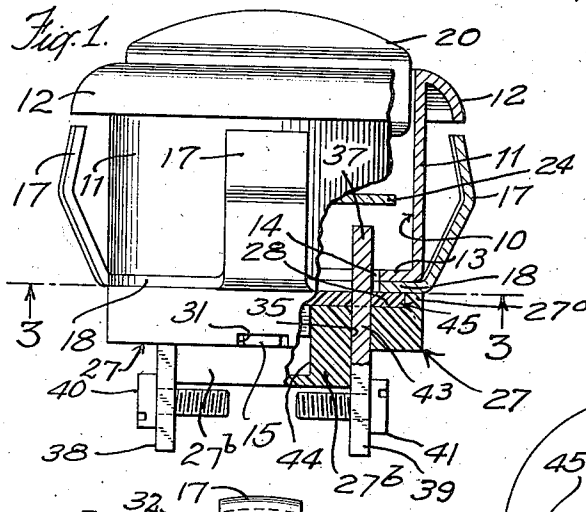
Sept. 9, 1947. C. MILLER 2,427,015

PUSH BUTTON SWITCH CONSTRUCTION

Filed June 5, 1946

Fig. 1.



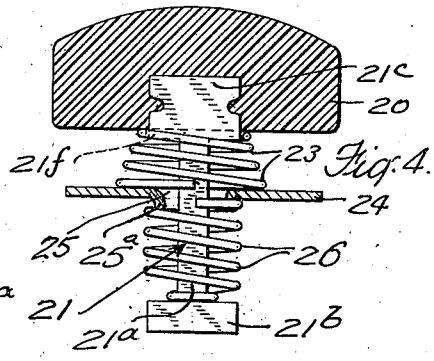


Fig. 4.

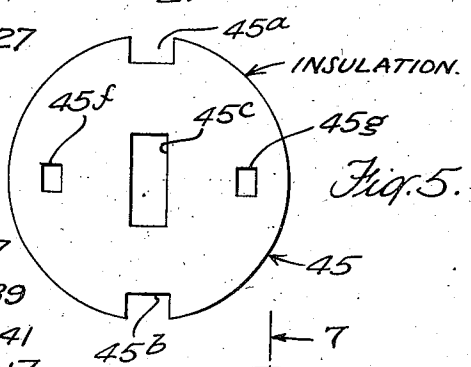


Fig. 5.

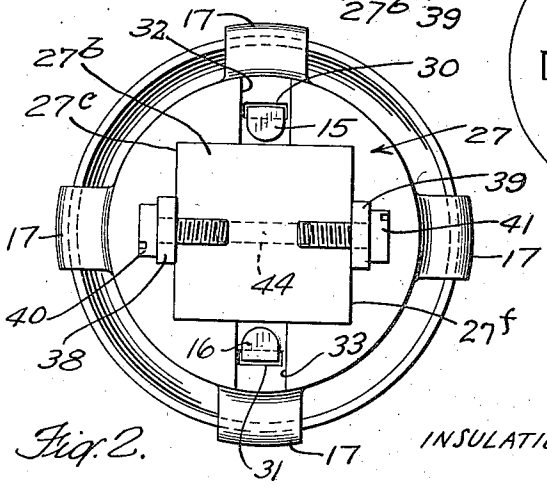


Fig. 2.

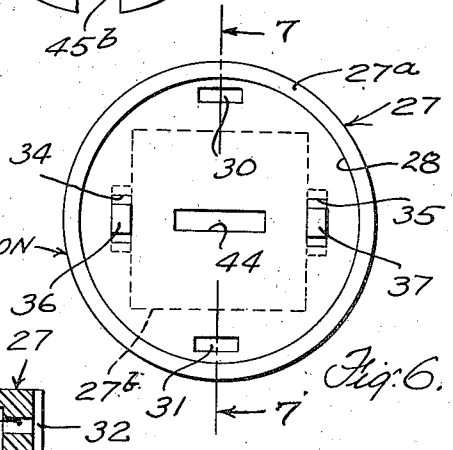


Fig. 6.

