Aug. 8, 1944. V. L. MARES 2,355,457

MECHANISM FOR ELECTRIC SWITCHES

Filed Feb. 4, 1943 2 Sheets-Sheet 1

Fig. 1.

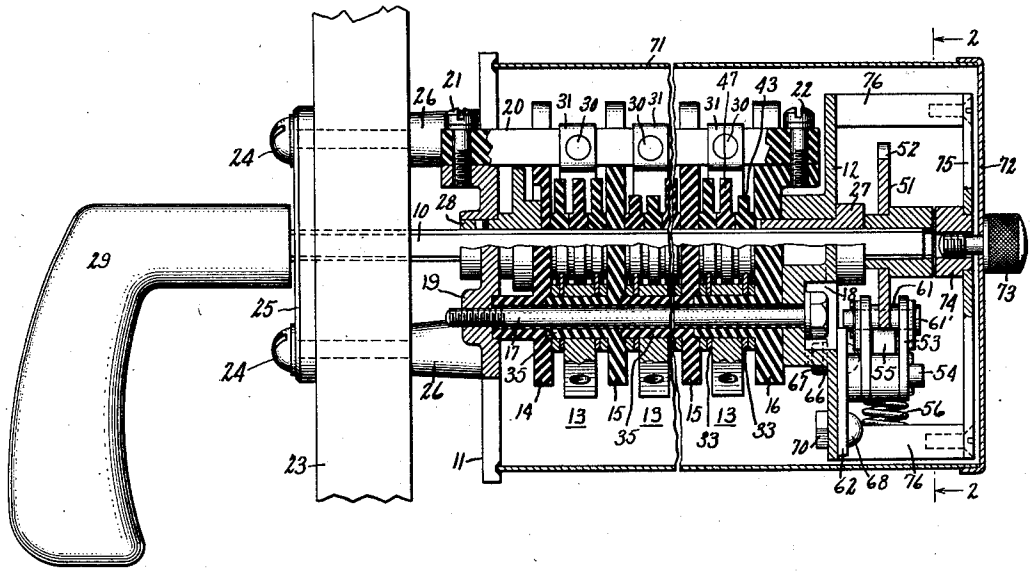


Fig. 2.

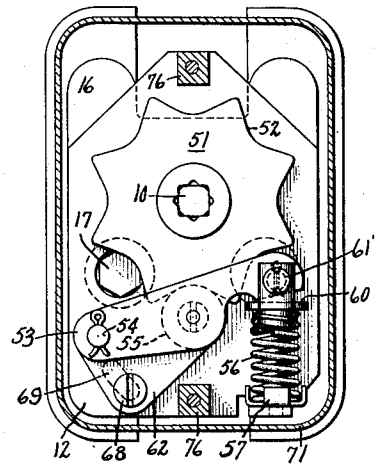


Fig. 3.

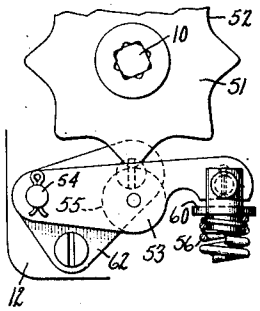
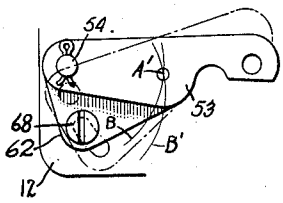


Fig. 4.



