Nov. 16, 1965 R. J. P. DUFOUR 3,218,402

MULTIPLE PROGRAMME ROTARY SWITCH ACTUATOR WITH CAM LIMIT APPARATUS

Filed Aug. 12, 1963 3 Sheets-Sheet 1

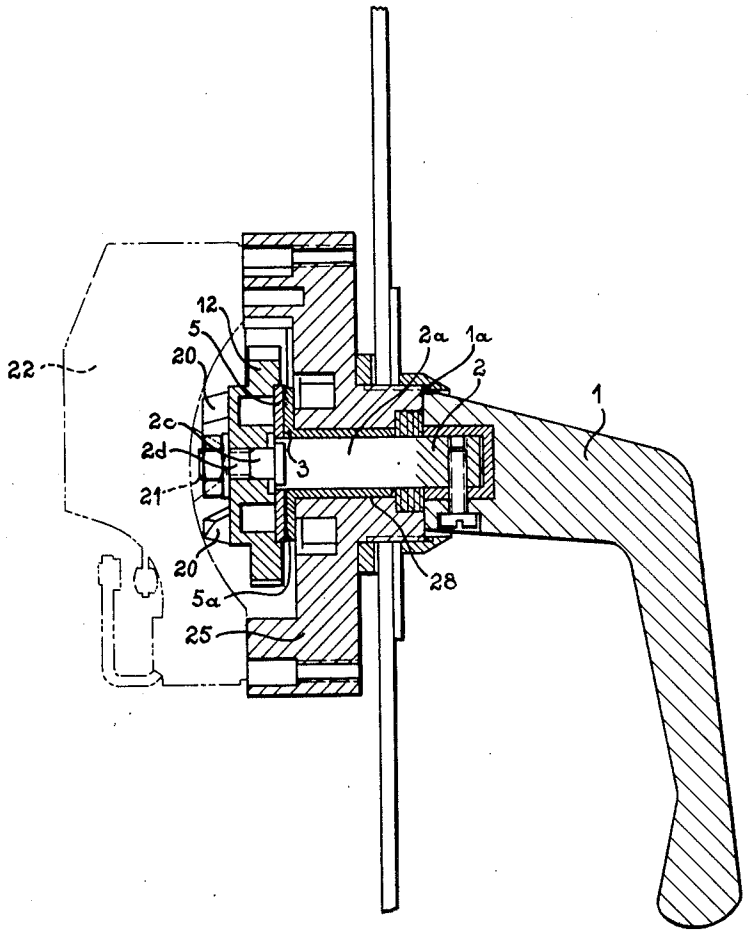

fig.1.

