

[54] ACTUATOR MEANS FOR A SWITCH  
CONSTRUCTION AND THE LIKE

[75] Inventor: George M. Hipple, Jackson  
Township, Ohio

[73] Assignee: Robertshaw Controls Company,  
Richmond, Va.

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Primary Examiner—Robert K. Schaefer

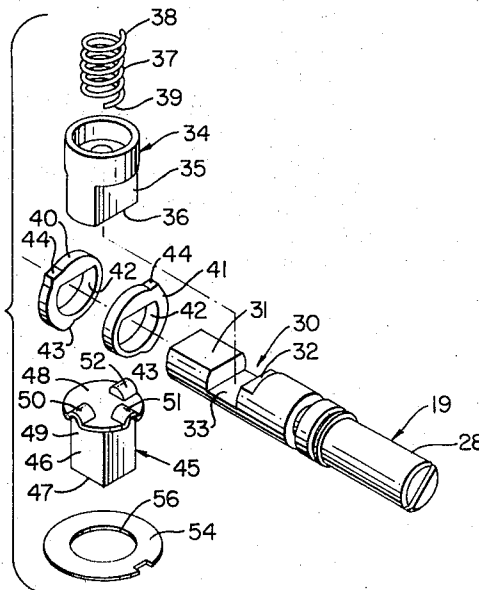
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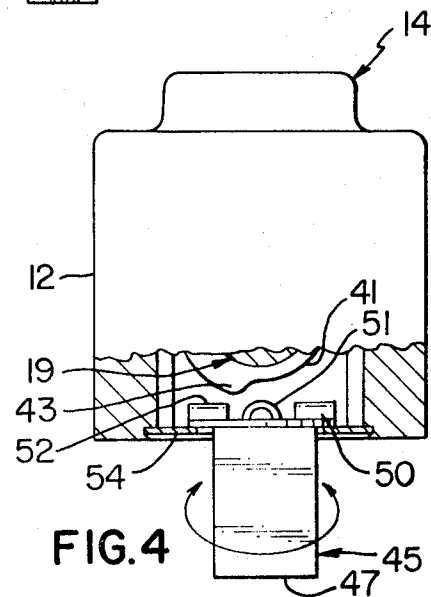
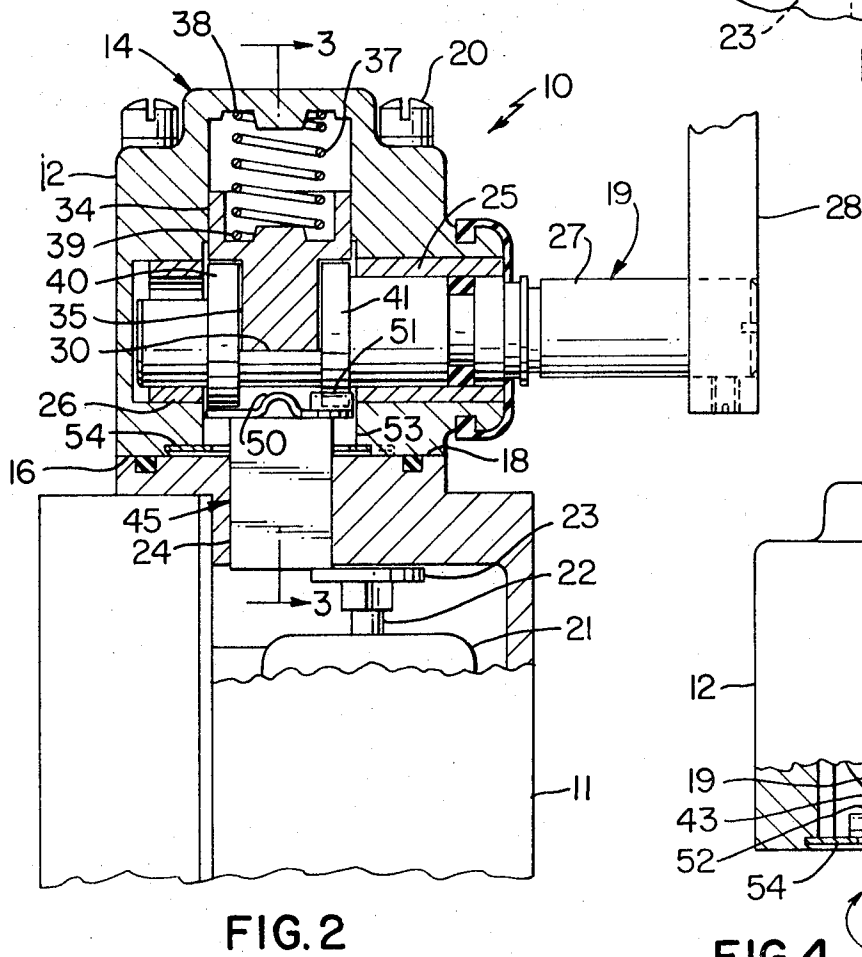
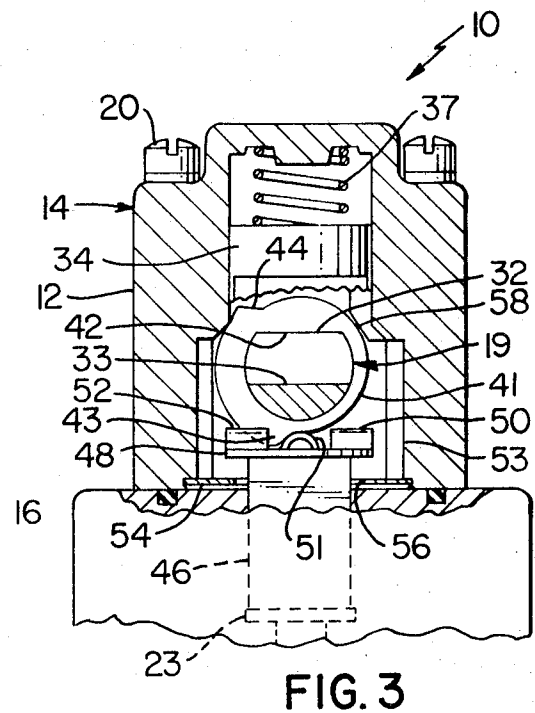
