July 13, 1965 A. VISCHER, JR 3,194,916

FLUID OPERATED SWITCH ACTUATOR

Filed March 1, 1962

Fig-2

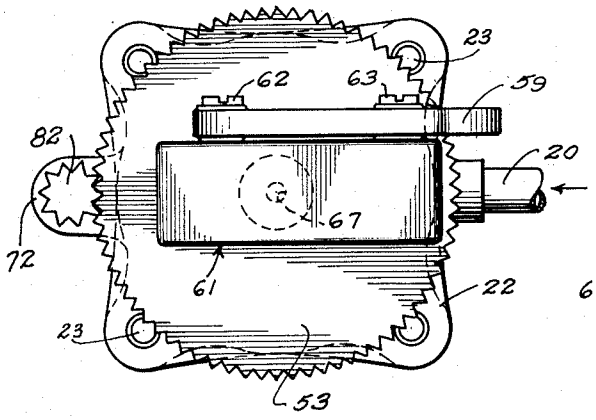


Fig-3

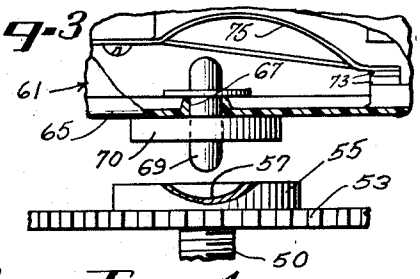


Fig-4

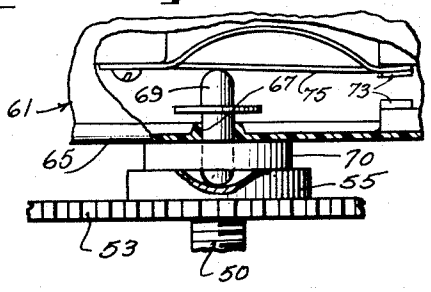
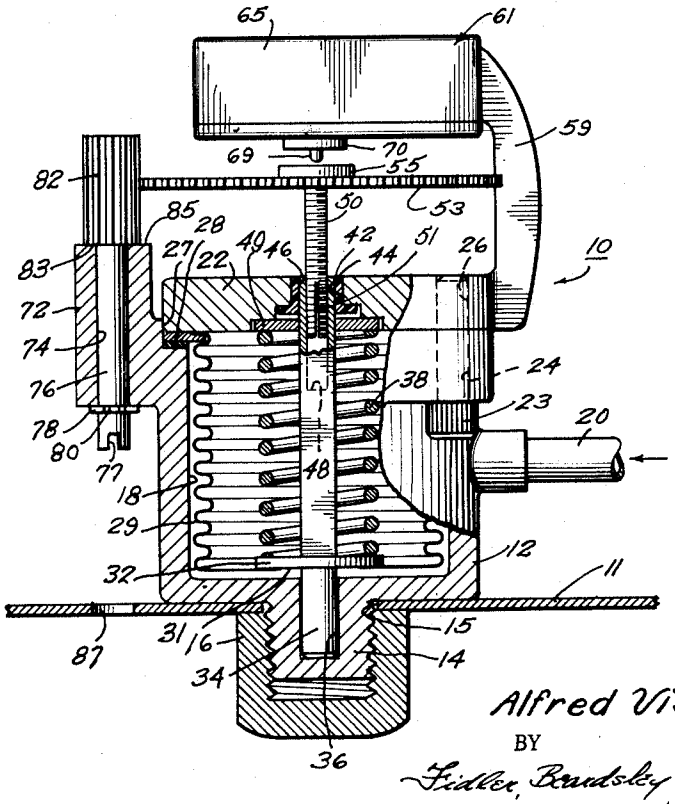


Fig-1



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United States Patent Office 3,194,916 Patented July 13, 1965

3,194,916

FLUID OPERATED SWITCH ACTUATOR

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Filed Mar. 1, 1962, Ser. No. 176,513
6 Claims. (Cl. 200—83)

The present invention generally relates to electric switch actuators of the type which are responsive to the pressure in an associated fluid system, and it more particularly relates to pressure operated switch actuating means wherein the pressure level at which the switch is actuated is panel adjustable.

