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T. S. MORRISON

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DIAPHRAGM MOUNTING

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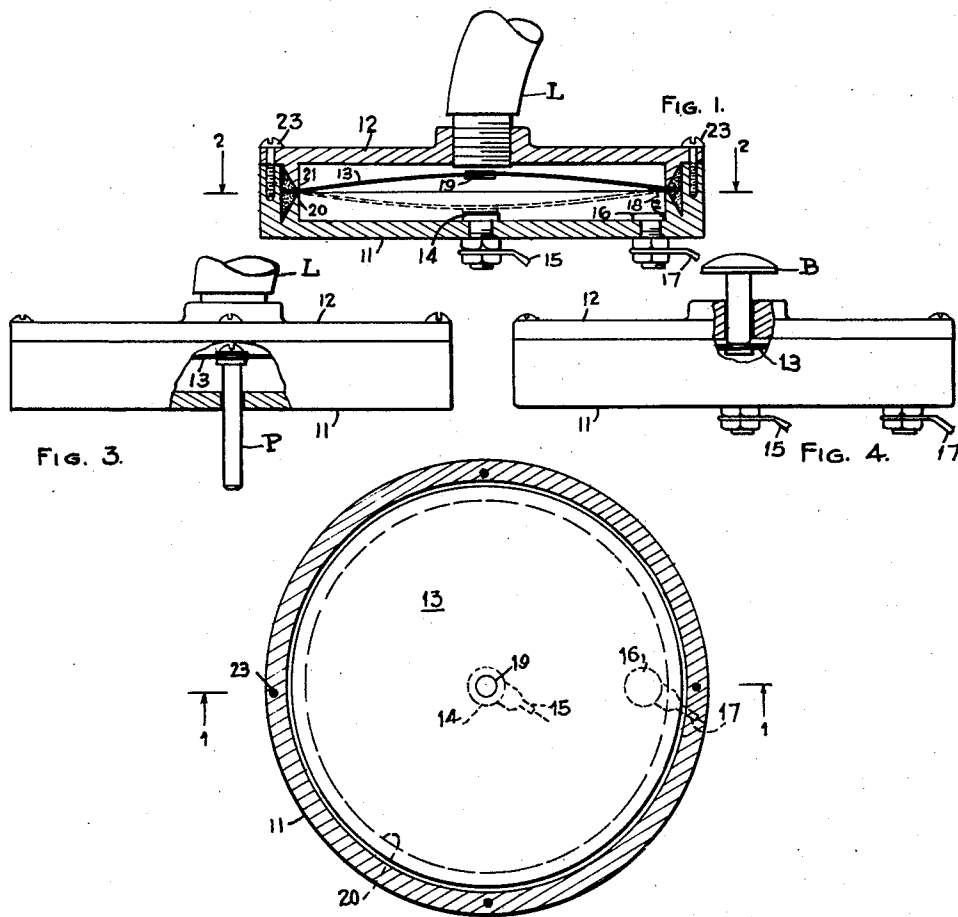
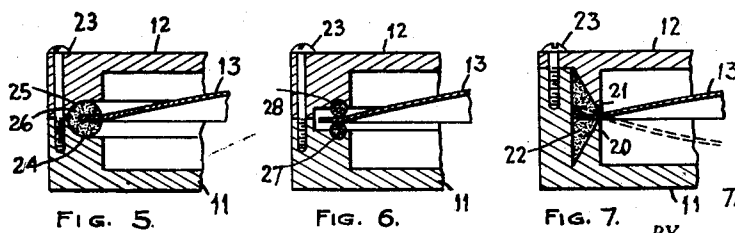


FIG. 2.



INVENTOR.

THOMAS S. MORRISON.

BY

Robert L. Sumner

ATTORNEY.

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Thomas Sidney Morrison, Los Altos, Calif., assignor of one-half to Halax Corporation, Los Gatos, Calif., a corporation of California

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1 Claim. (Cl. 137—791)

This invention relates to diaphragms and deals with an improvement in mounting diaphragms to increase the sensitivity and the usefulness thereof.

