May 1, 1951 D. W. FATH 2,550,792

ELECTRIC SWITCH

Filed June 24, 1946 2 Sheets-Sheet 1

Fig. 1

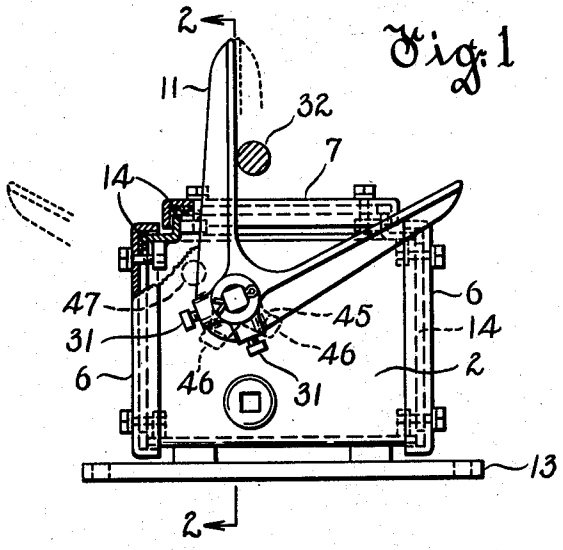
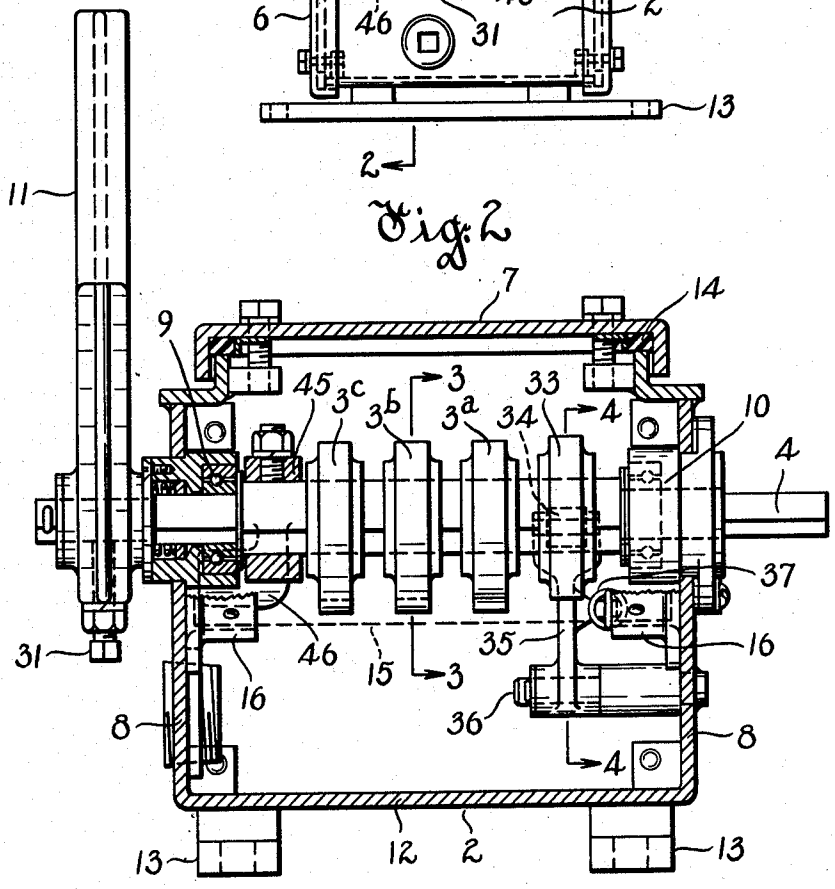


