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P. B. MURPHY

SWITCHING SYSTEM

Filed March 31, 1927

2 Sheets-Sheet 1

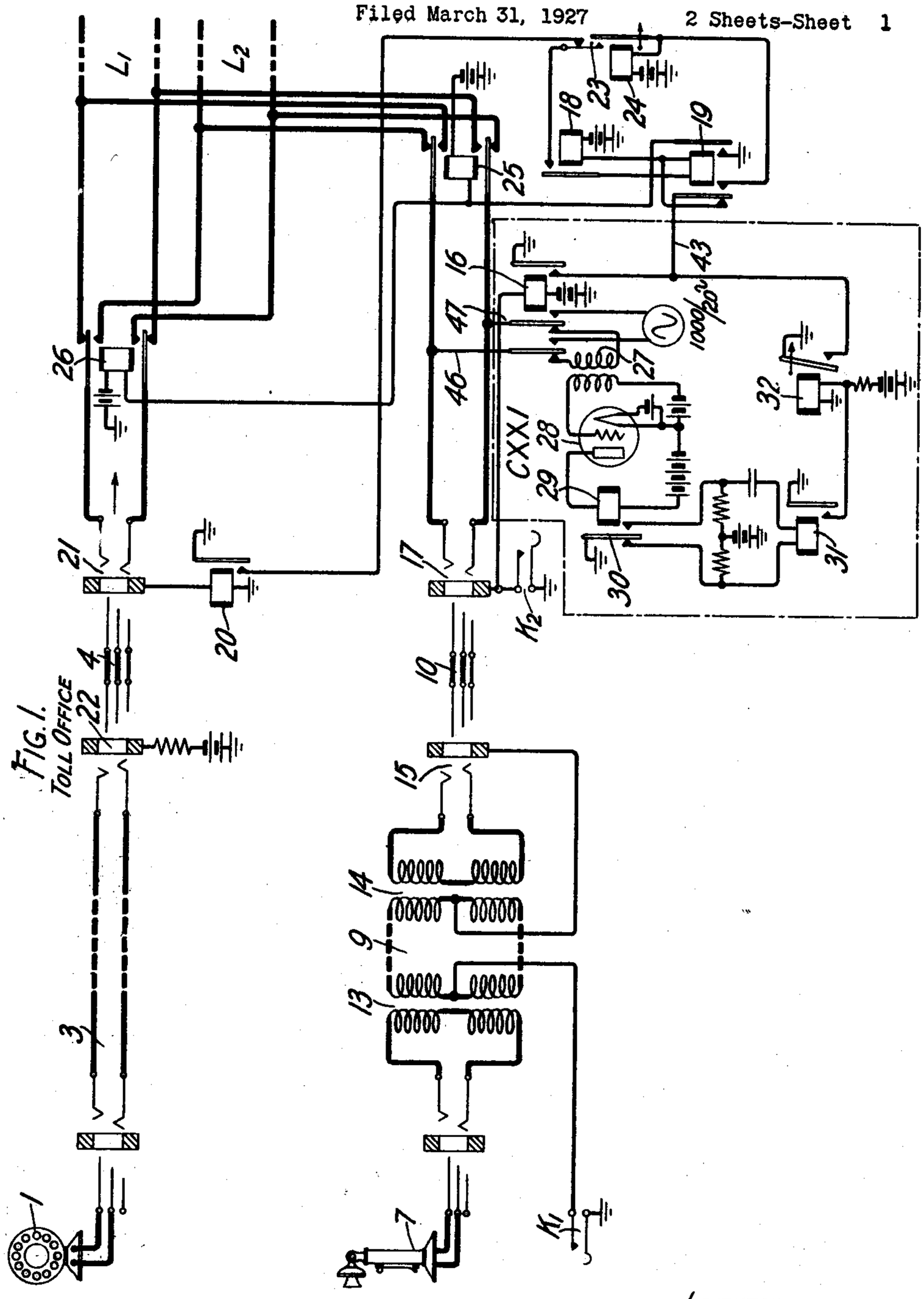

FIG. 1.
TOLL OFFICE

INVENTOR:
PAUL B. MURPHY
BY John A. Hall.
ATTORNEY

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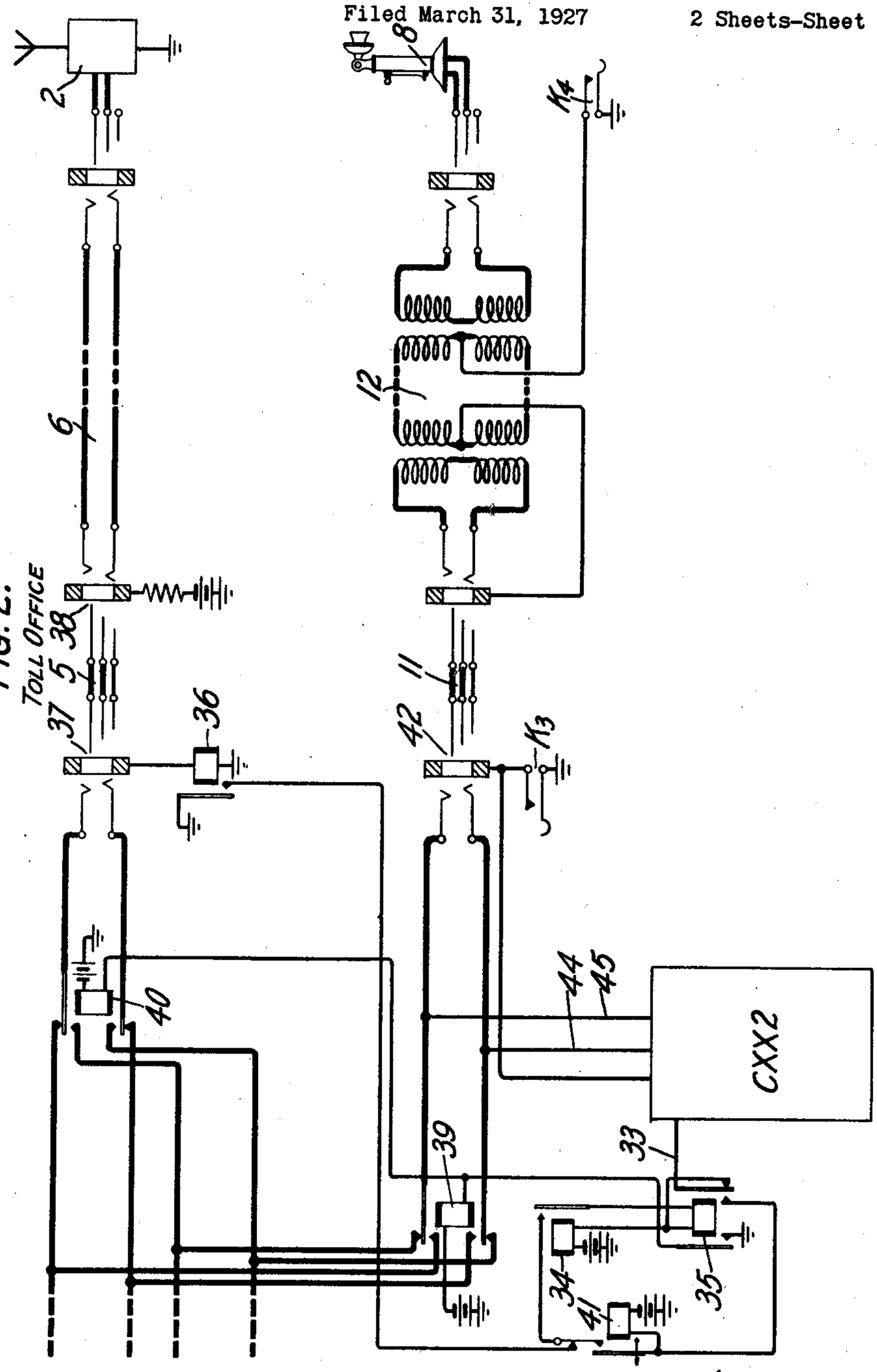
FIG. 2.



INVENTOR:
PAUL B. MURPHY
BY John A. Hall
ATTORNEY

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UNITED STATES PATENT OFFICE.

PAUL B. MURPHY, OF NYACK, NEW YORK, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

SWITCHING SYSTEM.

Application filed March 31, 1927. Serial No. 179,845.

This invention relates to switching systems, and more particularly to an arrangement for switching the terminals of two lines, at both ends thereof, simultaneously.

In program transmission, such as radio broadcasting, when the "pick-up" microphone is connected with the transmitting station by means of a toll circuit, it is sometimes desirable to provide a second or monitoring circuit over which the announcer at the program supply source, hereinafter referred to as the "pick-up point," can maintain communication with an attendant at the transmitting station.