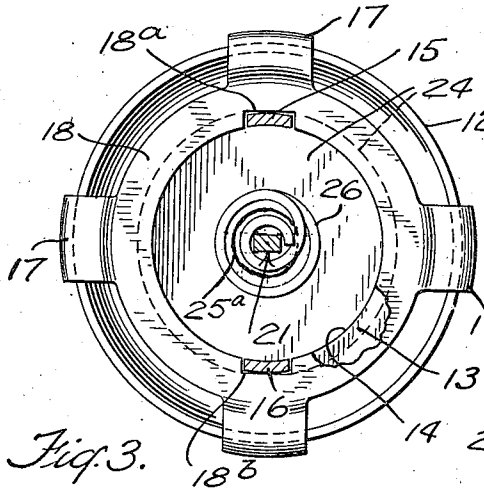


Fig. 3.

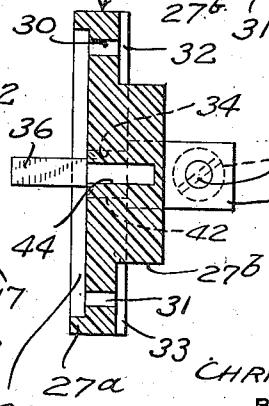


Fig. 7.

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PUSH-BUTTON SWITCH CONSTRUCTION

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Application June 5, 1946, Serial No. 674,454

10 Claims. (Cl. 200—159)

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This invention relates to push button switch construction.

One of the objects of this invention is to provide a push button switch construction that can be made of individually simple and inexpensive parts and capable of ease and dependability of assembly. Another object is to provide a push button switch construction the parts of which can be assembled with facility and dependability in the form of several sub-units, and the sub-units in turn assembled in a simple and reliable manner. Another object is to provide, in a push button switch construction and more particularly in a structure of the so-called "flush" type, dependable features of structure and assembly for dependably maintaining certain movable conductive parts electrically insulated from certain other conductive parts, more particularly the conductor-connecting element or elements. Another object is to employ, in structures of the above mentioned kind, parts made of non-conductive material and constructed so as to be capable of simple and inexpensive production as by molding, and still-shaped to achieve, in assembly, the desired co-action with other and conductive parts.

Another object is to achieve a small and compact switch construction which will be of strong and durable construction and of dependable and long-lasting electrical action. Another object is to provide a flush type of push button switch structure, capable of being set into a hole in a wall or the like, in which, though dimensionally restricted, good and lasting guidance of the manually movable part or parts and good electrical action may be achieved. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingdy consists in the features of construction, combination of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing in which is shown by way of illustration a preferred embodiment of my invention.

Figure 1 is a front elevation of an assembled push button switch, certain parts being broken away to show certain other parts in central vertical section;

Figure 2 is a bottom plan view as seen from the bottom in Figure 1;

Figure 3 is a transverse sectional view as seen along the line 3—3 of Figure 1;

Figure 4 is a detached front elevation, partly in central vertical section, of a sub-assembly that comprises the push button and a contactor, with the mounting of the latter to the former;

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Figure 5 is a plan view of a known conductive element of the push button switch structure;

Figure 6 is a plan view of a sub-assembly comprising contact and connector elements and their mounting, and

Figure 7 is a central vertical sectional view as seen along the line 7—7 of Figure 6.

In the accompanying drawing similar reference characters refer to similar parts throughout the several views.

Referring first to Figure 1, I first provide a casing or shell 10 which in the illustrative embodiment is preferably made of metal such as sheet metal and is shaped or drawn to provide a cylindrical side wall 11 of a diameter somewhat less than that of a hole drilled into a door-frame or wall and into which the ultimate switch button switch is to be set. Such a hole may be on the order of ⅝" in diameter. The upper end of the shell 10 is provided with a laterally extending flange 12 which serves to limit the entry of the structure into the hole of the wall or door-frame and it may be given a curved configuration as shown. At the lower end of the side wall 11 the shell 10 is shaped to have an inwardly directed horizontal flange 13, leaving a relatively large circular hole 14, and at suitable and preferably diametrically opposed points the flange 13 has extensions in the form of bendable ears or lugs shown in section in Figure 3 at 15 and 16 and in Figure 2 being shown bent over as in the final assembly.

