Nov. 1, 1955 W. C. HASSELHORN ET AL 2,722,580

PRESSURE SWITCH

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Fig. 1

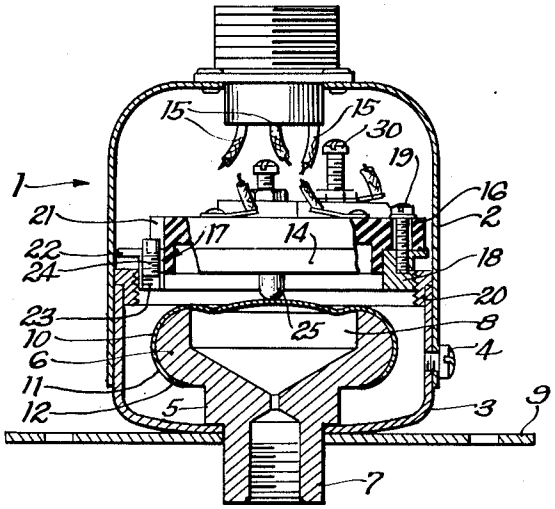
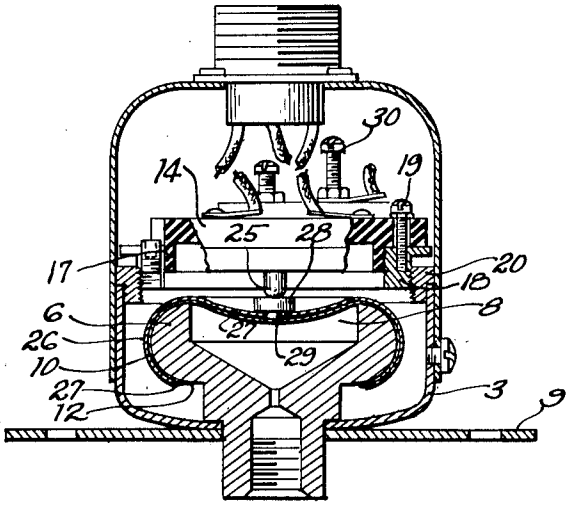