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MULTIPLE PROGRAMME ROTARY SWITCH ACTUATOR WITH CAM LIMIT APPARATUS

Filed Aug. 12, 1963 3 Sheets-Sheet 2

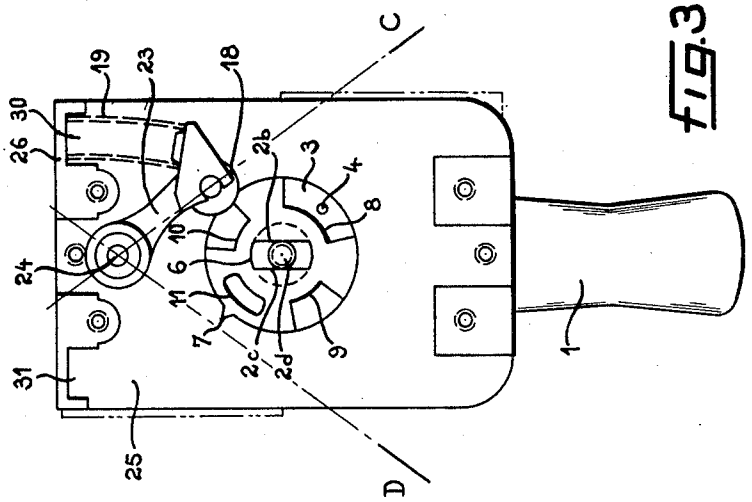

FIG. 3

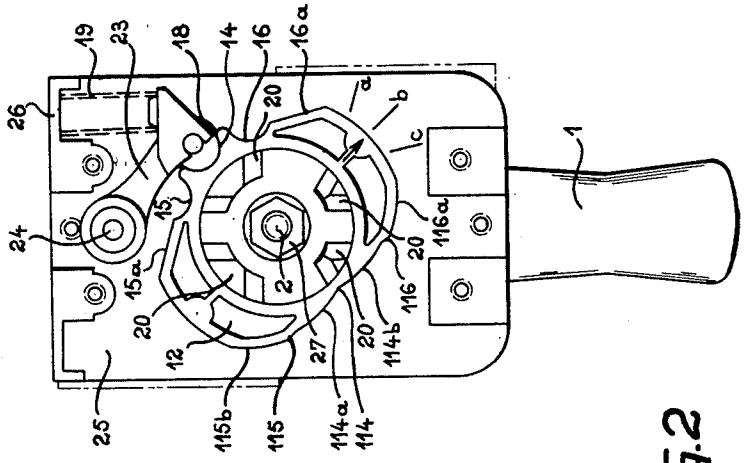

FIG. 2

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Filed Aug. 12, 1963 3 Sheets-Sheet 3

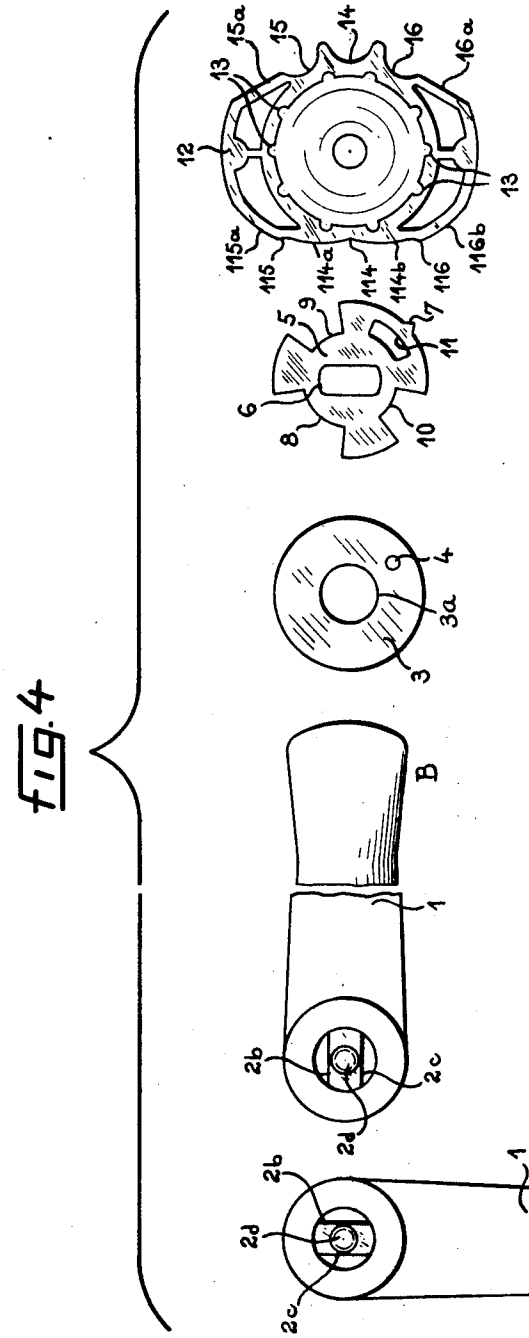

Fig. 4

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3,218,402

MULTIPLE PROGRAMME ROTARY SWITCH ACTUATOR WITH CAM LIMIT APPARATUS

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3 Claims. (Cl. 200—17)

This invention relates to a rotary cam switch actuator, whose angle of rotation is limited, for example to a maximum of 60°, but which is arranged so that it is possible to obtain at will several operating angles with respect to the neutral position of the actuating handle, with or without automatic return to this position. Another object of the invention is to facilitate modification of the action of the cams on normally open contacts (n.o. contacts) or normally closed contacts (n.c. contacts) of conventional switches. Another object of the invention is to conceive a mechanism having little depth between the operating handle and the switch itself, composed of very few parts, and arranged so that it suffices merely to modify the relative position of two or three of these parts to obtain a different programme of functioning. In this way, with only a single model of the actuator apparatus in stock, the manufacturer or distributor can deliver the apparatus to the customer already set with the desired programme of functioning. Such a switch actuator is suitable particularly for the control panels of machine-tools.

In variable programmation switching provision must be made firstly for locking to its control axle the notch system which defines the stable positions and the travel limits of the handle, and, secondly, for the adjustable locking of the cams with respect to the control axle.

A switch actuator having a handle and a control axle and comprising a movable cam co-operating, through notches, with a projection (runner or ballbearing) mounted resiliently on the frame of the actuator is already known.

Its cam comprises external ramps or contact studs destined to act on the n.o. or n.c. switch contact provided.

Such an actuator also comprises a stop member fixed to the frame limiting both the travel of the handle and that of the movable cam.