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MECHANISM FOR ELECTRIC SWITCHES

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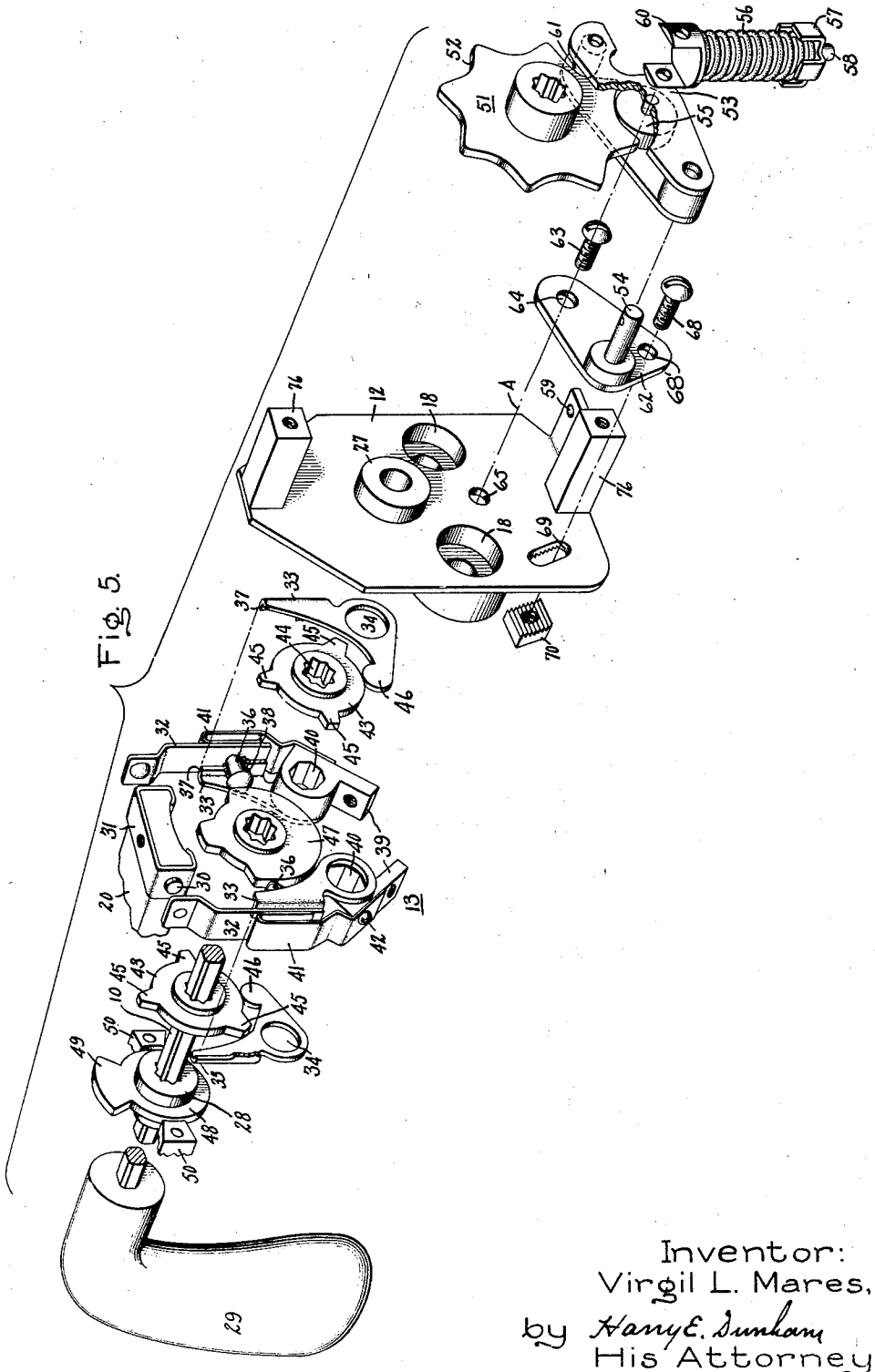


Fig. 5.

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MECHANISM FOR ELECTRIC SWITCHES

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Application February 4, 1943, Serial No. 474,633

8 Claims. (Cl. 74—97)

My invention relates to improvements in mechanism for electric switches and more particularly for mechanism for locating and maintaining the operating member of a switch, and especially a manually operated multistage switch, in the desired switching position.

