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MANUAL TELEPHONE SYSTEM

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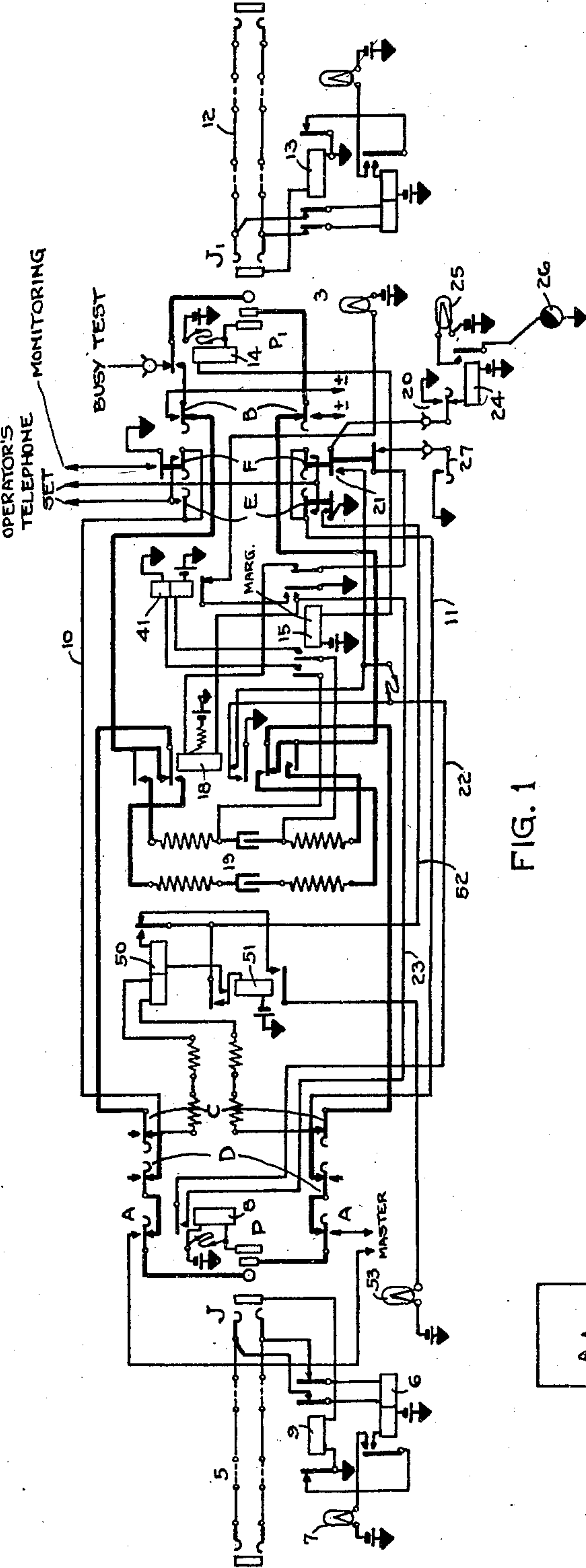


