

May 31, 1938.

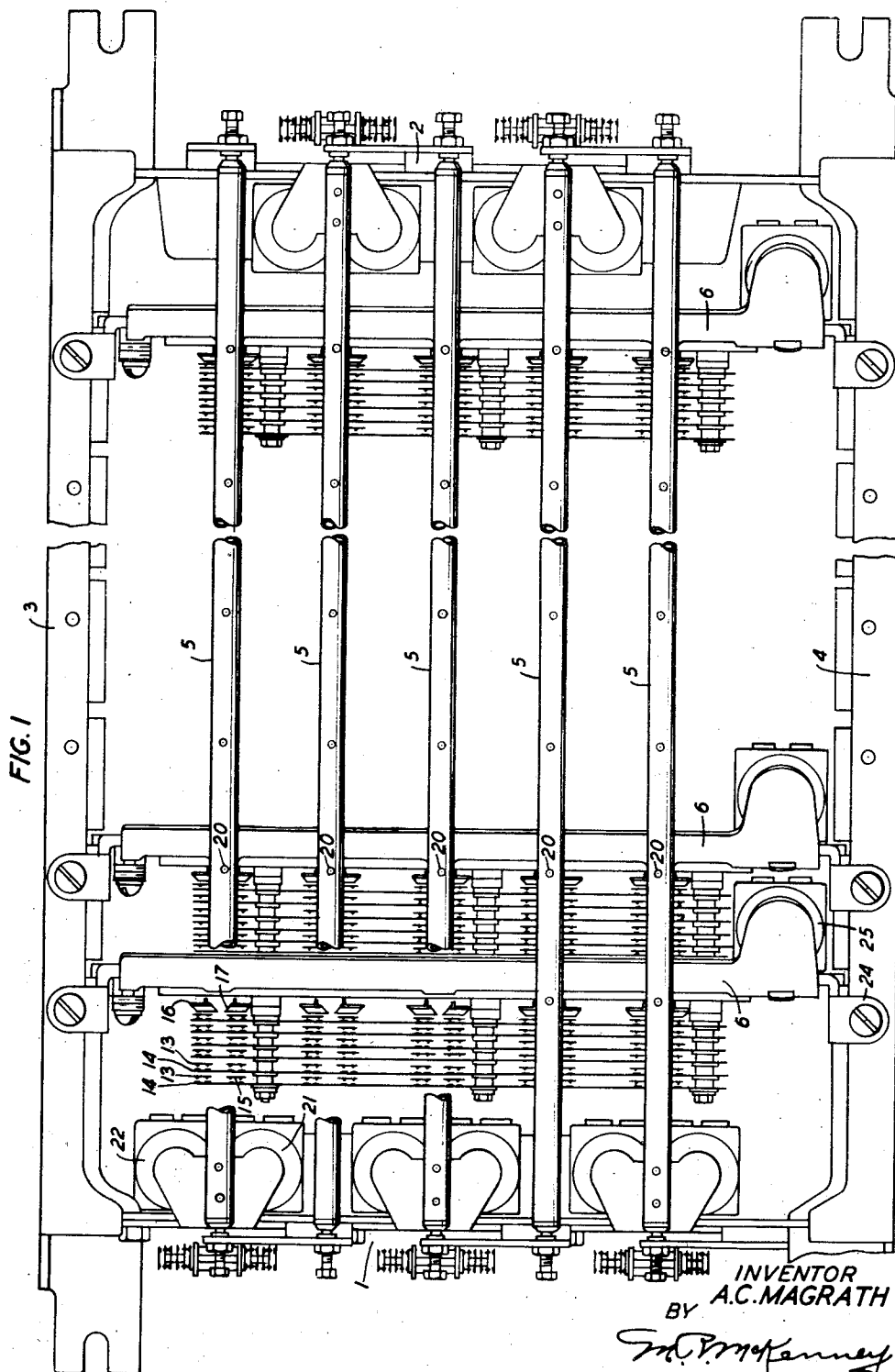
A. C. MAGRATH

2,118,935

SWITCH MECHANISM

Filed Aug. 6, 1936

2 Sheets-Sheet 1



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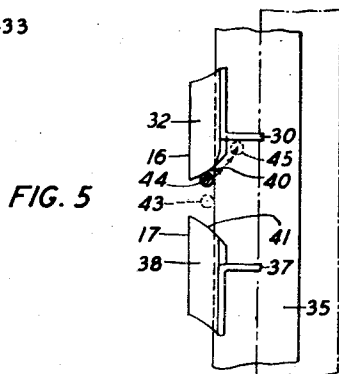
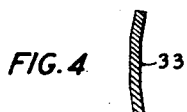
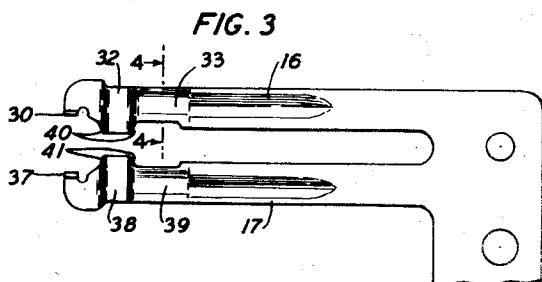
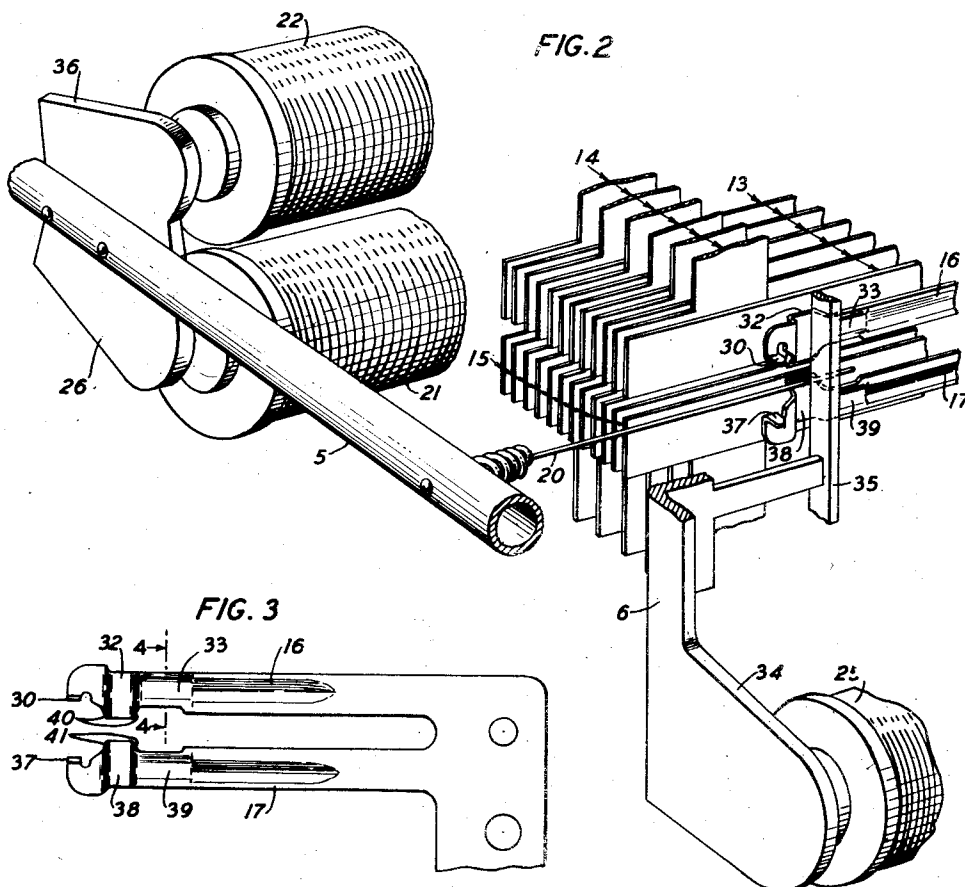
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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

2,118,935

## SWITCH MECHANISM

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4 Claims. (Cl. 179—27.54)

This invention relates to improvements in switching mechanisms and particularly to switches of the cross-bar type for use in establishing electrical connections.

It is an object of this invention to provide in a switch of this kind improvements that will cause its functions to be performed with greater accuracy and reliability.

Cross-bar switches to which the present invention may be applied are well-known in the art and consist essentially of contact sets arranged in horizontal and vertical rows and means including a group of horizontal operating members intersecting a group of vertical operating members controlled by magnets. In some type of switches the horizontal operating members are rotatable in two directions so that connections may be established at either of two sets of contacts at an intersecting point by the rotation of a horizontal bar in one direction or the other and the rotation of a vertical bar in one direction.

The present invention has been disclosed in connection with a cross-bar switch of this latter type and particularly with the switch disclosed in the patent to J. N. Reynolds 2,021,329 of November 19, 1935. In this switch the rotation of a horizontal bar causes a selecting finger to be placed opposite an actuating spring to select a set of contacts and when a vertical bar is operated it causes this finger to be pressed against the actuating spring which in turn causes a connection to be established between the contact sets at the corresponding cross-connecting point.