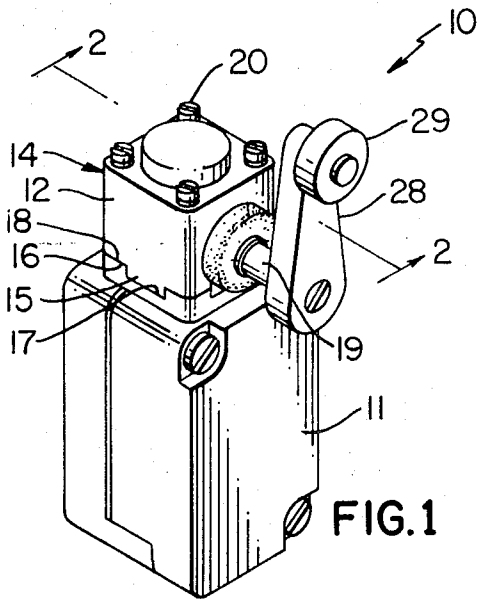
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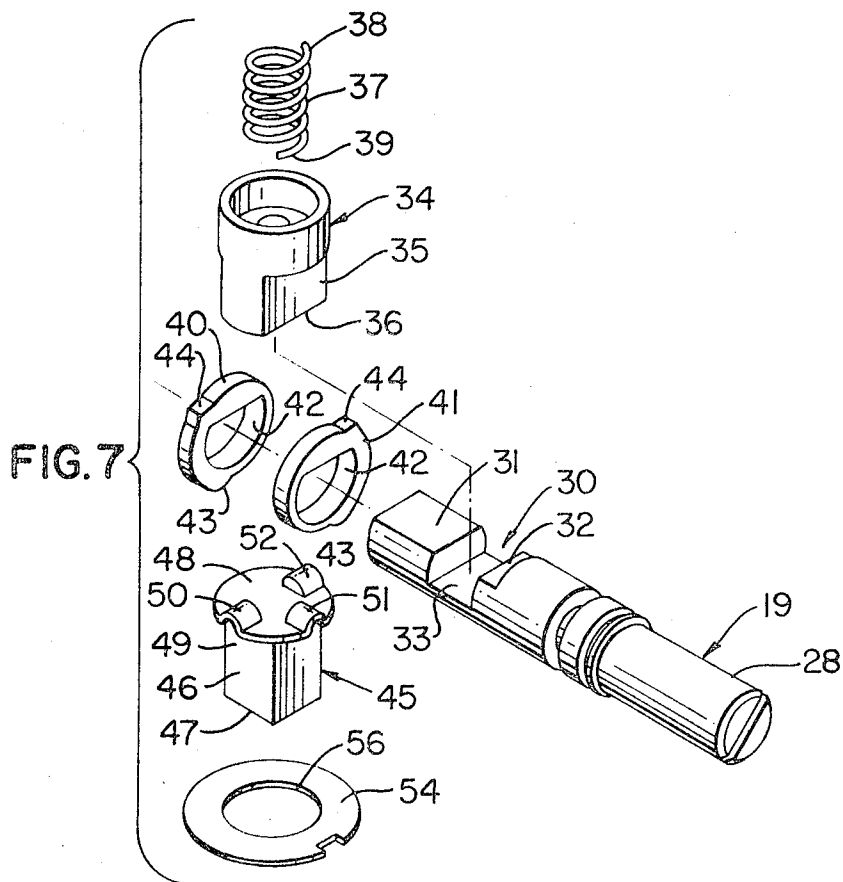
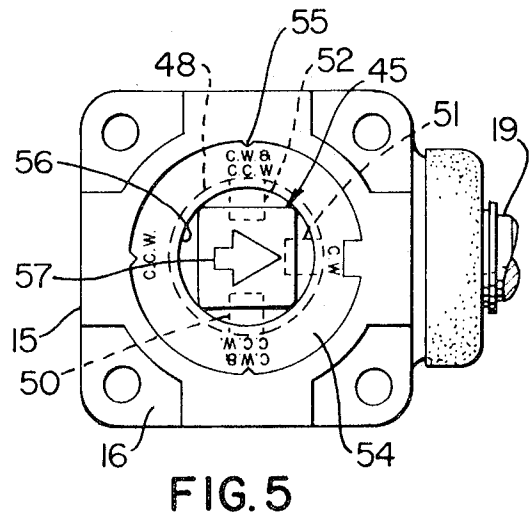
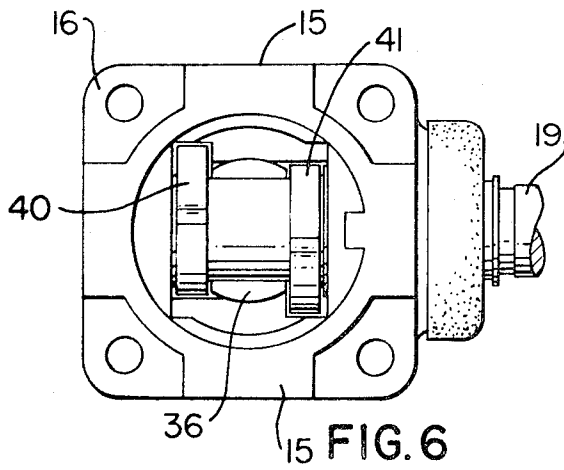
[57] ABSTRACT

