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W. B. DULL ET AL

2,876,313

ROTARY TYPE SWITCH

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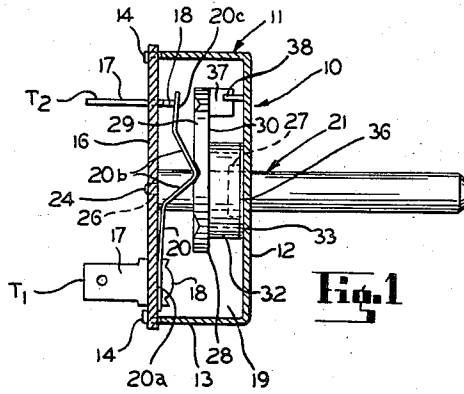


Fig. 1

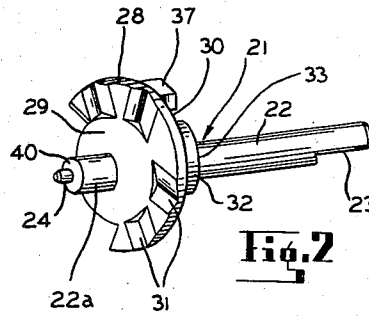


Fig. 2

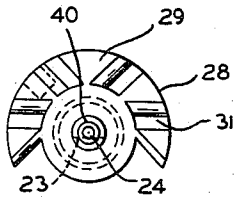


Fig. 3

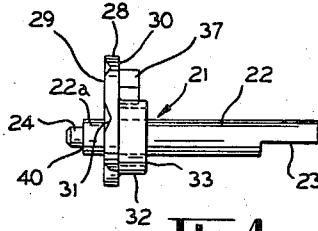


Fig. 4

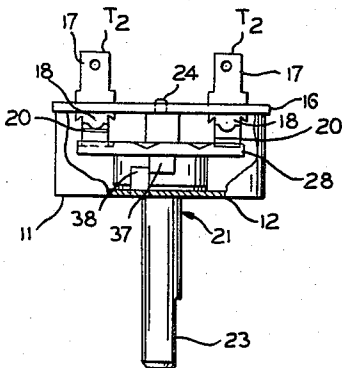


Fig. 5

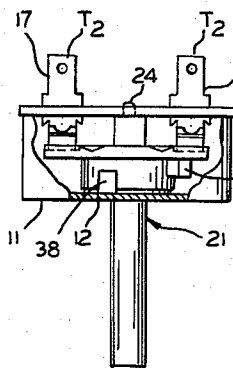


Fig. 6

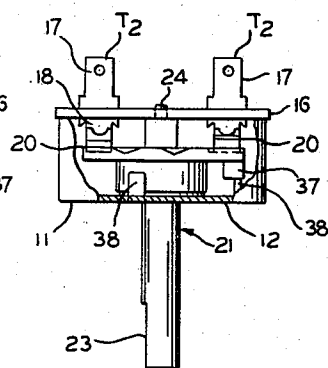


Fig. 7

INVENTORS

William B. Dull

Patrick E. Daugherty

Hill, Sherman, Morin, Chase & Simpson ATTORNEYS

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ROTARY TYPE SWITCH

William B. Dull, Coldwater, and Patrick E. Daugherty, Bronson, Mich., assignors to Kingston Products Corporation, Kokomo, Ind., a corporation of Indiana

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5 Claims. (Cl. 200—153)

This invention relates generally to electrical switch constructions and more particularly to a rotary switch wherein an angularly adjustable actuator member takes the form of a unitary stem having a camming flange cooperating with resilient contact arms, thereby effecting selective actuation of the contact arms with a self indexing operation.