It is a feature of the present invention to provide improvements in this actuating spring which consists in a special construction to prevent snagging of the selecting fingers on the spring and to thereby insure reliable and accurate performance of the switch. This feature consists essentially in a spring having projections to guide the selecting finger back to normal position after it had been actuated. In case of ordinary springs heretofore known, if a vertical or so-called holding bar is in operated position and then a horizontal or so-called selecting bar is operated the selecting finger at the cross-point may become snagged on its associated actuating spring. Thus when this holding bar is released, the snagged finger will not advance to its correct position between the spring and the holding bar. Therefore if this holding bar is again operated before the operated selecting bar releases, the contacts at this cross-point will not be operated. The present invention overcomes this difficulty by providing a projection on the spring at the point where the select-

ing finger comes in contact with the spring. This projection is cam-shaped or so formed that when the holding bar is released, the projection will guide or permit the finger to slide off the spring and advance to the position which it should occupy with the selecting bar operated. Consequently if the holding bar is again operated before the selecting bar is released, it will find the finger in a correct position for the proper operation of the associated contact sets.

The invention has been illustrated in the accompanying drawings in which Fig. 1 shows a front view of the cross-bar switch structure disclosed in the above-mentioned patent.

Fig. 2 shows a fragmentary perspective view of a horizontal bar with a selecting finger, two actuating springs and their associated contact sets and a portion of a corresponding vertical bar;

Fig. 3 shows the detailed construction of two actuating springs, and

Fig. 4 is a cross-section taken on line 4—4 of Fig. 3, showing the contour of the actuating spring at this point;

Fig. 5 shows a fragmentary front view of two actuating springs and a vertical bar with a selecting finger in the various positions it may occupy.

Referring now to the drawings and particularly to Fig. 1, the switch structure on which the applicant's invention may be applied may consist as disclosed in this figure of a frame consisting of 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 is marked 13 and the first vertical row is marked 14, while the second horizontal row is marked 15. The actuating spring for connecting the horizontal contacts 14 to the vertical contacts 13 is shown at 16 and the actuating spring for connecting the horizontal contacts 15 with the vertical contacts 13 is shown at 17. The first or upper horizontal bar 5 may be actuated to rotate a corresponding selecting finger of the associated selecting fingers 20 to select the upper row of horizontal springs 13 by the operation of the magnet 21 and to select the second row of horizontal strips 15 by being actuated by magnet 22. The vertical operating bars 6 may be rotatably guided on the frame members 23 and be actuated by magnets 25 to cause them to establish connections as will be hereinafter described in detail. The members 24 are secured to the upper and lower horizontal frame members 3 and 4 while the horizontal bars are pivotally supported 55

between frame members 1 and 2. For a complete description of further details of this switch structure, reference may be had to the above-mentioned patent.

5 The operation of this switch structure may be described in connection with the perspective view shown in Fig. 2. For example, if the horizontal bar 5 is operated by magnet 21, acting on the armature 26, the selecting finger 20 will be moved  
10 upward to engage a projection 30 on the upper actuating spring 16 and rests in a position in front of the U-shaped portion 32 and a trough shaped portion 33 shown in cross-section in Fig. 4, with the finger practically in the center of this  
15 trough. If now the vertical bar 6 is operated by a magnet 25 operating on armature 34, the angularly projecting operating member 35 which is located in front of the U-shaped portion 32 of the actuated spring will press the selecting finger  
20 20 against the actuating spring 16. This spring in turn is pressed against the corresponding group of horizontal contacts 13 which now contact, respectively, with the vertical contacts 14. The vertical bar now holds this connection while  
25 the selecting bar 5 is returned to normal. The selecting finger 20 is held between the actuating spring 16 and the member 35 and is prevented from slipping away from this position by resting in the trough 33 when the horizontal bar is re-  
30 turned to normal or during subsequent movements of this bar. Similarly, if the bar 5 is rotated in the opposite direction by having the magnet 22 act on the armature 36 the selecting finger 20 will be moved downward to engage the  
35 projection 37 of the actuating spring 17 and will be placed opposite the corresponding U-shaped portion 38 of this spring and the trough shaped portion 39. Then when the vertical bar 6 and its member 35 are operated the selecting finger  
40 20 will be pressed against the actuating spring 17 which in turn will act on the second horizontal row of contacts 15 to engage respectively with the vertical contacts 14, whereupon the horizontal bar will return to normal leaving the selecting finger  
45 engaged in the trough 39 until the bar 6 is released when the finger will be released and the spring 17 and contacts 15 restored to normal.

