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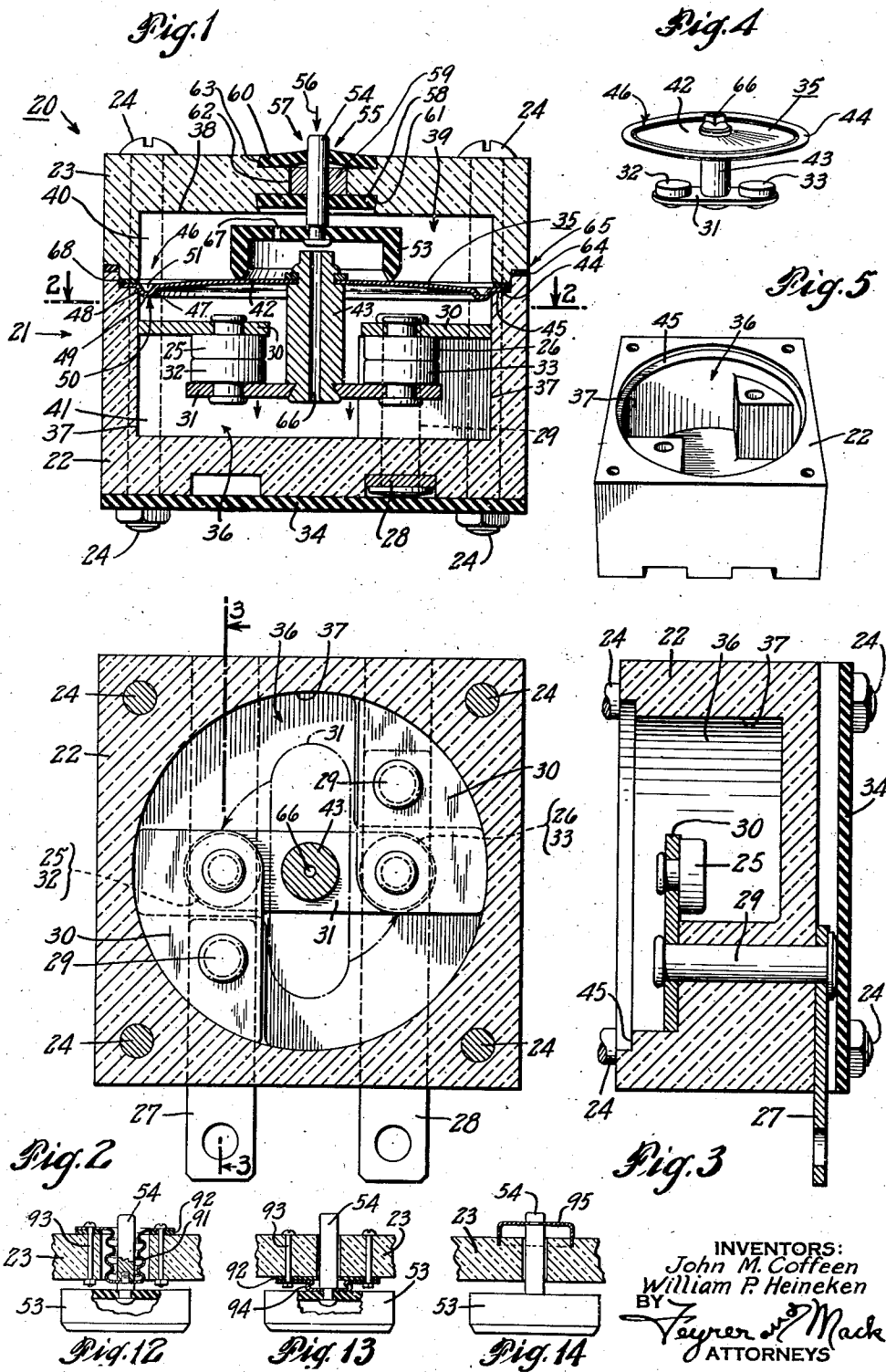
J. M. COFFEEN ET AL