Where it is preferred that the structure be yieldably or frictionally held in the wall hole or door-frame, I provide a suitable friction or gripping device which comprises a suitable member, illustratively 4, of spring arms 17 which are integrally formed, as by stamping and bending, with a ring-like frame 18 which has radial dimensions to just mate with and underlie the bottom shell flange 13, as is better shown in Figures 1 and 3, so that the upwardly bent spring arms 17 extend upwardly (in Figure 1) along and externally of the wall 11 of the shell 10, thus to be positioned to react, by their spring action, with the casing wall 11 and the wall of the hole in the wall or frame to hold the structure securely but releasably in place. As shown in Figure 3 the ring frame 18 is cut away as at 18^a and 18^b to snugly accommodate and interfit with the ears 15—16 which thereby center and align the fastening device 17—18 with respect to the shell 10 and particularly the bottom flange 13 of the latter. Thus these two parts are easily put together in the process of assembly of the entire structure.

The cylindrical wall 11 serves as a guide for slidably receiving therein a button 20 (Figures 1 and 4) which is preferably made of any suitable moldable material or socalled "plastic," such as,

for example, Bakelite, and depending from the button 20 (Figure 4) is a stem 21 which is preferably of metal and conveniently in the form of a stamping of suitably heavy sheet metal such as brass, being in configuration preferably as shown in Figure 4; thus it comprises a relatively long shank 21a terminating at its lower end in a cross part 21b which can be of relatively short length in the direction of the axis of the shank 21a, and terminating at its upper end in a cross part 21c which is preferably of substantial length in an axial direction as compared to the length of the cross part 21b.

The upper cross part 21c is partially embedded in the button 20 and preferably the two are secured together by molding and curing the material of the button 20 onto and about the major portion of the cross part 21c, the latter being appropriately notched in its vertical side edges, as indicated in Figure 4, to insure good mechanical interlock between the two parts. For these purposes the thickness and transverse dimensions of the cross parts 21b and 21c are preferably the same so that the stem 21 can be inserted into the correspondingly dimensioned recess in a wall of the mold, leaving the entire bottom cross-piece 21b neatly inter-fitted with the mold recess and bottoming therein to an extent to project the major portion of the upper cross part 21c into the mold cavity, leaving a minor portion 21f thereof within the mold recess and inter-fitted therewith, the parts 21b and 21f thereby neatly aligning the stem 21 at right angles to the face of the mold cavity against which the button 20 is then molded and interlocked, leaving the minor portion 21f of the cross part 21c, in the final sub-assembly, projecting downwardly below the under face of the button 20, as is clearly shown in Figure 4.

With the parts 20 and 21 assembled, there is now slipped over the stem 21 a spiral-helical spring 23 whose uppermost portion is of a diameter to receive therein this downwardly projecting portion 21f of the upper cross part 21c, thereby, and thereafter, aligning the axes of the spring 23 and stem 21. Against the lower turn of spring 23 is then positioned a disc-like contactor 24 which can be in the form of a simple stamping of sheet metal, preferably springy; it has a diameter materially less than that of the shell well 11 and is provided with a central hole 25 surrounded by a depending flange 25a, all dimensioned appropriately to pass the lower cross part 21b freely therethrough, for assembly purposes. Against the under face of contactor 24 and about the flange 25a rests the upper turn or end of a helical spring 26 which is sleeved over the cross-piece 21b and which coacts to hold the disc 24 against detrimental lateral shift. Spring 26 has one or more lower end turns (as indicated in Figure 4) of a diameter less than the width of the cross part 21b, over which these turns are sprung or expanded during assembly and against the upper edges of which they thereafter bear so that spring 26 can exert upward force against the contactor 24 and against the downward force of the spring 23, the strength of the springs being such that together they normally hold the contactor 24 just about midway of the ends of the shank 21a. This subunit, as shown in Figure 4, is now ready to be assembled to the rest of the structure.

The contactor 24 is to serve as a circuit-closing element to bridge the relatively fixed contacts of the switch structure. In the illustrative embodiment I provide two spaced contacts arranged to

