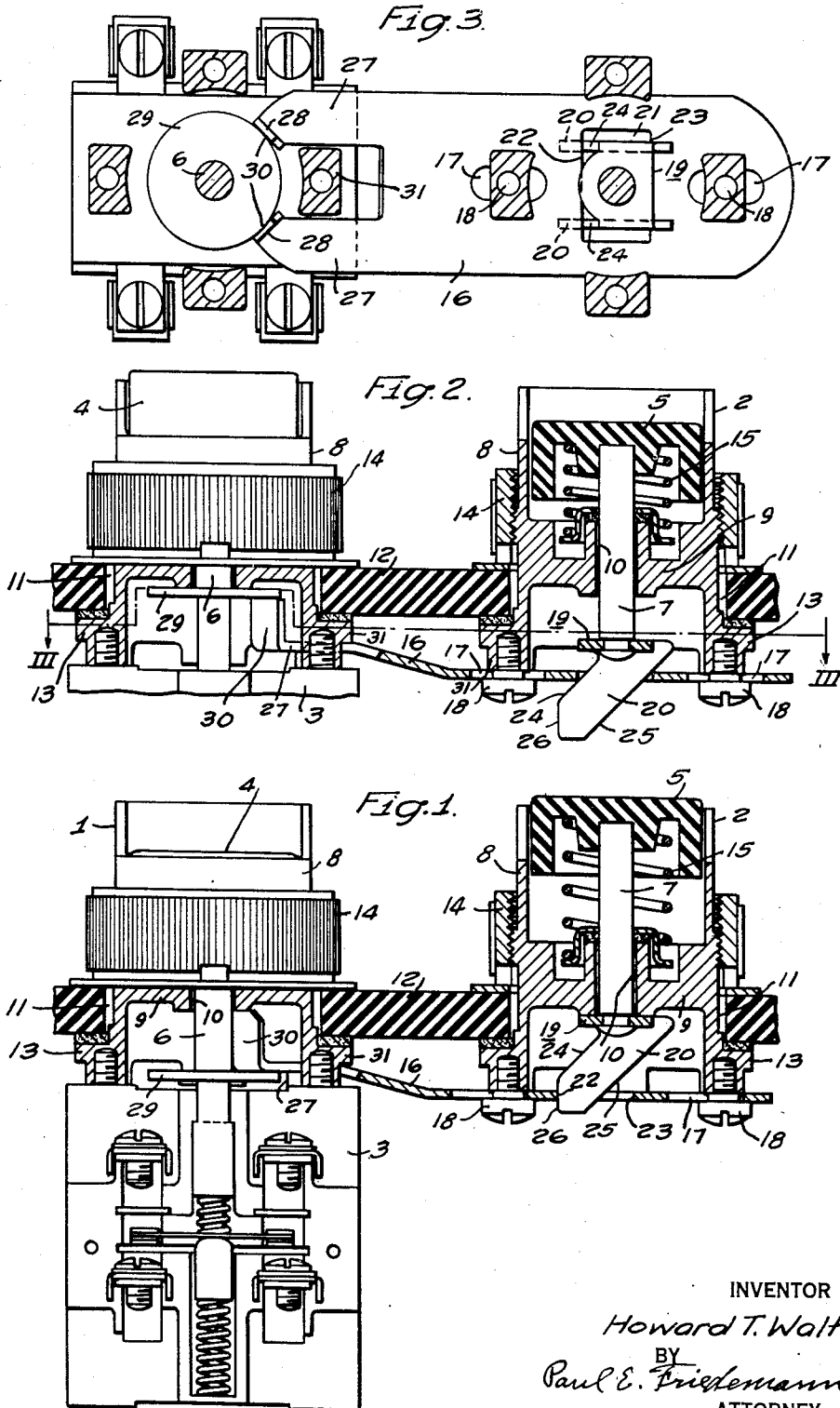


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PUSHBUTTON SWITCH

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PUSH-BUTTON SWITCH

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This invention relates to a pushbutton switch and, more particularly, to an improved arrangement of interlocking mechanism for controlling the operation of a pair of push buttons which is operable to prevent operation of the push buttons other than in an alternate manner.