Fig. 2



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Fig. 3

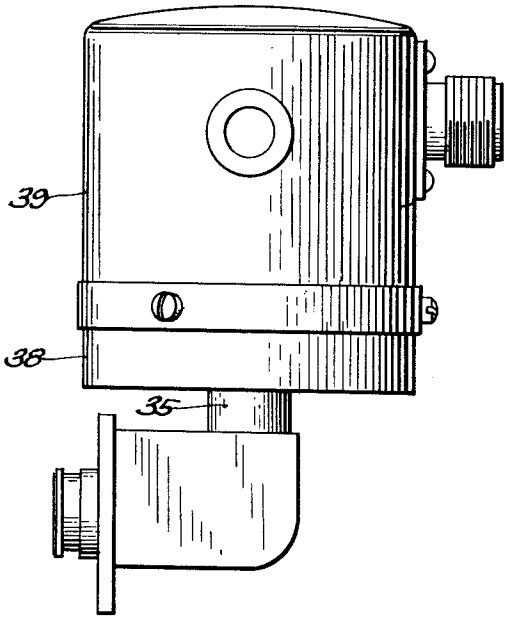


Fig. 5

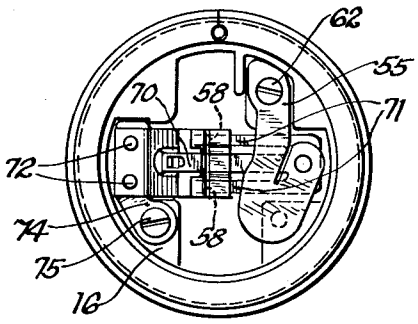


Fig. 6

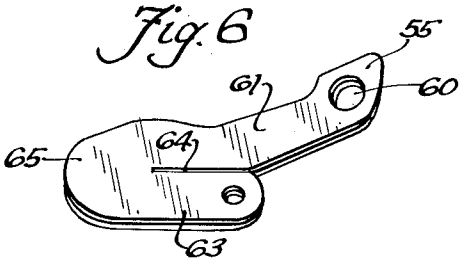


Fig. 4

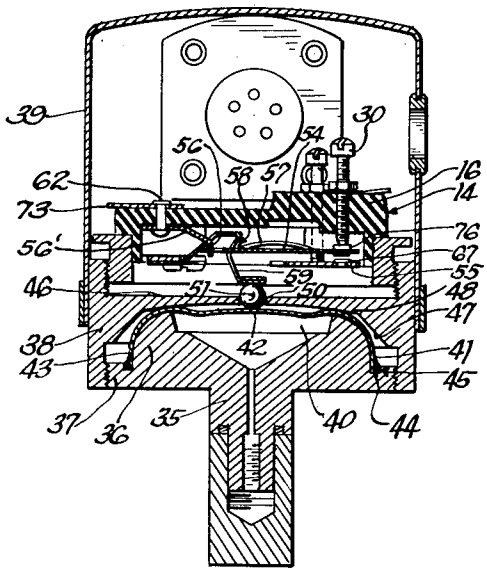
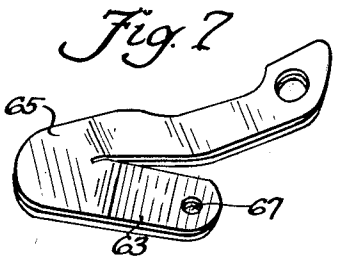