An actuator for a switch construction and having an actuator shaft rotatably carried by a housing and being provided with cams thereon. An axially movable plunger is carried by the housing and has a plurality of abutments thereon cooperable with the cams. The plunger is rotatable to be set to one of a plurality of positions thereof relative to the housing so that the abutments cooperate with the cams in selected manners whereby the shaft must be rotated in a selected direction or directions to have one or more of the cams thereof cam against one or more of the abutments and thereby cause axial movement of the plunger to operate the switch construction interconnected to the actuator housing.

22 Claims, 7 Drawing Figures







## ACTUATOR MEANS FOR A SWITCH CONSTRUCTION AND THE LIKE

This invention relates to an improved actuator for an electrical switch construction as well as to an improved switch construction utilizing such an actuator or the like.

It is well known that electrical switch constructions have been provided with actuators therefor wherein each actuator can be positioned in the path of movement of a moving part of an apparatus or the like so that when the actuator is moved to a particular position by such moving part, the actuator causes the switch construction to operate so as to open or close a circuit as the case may be and such a switch construction is usually termed a "limit switch."

It is also well known that it is desired to adapt such a switch construction so that the movement of the actuator thereof for causing operation of the switch construction can be readily changed to another direction of movement thereof.

Accordingly, it is a feature of this invention to provide an improved actuator for a limit switch construction wherein the direction of actuating movement of the actuating part of the actuator can be readily selected in a simple and effective manner.

In particular, one embodiment of this invention provides an actuator for a limit switch construction or the like and comprises a housing rotatably carrying an actuator shaft having cam means thereon. An axially movable plunger is carried by the housing and has abutment means thereon cooperable with the cam means of the shaft. The plunger is settable to one of a plurality of positions relative to the housing so that the abutment means cooperate with the cam means in selected manners whereby the shaft must be rotated in the selected direction to have the cam means thereof cam against the abutment means to thereby cause axial movement of the plunger. The plunger cooperates with the switch construction in such a manner that axial movement thereof changes the operative condition of the electrical switch construction.

Accordingly, it is an object of this invention to provide an improved actuator for a limit switch construction or the like, the actuator of this invention having one or more of the novel features set forth above or hereinafter shown or described.

Another object of this invention is to provide an improved limit switch construction utilizing such an actuator or the like.

Other objects, uses and advantages of this invention are apparent from a reading of this description which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIG. 1 is a perspective view of the improved limit switch construction of this invention.

FIG. 2 is an enlarged, fragmentary, cross-sectional view taken on line 2—2 of FIG. 1.

FIG. 3 is a fragmentary, cross-sectional view taken on line 3—3 of FIG. 2.

FIG. 4 is a partially broken away view of the actuator housing of the switch construction of FIG. 1 and illustrates the plunger thereof.

FIG. 5 is a bottom view of the actuator housing illustrated in FIG. 4.

FIG. 6 is a view similar to FIG. 5 but with the plunger and retaining plate of the actuator housing removed.

FIG. 7 is an exploded, perspective view of certain parts of the actuator of FIG. 4.

While the actuator of this invention is hereinafter described and illustrated as being particularly adapted to operate an electrical switch construction, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide actuator means for other devices as desired.

Therefore, this invention is not to be limited to only the embodiment illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIGS. 1, 2 and 3, the improved limit switch construction of this invention is generally indicated by the reference numeral 10 and comprises an electrical switch containing housing 11 detachably carrying a housing 12 of the actuator of this invention that is generally indicated by the reference numeral 14 in the drawings.

For example, the actuator housing 12 has a plurality of tongues 15 depending from the bottom side 16 thereof and being respectively received in grooves 17 formed in an upper side 18 of the housing 11 when the housing 12 is assembled thereto in the manner illustrated in FIG. 1. However, the tongues 15 and grooves 17 are arranged in such a manner that the housing 12 can be disposed on the housing 11 in only one position so that an actuator shaft 19 projecting from the actuator housing 12 will be pointed in the proper direction relative to the housing 11.

After the housing 12 has been assembled to the housing 11, the same are secured together by threaded fastening members 20 in a conventional manner.

As illustrated in FIG. 2, the switch housing 11 contains an electrical switch 21 having a cooperating plunger 22 which must be depressed in FIG. 2 to change the operating condition of the switch 21. The plunger 22 has an upper disk-like part 23 which overlaps an opening 24 passing through the upper wall 18 of the housing 11, the opening 24 having a square cross-sectional configuration for a purpose hereinafter described.

