June 30, 1953 W. L. DIETRICH 2,644,061

HERMETICALLY SEALED LEVER OPERATED SWITCH

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Fig. 2.

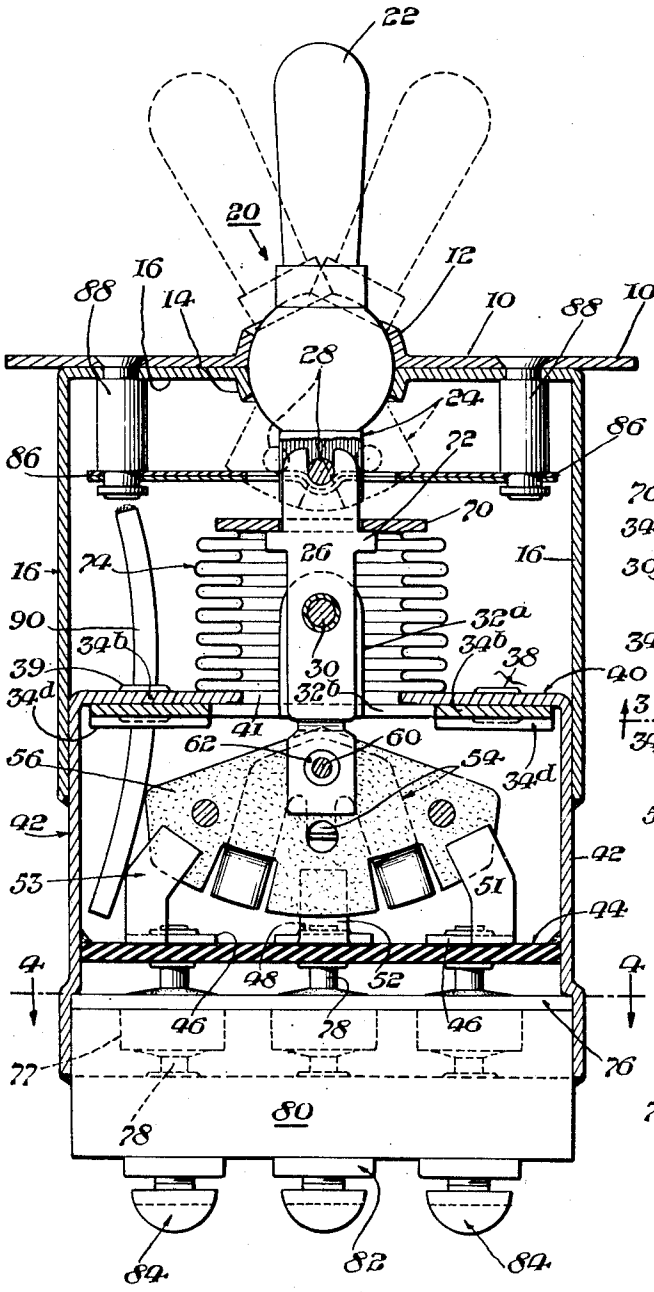

Fig. 1.

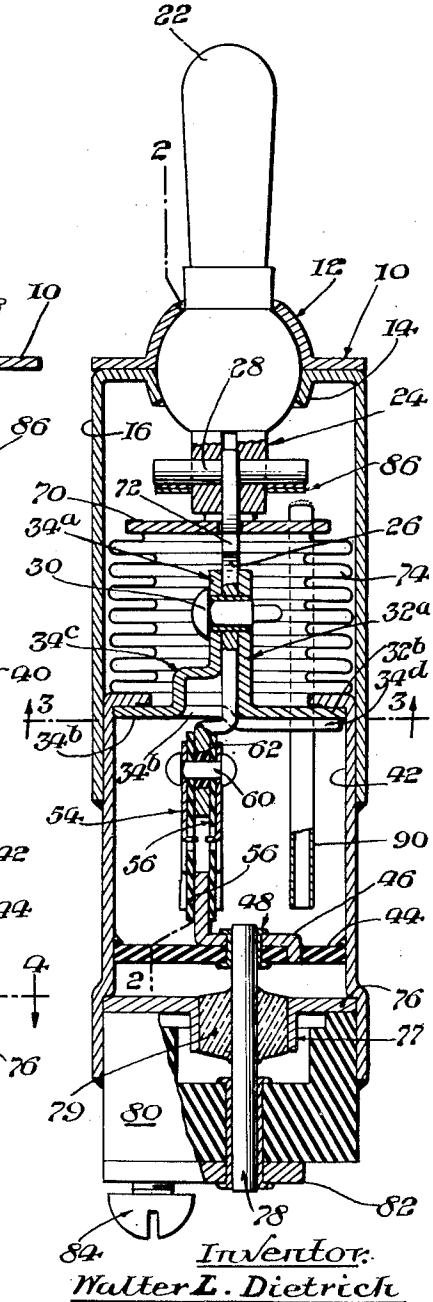

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Fig. 3.

