July 20, 1965 B. C. WESTGATE, JR 3,196,237

ROTARY SWITCH USING PLASTIC COVER WITH INTEGRAL LEAF SPRINGS AS POSITIONING MEANS

Filed July 11, 1962

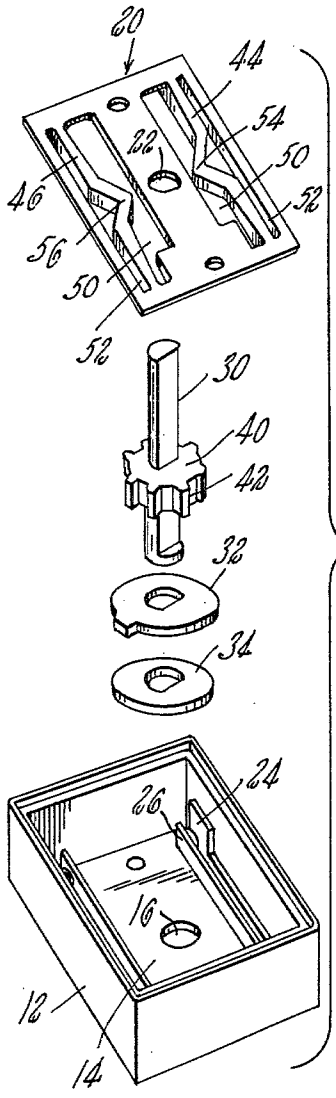

Fig. 1.

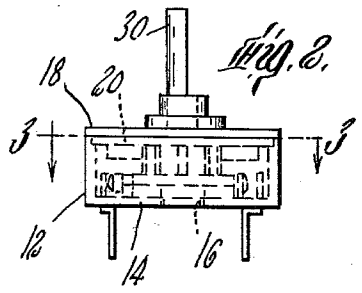

Fig. 2.

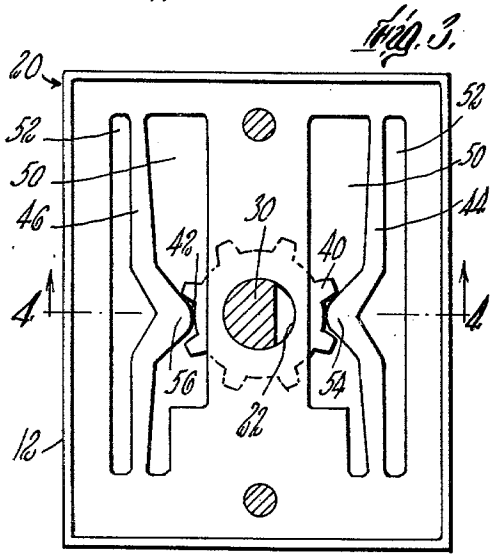

Fig. 3.

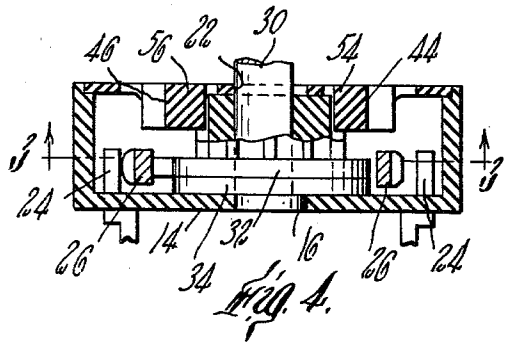

Fig. 4.

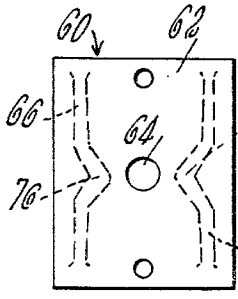

Fig. 5.

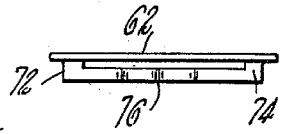

Fig. 6.

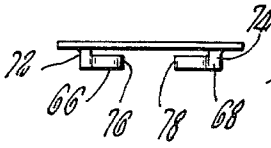

Fig. 7.

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ROTARY SWITCH USING PLASTIC COVER WITH INTEGRAL LEAF SPRINGS AS POSITIONING MEANS

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This invention relates to electric switches of the rotary type and more particularly to means for positioning such a switch in a selected one of its several predetermined angular positions.