In switches for the control of a plurality of circuits, it is common to have a plurality of switching stages, each of which comprises relatively movable cooperating contacts and all of which are arranged to be actuated by the turning of a rotatably mounted member. This member may be manually or otherwise actuated. In order to stop the member in the correct position, it is necessary to have some form of centering or locating mechanism which not only will provide the necessary warning or "feel" for the operator to stop turning through the desired position, but also will center the mechanism and maintain the desired switching position against shocks, vibrations, etc. The force for this centering action may be developed by stressing suitable biasing means in which energy is stored during the actuation of the switch operating member. Since the number of switching stages may vary widely in dependence on the number of circuits to be controlled, the centering force required will vary accordingly by reason of the increased load to be actuated. Likewise, the biasing means must exert a greater centering action. Also, operators have decided preferences concerning the "feel." One wants a stiff switching action, and another a weaker action. It must therefore be possible to vary the effect of the biasing means over a wide range in order to take care of these conditions and desires. Space limitations in these switches as well as general inaccessibility after installation complicate the matter because of the difficulty of providing biasing means, such as springs, capable of covering a sufficiently wide operating range to say nothing about the necessity for a simple and relatively economical arrangement whereby the necessary adjustment can be readily performed whether or not the switch is mounted on the switchboard.

An object of my invention is to provide for a switch having an operating member movable to a plurality of positions to control the different switching operations, improved means for locating and maintaining the operating member in the correct position for each switching operation. Another object of my invention is to provide an improved locating and maintaining means which is applicable over a wide range in the number of stages of a multistage switch and which can readily be adjusted to the number of stages involved in any particular switch and to the desire of the operator. A further object of my invention is to provide an improved locating and maintaining means which is compact, easily adjusted, simple in structure, and economical in cost. These and other objects of my invention will hereinafter appear in more detail.

In accordance with my invention, I provide for a switch having an operating member movable to a plurality of positions to control the different switching operations, improved means for locating and maintaining the operating member in the correct position for each operation. Also in accordance with my invention, this improved means comprises an element provided with a dentate surface and mounted to partake of the movement of said operating member and a follower which is pivotally mounted for engagement with the dentate surface and which is biased into engagement with this surface. Further in accordance with my invention, I provide means for varying the effect of the biasing means by changing the position of the pivotal axis of the follower and this means is so constructed and arranged as to insure the return of the follower to the correct holding position independently of the magnitude of the bias.

My invention will be better understood from the following description when considered in connection with the accompanying two sheets of drawings, and its scope will be pointed out in the appended claims.

In the accompanying drawings, Fig. 1 is a longitudinal vertical section, partly in elevation, of a multistage switch embodying my invention; Fig. 2 is a part sectional view on the line 2—2 of Fig. 1; Figs. 3 and 4 are fragmentary views similar to Fig. 2 explanatory of the operation of my invention; and Fig. 5 is an exploded perspective view of the switch disclosed in Fig. 1, some parts being omitted.

In the multistage switch shown for the purpose of illustrating my invention, an operating member such as a shaft 10 is rotatably supported in front and rear frames 11 and 12, respectively. Between these frames is positioned a plurality of switching stages 13, three of which appear in Fig. 1 and only one in Fig. 5. These switching stages are separated from each other and from the end frames by interlocking insulating barriers 14, 15 and 16. Two shaft-insulated bolts 17, which have their heads in recesses 18 in the rear frame, pass through holes in the rear frame 12 and the barriers 16, 15 and

14 and engage threaded bosses 19 on the front frame 11 to maintain the assembly. A stationary contact carrier 20 engages notches in the front frame 11 and in the barriers 14, 15 and 16 and is secured to the front frame and the barrier 16 by screws 21 and 22, respectively. This arrangement increases the rigidity of the assembly. As shown, this assembly is secured to a switchboard or like support 23 by screws 24 extending through an escutcheon plate 25 and the support 23 and engaging threaded portions 26 of the front frame 11. The shaft 10 is illustrated as of square cross-section with the corners flattened. Also as shown, the shaft 10 is mounted in a bushing 27 in the rear frame 12 and is secured to an insulating bushing 28 supported in the front frame 11. For turning, the shaft 10 is provided with a handle 29 which may be in the form of a pistol grip as shown. The handle 29 is suitably recessed for receiving the outer end of the shaft 10 and is provided with suitable means, such as a set screw, not shown, for maintaining it on the shaft.

