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H. B. TAYLOR

SWITCHING DEVICE

Filed Nov. 7, 1921

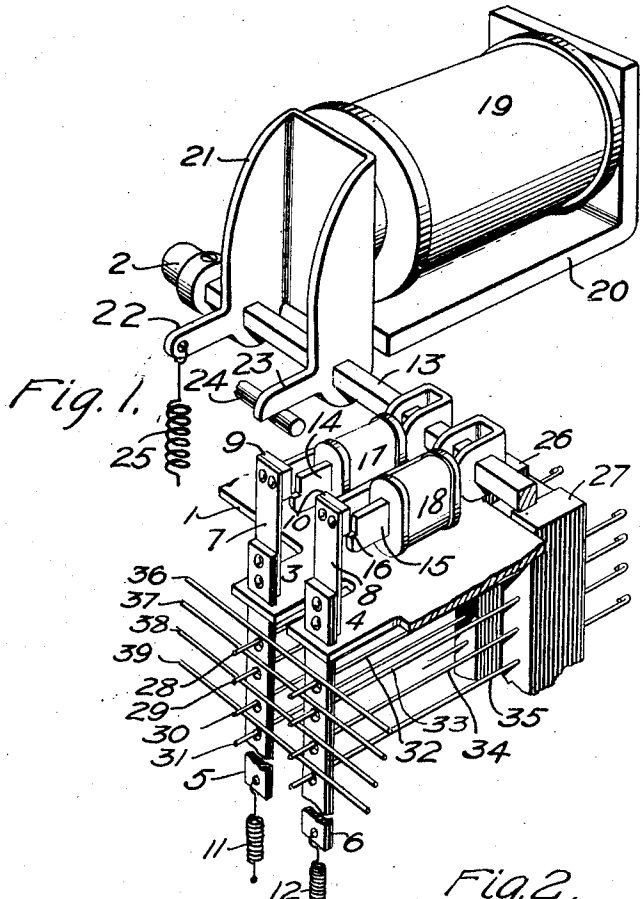

Fig. 1.

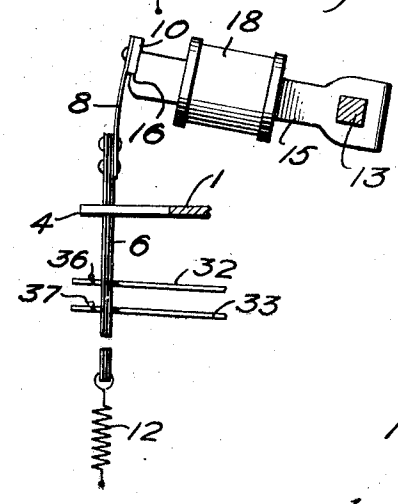

Fig. 2.

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UNITED STATES PATENT OFFICE.

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SWITCHING DEVICE.

Application filed November 7, 1921. Serial No. 513,282.

To all whom it may concern:

Be it known that I, HERBERT BELL 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 more particularly to switching mechanisms of the type wherein the actuating elements are arranged to be selectively operated to establish a multiplicity of circuit connections.

In certain types of switching mechanisms, adapted for the interconnection of an electrical circuit, such as a telephone line or trunk of one character, with any of a plurality of lines of trunks of another character, the circuit making terminals consist of a set of passive contact elements with which each of a plurality of sets of active elements cooperate, a selectable operating member being provided for each set of active elements for moving the same into engagement with said passive elements. By means of a suitable circuit and controlling arrangement any one of the several operating members is selected, such for example, as the one relating to the particular set of active contact elements that are to be engaged with the set of passive contact elements in order to obtain the circuit connection desired. Once the proper operating member has been chosen and rendered effective, it is then actuated, as a result of the requisite condition set up by a sequential change in the controlling circuits, to move the active contact elements into physical engagement with the cooperating passive contact elements, thus effecting the connection. With one of the operating members in its actuated condition, establishing a connection between the passive contact elements and the corresponding active elements, the selecting and operating mechanism for the remaining operating members is rendered temporarily ineffective to avoid a double connection.

