Oct. 30, 1923. 1,472,503

H. B. TAYLOR

SWITCHING DEVICE

Filed June 20. 1922

Fig. 1.

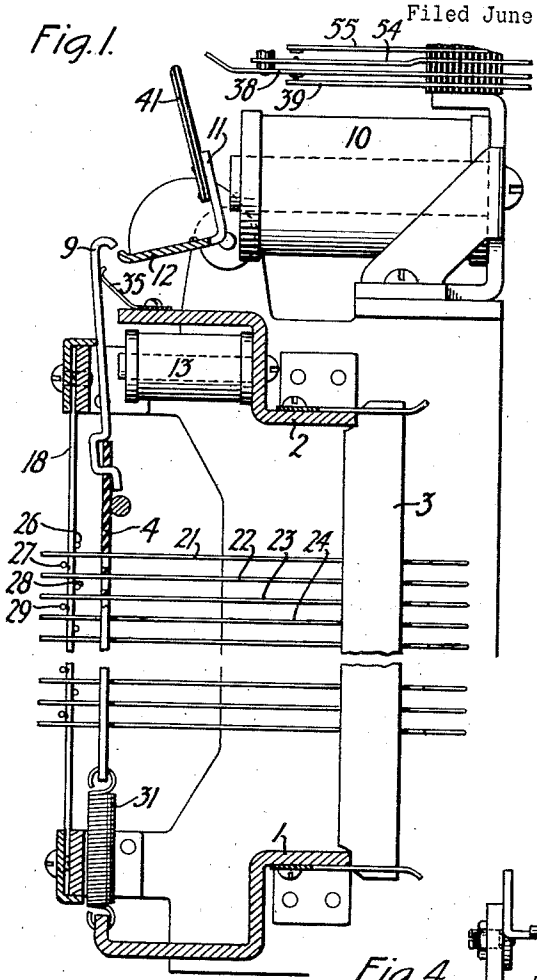


Fig. 2.

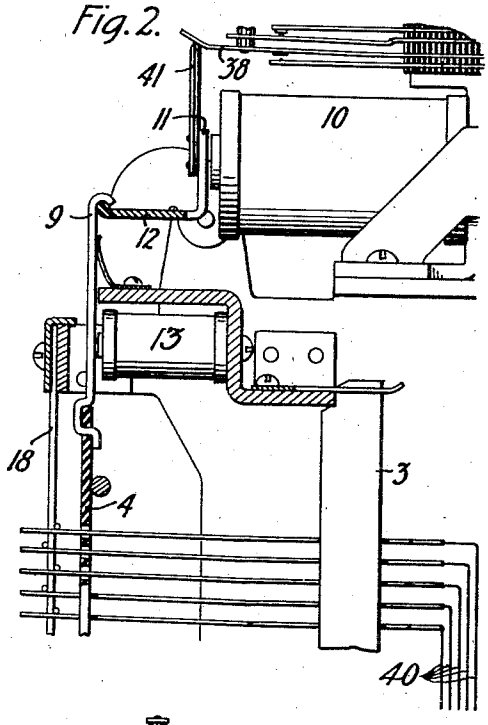


Fig. 3.

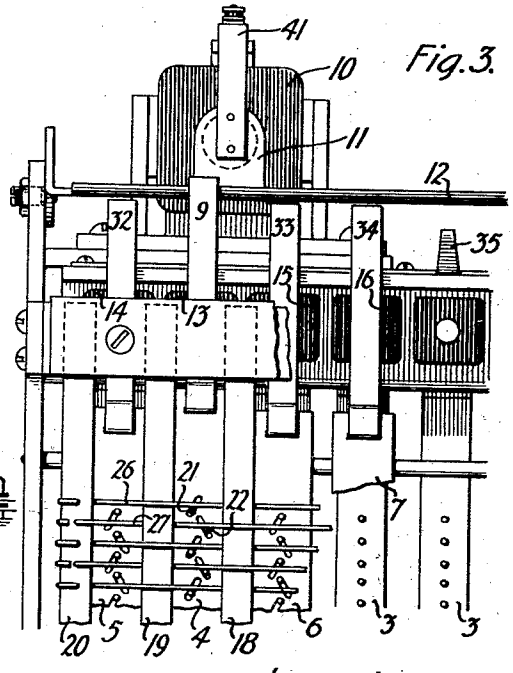
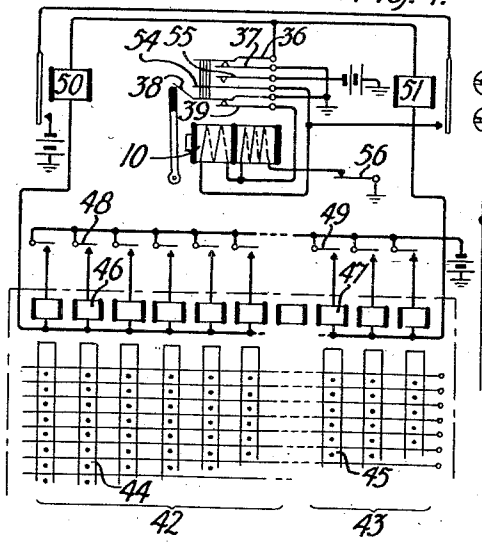