2,355,951

SNAP SWITCH

Filed Jan. 19, 1942

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 6

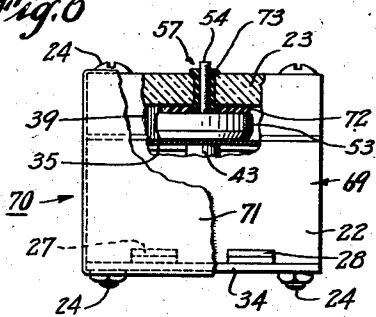


Fig. 7

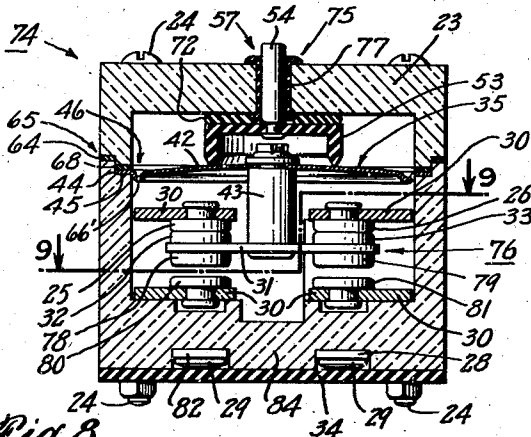
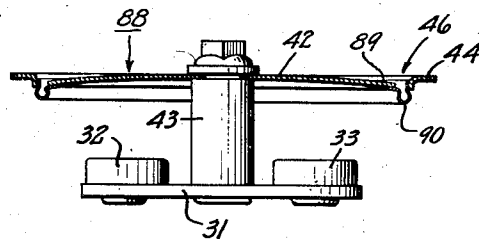


Fig. 8

Fig. 11

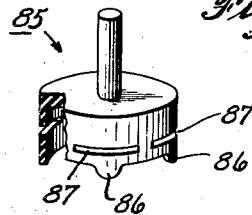


Fig. 10

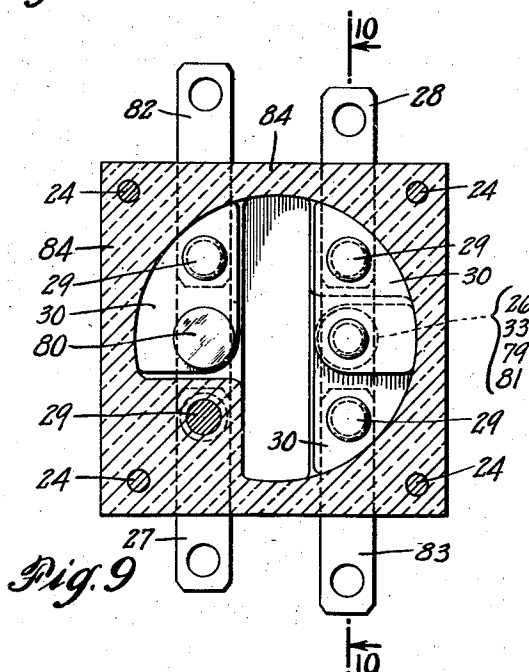
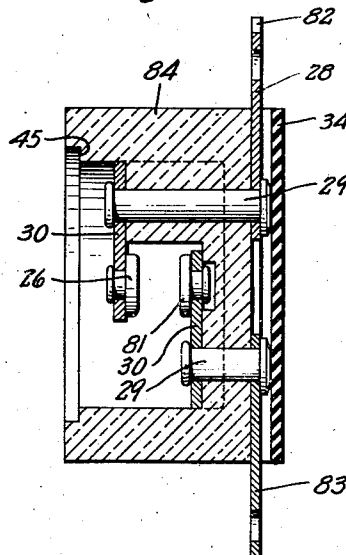


Fig. 9

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UNITED STATES PATENT OFFICE

2,355,951

SNAP SWITCH

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Application January 19, 1942, Serial No. 427,322

16 Claims. (Cl. 200—159)

This invention relates to electrical switches, and particularly to switches for control and many other types of apparatus. Such apparatus frequently provides only a very slight mechanical movement and/or movement of accurately predetermined force for actuating a switch. Accordingly, it is very important that switches for certain types of apparatus be responsive to only accurately predetermined forces and/or to very slight mechanical movement. However, it is also important that such switches resist the effects of vibration and other adverse environmental influences.

One switch which has proven particularly satisfactory and which is now extensively used industrially is that switch (sometimes hereinafter called an earlier snap switch) described and claimed in United States Patent 2,174,868 of October 3, 1939, to John M. Coffeen. The present invention constitutes an improvement over said earlier snap switch.

The earlier snap switch was sealed so that the electrical contacts would not become dirty and so that gas would not escape from the contact chamber. After extensive research it has been found that the force necessary to actuate the earlier switch is apparently affected by a difference in air pressure in the upper (actuator) and lower (contact) chambers. According to the present invention, the provision of means for equalizing the pressure in the upper and lower chambers produces a more satisfactory switch having the advantage of acting uniformly even under divers conditions. This is highly important in the field of small movement-type switches, to which the switch of the present invention pertains.

According to the present invention, it has been found that it is highly desirable to maintain an equalized air pressure on both sides of the diaphragm in switches used at high altitudes. Further, it has been found that when the pressure in the upper chamber is reduced, the likelihood of a reduction of pressure in the lower chamber is increased. The likelihood of arcing between the contacts and other electrical properties are affected whenever the predetermined pressure of the lower chamber is changed.