Rotary switches, for example, of the type which are commonly used in electrical appliances, must satisfy high mechanical and electrical standards as to reliability and safety, yet must be capable of being manufactured at low cost.

Insofar as safety is concerned, the use of molded plastic materials has simplified the problem of providing an insulated fully enclosed switch, as is required. However, there still remain problems in providing adequate insulation without undue complication in a switch utilizing a metal switch shaft partly by reason of the metallic leaf springs which are commonly used for positioning the switch shaft in its predetermined angular position.

Also, insofar as manufatcure of such switches is concerned, they have a large number of parts which must be assembled at a labor cost which is relatively high compared to the cost of the parts themselves.

Accordingly, it is a major object of the present invention to provide a novel rotary switch having a greatly reduced number of parts which may more quickly and easily be assembled into a completed switch.

It is another object of the present invention to provide a novel rotary switch with fewer metallic elements so that the problem of providing adequate insulation is reduced, particularly if a metallic shaft be employed.

These and other objects of the invention are achieved by reason of the use, in conjunction with conventional rotary switch parts such as a housing and a shaft for operating switching elements mounted therein, of a novel switch cover member of resilient molded plastic electric insulating material having molded integrally therewith resilient plastic leaf spring means having means such as lugs cooperating with suitable locating means mounted on the switch shaft corresponding to the predetermined discrete switch positions. Preferably, a pair of leaf springs is provided on opposite sides of a gear-like disk mounted on the switch shaft for rotation therewith, the notches on the disk defining the angular switch positions to which the switch is set by reason of the resilient engagement of the centrally mounted lugs of the opposed plastic leaf springs.

For the purpose of more fully explaining the above and other objects of the invention, reference is now made to the following detailed description of preferred embodiments of the invention, together with the accompanying drawings, wherein:

FIG. 1 is an exploded isometric view of a rotary switch according to the invention;

FIG. 2 is an end elevation of the switch of FIG. 1;

FIG. 3 is an enlarged top cross-section of the switch of FIG. 1, taken on the line 3—3 of FIG. 2;

FIG. 4 is an enlarged cross-sectional end elevation taken on the line 4—4 of FIG. 3; and

FIGS. 5, 6 and 7 are, respectively, top side and end elevations of a cover element modified from that of FIGS. 1–4.

The rotary switch of the invention includes a housing

member, preferably of molded plastic material, having side walls 12 and an end wall 14 with a bearing surface 16 therein in the form of a circular aperture in said end wall. A pair of cover members are provided for the housing, including an outer member 18 of metal or plastic and an inner cover member of resilient plastic insulating material, generally designated 20 and hereinafter more fully explained. The inner plastic cover member 20 is also provided with a bearing surface 22 in the form of a circular aperture therein, as is the outer cover member 18. The latter member may be omitted, as will hereinafter appear. Suitable rivet holes may be provided for attaching the housing and cover members to one another.

Suitable metallic switch elements having fixed contacts 24 and movable contacts 26 are secured in the housing member and are provided with external connectors in the usual manner. The bearing surfaces 16, 22 support a through shaft 30 which may be manually operated by a knob, not shown. A cam disk 32 and underlying washer 34 is mounted on shaft 30 for rotation therewith, said cam disk being effective, upon rotation of said shaft into a selected one of a plurality of predetermined angular positions, to actuate movable switch contacts 26.

According to the present invention, novel positioning means are provided for positioning shaft 30 in any selected one of its plurality of predetermined angular positions. In general, such positioning means comprises locating means mounted on shaft 30 for rotation therewith and resilient plastic spring means integrally molded as a part of plastic cover member 20 for cooperating with said locating means to position the shaft.

More specifically, the locating means comprises a gear-like disk 40 having a waved peripheral edge providing a plurality of notches 42 corresponding to the predetermined shaft positions. Preferably, said disk is of nylon, polypropylene or like plastic material, although it could be of metal, and is positioned adjacent to cover member 20 which serves to locate it in one direction so that its operating peripheral center line is spaced from said cover member and its bearing surface 22.