be exposed internally of the shell 10 and in the path of downward movement therein of the contactor 24. Preferably these contacts are diametrically opposed on a diameter materially less than the diameter of the contactor 24, and I prefer to mount them in a relatively heavy disc-like base-plate 27 made of any suitable non-conductive material and preferably of any suitable moldable plastic. Base-plate 27 is preferably of substantial thickness and has a diameter about the same as that of the shell 10 (see Figure 1), and in appearance is in effect a downward extension of the latter. In its upper face (Figure 1) it has a circular recess 28 (see also Figures 6 and 7) of uniform depth, peripherally bounded by the thin walled rim or flange 27a of the base-plate 27, and the upper edge face (Figure 1) of the part 27a is adapted to rest against the ring frame 18 and is thus supported against the shell flange 13. Spaced inwardly from the rim flange 27a, base-plate 27 has two rectangular apertures 30 and 31 (Figures 6, 7 and 2) which are diametrically opposed and dimensioned snugly to receive therethrough the ears or lugs 15, 16 of the shell 10, the under or outer face of the part 27 being provided with radially extending recesses 32 and 33 into which the apertures 30 and 31 respectively open so that when the ears 15 and 16 are ultimately bent over as shown in Figure 2, the bent-over portions of the ears are accommodated in these external recesses and thus need not project beyond the plane of the outer end-face of the base-plate 27.

The base-plate 27 I also provide with two spaced rectangular apertures 34 and 35 spaced along a diameter (see Figure 6) that is at right angles to the diameter along which the above-described apertures 30 and 31 are spaced. The spacing between apertures 34 and 35 is materially less than the diameter of the contactor 24 (see Figure 1) and the diameter of the latter is also materially less than that of the shell wall 11, the parts being so proportioned that any unintentional lateral shift of the contactor 24 relative to the stem 21 does not bring the contactor 24 into engagement with the shell wall and does not bring it out of a position where it overlies both apertures 34 and 35 from which project upwardly the contacts 36 and 37 respectively which the contactor 24 bridges upon depression of the button 20. The contact 36 is integrally formed, as by stamping, out of suitable sheet metal such as brass, which is stamped to provide a wider part 38 in which is provided a threaded hole to receive a binding screw 40 by which an electrical conductor may be mechanically and electrically connected, and intermediate of the parts 36 and 38 the stamping is provided with a shank portion 42 which is of a width intermediate of the width of the parts 36 and 38, as is better shown in Figure 7. It is the shank part 42 which is fitted in the aperture 34, the wider external part 38 providing shoulders to limit the extent of entry of the stamping through the aperture 34 and thus accurately to position the end-face of the contact part 36 relative to the part 27.

The contact 37 is formed out of a similar or identical stamping and has an outer wider part 39 with a threaded hole in it to receive the binding screw 41 (Figure 1) and an intermediate shank portion 43 of intermediate width that is interfitted with the aperture 35.

These stampings are held in the member 27 by any suitable means, as by a force-fit, or by molding and curing the part 27 about and on to the

stampings, or by laterally expanding the left-hand shoulder ends of the intermediate or shank portions, as indicated in Figure 7 and also in Figure 6, and thus hold them in place.

On the under-side of member 27 as viewed in Figure 1, and integrally formed therewith, is a downward extension 27b which is conveniently square in bottom view as seen in Figure 2 and in horizontal dimension as seen in Figures 2 and 6 it is preferably equal to the spacing between the apertures 34 and 35, so that its two opposed external side walls 27c and 27f are in alignment with the innermost walls of these apertures and provide a strong and rigid support for the two downwardly and externally projecting connecter portions 38 and 39 (see Figure 1). This extension 27b of the part 27 thus also gives the latter greater thickness and strength throughout its central portion (see Figures 1 and 7) and within this greater thickness is formed, as by molding, a rectangular and deep well 44 (Figures 7, 6 and 1) which in cross-section (Figure 6) is dimensioned to neatly and slidably receive therein the bottom cross part 21b (Figure 4) of the button shank 21. That cross part 21b is rectangular in cross section, and hence the well 44 (Figure 6) is also of rectangular cross-section with its major axis on the diameter along which the contacts 36, 37 are spaced.

The three parts shown assembled in Figures 6 and 7 form another sub-unit or sub-assembly and co-acting therewith is a disc-like member 45 of non-conductive material conveniently in the form of a stamping of hard fibre or the like. Member 45 (Figure 5) is stamped out in the form of a disc dimensioned to be neatly received in the above described circular recess 28 of the part 27 and to substantially fill that recess (see Figure 1), and it has cut-outs 45a and 45b diametrically opposed and dimensioned to coincide or register with the ear-receiving apertures 30 and 31 respectively of the part 27 (see Figure 6). Aligned along the diameter along which the cut-outs 45a and 45b are spaced is a rectangular hole 45c of the same dimension as the cross section of the end cross part 21b of the button shank 21, so that when the part 45 is seated in its recess 28 alignment of the cut-outs with the apertures 30 and 31 and the subsequent passage therethrough of the ears brings the hole 45c crosswise of and at 90° to the open end of the well 44 which the disc member 45 otherwise overlies.

