

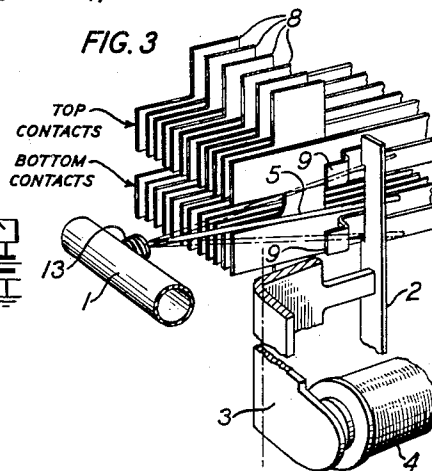
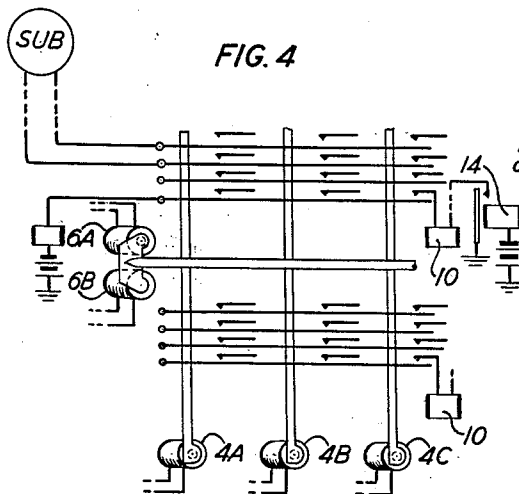
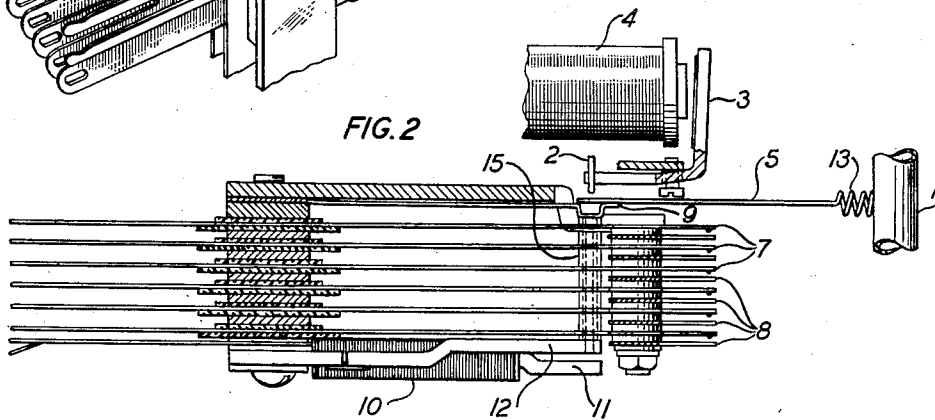
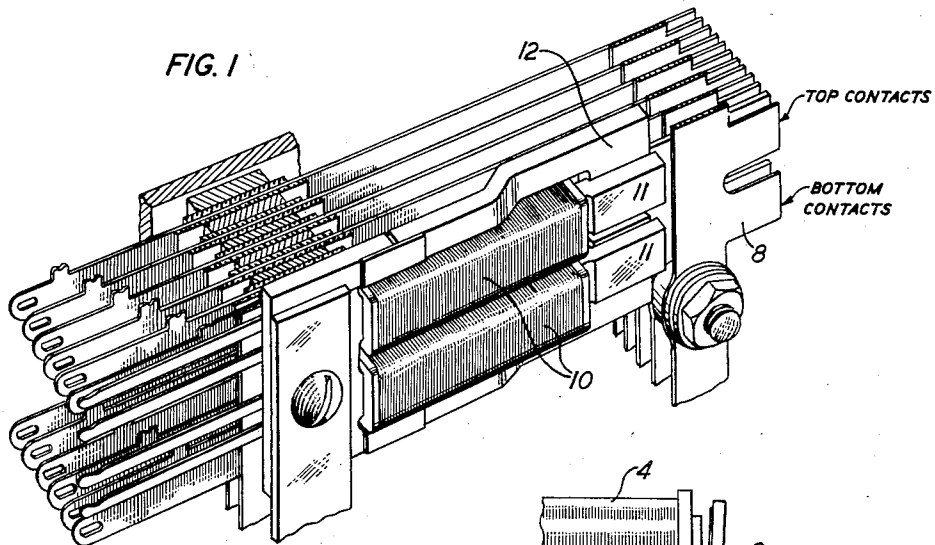
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SWITCHING DEVICE

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SWITCHING DEVICE

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This invention relates to switching devices and particularly to selective switches for use in automatic telephone systems.

