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SWITCHING MECHANISM

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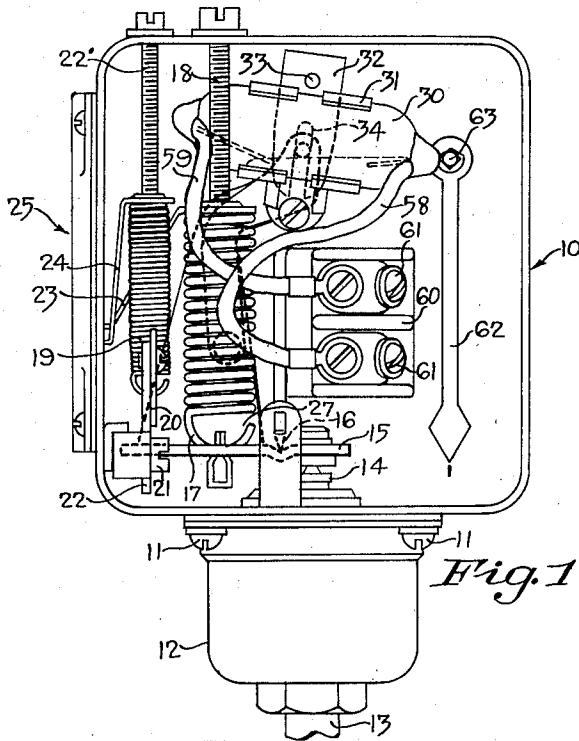


Fig. 1

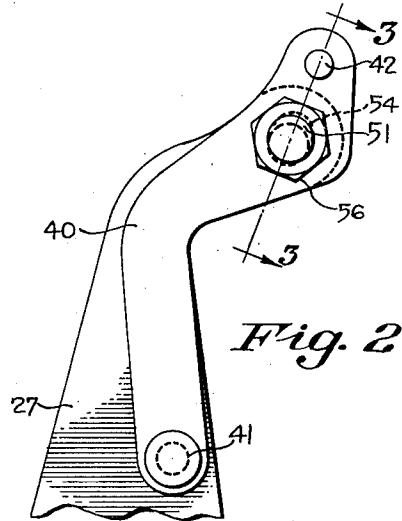


Fig. 2

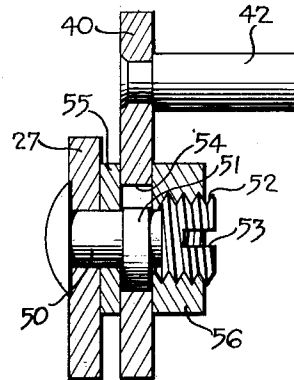


Fig. 3

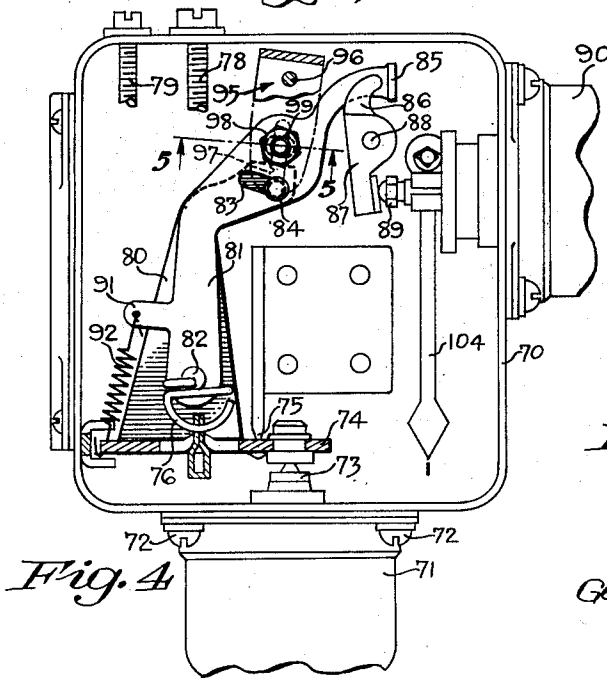


Fig. 4

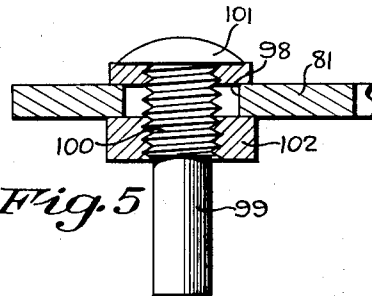


Fig. 5

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SWITCHING MECHANISM

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This invention relates to 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 centered accurately with respect to the instrument, such centering being substantially permanent with respect to each instrument whereby the switch may be readily replaced without the necessity for further centering of the replacement switch.

