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[54] DOUBLE DIAPHRAGM PRESSURE RESPONSIVE SWITCH CONSTRUCTION 16 Claims, 6 Drawing Figs.

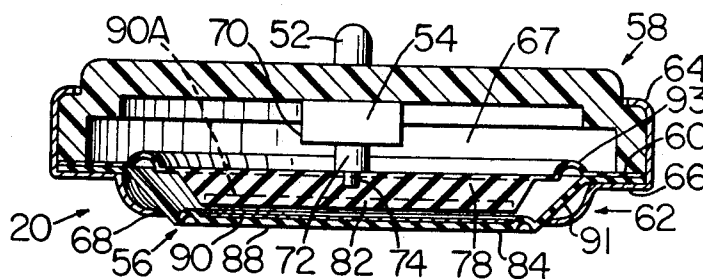
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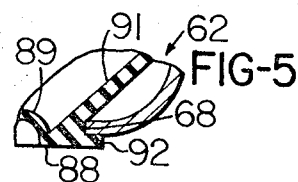
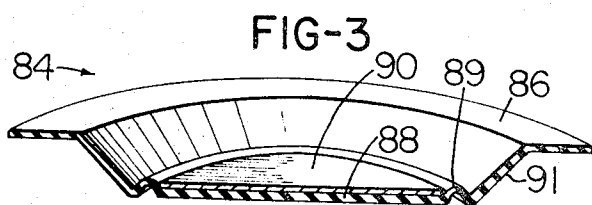
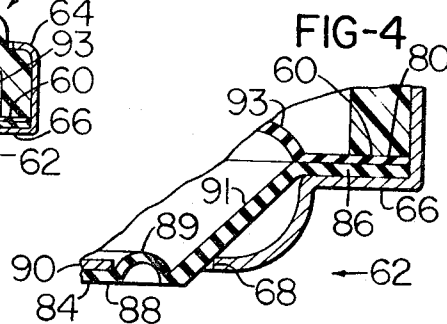
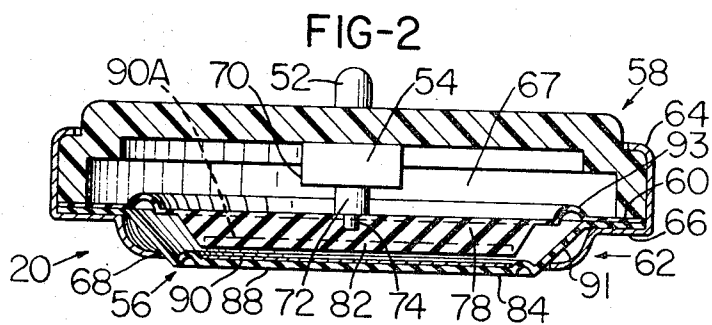
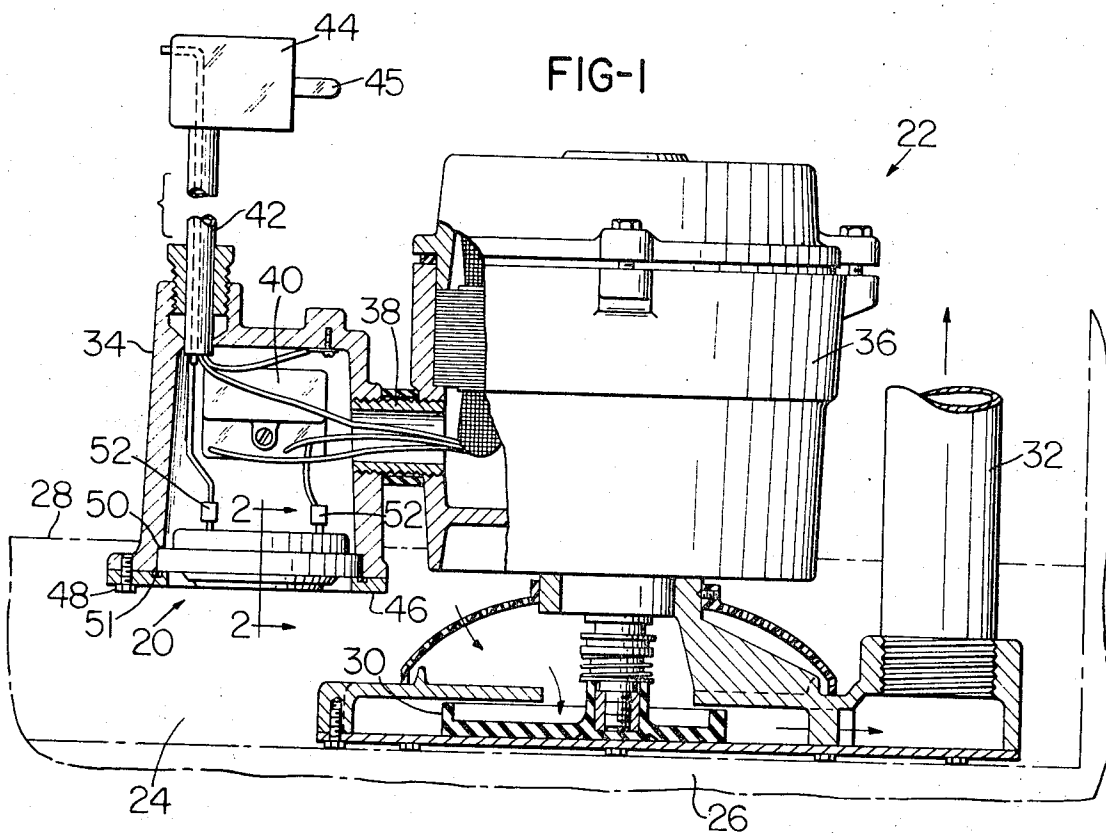
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ABSTRACT: A unitary pressure responsive switch construction may be mounted at the bottom of a control bell of a sump pump construction. This unitary switch construction includes a first casing member with a flat diaphragm engaging portion and a second casing member with a clamping rim in telescoping engagement with the first casing member and having a diaphragm engaging second flat casing portion. These flat casing portions are used to hold the rims of two adjacent diaphragms. The inner diaphragm actuates a switch means inside the switch casing whereas the outer diaphragm is exposed to, and resists adverse reaction from the liquid or sewage in the sump in which it is submerged. The outer diaphragm may have an aluminum disk bonded to the inner surface of said outer diaphragm. Alternatively or additionally, the outer diaphragm is held in closed relationship with the lower casing part by a lip on the outer diaphragm which prevents any silt or sewage from entering into the main part of the casing. The unitary pressure responsive switch construction may be assembled at the factory and may be inserted and clamped at the bottom of the control bell, so that the diaphragm portions are submerged in the liquid of the sump with the outer diaphragm protecting the inner diaphragm from the harmful effect of the liquid or sewage.