Fig. 7



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Fig. 8

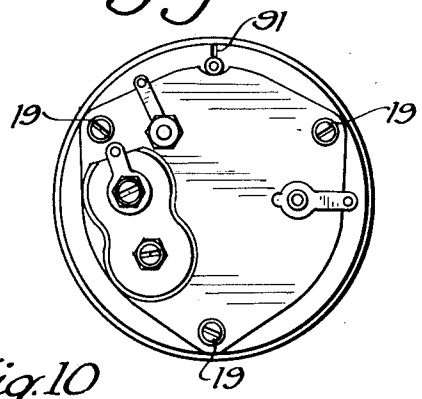


Fig. 9

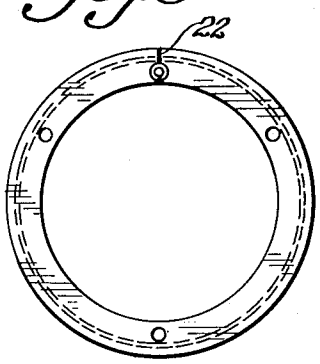


Fig. 10

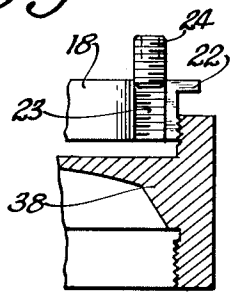


Fig. 11

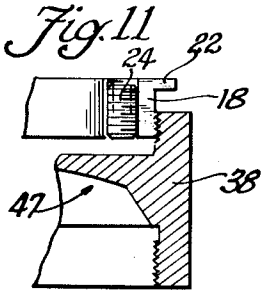


Fig. 12

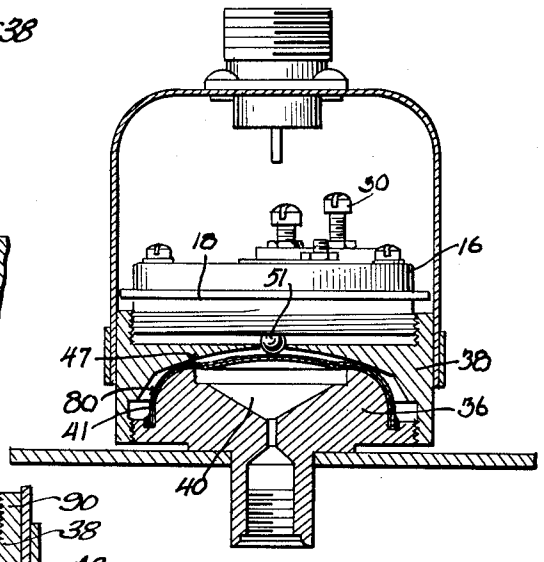


Fig. 14

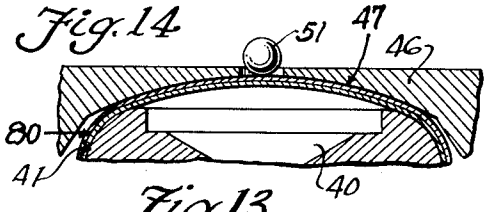
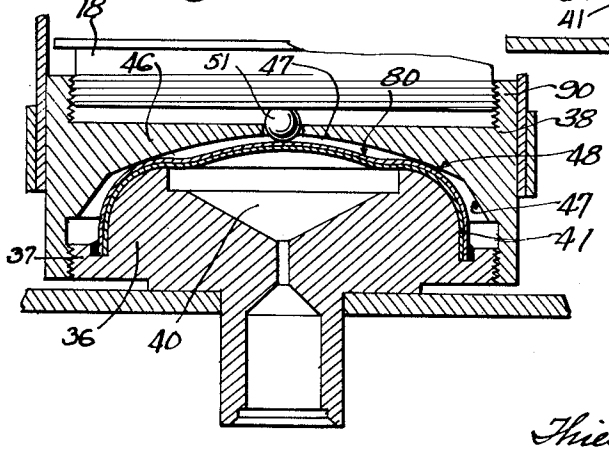


Fig. 13



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United States Patent Office 2,722,580
Patented Nov. 1, 1955

2,722,580

PRESSURE SWITCH

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Application December 2, 1949, Serial No. 130,632
16 Claims. (Cl. 200—83)

This invention relates to pressure switches and more particularly to pressure switches operated by fluid pressure and of the type which is capable of withstanding, without change, pressures far greater than the critical pressure for which the switch is set to operate.

In systems operated by fluid pressure, pressure surges of a magnitude greatly exceeding critical operating pressures are apt to occur. In the case of pressure switches of the type disclosed herein, these pressure surges are apt to flex the diaphragms beyond the elastic limit of their metal and cause distortion and a change in their operating characteristics. In addition to the diaphragms being ruptured, the diaphragm mountings are often strained to a point of causing leaks not easily detectable until considerable damage therefrom results. A further drawback has been the difficulty of providing in this type of switch a structure which can be readily adapted to different pressure ranges without requiring a complete rebuilding each time of the size of the unit to meet the pressure change desired. Moreover, the prior art structures failed to provide a structure that might be accurately calibrated and thereafter relied upon indefinitely for accurate operation.

An object of the invention is to provide a new and improved pressure switch capable of effectively overcoming the difficulties of prior art devices and operating accurately after being calibrated for any desired pressure range.

A further object of the invention is to provide a new and improved pressure switch which is simple, efficient and easy to manufacture, and capable of keeping a pressure adjustment.

Another object of the invention is to provide a new and improved pressure switch which is capable of withstanding, without damage, pressures far greater than the critical pressure for which the switch is set to operate.

Another object of the invention is to provide a new and improved pressure switch which is provided with a few parts capable of simple assembly and of retaining an adjustment.

Another object of the invention is to provide a new and improved pressure switch that limits the flexible area of the diaphragm so that excessive pressures that are apt to occur in the system above the critical pressure operating the diaphragm will not rupture the diaphragm or change its operating characteristics.

Another object of the invention is to provide a new and improved pressure switch having a toroidal or dome shaped diaphragm seat and pressure chamber therein and a relatively adjustable switch supporting member disposed above the diaphragm that may be brought against the diaphragm to clampingly engage the same against the seat adjacent the periphery of the pressure chamber so as to confine the flexing area of the diaphragm substantially to that spanning the chamber and prevent flexing stresses from reaching the peripheral joint of the diaphragm.

Another object of the invention is to provide a new and improved pressure switch having a diaphragm seat preferably of dome shape and a pressure chamber therein and a relatively adjustable switch supporting member disposed above the diaphragm and adapted clampingly to engage the diaphragm against said seat whereby a second

diaphragm may be employed and seated upon the first diaphragm and likewise clampingly engaged against said seat by the adjustable switch supporting member, the mere insertion in this manner of a second diaphragm of different strength changing the pressure range at which the unit may be calibrated for operation without any further change in structure, the range of pressure change being thus unlimited.