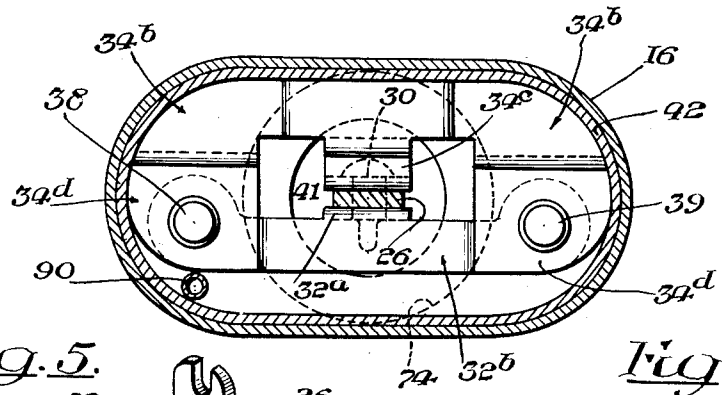


Fig. 5.

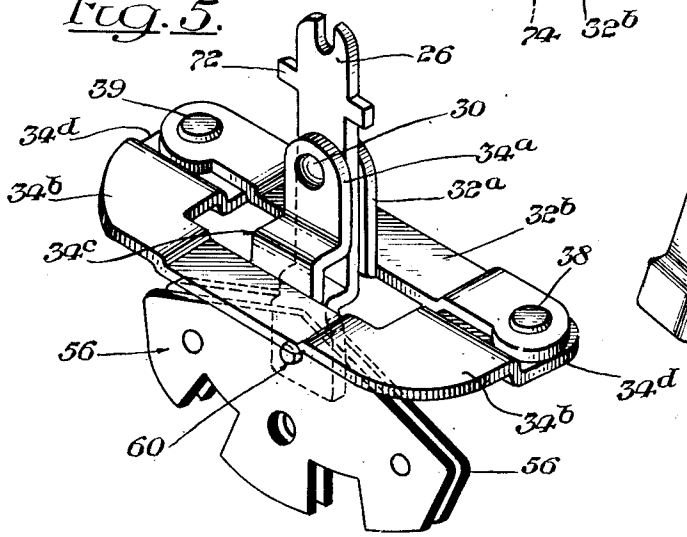


Fig. 6.

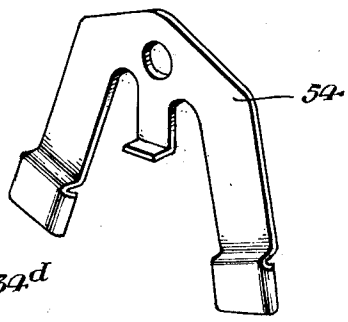
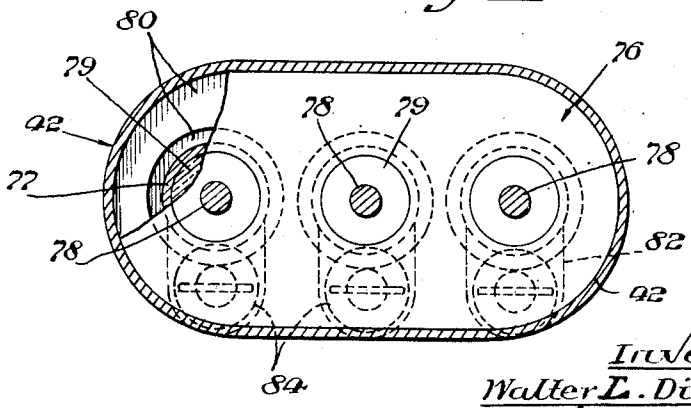


Fig. 4.