According to the general principles of the present invention, a one piece actuator made of molded nylon or the like and consisting of a stem having a flange formed thereon is used to actuate resilient contact arms into selective bridging engagement with contact terminals carried on a base plate. The contact arms and the actuating flange on the stem are enclosed in a switch enclosure. One side of the flange has camming surfaces formed thereon engaging the contact arms while the other side of the flange has a bearing member engaging an adjoining wall of the enclosure. Thus, the cooperative relation established between the resilient contact arms and the camming surface of the flange not only effects actuation of the contact arms to develop electrical functions but the contact arms and the camming surfaces function mechanically as spring biased detent means and give the switch construction of the present invention a self-indexing characteristic. Furthermore, because of the inherent resilience of the contact arms, all of the parts are preloaded, thereby avoiding unnecessary looseness between the parts, rattling and other undesirable action. Furthermore, the preloading gives a good positioning feel in the operation of the switch. Means are also provided between the back face of the flange and the housing to limit the angular adjustability of the actuator stem.

It is an object of the present invention, therefore, to provide an improved rotary switch assembly.

Yet another object of the present invention is to provide an electric switch of the rotary type which is preloaded and self-indexing with no other resilient means being incorporated into the switch other than the resilient contact arms used to effect electrical connection with the contact terminals.

A further object of the present invention is to provide a rotary switch which has a reduced number of simplified components.

Yet another object of the present invention is to provide a one piece actuator mechanism for a rotary switch which does not require lubrication.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art on making reference to the detailed description which follows and the accompanying sheets of drawings in which a preferred structural embodiment of a rotary switch incorporating the principles of the present invention is shown by way of illustrative example.

On the drawings:

Figure 1 is a cross sectional view with parts shown in elevation of a rotary switch provided in accordance with the principles of the present invention;

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Figure 2 is a perspective view of the actuator member incorporated in the switch of Figure 1;

Figure 3 is an end elevational view of the actuator member of Fig. 2;

Figure 4 is a side elevation of the actuator member of Fig. 2;

Figures 5, 6 and 7 are top plan views of the switch of Fig. 1 with the top wall broken away to indicate the positioning of the contact arms upon cooperative engagement with the camming surface of the actuator at different rotative positions of adjustment.

As shown on the drawings:

The switch of the present invention is indicated generally by the reference numeral 10 and comprises an enclosure 11 which can conveniently be made as a cup-shaped stamping of generally rectangular configuration including a wall 12 and upstanding side walls 13. At the edges of the side walls 13 there is provided a plurality of tangs or lugs 14 which can be struck over to retain in firm assembly across the open side of the enclosure 11 a base member 16 made of an electrically non-conductive material.

The base member 16 is a rectangularly shaped insulator sheet and has its edges notched to receive the tangs or lugs 14. Attached in firm assembly to the base member 16 is a plurality of contact terminals. For clarity in description, the terminals visible in Figure 1 are indicated at T₁ and T₂ in each instance. The contact terminals are disposed symmetrically on the base member 16 and, accordingly, it will be understood that another pair of contact terminals are provided on the other side of the base member 16. Each contact terminal extends completely through the base member 16 to provide a connecting contact portion 17 on the outside of the switch 10 and a switch contact portion 18 inside of the enclosure 11. The enclosure 11, being closed by the base member 16, has a hollow space 19 bounded on opposite sides by walls formed by the base member 16 and the wall portion 12 of the enclosure 11.

A pair of contact arms 20 is also connected to the base member 16 and are disposed inside of the space 19 of the enclosure 11. Each contact arm 20 has a body portion 20a slotted or otherwise adapted to effect a firm assembly with the switch portion 18 of a corresponding contact terminal such as the terminal T₁. Each contact arm 20 is made of a strip material which is electrically conductive and which preferably has inherent resilience or springiness in order to develop the novel functions of the present invention.

The body portion 20a extends towards the contact terminal T₂ and includes an angularly bent detent portion indicated at 20b, the legs of the detent portion 20b being bent to protrude inwardly into the space 19 of the enclosure 11.

At the free end of the contact arm 20 is provided a switch contact portion indicated at 20c lying in register with the switch portion 18 of the contact terminal T₂. If not otherwise acted upon, the contact arm 20 is shaped and arranged so that the switch contact portion 20c is spaced away from the switch portion 18 of the contact terminal T₂.