Further objects and advantages of the invention will be apparent from the following detail description when taken in connection with the accompanying drawings, in which:

Figure 1 is a transverse sectional view of a pressure switch embodying certain features of the invention;

Fig. 2 is a similar view but with certain added features of the invention;

Fig. 3 is an elevational view of another form of pressure switch embodying still further features of the invention;

Fig. 4 is a transverse sectional view of the structure shown in Fig. 3;

Fig. 5 is a bottom view of the casing carrying the switch contacts;

Fig. 6 is a perspective view of one of the switch members;

Fig. 7 is a similar view of the same member but showing it in its form to be mounted in the switch;

Fig. 8 is a top view of the switch casing mounted upon the retainer ring;

Fig. 9 is a view of the retainer ring;

Fig. 10 is a detail view in section of the retainer ring and supporting member before those parts are locked together;

Fig. 11 is a view of the same parts after they are locked together;

Fig. 12 is a transverse sectional view of the structure shown in Fig. 4 but illustrating how an additional diaphragm may be used to increase the pressure range of the unit;

Fig. 13 is an enlarged view of the portion carrying the diaphragm; and

Fig. 14 is a fragmentary detail view showing the diaphragm in flexed position.

Referring now to the drawings, the structure illustrated in Figs.1 and 2 embodies certain of the features of the invention and comprises a housing or body **1** having an upper part **2** preferably interfitting with a lower part **3**, so that they may be held together by any suitable means such as a screw **4** and thus they may be readily separated when access to the interior of housing **1** is desirable. Disposed in lower part **3** is a base member **5** having a toroidal or spherical shaped portion **6** and a depending internally threaded nipple **7** adapted to project through the bottom of lower part **3** and any suitable mounting plate **9**. Base **5** is provided with a centrally located pressure chamber **8** open at the top of dome portion **6** and connected with the pressure system through nipple **7**. A metal diaphragm **10** is seated upon dome portion **6**. Peripheral portion **11** of diaphragm **10** is spun by one or more operations about toroidal or spherical portion **6** to grip and embrace the same tightly. After the spinning operations are completed, diaphragm **10** may be welded or brazed at **12** to form a herimetic seal about the peripheral edge of the diaphragm. If the periphery of diaphragm **12** is welded, the diaphragm may thereafter be subjected to proper heat treatment to impart a predetermined spring rate to the diaphragm. The heat treatment will not affect base **5**, and, consequently, this type of mounting is exceptionally advantageous for the type of diaphragm disclosed herein because it permits imparting a predetermined spring rate to the bellows by a heat treatment subsequent to the welding operation.

A switch 14 having suitable contacts (not shown in Figs. 1 and 2 but in Figs. 3 to 7) is connected in a control circuit indicated by conductors 15. It is preferably provided with a body 16 of insulation material having a downwardly projecting inner flange 17 fitting within a retaining ring 18 and held from removal by suitable screws 19. Retaining ring 18 is threadedly received in an adaptor ring 20 seated upon the upper part of housing member 3. Switch housing 16 is cut away at 21 and the retaining ring 18 is split at 22 and internally tapped at 23 to receive a set screw 24 adapted to be driven home by a wrench to cause retaining ring 18 to expand at its cut 22 and cause a locking thereof in adaptor ring 20 against further movement after it has been adjustably seated.

Diaphragm 10 provides a flexible wall for pressure chamber 8. Switch actuating means 25 may be in the form of a pin riding upon diaphragm 10 and functioning to operate the contacts of the switch when an operating or a critical pressure occurs in pressure chamber 8.

The mounting of diaphragm 10 about portion 6 having a toroidal shape with a smooth outer surface, appearing much like a door knob, prevents stresses due from flexing reaching the joint 12 and thereby assures that leaks will not occur at this joint. The arrangement of the parts is exceptionally simple and assures adjustment and the maintenance thereof in the operation of the unit.

The structure shown in Fig. 2 is substantially the same as that illustrated in Fig. 1 but includes means for limiting the flexing of diaphragm 10. This means is in the form of a second diaphragm 26 having its peripheral portion likewise spun about dome portion 6 and its peripheral edge brazed or welded at 27. The central portion of outer diaphragm 26 has less inward curvature than the inner diaphragm 10 so that there is a space indicated at 27 between these diaphragms. A button 28 is provided with a depending shank 29 adapted to ride in an opening in outer diaphragm 26. Depending shank 29 engages inner diaphragm 10 and is adapted to move back and forth in said opening in outer diaphragm 26 when inner diaphragm 10 flexes. Outer diaphragm 26 may be of greater strength and, therefore, less flexible than inner diaphragm 10 and act as a backing plate for inner diaphragm 10. The contacts (not shown) of switch 14 may be calibrated by a screw 30 so that they will be operated by the movement of inner diaphragm 10 when it flexes sufficiently to engage flatly against the outer diaphragm 27, this flexing movement being transmitted to the contacts through button 28 and pin 25.