Each switching stage comprises two stationary contacts 30 mounted one on each end of a conducting bridge 31 which is clamped or otherwise suitably secured to the contact carrier 20, as more celarly shown in Fig. 5. Cooperating with the stationary contacts 30 are movable contacts 32 which are resiliently mounted on a generally U-shaped carrier 33. The legs of these carriers are provided with circular openings 34 which serve to mount the carriers rotatably on the interlocking lugs 35 of the barriers 16 and 15. The resilient mounting comprises a headed pin or rivet 36 which rests in a slot in the cross piece 37 of the carrier 33 and carries a spring 38 which biases the contact 32 against this cross piece and yet allows movement relatively thereto. Mounted on the barrier lugs 35, which may be octagonal in shape, are terminals 39 which are provided with holes 40 shaped to correspond to the lugs 35 so as to prevent turning thereon. Each contact 32 is connected to its associated terminal 39 by a flexible connection 41 which is secured to the contact by the rivet 36 and to the terminal by a screw 42.

For positively actuating the movable contacts 32 to and holding them in the circuit closing position, a closing cam 43 is provided for each movable contact. As shown, these cams 43 are provided with central openings 44 so shaped that the cams can be mounted in eight different positions on the shaft 10. Each cam 43 is provided with a plurality of projections 45 which are arranged to engage, upon rotation of the shaft 10, an arm or extension 46 on one leg of the associated contact carrier 33 so that when a projection engages this arm, the contact 32 is moved to and held against contact 30. The cams 43 may be staggered so as to obtain a sequential closing of the two movable contacts 32. When the cams 43 are so positioned, as shown in Fig. 5, that the arms 46 are between the projections 45, the contacts 32 may be moved to the open position. For effecting this movement, there is provided an opening cam 47 which is mounted on the shaft 10 between the two closing cams 43. Its angular position on the shaft 10 and its peripheral contour relatively to the cams 43 are such that it engages the heads of the pins 36 to move the contacts 32 out of engagement with the cooperating contacts 30 when the arms 46 of the carriers 33 engage the lower surfaces of the cams 43, as shown more clearly in Fig. 5.

In those cases where a limited motion of the shaft 10 is desired, there may be provided a stop mechanism suitable for the purpose desired. The particular stop mechanism illustrated comprises a stop wheel 48 which is mounted on the bushing 28 so as to turn therewith. The stop wheel 48 has a projection 49 in the path of movement of which are positioned stops 50 at angular displacements corresponding to the shaft movement desired. As shown in Fig. 5, there are two stops 50 so positioned that the shaft may be turned from the position shown in either direction 45°. The stops 50 may be mounted on the front frame 11.

From the foregoing, it will be apparent that a practically unlimited number of switching arrangements can be provided not only as to the number of circuits controlled but also the sequences of their control. But it is important that, for each switching stage, the parts be located and maintained in the necessary position to complete or to interrupt the desired circuits. For this purpose, I provide a mechanism by means of which the desired centering action is readily available for a wide range in the number of switching stages and also the desire of the operator for that "feel" peculiar to his own judgment. As shown, this centering means comprises an element 51 mounted to partake of the movement of the shaft 10 and provided with a dentate contour such as the indented periphery 52. For simplicity, the element 51 may be mounted directly on the shaft 10 so as to turn therewith. In the illustrated embodiment of my invention, the element 51 has eight indentations, but obviously any desired number within practical limits may be provided to suit the particular purpose at hand.