An object of the present invention is to provide a new and improved fluid operated switch actuator.

Another object of the present invention is to provide a new and improved device for actuating an electric switch which device includes means for adjusting the pressure at which the switch is actuated.

A further object of the present invention is to provide a new and improved switch actuator which is responsive to fluid pressure applied thereto and which is compact in design, sturdy in construction and substantially immune to damage caused by excessive pressure surges in the system.

Further objects and advantages and a better understanding of the present invention may be had by reference to the following detailed description taken in connection with the accompanying drawing in which:

FIG. 1 is a side elevational view partly in section of a switch actuator and associated electric switch embodying the present invention;

FIG. 2 is a top view of the device of FIG. 1 assuming the entire structure to be shown therein;

FIG. 3 is a greatly enlarged fragmentary view partly in section of a portion of the device of FIG. 1 in one condition of operation; and

FIG. 4 is an illustration similar to FIG. 3 showing the mechanism in a different condition of operation.

Referring now to the drawing and particularly to FIG. 1 thereof, there is shown a switch and actuator assembly 10 which is fixedly attached to a suitable support plate 11. The assembly 10 comprises a cup-like housing 12 having an externally threaded mounting boss 14 disposed axially thereof and extending through a D-shaped aperture 15 in the support plate 11. A cap nut 16 is threaded over the boss 14 to secure the assembly 10 to the support plate 11.

As shown, the housing 12 defines a cylindrical cavity 18 which is closed at the top by means of a removable cover plate 22 secured to the housing 12 by suitable means such, for example, as a plurality of screws 23 which extend through suitable apertures 24 in the housing 12 and are threadedly received in threaded apertures 26 in the cover 22. Pressurized fluid is adapted to be supplied to the cavity 18 via a conduit 20 suitably connected in the system to which the unit is responsive. A counterbore 27 surrounds the mouth of the cavity 18 to provide a rabbet in which the cover plate 22 is received. A sealing gasket 28 and an annular flange soldered on an expansible bellows 29 are sandwiched between the plate 22 and the housing 12 whereby the bellows 29 is sealably secured to the housing 12 and depends into the cavity 18. A circular aperture 31 is located in the bottom of the bellows 29 and is sealably closed by means of a flat washer 32 which is soldered to the bellows assembly 29 and to the rod 34 which extends therethrough. The lower end of the square rod 34 is cylindrical and slidably received in

a generally cylindrical hole 36 in the boss 14 thereby to provide a bearing surface for the axially movable rod 34.

In order to bias the bellows 29 into the illustrated position against a force exerted thereon by the fluid pressure in the cavity 18, a coil spring 38 surrounds the rod 34 internally of the bellows 29 and is compressed between the top face of the washer 32 and the bottom face of a washer 49 which is received in a suitable counterbore in the cover plate 22 and loosely fitted on the rod 34. The washers 32 and 49 have inwardly facing hubs to locate the spring 38 centrally with the axis of the housing 12. The rod 34 extends through a bearing member 42 formed of a suitable bearing material such, for example, as tetrafluoroethylene and is received in a centrally located aperture 44 and associated counterbore in the cover plate 22. The bearing 42 has a square bore 46 extending therethrough in which the upper end of the rod 34, which is also square in cross section, is received, whereby rotation of the rod 34 relative to the bearing 42 is prevented. The bearing 42 also has a square external cross section receivable in a square cross-sectional portion of the hole 44 whereby the rod 34 is prohibited from rotating relative to the cover plate 22. A cylindrical blind hole 48 is provided in the upper end of the rod 34 and is suitably threaded to receive a screw 50 having a longitudinal slot 51 in the lower end thereof. The portion of the screw 50 which is slotted is slightly expanded so as to tightly fit in the hole 48 to prevent rotation thereof within the bore 48 under the influence of spurious vibrations or the like.