The use of diaphragms for operating pumps, switches, technical instruments of all kinds, etc. is well known and when used in large sizes, the sensitivity does not present a serious problem. However, when used in sub-miniature work, where the diameter of the diaphragm is of a necessity extremely small, the problem of sensitivity becomes acute. There may be occasions where diaphragms of less than one-tenth of an inch in diameter are required to be operated, so the question of sensitivity becomes important. The principal object of this invention is, therefore, to provide a mounting for diaphragms whereby the sensitivity of the diaphragm to actuating pressure is increased. On other occasions, long life may be the chief requirement for a diaphragm. My mounting is designed to increase the life of a diaphragm regardless of size.

Although the invention to be described hereinafter has been directed toward and illustrated in connection with a snap switch, it is to be understood that the type of mounting shown and disclosed is applicable to all places or circumstances where a diaphragm is used including both large and small diaphragms. In the category of the switch, it is an object to provide a switch of the character described wherein the contact points and the moving parts of the switch are hermetically sealed.

Briefly stated, my invention amounts to introducing into a diaphragm mounting, a support near the outer edge of the diaphragm and allowing the outer edge or periphery of the diaphragm to move free and unhampered beyond the point of support. In the preferred form, I accomplish this by using a thin edged support for a fulcrum point and forming a cavity in the shape of an annular chamber behind the support which is adapted to be filled with a suitable sealant that not only seals the chamber in which the diaphragm works but also allows the necessary movement of the edge of the diaphragm. This structure lends itself particularly well to the formation and use of a hermetically sealed appliance, such as a switch. It is also easy to construct, easy to assemble, durable and inexpensive, and will find usefulness in any field where a diaphragm actuated mechanism is required that demands freedom from contamination, a long life, or a high degree of sensitivity.

Other objects and advantages will become apparent as the description proceeds in conjunction with the drawing in which:

Fig. 1 is a vertical cross section of the diaphragm mounting;

Fig. 2 is a horizontal cross section of the diaphragm mounting;

Fig. 3 shows the unit set up for operating a plunger instead of contacts for a switch;

Fig. 4 is the same as Figs. 1 and 2, with the exception that the device is operated by a push button instead of fluid pressure;

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Fig. 5 fragmentarily shows another form of my invention embodying the basic idea;

Fig. 6 fragmentarily shows still another form which my invention may take; and

Fig. 7 shows an enlarged fragmentary section of the preferred form of my invention.

In referring to the drawing, it should be understood that the illustrations are greatly magnified for the purpose of clarity and that when reduced to their actual size, the views shown in Figs. 1 to 4 might be as small as 100 mils in diameter. Under these conditions, the diaphragms will be exceedingly small, and in order to meet physical requirements of operating pressure must be highly sensitive. With these facts in mind, a description of the invention will be entered.

In Fig. 1, I have shown a snap switch arrangement operated by a diaphragm. Since this is one of the most useful forms of my invention, it will be described as an illustration, but since there are other forms, some of which are shown, the disclosure is intended to cover the inventive concept in all its applications. In this view, I have shown a case 11 and a cover 12, with a diaphragm 13 mounted in an operable position between the case and the cover. Fluid pressure for operating the diaphragm is supplied through a conduit L. The case is provided with a contact point 14, suitably mounted in the bottom thereof and connected to a lead wire 15. Also, in the bottom of the case, there is another terminal 16 suitably connected to a conductor 17. The terminal 16 is connected to the diaphragm by any suitable means such as a coiled wire 18. The diaphragm is provided with a contact point 19 adapted to engage the contact point 14 when the diaphragm is snapped through to its lower position, shown by dotted lines. It will be noted that the diaphragm 13 is supported near the periphery on knife edged shoulders 20 and 21 (see Fig. 7) and that back of these knife edged shoulders there is a cavity 22. Since the case 11 and the cover 12 are circular, the knife edges will be circular and the cavity will be annular. The diaphragm is made of suitable electrical conducting material such as Phosphor bronze and is of sufficient diameter to extend over the knife edges and into the cavity without touching the back wall of the cavity. The cavity can then be filled with a sealant such as potting resin, more commonly known as epoxy which for applicant's purpose is combined with a flexibilizer in the usual manner to produce a final product which has sufficient viscosity or enough elasticity to allow the peripheral edge of the diaphragm to swing freely beyond the point of support as the diaphragm member is snapped back and forth in its action. Examples of suitable sealants are: (1) Urethane Foam, sold by NOPOC Inc.; (2) flexibilized thermosetting resins, such as epoxy, manufactured by Minnesota Mining and Manufacturing Co.; (3) flexibilized thermo-plastic resins, such as vinyls, sold by CIBA; (4) latex based compounds, available Goodyear Rubber Co.; (5) silicon latex may be molded in place using cavity as mold. The cover may be held in place on the case by screws, such as 23. For best results, the conventional bend in the diaphragm forming the flange normally extending into a clamping support, should be near the point of support by the knife edges, and the diaphragm should be of the biased type that returns to a normal position by its own reaction. The sealant being of the potting variety of resin may be placed in the annular cavity at the time the diaphragm is placed in position and held in place by the cover, or if more convenient, the whole unit may be assembled and the sealant inserted afterward into the annular cavity through small holes in the casing, not shown. A diaphragm mounted in this manner will not have the ordinary stresses and strains set up in the body of the membrane brought about by clamping