It is an object of the present invention to provide a switch suitable for use at high altitudes or other places having an air pressure substantially different from one atmosphere.

A feature of the invention is the provision of gasket means (or secondary diaphragm) around the stem extending from the internal actuator

to the exterior of the main body. Complementary to this, a special form of gasket means, of substantially and advantageously reduced diameter, is provided which does not adversely affect operation of the actuator. Not only is the gasket means provided about the stem, but gasket means is also provided to completely seal a cavity, including both the upper and lower chambers, from the atmosphere.

When a diaphragm is inserted in a control switch, unsatisfactory or less uniform results are sometimes obtained unless the diaphragm is positioned exactly concentrically relative to the bore in the main body and/or relative to the actuator. Heretofore switches have been made in which the main body could grip the diaphragm other than concentrically relative to the body and/or to the actuator.

It is an object of the invention to provide a centralizing means for making certain that the diaphragm is positioned concentrically of the bore in the main body and/or to the actuator.

A feature of the present invention is the provision of a depending flange on the diaphragm, said flange having at least a portion contiguous the bore of the main body (and dividing the diaphragm into an inner (or flexing) section and a rim (or grip) section).

The resilient characteristics of a simple dished diaphragm have been found to be somewhat unsatisfactory because of the slow speed of action thereof, because of the tendency toward fatigue, because of the large diameter normally necessary, because of a relative uncertainty of the limits of the resilient movement, because of the susceptibility to distortion, etc.

It is an important object of the present invention to provide a switch with a diaphragm having improved resilient characteristics.

A feature of the present invention is the provision of an accentuating portion disposed between a rim portion and an inner (and/or dished) portion of the diaphragm.

The characteristics of an ordinary simple dished diaphragm are dependent to a substantial extent upon the force with which the divers portions of the periphery are secured. If an ordinary dished diaphragm is secured nonuniformly and/or in divers planes it may be easily distorted in such a manner as to alter its resilient characteristics. It is an object of the present invention to provide a means for securing uniform resiliency in a diaphragm notwithstanding nonuniform gripping of the rim portion thereof.

A feature of the present invention is the pro-

vision of a diaphragm having an inner (and/or dished) portion that is "floating" with respect to the rim portion thereof.

Heretofore, when an ordinary dished diaphragm has been flexed, the resilient action of the inner portion has been transmitted to the rim portion of the diaphragm. It is an object of the present invention to provide a diaphragm having a rim portion protected from the resilient action of the inner portion thereof.

A feature of the present invention is the provision of means for blocking and dissipating resilient forces intermediate the inner and dished portions of a diaphragm.

Other features of certain embodiments include: the provision of gasket means between the base and cap of the main body; the provision of coating means impervious to air and around the main body; the provision of a main body of porcelain especially prepared to be impervious to diffusion of gases; the provision of means for minimizing the diameter of a diaphragm; the provision of means carried by the diaphragm for locating movable contacts relative to stationary contacts; the provision of means carried by the diaphragm for centralizing it relative to the actuator; the provision of means such as passageways permitting air passage between upper and lower chambers; and other features apparent from a consideration of the drawings, claims and description.

In the drawings:

Figure 1 is a sectional view of a preferred embodiment of the present invention.

Fig. 2 is a top view, partly in section, taken along line 2—2 of Fig. 1.

Fig. 3 is a sectional view of a portion of the preferred embodiment as taken on the line 3—3 of Fig. 2.

Fig. 4 is a perspective view of a portion of the preferred embodiment.

Fig. 5 is a perspective view of another portion of the preferred embodiment.

Fig. 6 is a view, partially in section, of a modified form of the invention.

Fig. 7 is a sectional view of an alternative form of a portion of the invention.

Fig. 8 is a sectional view of a duplex form of the invention.

Fig. 9 is a sectional view taken along the line 9—9 of Fig. 8.

Fig. 10 is a sectional view taken along the line 10—10 of Fig. 9.

Fig. 11 is a perspective view, partially in section, of an alternative form of another portion of the invention.

Fig. 12 is a fragmentary sectional view of a modified (bellows) type of sealing means.

Fig. 13 is a fragmentary sectional view of a modified form of internal sealing means.

Fig. 14 is a fragmentary sectional view of external sealing means.

Before describing the present improvements and mode of operation thereof in detail it should be understood that the invention is not limited to the details of construction and arrangement of parts shown in the accompanying drawings, which are merely illustrative of the present preferred embodiments, since the invention is capable of other embodiments, and the phraseology employed is for the purpose of description and not of limitation.