Its objects are to increase the capacity of selective switches by permitting the establishment of a plurality of coexisting connections by the same operating means; to increase their flexibility by holding an established connection independently of the operating means, thus freeing these means for further use; and to otherwise improve the operation and efficiency of these switches.

It has been the practice heretofore in switches of the cross-bar type to establish a connection through a set of contacts by successively operating two of the coordinate bars, then releasing one of these bars and holding the connection by the continued operation of the other bar. This plan requires that one of the operating members be held out of service throughout the duration of the established connection, thereby limiting the number of coexisting connections that can be established to a number not exceeding the total number of operating bars in one direction.

According to the present invention these disadvantages are overcome and the capacity of a cross-bar switch is considerably increased by providing for each set of contacts a holding device, which becomes effective, following the operation of the contacts by the coordinate bars, to maintain the contacts in their operated condition, thus permitting both operating bars to restore and to be used again in establishing a subsequent connection. The holding means, which may consist of an electromagnet individual to each set of contacts, may be controlled by some suitable means external to the switch structure, such as a relay, whereby the operated contacts are released without any further participation on the part of the operating bars.

Another feature of this invention is a structure in which the coordinate operating bars, which close the contacts of the selected set, also serve to reduce the electromagnetic air-gap of the holding magnet such that when the magnet is subsequently energized it will be able to maintain the contacts in their operated condition.

A further feature of the invention is a structure of the foregoing character in which the holding magnet is energized and maintained in its operated condition over a circuit including contacts operated by the coordinate bars of the switch.

These and other features of the invention will be described more fully in the following specification, which should be taken in connection with the drawing.

In the drawing, Fig. 1 shows in perspective view a portion of a cross-bar switch structure comprising two complete sets of contacts and associated details, including the holding magnets with their associated structure;

Fig. 2 shows a top view of a set of contacts; Fig. 3 is a partial perspective view taken at a different angle from Fig. 1 in order to clarify the operation; and

Fig. 4 shows one of a number of circuit arrangements in which a switch of this kind may be employed.

For a more complete disclosure of the construction and operation of a cross-bar switch of the kind to which this invention is particularly applicable, reference is made to the copending application of J. N. Reynolds, Serial No. 702,453 filed December 15, 1933, granted as Patent 2,021,329, November 19, 1935.

Referring now to the drawing, the horizontal operating bar of the cross-bar switch is designated 1, and the vertical operating bar is designated 2. Horizontal bar 1 rests on appropriate bearing surfaces at its two ends, and is so interconnected with the armatures of two magnets (shown in Fig. 4 as 6A and 6B) that the finger 5 may be moved either upward or downward from its normal position depending upon which magnet is operated. Vertical operating bar 2 is fastened to the armature 3 of magnet 4, so that the operation of this magnet causes a movement of the vertical bar. The contacts 8 are stationary, whereas the contacts 7 are located on flexible springs and are capable of movement. Connections are completed through the set of contacts when the movable ones touch the fixed ones. The arrangement is such that all of the movable contacts of a set are fastened solidly together, although insulated from each other by means of a stud 15 and move as a unit when pressure is exerted on the flexible element 9 positioned at one end of the stud 15. When it is desired to operate a set of contacts the horizontal bar is rotated slightly under control of one of the magnets 6. If it is desired to operate the top set of the contacts 7 shown in Fig. 3, the proper magnet is actuated to raise the finger 5. This finger is now alongside the spring element 9 of the top set of contacts, being restrained from moving too far by the notch in the bar 2. At this time magnet 4 operates and through its armature forces the bar 2 against finger 5. The end of finger 5 is bridged across the U-shaped

part of element 9, and the full movement of armature 3 moves element 9 and its associated contacts 7 so that these movable contacts touch the fixed ones 8.

5 In order to hold the contacts operated after the release of the horizontal and vertical bars 1 and 2, the holding magnets 10 are used. The armature 12 is fastened to, although insulated from, the movable contacts 7 and the element 9.
10 This means that when the set of contacts is operated, the armature 12 is moved so that it almost touches core 11, thus reducing the air-gap. At this time the circuit is closed so that current flows through magnet 10, thus holding the set of contacts operated. The circuit may
15 be arranged so that the closure of one pair of contacts in the set involved establishes the holding circuit. With the small air-gap, it will be possible to use a correspondingly small number
20 of ampere turns for magnet 10.