Figs. 3 to 7, inclusive, illustrate a slightly modified form of pressure switch and the detail construction of switch 14. Base 35 is provided with toroidal or spherical like portion 36 but has a threaded flange 37 adapted to receive a supporting member 38 to which housing 39 is secured. A pressure chamber 40 is disposed in base 35 and is closed at the top by a diaphragm 41 having its central part 42 serving as a flexible wall for pressure chamber 40 and its peripheral portion 43 seated upon dome portion 36. The peripheral edge 44 of diaphragm 41 may rest in a groove 45 and be sealed therein as by brazing or welding.

Supporting member 38 has a transverse wall 46 extending across but above diaphragm 41. Wall 46 has a face 47 disposed on its underside opposing diaphragm 41. When supporting member 38 is threaded downwardly upon base 35, face 47 of wall 46 will peripherally engage against diaphragm 41 at 48 to clamp diaphragm 41 against portion 36 adjacent pressure chamber 40. The central part 42 of diaphragm 41 is free to flex within the area defined by pressure chamber 40. Face 47 of wall 46 opposing central portion 42 of diaphragm 41 is preferably of the same contour as central part 42 but is slightly spaced therefrom beginning at 48. Wall 46 is apertured at 50 to permit actuating means 51 in the form of a

ball or the like to ride upon central part 42 of diaphragm 41.

Switch 14 comprises contact members 54 and 55 disposed in the body of the switch. Contact member 54 is slotted at one end and a tongue 56 of bracket 56' riveted to switch body 16 at 62 to one terminal 73 of the switch passes through the slot whereby contact member 54 may pivot about this tongue 56. Contact member 54 is cut centrally at 57 to form a center finger 70 and two side fingers 71 having their free edges 58 abutting against spring member 59 adapted to be riveted at 72 to a bar 74 held to body 16 by a screw 75, which spring member 59 is also engaged by ball 51. When pressure increases in chamber 40 and reaches a critical operating point, flexible portion 42 of diaphragm 41 will move to engage against face 47 of wall 46. This movement of flexible portion 52 is sufficient to lift ball 51 and the upward pressure on spring member 59 causes contact member 54 by an over-center action to move its contact point 76 into engagement with contact point 67 and close a control circuit. It will be observed that calibrating screw 30 functions to control the normal spacing between contact members 54 and 55 so as to determine the critical pressure at which flexible portion 42 will move to raise ball 51 far enough to cause member 59 to swing contact member 54 downwardly. Temperature changes affecting this spacing between contact members 54 and 55 may be compensated for by a novel construction for contact member 55. As illustrated in Figs. 5 to 7, inclusive, contact member 55 is provided with a hole 60 in one of its legs 61. A screw 62 (Fig. 5) is adapted to pass through hole 60 and secure contact member 55 in the position shown in Fig. 4. Contact member 55 is a bimetallic element with leg 61 and a leg 63 formed by slotting as illustrated at 64. Being of two different metals, any increase of temperature tends to move the portion 65 of contact member 55 upwardly and further tends to cause leg 63 to move downwardly relatively so that the contact point 67 remains in the same position with respect to contact member 54. In other words, temperature changes are compensated by the movement of this bimetallic element so that the space between contact members 54 and 55, as shown in Fig. 4, remains substantially constant.

Excessive pressure surges will not rupture or stress any portion of the diaphragm beyond the yield point and change the operating characteristics, because, when the critical operating pressure in pressure chamber 40 flexes the central portion 42 to operate switch 14, this central portion 42 will flatly engage face 47 and further movement thereof by excessive pressure surges will be prevented. Calibrating screw 30 is used to critically adjust the spacing of contacts 67 and 76 to secure exceptionally sensitive operation for a given pressure. That is, to say, calibrating screw 30 functions primarily to calibrate the action of the contacts in order that any pressure adjustment may be had.