The object of the invention is to provide, in a switching mechanism of the character above described, for individually selecting and rendering the operating members effective and for actuating the selected members through the agency of a common means.

A feature of the invention relates to a switching mechanism in which a contact operating member is arranged to be rendered effective by an individual electromagnet, mounted on an actuating element for movement therewith, which element is moved by an operating device for imparting motion to the operating member.

Another feature of the invention relates to a switching mechanism in which the contact operating members are selected and rendered effective by electromagnets individual to said members, which magnets are mounted on a movable element, said element being actuated by a common operating electromagnet for moving said individual magnets and the selected operating member.

A still further feature of the invention relates to a flexible connecting device cooperating with the contact operating member and the individual movable magnet for placing said operating member under the control of the common operating electromagnet.

Other features and advantages of this invention will become apparent from a consideration of the following description and the appended claims.

Referring to the drawing, which forms a part of this application, Fig. 1 shows a portion of the structure of a switching device, illustrated in perspective, to which the principles of the invention are applicable.

Fig. 2 is a side view partly in section of a detail of the switch showing one of the contact operating members and the individual electromagnet controlling the same.

It has been chosen to illustrate the invention as embodied in a switch of the character in which the circuit making terminals or contact elements comprise sets of stationary conductors or bare wires with which a plurality of sets of movable conductors or wires are arranged to cooperate for establishing connections between the circuits represented by these different sets of contact elements. The sets of contact elements may each comprise a plurality of conductors arranged for movement into physical engagement with the corresponding stationary or passive conductors. For effecting the necessary displacement of the movable contact elements to bring them into engagement with the passive elements, there is provided for each such set of movable elements an

operating member. When it is desired to establish a connection between an incoming circuit, for example, which is represented by a particular set of movable contact elements and an outgoing circuit represented by the passive contact elements, the operating member individual to said movable elements is selected and operated to cause the displacement of the movable elements into engagement with the passive elements.

In order to avoid the necessity of providing an operating device for each separate operating member, a common electromagnet is employed which furnishes the motive power for any one of the plurality of operating members. The operating members, being all movable by a single electromagnet, must be selected individually and placed under the control of such magnet, one at a time so that only one such member may be actuated to effect a connection between the movable and passive terminals. This selection is accomplished in accordance with a feature of the invention by providing an individual electromagnet for each operating member, and mounting all such individual electromagnets upon a single actuating element which is movable under the influence of the common electromagnet. The movement of the actuating element carries all individual magnets therewith, and consequently, imparts its movement to the selected operating member to displace the corresponding set of movable elements into engagement with the passive contact elements. From the aforegoing description, briefly outlining the construction of the particular switching device in which the invention is illustrated, it will be apparent that the same is not to be limited with respect to any particular kind or disposition of contact elements or to the specific manner of bringing about contact engagement between such elements, or to any of the various other details of the structure and operation.

Referring to the drawing a description will now be given of the switching mechanism illustrated therein. A portion of the frame of the switch illustrated as a top supporting plate 1 acts as a support and guide member for certain of the movable members. The stationary plate 1 is fashioned to present a series of extending portions of which two, namely, the portions 3 and 4, are shown. These extending portions 3 and 4 are provided with rectangular slots or apertures which act as guides for the vertically arranged operating members 5 and 6. The operating members 5 and 6 fit loosely in the rectangular slots in the projections 3 and 4 to permit of vertical movement.

Attached to the upper ends of the operating members 5 and 6 are the flexible metallic reeds 7 and 8, respectively. These flexible reeds are secured to the operating members by means of rivets, as shown both in Figs. 1 and 2. The lowermost end of each of the reeds 7 and 8 presents a shoulder which normally rests against the corresponding projecting portion of the plate 1 to limit the downward movement of the operating member. Each of the operating members 5 and 6 is equipped with a helical spring, the tension of which normally retains said member in its extreme downward position with the shoulder of the flexible reed resting against the plate 1. The operating members 5 and 6 are shown in Fig. 1 as being in their normal condition.

