United States Patent

Werner

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[54] **PRESSURE-SENSITIVE SWITCH ASSEMBLY**

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[21] Appl. No.: **59,192**

[52] **U.S. Cl.** .....**62/188,** 200/61.2, 200/83 R

[51] **Int. Cl.** **F25c 7/10**

[58] **Field of Search**.....200/61.2, 61.21, 83 R; 62/188, 62/392

[56] **References Cited**

UNITED STATES PATENTS

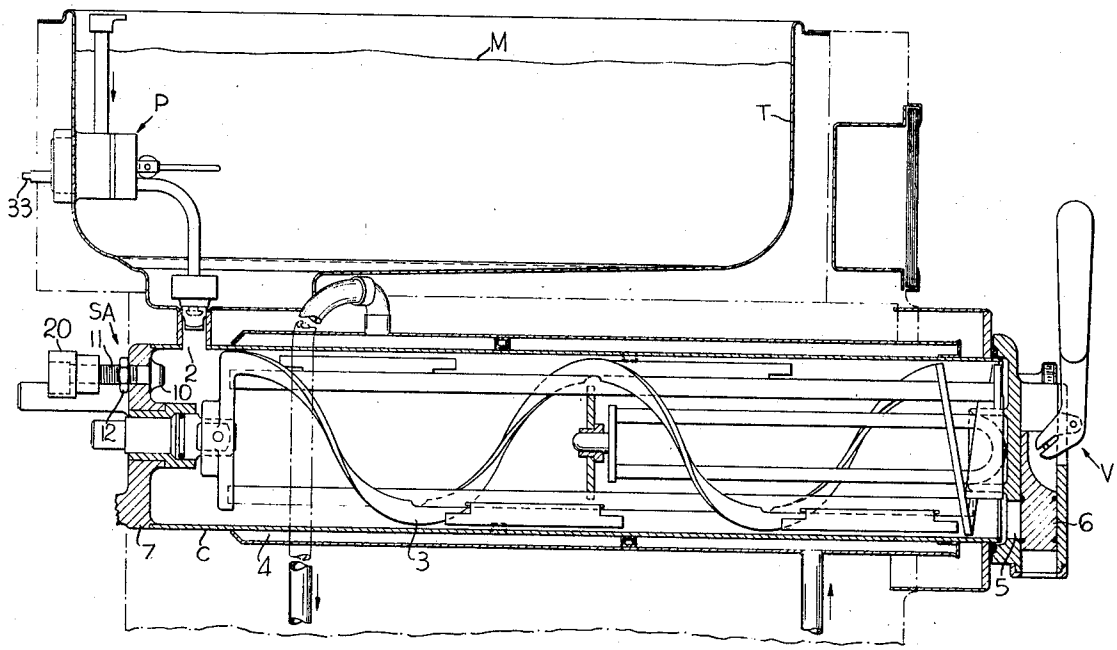
2,475,404	7/1949	Reed	200/61.21
2,919,320	12/1959	Edwards	200/83.2
2,814,703	11/1957	Martin	200/168 G
3,464,220	9/1969	Phelan	62/524
3,319,436	5/1967	Wilch	62/392

Primary Examiner—Robert K. Schaefer
Assistant Examiner—M. Ginsburg
Attorney—James E. Nilles

[57] **ABSTRACT**

A pressure-sensitive switch assembly for measuring the pressure of material and having a measuring head which is in direct contact with the material to be measured. The head includes a flexible diaphragm to which is attached a rod that engages an electric contact switch. The assembly is an integral and self-contained, sealed unit which can be readily mounted on a supporting wall with the head on the interior of the vessel containing the material to be measured. The invention finds particular utility when used in a continuous freezer for measuring the pressure within the cylinder and then stopping the operation of the pump which pumps material into the cylinder, when a predetermined pressure is reached, thus the pump is turned off and no longer pumps material into the cylinder.