If, however, it is desirable to use the pressure switch in installations calling for actuation of switch 14 at a different pressure in chamber 40, the feature of employing the wall 46 of supporting member 38 to clampingly engage the diaphragm at 48 to the portion 36 of base 35 novelly permits the use of an additional diaphragm 80 that may be inserted, as shown in Figs. 12 and 13, upon diaphragm 41 and thereafter clamped to the diaphragm 41 and dome portion 36 without requiring this additional diaphragm to be permanently seated at its periphery. Diaphragm 80 will be of the same contour as diaphragm 41 and will lie flatly thereagainst. Thus it is apparent that with wall 46 clampingly engaging the diaphragm against portion 36, it is not necessary that the second diaphragm extend completely over this portion 36 and be sealed at its periphery. It is only necessary that diaphragm 80 extend a short distance beyond point 48 so as to assure a sufficient gripping engagement by wall 46

against diaphragm **80** to hold the same firmly upon portion **36**. As in the form illustrated in Fig. 4, a space should be left between the flexible portion of diaphragm **80** and face **47**. The strength of diaphragm **80** will determine the increased pressure range to which screw **30** may be utilized to calibrate the closer operation of contacts **67** and **76** of switch **14**. When the critical operating pressure is reached in pressure chamber **40**, both diaphragms **41** and **80** will flex flatly to engage the face **47** of wall **46** at the central portion of the latter. When these diaphragms engage face **47** flatly, the latter will provide a uniform supporting surface for these diaphragms thereby preventing any portion of the diaphragms from being stressed beyond the yield point to give the same a new contour.

If a further increase of pressure range is desirable, diaphragm **80** may be removed and a diaphragm of greater strength inserted. It will be apparent that no other change in the structure of the unit is necessary to increase the critical operating pressure in pressure chamber **40**. This is indeed advantageous because a change in operating pressure can be made at any time without requiring any work other than the mere addition or change of a second diaphragm, this being done by merely dropping the second diaphragm in place upon the first diaphragm and threading base **35** back into position in supporting member **38**.

In this connection it will be observed that the form of supporting member **38** and retaining ring **18** carrying switch **14** provides a simple and unique assembly of parts in a pressure switch that can be finely calibrated for a given operating pressure and that can change the critical operating pressure range by merely inserting a second diaphragm. This second diaphragm is to be of a predetermined strength so that it will restrain the flexing of the first diaphragm until the desired critical operating pressure is reached in pressure chamber **40**. The supporting member in the form shown in Figs. 4 and 10 to 13, inclusive, is unique because it readily receives the opposite ends of the component parts making up the pressure switch by the use of outwardly extending internally threaded flanges at its opposite sides. Thus, at the lower end of supporting member **38**, the base **35** carrying the pressure responsive elements in the form of diaphragms may be readily threaded into postion. At the upper end, the electric switch **14** and its retaining ring **18** may likewise be readily threaded into position. In this form also, retaining ring **18** is split at **22** and tapped at **23** to receive a set screw **24**.

Fig. 10 illustrates the position of set screw **24** at the time retaining ring **18** is being threaded downwardly into position in the upper shoulder **90** of supporting member **38**. It is only necessary that the foot of spring member **59** bear lightly against the pressure actuating means **51** before the diaphragms are actuated. When this position is reached, screw **24** is threaded downwardly to the position shown in Fig. 11. This will cause the split **22** to increase as shown at **91** in Fig. 8 and cause retaining ring **18** to bind against the threaded walls of shoulder **90** of supporting member **38**. Further adjustment of retaining ring **18** is then impossible. With retaining ring **18** thus seated as explained, calibrating screw **30** may then be used to adjust contact points **67** and **76** of switch members **54** and **55**.

Without further elaboration, the foregoing will so fully explain the gist of our invention that others may, by applying current knowledge, readily adapt the same for use under varying conditions of service, without eliminating certain features, which may properly be said to constitute the essential items of novelty involved, which items are intended to be defined and secured to us by the following claims.

We claim:

1. A pressure switch of the class described comprising a body, a base attached thereto, said base including a toroidal shaped portion having a continuous outer surface and a pressure chamber therein, a diaphragm seated upon said toroidal portion and forming one wall of said pressure chamber, the peripheral part of said diaphragm embracing the curved surface of said toroidal portion and being sealed thereto on its underside, an adaptor ring seated within said body above said diaphragm, said adaptor ring being adjustable axially with respect to said diaphragm, a switch housing carried by and movable back and forth by the adjustment of said adaptor ring, a switch in said housing, and an actuator cooperating with said diaphragm to actuate said switch to control an electric circuit.