More specifically, the pushbutton interlocking mechanism of this invention is an improvement on the structure shown in U. S. Patent No. 2,284,813, issued to Clarence E. Gary. In Patent No. 2,284,813 there is shown a pair of manually operable push buttons for operating an electrical contact structure which are provided with an interlocking mechanism operable to maintain and lock one of the push buttons in a depressed or operated position at all times. Upon operation of the other of the push buttons to a depressed position, the interlocking mechanism operates to release the push button previously in a depressed position and to lock the other of the push buttons in the depressed position. By reason of the interlocking mechanism, it is necessary to operate one and then the other of the push buttons in an alternate manner in order to actuate the contact structure controlled thereby and the relative positions of the push buttons is thus operative to indicate the condition of the circuits controlled by the contact structure. The interlocking mechanism comprises a pivoted lever which pivots back and forth between the mechanism operated by push buttons and into and out of interlocking engagement with latching surfaces carried by such mechanism. By reason of the pivotal mounting of the movable interlocking lever, it is necessary that the operating parts of the interlocking mechanism be constructed with fairly close manufacturing tolerances in order to obtain a device that will operate properly. This requirement obviously involves expensive manufacturing operations which are to be avoided if possible.

One of the principal objects of this invention is to provide an improved arrangement of interlocking mechanism of the character referred to which may be produced at a minimum cost without sacrificing any advantages from the standpoint of serviceability in operation.

A further object of this invention is to provide an interlocking member which is mounted for rectilinear sliding movement back and forth between positions respectively operable to lock one of a pair of cooperating and manually operable push buttons in a depressed position.

A still further object of this invention is to provide a novel arrangement of operating mech-

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anism for controlling the rectilinear movement of an interlocking member in response to operation of a pair of alternately operable push buttons controlled thereby.

Other objects and advantages of this invention will become apparent from the following description.

In the drawing, there is shown a preferred embodiment of the invention. In the showing:

Fig. 1 is a side elevational view, parts thereof being shown in vertical section, of electrical contact structure controlled by a pair of push buttons having interlocking mechanism constructed in accordance with the principles of this invention;

Fig. 2 is a view similar to Fig. 1, with the electrical contact structure broken away, showing the push buttons in another position; and

Fig. 3 is a sectional view taken substantially along the line III—III of Fig. 2.

In the drawing, there is shown a pair of push buttons indicated as a whole by the numerals 1 and 2 for controlling the operation of electrical contact structure indicated by the numeral 3. The push buttons 1 and 2 are provided respectively with manually operable pushbutton elements 4 and 5 connected with operating members 6 and 7 for moving the operating members from an upper or unoperated position to a depressed or operated position. The push buttons 1 and 2 are constructed identically and are a type illustrated and described in the copending application of Stanley L. Frank, Serial No. 772,938, filed September 9, 1947, and entitled Electric Switches, to which reference is hereby made. Since the specific structure of the push buttons 1 and 2 forms no part per se of this invention, it will be sufficient to point out that each comprises a cylindrical sleeve 8 having an annular web 9 provided with a cylindrical opening 10 in which the operating members or rods 6 or 7 may be moved vertically. The supporting sleeves 8 are receivable in openings 11 formed in a support 12 and are provided with a flange 13 engageable with one side of the support 12. A clamping ring 14 has threaded engagement with the supporting sleeve 8 on the other side of the support 12 for clamping the supporting sleeve 8 in position on the support 12. A spring 15 is provided in each of the pushbuttons 1 and 2 for biasing the manually operable elements thereof to their upper or unoperated positions.

The interlock or latch of this invention comprises a substantially flat metallic stamping 16 having elongated slots 17 therein for the recep-

tion of threaded fastening elements 18 by which the interlock 16 may be secured to the lower portion of the supporting sleeve 8 of the push button 2, as best shown in Figs. 1 and 2. The fastening elements 18 are drawn up loosely so that the interlock 16 may move rectilinearly back and forth in a direction transversely of the drawing, the slots 17 being elongated to allow for such movement. A camming member 19 constructed of a metal stamping is secured to the bottom of the operating member 7. The camming member 19 is provided with a pair of angularly inclined and depending members 20 receivable in an opening 21 formed in the interlocking member 16. The opening 21 is substantially rectangular in shape and has spaced edges 22 and 23 extending transversely of the interlocking member 16. The angular inclination and shape of the depending members 20 provide an upper camming surface 24, a lower camming surface 25, and an abutting surface 26 for the purpose to be described.