For locating and maintaining the element 51 in the desired positions, I provide a follower 53 which is pivotally mounted as on a pin or shaft 54 for engagement with the indented periphery 52 of the element 51. In order to reduce friction, the following action may be obtained by means of a roller 55 which is rotatably mounted in the follower 53. I term the axis of this roller the centering line of the follower. For maintaining the roller 55 in yielding engagement with the indented surface 52, I provide suitable biasing means such as a spring 56. As illustrated, this spring is a compression spring having its lower end mounted in a base member 57 provided with a projection 58 which seats in a hole 59 on an extension of the rear frame 12. At its upper end, the spring 56 is provided with a yoke 60 which is suitably secured to the free end of the follower 53 as by a pin 61' passing through a spacer 61 positioned between the sides of the follower 53.

In accordance with my invention, I provide means for varying the magnitude of the bias on the follower without the necessity for changing the structural parts themselves. For this purpose, I provide means adapted to be operated to change the position of the pivotal axis 54 of the follower 53 so constructed and arranged as to insure the return of the follower to the correct holding position independently of the magnitude of the bias. For this purpose, the pivotal support 54 of the follower 53 is movably mounted on an arm 62 which is arranged to be turned about an axis which is indicated by the dash-dot line A of Fig. 5 and which is colinear with the axis of rotation of the roller 55 when this roller is in the centering position. As shown,

this is accomplished by having the arm 62 supported on the rear frame 12 so as to turn about an axis in line with the axis of the roller 55 when in the centering position. Thus, the arm 62 may be supported on a bolt 63 which passes through an opening 64 in the arm 62 and an opening 65 in the rear frame 12 and a lock washer 66 to engage a nut 67. In order to maintain the pivotal axis 54 in any desired position, it is arranged to be clamped in such position by suitable means such as a bolt 68 which passes through an opening 68' in the arm 62 and an arcuate slot 69 in the rear frame 12 to engage a serrated nut 70 which interlocks with serrations on the front side of the rear frame 12, as shown in Fig. 5. The center of the arcuate slot 69 is the center of the hole 65, that is to say, it is on the centering axis A of the roller 55. With the foregoing arrangement, it will be apparent that the roller 55 has its axis of rotation mounted for revolution about a center which is arranged for movement in a circular path, arcuate slot 69 having a fixed center in the axis of rotation of the roller when the roller is in the centering position.

Moreover, it will be apparent that merely by turning the arm 62 about its pivotal axis, which is the centering axis of the roller 55, the position of the pivot pin 54 or axis of rotation of the follower 53 may be raised or lowered thereby lowering or raising the free end of the follower 53 to change the compression or load on the spring 56. This will be more readily apparent from the diagrammatic arrangement shown in Fig. 4 which illustrates the highest and lowest positions of the arm 62. Thus, in the highest position of the arm 62, shown by the full lines, the free end of the follower 53 will be in its lowest position to provide the maximum bias; whereas in the lowest position of the arm 62, shown by the dash-dot lines, the free end of the follower 53 will be in its highest position to provide the minimum bias. But whatever the position of the arm 62, it will be apparent that the circular paths of the axis of the roller 55, indicated by the full line circles B and B', all pass through a common point A' which is in the axis A of the roller when the roller is in the centering position. In this way, the centering action can readily be adapted to any desired number of switching stages without the necessity for having a large number of different springs. Furthermore, the adjustment or change of the spring load can be readily made when the switch is assembled and is relatively easy to make with the switch in position on the switchboard.

In order to keep the parts of the switch clean and free of dust and falling objects, it is provided with a cover 71 which is arranged to seat in a slot in the front frame 11 and is held in position by a back plate 72. This plate is locked or held against the cover 71 by a thumb screw 73 which engages a threaded projection 74 mounted on a support 75 secured to arms 76 on the rear frame 12.