Fig. 2



Inventor
Douglas W. Fath
By Frank H. Hubbard
Attorney

May 1, 1951 D. W. FATH 2,550,792

ELECTRIC SWITCH

Filed June 24, 1946 2 Sheets-Sheet 2

Fig. 3

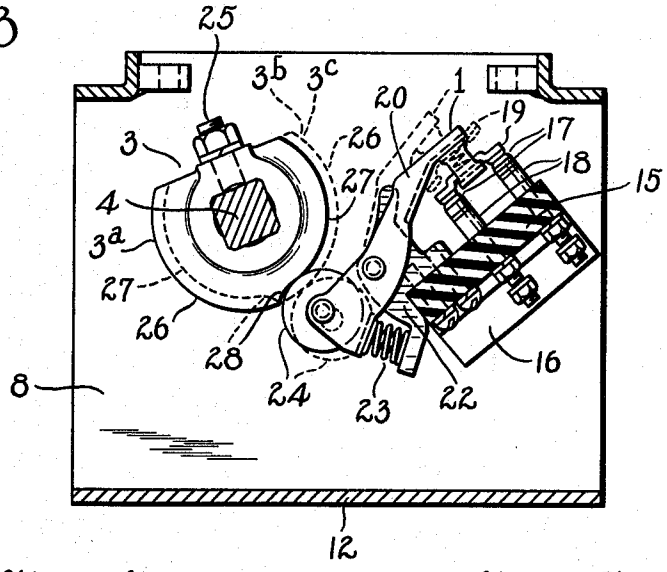


Fig. 4

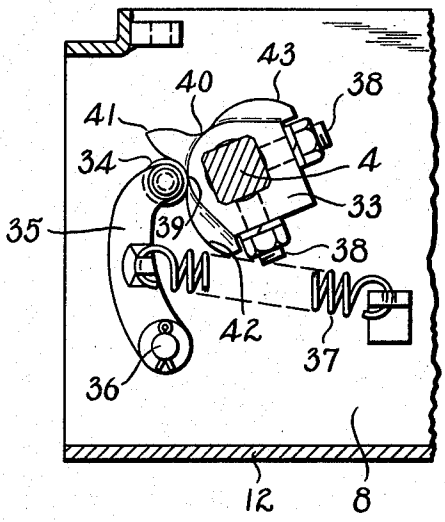


Fig. 5

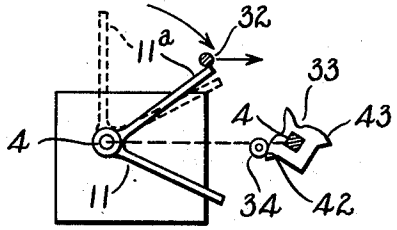
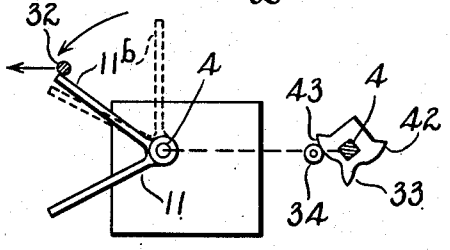


Fig. 6



Inventor
Douglas W. Fath.
By Frank H. Hubbard
Attorney

Patented May 1, 1951 2,550,792

UNITED STATES PATENT OFFICE

2,550,792

ELECTRIC SWITCH

Douglas W. Fath, Milwaukee, Wis., assignor to Cutler-Hammer, Inc., Milwaukee, Wis., a corporation of Delaware

Application June 24, 1946, Serial No. 678,786

3 Claims. (Cl. 200—47)

1

This invention relates to electric switches and is particularly applicable to control switches of the type commonly known as track type limit switches.

The invention has among its objects to provide an improved track type limit switch which is compact, simple and rugged in construction, inexpensive and economical to manufacture and positive and reliable in operation when actuated at exceedingly high operating speeds.

Another object is to provide a track type limit switch of the aforesaid character including a cam actuating element which is movable in opposite directions between given circuit controlling positions and which is also capable of emergency overtravel beyond either of said positions.

Another object is to provide a limit switch of the aforesaid type having biasing means associated therewith for effecting quick movement of the cam actuating element into either of its circuit controlling positions and for also biasing said actuating element against emergency overtravel beyond either of said positions.

Various other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate an embodiment of the invention which will now be described, it being understood that the embodiment illustrated is susceptible of modification without departing from the spirit and scope of the appended claims.

In the drawings,

Figure 1 is an end elevational view of a limit switch embodying the invention with a portion of the enclosing casing thereof broken away and shown in section;

Fig. 2 is a vertical sectional view taken substantially on line 2—2 of Fig. 1;

Figs. 3 and 4 are sectional views taken substantially on lines 3—3 and 4—4, respectively, of Fig. 2, and

Figs. 5 and 6 are schematic views illustrating the switch operating mechanism in over-travel positions.

Referring to the drawings, the same illustrate a track type limit switch including a plurality of control switches 1 which are mounted within an enclosing casing 2 and are operable by cams 3 fixed to a square operating shaft 4. Casing 2 is rectangular in shape and is provided with side openings which are closed by a pair of removable cover plates 6—6 and a top opening which is closed by removable cover plate 7. The end walls 8—8 of casing 2 are provided with openings for receiving end bearings 9 and 10 associated with shaft 4, and said shaft has a V-shaped operating lever 11 fixed to one end thereof. The bottom wall 12 of casing 2 is provided with mounting feet 13 and the joints between said casing and its associated cover plates 6 and 7 are sealed by gaskets 14 to provide a waterproof structure.