In Fig. 2 there is shown a side view of the operating member 6. From this view a better idea may be had of the manner in which the lower end of the flexible reed 8 cooperates with the projecting portion of the plate 1 to limit the downward movement of the operating member 6 under the influence of the retractile spring 12. In this figure, however, the operating member is shown in its actuated condition, drawn upwardly to the full extent by means to be hereinafter described in detail. While the drawing has been simplified by showing only a portion of the switch structure and only two of the operating members it will, of course, be understood that as many of these members may be provided as necessary to give a switch the required capacity and that all other parts may be increased in number to any desired extent.

For each of the operating members 5, 6, etc., there is provided an actuating lever 14, 15, etc., respectively. These actuating levers are made of magnetic material and are securely mounted upon a common operating rod 13. They each consist of a flat strip of soft iron enlarged at one end and bent back upon itself as best seen in Fig. 1. A square aperture is stamped through both thicknesses of the overturned end of the lever through which the operating rod 13 passes. By this arrangement the levers 14, 15, etc., are secured upon the actuating rod against rotation with respect to such rod and are also held from lateral displacement. The opposite ends of the actuating levers are notched to present shoulder 16. The shoulders 16 cooperate with pieces 9, 10, etc., riveted to the free end of the flexible reed carried by the operating members 5, 6, etc. Normally, the flexible reed 8, for example, when free from attraction assumes the position shown in Fig. 1, wherein the piece 10 is out of the path of the shoulder 16 on the lever 15. If, then, the lever 15 is rotated upwardly the shoulder 16 passes by the piece 10 and is without effect to disturb the corresponding operating member 6.

In order to effect a mechanical connection between the operating member 6 and the

actuating lever 15, it is necessary to flex the reed 8 as shown in Fig. 2 so that the piece 10 may be engaged by the shoulder 16 on the lever 15 when the latter is rotating upwardly. This is accomplished by providing the actuating levers 14, 15, etc., each with a coil consisting of a few turns of wire. The coils 17 and 18 when thus placed upon the respective levers 14 and 15 of magnetic material form an electromagnet. The extreme end of the levers 14 and 15 constitute the pole pieces thereof. The pieces 9, 10, etc., being also of magnetic material and normally disposed in proximity to the ends of the levers 14, 15, etc., are attracted whenever an electric current is passed through the coils. The armature piece 10 being attracted toward the end of the lever 15 flexes the reed 8 until said armature engages said lever. By maintaining the coil 18, for example, energized with an electric current, the piece 10 is held against the lever 15 with the reed 8 tensioned.

The operating rod 13 which carries the actuating levers 14, 15, etc., is mounted in the frame of the switch in any suitable manner. At the extreme end of the rod 13 there is shown a journal 2 which may fit in a bearing member (not shown) to enable the rod to rotate. In addition to the actuating levers 14, 15, etc., the rod 13 carries a member 21 which serves as the armature of an electromagnet 19. The armature 21 which is disposed upon the rod 13 securely so as to rotate therewith, has an extending lug 23 which encounters a pin 24 attached to the frame in order to limit the rotation of the rod 13 in one direction. The armature 21 also has a second lug 22 to which a retractile spring 25 is attached for normally retaining said armature in a position shown with the lug 23 resting against the stop pin 24. The electromagnet 19, which is common to all of the operating members 5, 6, etc., and serves to impart the movement to these members, is mounted upon a supporting iron 20 attached in some convenient manner to the frame of the structure.