To fully understand the function of the applicant's invention, it is pointed out that the U-shaped portion 32, for example, of spring 16 is  
50 extended downwardly beyond the normal width of the spring so that the lower edges of the sides of this U-shaped portion form slanting cam surfaces as shown clearly at 40 in Figs. 3 and 5. Similar slanting cam surfaces are formed on the  
55 upper side of the spring 17 as shown at 41. It is this shape of the U-shaped portion of the springs that prevents snagging of the selecting fingers. If it is assumed for a moment that the actuating spring 16 is not provided with these slanting cam  
60 surfaces 40 and a vertical bar is operated followed by the operation of a horizontal bar the selecting finger at the cross-point of these two bars may become caught or snagged on the under surface  
65 of the U-shaped portion of this spring and thus remain pressed against this under surface after the vertical bar has been returned to normal. The finger would consequently not advance to the position it should occupy on the side of the actu-  
70 ating spring. Such snagging will not take place with springs constructed in accordance with the present invention. If reference is made particularly to Fig. 5 it will be observed that with the member 35 actuated as shown in full lines in this  
75 figure, the selecting finger 20 will occupy the

position shown in dotted lines at 43 between the springs 16 and 17. Now in case the horizontal bar causes the selecting finger 20 to be moved  
upward, while the vertical bar remains actuated, it will come to rest against the cam surfaces 40  
5 for the time being, as shown in full lines at 44. The finger will, however, not be caught or snagged in this position when the member 35 later is re-  
leased but will, if the horizontal bar is still oper-  
ated when this release takes place, slide side-  
10 ways on the cam surfaces 40 in the direction of the arrows and advance to its proper position against the projection 30 as shown at 45 in dotted lines. The finger will now remain in this position as long  
as the horizontal bar is operated in readiness  
15 for selection by the vertical bar in case it is later operated. It is evident that as the selecting spring 17 is provided with similar slanting cam surfaces 41 extending upward from the U-shaped  
20 portion 38 as shown in Fig. 5, the selecting finger 20 if moved downwardly by the horizontal bar, will rest temporarily on these cam surfaces 41, but as soon as the vertical bar is released, the  
25 finger will slide downwardly thereon towards the right until it occupies its proper position against the projection 37. Thus under no circumstances can the selecting finger be snagged on the asso-  
ciated actuating springs.

What is claimed is:

1. The combination in a switch of intersecting  
30 rows of separately operable contact sets, contact operating springs individual respectively to said contact sets, selecting bars having selecting fin-  
gers thereon individual to the several contact sets and projecting into proximity with the corre-  
35 sponding operating springs, means for actuating one of said selecting bars to move a finger into operative position with respect to the associated  
operating spring, holding bars, means for actu-  
ating one of said holding bars to engage and move  
40 the positioned selecting finger and the associated operating spring to close the associated contact set, and a cam-shaped projection on each of said  
operating springs for guiding the corresponding  
45 finger into its correct operative position with respect to such operating spring.

2. The combination in a switch of intersecting  
rows of separately operable contact sets, contact  
operating springs individual respectively to said  
50 contact sets, selecting bars having selecting fin-  
gers thereon individual to the several contact sets and projecting into proximity with the corre-  
sponding operating springs, means for actuating  
one of said selecting bars to move a finger into  
55 operative position with respect to the associated  
operating spring, holding bars, means for actu-  
ating one of said holding bars to engage and move  
the positioned selecting finger and the associated  
operating spring to close the associated contact  
60 set, and a cam-shaped projection on each operat-  
ing spring engaged by the corresponding finger  
when the selecting bar is operated subsequent to  
the operation of the corresponding holding bar  
and which serves to guide the finger into its  
65 correct position with respect to the operating  
spring when the holding bar is subsequently released.

3. The combination in a switch of intersecting  
rows of separately operable contact sets, a con-  
70 tact operating spring individual to one of said  
contact sets, selecting bars having selecting fin-  
gers thereon, one of said fingers being individual  
to said contact spring and the associated contact  
set, a stop projection on said operating spring for  
75 limiting the movement of the corresponding fin-

ger and determining the operative position of said finger with respect to said operating spring, means for actuating the selecting bar to move said finger against said stop projection, a holding bar, means for operating said holding bar to engage and move the positioned finger and the associated operating spring to close the corresponding contact set, and a second projection on said operating spring shaped to guide the finger into its operative position against said stop projection.

4. The combination in a switch of intersecting rows of separately operable contact sets, a contact operating spring individual to one of said contact sets, selecting bars having selecting fingers thereon, one of said fingers being individual to said contact spring and the associated contact

set, a stop projection on said operating spring for limiting the movement of the corresponding finger and determining the operative position of said finger with respect to said operating spring, means for actuating the selecting bar to move said finger against said stop projection, a holding bar, means for actuating said holding bar either before or after the actuation of the selecting bar, and a cam portion on said operating spring for receiving the finger when the same is operated subsequent to the operation of said holding bar and for guiding the operated finger into its operative position against said stop projection when the holding bar is released subsequent to the operation of said finger.

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