

# United States Patent

[11] 3,562,456

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3,295,707 1/1967 Knies..... 215/41  
 3,359,387 12/1967 Rhodes..... 200/83  
 3,416,688 12/1968 Fanning..... 215/41

## FOREIGN PATENTS

6,500,918 7/1965 Netherlands ..... 215/41

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## [54] PRESSURE RESPONSIVE SWITCH CONSTRUCTION AND METHOD OF MAKING THE SAME

5 Claims, 7 Drawing Figs.

[52] U.S. Cl. .... 200/83,  
 215/41  
 [51] Int. Cl. .... H01h 35/40  
 [50] Field of Search. .... 200/83  
 (WM), 83 (9), 83; 215/41

## [56] References Cited UNITED STATES PATENTS

3,285,451 11/1966 Golde..... 215/41x  
 2,934,618 4/1960 Beller et al..... 200/83(.9)  
 3,230,328 1/1966 Chapin..... 200/83(.9)  
 3,247,992 4/1966 Exton..... 215/41  
 3,267,232 8/1966 Chapin..... 200/83(WM)

**ABSTRACT:** This application discloses a switch construction produced by forming a switch housing base of plastic material with a relatively thick circumferential base rim having an outward base flange with an inward hooker base flange surface. A switch means is mounted on the housing base. A closure is also made of plastic material with a relatively thin circumferential closure rim having an inward closure hooker flange inside said closure rim. A diaphragm is made with a circumferential rim which is placed on the base rim and base flange. The closure hooker flange is then placed on the diaphragm rim and on the outward base flange. Then the closure rim and base rim are pressed together to force the closure hooker flange past the base flange and into closing hooking engagement with the hooker base flange surface to close and assemble the switch construction.