FIG. 1

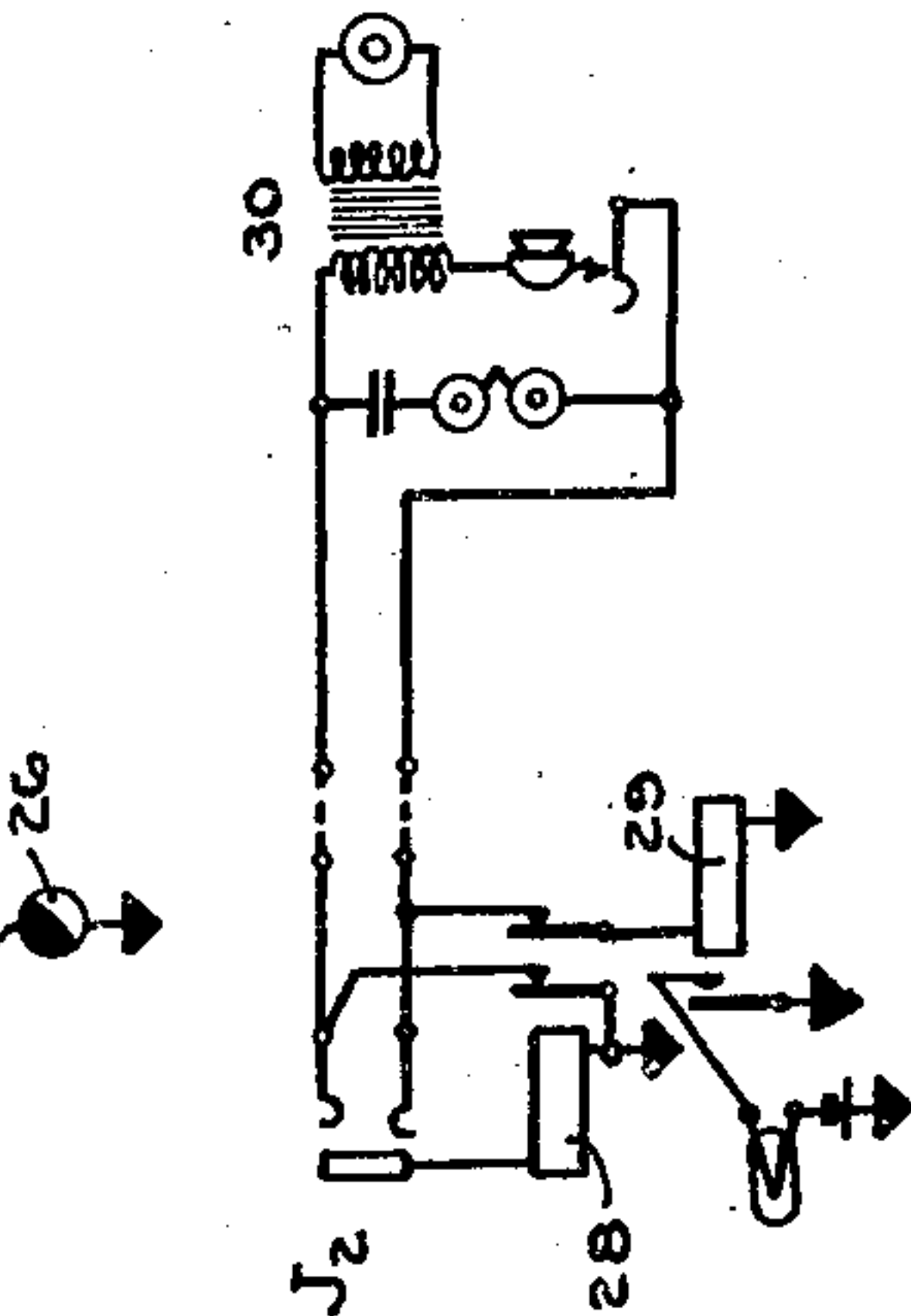
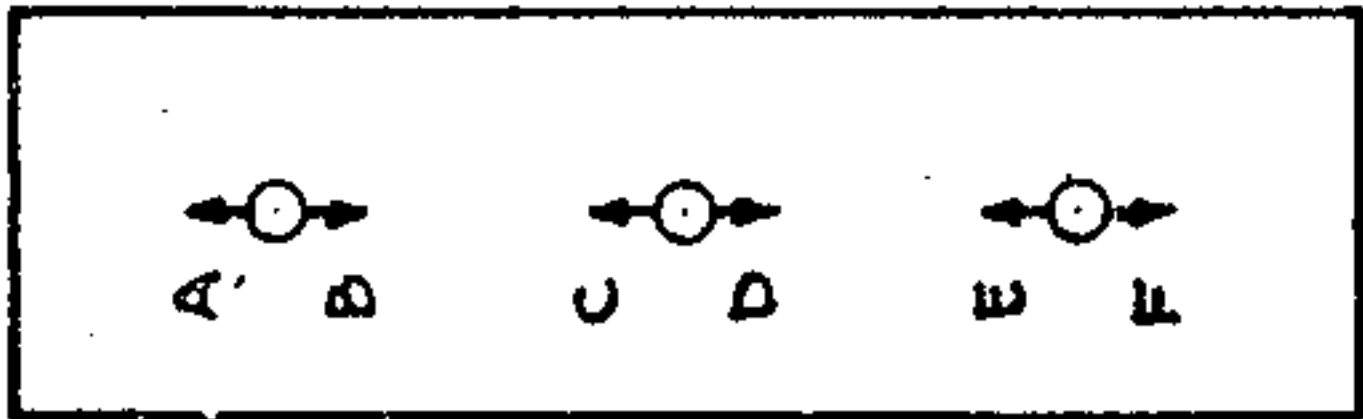