The other end of the interlocking member 16 is bifurcated to provide a pair of arms 27 which straddle part 31 depending from the sleeve 8 to which the electrical contact structure 3 is secured. The part 31 functions in cooperation with the arms 27 to guide the rectilinear movement of the interlocking member 16. The ends of the arms 27 are bent upwardly as at 28 to provide abutting members for a purpose to be described. The operating member 6 is provided with an operating disk or catch 29 which cooperates with the arms 27 and abutting members 28 in a manner to be described.

The structure and operation of the interlocking mechanism will be best understood by considering its function in the different positions of the push buttons 4 and 5. As pointed out above, the interlocking mechanism must be capable of preventing operation of the push buttons 4 and 5 other than in an alternate manner as described in above-mentioned Patent No. 2,284,813.

Referring to Fig. 1, it will be noted that the push button 4 and operating member 6 controlled thereby are in a depressed or operated position and the push button 5 and operating member 7 controlled thereby are in an upper or unoperated position. In this position, the arms 27 of the interlock 16 overlie the operating disk 29 and thus function to prevent movement of the operating member 6 and push button 4 to their upper or unoperated position by the biasing spring (not shown) for the push button 4. As long as the push button 5 is in the upper position, rectilinear movement of the interlock 16 to the right as viewed in Fig. 1 will be prevented by reason of the abutting surfaces 26 on the depending camming members 20 being in abutting engagement with the edge 22 of opening 21 in the interlock 16. The interlock 16 will thus be maintained in a position locking the operating member 6 against movement.

To actuate the electrical contactor, it is necessary to move push button 5 to its depressed or operated position which action releases push button 4 and operating member 6 for movement under their bias to an upper or unoperated position. As push button 5 is depressed, the operating member 7 will move downwardly and carry with it the camming member 20. The first action that takes place during downward movement of the cam 20 will be the movement of the abutting surface 26 out of engagement with the edge 22 to free the latch 16 for movement to the right, as viewed in Fig. 1. Continued downward move-

ment will then engage the camming surfaces 25 with the edge 23 and subsequent movement will operate to cam the latch 16 to the right as viewed in Fig. 1. The camming action accomplished by the camming surfaces 25 will effect a withdrawal of the arms 27 from a position overlying the operating disk 29. As the push button 5 moves into its fully depressed position, the arms 27 will be completely disengaged from the operating disk 29 and the operating member 6 and push button 4 will move upwardly to their unoperated position as shown in Fig. 2. During the camming movement of the latch 16 to the right, the edge 22 will move inwardly toward the camming surfaces 24 and will engage with such surfaces as the push button 5 moves into its depressed position as shown in Fig. 2. Engagement of the edge 22 with the camming surfaces 24 will be effective to prevent upward movement of the operating member 7 and its push button 5 as long as movement of the latch 16 to the left from the position shown in Fig. 2 is prevented. Movement of the latch 16 to the left is prevented by the operating disk 29 upon movement of the operating member 6 out of its depressed position. As the operating member 6 moves out of the position shown in Fig. 1, the edge of the operating disk 29 moves into abutting engagement with the surfaces 30 of the upturned members 28. The upward members 28 are inclined angularly with respect to the axis of movement of the latch 16 so that the surfaces 30 will engage tangentially with the edge of the operating disk 29 at spaced points. It will thus be seen that the abutting engagement of the disk 29 with the surfaces 30 will be effective to prevent movement of the latch 16 and thereby return of the push button 5 to its upward position as long as the push button 4 remains out of its operated or depressed position. The push buttons 4 and 5 will thus remain in the relative position shown in Fig. 2 as long as push button 4 is not moved to its depressed position.

Upon movement of the push button 4 to its depressed position, the edge of the operating disk 29 will move out of abutting engagement with the surface 30 to free the interlock 16 for movement to the left as viewed in Fig. 2. When the latch 16 is thus permitted to move to the left from the position shown in Fig. 2, the bias provided by the spring 15 on the push button 5 becomes effective to move the operating member 7 in an upward direction. This action will impart an upward movement to the cam 20 and its camming surfaces 24 will move the latch 16 to the left to return it to the position shown in Fig. 1 with the arms 27 overlying the disk 29 to lock the push button 4 in its depressed position. The final upward movement of the push button 5 will move the abutting surface 26 into a position preventing movement of the latch 16 to the right.