The width of the hole 45c is at least equal to the width of the shank 21a of the button stem 21 so that, once the cross part 21b has been passed through the hole 45c, the button and stem assembly can be rotated 90° and thus bring the cross part 21b to extend crosswise of the elongated hole 45c of the disc part 45.

The sub-unit, as shown in Figure 4, may now be inserted in the upper end of the shell 10 against the under flange 13 of which the ring frame 18 has been placed as above described. By thus appropriately projecting the free end of the shank 21 below the plane of the ring frame 18, the disc element 45 is now slipped over the end cross part 21b to enter the latter through the hole 45c and also to somewhat compress the springs, bringing the disc part 45 up against the under side of the ring frame 18, the ears 15 and 16 entering the cut-outs 45a and 45b and thus fixing the position of the part 45 relative to the shell. An appropriate turn of the button and stem assembly about its axis now brings the end cross part 21b at right angles to the major axis of the

hole 45c, the shank 21a being freely accommodated in the hole 45c for purposes of such turning. To either side of the hole 45c the disc part 45 is provided with holes 45f and 45g spaced and dimensioned to freely receive therethrough the contact elements 36 and 37 which project outwardly from the member 27 and which are of a length (Figures 1 and 7) materially greater than the depth of the recess 28.

The sub-unit or sub-assembly of Figures 6 and 7 is now brought into position, and due to the above described relationships it cannot be finally assembled to the rest of the parts unless the major axis of its well 44 is at the required angle (90° in the illustration) to the major axis of the hole 45c in the disc 45. This relationship of assembly is assured by reason of the relationship of the ear-receiving holes 30 and 31 to the cut-outs 45a and 45b through which the ears already extend as above described, and also by the relationship of the holes 45f and 45g to the contact elements 36 and 37, the latter not passing through these holes unless the required relationship exists. Thus simple and fool-proof assembly is made possible.

The part 27 takes over the disc 45 which is snugly accommodated in the recess 28 of the former and part 45 and the rim part 27a, together abut against the under face of the rim frame 18 whereupon the bending over of the ears 15 and 16 clamps all of these parts in final assembly relationship.

The button 20 forms an upper guide in co-action with the shell wall 11 for the reciprocating movements manually brought about upon depression and release of the button, and the cross part 21b forms, in co-action with the walls of the deep well 44, a dependable guide for the lower end of the button and stem assembly, and thus the circuit-making and circuit-breaking down and up movements of the contactor 24 relative to the contacts 36 and 37 remains unaffected by manual thrusts applied to the button in other than a true axial direction. The two springs are so proportioned that they normally hold the contactor (see Figure 1) above and out of contact with the contacts 36, 37 and so that a first portion of the button depressing movement effects a yielding or compression primarily of the lower spring 26 sufficient to cause the contactor 24 to bridge the contacts 36, 37 and the ensuing portion of the button depressing movement thereupon effects a major compression of the upper spring 23 to apply increased pressure of engagement of the contactor with the contact elements, equalized between the two, by the action of the spring. During these actions the springs can exert some torsional stress upon the contactor 24, tending to give it a slight rotary movement and hence a rubbing and self-cleaning action against the contacts 36 and 37. Also, if desired, the contactor 24, if made of a spring material and relatively thin, can partake of some dishing under pressure and thus also contribute to a self-cleaning and rubbing action. These actions may also be beneficially derived out of slight lateral displacement of the contactor 24 relative to the stem shank 21a, under the stress of spring pressure against the fixed contacts.

Upon release of the button, the end cross-piece 21b, guided upwardly along the well 44, abuts against the under face of the disc part 45, extending crosswise of the hole 45c, and thus limits the movement of the button 20 outwardly of the shell 10 to the desired extent and, in co-action

with the springs, holds the contactor 24 in the desired open-circuit position. The bottom end of the well 44 will be seen to be closed off (Figures 1 and 7), thus precluding the entry of foreign matter into the structure and thus also precluding the exposure from the structure of conductive parts other than the conductor connecting parts 38—40 and 39—41. Moreover, the well 44 co-acts with the end cross part 21b to prevent the button and stem assembly from rotating about its axis and thus it is impossible to bring the cross part 21b into alignment with the hole 45c; and thus the assembly of the structure is dependably maintained.