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UNITED STATES PATENT OFFICE

2,644,061

HERMETICALLY SEALED LEVER OPERATED SWITCH

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Application November 30, 1950, Serial No. 198,445

5 Claims. (Cl. 200—144)

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This invention relates to electric switches. More particularly it relates to switches which are operated from the exterior of a panel or casing by a lever and are usually a toggle-type mechanism.

Many of this type of switch have been used in airplanes which at one moment may be at a high or tropical temperature and only a short time later may be in extremely cold upper rarified atmosphere. Although such switches have often been enclosed, the usual enclosure did not prevent condensation in the form of moisture, frost or ice which greatly interfered with the operation of the switch or prevent it entirely on occasions. Obviously any such interference can be extremely hazardous or dangerous to life and property in an airplane when accurate and proper operation at any moment may become critical. Equally obviously hermetic sealing of the operating mechanism of switches for such uses presents many advantages. The sealing of the mechanism prevents any arcing between the switch contacts from igniting gases and also prevents condensation from affecting the operation of contacts.

Therefore it is an object of my invention to provide a lever operated switch mechanism which will be positive in operation and may be hermetically sealed in such a way as to not interfere with the normal operation of the switch.

Another object of my invention is to provide a switch of the foregoing type wherein the sealing means avoids the use of rubber or other materials which are strongly affected by moisture or changes in atmospheric conditions.

Another object of the invention is to provide a switch of the foregoing type which may be made economically, mainly from stamped sheet metal parts and may be assembled with a minimum labor expense.

Another object is to provide a switch having the foregoing characteristics which will be sturdy and reliable in operation over long periods of time and under various and severe conditions of use.

Other objects and advantages in the invention will become apparent as it is described in connection with the accompanying drawing.

In the drawing:

Fig. 1 is an end elevation view, partly in section.

Fig. 2 is a side elevational section view taken along line 2—2 of Fig. 1.

Fig. 3 is a transverse section view of the invention of Figs. 1 and 2 along line 3—3 of Fig. 1.

Fig. 4 is a transverse section view taken along line 4—4 of Fig. 2.

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Fig. 5 is a perspective view of the contact actuating lever and its supporting brackets.

Fig. 6 is a perspective view of one bridging contact element.

Referring to the drawing, the switch may conveniently be mounted on a plate 10 stamped in rectangular or other form from sheet metal and provided with a hollow semi-spherical boss 12 in its middle cooperating with a similar semi-spherical boss 14 in the middle of the top surface of a shell or top enclosure member 16. The shell may conveniently be stamped from sheet metal in inverted, hollow, oval, cup-shaped form. The top outer surface of the shell 16 may be secured against the mounting plate 10 in any suitable manner so that the bosses 12 and 14 form a socket for the spherical mid-portion of an operating lever 20 having a handle operation 22 outside the shell and above the mounting plate 10. By manipulation of the handle 22, the switch may be operated as will hereinafter more fully appear.

The lower or inner end of the operating lever 20 has parallel bifurcations 24 with flat sides between which is mounted one end of a contact actuating lever 26. A pivot pin 28 passing transversely through the bifurcation and said end of the actuating lever affords a pivotal driving connection between those parts. The contact actuating member 26 whose details will be more particularly set forth may be stamped from sheet metal into the form illustrated best in Figs. 1 and 2. The contact actuating member 26 is pivotally mounted near its mid-portion on a fixed pivot pin 30 which is supported in lever-supporting members 32 and 34 in the form of stamped sheet metal angle brackets. In order to permit movement of the drive pin 28 longitudinally of the contact actuating member 26 as the operating lever 20 is oscillated to move the actuating lever 26, the end of the lever 26 is slotted or bifurcated to receive the pin 28 (see Fig. 2).

The bracket 32 has a vertical leg 32*a* (referring to Fig. 1) extending at right angles from a horizontal substantially flat bar portion 32*b*. The bracket 34 has a vertical leg 34*a* parallel to the leg 32*a* extending at right angles to a horizontal mounting portion 34*d*. As shown in Fig. 1, the leg 34*a* has a right-angled bend 34*c* in its connection to the horizontal mounting portion 34*b*. The mounting portion 34*b* is of substantially U-shape and has the end portions 34*d* of the U offset and on these offset portions and across the U the horizontal mounting portion 32*b* of the other bracket is located as seen in Fig. 5. Registering apertures are provided in the offset portions 34*d* and 32*b* to receive securing means

such as a rivet 38 by means of which the brackets are secured together with their upper surfaces in the same plane.