FIG. 2



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MANUAL TELEPHONE SYSTEM

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The toll positions of a manual telephone system are frequently provided with a plurality of combination cord circuits by which a toll line may be connected either with another toll line, a rural telephone line or a common battery telephone line. Frequently the rural telephone lines are not properly maintained and portions of the toll lines are sometimes functioning below the desired efficiency so that in order to provide suitable transmission from a toll line to such a rural line or another toll line it is necessary to include a repeating coil in the combination cord circuit used to interconnect these lines. As is well-known, each cord circuit has associated therewith a plate or key strip on which there are mounted several keys by which the following operations may be controlled such as ringing either the answering or the calling end of the cord circuit, permitting the operator to converse either with the answering or the calling end of the cord circuit, bridging the operator's telephone set to the cord circuit or to permit a monitoring connection to be established to the cord circuit. Such a key strip occupies all of the space that can be conveniently used crosswise of the key shelf and in the past, manufacturers of such toll positions of a switchboard have been confronted either with the difficulty of crowding the key shelf or else utilizing one of the present keys of the strip for the purpose of cutting-in a repeating coil with the consequent omission of the necessary function controlled by the replaced key. This difficulty arose from the fact that it was necessary to utilize a repeating coil cut-in key for each cord circuit.

In accordance with the present invention it is proposed to utilize a common repeating coil cut-in key for a plurality of cord circuits of a toll position and to rearrange each of the cord circuits so that they may be controlled by the common cut-in key and still prevent the functioning of one cord circuit from interfering with that of the other cord circuits.

Other features of the invention include the novel arrangement for indicating when a repeating coil is included in a cord circuit and

also means including a common switch whereby the repeating coil may be cut out of any cord circuit at the will of the operator.

For a clearer understanding of the invention reference is made to the drawings wherein Fig. 1 represents a portion of a telephone system in which there is indicated at the extreme left a toll line and at the extreme right there is indicated a common battery telephone line and another toll line. In the center of this figure there is represented a combination cord circuit in which the present invention is included. Fig. 2 represents a key strip mounted on the key shelf of the toll operator's position in the switchboard, a key strip of this type being provided for each combination cord circuit.

It is believed that the invention will best be understood by describing the operation of establishing various connections such as a toll connection through the cord circuit shown in Figure 1. When a connection has been established at a distant exchange (not shown) to the toll line or trunk 5, the trunk relay 6 is operated in the well-known manner to complete a circuit for lighting the trunk lamp 7. The operator upon noting the lighting of this lamp inserts the plug P of one of the combination cord circuits at her position into the jack J of the toll line. On completing this portion of the connection the sleeve relay 8 is operated from grounded battery, winding of this relay through the sleeve contacts of plug P and jack J, winding of the cut-off relay 9, to ground. The sleeve relay 8 and the cut-off relay 9 are both operated, the last-named relay serving to disconnect the trunk relay 6 from the trunk line 5 and to extinguish the trunk lamp 7. The operator then closes the bridging listening key E to connect her telephone set to the trunk line 5 so that she may inquire the number designation of the wanted line. The connection from the operator's telephone set through the key E to the trunk line 5 extends through conductors 10 and 11 and through the normally closed contacts of the keys A and D.