The shaft 19 is rotatably mounted in the housing 12 by suitable bearing means 25 and 26 and is so constructed and arranged that a portion 27 thereof projects from the housing 12 to carry an arm 28 on the outer end thereof with the arm 28 having a roller 29 rotatably mounted thereon. In general, the moving part being controlled by the limit switch construction 10 moves against the roller 29 to cause the arm 28 to rock or rotate the shaft 19 relative to the housing 12 in a particular direction so that when the arm 28 has been rocked or moved a certain amount in the selected direction, the actuator 14 will cause the plunger 22 of the switch 21 to have been axially moved downwardly in FIG. 2 a sufficient distance to cause the switch 21 to change its operating condition for any desired purpose, such as to cause the moving part to reverse its direction of movement.

The shaft 19 has a cutout 30 formed therein adjacent two spaced apart flattened areas 31 and 32 thereof, the cutout 30 also defining a flat surface 33 of the shaft 19. A retainer 34 has a depending tongue portion 35 provided with a flattened end 36 adapted to be received in the recess 30 of the shaft 19 and engage against the flat surface 33 thereof in the manner illustrated in FIG. 2 to tend to maintain the shaft 19 in the rotational posi-

tion illustrated in FIGS. 2 and 3, the retainer 34 being continuously urged against the surface 33 of the shaft 19 by a compression spring 37 having one end 38 bearing against the housing 12 and the other end 39 thereof bearing against the retainer 34 as illustrated.

A pair of like cams 40 and 41 are respectively provided with openings 42 passing therethrough to receive the left-hand end of the shaft 19 and permit the same to be respectively telescoped onto the shaft 19 and be held from rotational movement relative thereto by the respective flat surfaces 31 and 32 as illustrated, the cams 40 and 41 being reversed relative to each other when assembled to the shaft 19 for a purpose hereinafter described. Each cam 40 and 41 has a cam lobe 43 thereon and a stop means 44 thereon for a purpose hereinafter described. However, it can readily be seen that when the cams 40 and 41 are assembled to the shaft 19 in a reverse relation relative to each other, the cam lobes 43 are on opposite sides of the shaft 19 as well as the stop lobes 44 thereof for a purpose hereinafter described.

A plunger 45 is provided for the actuator 14 and comprises a plunger part 46 having a square cross-sectional configuration complementary to the opening 24 of the switch housing 11 so that when the plunger part 46 is disposed in the opening 24 of the housing 11, the plunger 45 cannot rotate relative thereto but can axially move up and down in the opening 24 to operate the plunger 22 of the switch 21 in a manner hereinafter described. The plunger part 46 has a flat end wall 47 for engaging against the disk-like part 23 of the plunger 22 of the electrical switch 21 in the manner illustrated in FIG. 2. A disk-like member 48 is carried by the other end 49 of the plunger part 46 with the disk-like member 48 being formed with three abutments 50, 51 and 52 disposed in a circular array and being positioned at three corners of a square that could be described by the circle of such circular array of abutments 50-52.

The housing 12 has an opening 53 formed therein and alignable with the opening 24 of the housing 11 but being of larger cross-sectional dimension so as to receive the disk-like part 48 of the plunger 45. After the disk-like part 48 of the plunger 45 is disposed in the opening 53 of the housing 12, a retaining ring-like member 54 is disposed in the opening 53 against a recessed shoulder of the housing 12 and fastened therein, such as by staking 55 as illustrated in FIG. 5. The retainer 54 has an opening 56 passing therethrough which is of less diameter than the disk-like part 48 of the plunger 45 so as to hold the same within the housing 12 but permitting the plunger part 46 to extend out through the opening 56 as illustrated.

The distance between the retainer 54 and the cams 40 and 41 being carried by the actuator shaft 19 is such that when the housing 12 is disassembled from the housing 11 and held in the manner illustrated in FIG. 4, the abutments 50-52 of the plunger 45 clear the cams 40 and 41 so that the plunger 45 can be rotated relative to the housing 12 and thereby have the abutments 50-53 thereof selectively positioned relative to the cams 40 and 41 so that one or more of the cams 40 and 41 will act on one or more of the abutments 50-52 to cause axial movement of the plunger 45 only when the shaft 19 is rocked in the selected direction or directions.

