Oct. 19, 1948. C. G. KRONMILLER 2,451,751

SWITCH DEVICE

Filed May 19, 1944

Fig. 1.

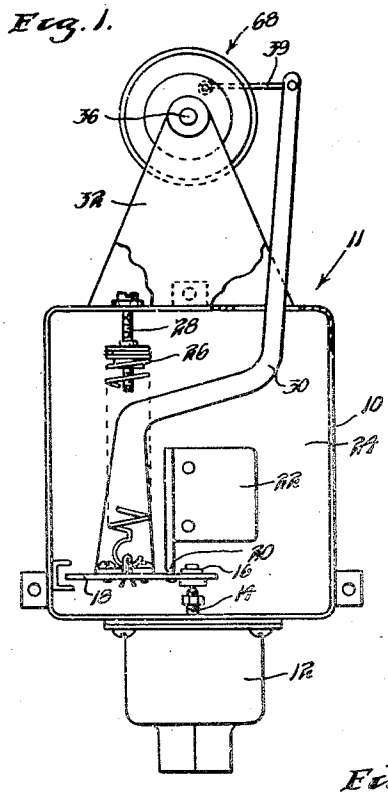


Fig. 2.

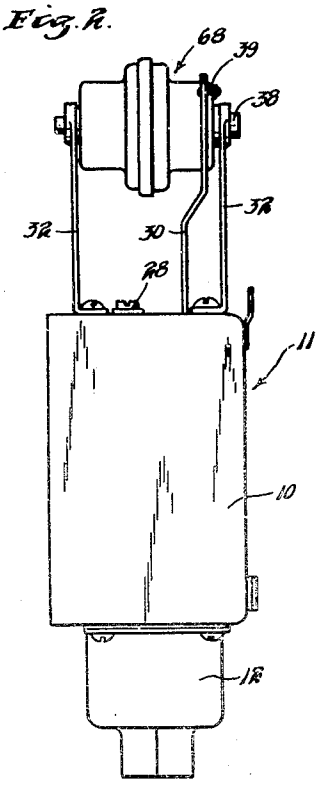
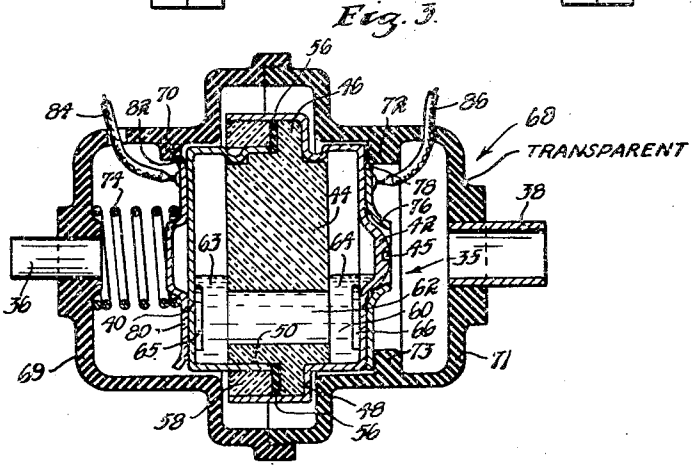


Fig. 3.



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SWITCH DEVICE

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5 Claims. (Cl. 200—152)

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This invention relates to a switching mechanism and more particularly to that type of switching mechanism wherein a mercury switch is utilized to make or break a circuit to control suitable apparatus in response to variations in the value of a condition.

A principal object of this invention is the provision in a switching mechanism embodying a mercury switch of means whereby the mercury switch may be adjusted with respect to the switching mechanism.

It is a further object of this invention to mount the switching mechanism which includes a mercury switch in any position such as in a vertical or horizontal position and provide means for adjusting the mercury switch to the necessary position for proper operation.

It is a further object of this invention to provide a transparent plastic casing for enclosing an adjustable mercury switch whereby the adjusted positions of the mercury switch may be easily observed.

It is another object of this invention to mount a mercury switch in a housing whereby the mercury switch may be adjusted with respect to the said housing.

It is a still further object of the invention to provide a casing for a mercury switch and means by which the switch is maintained in a central position in the casing while being adjustable in a rotary movement.

It is another object of this invention to provide a casing for housing a mercury switch and to provide means cooperating with loosely mounted conductor plates for the mercury switch for preventing the conductor plates from rotating when the mercury switch is adjusted relative to the casing so that conductor wires leading from the conductor plates may not be twisted or disturbed.

It is another object of this invention to utilize a switching mechanism comprising a mercury switch adjustably housed in a casing, whereby the switching mechanism may be mounted at various angles and still operate properly.

These and other objects will readily become apparent as the following specification is read in the light of the accompanying drawings.

The mercury switch employed in the switching mechanism is the metal clad switch disclosed in Patent Number 2,342,354, issued February 22, 1944 to Raymond P. Mattern. The switching mechanism is adapted to be associated with an apparatus to be controlled such as a refrigeration system.

Figure 1 is a front elevational view of the switching mechanism with the cover removed;

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Figure 2 is a side view, looking at the right side of Figure 1, of the switching mechanism; and

Figure 3 is a sectional view on an enlarged scale of the mercury switch and its associated housing member of this invention.

