

July 18, 1939.

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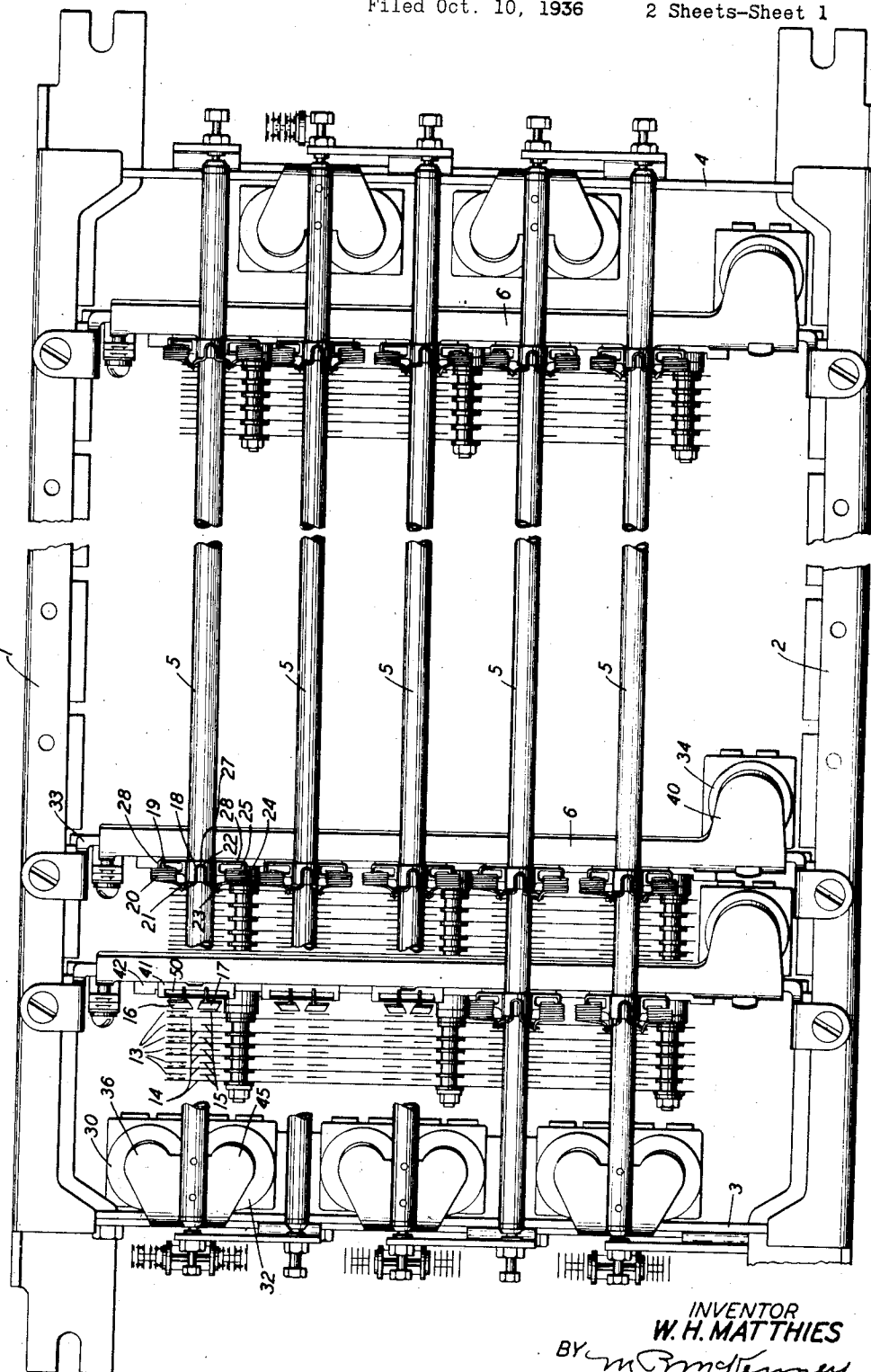
2,166,764