Fixedly secured to the head 55 of the screw 50 is a spur gear 53 over the hub of which the switch actuating head 55 is located. As best shown in FIG. 3, the screw head 55 includes a centrally disposed recess 57 having a generally spherical bottom wall. The cover plate 22 includes an upwardly disposed arm 59 to which an electrical switch 61, such, for example, as a snap-acting microswitch, is fixedly attached as by means of a plurality of screws 62 and 63. The switch 61 includes a rigid housing 65 having an aperture 67 therein through which extends a switch actuating plunger 69 axially movable within the hole 67. As shown, the plunger 69 is aligned with the axis of the screw 50 so that when the bellows 29 is forced upwardly by the pressure in the cavity 18, the disc 55 moves into engagement with the plunger 69 to move it through the over-center position of an over-center spring 75 into the position illustrated in FIG. 4, thereby to actuate the switch 61 and open the contacts 73. When the screw head 55 moves a short distance toward the switch 61 after actuation thereof, the portions of the screw head 55 surrounding the recess 57 engage a rigid disc-like boss portion 70 of the switch housing 65, as shown in FIG. 4, whereby no further force can be exerted on the switch actuating member 69.

In order to adjust the distance through which the bellows 29 and the rod 34, which extends therethrough, must move in order to actuate the switch 61, and thereby to control the pressure value at which the switch 61 is actuated, there is provided in accordance with another feature of the present invention means for controlling the unstressed or normal position of the actuator disc 55 relative to the switch actuator plunger 69. A lug 72 having a cylindrical bore 74 extending therethrough forms part of the housing 12, and an axle 76 is journalled in the bore 74 in parallel relationship with the screw 50. The lower end of the axle 76 is provided with a screwdriver slot 77 for facilitating rotation of the axle 76 by means of a screwdriver inserted through a suitable aperture 87 in the support plate 11, and a snap ring 78 received in an annular groove 80 in the axle 76

to limit upward movement of the axle 76 within the bore 74.

A pinion gear 82 is fixedly attached to the upper end of the axle 76 with the smooth lower face 83 thereof in engagement with a smooth upper surface 85 of the lug 72. Accordingly, downward movement of the axle 76 in the bore 74 is also prevented. The pinion gear 82 has a relatively long length and operatively engages the spur gear 53 whereby rotation of the pinion gear 82 rotates the screw 50 within the rod 34 thereby to move the actuator disc 55 toward or away from the switch actuating plunger 69, depending on the direction of rotation of the axle 76. Rotation of the pinion gear 82 thus results in the gear 83 moving axially along the pinion gear 82 which has a sufficient length to permit such movement without disengagement of the two gears.

While the present invention has been described in connection with a particular embodiment thereof, it will be understood that those skilled in the art may make many changes and modifications without departing from the true spirit and scope of the invention. Therefore, in the appended claims it is intended to cover all such changes and modifications as come within the true spirit and scope of this invention.

I claim:

1. A fluid operated switch actuator comprising a housing defining a cavity therein, a cover member sealably connected to said housing, a bellows secured to said cover depending into said cavity, a coil spring mounted within said bellows axially thereof to bias said bellows into said cavity, a fluid inlet to said cavity externally of said bellows, a control rod extending axially through said cover and secured to said bellows for axial movement in accordance with the expansion and contraction of said bellows in said cavity, said rod having an axial hole therein opening outwardly of said cover and having a threaded wall, a screw threadedly received in said hole, a spur gear secured to said screw, a pinion gear rotatably carried by said housing in operative meshing engagement with said spur gear whereby rotation of said pinion gear causes axial movement of said screw in said rod, a switch mounted to said housing beyond the exposed end of said screw, said switch having an actuator disposed axially of said screw, said actuator being operated by movement thereof along the axis of said screw, and means operatively connecting said screw to said actuator whereby axial movement of said screw operates said switch.

2. The switch actuator set forth in claim 1 wherein said switch includes a housing having said actuator extending outwardly through an aperture therein, and said means includes a member having a recess therein for receiving the end of said actuator, said member having a switch housing abutting portion surrounding said recess having a greater cross-sectional dimension than said aperture in said switch housing, said recess having a depth dimension such that movement of said member toward said switch housing causes actuation of said switch prior to engagement of said switch housing abutting portion with said switch housing, said abutting portion engaging said switch housing prior to actual seating of said actuator in said switch housing to prevent damage to said switching mechanism.