Let it be assumed that the wanted connection is to another toll line such as 12. The

operator after testing the wanted line, then inserts the plug P' of the cord circuit taken for use into the jack J' of the trunk line 12. The resistance of the sleeve relay 13 associated with this trunk is relatively high so that although a circuit is completed from ground through the winding of the relay 13, the sleeve contacts of the jack J' and plug P', winding of relay 14 and winding of marginal relay 15 to grounded battery, this marginal relay is not operated. The relays 13 and 14 are operated in this circuit although the marginal relay 15 will not operate in series therewith. Consequently the left-hand armatures and front contacts of relay 15 remain open so that the battery feeding relay 16 remains inoperative. Likewise at the inner armature and front contact of relay 15 the circuit of the repeating coil cut-in relay 18 is held open. The operator may then monitor the connection to determine whether or not the connection including the combination cord circuit in use provides satisfactory transmission. If it does not, the operator then proceeds to include the repeating coil 19 in series with the talking conductors. This is effected by operating the repeating coil cut-in key 20 which is common to a plurality of cord circuits at this operator's position. The operation of this key is effected to close a circuit from ground through its contacts, through the contacts 21 of the monitoring key F, contact and continuity spring of relay 18, conductor 22, inner armature and front contact of sleeve relay 18, conductor 23, winding of relay 18, through the resistance to grounded battery. The relay 18 is operated in this circuit and attracts its two uppermost and two lowermost sets of contacts to include the repeating coil 19 in the talking conductors of the cord circuit shown. The relay 18 on operation completes a locking circuit for itself which substitutes a ground connection through its innermost lower armature and front contact for the ground connection which was previously completed through the monitoring key F and the common cut-in key 20. The cut-in key 20 is non-locking so that when the operator releases it, a circuit is closed for the relay 24 from grounded battery through its winding, normally closed contacts and innermost armature of the relay 18, to ground. With the relay 24 operated the indicating lamp 25, common to a group of cord circuits, is intermittently lighted through the front contact and armature of the relay 24 and thence through the interrupter 26 to ground. It will be understood, of course, that while the operator is not monitoring the connection the monitoring key F is left in its normal condition with contacts 21 open so that the lamp 25 is not lighted. In the event that the operator wishes to determine whether the repeating coil is connected in this circuit she merely depresses the monitoring key for a

short interval and the presence or absence of the flash indicates whether or not the repeating coil is connected in circuit.

It will be further understood that if it is desired that the lamp 25 burn steadily instead of flashing intermittently, the armature of the relay 24 may be connected directly to ground instead of through the contacts of the interrupter 26. If for any reason the operator decides that the repeating coil 19 should not be included in the conversational circuit it may be rendered inoperative by depressing the cut-out key 27, which key is also common to the cord circuits at the toll operator's position. The depression of the cut-out key 27 is effective to shunt out the relay 18 by a circuit traceable from grounded contacts of the key 27, through monitoring key F, outer armature and back contact of relay 15, through the resistance to grounded battery. This is effective to cause the deenergization of the relay 18 which opens its locking circuit and also opens its contacts which connected the repeating coil 19 in circuit. At the time of disconnection the operator at the distant originating office operates equipment (not shown) to transmit disconnect current over the two sides of the toll line 5 and the left hand winding of relay 50. This relay is energized in this circuit and attracts its armature whereupon the relay 51 is operated in a circuit traceable from grounded battery, its winding, continuity spring and back contact, right hand winding of relay 50, its front contact and armature, conductor 52, to ground at the back contacts of listening key E. The relay 51 when operated closes a locking circuit for itself through its front contact and armature to ground over conductor 52, thereby maintaining itself operated independently of the relay 50 which deenergizes as soon as the relay 51 operates when the disconnect current is no longer applied. With the relay 51 operated and relay 50 deenergized the disconnect lamp 53 is lighted from grounded battery, lower armature and front contact of relay 51, back contact and armature of relay 50 to ground over conductor 52. The operator on receiving this disconnect signal removes the plugs P and P' from their respective jacks J and J' whereupon the cord circuit is restored to its normal condition.