2. A pressure switch of the class described comprising a body, a base attached thereto, said base including a toroidal shaped portion and a pressure chamber therein, a diaphragm seated upon said toroidal portion and forming one wall of said pressure chamber, the peripheral part of said diaphragm embracing the curved surface of said toroidal portion and being sealed thereto on its underside, a switch, an actuator cooperating with said diaphragm to actuate said switch to control an electric circuit, a housing for said switch, an adaptor ring carrying said housing, and means for adjustably carrying said adaptor ring in said body to adjustably position said actuator with respect to said diaphragm and said switch.

3. A pressure switch of the class described comprising a body, a base attached thereto, said base including a toroidal shaped portion having a continuous outer surface, a pressure chamber in said toroidal shaped portion, a diaphragm seated over said pressure chamber and upon said toroidal shaped portion whereby said diaphragm tangentially engages said toroidal shaped portion at all times, a switch above said diaphragm, an actuator cooperating with said diaphragm to actuate said switch to control an electric circuit, a housing for said switch, a ring carrying said housing, and means for adjustably mounting said ring within said body adjustably to position said actuator with respect to said diaphragm and said switch.

4. A pressure switch of the class described comprising a base having a toroidal shaped portion and a chamber therein, a diaphragm enclosing said chamber, an inlet in said base for communication with a source of pressure, a switch disposed above said diaphragm, actuating means cooperating with said diaphragm to actuate said switch to control an electric circuit, and a member adjustable relative to said toroidal portion for supporting said switch, said member having means for peripherally clamping said diaphragm against said toroidal portion adjacent said chamber.

5. A pressure switch of the class described comprising a base having a toroidal shaped portion and a chamber therein, a diaphragm enclosing said chamber, an inlet in said base for communication with a source of pressure, a switch disposed above said diaphragm, actuating means cooperating with said diaphragm to actuate said switch to control an electric circuit, a member adjustably threaded upon said toroidal portion for supporting said switch, said member having a portion thereof engaging said diaphragm to clamp said diaphragm against said toroidal portion.

6. A pressure switch of the class described comprising a base, a toroidal shaped portion extending centrally from said base and having a pressure chamber therein with a connection leading to a source of pressure, a diaphragm embracing the curved surface of said toroidal portion and being secured to said toroidal portion by being sealed about its periphery to said toroidal portion, a switch supporting member detachably connected to said base beyond said toroidal portion nad forming a closed compartment into which said toroidal portion and the diaphragm spanning the same project, said supporting member being provided with a wall corresponding in contour to the contour of the flexible portion of said

diaphragm and receiving said flexible portion in surface contact therewith whenever an excessive pressure exists in said pressure chamber, said supporting member being adjustably related to said base to cause said wall to clamp said diaphragm against said toroidal portion, a switch carried by said supporting member, and a connection between said diaphragm and said switch.

7. A pressure switch of the class described comprising a base, a toroidal shaped portion extending from said base and having a pressure chamber therein with a connection leading to a source of pressure, a flange extending outwardly of said toroidal portion, a switch supporting member provided with a surge wall and means for detachably receiving said flange, a diaphragm embracing the curved surface of said toroidal portion and being secured to said toroidal portion by being sealed about its periphery to said toroidal portion, said surge wall opposing said diaphragm and limiting the flexing area of said diaphragm by clampingly engaging said diaphragm against said toroidal portion when said supporting member is mounted over said base.

8. A pressure switch of the class described comprising a base provided with a toroidal shaped portion extending from said base and having a pressure chamber therein with a connection leading to a source of pressure, a diaphragm seated upon said toroidal portion and spanning said pressure chamber, said diaphragm being secured to said toroidal portion by being sealed about its periphery to said toroidal portion, a switch supporting member adapted to be seated upon and over said toroidal portion, and means for detachably mounting said switch supporting member upon said base, said means including an adjustable connection between said switch supporting member and said base.

9. A pressure switch of the class described comprising a base having a substantially toroidal portion, a diaphragm, and a switch supporting member, said parts being seated one within the other in the order named, said toroidal portion having a pressure chamber therein and a connection leading to a source of pressure, said diaphragm being spun over and upon said toroidal portion and secured to said toroidal portion by being sealed substantially at its periphery to said toroidal portion, said switch supporting member being detachably secured to said base and over said diaphragm.