From the foregoing it will be apparent that the latch 16 and parts cooperating therewith are effective to prevent operation of the push buttons 4 and 5 other than in an alternate manner. Attention is particularly invited to the fact that the latching and unlatching operations accomplished by the latching member 16 are effected by a movement of the member 16 which is entirely rectilinear with respect to the support 12. Attention is also invited to the fact that the interlocking member 16 may be constructed from sheet metal by a comparatively simple and in-

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expensive stamping operation. It is also to be noted that the camming member 20 may likewise be constructed from sheet metal by an inexpensive stamping operation. By reason of the simplicity of the interlocking mechanism comprising the interlock 16, disk 29 and camming member 20, it will be apparent that the parts may be assembled with a minimum of time and effort and considerable care need not be given the assembly operations to insure proper operation of the interlocking mechanism. Since the locking operations are accomplished by a rectilinear sliding movement of the latch 16 with respect to the support 12, it will be apparent that there are no complicated movements of the operating mechanism which are apt to become defective during the use of the apparatus after installation. It will thus be seen that expensive servicing operations subsequent to assembly are completely minimized.

While the support or base 12 has been shown as horizontal, the operators 6 and 7 have been referred to as vertically movable, the latch 16 is shown and has been designated as operable in a horizontal direction, etc., such positioning of the elements in the specification and the appended claims is merely chosen to facilitate the disclosure and to simplify the language of the claims. Obviously, the base 12 may be in any position in space with the parts in the same relative positions as shown in the drawing without affecting the invention.

Since certain changes may be made in the above-described construction and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all the matter contained in the above description and shown in the accompanying drawing shall be considered as illustrative and not in a limiting sense.

I claim as my invention:

1. Latching apparatus comprising a support, a pair of operating members respectively movable between operated and unoperated positions and having a bias to one of said positions, a latch mounted for rectilinear sliding movement on said support between positions respectively in latching engagement with said operating members, means responsive to operation of said operating members for effecting a rectilinear movement of said latch into latching engagement with the operating member moved to its operated position and out of latching engagement with the other of said operating members to release said other member for movement under its bias to the unoperated position, and cooperating parts respectively on said operating members and latch which are movable into abutting engagement when the operating member released by said latch moves to its unoperated position for preventing movement of said latch out of latching engagement with the operating member in its operated position.

2. Latching apparatus comprising a support, a pair of operating members respectively movable between operated and unoperated positions and having a bias to one of said positions, a latch mounted for rectilinear sliding movement on said support between positions in which it is respectively operable to latch one of said operating members in its operated position, a cam connected to and movable with one of said members, said cam having a camming surface operable to cam said latch toward and into locking engagement with said one member upon move-

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ment thereof to its operated position, said latch movement being effective to release said other member for movement by its bias to its unoperated position, and cooperating parts respectively carried by said other member and latch which are movable into abutting engagement for preventing movement of said latch while said other member is out of its operated position.

3. Latching apparatus comprising a support, a pair of operating members respectively movable between operated and unoperated positions and having a bias to one of said positions, a latch mounted for rectilinear sliding movement on said support between positions in which it is respectively operable to latch one of said operating members in its operated position, a cam connected to and movable with the other of said members, a catch connected to and movable with the said one of said members, said latch having a part thereof positioned over and engageable with said catch for locking said one member in operated position, said cam having a camming surface engageable with said latch for moving said latch rectilinearly away from said one member and out of locking engagement with said catch upon movement of said other member to its operated position, the movement imparted to said latch by said cam being effective to move said latch into a position locking said other member against movement out of its operated position, and an abutting member carried by said latch which is engageable with said catch for preventing movement of said latch out of its locking position with respect to said other member when said one member is out of its operated position.

4. Latching apparatus as claimed in claim 3 wherein said cam is provided with a second camming surface operative to cam said latch toward said one member upon movement of said one member to its operated position in which position said catch and abutting member are out of engagement with each other.

5. Latching apparatus as claimed in claim 4 wherein said cam is provided with a third surface movable into abutting engagement with said latch upon movement of said one member to its operated position for preventing movement of said latch during the time in which said one member is in its operated position.