The described construction of the brackets enables them to be secured against the inside of the top wall of a bottom casing member 42. The casing member 42 may be stamped from sheet metal into hollow, oval form and affords a housing for the fixed and movable contacts of the switch. In order to permit the desired movement of the contact actuating member 26, an opening 41 is formed in the top surface 40 of the casing member.

The fixed contacts are mounted upon a flat, oval-shaped insulating plate 44 of any suitable material. When a plate that will not be affected by moisture or the heat of soldering adjacent parts is required, fiber glass is desirable and may be used. The fixed contacts may be of any desired number but for the purpose of illustration, I have shown three. These contacts may be stamped from sheet copper, brass or other suitable conductive metal to provide anchor portions or feet 46 lying upon the upper surface of the insulating plate 44 and having apertures stamped therein to register with similar apertures in the insulating plate 44 in spaced positions. Hollow eyelets or rivets 48 may secure the fixed contacts to the insulating plate 44. Each of the fixed contacts has an upstanding contact portion such as 51, 52, 53 at right angles to the feet 46 and in a single plane in position to be engaged by the arms of a bridging contact member 54, as the switch is operated to its closed positions, or to be disengaged when the switch is in open position as illustrated in Fig. 2.

The bridging contact member may comprise two identical leaves stamped from thin resilient highly conductive sheet metal into substantially U shape. These leaves are mounted respectively against the outsides of each of two parallel arc quenching plates 56 of insulating material. These arc quenching plates are secured against opposite sides of the end of the contact actuating lever 26 and are thus spaced apart. They are so located that the fixed contacts 51, 52 and 53 enter into the space between the lower curved arcuate edges of the arc quenching plates. The arc plates and the movable contacts are secured upon the end of the contact actuating lever 26 by a rivet which may be insulated from the end of that lever by an insulating washer or other suitable means 62. Spaced notches are formed in the arcuate edges of the insulating plates. The notches in one plate being in register with the notches in the other in order that offset end portions of the movable contacts may enter and thus may engage the fixed contacts as actuating lever 26 pivots about its pivot 30 to cause movement of the other movable contact assembly.

In order to hermetically seal the top wall 40 of the casing 42 and at the same time permit movement of the contact actuating member 26, a circular plate or disc 70 is provided with a slot in the middle thereof through which the upper end of the contact actuating member 26 extends. In order to locate this disc 70, laterally extending shoulders or extensions 72 are provided from opposite side edges of the contact actuating member 26 between the pivot 30 and pin 28 as may be seen in Fig. 2. The disc 70 is soldered to the contact actuating member 26 to form a tight seal. Soldered to the periphery of the wafer 70 is the top end of a circular metallic bellows 74

whose bottom end is soldered around the periphery of the opening 41 in the top of the casing 40. In this manner the top of the casing is hermetically sealed by the flexible bellows 74 in a manner which permits entire freedom of movement within the limits necessary for the contact actuating member 26.

Often there are limitations upon the over-all depth of the switch and the amount of angular movement that the operating lever 20 may have. In order to provide the required degree of movement of the movable contact assembly under such conditions the relative locations of the stationary pivot 30 and the drive pin 28 are fixed and determined by said conditions. In order that the bellows have adequate and maximum life, it is desirable that it have as many folds as possible and move a minimum amount. Thus, if its top 70 be located near the fixed pivot, there must be greater initial compression of the bellows or the number of folds must be less; and the angular movement of the top will cause greater compressive and expansive flexing than if the top is farther from pivot 30. When the top is located as far as possible from pivot 30 toward drive pin 28, the angle of tilt of the top will be lessened and hence there will be less compressive and expansive flexing of the bellows and at the same time the bellows may have a maximum number of folds.