Referring now in detail to the drawings, and particularly to the preferred embodiment of the invention in Figs. 1 through 5, it will be seen that

there is provided a switch 20 with a main body 21 comprising a base 22 and cap 23, preferably secured together by screws 24. The main body is preferably made of porcelain especially prepared to resist diffusion of gases. If desired the proportions of particles of certain sizes may be adjusted during the preparation of the porcelain in order to minimize the gas permeability of the porcelain. Stationary electrical contacts 25 and 26 are electrically connected to bus bars 27 and 28 by means of rivets 29 and plates 30. A conductor 31 carries movable electrical contacts 32 and 33 which are normally pressed against the stationary contacts. Thus, the switch 20 is normally closed and is adapted to normally pass electrical current from the bus bar 27, through the rivet 29, plate 30, stationary contact 25, movable contact 32, conductor 31, movable contact 33, stationary contact 26, plate 30 and rivet 29 to the bus bar 28. The switch 20 may be used to close a circuit adapted to be opened by an external force. An insulating plate 34 may be provided to protect the bus bars 27 and 28.

Particular attention is directed to the fact that the switch 20 includes a diaphragm 35 for actuating the movable contacts 32 and 33. The base 22 has a bore or cavity 36 defined by a bore-defining wall 37, and the cap 23 has a bore or cavity 38 conjointly forming a main chamber 39. The diaphragm 35 divides said main chamber 39 into an upper chamber (or actuator chamber) 40 and a lower chamber (or contact chamber) 41. An inner portion 42 of the diaphragm is generally dish-shaped, and is operatively associated with the conductor 31 by means of a connector 43.

A rim portion 44 of the diaphragm 35 may be secured to the main body 21 by suitable clamping means. For example, the cap 23 may either directly, or preferably indirectly, press the rim portion 44 against a shoulder 45 in the base 22. Thus, the screws 24 clamp the rim portion of the diaphragm to the main body 21. Alternatively, two screws 24 may be used for this purpose, at diagonally opposite corners while the remaining two sets of holes may be used for screws, rivets or the like to secure the switch to apparatus or wherever desired. The main body may be cemented together and all four holes left available for mounting means.

Particular attention is directed to the fact that the diaphragm 35 is provided with a novel accentuating portion 46 disposed between the rim portion 44 and the inner portion 42. This accentuating portion includes an inner wall 47, an outer wall 48 and a bottom wall 49 which co-operatively define a hollow flange 50 and an annular recess 51. As shown in Fig. 1, the inner, outer and bottom walls 47, 48 and 49 of said flange 50 may be rounded and merge into each other without definite delimitations. Of particular importance, the outer wall 48 extends to a point substantially removed from the rim portion 44. The flange 50 preferably extends downwardly from the diaphragm; however, it might be an upstanding instead of a depending flange, as will be readily appreciated.

It should be especially noted that the inner portion 42 of the diaphragm 35 can circumferentially expand and thereby contract the annular recess 51. Moreover, the resiliency of the flange 50, functioning as a C spring, at times urges the inner portion to contract and the annular recess to expand. Thus, the accentuating portion 46 provides an additional resilient means cooperating with the natural resiliency of the

dished portion of the diaphragm. In this latter connection, it should be noted that the flexing of the inner portion is accentuated without increasing the diameter of the diaphragm. In fact, the diaphragm 35 has resilient characteristics comparable in some respects to simple dished diaphragms of much greater diameter; however, no plain dished diaphragm, regardless of its diameter, can have all of the desirable resilient characteristics achieved by the diaphragm 35 having the accentuating portion 46 of the present invention. Inasmuch as the accentuating portion 46 makes possible a reduction in the size of the diaphragm, it also makes possible a much greater reduction in the size and weight of the switch, an advantage of particular importance in the field of micro switches, to which the present invention pertains. As pointed out hereinabove, the accentuating portion achieves advantages other than the reduction of diameter of the diaphragm.

In diaphragms of an earlier switch, the resilient characteristics of the inner portion were to a substantial extent dependent upon the degree of uniformity with which the rim portion was secured to the main body; however, in the present invention, the resilient accentuating flange 50 operates to make the inner portion 42 "floating" relative to the rim portion 44. Particular attention is called to the fact that irregularities and nonuniformity in the gripping of the rim portion of the diaphragm of the present invention do not substantially affect the resilient characteristics of the inner portion.

Heretofore in the manufacture of a diaphragm switch, a diaphragm has sometimes been placed not perfectly concentrically relative to the bore in the main body and/or not perfectly concentrically relative to the actuator and/or not perfectly concentrically relative to the contacts. An eccentrically positioned diaphragm is not uniformly gripped by the main body, and is accordingly of unsatisfactory resilient characteristics. Of particular importance, an eccentrically positioned diaphragm positions the movable contacts incorrectly, and results in unsatisfactory operation of the contact points. Furthermore, the force necessary to operate the snap action of an eccentrically positioned diaphragm is not the same as the force necessary to operate a correctly concentrically positioned diaphragm; accordingly, a switch with an inadvertently eccentrically positioned diaphragm is not satisfactory for control apparatus. Moreover, if the diaphragm is not concentric relative to the actuator, the actuator normally presses on only a portion of the predetermined area of contact. Thus, the eccentric diaphragm can be deformed adversely by eccentric pressure thereon.