SWITCHING MECHANISM

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2 Sheets-Sheet 1

FIG. 1



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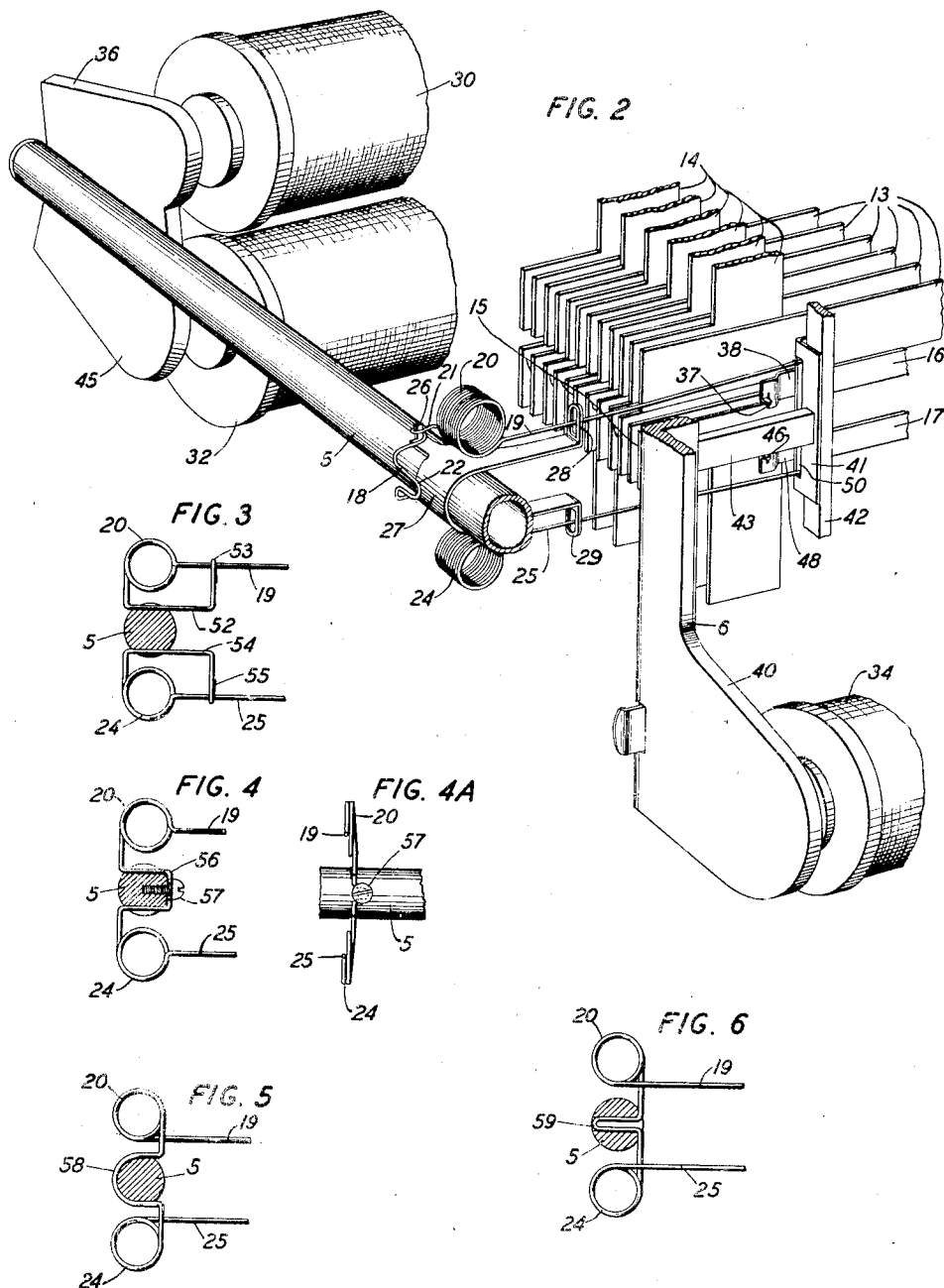
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2 Sheets-Sheet 2



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SWITCHING MECHANISM

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11 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 types of switches a horizontal operating member is 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 a switch of the type 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 the 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 a so-called actuating spring which in turn causes a connection to be established at a contact set at the corresponding horizontal cross-connecting point.