19 Claims, 5 Drawing Figures



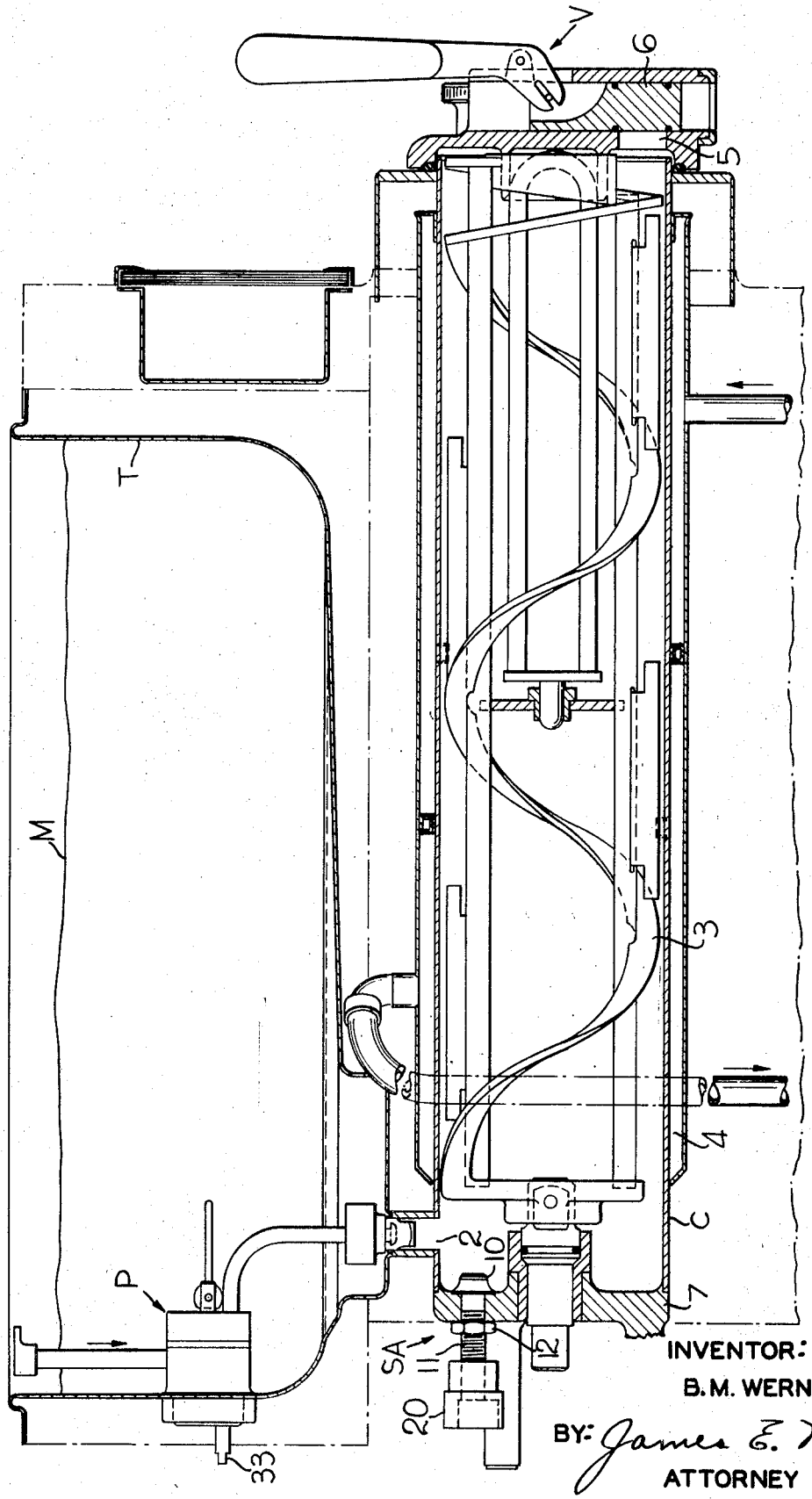


FIG. 1

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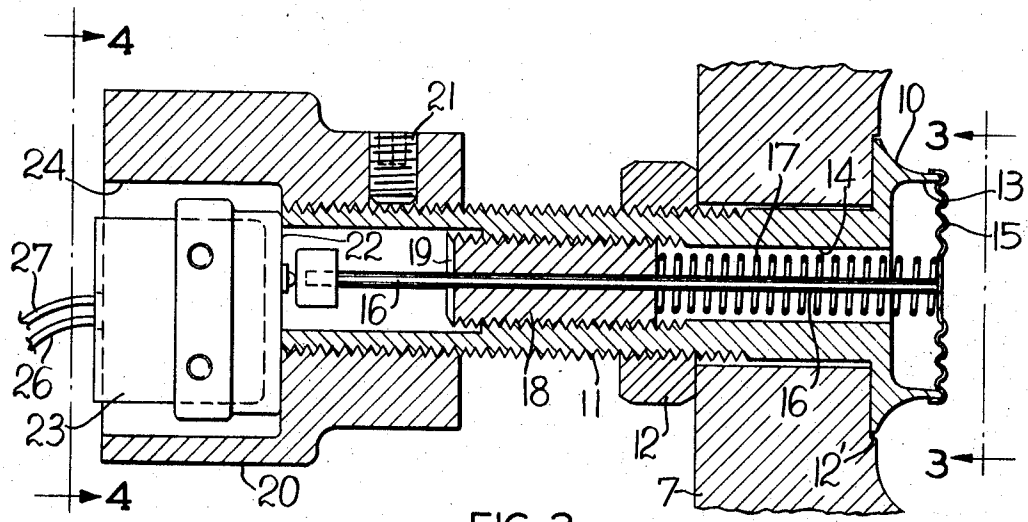


FIG. 2

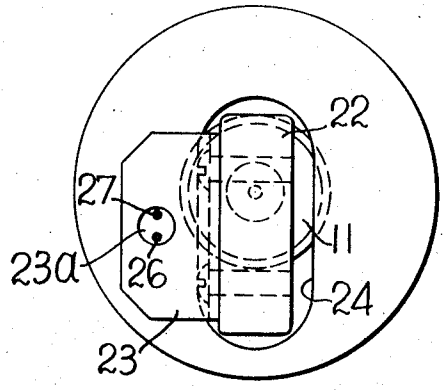


FIG. 4

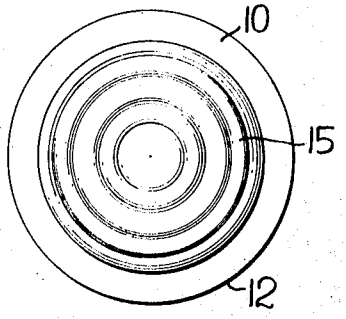


FIG. 3

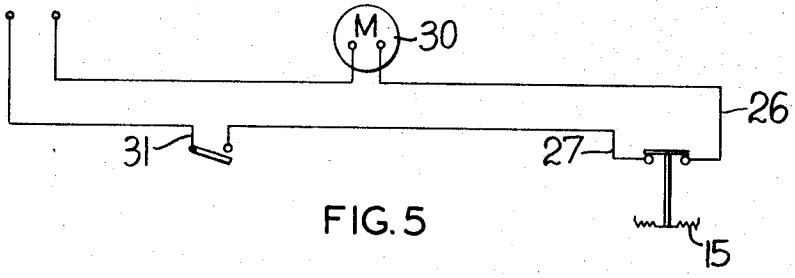


FIG. 5

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PRESSURE-SENSITIVE SWITCH ASSEMBLY

BACKGROUND OF THE INVENTION

The present invention relates to a pressure switch of the type which has a sensitive head that is shifted to open or close an electric circuit. The switch assembly is of the flexible diaphragm type which is sensitive and in direct contact with the material to be measured. These switches are generally electrically connected to other parts for causing operation thereof.

The invention finds particular utility when used with continuous ice cream freezers such as are shown in the U.S. Pat. No. 3,464,220, issued Sept. 2, 1969 and entitled "Machine for Making Frozen Confection".