In the event that the trunk circuit 5 is to be connected to a common battery line, when the operator inserts the plug P into the jack J and receives the designation of this called line which is assumed to be that shown at the lower right hand corner of the drawing, the operator then tests this line by touching the tip of the plug P' to the sleeve of the jack J² and on discovering that this line is idle, inserts the plug P' into the jack thereof. In this instance the sleeve relay 28 associated with this line is of low resistance so that in the circuit now completed from ground

through the winding of the sleeve relay 28, sleeve contacts of the jack and of plug P', winding of relay 14, and winding of relay 15 to grounded battery, the relays 14, 28 and marginal 15 are all operated. The operation of relay 14 closes a break-point in the tip conductor of the calling cord and the operation of the relay 28 disconnects the line relay 29 from the control of the substation generally designated 30. The relay 15 when operated at its left hand contacts and armatures connects the battery-feeding relay 41 to the calling end of the cord circuit and the closure of the inner armature and front contact of relay 15 completes a circuit through the winding of relay 18 and the resistance to grounded battery which is effective to operate the relay 18 for the purpose of connecting the repeating coil windings in series with the calling and answering ends of the cord circuit. The called substation 30 may be signalled by depressing the ringing key B in the well-known manner.

At the termination of this call the subscriber replaces his receiver on its switch-hook which is effective to open the line circuit which in turn causes the deenergization of the battery-feeding relay 31 whose windings have been connected in series with the called line. The deenergization of the relay 41 is effective to light the calling supervisory relay 32 in a circuit from grounded battery through the lamp, back contact and armature of relay 41, inner front contact and armature of relay 15, to ground. When the originating operator at the distant office desires to signal for disconnection the relays 50 and 51 are operated in the manner previously described to light the disconnect lamp 53 associated with the answering end of the cord circuit. The operator at the position including the cord circuit of Fig. 1 on noting the lighting of the lamps 32 and 53, removes the plugs P and P' from the jacks with which they have been in engagement causing the cord circuit to revert to normal condition.

What I claim, is:

1. In a telephone system, an incoming line, a plurality of outgoing lines, a plurality of cord circuits for interconnecting said incoming line with any of said outgoing lines, each of said cord circuits normally having its ends conductively connected together, and means including a manually controlled device for conductively separating but inductively connecting the ends of any desired one of said cord circuits.

2. In a telephone system, a plurality of incoming lines, a plurality of outgoing lines, a plurality of cord circuits for interconnecting said incoming lines with any of said outgoing lines, said cord circuits normally having their ends conductively connected together, means responsive to the connection of said cord circuits to certain of said lines for automatically

rendering said cord circuits inductively continuous but conductively discontinuous, and means including a device common to said cord circuits made effective by the connection of any cord circuit to any of the remaining telephone lines for rendering said cord circuit inductively continuous and conductively discontinuous at will.

3. In a telephone system, incoming lines, groups of outgoing lines, a plurality of cord circuits for interconnecting said incoming lines with any of said outgoing lines, each cord circuit being provided with a repeating coil normally electrically disconnected therefrom, means responsive to the connection of said cord circuit with any one of a certain group of said lines for connecting said repeating coil in said cord circuit whereby its ends are inductively connected together but conductively separated, and means including a switch common to a plurality of cord circuits for connecting the repeating coil into its associated cord circuit in response to the connection of said cord circuit to the other group of outgoing lines.

4. In a telephone system, incoming lines, a plurality of outgoing lines, a plurality of cord circuits for interconnecting said incoming lines with any of said outgoing lines, each cord circuit being provided with a repeating coil normally electrically disconnected therefrom, means responsive to the connection of said cord circuit with any one of a group of said lines for connecting said repeating coil in said cord circuit whereby its ends are inductively connected together but conductively separated, and means including a switch common to a plurality of cord circuits for connecting the repeating coil into its associated cord circuit in response to the connection of said cord circuit to a second group of outgoing lines, and a signal controlled by the operator for indicating when said repeating coil is connected into its associated circuit.

5. In a telephone system, incoming lines, groups of outgoing lines, a plurality of cord circuits for interconnecting said incoming lines with any of said outgoing lines, each cord circuit being provided with a repeating coil normally disconnected from its associated cord circuit, means responsive to the connection of said cord circuit with any line of one group of said lines for connecting said repeating coil into its cord circuit whereby its ends are inductively connected together but conductively separated, means including a switch common to a plurality of cord circuits for connecting the repeating coil into its associated cord circuits in response to the connection of said cord circuit to any line of the other group of outgoing lines, and means common to said cord circuits for disconnecting any repeating coil from its associated cord circuit.

