

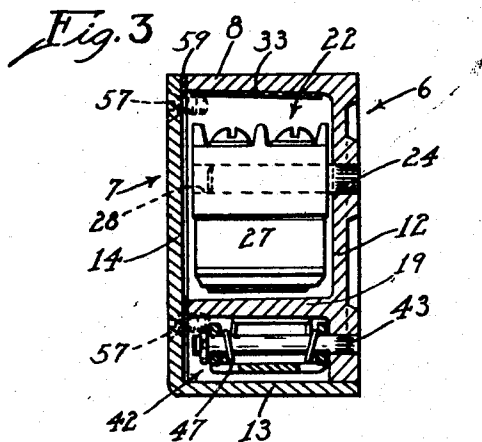
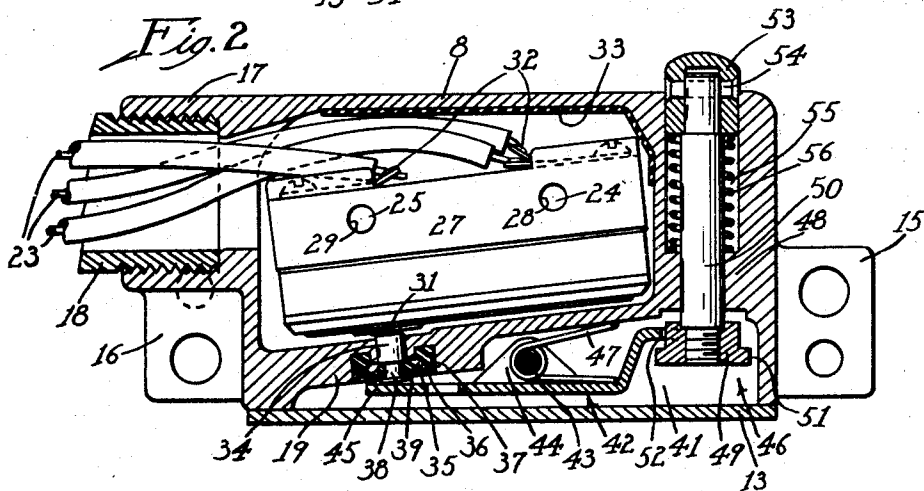
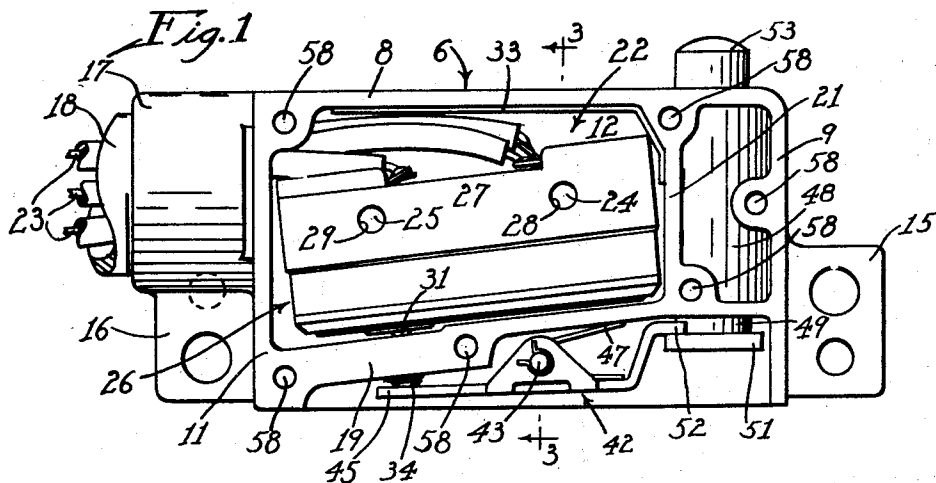
Dec. 2, 1947.