3. A fluid operated switch actuator comprising a housing defining a cavity therein, a cover member sealably connected to said housing, a bellows secured to said cover depending into said cavity, a coil spring mounted within said bellows axially thereof to bias said bellows into said cavity, a fluid inlet to said cavity externally of said bellows, a control rod extending axially through said cover and said bellows for axial movement in accordance with the expansion and contraction of said bellows in said cavity, said rod having a rectangular peripheral portion at the location where it passes through said cover, said cover having a complementary shaped

aperture in which said rectangular peripheral portion is disposed thereby to prevent rotation of said rod in said cover, said rod having an axial hole therein opening outwardly of said cover and having a threaded wall, a screw threadedly received in said hole, a spur gear secured to said screw, an axle rotatably secured to said housing in parallel relationship with said rod, a pinion gear fixedly secured to said axle in operative meshing engagement with said spur gear whereby rotation of said pinion gear causes axial movement of said screw in said rod, one end of said axle extending from said housing and having an irregularity thereon adapted to receive a tool for rotating said axle, a switch mounted to said housing beyond the exposed end of said screw, said switch having an actuator disposed axially of said screw, said actuator being operated by movement thereof along the axis of said screw, and means operatively connecting said screw to said actuator whereby axial movement of said screw operates said switch.

4. Apparatus for operating an electrical switch of the type having a rigid housing and an actuator member extending out of said housing through an aperture therein, axial movement of said actuator member through a predetermined distance into said housing causing actuation of switching mechanism disposed in said housing, the combination of controlled means mounted externally of said housing and movable along the axis of movement of said actuator member, an operating member connected to said controlled means and engageable with said actuating member for pressing said member into said housing, said operating member having a recess in which the exposed end of said actuating member is loosely receivable, said operating member having a shoulder adjacent said recess for abutment with said switch housing, the distance between said shoulder and the bottom of said recess being slightly greater than said predetermined distance, whereby movement of said operating member toward said switch causes said shoulder to engage said switch housing shortly after actuation of said switch to prevent damage to said switch mechanism.

5. A pressure operated electric switch for mounting on the back of a panel and adjustable from the front of said panel, comprising means defining a pressure chamber connectable to a source of pressurized control fluid, said means being secured to the one side of said panel, a bellows mounted across said chamber for controlled movement thereof under the influence of the fluid in said chamber, an electric switch fixedly mounted on said chamber defining means and having a movable actuatable portion, a bar secured to said bellows for axial movement therewith toward and away from said switch actuatable portion, means for restraining rotation of said bar relative to said chamber defining means, a switch actuating member threadedly received in an end of said bar facing toward said switch for selected movement toward and away from said switch actuatable portion in response to the pressure in said chamber, whereby relative rotation between said bar and said switch actuating member varies the distance between said switch actuating member and said actuatable portion of said switch, a first gear mounted on said actuating member for rotation therewith, a rotatable adjusting rod mounted on said chamber defining means in parallel relationship with said bar, a second gear mounted on said rod and mating with said first gear, and said panel having a small access opening therein adjacent to one end of said rod to enable rotation of said rod from the other side of said panel, whereby the pressure in said chamber at which said switch is actuated is adjustable from the front of said panel.

6. A pressure operated switch comprising a housing having a recess therein, said housing being provided with means for securing said housing to the rearward side of a support panel, an expansible bellows mounted in said housing across said recess to define a pressurizable cham-

ber, a switch mounted on said housing, a switch actuating member secured to said bellows and movable thereby into switch actuating position, and means for adjusting the relative positions of said actuating member and said switch to adjust the movement of said bellows required to actuate said switch, said means including a rotatable adjustment member mounted on said housing directly opposite an access opening in said panel, whereby the pressure at which said switch is actuated is adjustable from the front of said panel.

References Cited by the Examiner

UNITED STATES PATENTS

2,092,559	9/37	Runaldue	200—83
2,283,374	5/42	Kronmiller	200—83
2,432,312	12/47	Hasselhorn	200—83
2,768,646	10/56	Plank	200—83
2,977,814	4/61	Brunson	74—424
3,036,173	5/62	Perkins	200—83

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