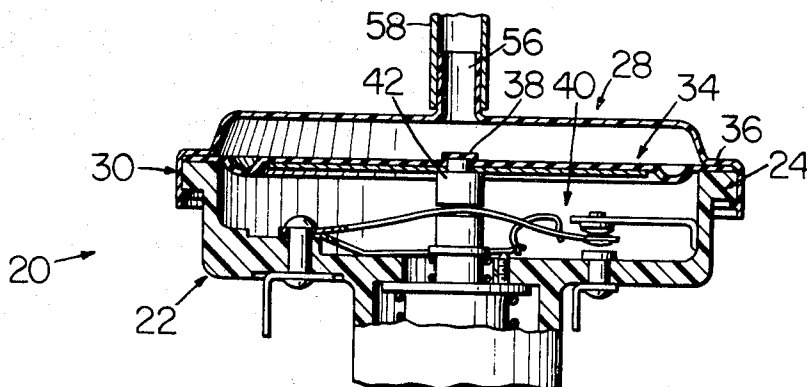


FIG-1

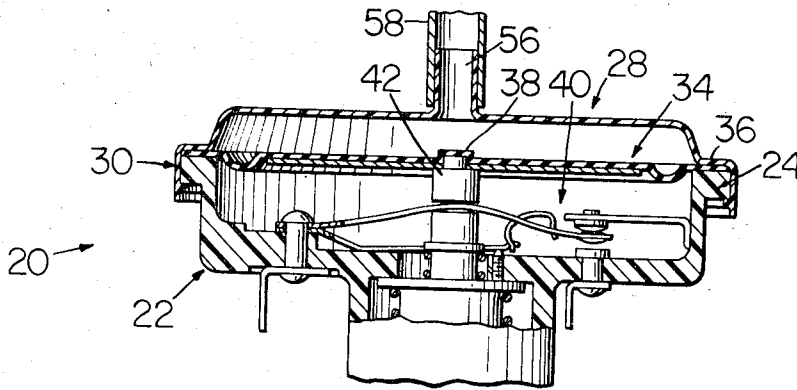
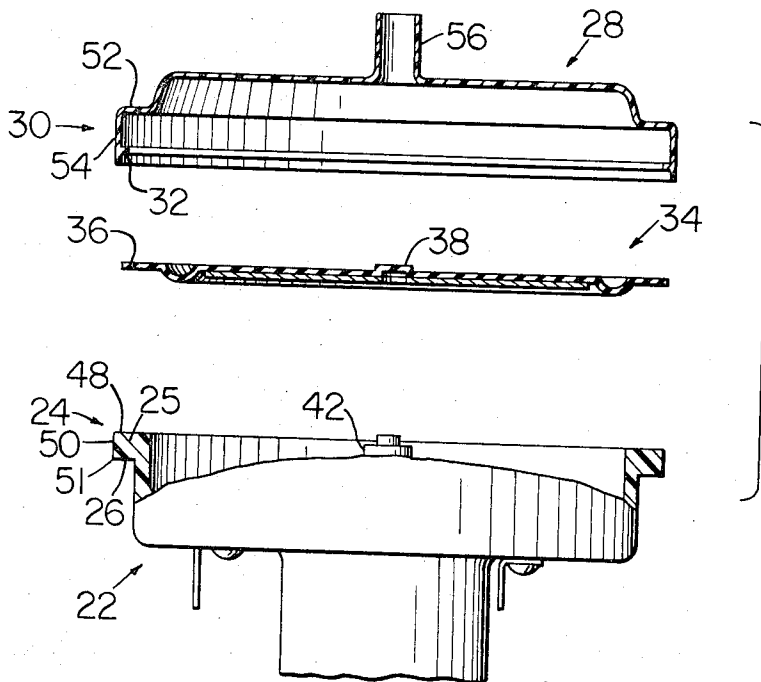