2

More specifically, the limit switch illustrated is provided with three control switches 1 which are mounted upon an insulating base 15 (Fig. 3) carried by brackets 16 fixed to the end walls 8 of casing 2. These control switches are of like construction, each comprising a pair of stationary contacts 17—17 carried by binding posts 18 which are mounted upon base 15 and a cooperating bridging contact 19 carried by a lever 20. The levers 20 of switches 1 are arranged in spaced parallel relation and each is pivotally mounted upon a bracket 22 fixed to base 15 and is biased by a spring 23 to maintain its associated bridging contact 19 in circuit closing position. Also each of the levers 20 is provided with an operating roller 24 which is constructed of insulating material and which rides upon the periphery of its associated cam 3.

The operating cam 3 are of like construction, each being provided with a square opening for receiving shaft 4 and being secured to said shaft by a set screw 25. Also each of the cams 3 is provided with high and low concentric cam faces 26 and 27 and a connecting inclined cam face 28. One of the cams 3, as for example the cam designated by exponent a in Fig. 2 is shown as being mounted upon shaft 4 in the full line position illustrated in Fig. 3, and the other cams designated by exponents b and c are shown as being mounted upon said shaft in the position illustrated by dotted lines in Fig. 3. With lever 11 positioned as shown in full lines in Fig. 1 the cam surface 27 of cam 3^a is positioned for closure of its associated switch 1 and the cam surfaces 26 of cams 3^b and 3^c are positioned for opening of their associated switches 1. Upon a given degree of counterclockwise rotation of operating lever 11 out of the position shown in Fig. 1 cam surface 26 of cam 3^a effects opening of its associated switch and cam surfaces 27 of cams 3^b and 3^c permit closure of their associated switches 1.

Shaft 4 is provided with square end portions which extend beyond bearings 9 and 10, and lever 11 may be secured to either of said end portions in any one of four different angular positions by means of set screws 31. As illustrated in Fig. 1 lever 11 is mounted upon the left hand

end portion of shaft 4 in a vertical position and is operable by a pin 32 which travels in a horizontal plane. Shaft 4 is provided with a biasing mechanism comprising a cam 33 and an associated roller 34 which is carried by a lever 35. Roller 34 is pivotally mounted upon one end of lever 35 and the opposite end of said lever is pivotally supported upon a pin 36 fixed to the right hand end wall 8 of casing 2, as shown in Fig. 2. Lever 35 is biased by a spring 37 to maintain its associated roller 34 in engagement with the periphery of cam 33. Cam 33 is provided with a square opening for receiving shaft 4 and is secured to said shaft by set screws 38. As shown in Fig. 4, cam 33 is provided with spaced roller receiving recesses 39 and 40 which are located on opposite sides of a V-shaped cam projection 41 and between a pair of eccentric cam surfaces 42 and 43.

As is apparent from the foregoing, when lever 11 is positioned as shown in full lines in Fig. 1, roller 34 engages within recess 39 in cam 33 to yieldingly hold shaft 4 against rotation in opposite directions out of the positions shown in Fig. 3. As hereinbefore stated, when lever 11 is positioned as shown in Fig. 1 the switch associated with cam 3^a is maintained in closed position and the switches associated with cams 3^b and 3^c are maintained in open position. Upon movement of lever 11 into the dotted line position shown in Fig. 1, roller 34 engages within the recess 40 in cam 33 to yieldingly hold shaft 4 against movement in opposite directions out of a position wherein the switch associated with cam 3^a is maintained in open position and the switches associated with cams 3^b and 3^c are maintained in closed position.

In connection with the foregoing it will be noted that when lever 11 is rotated by its associated operating pin 32 either in a counterclockwise direction out of the full line position illustrated in Fig. 1 or in a clockwise direction out of the dotted line position illustrated in this figure, roller 34 is moved outwardly against the action of spring 37 by one of the side faces of the cam projection 41 to oppose rotative movement of said lever until said roller moves over the peak or high point of said cam projection. Roller 34 is then moved inwardly under the action of spring 37 across the opposite face of cam projection 41 to move lever 11 into either its full or dotted line position, as the case may be, with a snap action.