In the switch as disclosed in the above-mentioned patent to Reynolds, No. 2,021,329, granted Nov. 19, 1935, having 100 sets of contacts, 5 horizontal bars and 10 vertical bars, the maximum
25 number of simultaneously operated contact sets is 10, equivalent to the number of vertical bars. After each connection is established, the magnets 6 are released, but the magnets 4 remain operated, thus holding the connection and finger
30 5, which is possible since this finger is fastened to the bar 1 by spring 13, which permits the necessary flexibility. In a switch of the foregoing size, utilizing the holding magnets 10 disclosed herein, the maximum number of simultaneously
35 operated contact sets is 100. This is possible because both the horizontal and vertical bars 1 and 2 are released after each connection and are left free to be used again.

In Fig. 4 the circuit through the winding of
40 holding magnet 10 is completed through contacts of relay 14. As outlined previously, the contacts of a set are closed by magnet 4 operating immediately after magnet 6. With relay 14 operated and the set of contacts operated, holding
45 magnet 10 will be energized to hold operated the set of contacts. The set of contacts will subsequently be released through the opening of the circuit of magnet 10 by the release of relay
50 14. The operating circuit for relay 14 has not been shown, but its release could be made dependent upon the subscriber's hanging up of his receiver or other action as desired. The holding magnet disclosed could be used equally
55 well in other circuit arrangements, it being the object in Fig. 4 to present merely a typical arrangement.

What is claimed is:

1. The combination in a switching device of a
60 set of circuit making contacts, a switch operating member having normal and operated positions, means for moving said operating member to its operated position to actuate said contacts, and electromagnetic means separate from said
65 operating member for holding the contacts in their actuated condition following the release of said operating member to its normal position.

2. The combination in a switching device of a set of circuit making contacts, a switch operating
70 member having normal and operated positions, means for moving said operating member to its operated position to actuate said contacts, and electromagnetic means separate from said operating member for maintaining said contacts
75 in their operated condition following the release

of said operating member to its normal position and for effecting the release of said contacts.

3. The combination in a switching mechanism of a plurality of sets of switch contacts, operating
5 members, means controlled by the conjoint movement of a plurality of said operating members to select and actuate any desired one of said plurality of sets of contacts, and means for holding and releasing said actuated contacts independently of said operating members. 10

4. The combination in a switching mechanism of a plurality of sets of switch contacts, operating
15 members, means controlled by the conjoint action of a plurality of said operating members to select and actuate any one of said plurality of sets of contacts, and electromagnetic means separate from said operating members for holding the selected contacts in their actuated condition after the release of the operating
20 members.

5. The combination in a switching mechanism of a plurality of sets of switch contacts, operating
25 members, means controlled by the conjoint action of a plurality of said operating members to select and actuate any one of said plurality of sets of contacts, and electromagnetic means separate from said operating members for controlling the release of the actuated contacts.

6. A switching device comprising a plurality
30 of sets of switch contacts arranged in rows, operating bars related to said rows of contacts, means for operating a pair of said bars simultaneously to select and actuate a desired set of switch contacts and for thereafter releasing both
35 of said bars for further use, and electromagnetic means for maintaining the selected set of contacts in their actuated condition independently of said operating bars.

7. The combination in a switching device of a plurality of switch contacts arranged in coordinate
40 rows, operating bars individual to the rows of contacts in one direction, other operating bars individual to the rows of contacts in the other direction, means for conjointly operating any desired pair of said bars a number of
45 times in succession to select and actuate a plurality of sets of contacts, and means individual to said sets of contacts for holding them actuated to maintain a corresponding number of co-existing circuit connections. 50

8. In a switch, a set of circuit making contacts,
55 an operating member having normal and operated positions, means for moving said operating member to its operated position to engage and move said contacts into their operated position, a magnet separate from said operating member for holding said contacts actuated following the release of said operating member to its normal position, and a circuit for said magnet closed
60 through a pair of said actuated contacts.

9. The combination in a switching device of rows of circuit making contacts, operating bars
65 one for each of said rows, means for operating a pair of said bars to select and actuate a set of contacts, an electromagnet separate from said operating bars and individual to the selected set of contacts for holding said contacts in their actuated condition, and a circuit for said magnet including a pair of said actuated
70 contacts.

10. The combination in a switch of a plurality
75 of circuit making contacts arranged in rows, operating bars one for each of said rows of contacts, holding magnets each individual to one of said sets of contacts, each of said magnets

having an armature for maintaining the corresponding set of contacts in their operated condition, means for operating a pair of said bars conjointly to effect the actuation of a desired
5 set of contacts and for moving the armature of the electromagnet individual to such set of contacts toward its pole piece, and a circuit for said electromagnet closed through a pair of actuated contacts.

10 11. In a switch, a set of circuit making con-

tacts, an operating bar, a magnet for operating said bar to first engage and then move said contacts to their operated position, a hold magnet having an armature for holding said contacts actuated following the restoration of said bar, and
5 a pole piece for said hold magnet, said armature being moved toward said pole piece by the operation of said operating bar.

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