FIG-2



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FIG-3

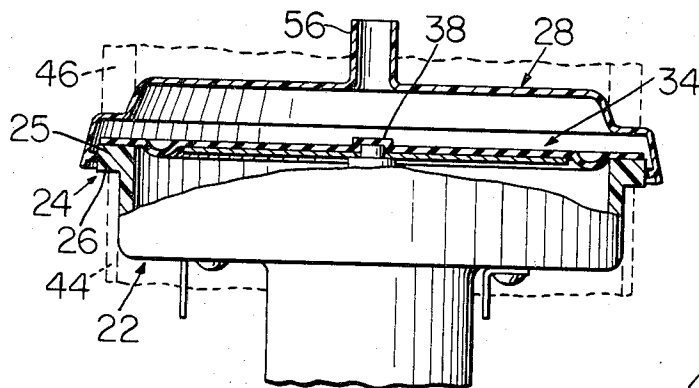


FIG-5

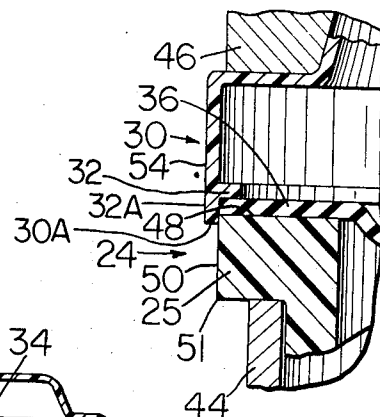


FIG-4

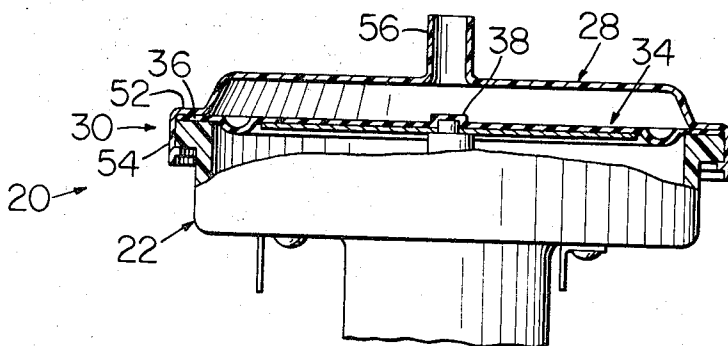


FIG-6

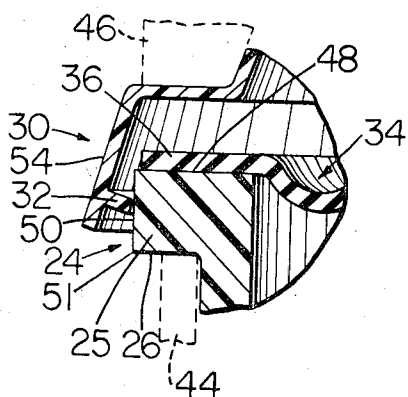
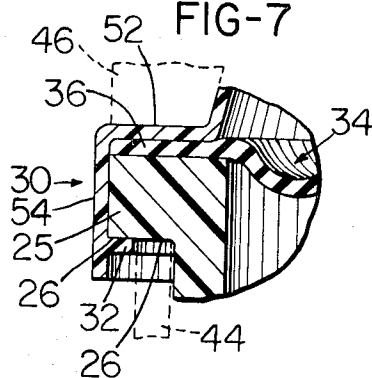


FIG-7



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# **PRESSURE RESPONSIVE SWITCH CONSTRUCTION AND METHOD OF MAKING THE SAME**

This invention relates to a pressure responsive switch construction and method of making the same.

This invention relates to a pressure responsive switch construction which may be used for controlling the water level in the tub of a domestic washing machine or the sump in a building basement or for any other fluid system level control.

Heretofore, a pressure switch construction of this type usually included a plastic molded base or housing which supports or contains the electrical switching element and the actuating means for such element. This housing or base is usually closed by means of a metal closure, and a flexible diaphragm is disposed between the base and the closure, which diaphragm also functions as a seal between the closure and base.

The metal closure usually has a tubular inlet which is formed either by joining a tubular eyelet or tube to the closure or by drawing the tubular inlet from the closure itself. The metal closure is usually attached to the molded switch housing by forcibly closing its larger open end over a rim on the molded switch casing of the housing.

In this type of construction, and particularly when the separate tubular inlet joined to the closure is used, problems do occur with air leaks developing where the metal closure is closed onto the molded switch housing. Problems also occur particularly in basement sump applications, in which corrosion of the metal closure frequently occurs.

One of the features of this invention is to provide a closure of a plastic material which will resist corrosion and certain chemical elements, and in which the tubular inlet may be integrally molded so as to be formed as one piece, thus preventing air leaks at the tubular inlet. Further, by using a plastic material, an inwardly projecting closure hooker flange is integrally molded on the inside of the closure side flange at the rim. The molded plastic switch housing base may be provided with a relatively thick circumferential base rim having an outward base flange with an inward hooker base flange surface.

The construction is such that switch means may be mounted on or in the base, with said switch means having a switch actuating means to be engaged by the diaphragm central portion. The diaphragm rim may be placed adjacent an outward base flange. The closure may be placed with the closure rim and with the closure hooker flange adjacent the diaphragm rim and the outward base flange. Then the base rim and the closure rim may be pressed toward each other to push the closure hooker flange past the diaphragm rim, past the outward base flange, to inwardly move the closure hooker flange into closing, hooking engagement with said hooker base flange surface and to assemble and produce such switch construction.

Other features of this invention become apparent from this description, the appended claimed subject matter, and/or the accompanying drawings, in which:

FIG. 1 is a diagrammatic cross section of the switch construction of this invention, after the same has been assembled by the pressing operation.

FIG. 2 is an exploded diagrammatic side view, partly in cross section, of the switch base, the diaphragm, and the closure before the same are secured together.

FIG. 3 is a diagrammatic side view, partly in cross section, showing the base and closure partly pressed toward each other.

FIG. 4 is a view similar to FIG. 3 and showing the parts after the pressing operation has been completed.

FIG. 5 is an enlarged view of a portion of the base, closure, and diaphragm assembled with the inward hooker flange resting on the diaphragm before the pressing operation, and also showing a portion of a diagrammatic pressing means for pressing the rims together.

FIG. 6 is a view similar to FIG. 5 and showing a later stage of the pressing operation.

FIG. 7 is a view similar to FIG. 6 and showing the completed pressing operation, which shows in enlarged view the completely assembled rims, which are also shown in FIGS. 1 and 4 in reduced scale.

Certain words are used in this application, indicating direction, relative position, and the like. These words are used only in connection with the views of the drawings. However, the parts so described, while in use, can have other direction, relative position, and the like. Examples of these words are "vertical," "horizontal," "upper," "lower," and the like.

