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PRESSURE-RESPONSIVE DEVICE AND MOUNTING MEANS THEREFOR

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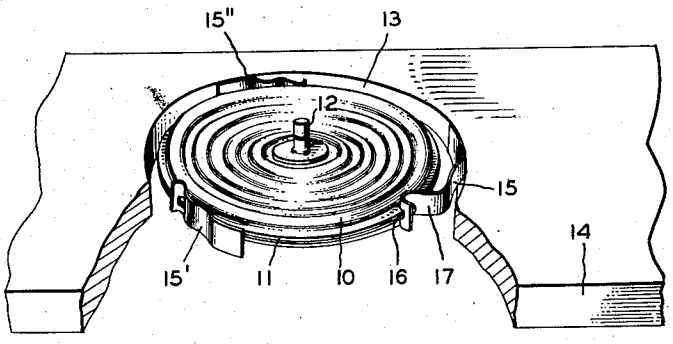


Fig. 1.

Fig. 2.

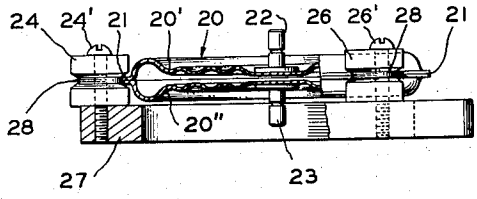


Fig. 4.

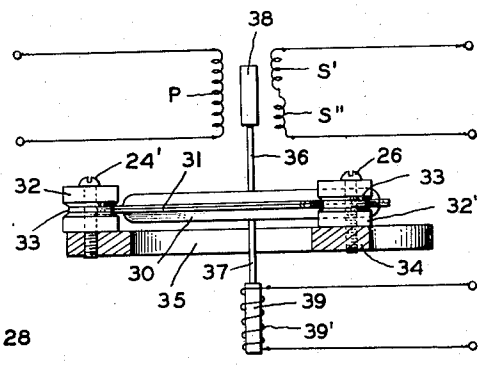
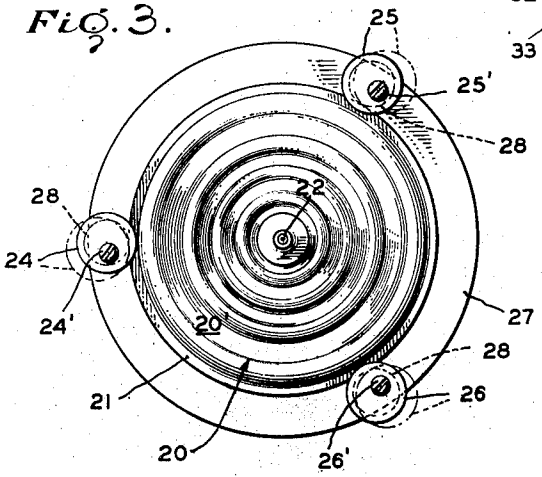


Fig. 3.



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PRESSURE-RESPONSIVE DEVICE AND MOUNTING MEANS THEREFOR

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7 Claims. (Cl. 137—784)

An example of a pressure-responsive device with which the present invention is concerned, is that type comprised of one or more relatively thin plates or shells formed of material such as Beryllium copper. Where a plurality of plates are employed, they are usually of dished or concavo-convex formation and joined at their circumferential edges to define a sealed chamber, which may be evacuated and/or charged with a suitable fluid, to obtain a desired response. A problem which confronts manufacturers and users of pressure-responsive devices of the type specified is the error factor resulting from vibration; and an object of this invention is to provide a pressure-responsive device of the diaphragm type and mounting means therefor which will prove helpful toward a solution of such problem.

Another object is to provide a diaphragm type pressure-responsive device and a peripheral edge mounting means therefor which will enable the diaphragm plate or plates to have limited movement or "give" in a plane normal to the direction of response of the said plate or plates without introducing disturbing or opposing forces to such response, while at the same time the device as a whole will be held against movement in an axial plane.

Another object is to provide a mounting means for a pressure-responsive device of the type specified which will facilitate location of the device in cramped spaces without hindering the effective response thereof.

A further object is to provide a mounting for a pressure-responsive cell of the diaphragm type which will not only support the diaphragm in a highly effective manner but will at the same time leave both sides of the diaphragm clear and free for use as requirements dictate.

In the drawing:

Fig. 1 is a view in perspective of a diaphragm type pressure-responsive cell or capsule and mounting means therefor in accordance with the invention;

Fig. 2 is a view in sectional elevation of a modification with respect to Fig. 1;

Fig. 3 is a plan view of the complete unit of Fig. 2; and

Fig. 4 is a view in elevation illustrating how the device of Figs. 2 and 3 may be used to control electric circuitry.

Referring to Fig. 1, a pressure sensitive device or cell is generally indicated at **10**; it comprises a pair of reversely-dished, annularly corrugated diaphragm shells (although it could consist of a single shell if so desired) joined together at their meeting edges, defining a peripheral bead as at **11**. In the center of the upper shell is a stud or like member **12**, which serves as a means for operatively connecting the said shell to a part to be controlled. If desired, a similar member **12** may be connected to the lower shell of the device.

The cell **10** is shown as being mounted in an opening **13**, formed in a plate **14**. It will be noted that the shell is suspended at three points, preferably spaced 120 degrees apart, by resilient leaf spring members **15**, **15'** and **15''**, each of which has one end fixed to the plate **14**, as by soldering, the opposite end projecting free and being formed with a notch **16**, adapted to receive the bead **11**.