SUMMARY OF THE PRESENT INVENTION

The present invention provides a pressure-sensitive switch assembly for measuring the pressure of a material by placing the head of the assembly in direct contact with the material. The head includes a flexible diaphragm to which is connected a rod that engages an electric switch also mounted in the assembly. The entire assembly is an integral and self-contained unit and has means for being mounted with its head in the container in which the material is located. A more limited aspect of the invention relates to the construction of the diaphragm itself, the diaphragm being made of metal and formed with concentric corrugations so as to provide good flexibility for a relatively small area of diaphragm. Still another aspect of the invention relates to the means for mounting the electric contact switch within the assembly, the switch being encapsulated within the assembly body by means of an epoxy to thereby seal the unit.

Another aspect of the invention relates to a continuous ice cream freezer having such a switch assembly, and which combination includes an electric circuit containing an electric motor driven pump for pumping a product to be frozen into the freezing cylinder. The circuit also includes an on-off switch which is manually operated by the attendant. The arrangement of the circuitry is such that when the on-off switch is turned on, and the pressure within the cylinder reaches a predetermined amount, then the pressure sensitive switch will open the circuit thereby terminating operation of the pump motor. In this manner, excessive pressure within the cylinder is prevented, particularly when the pump is operating and the drawoff valve is closed. On the other hand, the arrangement is such that sufficient pressure is maintained within the cylinder so as to insure that the product within the cylinder is sufficiently pressurized to be forcefully ejected from the drawoff valve when desired.

These and other objects and advantages of the present invention will appear hereinafter as this disclosure progresses, reference being made to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal, cross-sectional view through a continuous ice cream freezer and showing the pressure switch of the present invention as mounted thereon;

FIG. 2 is a longitudinal, cross-sectional view through the switch assembly shown in FIG. 1, but on an enlarged scale;

FIG. 3 is an end view taken generally from line 3—3 in FIG. 2;

FIG. 4 is a view taken generally along line 4—4 in FIG. 2; and

FIG. 5 is an electrical circuit diagram showing the pressure switch, the on-off switch, and the pump motor as used with the continuous freezer shown in FIG. 1.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring in greater detail to FIG. 1, the continuous freezer includes a freezing cylinder C, a fresh mix tank T containing mix M, a pump P mounted in the tank T for mixing air and mix M together and forcing it into the freezing cylinder via opening 2. The freezing cylinder also includes a rotary scraper assembly 3 and a drawoff valve V at the front end of the freezer. The cylinder furthermore includes an annular freezer chamber 4 located for substantially the full length of the cylinder C.

If a more complete description of the pump P is believed to be either necessary or desirable, reference may be had to the copending U.S. application, Ser. No. 59,191, filed July 29, 1970 and entitled "Positive Displacement, Gear Type Pump."

If a more complete description of the drawoff valve is believed to be either necessary or desirable, reference may be had to the copending U.S. application Ser. No. 59,100, filed July 29, 1970 and entitled "Freezer Door and Draw Off Valve for a Continuous Freezer."

If a more complete description of the scraper assembly 3 is believed to be either necessary or desirable, reference may be had to the copending U.S. application Ser. No. 59,099, filed July 29, 1970 and entitled "Scraper Assembly and Material Retarder for a Cylindrical Continuous Freezer."

For purposes of the present invention, it is believed sufficient to say that the freezing cylinder receives the mix via opening 2, and the scraper assembly moves the material towards the serving valve V as the material is being frozen. The interior of the cylinder is pressurized by the pump P so that the product is forcefully ejected through the outlet 5 at the drawoff end of the freezing cylinder when the plunger 6 of the valve V is raised in the known manner. If excessive pressure is present in the cylinder when the drawoff valve is open, the product is ejected too rapidly. Furthermore, it is dangerous for excessive pressure to be present in the cylinder, for example, if the pump were continuously operated even though the on-off switch for causing pump operation was in the "on" position.

Various safety devices have been proposed for regulating the pressure within the container, but they have generally proved to be unsatisfactory in some manner or another. For example, it is particularly important that sufficient pressure be maintained in the cylinder when the drawoff valve is opened for any appreciable length of time or in rapid succession for repeated draws of product. On the other hand, when the drawoff valve is repeatedly opened and sufficient pressure is present within the cylinder, the pump should not be operated even though the on-off switch for the pump is in the "on" position.