It should also be noted that the above described operating mechanism is advantageous in that the same permits safe emergency overtravel of operating lever 11 beyond the positions illustrated in full and dotted lines in Fig. 1. Thus assuming that the operating mechanism is maladjusted so that operating pin 32 in moving toward the right engages the arm 11^a of lever 11 to effect overtravel of said lever beyond the position illustrated in full lines in Fig. 1 into the position illustrated by full lines in Fig. 5. Cam 33 then assumes a position in which the surface 42 thereof is engaged by roller 34 to bias operating lever 11 and shaft 4 for return to the full line position shown in Fig. 1 upon movement of operating pin 32 toward the right beyond arm 11^a of said operating lever. On the other hand, assuming that the operating mechanism is maladjusted so that operating pin 32 in moving toward the left engages arm 11^b of lever 11 to effect overtravel of said lever beyond the position illustrated in dotted lines in Fig. 1 into the position illustrated by full lines in Fig. 6. Cam 33 then assumes a position in which the surface 43 thereof is engaged by roller 34 to bias operating lever 11 and shaft 4 for return to the dotted line position illustrated in Fig. 1 upon movement of operating pin 32 toward the left beyond arm 11^b of said operating lever. As is apparent from Fig. 3, the cam surfaces 26 and 27 of cams 3 permit a wide degree of overtravel of operating lever 11 and shaft 4 beyond the positions illustrated in full and dotted lines in Fig. 1 without operation of their associated switches 1.

As shown in Fig. 2, shaft 4 has a lever 45 fixed to the left hand end thereof. Said lever is provided with projecting arms 46 which cooperate with a fixed stop 47 on the left hand end wall of casing 8 to permit a limited degree of overtravel of shaft 4 and its associated operating lever 11 in opposite directions beyond the positions illustrated by full and dotted lines in Fig. 1.

What I claim as new and desire to secure by Letters Patent is:

1. In combination, a control switch having a rotatable cam operating element movable in opposite directions between two normal limits for opening and closure of the switch and being capable of emergency overtravel a given degree beyond either of its normal limits without effecting change in the position of the switch, means limiting said cam operating element to overtravel to said given degree beyond either of its normal limits, an operating lever fixed to said cam operating element, a traveling operating part for said lever, said operating part being normally associated with said lever to effect movement of said cam operating element in opposite directions between its normal limits and being operative upon maladjustment with respect to said lever to cause overtravel of said cam operating element beyond its normal limits, and a cam biasing mechanism associated with said cam operating element for effecting snap movement of said cam operating element into either of its normal limits upon a given movement thereof away from the other of its normal limits and for also effecting return of said cam element to either of its normal limits upon overtravel therebeyond.

2. A limit switch mechanism comprising an enclosing casing, an insulating base mounted within said casing, a plurality of control switches mounted upon said insulating base and each biased toward circuit closing position, a cam operating element for said switches rotatably mounted within said casing, said cam operating element being movable in opposite directions between two limits to effect opening and closure of said switches selectively and being capable of emergency overtravel a given degree beyond either of its normal limits without effecting change in the position of said switches, means limiting said cam operating element to overtravel to said given degree beyond either of its normal limits, an operating lever fixed to said cam operating element, a traveling operating part associated with said lever, said operating part being normally associated with said lever to effect movement of said cam operating element in opposite directions between its normal limits and being operative upon maladjustment with respect to said lever to cause overtravel of said cam operating element beyond its normal limits, and a cam biasing mechanism associated with said cam operating element for effecting snap movement of said cam operating element into either of its normal limits upon a given movement thereof away from the other of its normal

limits and for also effecting return of said cam operating element to either of its normal limits upon overtravel therebeyond.

3. In combination, a control switch having a rotatable cam operating element movable in opposite directions between two normal limits for opening and closure of the switch and being capable of emergency overtravel a given degree beyond either of said limits without change in the position of said switch, means limiting said cam operating element to overtravel to said given degree beyond either of its normal limits, a V-shaped operating lever fixed to said cam operating element, a traveling operating part for said lever, said operating part being normally operable by engagement with the opposing sides of the arms of said lever to effect movement of said cam element in opposite directions between its normal limits, and said operating part upon maladjustment of said lever with respect thereto being operable by engagement with the outer sides of the arms of said lever to effect overtravel of said cam operating element beyond its normal limits, and a cam biasing mechanism associated with said cam operating element for effecting snap movement of said cam operating element

into either of its normal limits upon a given movement thereof away from the other of its normal limits, and for also effecting return of said cam element to either of its normal limits upon overtravel therebeyond.

DOUGLAS W. FATH.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,169,957	Henry	Feb. 1, 1916
1,386,897	Rockwell et al.	Aug. 9, 1921
1,633,825	Prescott	June 28, 1927
1,768,756	Gersmann et al.	July 1, 1930
2,059,023	Perry	Oct. 27, 1936
2,130,153	Plensler	Sept. 13, 1938
2,181,829	Jeffrey	Nov. 28, 1939

FOREIGN PATENTS

Number	Country	Date
379,687	Great Britain	Aug. 23, 1932
439,641	Great Britain	Dec. 11, 1935
725,626	France	Feb. 15, 1932