscriber's line is reached. This will partly shunt the sleeve circuit to ground,

through relays 42 and 43 by the closure of the armature of relay 51 at its front contact to ground, through a resistance. Relay 21 will now receive sufficient current to cause it to operate and lamp 25 is, therefore, maintained lighted after key 12 has been released. The circuit for the lamp in this instance will be completed through contacts 26 of key 50 and the armature and front contact of relay 21.

The operation of key 14 applies ringing current to the trunk 41 and, as is well known in the art, machine ringing apparatuses are thereby actuated at the incoming end of the trunk to signal the wanted subscriber's line. When the subscriber answers polarized relay 51 releases and lamp 25 is consequently extinguished as an indication that the subscriber answered.

The operator may now complete the talking connection between the subscriber connected at jack 1 and the called subscriber at the automatic exchange independent of the common equipment by restoring the talking key 50 to normal. In doing this, relay 60 is restored to complete the tip and ring leads directly through the cord and the sleeve circuits are extended to the lamps 23 and 25 at the contacts 29 and 32, respectively, while the relays 21, 22 and 33 and relays 18, 19 and 30 are all restored to normal positions. This common equipment, including the dialing, ringing and splitting keys, the common busy test arrangement and the operator's telephone set may all be appropriated for use in connection with another cord.

It should be observed that the subscribers located in an automatic exchange may also be reached by means of plug 2 through the use of this common equipment, that is, by manipulation of dialing key 11, the dial 47 may be associated with this plug and by the operation of the splitting key 15 the opposite end of the cord and the operator's telephone set may be disconnected from this end of the cord while ringing of the automatic subscriber may be done by the operation of key 13. All these operations may take place in the same manner as when an automatic subscriber is called through plug 3, as hereinbefore described.

It should be understood that this invention is not limited to the particular disclosure described above, but may readily be modified to include in the common equipment any other apparatus well known in the art for performing other operating functions now performed by equipment individual to the cord circuits, for it is readily seen that, for example, additional keys may be inserted between the dialing keys 11 and 12 that may be used for extending the common equipment to monitoring, testing or wire chiefs' desks as required.

What is claimed is:

1. In a telephone system, lines, a plurality of cord circuits each including a talking key, an operator's telephone set and means common to said cord circuits for testing for the idle or busy condition of any one of said lines from either plug of any one of said cord circuits, means for appropriating said common testing means for the use of a cord circuit on the operation of the corresponding talking key, and means for connecting the operator's telephone set to said cord when the common testing means has been appropriated by said cord responsive to the connection of the cord with an idle line.

2. In a telephone system, lines, a plurality of cord circuits each including a talking key, an operator's telephone set and means common to said cord circuits for testing for the idle or busy condition of said lines by either plug of said cord circuits, comprising means for connecting a common test lead associated with the operator's telephone set to the tips of the plugs of any cord circuit by the operation of the corresponding talking key for receiving test indication at the operator's telephone set, means for disconnecting said test lead from said cord circuit, and for connecting the operator's telephone set to said cord circuit responsive to the insertion of the plugs of said cord circuit into the jacks of said lines, and means for disconnecting said telephone set from said cord circuit when the corresponding talking key is released.

3. In a telephone system, lines, a plurality of cord circuits, equipment common to said cord circuits comprising means for testing for the idle or busy conditions of lines from either plug of any one of said cord circuits, means for transmitting dialing impulses over either plug of any of said cord circuits to connected lines and means for transmitting ringing current over either plug of any of said cord circuits to connected lines, and means for appropriating said common equipment for the exclusive use of any one of said cord circuits.

4. In a telephone system, lines, a plurality of cord circuits, equipment common to said cord circuits comprising means for testing for the idle or busy conditions of lines from either plug of any one of said cord circuits, means for transmitting dialing impulses over either plug of any of said cord circuits to connected lines and means for transmitting ringing current over either plug of any of said cord circuits to connected lines, means for appropriating said common equipment for the exclusive use of any one of said cord circuits and means responsive to the appropriation of said common equipment of a cord circuit for preserving the continuity of said cord circuit through said common equipment.

5. In a telephone system, lines, a plurality of cord circuits, means common to said cord circuits for testing for the idle or busy condition of lines from either plug of any of said cord circuits, means common to said cord circuits for transmitting dialing impulses and ringing current over either plug of any of said cord circuits to connected lines, means for appropriating said testing and dialing and ringing means for the exclusive use of any one of said cord circuits, means for disconnecting said testing means from and connecting said dialing and ringing means to one plug of a cord circuit when said cord circuit is associated with said common means and operative in response to the association of said plug with a line, and means for disconnecting said testing means from and connecting said dialing and ringing means to the other plug of said cord circuit operative in response to the association of this plug with a line.

6. In a telephone system, lines, a plurality of cord circuits, means common to said cord circuits for testing for the idle or busy condition of any of said lines from either plug of any of said cord circuits, means common

to said cord circuits for transmitting dialing impulses over either plug of any of said cord circuits to connected lines, means common to said cord circuits for transmitting ringing current over either plug of any of said cord circuits to connected lines, means for associating said various common means with any one of said cord circuits, means for disconnecting said testing means from and connecting the impulse transmitting means to either or both plugs of a connected cord circuit, said disconnecting and connecting means being responsive to associate the impulse transmitting means with one plug when said plug is inserted in a jack of a line and responsive to associate the impulse transmitting means with the other plug when said other plug is inserted in the jack of a line and means for disconnecting the impulse transmitting means and connect the ringing current transmitting means to either or both plugs of the associated circuit.

In testimony whereof, I have signed my name to this specification this 10th day of April, 1925.

JOHN F. TOOMEY.