An additional object is the provision of a structure wherein the mercury switch may be readily replaced by unskilled persons and the replaced switch will be centered in the identical manner of the original switch.

As conducive to a clearer understanding of this invention it may here be pointed out that in switching mechanisms of the type to be hereinafter described, it is essential that the switch be so positioned with respect to the instrument that when the instrument is in its desired position and properly aligned the circuit through the mercury switch will either be made or broken as the case may be at a substantially equal distance upon each side of the horizontal plane of the instrument. This factor is well known in the art and hitherto it has been common practice to center each switch individually in the instrument in the factory before placing the same on the market. Various expedients have been utilized to accomplish this, the more common being to provide a clip for the mercury switch movable with respect to the tiltable support and provide an eccentric to vary the respective positions of the clip and the support whereby the switch may be centered subsequent to the mounting thereof in the instrument. This method has proved satisfactory in factory assembled switches, its chief disadvantage being that when, as frequently occurs, it is necessary to replace a damaged mercury switch after the instrument has left the factory, the centering of the replaced switch is placed in the hands of an unskilled person and is, accordingly, frequently improperly done with resultant improper operation of the switching mechanism.

Another object of this invention is the provision of mechanism whereby the mercury switch may be centered and upon the necessity of replacement thereof, an additional switch and sup-

port therefor, factory assembled, may be readily installed and centered substantially automatically, the previous centering in the factory being so arranged as to readily accommodate the replacement switch and clip.

Other objects will in part be obvious and in part pointed out hereinafter.

The invention, accordingly, consists in the combinations of elements, arrangements of parts and features of construction, all as will be pointed out more fully hereinafter and disclosed in the accompanying drawing.

Having reference now to the accompanying drawing:

Figure 1 is a front elevational view of one form of switching mechanism disclosing an illustrative embodiment of the invention;

Figure 2 is an enlarged fragmentary view disclosing certain details of construction;

Figure 3 is an enlarged sectional view taken along the line 3—3 of Figure 2 as viewed at an angle from the left;

Figure 4 is a front elevational view of a switching mechanism embodying a modification of the invention, certain parts thereof being cut away and certain others being omitted, and

Figure 5 is an enlarged sectional view taken along the line 5—5 of Figure 4 as viewed from the bottom.

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

Referring now to Figure 1, there is generally indicated at 10 a casing to the lower portion of which is secured, as by screws 11, a housing 12 which contains a conventional Sylphon bellows (not shown). A suitable pressure or capillary tube 13 leads into housing 12 from any suitable source (not shown), the arrangement being such that 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. Operating rod 14, in turn, abuts an end of a lever 15 which is fulcrumed on a knife edge 16. A spring 17 suitably secured to lever 15 biases the same in a direction opposite that of the pressure exerted by operating rod 14. Spring 17 may be adjusted as by a screw 18 in a known manner to vary the value of the condition at which the device will operate. A second lighter spring 19 is secured to a member 20 pivoted at 21 and provided with an extension 22 which, in turn, abuts an end of lever 15 and is adjustable as by a screw 22' to vary the operating differential of the instrument, also in a known manner.

Suitable indicating pointers 23 and 24 secured to springs 17 and 19, respectively, extend exteriorly of the casing through suitable apertures (not shown) to indicate the value of the condition required to operate the switching mechanism and the operating differential thereof upon a suitable scale plate, a side elevation of which is generally indicated at 25.

Lever 15 is provided with a substantially integral upwardly extending portion 27. A mercury tube switch 30 is carried by a tube clip 31 in turn secured to a U-shaped bracket member 32 pivotally mounted as on a pivot pin 33. The rear leg of U-shaped member 32 is provided with a substantially vertically extending slot 34 as shown in dotted lines. The structure hereinbefore described is known in the art and in those constructions hitherto utilized a pin would have been secured directly to extending portion 27 to engage slotted aperture 34 and hence tilt the switch. In the instant invention, however, as better shown in Figure 2, a lever 40 is pivoted to upwardly extending portion 27 as by a pivot 41. The upper end of lever 40 carries a pin 42 adapted to engage slotted aperture 34 to tilt mercury switch 30 upon movement of operating rod 14 and hence lever 15 and extending portion 27 in a manner now to be described. Such movement will, of course, result in a variation in the position of pin 42 and hence a resultant tilting of support 32 to tilt switch 30.