6. In a telephone system, a plurality of incoming lines, two groups of outgoing lines, the lines of one group being electrically distinguished in one manner and the lines of the other group being electrically distinguished in a different manner, a plurality of cord circuits for interconnecting said incoming lines with the outgoing lines of either of said groups, each cord circuit being provided with a repeating coil normally disconnected therefrom, automatic means responsive to the connection of any cord circuit to one of said groups for automatically connecting the repeating coil operatively in its associated cord circuit, and means including a manually controlled device effective on the connection of any cord circuit to any of the second group of lines for electrically connecting the repeating coil into its associated circuit.

7. In a telephone system, a plurality of incoming lines, two groups of outgoing lines, the lines of one group being electrically distinguished in one manner and the outgoing lines of the other group being electrically distinguished in a different manner, a plurality of cord circuits for interconnecting said incoming lines with the outgoing lines of either of said groups, each cord circuit being provided with a repeating coil normally disconnected therefrom, automatic means responsive to the connection of any cord circuit to one of said groups for automatically connecting the repeating coil operatively in its associated cord circuit, means including a manually controlled device effective on the connection of any cord circuit to any of the second group of lines for electrically connecting the repeating coil into its associated circuit, and a second device common to said cord circuits operated at will for disconnecting any repeating coil from its associated circuit when it is connected to any line of the second group.

8. In a telephone system, a plurality of incoming lines, two groups of outgoing lines, a plurality of cord circuits for interconnecting said incoming lines with any of said outgoing lines, each cord circuit being provided with a repeating coil normally electrically disconnected from its associated cord circuit, monitoring mechanism common to said cord circuits, a monitoring key for connecting said monitoring mechanism to its cord circuit, means responsive to the connection of any cord circuit to any outgoing line in one of said groups for automatically electrically connecting said repeating coil in circuit with its associated cord circuit, and other means including a device common to said cord circuits for electrically connecting the repeating coil in its associated cord circuit on the connection of said cord circuit to any outgoing line of the second group, said other means being controlled in part by said monitoring key.

9. In a telephone system, a plurality of incoming lines, two groups of outgoing lines, a plurality of cord circuits for interconnecting said incoming lines with any of said outgoing lines, each cord circuit being provided with a repeating coil normally electrically disconnected from its associated cord circuit, monitoring means common to said cord circuits, a monitoring key individual to each cord circuit for connecting said monitoring means to its cord circuit, means responsive to the connection of any cord circuit to any outgoing line in one of said groups for automatically electrically connecting said repeating coil in circuit with its associated cord circuit, other means including a device common to said cord circuits for electrically connecting the repeating coil in its associated cord circuit on the connection of said cord circuit to any outgoing line of the second group, said other means being controlled in part by said monitoring key, a lamp common to said cord circuits for indicating when said cord circuit has its associated repeating coil electrically included therein, and means including the monitoring key of said cord circuit for rendering the lamp of its cord circuit effective.

10. In a telephone system, a plurality of incoming lines, two groups of outgoing lines, a plurality of cord circuits for interconnecting said incoming lines with any of said outgoing lines, each cord circuit being provided with a repeating coil normally electrically disconnected from its associated cord circuit, monitoring means common to said cord circuits, a monitoring key individual to each cord circuit for connecting said monitoring means to its cord circuit, means responsive to the connection of any cord circuit to any outgoing line in one of said groups for automatically electrically connecting said repeating coil in circuit with its associated cord circuit, other means including a device common to said cord circuits for electrically connecting the repeating coil in its associated cord circuit on the connection of said cord circuit to any outgoing line of the second group, said other means being controlled in part by said monitoring key, a lamp common to said cord circuits for indicating when said cord circuit has its associated repeating coil electrically included therein, and means including the monitoring key of said cord circuit for rendering said lamp effective, and disconnecting means including a cut-out switch common to all of said cord circuits and controlled in part by the monitoring key of any desired cord circuit for electrically disconnecting the repeating coil from said desired cord circuit.

In witness whereof, I hereunto subscribe my name this 20 day of April, A. D. 1928.

JOHN H. LEVIS, JR.