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DOUBLE DIAPHRAGM PRESSURE RESPONSIVE SWITCH CONSTRUCTION

This invention relates to a double diaphragm pressure responsive switch construction.

Several sump pump manufacturers have been using pressure responsive switch constructions at the bottom of a control bell and the like and in which the main diaphragm is in direct contact with the liquid and sewage of the sump. This practice, in time, has rendered the pressure responsive switch construction inoperative. Attempts have been made to improve such constructions. However, such previous attempts have been complicated, and require assemblage of the parts at the place of installation and/or many complicated rings and the like for supporting the parts of the switch construction at the bell.

Accordingly, one of the features of this invention includes a unitary double diaphragm pressure responsive switch construction that may be quickly and easily attached to, and/or removed from the bottom of a control bell of a sump pump, and the like.

Another feature of this invention includes a switch construction according to the preceding feature, in which the two diaphragms have their rims secured between two switch casing members of such switch construction.

Another feature of this invention includes a switch construction as above described in which an outer or lower one of such diaphragms protects the inner or upper one of such diaphragms from adverse reaction of the liquid or sewage in the sump.

Another feature of this invention includes a unitary double diaphragm pressure responsive switch construction in which the rims of two diaphragms are held by diaphragm rim engaging portions of two casing parts.

Another feature of this invention includes the use of first and second casing members with flat casing portions clamping the rims of two diaphragms which are held between such flat casing portions.

Another feature of this invention includes a first cup-shaped member to form the first or upper casing member and an annular member forming the second or lower casing member, these two casing members clamping the adjacent rims of two diaphragms.

Another feature of this invention includes a dish-shaped second or lower diaphragm, which engages the lower rim of the second or lower casing member in a manner to prevent silt and sewage from entering the inner parts of the casing construction.

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

FIG. 1 is a diagrammatic side view, partly in cross section, showing the switch construction of this invention, as shown in FIGS. 2-4, connected to a sump pump, and located in a sump that is drained by the pump.

FIG. 2 is an enlarged cross-sectional view of the pressure responsive switch construction of this invention, and taken along line 2-2 of FIG. 1.