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the outer edge of the diaphragm firmly between two rigid supports, forming a cantilever support in the conventional manner. But, by being unhampered and unimpeded against movement in its point of support, it will operate more freely and more easily with less pressure, thereby increasing its sensitivity. Also, there will be less bending of the material in the diaphragm and consequently a longer life to the device.

Figs. 3 and 4 show two variations of the form shown in Figs. 1 and 2. The same case 11 and cover 12 are used with the diaphragm 13 mounted in the same manner. Fig. 3, however, shows a plunger P actuated by the diaphragm instead of the switch arrangement shown in Fig. 1. The plunger is merely a means of translating movement from the diaphragm to an external member such as a linear potentiometer, valve, pressure transducer or transmitter, pressure switch, or the like and will find usefulness where a limited amount of movement remotely controlled is desired. The actuating pressure for the diaphragm may be a fluid, either liquid or gaseous, and is brought to the diaphragm in a conventional manner through a line L, the same as shown in Fig. 1.

Fig. 4, again is the same as Fig. 1 with a variation in the means for actuating the diaphragm. Instead of using fluid under pressure, I may use a push button B which bears directly against the diaphragm and serves to push the diaphragm into the dotted position shown in Fig. 1. This form may also be equipped with the switch arrangement shown or it may be provided with the plunger shown in Fig. 3.

In Figs. 5 and 6, I have shown two other ways in which my invention may be used to mount diaphragms. Fig. 5 shows a fragmentary section of a diaphragm mounting comprising a bottom member 11, with a cover 12 held in place by screws 23, similar to Figs. 1 to 4. In this view, it will be seen that the two members 11 and 12 are provided with complementary cavities 24 and 25, respectively, and that the diaphragm 13, instead of being supported on knife edges, is supported on an elastic ring 26 that fits into the annular space formed by the cavities

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24 and 25 when the top and bottom members are assembled in the manner shown. The ring 26 should be of material suitable for the purpose described and for purposes of discussion may broadly be termed elastic.

5 In Fig. 6, I have shown another form of mounting for a diaphragm. The same bottom member 11 and the cover 12 are used here as well as the diaphragm 13 and the holding screws 23. It will be noted that the diaphragm 13 in this case, is supported on two members 27 and 28 which, in turn, are mounted in recesses in the bottom member and the cover. This type of mounting will also provide for free movement of the periphery of the diaphragm as the membrane is snapped back and forth.

15 I am aware that there may be other forms which, because of limited space cannot be shown here. I, therefore, intend this disclosure to cover all forms of my invention that come within the scope of the disclosure and the purview of the claim.

20 I claim:

In a diaphragm operated switch, a case having a knife edged circular shoulder with an annular cavity therebehind, a cover adapted to fit over said case, said cover having a knife edged circular shoulder with a cavity therebehind adapted to coincide with said first mentioned shoulder and cavity when the cover is placed on said case, a diaphragm mounted on said knife edged shoulders between said case and cover, and an elastic sealant in said cavity for holding said diaphragm in place and permitting movement of the edge of said diaphragm.

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