Fig. 4.



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UNITED STATES PATENT OFFICE.

HERBERT B. TAYLOR, OF WESTFIELD, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

SWITCHING DEVICE.

Application filed June 20, 1922. Serial No. 569,650.

To all whom it may concern:

Be it known that I, HERBERT B. TAYLOR, a citizen of the United States, residing at Westfield, in the county of Union, State of New Jersey, have invented certain new and useful Improvements in Switching Devices, of which the following is a full, clear, concise, and exact description.

This invention relates in general to electrical switching devices and is directed more particularly to devices of this character employed in telephone exchange systems for interconnecting lines, trunks and other circuits.

The object of the invention is an improved switching device adapted for use in automatic and semi-automatic telephone systems to establish connections between incoming lines and outgoing lines.

A feature of the invention relates to the provision, in a mechanism having switching elements for each of the several lines and a common member for operating said elements, of means effective upon the simultaneous selection of a plurality of switching elements for actuating said common operating member.

Another feature of the invention relates to an improved mechanical arrangement whereby the individual switching elements are mechanically connected to the common operating member.

Other and further features and advantages contemplated by the present invention will become more clearly apparent from the detailed description given hereinafter and also from the appended claims.

Referring to the drawing, Fig. 1 is a side view of the switching mechanism illustrating the structural arrangement of the several parts and showing also the construction of the terminal bank.

Fig. 2 is a view similar to Fig. 1 illustrating the several parts of the switch in their operated condition with a set of movable terminals advanced into engagement with the cooperating stationary terminals.

Fig. 3 is a front view of the switching mechanism showing the essential parts thereof, wherein one of the switching elements is in its operated condition, while the remaining elements shown are in their normal positions.

Fig. 4 is a schematic outline of the circuit arrangement of the selecting and operating magnets.

Although the features of this invention are illustrated as embodied in a switching mechanism, especially suited for the establishment of connections involving a multiplicity of contacts, it is obviously applicable to switches required for many of the various purposes in telephone and similar systems. In its broadest aspects the invention relates to a switching apparatus for variously establishing connections between a plurality of incoming lines and a plurality of outgoing lines.

Through the medium of link circuits, any one of the incoming lines may be connected to any one of the outgoing lines. Owing to the construction of the switch the incoming and outgoing lines, which are interconnected through the medium of a link circuit, may be provided with any desired number of conductors and the connections may be made by the use of bare wire contacts.

The invention will best be understood from a detailed description of the switch structure and of its circuit operation which will now be given.

The switch consists of a suitable frame made up of angle irons 1 and 2 and other members fashioned to receive and support the several parts of the mechanism. Considering first the arrangement of the terminal or contact bank, the several lines, trunks or circuits, such as the circuit 40 entering the switch, are provided with a set of plain bare wire terminals which serve as the movable or active contacts. Each of these lines may comprise as many conductors as necessary and each conductor is represented in the terminal bank by a movable bare wire terminal. The line 40 is illustrated with a plurality of conductors and corresponding movable terminals 21, 22, 23, 24, etc. The movable terminals are supported in an insulating block 3 and project through diagonal apertures in a longitudinally slidable draw bar element 4.

The passive contacts or terminals of the switch consists of a plurality of plain bare wires 26, 27, 28, 29, etc., which extend horizontally across the front of the structure and are woven in and out among the vertical insulating strips 18, 19, 20, etc., in such a

way as to form a grid. The passive terminals 26, 27, 28, are spaced from each other and so disposed that the active terminal wires 21, 22, 23, extend and normally reside in proximity to the respective passive terminal wires. This arrangement is best seen in Fig. 1 where the active terminal wires are in their normally released condition and out of contact with the respective passive terminal wires of the grid.