The position of the cam with respect to the control axle is established by means of a non-sliding connecting member on the control axle.

The connecting member is integral with the cam.

Another type of switch actuator is known having a stop member fixed to the frame which limits solely the travel of a control handle. An extension of this handle or of its axle is pierced with apertures adapted to be traversed by the fixed stop member.

Finally, another type of known switch actuator has a control axle of quadrangular section on which can be slid a removable disc having a stud adapted to strike against fixed stop members on the frame. In this manner the disc limits the travel of the control axle and consequently that of the handle.

In the switch actuator conforming to the present invention the connecting member for the movable cam and the control axle is a removable and reversible member having the additional task of limiting the travel of the control axle as well as that of the movable cam, the said removable reversible member comprising apertures of which any one can be engaged by a fixed stop member on the frame, and means being additionally provided to interconnect in any of a variety of different relative positions the travel-limiting member and the movable cam.

Other features and advantages of the present invention will be brought out in the following description given with respect to the accompanying drawings in which:

FIGURE 1 is a longitudinal section of the switch actuator according to the invention;

FIGURE 2 is a front view of this actuator with the n.o. or n.c. switch contacts removed;

FIGURE 3 is a view similar to FIGURE 2 but in which the actuator has had the movable cam also removed;

FIGURE 4 is an exploded diagram of the operating handle (represented in two different normal positions), of a fixed annular bearing surface, of the removable and reversible member and of the movable cam.

In the form of embodiment illustrated in the drawings the multiple-programme rotary switch actuator of the invention comprises:

an external operating handle **1** having an axle **2**. This axle has a cylindrical portion **2***a*, two parallel flats **2***b* and **2***c*, and finally a threaded portion **2***d*;

a fixed annular bearing surface **3** having a stud **4**;

a flat, removable, and reversible member **5**, pierced with a central rectangular opening **6** whose perimeter corresponds to that of the portion of the axle having the parallel flats **2***b* and **2***c*. This positioning member can be mounted either face-up or face-down on the axle **2** of the handle. It also comprises a peripheral lug **7** and four radial openings **8**, **9**, **10** and **11** of different angular dimensions and positions.

The openings **8**, **9** and **10** are not bounded by an outer edge, whereas the opening **11** is so bounded.

The lateral edges of these openings are adapted to strike against the cylindrical stud **4** on the bearing **3** in order to limit the angular displacement of the handle **1**;

an oblong movable cam **12** having ten notches **13** embedded into its rear surface, the lug **7** of the member **5** engaging with any one of these notches, thereby setting the relative positions of the cam **12** and the member **5**.

At one of its longer sides the cam **12** has three semi-circular recesses or notches **14**, **15** and **16** and on the other of its longer sides it has three depressions **114**, **115** and **116**.

These recesses and depressions are adapted to receive a cam-follower or runner **18** biassed by a spring **19**. They thus define the positions and if desired, the automatic return of the handle by virtue of ramps **15***a* and **16***a* which follow the recesses **15** and **16**, curved ramps **114***a* and **114***b* provided on either side of the depression **114**, and other curved ramps **115***a* and **116***a* situated beyond the depressions **115** and **116**.

On the front surface of cam **12** are a certain number of ramps **20** engaging with the push-buttons **21** of the n.o. or n.c. switch contacts provided (**22**).

The runner **18** is mounted on a lever **23** pivoting on a spindle **24** secured to the frame **25** of the actuator. The spring **19** is interposed between the lever **23** and an edge **26** of the frame **25**.

Both the cam **12** and the runner **18** are made from a molded synthetic material contributing to the flexibility of the control.

A nut **27** locks the member **5** and the cam **12** together, these latter being slid onto axle **2**, the first-mentioned on the portion of this axle comprising the flats **2***b* and **2***c*, the second-mentioned on the portion **2***d* of this axle.

The nut **27** screws onto this portion **2***d* which is threaded. It locks onto the shoulder formed on the axle by the flats **2***b* and **2***c*, whereas the cylindrical portion **2***a* of the axle passes through a hole **28** pierced in the frame **25** and is supported in opening **3***a* in a sleeve having the bearing surface **3**, whilst a slight longitudinal play exists with respect to the stop surface **1***a* and **5***a*.

These arrangements enable the actuator to have numerous different switching programmes.

Each of these switching programmes can be represented by means of a number of three figures or letters or other indicia, engraved for instance on the frame, thereby facilitating programmes setting without error.