In accordance with the present invention, the switch assembly SA is mounted in the rear wall 7 of the freezing cylinder and has a head 10 which is located within the cylinder and is exposed directly to the product therein. The switch assembly includes a threaded portion 11 which extends through the wall 7 and has a nut 12 threadably engaged on portion 11 and by means of which the head 10 can be drawn up tightly against the interior of the wall 7. In this manner, the switch assembly is rigidly mounted to the rear wall.

The head 10 of the switch assembly has a relatively narrow radial flange 12' (FIG. 2) that can abut against the interior of the wall for sealing contact therewith. The head 10 also includes a recess 13 with which communicates a central bore 14 that extends rearwardly from the head and through the portion 11. A metal diaphragm 15 is secured over the recess 13 and in sealing contact with the head. The diaphragm 15 has a series of concentric corrugations formed therearound so as to provide good flexibility for a relatively small area of diaphragm and thus provides a sensitive head for the assembly.

The assembly also includes a central rod 16 that extends through the body of the assembly and into the recess where it is secured at one end to the central portion of the diaphragm 15, as by welding, brazing, or the like. A spring 17 is mounted on the rod and bears against the diaphragm at one end while the other end of the spring is seated on the end of a pressure adjusting screw 18 which is threadably engaged within the body 11. The end of the screw is formed as at 19 so as to be readily grasped by an adjusting tool prior to the assembly of

body portion **20**, to be described. The adjusting screw is hollow so that the rod **16** can extend freely therethrough.

An enlarged portion **20** of the body is threadably engaged on the portion **11** of the body and held in position by a setscrew **21**.

Located in the hollow end of portion **20** is a miniature microswitch which in effect, is an electrical contact switch **22**. This switch is held in position by a bracket **23** and within the portion **20** and after it has been mounted therein, the opening **24** of the portion **20** is filled with an epoxy so as to completely fill the switch therein and prevent damage and render the assembly an integral and self-contained package. Electric wires **26** and **27** extend from the switch **23** and as shown in FIG. **5** connect respectively with the electric motor **30** and the manually operated on-off switch **31**, respectively. The pump motor **30** is directly connected to the shaft **33** (FIG. **1**) of the pump P and whenever the motor **30** is operating, the pump is likewise operating to force the product into the freezing cylinder.

The on-off switch **31** is flipped to the "on" position by the attendant so as to periodically recharge the cylinder with product.

The operation of the switch assembly is as follows. When pressure within the cylinder C reaches a predetermined value, say 30 p.s.i., the flexible diaphragm **15** will be pushed inwardly, that is into the recess **13** a small amount, thereby carrying with it the rod **16**. As the rod **16** moves to the left as viewed in FIG. **2**, it causes the electric switch **22** to be opened, thereby opening the circuit and terminating operation of the pump motor. After the operator has opened the valve sufficiently to draw product from the cylinder, the pressure in the cylinder drops and the diaphragm returns to the normal position shown in FIG. **2**, with the aid of the spring **17**. When the diaphragm is thus returned to its normal position, the circuit is closed, thus again placing the pump motor in the completed circuit for operation whenever the on-off switch **31** is again closed by the attendant.

The pressure switch can be set to open, for example, at 30 p.s.i. and to close at 25 p.s.i.

The pressure-sensitive switch assembly provided by the present invention includes a diaphragm head which is particularly sensitive considering the area of the head and which head can be placed in direct contact with the material to be measured. It is an easy matter to completely and thoroughly clean the head without removing it from the cylinder. The assembly is a self-contained and integral unit which is virtually trouble-free in operation and easily removed from and assembled on its supporting wall, such as the cylinder wall **7**.

I claim:

1. A fluid pressure-sensitive switch assembly for measuring pressure of a fluid material in a sealed container and comprising, a body having an enlarged head with a recess formed therein, said head also having a radial flange defining a sealing surface for sealed contact with said container a flexible diaphragm sealingly mounted across said recess for sealingly enclosing said recess, a rod in said body and extending into said recess and rigidly secured at one end to said diaphragm, an electric switch mounted on said body, means whereby said electric switch is engageable for operation by the other end of said rod, and means for mounting said body with said diaphragm in said sealed container and in direct contact with the fluid material to be measured; whereby when said switch assembly is mounted in said sealed contact with said container, said diaphragm flexes in one direction due to pressure of the fluid material, and said rod moves with said diaphragm and engages said switch.