The spring means are integrally molded as a part of cover member 20 and comprise a pair of opposed resilient plastic leaf springs 44, 46 which lie generally in a plane axially spaced along shaft 30 from cover member 20 and its bearing surface 22, and are supported solely at their ends by said cover member, by reason of inner slots 50, and outer slots 52. The central portions of springs 44, 46 are thus resiliently movable toward and away from one another, radially of shaft 30. In order that said springs may establish the predetermined position of shaft 30, at their central portions they are provided with lugs 54, 56 which extend toward one another and are maintained in resilient contact with the cooperating notches 42 of disk 40. Springs 44, 46, in addition to being spaced from the cover member 20 by slots 50, 52 are spaced axially thereto as well insofar as their center line is concerned so that it and the peripheral center line of locating disk 40 will generally coincide. this being necessary in the preferred form of the invention because of the location of disk 40 at one side of the bearing surface 22 of cover member 20.

The operation of the switch will be clear from the above, the resilient leaf springs 44, 46 cooperating by means of their lugs 54, 56 with the notches 42 of locating disk 40 so that one of the discrete predetermined positions defined thereby will be automatically reached when turning force is no longer applied to shaft 30. To this end, a suitable plastic material is needed to provide a sufficiently high spring force, and both lugs 54, 56 and the lands between notches 42 should be rounded generally as

shown. Such plastic materials as nylon, polypropylene and the like are effective as leaf spring elements molded as a part of the cover member of the invention, which, by reason of their electric insulating nature, make possible a switch construction free of additional insulating structure interposed between said spring elements and the metallic switch elements.

As shown in FIGS. 5–7, a closed cover member **60**, free of slots such as the slots **50**, **52** of FIGS. 1–7 may be substituted for the pair of cover members of the latter recited figures. Such modified cover member has an entirely closed outer sheet portion **62**, except for a shaft bearing **64** and possibly rivet holes, with a pair of opposed leaf springs **66**, **68** supported solely at their ends from cover member sheet portion **62** by integrally molded torsion spring elements **72**, **74** to space said springs from said sheet portion. As with the structure of FIGS. 1–7, the unsupported central portion of said springs has lugs **76**, **78** resiliently engaging notches **42** on opposite sides of disk **40** to position shaft **30** in any selected one of its predetermined positions. The modified cover member **60**, although somewhat more difficult to mold, makes possible the elimination of the outer cover member **18** which would usually be necessary for safety reasons.

Thus, it will be seen that the invention provides novel rotary switches having unique integral cover and positioning spring means whereby assembly of such switches is simplified to a significant extent. Various modifications of the invention, other than those described herein, within the spirit of the invention and the scope of the appended claims will occur to those skilled in the rotary switch art.

What is claimed is:

1. An electrical switch comprising a closed housing member and a closed cover member, said members having bearing means therein and at least one of said members being of resilient plastic insulating material, metallic switch elements mounted on at least one of said members, shaft means supported for rotation by said bearing means, switch operating means effective upon rotation of said shaft means into a plurality of predetermined angular positions to actuate said switch elements and positioning means effective to position said shaft means in any selected one of said predetermined angular positions, said positioning means comprising a plurality of locating means on said shaft corresponding to said angular positions and resilient plastic spring means integrally molded with one of said members, said spring means lying generally in a plane axially spaced along said shaft from said one member and its bearing surface and supported solely at its ends from said one member by a torsion spring element integrally molded of plastic insulating material with said cover member to space said spring means from said one member, the unsupported central portion of said spring means having means engaging said shaft in said predetermined positions.

2. An electrical switch comprising a housing member having side walls and an end wall with a bearing surface therein, a cover member of resilient plastic insulating material, metallic switch elements having fixed and movable contacts secured in said housing member, a shaft supported for rotation in said housing member, means mounted on said shaft means effective upon rotation of said shaft means into a plurality of predetermined angular positions to actuate said movable contacts, and positioning means effective to position said shaft in any selected one of said predetermined angular positions, said positioning means comprising a gear-like disk having a waved peripheral edge providing a plurality of notches corresponding to said angular positions and a pair of opposed resilient plastic leaf springs integrally molded of plastic insulating material with said cover member, said springs lying generally in a plane axially spaced along said shaft from said cover member and its bearing surface and supported solely at their ends from said cover member, the unsupported central portion of said springs having

lugs resiliently engaging said notches on opposite sides of said disk positioning said shaft in said predetermined positions, said switch being free of additional insulating structure interposed between said springs and said metallic switch elements.