According to the principles of the present invention, there is provided a one piece actuator member which is conveniently fabricated as an integral molded article made of a suitable electrically non-conductive material such as nylon or the like. In this connection, it may be noted that the material selected may include such a representative plastic material as nylon which has the characteristic of being self-lubricating when fitted in bearing engagement with a metallic surface.

The actuating member of the present invention is in-

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licated generally at 21 and comprises a generally cylindrical stem 22 flattened as at 23 to receive a finger manipulable knob (not shown) to facilitate manual actuation of the switch 10.

At the opposite end of the stem 22 is provided a reduced diameter pin 24 which is received and seated in an aperture 26 centrally located in the base member 16, thereby to provide a bearing and journaling support for the end of the actuator 21.

The wall portion 12 of the enclosure 11 is also provided with an apertured embossment 27 sized to provide a bearing and journaling engagement with the stem 22 of the actuator 21.

At an intermediate portion of the stem 22, the actuator 21 is provided with a flange 28 which extends radially outwardly from the stem 22 inside the space 19 of the enclosure 11. The flange 28 has front and rear faces 29 and 30 respectively spaced from the base member 16 and from the wall 12.

The face 29 of the flange 28 is constructed to provide camming surfaces and in this connection, it should be noted that the face 29 is particularly characterized by the formation of a plurality of camming notches 31 which are shaped and disposed to cooperatively seat and engage the detent portions 20b of the contact arms 20, 20.

Projecting axially from the face 40 of the flange 28 is an annular bearing ring 32 spaced concentrically outwardly of the stem 22, thereby affording clearance for the embossment 27 and providing an annular bearing edge 33 for slidably abutting the wall 12 of the enclosure 11. If desired, a supplemental bearing ring 36 may be interposed between the bearing ring 32 and the wall 12.

The face 30 is also characterized by the provision of an axially projecting lug 37. Struck inwardly from the wall 12 of the enclosure 11 is a pair of tangs 38 spaced apart from one another and adapted to engage the sides of the lug 37 to limit the total angular adjustability of the actuator 21.

Between the pin 24 and the stem 22 there is a radial shoulder 40 which engages against the base member 16. Thus, the portion of the stem 22 indicated at 22a and lying between the pin 24 and the flange 28 operates as a spacer in positioning the flange relative to the base member 16. Likewise, the bearing ring 32 operates as a spacer positioning the flange 28 relative to the wall 12. The axial dimension between the shoulder 40 and the bearing surface 33 is such that when the actuator 21 is positioned with the flange 28 interiorly of the space 19, the resilient contact arms 20 resiliently engage the camming surface 29 and develop a spring bias detent function upon cooperatively engaging the camming recesses 41.

The operation of the switch can be most conveniently understood by referring to Figs. 5, 6 and 7. In Fig. 5, the lug 37 is engaged against the tang 38, thereby positioning the actuator 21 in an end position of adjustment relative to the contact arms 20, 20. In this position, the detent means 20b of the contact arms are positioned so that the spring arm 20 is engaged in one of the notches 31 and biased into engagement with the switch contact portion 18 of the left-hand contact terminal T₂. This effects a bridging between the contact terminals T₁ and T₂. At this position, the bridging action, of course, controls the circuitry to be regulated by the switch 10 and which is electrically connected to the connection portions 17 of the contact terminals T₁ and T₂. In this position of adjustment (Fig. 5) the right-hand contact arm 20 remains spaced from the corresponding switch contact portion 18 of the contact terminal T₂.

In the position of adjustment indicated by Fig. 6, it will be noted that the lug 37 is displaced away from the tang 38 and the actuator 21 is retained in an intermediate position of adjustment because both of the detent

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means 20b, 20b of the two contact arms 20, 20 are seated in corresponding notches 31 on the camming surface 29 of the flange 28. Accordingly, both contact arms 20 bridge corresponding pairs of contact terminals T₁ and T₂.