V. H. FRY

2,431,747

SWITCH MECHANISM

Filed July 15, 1943



Inventor:
Virgil A. Fry

By
McCanna, Wintercorn & Morbach *Attys.*

UNITED STATES PATENT OFFICE

2,431,747

SWITCH MECHANISM

Virgil H. Fry, Freeport, Ill., assignor, by mesne assignments, to First Industrial Corporation, Wilmington, Del., a corporation of Delaware

Application July 15, 1943, Serial No. 494,761

4 Claims. (Cl. 200—168)

1

This invention relates to electric switches and has particular reference to limit switches such as used with power machinery, machine tools and the like, and adapted particularly for applications where the switch is exposed to liquids.

Increasing use of limit switches in machine tool applications and other locations where the switch is exposed to liquids presents a difficult problem. In such uses, for example, the switch is frequently exposed to oil, soap solution, and other coolants, as in machine tools, to milk, water, and steam, as in dairies, and in other instances is subjected to severe weather conditions. Under these circumstances it is necessary in order to maintain the accuracy and precision of the switch as well as to preserve the life thereof that the actual switching mechanism be protected from contact by these liquids. The problem is further aggravated by the necessity for providing overtravel in the switch mechanism such that the actuating button of the switch will accommodate considerably more motion than that actually used for operating the switch mechanism.

An important object of the invention is the provision of a low cost precision type switch suitable for use as a limit switch in the presence of liquids such as oil and water wherein a unitary switch adapted for operation by a movement of small magnitude is sealed from access by the liquid, and an actuating and overtravel mechanism is disposed in the switch outside the sealed chamber.

A further object of the invention is the provision of a novel actuating mechanism, a novel switch housing, and novel overtravel mechanism together with other objects as will appear from the following description and the accompanying drawing, in which—

Figure 1 is a side elevation of the switch with the cover removed therefrom;

Fig. 2 is a longitudinal section through the switch mechanism, and

Fig. 3 is a section on the line 3—3 of Figure 1.

In the present embodiment of the invention which is shown by way of example, the invention includes a housing including a case 6 and a cover 7. In this instance the case and cover are of die cast construction. The case has an upstanding top wall 8 and upstanding end walls 9 and 11 which define outer walls of the housing, the case also having a side wall 12 integral with the top and end walls. The bottom wall 13 of the housing is formed by a flange on the cover which also has a panel 14 forming the front wall of the housing. The case also has outwardly disposed mounting

2

lugs 15 and 16, in this instance the mounting lug 16 being integral with a threaded conduit flange 17 adapted to receive a threaded conduit as shown at 18. Intermediate the peripheral walls of the housing is an intermediate wall comprising a horizontally disposed wall 19 and a vertically disposed wall 21 which define a chamber 22 within the case. The flange 17 has a central opening communicating with the chamber 22 for the passage of electrical conductors 23 into the interior of the chamber as will be apparent from Fig. 2. Fixed in the back wall 12 of the housing are pins 24 and 25 which project into the chamber 22 for the purpose of supporting a unitary switch structure 26.

This unitary switch structure is of the precision snap acting type such as that disclosed in United States Patent 1,960,020, to Phillip K. McGall, the switch in this instance including a molded casing designated generally by the numeral 27 having openings 28 and 29 for the reception of the pins 24 and 25 to support the switch in fixed position within the chamber 22. As described in said patent, the unitary switch also has a pin 31 projecting therefrom and movable transversely of the housing 27 for the purpose of actuating the contact mechanism therein. This McGall switch is of the snap acting type and requires only a small transverse movement of the pin 31 (on the order of a few thousandths of an inch) for actuation of the contact mechanism. As will be seen from Fig. 2, the electrical conductors 23 pass into the chamber 22 and are attached to the unitary switch mechanism as indicated at 32. A layer of electrical insulation 33 may suitably be disposed along the inner wall of the chamber 22 opposite the connections 32 for the purpose of shielding the case against any possible contact with the conductors.