In case the circuit, over which an important program is being transmitted, should become noisy or otherwise fail to function properly, it is obviously desirable to substitute another circuit therefor as quickly as possible, and the main feature of this invention is an arrangement whereby means, controlled either by the transmitting station attendant, the announcer or attendants at the toll offices at the ends of the two lines, is effective to simultaneously switch both ends of both toll lines in such a manner that the program is transferred to the line originally used for monitoring purposes and the announcer is connected with the transmitting station over the defective circuit, which may be sufficiently operative to serve as a monitoring circuit during the emergency.

The invention will be understood from the following description when read in conjunction with the drawings:

Fig. 1 of which represents the circuit arrangement and apparatus at the pick-up end; and

Fig. 2 represents the incoming or transmitting station end.

Referring to the drawing a pick-up microphone 1 is connected with the transmitter (not shown) of a broadcasting station 2 over a trunk circuit 3, patching cord 4, toll line L_1, patching cord 5 and trunk circuit 6. The announcer's telephone set 7 is shown connected with an attendant's telephone 8, at the broadcasting station, over a trunk circuit 9, patching cord 10, tool line L_2, patching cord 11 and trunk circuit 12.

Repeating coils 13 and 14 are connected in each end of the trunk circuit 9 which terminates in the toll test board jack 15 at the toll office. The sleeve of jack 15 is connected to the mid-point of the line winding of repeating coil 14 and the mid-point of the line winding of repeating coil 13 is connected to a key K_1, one side of which is grounded, thereby providing a circuit for operating relay 16, when jacks 15 and 17 are connected by the patching cord 10 and K_1 is operated. A second key K_2, located at the toll office, is also arranged for operating relay 16 from that point, if desired.

The operation of the circuit will now be described: Let it be assumed that a program is being "picked-up" by the microphone 1 and transmitted over toll line L_1 to the broadcasting station and that the announcer at the "pick-up point" is connected with an attendant at the broadcasting station over a toll line L_2, and further, that toll line L_1 suddenly becomes noisy or otherwise fails to properly transmit the program, which fact becomes known immediately to either the attendant at the broadcasting station, the announcer at the pick-up point or an attendant at once of the tool offices in which the lines L_1 and L_2 terminate.

It will be further assumed that the announcer, being appraised of the trouble, desires to immediately transfer the program from line L_1 to line L_2. He therefore momentarily depresses key K_1 which closes an obvious circuit for relay 16 of the composite ringer CXX1 which relay, in operating, closes a circuit to operate relay 18 which may be traced from ground at the right hand contact of relay 16, over lead 43 and the left hand normal contact of relay 19 to battery through the winding of relay 18. The closure of the contacts of relay 18 provides an energizing circuit for relay 19 and a holding circuit for relay 18 when relay 16 releases, which circuit may be traced from ground over the contact of sleeve relay 20 of the jack 21, which relay will be operated during the time patching cord 4 is plugged into jacks 21 and 22, contacts 23 of relay 24, contacts of relay 18, winding of relay 19 and winding of relay 18 to battery. Relays 18 and 19 are now held operated in series under control of relay 24. When relay 19 operates it connects ground at its right hand contacts to operate relays 25 and 26 which interchange lines L_1 and L_2 with respect to jacks 21 and 17 so that the pick-up microphone is now connected to line L_2 and the announcer's telephone set to line L_1.

When relay 16 operated it also connected

ringing current of any suitable frequency, which may be within the voice range and of the order of 1,000 cycles, to line L_2 to actuate relays, not shown. of the composite ringer CXX2 at the other end of the line. The composite ringers CXX1 and CXX2 being exactly alike, it is believed that the operation of the circuit will be understood from the arrangement of the ringer CXX1, the circuit of which is shown in detail. The ringing current transmitted over line L_2 in response to the energization of relay 16 is received at the composite ringer CXX2 over leads 44 and 45 which correspond to leads 46 and 47 of the ringer CXX1 and passes through the primary winding of a transformer corresponding to winding 27 as shown in ringer CXX1. The current generated in the secondary winding of this transformer affects the grid of a vacuum tube device corresponding to 28, the output circuit of which includes a relay corresponding to relay 29 which has a vibrating armature. The alternating current impulses from the line passing through the transformer are amplified by the vacuum tube corresponding to 28 and cause the armature of the relay corresponding to 29 to vibrate between its contacts thereby causing an alternating current to be generated in the circuit which includes a relay corresponding to relay 31 which relay thereupon operates to short-circuit a normally energized relay corresponding to relay 32 which thereupon releases and connects ground to lead 33 corresponding to lead 43 of ringer CXX1 to operate relay 34 of Fig. 2 which corresponds to relay 18 of Fig. 1. Relay 34 operates and when ground is removed from lead 33 due to the cessation of the ringing impulses relay 35 will be energized in series with relay 34 from ground supplied at the front contact of relay 36 which relay is energized due to the connection of jacks 37 and 38 by patching cord 5. The operation of relay 35 connects ground, at its left hand contacts, to relays 39 and 40 which transpose lines L_1 and L_2 with respect to jacks 37 and 42 simultaneously with the operation of relays 25 and 26. Relays 34 and 35 are held energized in series under control of relay 41.