Particular attention is directed to the fact that, according to the present invention, centralizing means are provided to eliminate the possibility of manufacturing a switch with a diaphragm inadvertently eccentrically positioned relative to the bore in the main body and/or relative to the contacts and/or relative to the actuating means. Because portions of the outer wall 48 of the accentuating flange 50 fit against the bore-defining wall 31 in the base 22, the possibility of the diaphragm 35 being adversely positioned is substantially eliminated. It should be noted that the diaphragm carries contacts 32 and 33 and centralizing means for positioning the contacts 32 and 33 relative to the contacts 25 and 26.

The inner portion 42 of the diaphragm 35 provides a snap action in two directions; that is, it resiliently urges its center 52 to a fully retracted position with a major force. Only when an external force greater than said major force operates can the center be moved from its retracted position past a neutral point. When the center is moved past a neutral position, the center is resiliently urged by the stored energy of said diaphragm to an advanced position with a minor force. When the center is in the neutral and/or the advanced position, however, the major force operates to urge said center to return to the retracted position. As soon as the superior external force is removed, the major force operates to return the center of its retracted position. The major and minor forces are stored within the diaphragm itself, which is so prepared as to inherently possess the desired resilient characteristics. Moreover, a small mechanical movement of a point removed from the center 52 but on the inner portion 42 operates to move the center 52 a much greater distance. Thus, the operation of the inner portion 42 of the diaphragm 35 is in many respects similar to the operation of the diaphragm described in Patent 2,174,868. However, it should be particularly noted that, according to the present invention, the diaphragm 35 is provided with: (a) accentuating means to achieve resilient characteristics not heretofore attainable in diaphragms; (b) diameter-minimizing means; (c) means for centralizing the diaphragm relative to the bore, for centralizing the diaphragm relative to the actuator, and for positioning the movable contacts relative to the stationary contacts; (d) means for "floating" the inner portion relative to the rim portion; and, (e) means for blocking the flexing action at a section inwardly removed from the gripped rim portion.

In an ordinary simple dished diaphragm, the flexing action is transmitted from the center to the rim portion. However, according to the present invention, means are provided for blocking the resilient action before it can be transmitted to the rim portion 44. Any of the walls 47, 48 and 49, and particularly the inner wall 47, can function as a blocking means acting to dissipate any residual flexing action transmitted thereto. Ordinarily the inner wall flexes with the inner portion, and the outer wall functions as a barrier preventing any further transmittal of flexing action. Thus, the rim portion 44 is protected against the resilient action. Because the rim portion is protected against resilient action, the inner portion 42 can function efficiently regardless of the degree of nonuniformity of the gripping of the rim portion, and other advantages are achieved.

An actuator 53 is provided for moving the inner portion 42 of the diaphragm 35. The actuator may be in the form of a Bakelite button secured to a metal stem 54 extending through an opening 55 in the cap 23. It should be especially noted that in the operation of the switch 20 the stem 54 is depressed as indicated by an arrow 56, thereby causing the actuator 53 to depress the inner dished portion 42 of the diaphragm 35. The connector 43 and conductor 31 in the lower chamber 41 are thereby lowered with a snap action, and maintained in an advanced position beyond a neutral point with a minor force.

The possibility of adverse arcing between the stationary contacts 25 and 26 and the corresponding movable contacts 32 and 33 is elimi-

nated by reason of the fact that substantially as long as the switch is open the movable contacts are maintained advanced beyond the neutral point. When the pressure on the stem 54 is released sufficiently to permit the diaphragm to move to the neutral point, then the major force urges the diaphragm into retracted position and actuates the movable contacts until they firmly press against the stationary contacts. As explained hereinabove, the diaphragm possesses a novel resilient action by reason of the provision of the accentuating portion 46, and the two-way snap action is not dependent entirely upon the dished shape of the inner portion of the diaphragm.

Particular attention is directed to the fact that a joint 57 between the stem 54 and the cap 23 is made substantially gastight, notwithstanding the fact that the stem slides therein. An inner resilient gasket 58 (e. g., a gasket of rubber), a middle metallic gasket 59 (e. g., a gasket of Babbitt metal) and an outer resilient gasket 60 in bores 61, 62 and 63 function to substantially prevent any gas from escaping from the upper chamber 40 at the joint 57. In some instances the Babbitt or metal gasket 59 may be dispensed with, and the bore 62 may be smaller in diameter to merely allow the stem to reciprocate therein.