2. The assembly set forth in claim **1** further characterized in that said diaphragm is of corrugated metal construction.

3. The assembly claimed in claim **2** further characterized in that said rod is welded to the diaphragm.

4. The assembly set forth in claim **1** further characterized in that said switch is encapsulated in said body with an epoxy.

5. The assembly set forth in claim **2** further characterized in that said switch is encapsulated in said body with an epoxy.

6. The assembly set forth in claim **3** further characterized in that said switch is encapsulated in said body with an epoxy.

7. An assembly as recited in claim **2** including a spring mounted on said rod and acting between said body and said diaphragm for urging said diaphragm outwardly from said recess.

8. An assembly as set forth in claim **1** further characterized in that said body includes a threaded portion, and means threadably engagable on said threaded portion whereby said body can be inserted through a wall for being secured thereto with said head on one side of said wall and said means is located on the other side of said wall.

9. An assembly as set forth in claim **3** further characterized in that said body includes a threaded portion, and means threadably engagable on said threaded portion whereby said body can be inserted through a wall for being secured thereto with said head on one side of said wall and said means is located on the other side of said wall.

10. An assembly as set forth in claim **4** further characterized in that said body includes a threaded portion, and means threadably engagable on said threaded portion whereby said body can be inserted through a wall for being secured thereto with said head on one side of said wall and said means is located on the other side of said wall.

11. An assembly as set forth in claim **7** further characterized in that said body includes a threaded portion, and means threadably engagable on said threaded portion whereby said body can be inserted through a wall for being secured thereto with said head on one side of said wall and said means is located on the other side of said wall.

12. In a continuous freezer having a sealed freezing cylinder which can be pressurized to thereby force the product in the cylinder out of a serving valve, a pump for intermittently pumping material into said cylinder for being frozen, an electric circuit including an electric motor for actuating said pump intermittently to thereby pump material into said cylinder and build up pressure in said cylinder, an electric on-off switch in said circuit and electrically connected with said motor and for operating said pump, a pressure switch assembly in said circuit for measuring the fluid pressure within said sealed cylinder, said assembly comprising; a body having an enlarged head with a recess formed therein, said head also having a radial flange defining a sealing surface for sealing contact with a wall of said cylinder, a flexible diaphragm sealingly mounted across said recess for sealingly enclosing said recess, a rod in said body and extending into said recess and rigidly secured at one end to said diaphragm, an electric switch mounted on said body, means whereby said last mentioned switch is engagable for operation by the other end of said rod, and means mounting said body in the wall of said cylinder and with said diaphragm in direct contact with the fluid in the interior of said cylinder; whereby when said on-off switch is on to operate said pump and when pressure in said cylinder reaches a predetermined value, then said diaphragm flexes in one direction due to said pressure in said cylinder and said rod moves with said diaphragm and engages said rod-engageable switch to turn off said pump.

13. The assembly set forth in claim **12** further characterized in that said diaphragm is of corrugated metal construction.

14. The assembly claimed in claim **13** further characterized in that said rod is welded to the diaphragm.

15. The assembly set forth in claim **12** further characterized in that said rod engageable switch is encapsulated in said body with an epoxy.

16. The assembly set forth in claim **13** further characterized in that said rod-engageable switch is encapsulated in said body with an epoxy.

17. The assembly set forth in claim **14** further characterized in that said rod-engageable switch is encapsulated in said body with an epoxy.

18. An assembly as recited in claim **13** including a spring mounted on said rod and acting between said body and said diaphragm for urging said diaphragm outwardly from said recess.

19. An assembly as set forth in claim 12 further characterized in that said body includes a threaded portion, and means threadably engagable on said threaded portion whereby said body is inserted through the wall of said cylinder and being secured thereto with said head located within said cylinder and said means is located on the outside of said cylinder.

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