Composite ringer CXX2 being exactly like ringer CXX1, it will be evident that the same series of operations may be initiated from the broadcast station end of the lines by the depression of either key K_3 or K_4.

Now let it be assumed that lines L_1 and L_2 have been transposed as previously described and the announcer at the pick-up point or the test board attendant at the toll office desires to return them to their original position, i. e., line L_1 connected to jack 21 and L_2 to jack 17. This transfer will be effected by momentarily depressing either key K_1 or K_2 which will again energize relay 16 which in turn connects ground to lead 43 thereby closing an energizing circuit for relay 24, which relay up to the present time has not been operated. This circuit may be traced over the make contacts of relay 19 which are closed due to the fact that relays 18 and 19 are locked up to ground at relay 20 under control of relay 24. Relay 24 in operating opens, at its contacts 23, the holding circuit for relays 18 and 19 but during the period the key K_1 or K_2 is depressed, the make contacts of relay 24 provide a substitute holding path for relays 18 and 19 which may be traced from ground over the right hand contacts of relay 16, left hand make contact of relay 19, make contact of relay 24, contacts of relay 18, winding of relay 19 and winding of relay 18 to battery and ground. When relay 16 is deenergized due to the release of the depressed key, the holding circuit for relays 18 and 19 is broken and these relays restore to normal thereby opening the circuit for relays 25 and 26 which thereupon release and transfer the conductors of lines L_1 and L_2 back to jacks 21 and 17, respectively.

The operation of relay 16 also connects alternating current to line L_1, which at the time is connected to composite ringer CXX2 at the other end of the line, by means of leads 44 and 45. This causes the release of a relay corresponding to relay 32 of ringer CXX1, thereby connecting ground over lead 33 to cause the operation of relay 41. The removal of ground from lead 33, upon cessation of the ringing impulse, releases relays 34 and 35 which in turn causes the release of relays 39 and 40 to transfer the lines L_1 and L_2 back into connection with jacks 42 and 37, respectively. The release of relays 19 and 35 release relays 24 and 41 thus restoring the circuit to normal.

It should be understood from the foregoing description that operation of any one of the keys K_1, K_2, K_3 or K_4, when the circuit is normal, causes relays 25, 26, 39 and 40 to simultaneously operate to transpose lines L_1 and L_2 with respect to jacks 21 and 17 at one end and jacks 42 and 37 at the other end, and when these relays are operated the actuation of any of the above mentioned keys causes the release of these relays to restore the lines to their original connections.

What is claimed is:

1. In an electrical system, two circuits, outgoing terminals for each circuit at one end thereof and incoming terminals therefor at the other end, and means controlled in part over one circuit for simultaneously interchanging both ends of said circuits with respect to their terminals.

2. In an electrical switching system, two lines, outgoing terminals for each line at

one end thereof and incoming terminals therefor at the other end, and means, including a voice frequency operated composite ringer, controlled in part over one line for simultaneously interchanging both ends of said lines with respect to their terminals.

3. In an electrical switching system, two lines, outgoing terminals for each line at one end thereof and incoming terminals therefor at the other end, and means, including a voice frequency operated device, controlled in part over one line for simultaneously interchanging both ends of said lines with respect to their terminals.

4. In an electrical switching system, lines terminating in switching terminals at both ends thereof, and switching apparatus interposed in all of said lines at each end thereof for simultaneously interchanging both ends of all of said lines with respect to said terminals, said switching apparatus being in part controlled over one of said lines from either end thereof.

5. In an electrical system, lines terminating in switching terminals at both ends thereof, switching apparatus interposed in all of said lines at each end thereof for simultaneously interchanging both ends of all of said lines with respect to said terminals, said switching apparatus being in part controlled over one of said lines from either end thereof by means of alternating current of a frequency within the voice range.

In witness whereof, I hereunto subscribe my name this 29th day of March, A. D., 1927.

PAUL B. MURPHY.