Positioned in the wall 19 opposite the pin 31 is a plunger 34, the plunger having a snug fit in the wall and being adapted to move laterally thereof for the purpose of actuating the pin 31. The wall 19 has an annular recess 35 surrounding the pin 34 in which is received a diaphragm 36 of synthetic rubber such as neoprene, the diaphragm being secured therein by a ring 37 press fit into the opening. The plunger 34 has a portion 38 of smaller diameter than the remainder of the plunger. This portion of the plunger passes through an opening in the diaphragm and the diaphragm is snugly secured around the plunger by means of a fastening ring 39, the arrangement being such that no movement occurs as between

the diaphragm and the wall or the diaphragm and the plunger with longitudinal movement of the plunger so that in this way a tight seal is effected around the plunger.

It will be seen that the structure heretofore recited defines a chamber 41 below the wall 19 and above the outer wall 13, and in this chamber is located a rocker arm 42. The rocker arm 42 is carried on a pin 43 fixed in the back wall 12 and projecting into the chamber, the rocker arm having upstanding ears 44 journaled on the pin 43. One end 45 of the rocker arm is disposed adjacent the outer end of the plunger 34, and the opposite end of the rocker arm projects longitudinally of the casing into the vicinity of an actuating rod assembly designated generally by the numeral 46. A coil spring 47 acts between the lever and the wall 19 urging the lever in a clockwise direction so as to urge the end 45 of the lever against the plunger to move the pin 31 inwardly unless otherwise restrained.

The actuating rod assembly 46 includes a rod 50 positioned for longitudinal movement in the case in an enclosing wall 48 adjacent the end wall 9, the lower end of the rod being threaded and carrying a head 49 having a square annular flange 51 adjacent the lower end thereof. The end of the rocker arm 42 is curved as shown at 52 and rests above the annular flange 51 so that when the head moves down the rocker arm is free to rotate under the action of the spring 47 to operate the plunger 34 and the pin 31, whereas when the head 49 moves upwardly the flange 51 engages the end of the rocker arm rotating the arm in a counterclockwise direction against the action of the spring to permit outward movement of the pin 31. The upper end of the rod 50 carries a cap 53 which is secured thereon by a pin 54 passing through the head and the pin and riveted thereto in fixed relationship. The case has a counterbore 55 around the rod 50 and in which is disposed a coil spring 56 which acts between the case and the cap to normally urge the rod 47 upwardly and permitting the head 53 to be depressed a distance sufficient to bring the top of the head flush with the top wall 8 of the case.

It will be seen that the actuating rod assembly is such as to provide a large amount of overtravel without in any way affecting the operation of the rocker arm 42 and the pin 31 since the flange 51 engages the rocker arm toward the upper end of its movement. Thus with the initial downward movement of the rod 50, the annular flange 51 is moved downward to permit rotation of the rocker arm and actuation of the switch, and that thereafter the plunger rod assembly continues its downward movement free of the rocker arm as will be apparent from Fig. 2. This provides a particularly sturdy and rugged construction and one in which the head 53 may be struck with relatively great severity without imparting an equally severe blow to the rocker arm and the switch mechanism. Likewise, this assembly permits a large amount of overtravel in the actuating rod assembly without affecting the length of travel of the plunger 34, which in every operation of the switch travels through an identical very small stroke.

The cover 7 is secured across the front of the case 6 by means of a plurality of screws 57 engaging screw openings 58 in the case and a gasket 59 is disposed between the case and the cover along the front edges of the walls 8, 9, 11, 19 and 21, the screws drawing the gasket up so as

to provide a liquid-tight seal in this area. This arrangement renders the chamber 22 completely sealed against the entrance of liquid from the exterior. This is rendered possible through the fact that the actuating rod assembly 46 is disposed outside the chamber and gives the relatively large amount of overtravel necessary for the limit switch, and through the fact that only a relatively small amount of motion is imparted through the plunger 34, and this plunger is effectively sealed by the use of the diaphragm 36 which flexes sufficiently to permit of the necessary small movement required to actuate the pin 31.