The description above given explains the appearance of the circuit 40 in the switch, and the manner in which it may be connected to the passive conductors. In a similar manner each of the remaining circuits appears and has a set for active contacts arranged in cooperative relation with the passive terminals of the switch. Referring especially to Fig. 3, there are shown three other draw bar elements 5, 6 and 7, each individual to another line similar to the line 40, and each of which lines is provided with a set of movable terminals extending through the diagonal apertures in said draw bars to cooperate with the stationary or passive terminal wires 26, 27, 28, 29, etc.

The draw bar, which is individual to the line 40, is secured at its lower end to the helical spring 31 attached to the angle iron 1. The upper end of the draw bar is provided with an aperture through which the hooked end of the coupling or connecting member 9 extends. The end of the connecting member 9 is so fashioned that it passes through the aperture in the upper end of the switching element 4 and fits loosely therein to participate in a small amount of swinging or hinging motion with respect to the element 4. The description just given for the draw bar 4 and the associated elements all individual to the particular line 40 also applies to the corresponding elements of the remaining lines represented in the switch. For example, the draw bars 5, 6 and 7 are also attached to helical springs and are equipped at their upper ends with the connecting members 32, 33 and 34.

For operating the individual draw bars of the lines, there is provided a common operating electromagnet 10 mounted on the top of the structure and having an armature 11 secured to a rotatable feather or flange 12. The flange element 12 is pivoted at either end so as to rotate through a slight angle under the influence of the electromagnet 10.

In order to associate the several draw bars 4, 5, 6, 7, etc., with the common operating magnet 10, there are provided a series of individual selecting electromagnets. The electromagnet 13, as shown in these figures, is individual to the draw bar 4 and serves to associate that bar with the common electromagnet 10. The other selecting magnets 14, 15 and 16 are likewise individual to the respective draw bars 5, 6 and 7.

Considering the particular selecting magnet 13, the connecting member 9 attached to the upper end of the draw bar 4, is, like the remaining connecting members, of magnetic material and is disposed adjacent to the pole piece of said magnet 13 so as to form the armature thereof. Normally, the member 9 is held in the position shown in Fig. 1 by means of a spring 35 secured to the angle iron 2 such that the hooked end of the member 9 lies out of the path of the flange 12. When, however, the electromagnet 13 is energized, it attracts the metallic member 9 against the pressure of spring 35 and places the hooked portion of said member 9 in the path of the flange 12 so that a subsequent rotation of said flange causes the draw bar 4 to be lifted upwardly against the action of the helical spring 31.

In Fig. 2 the switch is shown in its operated condition. In order to connect the incoming line 40 to the conductors 26, 27, 28, etc., of the grid, it is first necessary to electrically energize the magnet 13 to attract the connecting member 9. The member 9 rotates in its aperture in the draw bar 4 and moves into the line of the flange 12. Following this the common operating magnet 10 is energized and through its armature 11 causes the flange 12 to lift the connecting member 9 and the draw bar 4 upwardly. The upward movement of the draw bar 4 carries the movable contact wires 21, 22, 23 and 24 up and into contact with respective stationary wires 26, 27, 28, 29. After encountering these stationary wires the diagonal slots in member 4, through which the movable wires pass, cause these movable wires to ride over the surface of the stationary wires. This insures a good electrical contact.

For bringing about circuit conditions, there is provided a set of contact springs 36, 37, 38, 39, 54 and 55, suitably mounted on the frame of the switch. An insulating piece 41, secured to the armature 11 of the common magnet 10, is arranged to engage the contact spring 38 each time the magnet operates. The movement of the spring 38 causes it to disengage the spring 39, causes the spring 36 to disengage the spring 37 and also causes spring 54 to engage spring 55.

Referring to Fig. 4, an explanation will now be given of the circuit arrangement for operating the switch. Consider, for example, that the total number of lines entering the switch are divided into two groups 42 and 43. While the group 42 is illustrated as comprising six lines and group 43 comprising three lines, it is obvious that there may be as many lines in either group as necessary. For instance, the lines 42 may constitute a group of incoming lines and the lines 43 a group of outgoing lines or trunks or other circuits. In order to con-

nect any incoming line to any outgoing line, all that is necessary is to mechanically connect the draw bars individual to the incoming and outgoing lines, respectively, to the common operating flange 12 and then to energize the common operating magnet 10. In this way the draw bars of the lines are operated and the incoming line is connected through the grid conductors which constitute a link circuit to the desired outgoing line.