FIG. 3 is a diagrammatic combined cross section and perspective view of the outer diaphragm of FIG. 2.

FIG. 4 is an enlarged view of a portion of FIG. 2.

FIG. 5 is a view similar to a portion of FIG. 4 and showing the addition of a circumferential lip on the second diaphragm in closing engagement with the pressure transmitting rim of the second casing member.

FIG. 6 is a view similar to a portion of FIG. 4 and showing the circumferential rim of FIG. 5.

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

A pressure responsive switch construction 20, according to this invention, may be used in combination with a motor and pump construction 22, which may be used to drain the liquid or sewage 24 from a basement sump 26, or the like. The motor pump construction 22 is adapted to pump liquid 24 from the sump 26 until the liquid 26 reaches a minimum level, such as 28, whereupon the motor pump construction 22 is stopped by the pressure responsive switch construction 20 until the liquid level rises to a selected or regulated higher level, whereupon the switch construction 20 will start the motor pump construction 22, so that the liquid is pumped by the pump 30 through the discharge pipe 32 as long as required to reduce the liquid level down to the minimum level 28.

The pressure responsive switch construction 20 may be secured in a downwardly directed bell construction 34, which is supported by the motor 36, by the pipe nipple 38, for example. The bell 34 may contain a relay 40 and may have sealed thereto an electric power supply cable construction 42, to which a control master switch 44 is connected. The master switch is opened and closed by the manual controller 45 manually to connect and disconnect the motor pump construction from the power supply.

The general construction shown in FIG. 1 is well known, except for applicant's switch construction 20, and its connection with the bell 34, and it is therefore believed unnecessary to further describe such general construction of FIG. 1.

The pressure responsive switch construction 20 of this invention may be secured at the bottom of the bell 34 by any suitable means capable of sealingly securing the construction 20 to the bottom of the bell 34. This is indicated diagrammatically by a ring 46 which is secured to the bottom of the bell 34 by screws 48 or the like. Such illustration is intended diagrammatically to indicate any switch supporting construction that holds the switch construction 20 against a flange 50, or the like, in a manner to prevent liquid 24 from entering past the construction 20 into the interior of the bell 34. A flexible seal ring 51 may be interposed between the ring 46, the bottom of the bell 34 and a part of the switch construction 20 effectively to affect such sealing action.

The switch construction 20 may have two terminal connectors 52 which are connected and disconnected by a switch means 54 which is diagrammatically indicated in FIG. 2 which electrically disconnects and connects the connectors 52 in response to the pressure of the liquid acting on the bottom of the switch construction 20 in response to the height of the liquid in the sump 26 or the like.

This invention may include a double diaphragm construction 56 that can be quickly, simply, and economically made and which may be easily inserted in and/or removed from the bell construction 34 as a unit such as for replacement or repair, and the like.

The pressure responsive switch construction 20 may include a first casing member 58 with a circumferential diaphragm engaging first flat casing portion 60. A second casing member 62 is provided with a clamping rim 64 which is in sealing and telescoping engagement with said first casing member 58.

The second casing member 62 also has a circumferential diaphragm engaging second flat casing portion 66.

The casing members 58 and 62 form a switch casing, which has a switch cavity 67, in which the switch means 54 is located.

The second casing member 62 has a fluid pressure transmitting rim 68 which also forms a pressure transmitting opening 68 in the casing.

Any type of well known switch means 54 may be placed in the switch casing opening or cavity 67. Such switch means 54 is diagrammatically shown merely as a rectangle 70, to indicate, for example, a snap switch from which extends the plunger construction 72 which engages the opening 74 in a pressure responsive first diaphragm 78. The switch means 54 may be any type of snap switch that opens and closes suitable contacts, not shown, in the switch means 54. These contacts electrically connect and disconnect the two fluidtight connec-

ters 52 to make and break the circuit to the motor 36 in a well known manner.

The pressure responsive first diaphragm 78 may have a first diaphragm rim 80 held between the first and second flat casing portions 60 and 66. Such first diaphragm 78 may have a first central diaphragm portion 82, which actuates the switch means 54, through the medium of the plunger 72.

A pressure responsive second diaphragm 84 may have a second diaphragm rim 86 which is held between said first and second flat casing portions 60 and 66. The second diaphragm 84 may have a second central diaphragm portion 88, which actuates said first central diaphragm portion 82. The said second central diaphragm portion 88 has an outer surface adjacent to the fluid pressure transmitting opening 68 in the casing which is formed by the rim 68.