It will be seen that this construction provides a very simple arrangement by which a liquid-tight switch is provided completely eliminating the possibility of the entrance of liquid into the unitary switch 26. The structure is such that it is not readily damaged in service and such that wear in the various actuating parts does not affect the accuracy of the mechanism.

I claim:

1. The combination in a switch mechanism of the class described of a switch housing and operating structure comprising a case having a rear wall, upstanding top and end walls integral therewith, and an upstanding wall intermediate the top and bottom edges of said rear wall, a cover for said case comprising a front wall and a bottom wall defining with said case separate switch and actuator compartments, sealing means disposed between said cover and the front edges of said top, end and intermediate walls for sealing said switch compartment against the entrance of liquid thereto, means in said switch compartment for supporting a switch therein, a secondary actuator sealed in said intermediate wall, an operating lever disposed in said actuator compartment in engagement with the secondary actuator, and an overtravel primary actuator carried in said case outside said switch chamber and arranged for axial movement in said case, said primary actuator having one end projecting from said top wall and the other end projecting into said actuator compartment for engagement and actuation of said operating lever.

2. The combination in a switch construction of the class described of a housing having walls defining a sealed compartment, means in said compartment for supporting a unitary switch having an operating pin movable through a small motion, a primary actuator comprising a rod carried by said housing outside said compartment, a secondary actuator comprising a plunger disposed in one of said walls adjacent said operating pin for longitudinal reciprocation through the wall for actuating the pin, a flexible seal outside said compartment between said wall and said secondary actuator for preventing liquid from entering said sealed compartment around said secondary actuator, and means outside said compartment including a lever and a lost motion connection between said actuators for moving said secondary actuator in response to movement of said primary actuator.

3. The combination in a switch construction of the class described of a housing having walls defining a sealed compartment, a secondary actuator comprising a plunger carried in one of said walls for movement axially through a small movement with respect thereto, a seal for said secondary actuator comprising a flexible rubber like disc disposed in one of said walls outside the compartment attached at its periphery to said

5

wall and at its center to said plunger shaped to flex upon movement of the plunger, means in said compartment for supporting a unitary switch having an operating means movable through a small motion to operate the same with said operating means in registration with said secondary actuator to be actuated upon movement thereof, a lever outside said compartment engaging said plunger and rotatable to operate the same, a primary actuator on said housing outside said compartment engaging said lever movable through a large movement to actuate said secondary actuator, and an overtravel connection between said primary actuator and the lever to accommodate for the difference in the degree of movement between said actuators.

4. The combination in a switch construction of the class described of a housing having walls defining a sealed compartment, means in said compartment for supporting a unitary switch therein having an operating member movable through a small motion to operate the same, a secondary actuator comprising a plunger disposed in one of said walls and in juxtaposition to said switch member, movable axially through said wall through a small movement to actuate said member, a flexible diaphragm around said plunger attached thereto and to said one of said walls to seal said plunger with respect thereto and permit said small movement, a lever outside said compartment positioned to engage said

6

plunger and spring pressed to move in one direction between small limits to actuate said plunger in one direction to operate said switch, and a primary overtravel actuator comprising a second plunger disposed in said housing outside said compartment and projecting outwardly from said housing for movement through a stroke substantially greater than the movement of said lever, spring means for urging said secondary plunger to an outwardly projected position, and a lost motion connection between said secondary plunger and said lever comprising an abutment on said second plunger shaped and positioned to engage said lever only during the initial part of the inward movement of said second plunger and the final portion of the outward movement thereof to actuate said switch.

VIRGIL H. FRY.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,236,680	Fry	Apr. 1, 1941
2,192,296	Boynton	Mar. 5, 1940
2,357,973	Robbins	Sept. 12, 1944
2,202,207	Johnson	May 28, 1940
2,244,373	Powers	June 3, 1941