Not only at the joint 57 but also throughout the switch 20 precautions are taken to make the entire structure entirely impervious to the passage of gas. For example, a resilient gasket 64 may be provided at a joint 65 between the cap 23 and the base 22. As pointed out hereinabove, the cap and base are made of insulating materials substantially impervious to gas and preferably resistant to high temperatures. For example, certain varieties of porcelain are suitable. It is highly important to prevent gas from entering or leaving the lower chamber 41 because if oxidizing or corrosive gases were to enter the lower chamber, the contacts 25, 26, 32 and 33 would be corroded; and because if the predetermined gas pressure in the lower chamber were reduced, objectionable arcing between the contact points during the opening and closing of the switch might result.

According to the present invention, it is highly important to maintain an equal pressure in the upper and lower chambers. To this end, the connector 43 is provided with an axial passageway 66, and the actuator 53 is provided with a vent 67. The flexing of the diaphragm 35, although creating a breathing action, does not create adverse pressure differences between the upper chamber 40 and the lower chamber 41. Thus, it is possible to maintain a constantly equalized fluid pressure in both the upper and lower chambers. According to the present invention, the upper and lower chambers may be filled with either gaseous or liquid fluids. If insulating fluids, such as fluorocarbons, chlorinated paraffin oil, transformer oil, etc., are used it is possible to utilize the switch at voltages, temperatures, etc., which have heretofore been outside the field of micro switches. Vents 66' may be provided in the diaphragms.

Although the passageways 66 and vent 67 equalize the pressure throughout the main chamber 39 in the main body 21, every precaution is taken to prevent gas diffusion to or from the main chamber. Not only is the gasket 64 provided at the joint 65 but a gasket 68 is preferably disposed between the cap 23 and the rim portion 44 of the diaphragm 35.

In the modified form of invention shown in Fig. 6, the main body 69 of a switch 70 is covered with a coating 71 of a material impervious to the passage of gas, and the sealing of the main chamber 39 discussed above is further assured. The coating may be of wax, polyvinylidenechloride, glass or the like. It will be particularly noted that the joint 57 between the stem 54 and the cap 23 includes novel gasket means.

Fig. 6 discloses a modified form of sealing means for the stem 54 including a flat resilient washer 72 disposed between the actuator 53 and the cap 23, which is compressed while the actuator is in its normal retracted position. Moreover, there is provided a simple resilient gasket 73 of substantial thickness disposed between the cap 23 and the stem 54 adapted to allow the stem to freely slide yet prevent any gas from passing through the sliding joint 57.

Referring now to the duplex form of the invention shown in Figs. 8, 9 and 10, it will be seen that there is provided a switch 74 having stem 54, actuator 53, diaphragm 35, rim portion 44, accentuating portion 46, dished portion 42, connector 43, contacts 25, 26, 32 and 33, plates 30, bus bars 27 and 28 and rivets 29, as discussed in connection with the switch 20. However, the switch 74 differs from the switch 20 in the provision of novel gasket means 75 for the joint 57, and in the provision of duplex switching means 76 instead of single switching means.

The novel gasket means 75 include a resilient gasket 77 snugly embracing the stem 54 and securely adhered to the cap 23, as by vulcanization. As an additional safeguard against diffusion there may be (though not necessarily) provided the washer 72 described in connection with Fig. 6.

The conductor 31 carries the pair of upper contacts 32 and 33 normally pressed against the pair of stationary contacts 25 and 26 with a major force. When the stem 54 of the switch 74 is depressed, a pair of lower contacts 78 and 79, carried by the conductor 31, is pressed against a pair of lower stationary contacts 80 and 81 with a minor force. Two bus bars 82 and 83 are connected with the stationary contacts 80 and 81 by means of the plates 30 and rivets 29 in a base 84 of the switch 74.

It should be particularly noted that when the stem is in a retracted position the bus bar 27 is electrically connected with bus bar 28 through stationary contacts 25 and 26. However, when the stem is moved to the advanced position the bus bar 82 is electrically connected with bus bar 83 through the stationary contacts 80 and 81.

Instead of using the actuator 54 in the switch 20, the switch 70 or the switch 74, it is possible to use an actuator 85 shown in Fig. 11. Particular attention is directed to resilient fingers 86 on the actuator 85, and to slots 87 which cooperate therewith. In a switch provided with the actuator 85 a particularly desirable relationship between the actuating force, actuating distance and resiliency (and also a fuller utilization of the minor force) is achieved.

An alternative form (88) of the diaphragm 35 is shown in Fig. 7. Particular attention is directed to the fact that said diaphragm 88 includes the dished portion 42 and center discussed in connection with the diaphragm 35. However, the diaphragm 88 may include a rim portion 89 and an accentuating flange 90 having characteristics differing from the inner portion 42. The rim 89 may be of different thickness, temper and/or rigidity from similar properties of the flange 90

and/or the dished portion 42. The rim 89, flange 90 and dished portion 42 may be formed integrally or separate members may be electrically welded together to produce the diaphragm 88 having rim, flange and inner portions of differing characteristics.