In order to hermetically seal the bottom of the casing 42, a metallic bottom plate 76 is stamped from sheet metal in form to conform to the lower interior wall of the casing 42; and its periphery is soldered to that wall. In order to provide an exterior connection for the fixed contacts, three rods, such as 78, are soldered at one end to the eyelets which secure the fixed contacts upon their insulating mounting plate 44. These rods extend through relatively large openings formed in the bottom casing plate 76. Each of these openings has a circular flange 77 extending outwardly around it in which a glass bead or bushing 79 is fused to the rod 78 as well as to the walls of the flange 77. Preferably the rod 78 will be of sufficient area to form adequate electrical conductivity and will be of a material having coefficient of expansion approximately equal to that of the glass so that expansion and contraction of the rod will not cause cracking of the glass. Thus a hermetically sealed exterior connection for the fixed contacts is provided via the rods 78; and since the bottom casing plate 76 is soldered to the lower portion of the casing 42, the whole lower end of the casing is hermetically sealed.

If desired, a base 80 of molded insulating material can be provided through which the ends of the rods 78 may extend and be connected in conventional fashion to terminal plates such as 82 provided with conventional binding screws 84.

In order to hold the switch in its "on" and "off" positions, an indexing leaf spring 86 with a central opening for the bifurcations 24 on the operating lever 20 may be provided. The ends of the leaf spring may be secured to posts 88 extending into the top casing or shell 16 on opposite sides thereof. These posts may have reduced ends extending through the mounting plate 10 and top wall of shell 16 and be peened over to secure those parts together. The central portion of the leaf springs may be formed with transverse semi-cylindrical grooves to afford a seat for the ends of the driving pin 28. These ends extend beyond the bifurcations 24 of

the operating member in which the pin is mounted. As the operating lever 20 is moved from the mid-position of Fig. 2 to the right or to the left, the driving pin 28 will move out from seat 37 and up on to the flat top surface of the springs 66 thus biasing the upper lever 20 into its new position. In this manner the operating lever may be held in any of its three positions.

In order that the air within the hermetically sealed casing may be evacuated and replaced with nitrogen or other inert gases, preferably without moisture content, an evacuating tube of metal 90 may extend through the hollow rivet 38 which secures the brackets 32, 34 and top wall 40 of the casing 42 together. The connection between the evacuating tube 90 and the rivet and the casing wall may be soldered to form a tight seal. After the evacuation and filling of the casing with the desired gas the evacuating tube 90 will be sealed off at its top end as illustrated in Fig. 1.

From the foregoing, it may be observed that I have provided a lever operated switch of a size and form permitting its use in ordinary spaces and locations where heretofore lever operated switches have been employed; but at the same time I have provided for hermetically sealing of the switch contacts and actuating mechanism within a casing to isolate them from variations and atmospheric conditions. Also the invention provides for positive operation of the contacts under all conditions to overcome any tendency of the contacts to stick or resist movement from one position to another.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore I do not limit the invention to the exact form and detail as illustrated and described.

What is claimed is:

1. An electric switch comprising fixed and movable contacts, a contact-moving member for operating said contacts between engaged and disengaged positions, an hermetically sealed enclosure for said contacts including a rigid housing and flexible means sealed thereto, said flexible means also being sealed to said contact-moving member with said member extending therethrough for manipulation outside the enclosure, said rigid housing part being laterally extended from its connection with said flexible means providing room for said contacts, and a pivot within said enclosure for said contact moving member, a tiltable operating member engaging the exteriorly extending portion of said contact moving member, and means mounted on said enclosure to support said operating member exteriorly of said enclosure.

2. An electric switch as claimed in claim 1 having connecting means for said fixed contacts extending through the wall of said enclosure, and a glass bead fused to said connecting means and to said enclosure.

3. An electric switch comprising fixed and movable contacts, rigid enclosing means for said contacts having an opening therein, a contact-moving member extending into said opening for operating said contacts between engaged and disengaged positions, flexible means around and sealed to said contact-moving member and through which said member extends for manipulation outside the enclosure, said flexible means also being sealed to said enclosing means to hermetically enclose said contacts, supporting means secured within said enclosure, and a pivot for said contact-moving member on said supporting means within the area of said flexible means.

4. An electric switch as claimed in claim 3 wherein the flexible means is a metallic bellows and the connection of said bellows to said contact moving member is on the opposite side of said pivot from said enclosure.

5. An electric switch as claimed in claim 3 wherein the flexible means is a metallic bellows, a tiltable operating lever cooperating with the end of said contact-moving member outside the bellows to move that member, said bellows being sealed to said contact-moving member more approximately to the point of engagement of said operating member and said contact-moving member than to the pivot of said contact moving member to provide minimum bellows movement.

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