In the position of adjustment illustrated by Fig. 7, the actuator 21 has been moved to opposite extreme position of adjustment so that the lug 47 engages an adjoining tang 38. In this position of adjustment, the right-hand contact arm 20 bridges the corresponding contact terminals T₁ and T₂ while the left-hand contact arm 20 is spaced from its corresponding switch contact portion 18 of the contact terminal T₂.

One exemplary use of the switch 10 is to control the circuitry of a washing machine and specifically the circuitry associated with a mixing valve admitting laundry liquid to the machine. The three positions of the switch correspond to the "hot," "medium" and "cold" control conditions of the water mixing valves.

Because of the inherent resilience of the spring contact arms 20, the actuator 21 is, in effect, preloaded, thereby tending to maintain selected positions of adjustment effected upon relatively rotating the actuator 21 with respect to the detent portions 20b of the contact arms 20. When the actuator 21 is manually operated, good positioning feel is afforded because the contact arms 20 tend to definitely snap in place when the detent portion 20b seats in a corresponding cam recess or notch 31. The actuator is also securely locked in place and is not moved out of selected positions of adjustment because of vibration or by inadvertent turning of the stem 22.

Although various minor structural modifications might be suggested by those versed in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of our contribution to the art.

We claim as our invention:

1. A switch comprising a sheet form member having a first wall portion and side wall portions offset therefrom to form a generally cup-shaped enclosure, tangs on said side wall portions, a terminal member having contact means thereon and extending across said side wall portions to close said enclosure and being engaged by said tangs in firm assembly with said sheet form member, said first wall portion having an aperture formed therein with embossed inwardly extending edge portions forming an axially extending bearing surface at said aperture, a one piece actuator member having a stem extending through said aperture and journaled in said bearing surface and a flange inside of said enclosure, one side of said flange having cam surfaces formed thereon engaging said contact means of said terminal member to effect self-indexing actuation thereof, the opposite side of said flange having an annular hub formed thereon abutting against an adjoining surface of said first wall portion and surrounding the embossed inwardly extending edge portions thereon, and stop means comprising cooperating abutment means formed on the first wall portion and on the opposite side of the flange limiting angular rotation of said actuator inside of said enclosure.

2. A switch as defined in claim 1, said stop means comprising lugs struck out from said first wall and at least one lug formed on the opposite side of the flange radially outwardly of the annular hub engaging the lugs on the first wall during rotation of the actuator.

3. A switch as defined in claim 1, said terminal member having an aperture formed therein and said actuator member having a portion on said one side of said flange engaged in said aperture to help journal the actuator member.

4. A switch as defined in claim 1, said contact members comprising spring blades to resiliently preload said actuator.

5. A rotary switch comprising a sheet form member

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bent to form a cup-shaped enclosure having an open side, a closed side and wall portions therebetween, a contact base closing said open side of said enclosure, said wall portions having tangs engaging said contact base and retaining said base in assembly with said sheet form member, said base having a plurality of spaced apart contact terminals mounted thereon, a plurality of resilient contact arms inside of said enclosure carried by said base and each being electrically connected to at least one of said contact terminals and each having portions thereof spaced from another of said contact terminals, said closed side wall portion having an aperture formed therein with embossed inwardly extending edge portions forming an axially extending bearing surface at said aperture, and an actuating member comprising an integral one-piece non-conductive actuator member including a stem portion extending outwardly of said closure through said closed side and journaled in said bearing surface, a flange on said stem portion ex-

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tending radially outwardly inside of said enclosure and having a camming face on one side of said flange adjoining said base operatively confronting said contact arms and shaped to cam selected arms into bridging relation with the contact terminals, the opposite side of said flange having a hub portion formed thereon slidably engaging the adjoining surface of said closed side of said enclosure and surrounding the embossed inwardly extending edge portions formed in said closed side, said opposite side of the flange being further provided with at least one abutment engageable with the closed side of the enclosure to limit rotation of the actuating member.

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