According to this invention, a pressure responsive switch construction 20, and the like, may be made by forming or molding a switch housing base 22 of plastic material with a relatively thick circumferential or circular base rim 24, said rim 24 having an outward base flange 25 and an inward hooker base flange surface 26 on said base flange 25.

A closure 28, for the housing base 22, may be formed of plastic material. Such a closure 28 may have a relatively thin circumferential or circular closure rim 30. Such rim 30 may have an inward closure hooker flange 32 inside the closure rim 30 and spaced inboard of the free end 30A of the rim 30.

A resilient switch operating diaphragm 34 may be formed of rubber or the like with a resilient outward circumferential or circular diaphragm rim 36, substantially of the same outside dimension or diameter as said outward base flange 25. Such diaphragm 34 may have a diaphragm central portion 38 which may include an indentation to receive a switch actuating means.

A switch means 40 may be placed or assembled on or in said switch housing base 22. Said switch means 40 may have a switch actuating means 42 to be engaged by said diaphragm central portion 38. Such switch means may be of any well known type of switch means.

In assembling the switch construction 20, the diaphragm 34 may be placed with the diaphragm rim 36 adjacent to the outward base flange 25. Thereafter, the closure rim 30 may be placed over the diaphragm rim 36 with said closure hooker flange 32 adjacent to the diaphragm rim 36 and adjacent said outward base flange 25, as shown in FIG. 5 whereby the part 32A of the rim 30 below the flange 32 locates the closure rim 30 relative to the base flange 25 as the part 32A overlaps part of the flange 25 when the hooker flange 32 is resting on the diaphragm rim 36 as illustrated in FIG. 5.

The base rim 24 and the closure rim 30 may be pressed toward each other to push said closure hooker flange 32, from the position of FIG. 5, past said diaphragm rim 36, past said outward base flange 25, as shown in FIG. 6, to inwardly move said closure hooker flange 32 into closing hooking engagement with said hooker base flange surface 26, as shown in FIG. 7, to assemble and produce said switch construction 20, as shown in FIGS. 1 and 3.

In practicing the method of making the switch construction, pressing means 44 and 46 respectively engage the base rim 24 and the closure rim 30 and press said base rim 24 and closure rim 30 toward each other.

Any suitable type of press, not shown, may operate the pressing means 44 and 46 to bring them together to seal, assemble, and produce the switch construction 20.

In practicing the method of making the switch construction 20, and in the switch construction 20 itself, the switch construction 20, said switch housing base 22, said base rim 24, said outward base flange 25, said inward hooker base flange surface 26, said closure 28, said closure rim 30, said closure hooker flange 32, said diaphragm 34, said diaphragm rim 36, said diaphragm central portion 38, said switch means 40, said switch actuating means 42, are each a means to cooperate with all other means to perform such method and to assemble and produce said switch construction 20.

Further features of the method and switch construction may include a substantially flat outward base flange surface 48 with a substantially right-angled flat base side flange surface 50, which has a relatively sharp inward angle 51 to form the flat inward base flange surface or hooker surface 26.

The closure 28, for the base 22, may have a relatively thin circumferential closure rim 30 having a substantially flat outward closure flange 52 with a substantially right-angled flat closure side flange 54 which has the inward closure hooker flange 32 on the inside of such closure side flange 54.

The resilient switch operating diaphragm 34 has the circumferential diaphragm rim 36 substantially of the same side dimension or diameter as said base rim 24.

The construction is such that the outward closure flange 52 may be placed adjacent to the diaphragm rim 36 with the inward closure hooker flange 32 adjacent the diaphragm rim 36 and base rim 24, as shown in FIG. 5.

It is to be seen that the base rim 24 and the outward closure flange 52, of the closure rim 30, are pressed toward each other to push the hooker flange 32 past the diaphragm rim 36, past the outward base flange surface 48, past said base side flange surface 50, and to inwardly move hooker flange 32 against said inward base flange surface or inward hooker base flange surface 26 to assemble and produce the switch construction 20. The pressing means 44 and 46 engage the base rim 24 and the closure rim 30 and press them toward each other.