Considering next the terminal structure of the switch by means of which the electrical circuits are established, there is provided a set of stationary or passive conductive elements 36, 37, 38 and 39 secured in any suitable manner to the frame. While only four of these elements are shown, it will be obvious that there may be as many as the conditions require and that while they are shown as consisting of bare wires, they may be constructed in any desired shape. For cooperation with the passive contact elements there are provided a plurality of sets of movable contact elements. Two of these are shown, one consisting of the bare wires 28, 29, 30 and 31, and the other comprising the bare wires 32, 33, 34 and 35. The first set of active or movable contact elements 28, 29, 30 and 31 are secured to a vertical insulating strip 26 attached to the frame of the switch. The several bare wires of this set pass through the insulating strip 26 and then are overturned at the rear end to provide an opportunity for soldering the conductors of the circuits represented by these contacts. The free ends of the wires 28, 29, 30 and 31 pass through corresponding apertures in the operating member 5, as shown, this member likewise being constructed of some suitable insulating material. The second set of active contact elements 32, 33, 34 and 35 are secured to the insulating support 27 and extend through a series of apertures in the individual operating member 6 also made of an insulating substance. Likewise, as many additional sets of active contact elements may be provided as are needed.

With the operating members 5, 6, etc., in their normal positions, so retained by the retractile springs 11, 12, etc., the several sets of active contact elements are held out of engagement with the corresponding conductors of the passive set 36, 37, 38 and 39. The disposition of these elements while the device is in its normal position is best seen in Fig. 1. When, however, one of the operating members, such as the operating member 6, is drawn upwardly against the tension of spring 12, the active contact elements 32, 33, 34 and 35 are flexed and moved upward bodily into engagement with the corresponding conductors 36, 37, 38 and 39 of the stationary set. This condition is seen in Fig. 2.

Consider now the manner in which the several elements which constitute the switching mechanism are operated to effect an electrical connection between the active and passive contact elements. By means of any suitable controlling circuit arrangement which will depend upon the character of the system wherein a switching device of this character is employed, it is first determined that a particular circuit such as an incoming line or a trunk in a telephone system is to be connected to the outgoing line or trunk. For example, the incoming lines may be represented by the respective sets of active contact elements, while the outgoing line is represented by the set of passive contact elements. Hence, if it is required to establish a connection between the incoming line represented by the active elements 32, 33, 34 and 35 and the outgoing line represented by the passive elements 36, 37, 38 and 39, a circuit condition is first brought about for energizing the electromagnet 18 individual to the operating member 6. The electromagnet 18, upon being energized, attracts the armature piece 10 flexing the reed 8 as shown in Fig. 2. At the same time that the

electromagnet 18 is energized or at any convenient time thereafter, a condition is set up in the controlling circuits for energizing the common operating magnet 19. The energization of the common operating magnet 19 attracts the armature 21 and rotates the rod 13 against the resistance of the retractile spring 25. The rod 13 in rotating carries all of the individual electromagnets 17, 18, etc. Since a particular one of the operating members, namely, the member 6 is mechanically connected to its individual actuating lever 15 through the flexible reed 8 and the armature piece 10, this upward movement of the actuated lever 15 draws the operating member 6 longitudinally against the tension of the spring 12. Inasmuch as the circuit arrangement for controlling the switch is so provided that only one of the electromagnets 17, 18, etc., can be energized at a time, all of the other magnets excepting magnet 18 are inert, and consequently, none of the remaining flexible reeds is attracted. Therefore, only the operating member 6 is moved upwardly in response to the energization of the common operating magnet 19. The upward movement of the member 6 displaces the active contact elements 32, 33, 34 and 35 and carries them into physical engagement with the corresponding passive contact elements 36, 37, 38 and 39, whereby the desired connection is established between the incoming and the outgoing circuit. When the time arrives that the established connection is no longer required, a certain change is brought about in the controlling circuits whereby the individual electromagnet 18 and the common electromagnet 19 are both deenergized. The deenergization of the magnet 18 permits the reed 8 to unflex and uncouple the mechanical engagement between the operating member 6 and the actuating lever 15. The deenergization of the common operating magnet 19 permits the retractile spring 25 to withdraw the armature 21 rotating the rod 13 back to its normal position, carrying all of the actuating levers 14, 15, etc. again in a position of cooperation with their respective armature pieces 9, 10, etc.