It is a feature of the present invention to provide improvements in the selecting finger mechanism for switches of this type, each selecting finger mechanism comprising two straight selecting fingers terminating in individual coils secured to the horizontal bar. The axes of the coils are at right angles to the longitudinal direction of the straight fingers and these coils may be secured permanently or detachably to the bar. In the preferred form of this invention a bracket with a guide for the fingers is secured permanently to the bar and the coils are connected together and secured detachably to the bracket. The rotation of the bar in one direction operates one of the fingers and the rotation of the bar in the opposite direction operates the other finger to perform its function. The fingers are thus operated in opposite directions toward each other and the guide provided limits movement of the fingers in opposite directions away from each

other and guide the fingers from their normal to operated positions.

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

Fig. 1 shows a front view of the cross-bar structure disclosed in the above-mentioned patent;

Fig. 2 shows a fragmentary perspective view of a horizontal bar with a selecting finger mechanism in accordance with the preferred form of the applicant's invention. It also shows two actuating springs and their associated contact sets and a portion of a corresponding vertical bar; and

Figs. 3, 4, 4A, 5 and 6 show four other modified forms of the selecting finger mechanism in accordance with the applicant's invention.

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. To clearly show the arrangement of these contact strips the first three horizontal bars have been partially cut away to disclose the first vertical unit. The selecting finger mechanism for selecting the various rows of horizontal contacts to be actuated is shown at 18. The upper straight selecting finger is marked 19 and terminates in a coil 20 at right angles to the longitudinal direction of this finger 19 and is located immediately above the horizontal bar 5. This coil then extends into a loop at 21 and from there it is formed into another loop 22. The latter loop is then extended into another loop 23 which terminates into a coil 24 ending in other straight selecting finger 25. The coil 24 is located at right angles to the longitudinal direction of the finger 25. The loops 21 and 23 engage lugs 25 extending upwardly and downwardly from a bracket 27 which is secured to the horizontal bar 5. This bracket 27 extends inwardly at right angles to the bar in two members, terminating in loops or guiding apertures 28 and 29 through which the straight fingers 19 and 25 project, respectively. In gen-

eral, the horizontal bar 5 may be actuated to rotate in one direction to actuate selecting finger 19 to engage the associated actuating spring such as 16 to select the upper row of horizontal contacts such as 15 by the operation of the magnet 30. This bar may be rotated in the opposite direction to actuate the straight selecting finger 25 to engage the corresponding actuating spring such as 17 to select the second row of horizontal contacts 15 for engagement with the vertical row 14. The bar is actuated in this direction by the magnet 32. Each vertical operating bar 6 may be rotatably guided by a frame member 33 and be actuated by a magnet 34 to cause it to establish a connection as will be hereinafter described in detail. The members 33 are secured to the upper and lower horizontal frame members 1 and 2 while the horizontal bars are pivotally supported between frame members 3 and 4. For a complete description of further details of switch structures having these essential parts reference may be had to the above-mentioned patent.