10. A pressure switch of the class described comprising a base having a substantially toroidal portion, a diaphragm, and a switch supporting member, said parts being seated one within the other in the order named, said toroidal portion having a pressure chamber therein and a connection leading to a source of pressure, said diaphragm being seated upon and secured to said toroidal portion, there being means to adjustably mount said switch supporting member upon said base and to adjustably engage said switch supporting member against said diaphragm substantially adjacent to its flexible area spanning said pressure chamber.

11. A pressure switch of the class described comprising a base having a substantially toroidal portion, a switch supporting member embracing said toroidal portion, the former being nested within the latter, said toroidal portion having a pressure chamber therein and a connection leading to a source of pressure, diaphragm means between said toroidal portion and said switch supporting member, and means to seal said diaphragm means to said toroidal portion, there being means between said toroidal portion and said switch supporting member to provide for adjustability therebetween whereby to compensate for a variation in cross-sectional thickness of said diaphragm means.

12. A pressure switch of the class described comprising a base having a diaphragm receiving portion, a switch supporting member embracing said diaphragm receiving portion, the former being nested within the latter, said diaphragm receiving portion having a pressure chamber therein and a connection leading to a source of pressure, a plurality of diaphragms seated upon said diaphragm receiving portion and spanning said pressure chamber, the diaphragm directly seated upon said diaphragm receiving portion being sealed thereto along the periphery of said diaphragm, and means to adjustably mount said switch supporting means upon said base and to engage said switch supporting means against the other diaphragm whereby to clamp the other diaphragm against said first diaphragm.

13. A pressure switch of the class described comprising a body, a base attached thereto, said base including a diaphragm receiving portion, a pressure chamber therein and a connection leading to a source of pressure, a diaphragm seated upon said diaphragm receiving portion and spanning said pressure chamber, said diaphragm being in sealed relation with respect to said pressure chamber, a switch, an actuator cooperating with said diaphragm to actuate said switch to control an electric circuit, an adapter ring carrying said switch, and means for adjustably carrying said adapter ring on said body to adjustably position said actuator with respect to said diaphragm.

14. A pressure switch of the class described comprising a base having a diaphragm receiving portion and a pressure chamber therein together with a connection leading to a source of pressure, a diaphragm seated upon said diaphragm receiving portion and spanning said pressure chamber, a switch, a switch supporting member carried by said base, an actuator between said diaphragm and said switch, and an adjustable adapter ring providing an adjustment between said diaphragm and said actuator to change the pressure at which said diaphragm actuates said switch.

15. A pressure switch of the class described comprising a base having a diaphragm receiving portion and a pressure chamber therein together with a connection leading to a source of pressure, a diaphragm seated upon said diaphragm receiving portion, an electric switch having relatively movable contacts, an actuator between said diaphragm and said electric switch, an adjustable adapter ring providing an adjustment between said diaphragm and said actuator to change the range of pressure at which said diaphragm actuates said switch, said adapter ring being carried by said base, and means for providing a calibrated pressure adjustment between said relatively movable contacts.

16. A pressure switch of the class described comprising a base having a diaphragm receiving portion and a pressure chamber therein together with a connection leading to a source of pressure, a diaphragm seated upon said diaphragm receiving portion, an electric switch having relatively movable contacts, an actuator between said diaphragm and said electric switch, an adjustable adapter ring providing an adjustment between said diaphragm and said actuator to change the range of pressure at which said diaphragm actuates said switch, and a supporting member threadedly connected to said base and carrying said adapter ring, said supporting member clampingly engaging said diaphragm against said diaphragm receiving portion adjacent to the periphery of the flexible area of said diaphragm, said supporting member having a surface in close proximity to said diaphragm to act as a surface plate for said diaphragm to protect against an excessive pressure in said pressure chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

1,231,561	Briggs	July 3, 1917
1,306,007	Hack	June 10, 1919
1,759,537	Buckbee	May 20, 1930
1,932,988	Raney	Oct. 31, 1933
2,080,661	Hill	May 18, 1937
2,327,069	Satterlee	Aug. 17, 1943
2,339,087	Mantz	Jan. 11, 1944
2,551,489	Eichmann	May 1, 1951

FOREIGN PATENTS

503,949	Germany	July 28, 1950