The second diaphragm 84 has a stiffening plate of disk 90 which may be a metal plate such as an aluminum disk 90, which is bonded to the second central diaphragm portion 88 of the second diaphragm 84. Such bonding may be a chemical bonding action, adhesive action, or any other suitable bonding action desired.

A suitable circumferential convolution 89 may be formed around the second diaphragm 84 adjacent to the rim of disk 90, and adjacent to the slanting or funnel shaped or frustoconical intermediate portion 91 which merges with the second diaphragm rim 86 of the diaphragm 84.

The central thick portion 82 of the interior or first diaphragm 78 not only acts as a temperature compensator, but is stiff enough at such central thick portion 82 to continue to drive and actuate the rod or plunger 72 for long periods of time.

The stiffening plate or metal disk 90 drives the lower surface of such central thick portion 82 upwardly when there is a rise of the liquid level 28 to a dotted line position 90A which pushes up the plunger 72 and actuates the switch 54 to start operation of the motor 36 until the liquid level 28 is pumped down or falls to a motor stopping level.

Alternatively or additionally, the second diaphragm 84 may be provided with an integral circumferential lip 92 in closing engagement with the fluid pressure transmitting rim 68 of the second casing member 62. This lip 92 surrounds the lower portion of said second diaphragm 84 in a manner so that no foreign material, silt, and the like, can enter between the auxiliary or second diaphragm 84 and the inner rim base area inside the rim 68. If desired the central portion 88 of the second diaphragm can rise to its upper level 90A without materially moving the lip 92 because of the yielding nature of the convolution 89. Also, the convolution 89 can be made so that it allows upward movement of the central portion 88 to take place without materially lifting the second diaphragm 84 from the rim 68 when the lip 92 is not used.

The first central diaphragm portion 82 of the first diaphragm 78 is relatively thick compared with the second central diaphragm portion 88, which is relatively thin compared with the first central diaphragm portion 82. The diaphragms 78 and 84 may be made of any suitable elastomer or rubberlike material so that they function in a frictionless manner accurately to transmit the pressure of the liquid 24 in the sump 26 to the switch means 54 to cause said switch means 54 to energize and deenergize the motor 36 to maintain the proper level 28 of such liquid.

The first casing member 58 may be a plastic cup-shaped member, with said flat casing portion 60 forming the cup rim of the cup-shaped member 58. The second casing member 62 may be a double edged metal or steel annular member 62 with the clamping rim 64 forming one edge of the annular member and with the fluid pressure transmitting rim 68 forming the other edge of the annular member.

It is thus to be seen that a unitary pressure responsive switch construction has been provided which is adapted to be submerged in a basement or sewage sump, and which can be unitarily manufactured at the factory, if desired, and can be unitarily installed on the motor pump construction 22, such as

at the bottom of the bell 34, from which it can be easily removed and replaced or repaired, as desired. The two diaphragms 78 and 84 are unitarily held together by the flat casing portions 60 and 66. The diaphragm 78 may be made with a relatively thick central portion 82 which is engaged and actuated by the aluminum disk 90 of the second diaphragm. The diaphragm 78 can transmit the pressure responsiveness received from the thin diaphragm 84, to impart proper pressures to the switch 54. The first diaphragm 78 may have a thin convolution 93 if desired. The diaphragm 84 can prevent sewage and silt from damaging the inside parts of the switch construction.

A new, useful and unobvious double diaphragm pressure responsive switch construction is thus provided.

While the form of the invention now preferred has been disclosed as required by statute, other forms may be used, all coming within the scope of the appended claimed subject matter.

I claim:

1. A pressure responsive switch construction comprising:
 - a first casing member with a circumferential diaphragm engaging first flat casing portion;
 - a second casing member with a clamping rim in telescoping engagement with said first casing member, and having a circumferential diaphragm engaging second flat casing portion, said first and second casing members forming a switch casing;
 - said second casing member having a fluid pressure transmitting rim forming a pressure-transmitting opening in said casing while being spaced from and inboard of said second flat casing portion;
 - switch means in said casing;
 - a pressure responsive first diaphragm in said casing with a first diaphragm rim held between said first and second flat casing portions, said first diaphragm having a first central diaphragm portion actuating said switch means; and
 - a pressure responsive second diaphragm having a second diaphragm rim held between said first and second flat casing portions, and having a second central diaphragm portion actuating said first central diaphragm portion, said second central diaphragm portion having an outer surface adjacent and inboard of said fluid pressure-transmitting opening in said casing, said second diaphragm having a frustoconical intermediate portion interconnected to said diaphragm rim at the larger end thereof and to said second central diaphragm portion at the smaller end thereof, said intermediate portion being engageable with said fluid pressure-transmitting rim at said opening in said casing, said second central diaphragm portion having an annular convolution therein inboard of said opening to provide flexure for said central portion independently of said intermediate portion.
2. A switch construction according to claim 1 in which said second diaphragm has a stiffening plate which engages said first central portion of said first diaphragm.
3. A switch construction according to claim 2 in which said stiffening plate is an aluminum plate.
4. A switch construction according to claim 3 in which said first central diaphragm portion is relatively thick compared with said second central diaphragm portion which is relatively thin compared to said first central diaphragm portion.
5. A switch construction according to claim 1 in which said first casing member is a cup-shaped member with said first flat casing portion forming a cup rim for said cup-shaped member.
6. A switch construction according to claim 1 in which said second casing member is an annular member with said clamping rim forming one edge of said annular member, and said fluid pressure transmitting rim forming the other edge of said annular member.
7. A switch construction according to claim 1 in which said first casing member is a plastic cup-shaped member with said first flat casing portion forming a cup rim for said cup-shaped member.

8. A switch construction according to claim 1 in which said second casing member is a metal annular member with said clamping rim forming one edge of said annular member, and said fluid pressure transmitting rim forming the other edge of said annular member.

9. A switch construction according to claim 1 in which said first casing member is a plastic cup-shaped member with said first flat casing portion forming a cup rim for said cup-shaped member, and in which said second casing member is a metal annular member with said clamping rim forming one edge of said annular member and which is in clamping engagement with said cup-shaped member, and in which said fluid pressure transmitting rim forms the other edge of said annular sheet metal member.

10. A switch construction according to claim 9 in which said second diaphragm is a dishlike member and has a stiffening plate in engagement with said central diaphragm portion of said first diaphragm.

11. A switch construction according to claim 10 in which said stiffening plate is an aluminum plate.

12. A switch construction according to claim 11 in which said first central diaphragm portion is relatively thick compared to said second central diaphragm portion which is relatively thin.

13. A pressure responsive switch construction comprising:
a first casing member with a circumferential diaphragm engaging first flat casing portion;

a second casing member with a clamping rim in telescoping engagement with said first casing member, and having a circumferential diaphragm engaging second flat casing portion, said first and second casing members forming a switch casing;

said second casing member having a fluid pressure-transmitting rim forming a pressure-transmitting opening in said casing;

switch means in said casing;

a pressure responsive first diaphragm in said casing with a first diaphragm rim held between said first and second flat casing portions, said first diaphragm having a first central diaphragm portion actuating said switch means; and

a pressure responsive second diaphragm having a second diaphragm rim held between said first and second flat casing portions, and having a second central diaphragm portion actuating said first central diaphragm portion, said second central diaphragm portion having an outer surface adjacent said fluid pressure-transmitting opening in said

casing, said second diaphragm being a dishlike member and having a circumferential lip in closing engagement with said fluid pressure-transmitting rim of said second casing member.

14. A switch construction according to claim 13 in which said circumferential lip surrounds the lower portion of said second diaphragm.

15. A pressure responsive switch construction comprising:
a first casing member with a circumferential diaphragm engaging first flat casing portion;

a second casing member with a clamping rim in telescoping engagement with said first casing member, and having a circumferential diaphragm engaging second flat casing portion, said first and second casing members forming a switch casing;

said second casing member having a fluid pressure-transmitting rim forming a pressure-transmitting opening in said casing;

switch means in said casing;

a pressure responsive first diaphragm in said casing with a first diaphragm rim held between said first and second flat casing portions, said first diaphragm having a first central diaphragm portion actuating said switch means;

a pressure responsive second diaphragm having a second diaphragm rim held between said first and second flat casing portions, and having a second central diaphragm portion actuating said first central diaphragm portion, said second central diaphragm portion having an outer surface adjacent said fluid pressure-transmitting opening in said casing;

said first casing member being a plastic cup-shaped member with said first flat casing portion forming a cup rim for said cup-shaped member, said second casing member being a metal annular member with said clamping rim forming one edge of said annular member and which is in clamping engagement with said cup-shaped member, said fluid pressure-transmitting rim forming the other edge of said annular sheet metal member; and

said second diaphragm being a dishlike member and having a circumferential lip in closing engagement with said fluid pressure-transmitting rim of said annular sheet metal member.

16. A switch construction according to claim 15 in which said circumferential lip surrounds the lower portion of said second diaphragm.

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