As better shown in Figure 3, a pin 50 passes through a suitable aperture in extending portion 27. Pin 50 is provided with an eccentric cam 51 and a threaded extremity 52 provided with a tool engaging aperture 53. Eccentric 51 is positioned within an aperture 54 in lever 40. A suitable washer 55 surrounds pin 50 and is positioned between extending portion 27 and lever 40. A lock nut 56 is provided with the threads which are engaged by threaded extremity 52. Thus it will appear that rotation of pin 50 as by the insertion of a tool, such as a screw driver, in slot 53 occasions a corresponding rotation of eccentric 51 in aperture 54 and correspondingly moves lever 40 about its pivot 41 and hence pin 42 to the right or left with respect to extending portion 27 and that such movement results in a slight tilting of mercury switch 30, which, when properly adjusted, results in the proper alignment of the switch.

Accordingly, it will now be seen that once a switch is properly aligned if for any reason the switch should prove defective and replacement is desired, it will be a relatively simple matter to remove the support 32 from pin 33 and replace the support and switch as a unit, and it will correspondingly appear that any similar support and switch applied to the device by mounting on pivot pin 33 will of necessity assume the same alignment as that imparted to the original switch by adjustment of pin 50 and that therefore an inoperative switch may be readily replaced by anyone regardless of their skill merely by positioning a new switch and support on pin 33. Any suitable securing means (not shown), such as a spring clip, may be utilized to hold the switch support in related assembly with pin 33.

Suitable conventional leads 58 and 59 lead from terminals of mercury switch 30 to a terminal block 60 provided with terminals 61 to which may be secured leads (not shown) extending to any suitable apparatus to be controlled by switch 30. A conventional aligned pendulum 62 is pivoted in casing 10 as at 63 in a known manner in order

that the instrument may be properly aligned when installed.

Having reference now to that modification disclosed in Figure 4, a refrigeration control having an auxiliary high pressure cut-out is disclosed. In the modification disclosed in this figure, a casing 70 has secured thereto a housing 71, as by screws 72, which housing contains a conventional Sylphon bellows (not shown) which may be actuated in a manner similar to that of the bellows described in connection with Figure 1 to move an operating rod 73 which, in turn, acts on an end of a lever 74 fulcrumed as at 75. A spring 76 similar to spring 17 biases lever 74 in a direction opposite to that of the pressure exerted by the bellows and a differential adjusting spring (not shown) similar to spring 19 is also provided. Screws 78 and 79 adjust spring 76 and the differential adjusting spring in a manner similar to that described in connection with screws 18 and 22.

Lever 74 is provided with an upwardly extending portion 80 upon which is pivoted a lever 81 as by a pivot 82. Lever 81 is provided with a slot 83 which accommodates a pin 84 rigidly secured to upwardly extending portion 80. Lever 81 also has an angularly disposed portion 85 positioned for abutment by an end 86 of a pivoted member 87 carried by a pivot 88. The opposite end of member 87 is positioned for abutment by an operating rod 89 in turn actuated by a sylphon bellows or other suitable mechanism (not shown) contained in housing 90 and operated in the illustrative embodiment by a predetermined high pressure or other condition. Lever 81 is also provided with an extending portion 91 to which is secured one end of a strain release spring 92, the other end of which is secured to an end of lever 74.

A mercury switch support 95 is pivotally mounted as on a pivot 96 and carries a mercury switch clip and mercury switch (not shown) similar to clip 31 and mercury switch 30. Support 95 is provided with an elongated slot 97 similar to slot 34. An elongated slot 98 is also provided in lever 81 and, as better shown in Figure 5, has passed therethrough a pin 99 provided with a threaded portion 100 and a head 101. A lock nut 102 is positioned for engagement with threaded portion 100. Thus it will be seen that by loosening lock nut 102, pin 99 may be positioned at any point within slot 98. An alignment pendulum 104 similar to pendulum 62 and utilized for a similar purpose is also provided.

