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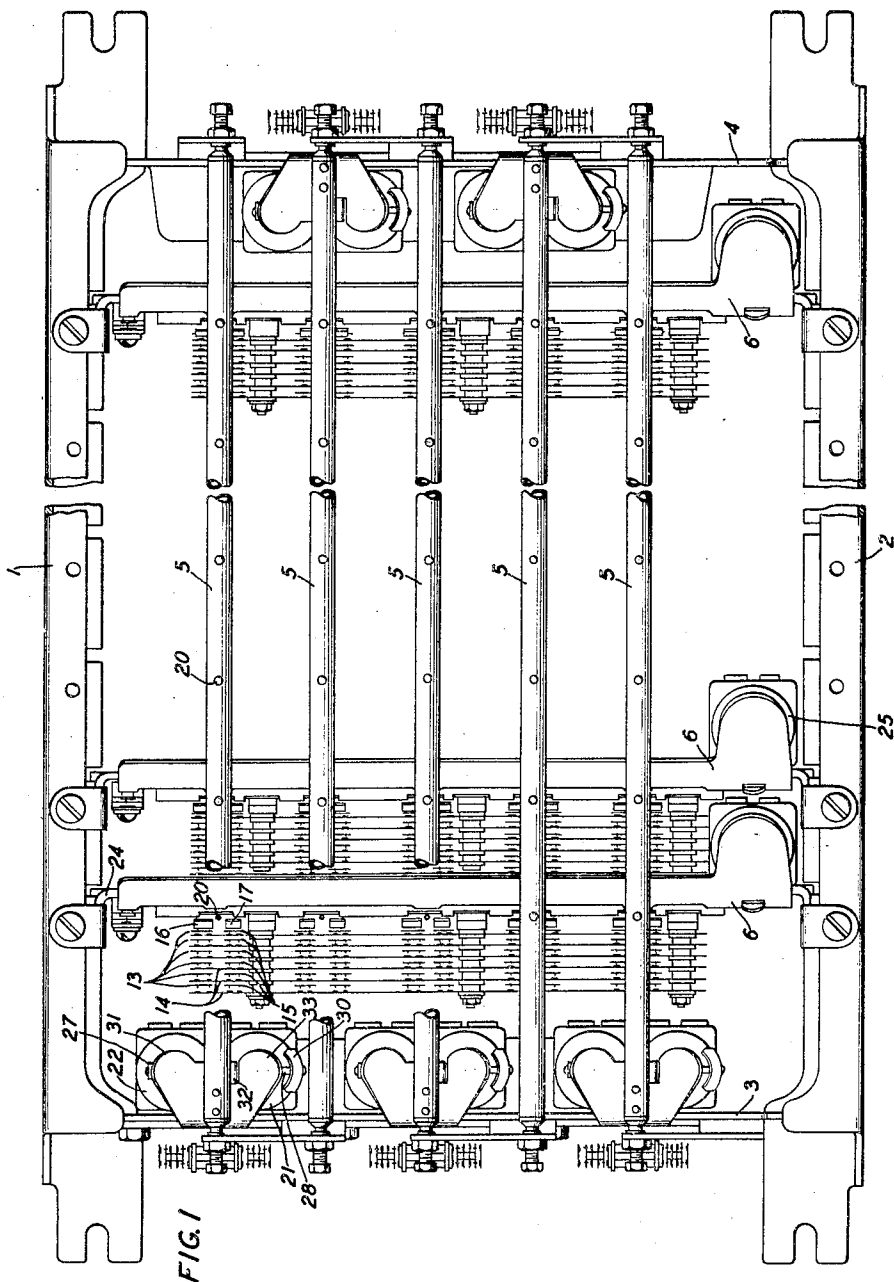
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2,114,046