3. An electrical switch comprising a housing member having side walls and an end wall with a bearing surface therein, a closed cover member of resilient plastic insulating material having a bearing surface therein, metallic switch elements having fixed and movable contacts secured in said housing member, a shaft supported for rotation by said bearing surfaces, cam means of insulating material mounted on said shaft means effective upon rotation of said shaft means into a plurality of predetermined angular positions to actuate said movable contacts, and positioning means effective to position said shaft in any selected one of said predetermined angular positions, said positioning means comprising a gear-like disk of insulating material having a waved peripheral edge providing a plurality of notches corresponding to said angular positions and a pair of opposed resilient plastic leaf springs integrally molded of plastic insulating material with said closed cover member, said springs being generally in a plane axially spaced along said shaft from said cover member and its bearing surface and supported solely at their ends from said cover member by integrally molded torsion spring elements to space said springs from said cover member, the unsupported central portion of said springs having lugs resiliently engaging said notches on opposite sides of said disk positioning said shaft in said predetermined positions.

4. An electrical switch comprising a housing member having side walls and an end wall with a bearing surface therein, a pair of cover members including an outer metallic cover member and an inner cover member of resilient plastic insulating material, metallic switch elements having fixed and movable contacts secured in said housing member, a metallic shaft supported for rotation in said housing member, cam means mounted on said shaft means effective upon rotation of said shaft means into a plurality of predetermined angular positions to actuate said movable contacts, and positioning means being effective to position said shaft in any selected one of said predetermined angular positions, said positioning means comprising a gear-like disk of insulating material having a waved peripheral edge providing a plurality of notches corresponding to said angular positions and a pair of opposed resilient plastitc leaf springs integrally molded of plastic insulating material with said plastic cover member, said springs lying generally in a plane axially spaced along said shaft from said cover member and its bearing surface and supported solely at their ends from said cover member, the unsupported central portion of said springs having lugs resiliently engaging said notches on opposite sides of said disk positioning said shaft in said predetermined positions, said switch being free of additional insulating structure interposed between said springs and said metallic switch elements.

5. In an electrical switch comprising a main housing having side walls and an end wall, metallic switch elements contained in said housing, and a shaft, carrying switch operating means, mounted adjacent said switch elements, said switch elements being operable by rotation of said shaft into a plurality of predetermined angular positions and said shaft also carrying a gear-like disk having a waved peripheral edge providing a plurality of notches corresponding to said angular positions,

the improvement comprising a cover member of plastic insulating material, said cover member including a pair of opposed integrally molded elongated resilient plastic leaf springs disposed inwardly on said cover member adjacent said disk and operable to cooperate with said disk to position said shaft, said switch being free of insulating structure interposed between said metallic switch elements and said springs.

6. In an electrical switch comprising a housing with side walls and top and bottom end walls of resilient plastic insulating material, at least one of said end walls being removable to enable access to the interior of the switch, metallic switch elements contained in said housing, and a shaft, carrying switch operating means, mounted adjacent said switch elements, said switch elements being operable by rotation of said shaft into a plurality of predetermined angular positions and said shaft also carrying a gear-like disk having a waved peripheral edge providing a plurality of notches corresponding to said angular positions,

the improvement comprising a pair of elongated resilient plastic leaf springs, integrally molded of plastic insulating material with one of said end walls and inwardly disposed upon said one of said end walls adjacent said disk, and operable to cooperate with said disk to position said shaft, said switch being free of insulating structure interposed between said metallic switch elements and said springs.

7. In the switch as claimed in claim 6 wherein said cover member includes cutout portions running adjacent both sides of each of said plastic springs, said springs being incorporated into said cover only at their ends, said springs thereby being operable to flex toward and away from each other, the unsupported central portions of said springs having lugs to resiliently engage said notches on opposite sides of said disk.

8. In the switch as claimed in claim 7 wherein said one end wall is closed and said plastic leaf springs are incorporated into said wall solely at their ends by means of integrally molded insulating plastic torsion spring elements which elements space the central portions of said springs from said wall, the unsupported central portions of said springs having lugs to resiliently engage said notches on opposite sides of said disk.

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