From the foregoing, the operation of the switching mechanism should now be apparent. The device is normally controlled by the condition controlling the bellows contained in housing 71 and through operating rod 73 and its corresponding movement of lever 74 and pin 99 serves to move the mercury switch support 95 and its associated switch to open or closed position in accordance with the value of the condition. It will also be seen, however, that upon the achievement of a predetermined condition value of the condition controlling the bellows contained in housing 90, operating rod 89 acts through pivoted member 87 to move the switch through projection 85 to on or off position as the case may be independently of the position of operating rod 73, spring 92 serving, as above stated, as a strain release to permit such movement without affecting the position of member 80 and lever 74.

In the manufacture of the structure described in connection with the above modification, it will

also be understood that the mercury switch support 95 and hence its associated switch may be readily centered as in connection with the modification previously described by horizontal movement of pin 99 in slot 98 and upon the achievement of such centering a permanent relationship between pin 99 and slot 97 may be established by a simple tightening of lock nut 102. Once such relationship is established and the device is placed in the hands of the ultimate user, should the mercury switch fail for any reason it becomes a relatively simple matter to provide to the user a pre-assembled mercury switch and support identical to support 95 which may be readily replaced merely by removing support 95 from its pivot pin 96 and replacing the same with the new support and assembled switch. The relationship of the parts, it will readily be understood, will be identical to that previously existing and the new mercury switch will, therefore, be perfectly centered without the necessity of any fine adjustment on the part of the person replacing the switch.

Thus it will be seen that in the above described structures there are provided devices achieving the objects of this invention and others including many advantages of great practical importance particularly with respect to simplicity of assembly and ease of proper replacement of inoperative mercury switches.

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 switching mechanism, in combination, a mercury switch, a support therefor pivoted for rotation, means for rotating said support comprising an operating member, a condition responsive device for operating said operating member, a connecting member pivotally mounted on said operating member and engaging said support, and means for rotating said connecting member with respect to said operating member comprising an elongated slot in said connecting member and a pin rotatably mounted in said operating member and having an eccentrically mounted cam cooperating with said slot.

2. In a switching mechanism, in combination, a mercury switch, a support therefor pivoted for rotation, means for rotating said support comprising an operating member, a condition responsive device for operating said operating member, a connecting member mounted on said operating member, a strain release between said operating member and said connecting member, means for moving said connecting member independently of said operating member through said strain release, a slot in said connecting

member, a pin mounted in said slot for rotating said support, and means for adjusting said pin along said slot whereby the mercury switch may be properly aligned with respect to said operating member.

3. In a switching mechanism, in combination, a condition responsive means, a member movable thereby, a first lever movable by said member, a second lever pivotally mounted on said first lever, a pin carried by said second lever, a rotatably mounted support having an aperture therein engaged by said pin, a mercury switch carried by said support, and means to vary the position of said pin with respect to said levers for centering said mercury switch, said means comprising a lock nut on said pin, said pin extending into a slotted aperture in said second lever whereby by release and tightening of said nut said pin may be moved within the limits defined by said slot and secured in any desired position therein.

4. In a switching mechanism, in combination, a condition responsive means, a member movable thereby, a first lever movable by said member, a second lever pivotally mounted on said first lever, a pin carried by said second lever, a rotatably mounted support having an aperture therein engaged by said pin, a mercury switch carried by said support and pre-assembled therewith to form a substantially integral unit, said unit through said pin and slot connection, means to rotate said second lever and hence vary the position of said pin with respect to said first lever for centering said mercury switch, and means allowing removal and replacement of said unit, said replaced unit being thus accurately centered in said mechanism.

5. In a switching mechanism, in combination, a condition responsive means, a member movable thereby, a first lever movable by said member, a second lever pivotally mounted on said first lever, a pin carried by said second lever, a pivotally mounted support having an aperture therein engaged by said pin, a mercury switch carried by said support and pre-assembled therewith to form a substantially integral unit, said condition responsive means serving to rotate said unit through said pin and aperture connection, means to vary the position of said pin with respect to said lever for centering said mercury switch, said means comprising a lock nut on said pin, said pin extending into a slotted aperture in said lever whereby by releasing and tightening of said nut said pin may be moved within the limits defined by said slot and secured in any desired position therein, and means allowing removal and replacement of said unit, said replaced unit being thus accurately centered with respect to said mechanism.

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