SWITCHING MECHANISM

Filed Feb. 11, 1937

2 Sheets-Sheet 1



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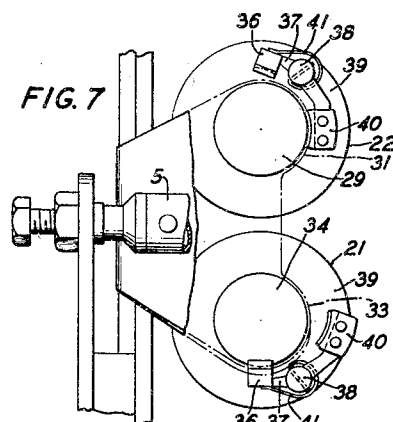
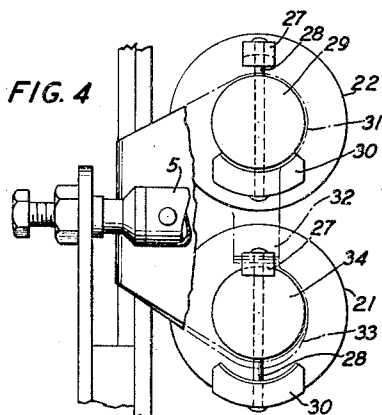
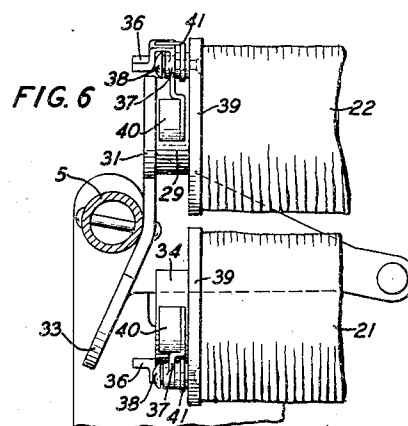
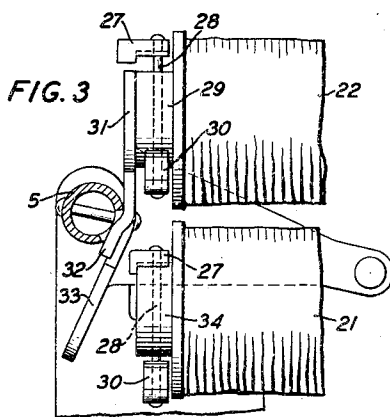
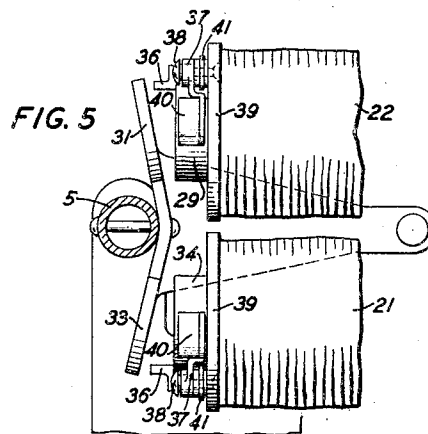
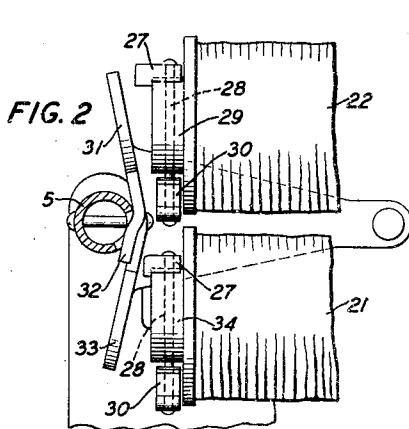
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SWITCHING MECHANISM

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2 Sheets-Sheet 2



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2,114,046

SWITCHING MECHANISM

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Application February 11, 1937, Serial No. 125,234

8 Claims. (Cl. 179—27.54)

This invention relates to improvements in electromagnetic devices and particularly to those applicable to switches of the cross-bar type for use in establishing electrical connections.

It is an object of this invention to secure greater accuracy and reliability in the operation of devices of this character.

There are in the prior art numerous types of cross-bar switches. In general these switches are provided with sets of horizontal and vertical bars actuated by selecting magnets to establish connections between sets of contacts at the cross-points of said bars. A selecting finger or similar device is associated with each horizontal bar at each point where said bar is crossed by a vertical bar, and means is provided whereby when a horizontal bar is rotated by a selecting magnet operating on an armature attached to the bar, the selecting fingers are moved into a position where if the vertical bar is rotated, it will, due to the position of the corresponding selecting finger cause the operation of one set of contacts to connect with another set of contacts at the cross-point of said two operated bars. The horizontal bar may then be returned to normal position for use in the establishing of other connections through the switch.

A feature of the present invention is to improve upon these prior switches and to eliminate the possibility of false operations of the switch by reducing the rebound of the horizontal bars after their return to normal. This may be accomplished in accordance with the applicant's invention by providing a stop member for the armature of a bar. This stop member is connected to an auxiliary armature by means of a rod which passes through a hole in the head of a selecting magnet that operates the bar. The stop and the connecting rod are constructed of a non-magnetic material whereas the auxiliary armature may be constructed of permalloy. This auxiliary armature and its associated parts are of light construction and therefore will operate much faster than the regular main armature of the horizontal bar. The arrangement of these parts is such that when the select magnet for a bar is energized, the auxiliary armature operates immediately to remove the stop from its normal position between the magnet head and the main armature so that the main armature will be fully actuated to rotate the horizontal bar to its fully actuated position. Then when the magnet is deenergized, the bar is released and the stop falls back into its normal position between the head of the magnet and the main armature.