While I have shown and described my invention in considerable detail, I do not desire to be limited to the exact arrangements shown, but seek to cover in the appended claims all those modifications that fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Means for locating and maintaining a member movable to a plurality of positions in each of said positions comprising an element provided with an indented surface and mounted to partake of the movement of said member, a roller, and means mounting said roller for engagement with said indented surface including a support for said roller and a mounting for said support comprising an arm mounted for movement about an axis substantially in line with the centering axis of said roller, means for angularly varying the position of said arm, and means biasing said support in a direction to cause said roller to engage said indented surface under a force whose magnitude is dependent on the position of said arm.

2. Means for locating and maintaining a member movable to a plurality of positions in each of said positions comprising an element provided with an indented surface and mounted to partake of the movement of said member, a follower, and means mounting said follower for engagement with said indented surface comprising an arm mounted for movement about an axis substantially in line with the centering axis of said follower, means for holding said arm in a plurality of positions; and means biasing said follower into engagement with said indented surface with a force having a magnitude dependent on the position of said arm.

3. Means for positively locating and maintaining a rotatably mounted shaft successively movable through a plurality of positions in each of said positions comprising an element mounted on said shaft for rotation therewith and having a regularly indented periphery, a roller, and means mounting said roller for engagement with the periphery of said element including a support on which said roller is pivotally mounted and an adjustably positionable pivotal mounting for said support comprising an arm pivoted for a predetermined movement about an axis substantially in line with the axis of said roller when the roller is in the correct holding position and resilient means biasing said support in a direction to cause said roller to engage the periphery of said element under a force having a magnitude dependent on the position of said arm.

4. Means for locating and maintaining a member movable to a plurality of positions in each of said positions comprising an element provided with an indented surface and mounted to partake of the movement of said member, a roller, and means mounting said roller for engagement with said indented surface including a support on which said roller is pivotally mounted and a mounting for said support comprising an arm pivoted for movement about an axis substantially in line with the pivotal axis of said roller when the roller is in the correct holding position, means for holding said arm in a plurality of positions, and means biasing said support in a direction to engage said indented surface under a force having a magnitude dependent on the position of said arm.

5. Means for locating and maintaining a member movable to a plurality of positions in each of said positions comprising an element provided with an indented surface and mounted to partake of the movement of said member, a roller having its axis of rotation mounted for revolution about a center arranged for movement in a circular path having a fixed center in the axis of rotation of said roller when the roller is in the centering position, and means biasing said roller into engagement with said indented surface.

6. Means for locating and maintaining a mem-

ber movable to a plurality of positions in each of said positions comprising an element provided with a dentate surface and mounted to partake of the movement of said member, a follower, means pivotally mounting said follower for engagement with said surface, means biasing said follower into said engagement, and means for varying the magnitude of said bias including means adapted to be operated to change the position of the pivotal axis of said follower constructed and arranged to insure the return of the follower to the correct holding position independently of the magnitude of said bias.

7. In combination, a shaft adapted to be turned successively through a plurality of positions, means for positively locating and maintaining said shaft in each of said positions comprising a regularly dentate element mounted on said shaft to turn therewith, a cylinder, means mounting said cylinder for rolling engagement with said dentate element comprising a support on which said cylinder is rotatably mounted and an adjustably positionable pivotal mounting for said support comprising an arm pivoted for movement about an axis substantially in line with the axis of rotation of said cylinder when the cylinder is in the correct holding position, and a spring having one end fixed and the other end bearing against said support for biasing the support for angular movement in a direction to cause said cylinder to engage said dentate element under a force having a magnitude dependent on the position of said arm.

8. Means for locating and maintaining a member movable to a plurality of positions in each of said positions comprising an element provided with an indented surface and mounted to partake of the movement of said member, a follower, and means mounting said follower for engagement with said indented surface comprising supporting means arranged for movement about an axis substantially in line with the centering line of said follower, means for holding said supporting means in a plurality of positions and means biasing said follower into engagement with said indented surface with a force having a magnitude dependent on the position of said supporting means.

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