Instead of utilizing any of the gasket-sealed sliding joints between the stem 54 and the cap 23, there may be provided in any of the above-described switches 20, 70 and 74, a sealing means having no sliding joint. For example, and as shown in Fig. 12, metal (or rubber) bellows 91 may be securely affixed not only to the stem 54 but also to the cap 23. The stem 54 may include upper and lower portions threadedly interengaged and clamping the inner portion of the bellows thereto in a gas-tight connection. The outer portion of the bellows may be clamped to the cap 23 by suitable means, such as a gasket 92 cemented thereto, and a plurality of circumferentially disposed screws 93.

In that form of seal shown in Fig. 13, there is provided a bellows 94 clamped against the inside of the cap 23 by the circumferentially disposed screws 93. Thus, the area of the bellows which might possibly be acted upon by external atmospheric pressure is minimized. If desired, the gasket 92 may be positioned between the bellows and the inside of the cap 23.

In Fig. 14 there is shown a gasket diaphragm 95 adapted to seal the joint between the cap 23 and the stem 54 without any possibility of gas leaking through a sliding joint. The diaphragm 95 may be of rubber, metal or other suitable material, and may be secured (e. g., by cementing and/or vulcanization) in suitable annular slots in the cap and stem. It will be noted that the area of the gasket diaphragm 95 is only a small fraction of the area of the main diaphragm 42.

Particular attention is directed to the fact that the metal used in the bellows 91 or 94 or the diaphragm 95 is so thin that it is not necessary to provide an extensive area to achieve the necessary flexibility. Moreover, the bellows or diaphragm is so designed that its effective area is substantially less than one tenth the area of the main diaphragm and/or the top of the cap.

It should be particularly noted that the present invention does not consist of three mutually exclusive species but consists of improvements illustrated in connection with the switches 20, 70 and 74, and that the diverse features of said switches 20, 70 and 74 may be utilized in each other.

Variations and modifications may be made within the scope of this invention and portions of the improvements may be used without others.

Having thus described the invention what is claimed as new is:

1. In an electrical switch, the combination of a main body having a main bore defined by a wall; stationary contacts in said body; a diaphragm secured to said main body; movable contacts associated with said diaphragm; an actuator supported by said body and adapted to operate said diaphragm; and means on said diaphragm, spaced inwardly from the periphery thereof, cooperating with the wall of the main bore for locating said diaphragm centrally relative to the main body and relative to the actuator, and for locating the movable contacts relative to the stationary contacts.

2. In an electrical switch, the combination of a body having a main chamber; contacts within

said chamber; a diaphragm associated with at least one contact and secured to said main body; an actuator having a cavity and acting on the diaphragm, and with the latter forming a closed chamber, and including a passageway from said cavity to the exterior of said actuator.

3. In an electrical switch, the combination of at least two body members forming a main body having a main chamber; stationary contacts within said chamber; a diaphragm clamped between said body members for dividing said main chamber into a plurality of chambers, and at least one vent associated with said diaphragm for permitting the free passage of fluid from one to the other of said plurality of chambers; movable contacts associated with said diaphragm; and means for positively centralizing said diaphragm relative to the main chamber and said stationary and movable contacts relative to each other.

4. In an electrical switch, the combination of a body having a main chamber; contacts within said chamber; a diaphragm unit supported by said body and dividing said main chamber into a plurality of chambers including means for permitting the free passage of fluid from one to the other of said plurality of chambers; a reciprocable actuator supported by said body for direct engagement with said diaphragm; and means for positively centralizing said disc relative to the main chamber and relative to the actuator.

5. In a switch, the combination of a body having a main chamber; contacts within the main chamber; an actuator supported by said body and extending from within the main chamber to a point at the outside of the body; means associated with said contacts and with said body dividing said main chamber into a plurality of chambers; and means for maintaining a uniform pressure within said plurality of chambers at all times and for excluding external pressure changes therefrom.

6. In an electrical switch, the combination of a main body; electrical contacts; a diaphragm supported by said body, and associated with and controlling at least one contact; a rim portion on the diaphragm; an accentuating portion in the diaphragm; and a dished portion in the diaphragm, said rim portion, accentuating portion and dished portion differing from each other in resiliency characteristics, and the accentuating portion being adapted to prevent flexing of the dished portion from flexing the rim portion.

7. In an electrical switch, the combination of a body having a main chamber; a diaphragm unit associated with said body, dividing the main chamber into upper and lower chambers, and including a passageway between the upper and lower chambers; a stationary contact associated with said body; a movable contact operatively associated with and carried by the diaphragm; an actuator associated with said body and said diaphragm for operating the diaphragm; a stem for operating the actuator and extending through the body; gasket means associated with said stem for preventing fluid from entering or leaving the main chamber; and an insulating liquid filling the main chamber.