Similar reference characters refer to similar parts throughout the several views of the drawing.

Referring now specifically to the drawing, there is indicated at 10 a casing of a switch mechanism 11 to the lower portion of which is secured a housing 12 which contains a conventional Sylphon bellows, not shown. A suitable pressure or capillary tube, not shown, may lead into the housing 12 from any suitable source, not shown, the arrangement being such that a condition change adjacent the said source causes expansion or contraction of the Sylphon bellows in a known manner to produce upward or downward movement of an operating rod 14. On the other hand, the bellows may be connected directly to a source of pressure. Operating rod 14 bears against a member 16 carried by one end of a lever 18 which is fulcrumed on a knife edge 20 of a bracket 22 which is secured to the rear portion 24 of the casing 10. A spring 26, suitably secured to the lever 18, biases the lever in a clockwise direction so as to oppose movement of operating rod 14 when the rod 14 is actuated by a change in the condition. The spring 26 may be adjusted as by a screw 28 in a known manner to vary the value of the condition at which the mechanism will operate.

An angular upwardly extending rod 30 is appropriately secured to the lever 18 and extends through an opening in the top of the instrument 10. There are two spaced apart plates 32, each having a flanged portion by which the said plates are secured to the outside top portion of the casing 10. A casing 33 is provided with shafts 36 and 38 for mounting the housing 33 in appropriate apertures in the spaced apart plates 32. A link 39 is pivoted at one end to the upwardly extending rod 30 and is appropriately secured at its other end to the switch housing 68.

Two metal cups 40 and 42 form an envelope for a mercury switch 35. These two cups cooperate with a partition 44 which is composed of a high grade of lava or molded ceramic having substantially the same characteristics as lava. The partition 44 is provided with a circumferential flange 46 which forms a pair of shoulders 48 and 50. The said cups 40 and 42 are seated respectively on the shoulders 50 and 48.

The cup 42 is provided with an open end which is of greater diameter than the cup 40 and which

extends over the flange 46 of the partition 44 and also telescopes over the open end of the cup 40. An asbestos washer 56 is placed against the shoulder 50, and the open end of the cup 40 seats against this washer. A ring of glass 58 is fused to the two metal cups and seals the angular space between the two cups in order to seal the interior of the switch from the external atmosphere.

The switch envelope is partially filled with some suitable electrically conducting fluid such as mercury as indicated at 60. The partition 44 is provided with an opening indicated at 62 by means of which two pools of mercury 63 and 64 may be connected when the opening 62 is in the position shown in Figure 3. The switch mechanism 11 is actuated by a change in the condition at the source (not shown). This change in the condition actuates the bellows contained in the housing 12 which moves the operating rod 14, lever 16, upwardly extending rod 30, and link 32 thereby rotating the switch housing 68 and the mercury switch 35 which is spaced in the housing 68 so that the opening 62 of the switch is moved out of the mercury 60, at which time the partition 44 will divide the mercury into the two separate pools 63 and 64 and therefore break the circuit through the switch 35. When the value of the condition acting on the bellows in the housing 12 is lowered, the housing 68 carrying the switch 35 inside thereof is rotated through the means of the operating rod 14, lever 16, rod 30, and link 32 whereby the opening 62 in mercury switch 35 is lowered into the mercury 60 and the circuit is again established through the mercury switch 35.

A pair of contacts 65 and 66 are respectively welded to the metal cups 40 and 42. These contacts are composed of material which is readily wet by the mercury, preferably nickel, and therefore the resistance between the mercury and these contacts is relatively low.

The casing 68 for housing the mercury switch 35 is preferably formed of transparent plastic material, although other insulation materials may be employed. The plastic casing comprises two cup-like members 69 and 71, each having an enlarged portion at its open end provided with screw threads for securing the two cup members together in assembled relationship. The cuplike member 71 of the plastic casing 68 is provided with an inner annular flange 73 against which a collector plate 76 is loosely mounted. The collector plate is provided with an opening in its central portion, for purposes which will be later noted. The switch 35 is fitted into the cuplike member 71 so that the metal cup 42 of said switch abuts plate 76. One end of a compression spring 74 is positioned against the closed end of the cuplike member 69 and the opposite end engages a collector plate 80. When members 69 and 71 of casing 68 are assembled together, the collector plate 80 will be held in abutting relationship with metal cup 40 of the switch 35 by spring 74 which also provides a means for positioning switch 35 in casing 68 by biasing the switch 35 and collector ring 76 against the flange 73. Spring 74 further biases the collector plates 80 and 76 into frictional engagement with switch 35 to provide for movement of the mercury switch with the casing 68. The central circumferential portion of the mercury switch is receivable in the enlarged portion of casing 68 for positioning the switch in the midsection of the casing. The annular flange 73 includes a lug portion 72 which fits into a recessed portion 78 of collector plate 76 prohibiting rotative movement of plate 76 with respect to casing 68 as will be later noted. A lug 78 formed in cuplike member 69 of casing 68 extends into a recess 82 in collector plate 80 preventing the loosely mounted collector plate 80 from rotating with respect to casing 68. Conductors 84 and 86 lead from the loosely mounted collector plates 80 and 76 respectively and extend through openings in the casing 68 and lead to a panel plate not shown.