For example, the end 47 of the plunger 45 can have an arrow 57 provided thereon which cooperates with

nomenclature on the retainer 54 to indicate the operating direction. As illustrated in FIG. 5, the arrow 57 is pointing to a clockwise actuation so that when viewing the switch construction 10 in FIG. 1, rocking of the shaft 19 in a clockwise direction will cause the plunger 45 to operate the switch 21 but a counterclockwise movement of the shaft 19 will not cause the plunger 45 to operate the switch 21 as will be apparent hereinafter.

When the plunger 45 is rotated so that pointer 57 is 90° disposed in either direction from the position illustrated in FIG. 5, rocking of the shaft 19 in either the clockwise or counterclockwise direction will cause actuation of the switch 21. When the plunger 45 is rotated 180° from the position illustrated in FIG. 5, counterclockwise rocking of the shaft 19 will operate the switch 21 and clockwise rotation or rocking will not operate the switch 21 as will be apparent hereinafter.

After the plunger 45 has been rotated to the desired selected position thereof in the manner illustrated in FIGS. 4 and 5, the housing 12 is then assembled to the housing 11 by having the plunger part 46 received in the opening 24 thereof so that further rotation of the plunger 45 is prevented. When the housings 12 and 11 are secured together by the fastenings means 20, the plate-like part 23 of the plunger 22 of the switch 21 which is normally spring-biased in an up direction to the position illustrated in FIG. 2 holds the plunger 45 of the actuator 14 in the up position as illustrated in FIG. 2 so that the abutments 50-52 are in operative alignment with the shaft 19.

However, in the particular selected position of the plunger 45 for only clockwise rocking of the shaft 19 to operate the switch 21, the abutment 51 is in the path of the cam lobe 43 of the cam 41 so that upon clockwise rocking of the shaft 19, the cam lobe 43 will operate on the abutment 51 to cam the plunger 45 downwardly and, thereby, cause downward movement of the plunger 22 of the switch 21 to operate the same. Such clockwise rotation of the shaft 19 is limited by the stop 44 on the cam 40 engaging against a stop shoulder 58 of the housing 12 after the shaft 19 has been rocked in a clockwise direction from its normal position illustrated in FIG. 2 about 90°. Counterclockwise rotation of the shaft 19 is limited to about 90° of movement before the stop lobe 44 on the cam 41 likewise engages against a stop shoulder 58 of the housing 11. However, since there is no abutment 50, 51 or 52 disposed beneath or in alignment with the cam 40 during such counterclockwise rotation of the shaft 19 when the plunger 45 is disposed in the position illustrated in FIG. 5, the plunger 45 is not operated during such counterclockwise movement so that the switch 21 is likewise not operated.

However, it can be seen that when the plunger 45 is rotated to the position where the arrow 57 is pointing 90° in either direction from the position illustrated in FIG. 5, the abutments 50 and 52 are in alignment with the cams 40 and 41 or the abutments 52 and 50 are in alignment with the cams 40 and 41 so that clockwise or counterclockwise rocking of the shaft 19 from the home position of FIG. 1 will cause axial movement of the plunger 45 and, thus, operation of the switch 21.

Of course, when the plunger 45 is rotated 180° from the position illustrated in FIG. 5, no abutment 50, 51 or 52 is in alignment with the cam 41 and only the abutment 51 is in alignment with the cam 40 whereby only counterclockwise rocking of the shaft 19 will cause ac-

tuation of the plunger 45 in the manner previously described.

Therefore, it can be seen that the actuator 14 of this invention provides a plunger 45 which can be set in a plurality of settable positions thereof by rotating the plunger 45 relative to its housing 12 so that when the same is assembled with the switch housing 11, the actuating shaft 19 must be rocked or rotated in a particular direction or directions to cause operation of electrical switch 21.

While the form of the invention now preferred has been described as required by the patents statutes, it is to be understood that other forms can be utilized and all come within the scope of the appended claims.