Should the main armature at this time rebound from its normal position it will be prevented from fully operating due to the presence of the stop in front of the magnet head. Other modified forms of this device may be made without departing from the spirit of the invention, as long as such modified forms provide means for preventing a complete movement of the armatures of the bars toward the magnet heads when the magnets are deenergized and removing said restrictions when the magnets are energized.

This invention has been illustrated in the accompanying drawings in which:

Fig. 1 is a front view of a cross-bar switch structure with devices constructed in accordance with the applicant's invention applied thereto;

Figs. 2, 3 and 4 show various views of a preferred form of the applicant's invention applied to the selecting magnets for a horizontal bar, Fig. 2 is an end view with the horizontal bar in normal position, Fig. 3 is a similar view with one armature attracted by the upper magnet, Fig. 4 shows a front view of a portion of a horizontal bar and the two associated selecting magnets with the upper magnet in energized condition; and

Figs. 5, 6 and 7 are identical with Figs. 2, 3 and 4, respectively, except that they show a modified form of the applicant's invention as applied to the selecting magnets for a horizontal bar.

While the invention is applicable in general to cross-bar switches and relay structures, it has been illustrated in Fig. 1 as applied to a switch of the type having select fingers attached to the horizontal bars. A switch of this kind is described in the patent to J. N. Reynolds 2,021,329 of November 19, 1935. Referring now particularly to Fig. 1 of the drawings a description of the operation of this switch structure will be given. This switch may consist, as disclosed in this figure, of a frame comprising members 1, 2, 3 and 4, five horizontal bars 5 and a series of ten vertical bars 6, the first, second and last of the latter bars only having been shown in full with their corresponding horizontal and vertical rows of contact strips. The first horizontal row of contact strips is marked 13 and the first vertical row is marked 14, while the second horizontal row is marked 15. A so-called actuating spring for the connection of the horizontal contacts 13 to the vertical contacts 14, is shown at 16 and an identical actuating spring for connecting the horizontal contacts 15 with the vertical contacts 14 is shown at 17. The first or upper horizontal

bar 5 may be rotated in one direction to cause the associated selecting finger of the group marked 20 to select the upper row of horizontal contacts 13 by the operation of the magnet 21 and be rotated in the opposite direction to cause the fingers to select the second row of horizontal contacts 15 by the operation of magnet 22. The vertical operating bars 6 may be rotatably guided on the frame members 24 and be actuated by magnets 25 to cause them to complete connections by pressing a finger against an actuating spring to move it to close connections between, for example, the vertical contacts 13 and 14. After a vertical bar has been actuated the previously operated horizontal bar may be returned to normal as the vertical bar will hold the established connection until released. The members 24 are secured to the upper and lower horizontal frame members 1 and 2 and the horizontal bars are pivotally supported between frame members 3 and 4. For a complete description of the operation of this switch and further details of its construction, reference may be had to the above-mentioned patent.

In view of the above description of a switch structure to which the applicant's invention may be applied, it is evident that the horizontal bars when returning to normal position may possibly rebound sufficiently to cause a selecting finger to be caught between an actuating spring and an operating vertical bar and thus cause a false connection to be established. It is to prevent such false operation that the applicant's invention has been applied to a structure of this kind. The preferred form illustrated in Figs. 2, 3 and 4 consists essentially of a stop 27 attached to a rod 28 that passes through a hole in, for example, magnet head 29 of magnet 22. At the other end of rod 28 is secured an auxiliary armature 30 preferably made of permalloy and lightly constructed as compared with the armature 31, for example. It should be noted that with the rod 5 in normal position, the stop 27 extends between the armature 31 and the magnet head 29 so that under these circumstances the armature 31 cannot be fully operated toward the magnet head 29 to rotate rod 5 to its fully operated position where the selecting fingers may normally be placed between an actuating spring such as 17 and a vertical rod for selections at a cross point. Magnet 21 is also provided with a device in accordance with the applicant's invention in the same manner as magnet 22. In this case the stop member 27 is interposed between a projection 32 of the armature 33 which prevents the armature 33 from being fully operated toward the magnet head 34 of magnet 21.

The operation of this device is as follows. For example, if magnet 22 is energized to rotate the rod 5, the auxiliary armature 30 will first be attracted toward the magnet head 29 and consequently by means of the rod 28 causes stop member 27 to be lifted from between the magnet head 29 and the armature 31 to permit the full attraction of the armature 31 toward the magnet head 29 and consequently rotate the rod 5 to its fully operated position. This stop 27 will therefore cause no interference with the proper operation of the bar 5. Then when the magnet 22 is deenergized the rod 5 is rotated back and the armature 31 returned to normal position while the auxiliary armature 30 is also released and returns the stop 27 to its normal position. Should the rod after its return to normal position rebound back to cause the armature 31 to be moved again