What is claimed is:

1. In a switching device, electrical contact elements for establishing circuit connections, an operating bar for moving said contact elements into engagement with each other, a rotatable rod, an electromagnet secured to said rod and rotatable therewith, means controlled by the electromagnet for connecting said operating bar to the rotatable rod, and an electromagnet for rotating said rod to move said bar.

2. In a switching device, electrical contact elements for establishing circuit connections, an operating member for moving said contact elements into engagement with each other, an actuating element having a projecting member secured thereto and movable therewith, a coil of wire carried by said projecting member for magnetizing the same, means attached to the operating member and attractable by said projecting member when magnetized for mechanically connecting said operating member to the actuating element and an electromagnet for moving the actuating element.

3. In a switching device, electrical contact elements for establishing circuit connections, an operating bar for moving said contact elements into engagement with each other, a rotatable rod having a projecting member secured thereto and rotatable therewith, a coil of wire carried on said projecting member for magnetizing the same, means secured to said operating bar and attractable by the projecting member for connecting the operating bar to the projecting member, and an electromagnet for rotating said rod.

4. In a switching device, passive contacts, active contacts, an operating member through which the active contacts pass for moving the same into engagement with said passive contacts, an actuating element, an electromagnet mounted on said actuating element for movement therewith, means controlled by the electromagnet for connecting said operating member to the actuating element, and means for moving the actuating element to move said operating member.

5. In a switching device, passive bare wire conductors, active bare wire conductors, an operating bar through which the active wires pass for moving the same into engagement with said passive wires, an actuating element, an electromagnet mounted on said actuating element for movement therewith, means controlled by the electromagnet for mechanically connecting said operating member to the actuating element, and means for moving the actuating element.

6. In a switching device, a passive contact element, a plurality of active contact elements, a plurality of operating members, one for each active contact for moving the same into engagement with said passive contact, an actuating element, a plurality of electromagnets, each individual to said operating members respectively and mounted on said actuating element for movement therewith, means controlled by one of said electromagnets for connecting the individual operating member to said actuating element, and means for moving the actuating element.

7. In a switching device, a set of passive contact elements, a plurality of sets of active contact elements, a plurality of movable bars, one for each set of active contacts for moving the same into engagement with said set of passive contacts, a rotatable rod, a plurality of electromagnets individual

respectively to said operating bars and mounted on said rotatable rod for movement therewith, each controlled by one of said electromagnets for mechanically connecting the individual operating bar to said rotatable rod, and means for rotating said rod.

8. In a switching device, a passive contact, a plurality of active contacts, a plurality of operating members, one for each of said active contacts for moving the same into engagement with said passive contact, an actuating element having a plurality of projecting members secured thereto, one for each of said operating members, said projecting members being movable with the actuating element, a coil of wire carried by each of said projecting members for magnetizing the same, means attractable by any one of said projecting members for connecting the corresponding operating member to the actuating element, and an electromagnet for moving the actuating element.

9. In a switching device, electrical contact elements for establishing circuit connections, an operating member for operating said contact elements and having a resilient portion, an actuating element, electromagnetic means for flexing said resilient portion to mechanically connect the operating member to said actuating element, and means for moving the actuating element.

10. In a switching device, electrical contact elements for establishing circuit connections, an operating member for operating said contact elements and having a flexible reed secured thereto, an actuating element, an electromagnet mounted on said actuating element for movement therewith, means controlled by said electromagnet for flexing said reed to establish a mechanical connection between the operating member and said actuating element, and means for operating the actuating element.

11. In a switching device, a set of passive contacts, a plurality of sets of active contacts, a plurality of operating bars, one for each set of active contacts for moving the same into engagement with said passive contacts, each bar having a resilient portion, a rotatable rod carrying a plurality of electromagnets, one for each of said operating bars, means controlled by any one of said electromagnets for flexing the resilient portion of the corresponding operating bar to establish a mechanical connection between such bar and the rotatable rod, and a common electromagnet for rotating said rod.

In witness whereof, I hereunto subscribe my name this 4th day of November A. D., 1921.

HERBERT BELL TAYLOR.