The first figure could represent the normal position of the handle (either the position A illustrated on all of the FIGURES 1 to 4, i.e. in the longitudinal axis of the actuator, or the position B, perpendicular to this axis, as illustrated in FIGURE 4 only).

The second figure could represent the position of the flat removable and reversible member **5** which has eight possible positions of fit onto flats **2***b* and **2***d*:

position A, opening **9** receiving the stud **4**;
position A, opening **10** receiving the stud **4** by rotation of the member **5**;
position A, opening **8** receiving the stud **4** by turning over the member **5**;
position A, aperture **11** receiving the stud **4** by rotation of the member **5**;
position B, opening **9** receiving the stud **4**;
position B, opening **10** receiving the stud **4** by rotation of the member **5**;
position B, opening **8** receiving the stud by turning over the member **5**;
position B, aperture **11** receiving the stud **4** by rotation of the member **5**.

The third figure could represent the combination, with return, of the handle and the position of the cam **12** which has forty-eight different relative positions with respect to the member **5**, these being decided by:

the positions A and B;
the rotations of member **5**, face up;
the rotations of this member face down;
the six possible housings for runner **18**, either in the recesses **14**, **15** and **16** or in the depressions **114**, **115** and **116**. These different housing are obtainable by inclining the cam **12** according to the inclination *a*, *b* or *c* with respect to the transverse and longitudinal axes of the switch actuator and by turning the cam **12** so as to present to the runner **18** its side **14**, **15**, **16** or its side **114**, **115**, **116**.

Preferably, the choice of the angular positions corresponding to the movements of the handle, or the notches **14**, **15**, **16** or even the ramps **114***a*, **114***b* will be established by two separate marks at 90°. For that, the runner lever **23** can take up, as desired, either of two symmetrical positions C and D and the spring **19** will be located either at **30** or **31**. Correspondingly, the cam **12** is rotated through 90°.

These two methods of mounting thus correspond to either three or two positions. Each position is separated from its immediately adjacent positions by an angular interval of 30°. The three-position combination is always symmetric with respect to one of the geometrical axes of the switch actuator, whilst the two-position combination gives rise to the following choice;

two symmetrical positions at 15° on either side of one of the axes;
one position on one of the axes and the other to the right;
one position on one of the axes and the other to the left.

It is thus possible to obtain:

(a) with recesses **14**, **15** and **16** and ramps **14***a* and **14***b*:

two or three stable positions, the runner **18** being maintained in the recesses **14**, **15** and **16**;
three positions of which two are stable, the runner being maintained for two of them and returned for the third, either by the ramp **15***a* or by the ramp **16***a*;

(b) with depressions **114**, **115** and **116** and ramps **114***a*, **115***a* and **116***a*:

two or three positions with return to one side, this side being selected at will to left or to right;
three positions with return from either side of a central position.

On the other hand the ramps **20** can be conceived so as to cause the simultaneous actuation of the push-buttons **21** in the two-position combinations.

In the three-position combinations the push-buttons **21** can be actuated either individually or successively.

Naturally the scope of the invention is not limited solely to the particular form of embodiment described by way of example, as numerous forms of embodiment can be constructed by a man of the art in the light of the teachings of this invention.

I claim:

1. A multiple program rotary switch actuator having switch contacts thereon comprising

a frame having an opening therethrough;
a control axle supported in the opening in said frame;
a removable and reversible non-slipping connecting member attached to said control axle for rotation therewith having radial openings of differing angular positions therein;
a stop member secured to said frame and positioned for operative contact with the radial openings in said connecting member;
a movable cam mounted on said control axle locked in rotative relation to said connecting member having notches in one of its faces, external ramps on its opposite face in operative relationship with the switch contacts of the actuator, and recesses and ramps on its peripheral edges;
and a follower resiliently mounted on said frame and positioned for operative contact with the recesses and ramps on the peripheral edge of said movable cam.

2. The switch actuator of claim **1**, further characterized by

a lug projecting radially from the peripheral edge of said connecting member positioned for insertion into said notches in one of said faces of said movable cam.

3. The switch actuator of claim **1**, further characterized by

said movable cam having an oblong shape and having said recess and ramps on its peripheral edges located on the longer edges of the oblong shaped cam.

References Cited by the Examiner

UNITED STATES PATENTS

1,993,540	3/1935	Brogger.	
2,435,857	2/1948	Werner	74—528
2,647,962	8/1953	Batcheller	200—153 X
2,794,103	5/1957	Moore et al.	200—18 X
2,796,474	6/1957	Glogan	200—17
2,967,215	1/1961	Whiting	200—153 X
3,089,926	5/1963	Everard et al.	200—38

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