toward the magnet head 29, the stop 27, having been released and placed between the armature 31 and the magnet head 29, will prevent the armature 31 from returning back completely toward the magnet head 29. This will effectively prevent the selecting fingers from being caught by operating vertical bars and establish false connections. It is possible, of course, that the bar 5 may on its return to normal move past the normal position and cause the armature 32 to be moved toward the magnet head 34. In this case the stop 27 on magnet head 34 would prevent a complete movement of the bar in this direction by contacting with the armature 33. The raised portion 32 on the armature 33 is to permit the armature to be fully operated when the stop 27 is raised. Fig. 3 illustrates how the stop 27 has been removed from between the armature 31 and the magnet head 29 to permit full operation of bar 5. In Fig. 4, the armature 30 for magnet 22 has been shown in attracted position with the stop 27 raised out of the way of armature 31 and the armature 30 for magnet 21 has been shown in normal position with the associated stop 27 projecting in front of the magnet head 34.

Figs. 5, 6 and 7 show a modified form of the applicant's invention as applied to the magnet heads 21 and 22. In this case a stop 36 is attached at one end of a lever 37 pivoted on a pinion 38 secured to the spoolhead 39 of magnet 22. At the other end of this lever 37 is attached a permalloy auxiliary armature 40 and a spring 41 is secured at one end to the pinion 38 and at the other end rests on the stop 36. This spring 41 is so tensioned as to normally press the stop 36 between the magnet head 29 and the armature 31. In Fig. 5 the parts are shown in their normal positions. In Figs. 6 and 7 the auxiliary magnet 40 for magnet 22 is shown in attracted position by the magnet head 29 with the stop 36 removed from between the armature 31 and the magnet head 29 and the auxiliary armature 40 for magnet 21 is shown in normal position with the associated stop 36 inserted between the magnet head 34 and the armature 33 as held by the spring 41. The operation of the modified disclosure of the applicant's invention in these figures is therefore identical with that described in connection with the preferred form of the applicant's invention disclosed in Figs. 2 to 4.

What is claimed is:

1. The combination in an electromagnetically operated device of a magnetic coil having an armature attractable by said coil when energized, and means associated with said coil for restricting the movement of the armature toward the coil within certain limits when the coil is deenergized and for removing said restriction when the coil is energized.

2. The combination in an electromagnetically operated device of an electromagnet, a pivoted armature, and a blocking means for the armature controlled by said magnet when energized to permit the armature to swing from a normal position to an attracted position and released when said magnet deenergizes to block the armature from swinging from the normal position back to said attracted position.

3. The combination in an electromagnetically operative device of an electromagnet, comprising a coil and a core, an armature adapted to swing from a normal position to an attracted position adjacent said coil when said coil is energized, another armature adapted to be attracted by said coil when said core is energized and

an obstruction member attached to said second armature and so located between the coil and the first armature as to prevent said first armature from reassuming its actuated position when the coil is deenergized and so located as to be removed by said second armature from between the coil and the first armature to permit said first armature to occupy its attracted position when the coil is energized.

4. In an electromagnetically operative structure, a core, a main armature magnetically attractable by said core, an auxiliary armature loosely mounted on said core, a stop member attached to said auxiliary armature normally located between the head of the core and the main armature and so arranged that when the core is energized, the auxiliary armature is attracted before the main armature and removes the stop member from between said armature and the head of the core to permit the main armature to be fully attracted by the core and so arranged that when the core is deenergized the stop member will return to normal position in time to prevent the main armature from rebounding to its fully attracted position.

5. In an electromagnetically operative structure, a coil, and an armature magnetically attractable by said coil from a normal position to an attracted position, and means associated with said structure for preventing the armature from occupying the attracted position when the coil is deenergized if advanced toward said position.

6. The combination in a cross-bar switch of

electro-magnets, armatures for said magnets to control the operations of said switch when fully operated, and means controlled by certain of said magnets for preventing the associated armatures from reassuming fully operated positions after said magnets are deenergized.

7. In a cross-bar switch structure having horizontal and vertical bars and means including selecting magnets for rotating said bars to establish a connection at the cross-points of said bars, an armature on each horizontal bar for operation by the associated selecting magnets, an auxiliary armature on each selecting magnet for the horizontal bars, and means controlled by said auxiliary armatures to prevent the main armature from fully rotating the associated horizontal bars to establish connections except when said magnets are energized.

8. In a cross-bar switch having horizontal and vertical bars and means including selecting magnets for rotating said bars to establish connections at cross-points of said bars, two main armatures on each horizontal bar, each in position to be acted upon by a separate selecting magnet to initiate different selecting operations of the switch, an auxiliary armature on each of said selecting magnets for the horizontal bars, and means associated with each auxiliary armature operative when the associated selecting magnet is not energized for preventing the selective operation of the associated bar and operating when the associated magnet is energized to permit the selective operation of the associated bar.

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