It will thus be seen that there has been provided in this invention a structure in which the various objects above noted, together with many thoroughly practical advantages, are successfully achieved.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. A push button switch construction comprising a shell having a bottom wall provided with a well of elongated cross-section and opening into the shell, said bottom wall having a recess in its upper face peripherally bounded by a flange-like portion of the bottom wall, a plurality of connector-contact means extending through said bottom wall and insulated from each other and having the contact portions thereof exposed interiorly of the shell, a button for entry into said shell and having a depending stem provided at its lower end with a cross part of elongated cross-section for entry into said well, a plate member received in said recess and having an aperture of elongated cross-section for the passage therethrough of said cross-part, said plate member being positioned so that the major axis of its aperture is at an angle to the major axis of the cross-section of the well, thereby to prevent said cross-part from riding upwardly and outwardly from said well, and a contactor associated with said button to co-act with said contact portions, and spring means within said shell opposing depression of the button relative to the shell.

2. A push button switch construction as claimed in claim 1 in which said bottom wall is a part separate from the rest of the shell, and means securing said bottom wall to said shell.

3. A push button switch construction as claimed in claim 1, in which said plate member has cut-out means for co-action with at least one of said connector-contact means to hold the plate member against rotary displacement relative to said well and thereby maintain the aforesaid angular relation between said two major axes.

4. A push button switch construction as claimed in claim 1 in which the portion of said bottom wall containing said well comprises a downward central extension of the material of the bottom wall to expose exteriorly thereof lateral faces, said connector-contact means having the connector portions thereof engaging against said lateral faces.

5. A push button switch construction as claimed in claim 1 in which said spring means

comprises a coiled spring substantially coaxial with said stem and having its lower end turn constricted about said stem to an internal dimension less than the major axis of said cross-part, said spring abutting at its lower end against said plate member.

6. A push button switch construction as claimed in claim 1 in which the button end of said stem comprises a cross-part of a cross-section substantially the same as that of said first cross-part, said second cross-part having a major portion thereof entered and secured into the button and having a minor portion thereof projecting below the under-face of the button, said spring means comprising a coiled spring having an upper end turn received about said projecting minor portion of said second cross-part to thereby substantially center said spring.

7. A push button switch construction comprising a metal shell having a cylindrical side wall, a bottom member of insulating material having a substantially central guide-way of elongated cross-section, said bottom member having extending therethrough and insulated from each other thereby a plurality of connector-contact elements with the contact portions thereof exposed internally of the shell, a push button having a depending stem provided at its lower end with a cross-piece of elongated cross-section for entry into said guideway, a plate member interposed between said bottom member and the rear end of the shell and having an elongated aperture therein for the passage therethrough of said cross-piece, said plate member overlying said bottom member with the major axis of its aperture making an angle with the major axis of the cross-section of said guideway to thereby hold said stem from upward movement out of said guideway, a contactor associated with said button for coaction with said contact portions, spring means opposing depression of said button, and means holding said bottom member, said plate member, and said shell together.

8. A push button switch construction as claimed in claim 7 in which said plate member is provided with cutouts to substantially interfit with said connector-contact means and thereby hold said plate member against rotary displacement to prevent its aperture from becoming aligned with said guideway.

9. A push button switch construction as claimed in claim 7 in which said spring means comprises two coiled springs coaxial with said stem and said contactor comprises a metal plate-like element having an aperture through which said stem extends, said plate-like element being interposed between the adjacent ends of said two springs.

10. A push button switch construction as claimed in claim 7 in which said spring means comprises two coiled springs coaxial with said stem and said contactor comprises a metal plate-like element having an aperture through which said stem extends, said plate-like element being interposed between the adjacent ends of said two springs, the end turn of the spring that is adjacent the cross-part of said stem being constricted to a dimension less than the major dimension of said cross-part whereby said button, stem, springs, and contactor form a sub-assembly, said end turn of said spring abutting against said plate member.

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