In practicing the more detailed method of making the switch construction 20, and in the switch construction 20 itself, it is to be seen that the switch construction 20, the housing base 22, the base rim 24, the outward base flange 25, the outward base flange surface 48, the base side flange surface 50, the inward base flange surface 26, the closure 28, the closure rim 30, the outward closure flange 52, the closure side flange 54, the inward closure hooker flange 32, the diaphragm 34, the diaphragm rim 36, the diaphragm central portion 38, the switch means 40, the switch actuator means 42, are each a means to cooperate with all other means to perform such method and to assemble and to produce said switch construction 20.

The closure 28 may have an integral fluid pressure tube 56 which may receive any desired pressure tube 58, which may telescope over the tube 56.

It is thus to be seen that the closure 28 of plastic material will resist corrosion and certain chemical elements and in which the tubular inlet 56 is integrally joined so as to be formed as one piece, thus preventing air leaks at the tubular inlet. By using a plastic material for the closure, the internally projecting hooker flange 32 is integrally molded on the inside surface at the larger open end of the closure 30. The molded switch housing or base 22 has a sharp cornered exterior rim 24 formed for accepting the plastic closure 28 in the sealing action.

With the diaphragm seal rim 36 in position as shown in FIG. 5, the plastic closure 28 is forced down by machine pressure onto the molded switch housing base 22. The internal molded closure hooker flange 32 inside the plastic rim 30 being of lesser diameter than the exterior base rim 24 provides an interference fit and resists being forced onto the molded switch housing. The pressure exerted by the machine, however, overcomes this resistance, causing the plastic closure side flange 54 to expand with its internal hooker flange 32, so that the flange 32 is pushed over the rim 24 of the base into hooking engagement with the hooker base flange surface 26.

The dimensions of the plastic closure 28 and the positioning of its hooker flange 32 and in combination with the height of the sharp edged exterior base rim 24, are such that the diaphragm seal or rim 36 is compressed to achieve a proper seal between the plastic closure 28 and the molded switch housing base 22 in a very simple and effective manner.

While the form of the invention now preferred has been dis-

closed, as required by statute, other or forms may be used, all coming within the scope of the claimed subject matter which follows.

I claim:

1. A switch construction comprising:

a switch housing base of plastic material with a relatively thick circumferential base rim having an outward base flange with a rectangular cross-sectional configuration having sharp right angled corners and being defined by a flat outward base flange surface, with a right angled flat base side flange surface, and with a flat inward base flange surface;

a closure of plastic material for said base with a relatively thin circumferential closure rim having a flat outward closure flange, with a right angled flat closure side flange, and with an inward closure hooker flange on the inside of said closure side flange at a right angle relative thereto and being disposed inboard of the free end of said closure side flange;

a resilient switch operating diaphragm with a resilient outward substantially flat circumferential diaphragm rim substantially of the same outside dimension as said base rim and having a diaphragm central portion;

a switch means mounted on said base and having a switch actuating means to be engaged by said diaphragm central portion;

said diaphragm having been placed with said diaphragm rim adjacent said base rim and with said diaphragm central portion adjacent said switch actuating means;

said outward closure flange having been placed adjacent said diaphragm rim and said base rim with said inward closure hooker flange adjacent said diaphragm rim and said base rim and with said free end of said closure side flange overlapping part of said base rim to locate said closure relative to said base; and

said base rim and said outward closure flange having been pressed toward each other to push said hooker flange past said diaphragm rim, past said outward base flange surface, past said base side flange surface, and to inwardly move said hooker flange against said inward base flange surface, to assemble and produce said switch construction.

2. A switch construction according to claim 1 in which pressing means have engaged said base rim and said outward closure flange to press said base rim and outward closure flange toward each other.

3. A switch construction according to claim 2 in which press means has operated said pressing means.

4. A switch construction according to claim 1 in which said base rim and said closure rim are each made circular.

5. A switch construction according to claim 1 in which said switch construction, said housing base, said base rim, said outward base flange, said outward base flange surface, said base side flange surface, said inward base flange surface, said closure, said closure rim, said outward closure flange, said closure side flange, said inward closure hooker flange, said diaphragm, said diaphragm rim, and said diaphragm central portion are each a means to cooperate with all other means to assemble and produce said switch construction.