Preferably, the free end of each spring is reversely bent into a partial U-shape, as indicated at **17**, to provide a better grip on the bead **11**.

It will be obvious that the diaphragm plates are free for normal movement in response to changes in pressure while at the same time they are held against movement bodily in the axial direction but may have limited movement in the plane of the plates or cell in response to expansion and contraction of the supporting means for the cell and/or the material of which the plates are made. However, such latter movement does not cramp or place a strain on the pressure-responsive portions of the diaphragm walls. The effects of vibration on a diaphragm mounted in this manner will be substantially nullified, since same will be absorbed by the resilient mounting means therefor and will not materially affect the response characteristics of the diaphragm. Both sides of the cell are clear of mounting obstructions and hence may be used as requirements dictate. For example, one side may be used to sense pressure and the other side used as a seal, or both sides may be used to sense pressure and transmit a force as a function of changes in pressure. Thus the improved mounting arrangement as herein disclosed has all the advantages of the encircling rigid-type edge mounting while at the same time it eliminates all of the disadvantages of the latter type of mounting.

Figs. 2 and 3 show a modified arrangement with respect to that shown in Fig. 1. In this instance the cell is indicated at **20**; it comprises a pair of reversely-dished and corrugated diaphragm plates or shells **20'** and **20''**, joined at their meeting edges and defining a bead as at **21**. The members **22** and **23** connected to the upper and lower plates or shells correspond to the stud **12** of Fig. 1.

The cell **20** is supported by three annular members **24**, **25** and **26**, preferably located at approximately 120 degrees apart and secured to an annular supporting ring **27** by screws **24'**, **25'** and **26'**. Preferably, the supporting members **24**, **25** and **26** are annular in shape and the screws **24'**, **25'** and **26'** are located eccentrically with respect to each member so as to permit the members to be rotated for adjustment purposes. Each of the mounting members is formed with an annular groove **28**, adapted to receive the edge or bead **21** of the cell **20**. By loosening any one of the screws **24'**, **25'** or **26'**, the coacting supporting member may be rotated to locate the cell **20** at a predetermined position and to also exert the desired amount of grip on the bead **21**. If desired, the members **24**, **25** and/or **26** may be made of resilient material, such as rubber, to obtain the cushioning action afforded by the resilient supporting members **15**, **15'** and **15''** of Fig. 1. It will also be noted that the diaphragm shells **20'** and **20''** are free to move axially in opposite direction in response to changes in pressure while at the same time the cell is supported firmly in a restricted space.

Fig. 4 illustrates how a pressure-responsive cell, mounted as disclosed herein, may be used to control different electric circuits or components as a function of changes in pressure. In this instance, the cell, indicated at **30**, comprises a pair of reversely-dished diaphragm shells joined at their meeting edges, at which point a bead **31** is defined. Here, as in Figs. 2 and 3, there are three supporting members, located 120 degrees apart, two of which are visible and indicated at **32** and **32'**, each of said members being formed with an annular groove, as indicated at **33**. The supporting members **32** and **32'** are anchored to an annular ring or plate **34**, having a central opening **35**. Posts or rods **36** and **37** are connected to the upper and lower plates of the diaphragm. On the outer end of post or rod **36** is an armature **38**, movable to vary the coupling effect between the primary P and the secondaries S' and S'' of an input transformer, the secondaries being arranged in phase-opposed relation. On the outer end of

post or rod 37 is core member 39, movable to vary the inductance in a coil 39'. When the cell 30 is subjected to changes in pressure, the upper and lower shells will move in response to said changes and reposition the armature 38 and core 39.

The different embodiments of the invention shown and described herein are to be considered as illustrative rather than restrictive, it being understood that limited changes in construction and design may be made to adapt the improved device to different installations within the scope of the invention as defined by the appended claims.

What is claimed and desired to be secured by United States Letters Patent is:

1. In combination, a pressure-responsive device having walls defining an expansible chamber including a disc-shaped diaphragm formed of relatively thin metallic material, and means for supporting said device, comprising a plurality of resilient members located at spaced points around the peripheral portion of said diaphragm in gripping engagement with said portion at said spaced points only.

2. In combination, a pressure-responsive device having walls defining an expansible chamber including a disc-shaped diaphragm formed of relatively thin metallic material having a central portion movable in response to changes in pressure and a peripheral edge portion, and supporting means for said device comprising three members spaced at substantially 120 degrees apart around the periphery of said diaphragm in gripping engagement with said edge portion.

3. In combination, a pressure-responsive device including a pair of flexible metallic disc-shaped diaphragms joined along their peripheral edges and defining an expansible chamber therebetween, and supporting means for said device comprising supporting elements located at spaced points around the periphery of said diaphragms and gripping said pheripheral edges at the line of jointure thereof at said spaced points only.

4. A device as claimed in claim 3 wherein said supporting elements are spaced at approximately 120° apart and resiliently engage said edges.

5. In combination, a pressure-responsive device comprising a pair of reversely-dished disc-shaped diaphragms of relatively thin metallic material joined at their peripheral edges and defining a fluid enclosure therebetween, and supporting means for said device including at least three resilient elements arranged in spaced relation around the periphery of said diaphragms in gripping engagement with said edges at the line of jointure thereof.

6. A device as claimed in claim 5 wherein said supporting elements consist of spring members formed of a strip of resilient metallic material, each member having a portion thereof sprung into engagement with said peripheral edges.

7. The combination as claimed in claim 5 wherein said supporting elements consist of strips of resilient metallic material each having a portion thereof sprung into engagement with said peripheral edges and formed with a slot to receive said edges.

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