6. In a mechanical interlock for electric switching means, in combination, a horizontal base, a first elongated member mounted for limited vertically guided movement from a top end position to a bottom end position, a spring for biasing the member to its top end position, a second elongated member mounted beside the first elongated member and also mounted for limited vertically guided movement from a top end position to a bottom end position, a spring for the second elongated member for biasing the second member to its top end position, a latch bar mounted for horizontal rectilinear movement with the ends of the bar being disposed in cooperative relation respectively with the elongated members, means for actuating said bar toward the first elongated member upon operation of the first elongated member to its bottom end position, means for actuating said bar toward the second elongated member upon operation of the first elongated member to its top end position by its biasing spring, means associated with the end of the bar adjacent the second elongated member for locking the second elongated member to its bottom position when said second elongated

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member is in its bottom end position, and cam means at the end of the bar adjacent the first elongated member for locking the bar against movement toward the first elongated member.

7. In a mechanical interlock for electric switching means, in combination, a horizontal base, a first elongated member mounted for limited vertically guided movement from a top end position to a bottom end position, a spring for biasing the member to its top end position, a second elongated member mounted beside the first elongated member and also mounted for limited vertically guided movement from a top end position to a bottom end position, a spring for the second elongated member for biasing the second member to its top end position, a latch bar mounted for horizontal rectilinear movement with the ends of the bar being disposed in cooperative relation respectively with the elongated members, means for actuating said bar toward the first elongated member upon operation of the first elongated member to its bottom end position, means for actuating said bar toward the second elongated member upon operation of the first elongated member to its top end position by its biasing spring, and cam means associated with the end of the bar adjacent the second elongated member for locking the second elongated member to its bottom position when said first elongated member is in its top end position.

8. In a mechanical interlock for electric switching means, in combination, a horizontal base, a pair of pushbuttons mounted side-by-side on the base to thus comprise a left pushbutton and a right pushbutton, each pushbutton having a spring for biasing it to a top position, each pushbutton being operable to a bottom position, an elongated latch element mounted for horizontally guided movement on the base and having its ends adjacent the respective pushbuttons, means on the latch element for locking the left pushbutton in its bottom position, means on the right pushbutton for locking the latch element against movement from its locking position while said right pushbutton is in its top position, means on said right pushbutton for actuating the latch element to unlock the left pushbutton upon actuation of the right pushbutton to its bottom position, and means on the left pushbutton for locking the latch element against movement from its second locking position while said left pushbutton is in its top position.

9. In a mechanical interlock, in combination, a base, an operating member mounted on said base for rectilinear movement between two end positions, a spring for biasing the operating member to one of its end positions, a second operating member mounted on the base for rectilinear movement between two similar end positions, a spring for biasing the second operating member to one of its end positions, a bar mounted for

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rectilinear movement on the base transverse of the movement of said operating members, said bar having two cam surfaces, the first operating member being provided with a cam having one surface engaging one of the cam surfaces on the bar to operate said bar away from the second operating member upon manual actuation of the first operating member to one end position against its spring bias and having another surface engaging the other cam surface of the bar to operate said bar toward the second operating member upon movement of the first operating member to its second end position by the biasing spring of the first operating member, and means on said bar adjacent the second operating member and coacting therewith for latching the first operating member in its first end position.

10. In a mechanical interlock, in combination, a base, an operating member mounted on said base for rectilinear movement between two end positions, a spring for biasing the operating member to one of its end positions, a second operating member mounted on the base for rectilinear movement between two similar end positions, a spring for biasing the second operating member to one of its end positions, a bar mounted for rectilinear movement on the base transverse of the movement of said operating members, said bar having two cam surfaces, the first operating member being provided with a cam having one surface engaging one of the cam surfaces on the bar to operate said bar away from the second operating member upon manual actuation of the first operating member to one end position against its spring bias and having another surface engaging the other cam surface of the bar to operate said bar toward the second operating member upon movement of the first operating member to its second end position by the biasing spring of the first operating member, means on said bar adjacent the second operating member and coacting therewith for latching the first operating member in its first end position, and means on said bar adjacent the first operating member and coacting therewith for latching the second operating member in its first end position.

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