The shaft 38 of the housing 68 is hollow whereby a tool such as a screw driver may be inserted through the hollow shaft 38 to engage a slot 40 in the plate 42 for adjusting the mercury switch 35 in relation to the casing 68. When the mercury switch 35 is adjusted with respect to the plastic casing 68, the loosely mounted conductor collector plate 80 is prevented from rotating because the lug member 78 extends into the recess 82 of the plate member 80. The sides of the recessed portion 78 of the collector plate 76 engaging the lug member 72 of the plastic casing 68 prevents the collector plate 76 from rotating with respect to the casing 68 when the mercury switch is adjusted by a tool. The mercury switch 35 may be adjusted when necessary, and since the collector plates 80 and 76 are not rotated, their conductors 84 and 86 are not twisted or disturbed and the operating characteristics of the mercury switch are maintained. The mercury switch 35 is provided with indicia to indicate when the mercury switch is in its properly adjusted position in the plastic casing 68, and the positioning of the mercury switch is easily discernible through the transparent plastic casing 68.

In providing a mercury switch which is housed in a casing member so that the mercury switch can be adjusted with respect to said plastic casing, it is possible when the mercury switch is used in combination with a switching mechanism as disclosed in Figure 1 for the switching mechanism 11 to be mounted at different angles such as vertical and horizontal angles on the apparatus to be controlled. That is, the switching mechanism 11 may be mounted on the apparatus to be controlled at any desired angle or position, and the mercury switch 35 may be adjusted with respect to the casing 68 to the position necessary for proper operation.

As many embodiments may be made of the above described invention and as many modifications may be made in the embodiments above described, it is to be understood that all matter hereinbefore described or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In a switch device of the class described, a transparent casing, and a cylindrical mercury switch which is operative by rotation on its longitudinal cylindrical axis positioned within said casing, biasing means within said casing and abutting said mercury switch to cause said switch to move in unison with said casing in response to movement of said casing, a tool receiving portion on said mercury switch to provide means for manual rotation of said switch independent of said casing, said casing having an aperture adjacent said tool receiving portion to provide access for insertion of a tool, the transparency of said casing providing for visual observation of the position of said switch with respect to said casing during the period of manual rotation whereby said switch may be manually rotated to an operative position without respect to the position of said casing.

2. A control device, comprising, a supporting

member, a condition responsive means mounted on said supporting member, an enclosed casing carried by said supporting member, a pair of spaced electrically conductive elements located on the interior of said casing, said casing and said elements being rotatable in respect to said supporting member, a connection between said condition responsive means and said casing for slightly rotating the same upon change in the value of the condition to which said condition responsive means responds, a liquid contact switch having an operative position in which small movements thereof cause making and breaking of the circuit therethrough, said switch being mounted on said conductive elements and having two circuit completing conductive members one of which is in contact with each of said conductive elements, and means mechanically connecting said liquid contact switch to said conductive elements for rotation therewith, said switch having a tool receiving portion and said enclosing casing having an aperture therein adjacent said tool receiving portion for insertion of a manually operable tool to rotate said liquid contact switch through 360 degrees in respect to said conductive elements whereby said switch may be placed in its operative position for any position of said supporting member within a single plane of rotation.

3. In a device of the class described, an insulating casing, a liquid contact switch having operative positions from which small movements thereof cause making or breaking of a circuit therethrough mounted within said insulated casing, means within said casing and abutting said switch to cause said switch to move in unison with said casing in response to movement of said casing, a tool engaging portion on said switch to provide means for manual rotation of said switch independent of said casing, said casing having an aperture therein adjacent said tool engaging portion to provide for insertion of a tool, and means for visually indicating the relative position of said switch within said casing from a point external of said casing whereby said switch may be positioned in an operative position by manual adjustment.

4. In a switch device of the class described, a supporting member, a condition responsive means

mounted on said supporting member, an insulating casing carried by said supporting member and mounted for movement relative to said supporting member, a connection between said condition responsive means and said casing for moving the same upon change in the value of the condition to which said condition responsive means responds, a liquid contact switch having an operative position from which small movements therefrom cause making and breaking of a circuit therethrough, means mounting said switch within said casing to cause said switch to move in unison with said casing in response to movement of said casing, a tool engaging portion on said switch to provide means for manual rotation of said switch independent of said casing, said casing having a tool receiving aperture therein adjacent said tool engaging portion for insertion of a manually operable tool to rotate said switch with respect to said casing whereby said switch may be placed in an operative position, and means for indicating the relative position of said switch within said casing.

5. In a switch device of the class described, an insulating casing, a liquid contact switch having operative positions from which small movements thereof cause making or breaking of a circuit therethrough, means mounting said switch within said insulating casing and adapting it to normally move with said casing, and means for applying movement to said casing to operate said switch, said switch having a tool engaging means thereon by which said switch may be rotated independent of said casing, said casing having an aperture therein adjacent said tool engaging portion to provide for insertion of a tool.

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