8. In an electrical switch, the combination of a body having a main chamber defined by a wall; a diaphragm unit associated with said body, dividing the main chamber into upper and lower chambers, and including a passageway between the upper and lower chambers; a rim portion on the diaphragm; a dished portion on the diaphragm; an accentuating flange between the rim

and dished portions; means urging the diaphragm to snap from a neutral position to an advanced position with a minor force and urging the diaphragm to snap from the neutral and from advanced position to a retracted position with a major force; means centralizing the diaphragm including a portion of the flange contiguous the chamber-defining wall of the main body; and gasket means preventing any fluid from entering or leaving the main chamber.

9. In an electrical switch, the combination of a main body having a bore-defining wall; a diaphragm carried by said body normally urged to a retracted position; a rim portion on the diaphragm; means securing the rim portion to the main body; an inner dished portion on the diaphragm; an accentuating flange on the diaphragm disposed between the rim portion and the dished portion; a stationary contact; a contact carried and moved by the diaphragm; means urging the diaphragm to snap from a neutral position to an advanced position with a minor force and urging the diaphragm to snap from the neutral and from the advanced position to a retracted position with a major force; and means centralizing the diaphragm relative to the bore including at least a portion of the flange substantially contiguous the bore-defining wall.

10. In an electrical switch, the combination of a main body; a diaphragm carried by said body; a rim portion on the diaphragm; means securing the rim portion to the main body; an inner dished portion on the diaphragm; an accentuating flange on the diaphragm between the rim portion and the dished portion adapted to confine flexing of the diaphragm to the dished portion and away from the rim portion; a stationary contact; a contact carried and moved by the diaphragm; and means urging the diaphragm to snap from a neutral position to an advanced position with a minor force and urging the diaphragm to snap from the neutral and from the advanced position with a major force.

11. In an electrical switch, the combination of a main body having a bore and a shoulder; a diaphragm; at least one stationary contact; at least one movable contact carried and moved by said diaphragm; a rim portion on the diaphragm; means maintaining the rim portion on the shoulder; an inner dished portion on the diaphragm, said dished portion having a snap action in two directions, normally flexed to a position at one side of its neutral point and exerting a continuous reaction to return thereto when moved to a position at the other side of the neutral point; an accentuating flange on the diaphragm between the rim portion and the dished portion; and means centralizing the diaphragm relative to the main body, including at least a portion of the flange substantially contiguous the bore.

12. In an electrical switch having a body; and dished diaphragm resiliently urging its innermost portion to snap from a neutral position to

an advanced position with a minor force and resiliently urging its innermost portion to snap from the neutral and from the advanced position to a retracted position with a major force, the combination of flange-defining inner, outer and bottom walls on the diaphragm, said walls defining a flange adapted to accentuate said resilient urging and adapted to centralize the position of the diaphragm relative to the body.

13. In an electrical switch, the combination of a main body having a main chamber; a stationary contact; a movable contact; a diaphragm unit associated with said main body and dividing said main chamber into upper and lower chambers, adapted to move said movable contact relative to said stationary contact, and including a vent between said upper and lower chambers; an actuator slidably supported by said body, in operative association with said diaphragm; and gasket means on said body for excluding external fluid from and internal fluid uniformly in both of said pair of chambers.

14. In an electrical switch, the combination of a base having a cavity; a cap having a cavity and an aperture; a diaphragm associated with and between said base and cap, dividing the cavities of the base and cap into a pair of chambers and including a vent for equalizing the pressure in said pair of chambers at all times; a rim portion on the diaphragm having a minor force in one direction and a major force in another direction; an accentuating flange between the rim and dished portion; means for securing said base cap and rim portion together; sealing means between the base and cap; a stationary contact secured to said base; a movable contact carried by said diaphragm; an actuator in one of said chambers associated with said diaphragm and having a stem extending through the aperture in the cap; and gasket means between said stem and cap for preventing passage of fluid therebetween.

15. In an electrical switch, the combination of a main body having a main chamber; stationary contacts; movable contacts; and means secured to said main body for reciprocating said movable contacts and for dividing said main chamber into a plurality of substantially closed chambers, including a diaphragm unit with a duct adapted to pass fluid between the plurality of chambers.

16. In an electrical switch, the combination of a main body having a main chamber; at least one stationary contact; a diaphragm secured in said body and having a clamped section and a flexible section; at least one movable contact actuated by said diaphragm relative to said stationary contact; and means for limiting and terminating movement of the flexible section of said diaphragm at a section spaced appreciably inwardly of said clamped section.

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