What is claimed is:

1. An actuator for a switch construction comprising a housing having an opening, an actuator shaft rotatably carried by said housing and having cam means thereon, and an axially movable plunger carried by said housing and having abutment means thereon cooperate with said cam means, said plunger having a portion thereof projecting out of said opening and another portion thereof larger than said opening and disposed in said housing whereby said plunger cannot be removed from said housing through said opening, said plunger being settable to a plurality of positions relative to said housing while said other portion of said plunger is disposed in said housing so that said abutment means cooperate with said cam means in selected manners whereby said shaft must be rotated in the selected direction to having said cam means thereof cam said abutment means and thereby cause axial movement of said plunger.

2. An actuator as set forth in claim 1 wherein said plunger is rotated relative to said housing to be set in said selected positions thereof.

3. An actuator as set forth in claim 2 wherein said plunger has opposed ends, one of said ends having said abutment means thereon.

4. An actuator as set forth in claim 3 wherein said abutment means comprises a plurality of abutments projecting from said one end of said plunger.

5. An actuator as set forth in claim 4 wherein said abutments are disposed in circular array.

6. An actuator as set forth in claim 5 wherein said abutments comprise three abutments respectively disposed at three corners of a square described by said circular arrangement.

7. An actuator as set forth in claim 1 wherein said cam means comprise two cams carried by said shaft.

8. An actuator as set forth in claim 7 wherein said cams are like cams and are carried on said shaft in reversed relation relative to each other.

9. An actuator as set forth in claim 1 wherein said housing has stop means for limiting rotational movement of said shaft in each direction of rotational movement thereof.

10. An actuator as set forth in claim 9 wherein said cam means of said shaft abut said stop means to determine the limits of rotational movement of said shaft.

11. In combination, a switch construction having an operator therefor, an actuator for said switch construction and comprising a housing detachably intercon-

nected to said switch construction and having an opening facing said switch construction, an actuator shaft rotatably carried by said housing and having cam means thereon, and an axially movable plunger carried by said housing and having abutment means thereon cooperate with said cam means, said plunger having a portion thereof projecting out of said opening and another portion thereof larger than said opening and disposed in said housing whereby said plunger cannot be removed from said housing through said opening, said plunger being associated with said operator to actuate the same when said plunger is moved to a certain axial position thereof, said plunger being settable to a plurality of positions relative to said housing while said other portion of said plunger is disposed in said housing so that said abutment means cooperate with said cam means in selected manners whereby said shaft must be rotated in the selected direction to having said cam means thereof cam said abutment means and thereby cause said axial movement of said plunger to said certain axial position thereof.

12. A combination as set forth in claim 11 wherein said plunger is adapted to be rotated relative to said housing to be set in said selected positions thereof.

13. A combination as set forth in claim 12 wherein said plunger has opposed ends, one of said ends having said abutment means thereon.

14. A combination as set forth in claim 13 wherein said abutment means comprises a plurality of abutments projecting from said one end of said plunger.

15. A combination as set forth in claim 14 wherein said abutments are disposed in circular array.

16. A combination as set forth in claim 15 wherein said abutments comprise three abutments respectively disposed at three corners of a square described by said circular arrangement.

17. A combination as set forth in claim 11 wherein said cam means comprise two cams carried by said shaft.

18. A combination as set forth in claim 17 wherein said cams are like cams and are carried on said shaft in reversed relation relative to each other.

19. A combination as set forth in claim 11 wherein said housing has stop means for limiting rotational movement of said shaft in each direction of rotational movement thereof.

20. A combination as set forth in claim 19 wherein said cam means of said shaft abut said stop means to determine the limits of rotational movement of said shaft.

21. A combination as set forth in claim 11 wherein said plunger is adapted to be rotated relative to said housing to be set in said selected positions thereof only when said housing is detached from said switch construction.

22. A combination as set forth in claim 21 wherein said switch construction has an opening for receiving part of said plunger when said housing is being interconnected to said switch construction, said opening and said part of said plunger cooperating together to prevent rotational movement of said plunger.

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