The operation of this switch structure with the applicant's selecting finger mechanism attached may be described in connection with the perspective view shown in Fig. 2. For example, if the horizontal bar 5 is operated by magnet 30 acting on the armature 36, the straight finger 19 of the selecting finger mechanism will be moved downward and guided in the aperture 28 of the bracket 27 to engage a projection 37 on the upper actuating spring 16 and come to rest in a position in front of the U-shaped portion 38 of this spring. If now the vertical bar 6 is operated by the magnet 34 acting on the armature 40, the guiding member 41 secured to a bar 42 connected to an angular projection 43 on bar 6 will press the selecting finger 19 against the actuating spring 16. This spring in turn is pressed against the corresponding group of horizontal contacts 13 which now connect respectively with the vertical contacts 14. The vertical bar now holds these connections while the selecting bar 5 is returned to normal. The selecting finger 19 is held between the actuating spring 16 and the member 41. If the bar 5 is rotated in the opposite direction by having the magnet 32 act on the armature 45, the selecting finger 25 will be moved upward and guided in the aperture 29 of the bracket 27 to engage a projection 46 on the actuating spring 17 and come to rest in a position in front of a U-shaped portion 48 of this spring. The vertical bar 6 and its member 41 are then operated and the selecting finger 25 will be pressed against the actuating spring 17 which in turn will act on the second horizontal row of contacts 15 to connect respectively with the vertical contacts 14. The horizontal bar may then be returned to normal leaving the selecting finger 25 engaged until the bar 6 is released, when the finger 25 will be released and the spring 17 and the contacts 15 restored to normal. It should be noted that the guiding member 41 is provided with a slot 50 that limits the movements of the selecting fingers 19 and 25 so that when the horizontal bar 5 is rotated to lower selecting finger 19, the selecting finger 25 is held against the lower edge of the slot 50 to prevent it from moving downward, while if the bar 5 is rotated in the opposite direction, to raise the selecting finger 25, the selecting finger 19 is held against the upper edge of the slot 50 to prevent it from moving upward. It is readily seen that if a finger such as 19 is held by a vertical bar and the horizontal bar is returned to normal and then is again operated for

the selection at other points in the switch, the finger 19 will not be greatly disturbed by these movements as the coil 20 will easily yield and permit the bar to be readily rotated in either direction. If the bar is rotated to select an upper finger the coil 20 will be slightly twisted in one direction and if the bar 5 is rotated in the opposite direction the coil 20 will be slightly twisted in the opposite direction.

In Fig. 3 has been shown a modified form of the selecting finger mechanism with the upper straight finger 19 and coil 20 connected directly to the bar 5 by a U-shaped extension 52 which is provided with a hook 53 for the guiding of the finger 19. Similarly, the straight finger 25 with its coil 24 is connected to the bar 5 by a U-shaped extension 54 having a hook 55 for the guiding of the finger. The extensions 52 and 54 may be staked to the bar in slots cut transversely therein. In Figs. 4 and 4A is shown another form of the selecting finger mechanism in which the fingers 19 and 25 and coils 20 and 24 are connected together with a U-shaped portion 56 which is secured to the bar 5 by a screw 57.

In Fig. 5 the fingers 19 and 25 with their coils 20 and 24 are connected together by a portion 58 that is secured to the bar by being partially wrapped around it and soldered or otherwise fastened in place. Fig. 6 shows the fingers secured to the bar 5 by a U-shaped portion 59 that is inserted in a hole in the bar. In the preferred form shown in Fig. 2 and in the modified forms shown in Figs. 4, 4A and 6, it will be seen that the selecting finger mechanisms may be easily detached from the bar; in the preferred form by unhooking it from the lugs 25 on the bracket 27, in Fig. 4 by removing the screw 57, and in Fig. 6 by merely pulling the U-shaped portion 59 out of the hole in the bar.

What is claimed is:

1. The combination in a switch of sets of contacts, a rotatable bar, two selecting fingers terminating in individual coils secured to said rotatable bar, means responsive to the rotation of said bar in one direction for advancing only one of the two fingers to its operative position and responsive to the rotation of said bar in the opposite direction for advancing only the other of the two fingers to its operative position, and means responsive to the movement of either of said two fingers for operating a corresponding set of contacts.

2. The combination in a switch of sets of contacts, a rotatable bar, two selecting fingers formed with individual coils from a single length of spring wire which is attached to said bar at a point intermediate said coils, means for rotating said bar in either of two directions to advance said fingers into operative position, and means controlled by either of said fingers when in its operative position for actuating a set of said contacts.

3. The combination in a switch of sets of contacts, a rotatable bar, a mounting bracket secured to said bar, two selecting fingers terminating in individual coils detachably mounted on said bracket, means responsive to the movement of the bar for advancing either of said fingers to its operative position independent of the other finger, and means responsive to the movement of either of said fingers for operating corresponding set of contacts.

4. The combination in a switch of sets of contacts, a rotatable bar, two straight selecting fingers terminating in individual coils with their axes at right angles to the longitudinal direc-

tion of said fingers and with said coils secured to said bar, means responsive to the rotation of said bar in one direction for advancing only one of said fingers to its operative position and responsive to the rotation of said bar in the opposite direction for advancing only the other of said two fingers to its operative position and means operative on the advancement of either of said two fingers to its operative position for actuating a corresponding set of contacts.