Assume, for example, that it is desired to connect the incoming line, represented by the draw bar 44, to the outgoing line, represented by the draw bar 45. By any suitable selecting arrangement, which may be controlled manually or automatically in response to impulses, a circuit is closed for the individual selecting magnet 46 belonging to the incoming line. Also a circuit is closed for the individual selecting magnet 47 belonging to the outgoing line. The circuit for magnet 46 may be traced from battery, through the contact 48, winding of magnet 46, thence through the winding of relay 50, spring contacts 36 and 37 to ground. The circuit for magnet 47 may be traced from battery, through the contact 49, winding of magnet 47, winding of relay 51, spring contacts 36 and 37 to ground. It will be noted that the relay 50 is common to all the selecting magnets relating to the group of incoming lines 42 and is operated in series with any one of these magnets. In a like manner the relay 51 is common to all the selecting magnets pertaining to the group of outgoing lines 43. Hence, when any selecting magnet of an incoming line and a selecting magnet of an outgoing line are energized, both relays 50 and 51 are also operated. With relays 50 and 51 operated, a circuit is closed from battery, through contacts of these relays, the left-hand winding of the common operating magnet 10, spring contacts 39 and 38, to ground. The magnet 10 becomes energized, rotates the flange member 12 and operates the draw bars 44 and 45 to connect the incoming line through the link circuit to the outgoing line. Also, the magnet 10, upon operating, shifts the contact springs and thereby opens the circuits through the selecting magnets 46 and 47 and relays 50 and 51. Before relays 50 and 51 have time to release to open the circuit through the left-hand winding of magnet 10, the spring contacts 54 and 55 are closed to prepare the following holding circuit for the magnet 10: battery, through said contacts 55 and 54, left-hand winding of magnet 10, right-hand winding of said magnet and contact 56 to ground.

When the connection is no longer desired, the contact 56 may be opened in any well known manner to cause the deenergization of the common magnet 10, whereby the draw bars 44 and 45 are released and the incoming and outgoing lines disconnected from each other.

What is claimed is:

1. The combination with a plurality of groups of lines, of a switching mechanism having an individual switching element for each line, a common operating member, selecting devices individual to said switching elements for connecting the same to the common operating member, a controlling device for each group of lines, each controlling device arranged for operation with the operation of any selecting device of the corresponding group, and means controlled jointly by said controlling devices for rendering said operating member effective.

2. The combination with a plurality of groups of lines, of a switching mechanism having an individual switching bar for operating the contacts of each line, a common operating member, individual selecting devices for said bars for connecting the same to the common operating member, a controlling device for each group of lines, each device arranged for operation with the operation of any selecting device of the corresponding group, and means controlled jointly by said controlling devices for rendering said common operating member effective to actuate said bars.

3. The combination with a plurality of groups of lines, of a switching mechanism having an individual switching bar for each line, a common operating magnet for actuating said bars, individual selecting magnets for said switching bars for connecting the same to the common operating magnet, a controlling device for each group of lines, each device arranged to be operated with the operation of any selecting magnet of the corresponding group, and means controlled jointly by said controlling devices for rendering the common operating magnet effective.

4. The combination with a plurality of groups of lines, of a switching mechanism having an individual switching bar for each line for operating the contacts thereof, a common operating member and a common magnet therefor for actuating said switching bars, individual selecting magnets for said bars for connecting the same to said common operating member, a controlling relay for each group of lines, each relay arranged to be operated with the operation of any selecting magnet of the corresponding group, and means controlled jointly by said relays for rendering the common operating magnet effective.

5. The combination with a group of incoming lines and a group of outgoing lines, of a switching mechanism having individual switching bars for each line, a common operating member, individual selecting devices

for said switching bars for mechanically connecting the same to said common operating member, a controlling device for each group of lines, each controlling device arranged for operation with the operation of any selecting device of the corresponding group, means controlled jointly by said controlling devices for rendering the common operating member effective to operate the selected switching bars, and contacts controlled by the operated switching bars for connecting an incoming line to an outgoing line.

6. The combination in a switching mechanism, of a plurality of contact operating bars, a common operating device for actuating said bars, individual selecting magnets for said bars, and an element pivotally attached to the end of each bar and controlled magnetically by the corresponding magnet for mechanically connecting said bar to the common operating device.

7. The combination in a switching mechanism of a frame, a plurality of contact operating bars arranged for longitudinal movement, a common operating device for actuating any number of said bars, individual electromagnets for selecting said bars for operation, said magnets being mounted upon the said frame, and a connecting element loosely attached to each of said bars for relative movement with respect thereto and magnetically controlled by the corresponding magnet for mechanically connecting the bar with the common operating device.

In witness whereof, I hereunto subscribe my name this 19th day of June A. D., 1922.

HERBERT B. TAYLOR.