5. The combination in a switch of sets of contacts, a select bar, two selecting fingers terminating in individual coils secured to said bar, means responsive to the rotation of said bar in one direction for advancing one finger only to its operative position and responsive to the rotation of said bar in the opposite direction for advancing only the other finger to its operative position, an operate bar, means for moving said operate bar to cause a positioned finger to close a corresponding set of contacts and to hold said positioned finger in fixed position, the coil of said positioned finger being sufficiently yielding to permit subsequent rotations of said select bar to take place without disturbing the fixed position of said positioned finger.

6. The combination in a switch of contact sets, a rotatable bar, a bracket secured to said bar, a pair of contact operating fingers mounted on said bracket, each comprising helical coils and a straight comparatively stiff member, said stiff members extending in the same direction and capable of participating each in a different rotating movement of said bar under the control of said bracket, a guide member independent of said fingers for maintaining one of said stiff members in a certain position while the other is moved from its normal to its operative position by said bracket and means controlled by each of said stiff members in its operative position for closing a corresponding set of contacts.

7. The combination in a switch of contact sets, a rotatable bar, a mounting bracket secured to said bar, a pair of contact operating fingers detachably mounted on said bracket each comprising a helical coil and a straight comparatively stiff member, said straight members extending in the same direction, said bracket being so shaped and located as to cause each straight member to participate in a different rotating movement of said bar, a guide member independent of said straight members for maintaining one of said straight members in a stationary position while the other is moved to its operative position, and means controlled by either of said straight members in operative position for closing a corresponding set of contacts.

8. The combination in a switch of sets of contacts, a rotatable bar, two selecting fingers each comprising a straight member continuing at its base in a coil terminating in a guide hook engaging the straight member, means for securing said guide hooks to said bar, said hooks being so shaped and located that the movement of the bar in one direction will advance one of said members in an operative position and the move-

ment of the bar in another direction will advance the other member in its operative position, and means controlled by either of said members in operative position for closing a corresponding set of contacts.

9. The combination in a switch of sets of contacts, a rotatable bar, two selecting fingers terminating in individual guide hooks engaging their corresponding fingers and secured to said bar, said hooks being so shaped and located that the movement of the bar in one direction advances one of said fingers to its operative position under control of the associated hook and the movement of the bar in another direction advances the other finger to its operative position under control of its associated hook, and means controlled by either of said fingers in operative position for closing a corresponding set of contacts.

10. A contact selecting and operating mechanism for cross-bar switches comprising a rotatable bar, a mounting bracket secured to said bar, a selecting member having a portion removably mounted on said bracket, said portion continuing in opposite directions into two helical coils each terminating in a straight selecting finger extending at right angles to the axis of its associated coil and to the axis of the bar, said fingers extending in the same direction and in parallel relation to each other, a stop member for holding said fingers in this relation to each other, mounting brackets being provided with a guide for each finger, one of said guides adapted to steer one of said fingers in one direction with the bar rotated in the same direction and the other guide adapted to steer the other finger in the opposite direction when the bar is rotated in its opposite direction, the direction of movement of said fingers being such that the fingers move towards each other, another controlling guide member for preventing movement of the fingers in opposite directions away from each other from a normal position, and means associated with said last-mentioned controlling guide member and controlled by the fingers in their operated position for closing a corresponding set of contacts.

11. The combination in a selecting switch of two sets of contacts located one above the other, a select bar located in a position equidistant from the two sets of contacts and in front thereof, a magnet located above said bar, a magnet located below said bar, two selecting fingers terminating in individual coils secured to said bar and extending one above and the other below the bar, means responsive to the energization of the magnet above the bar for rotating it to advance the upper finger to its operated position in front of the upper set of contacts, means responsive to the energization of the magnet below the bar for rotating it to advance the lower finger to its operated position in front of the lower set of contacts, and means responsive to the movement of either of said fingers for operating the corresponding set of contacts.

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