

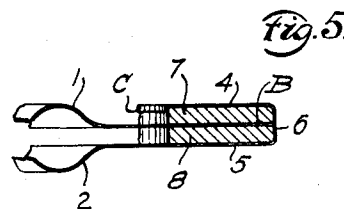
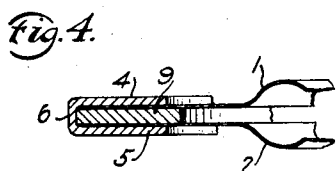
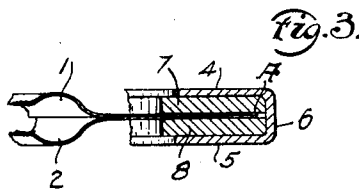
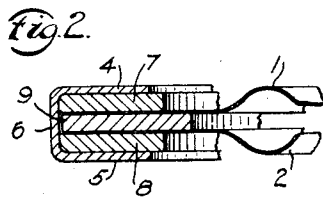
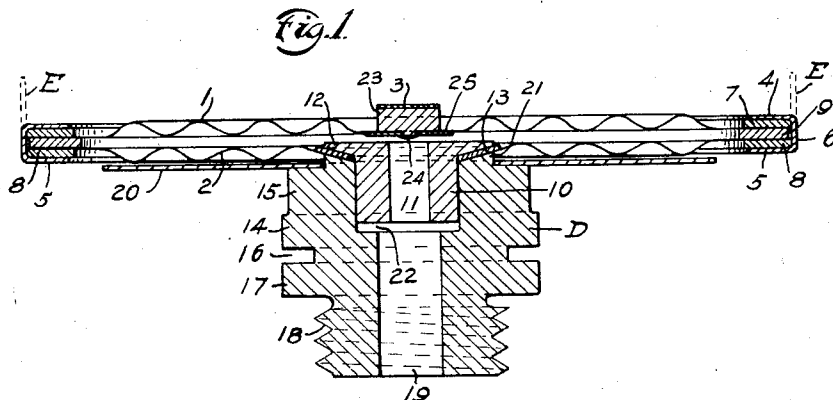
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P. M. FARMER ET AL

2,109,145

DIAPHRAGM SWITCH

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DIAPHRAGM SWITCH

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The present invention relates to an improvement in air actuated diaphragm switches especially for those used in the so called aero-tube fire alarm systems, in which the rise and fall of air pressure in the tubes is automatically varied in accord with the room temperature changes in which the system is installed.

One of the main advantages gained by the present structure is through the use of duplex, concentrically convoluted, thin, metallic diaphragms, preferably of a suitable light metal such as aluminum, whereby greater sensitivity to air pressure fluctuations is obtained, and, due to the mode of attaching the diaphragms to join them at their perimeters, there is no tendency of drawing the natural spring temper of the diaphragms as when soldered, and thus all diaphragms of given diameter, are all alike in operative characteristics and of uniform structure and results.

Further, due to the present method of assembling the components of an instrument as herein outlined the two diaphragms are connected into operative assembly with themselves and their cooperating appurtenant parts, which prevent the diaphragms from becoming distorted and from being given undesired internal stresses.

Another feature of advantage is accomplished by the manner in which the diaphragms are peripherally connected, this mode of fastening having two functions, one, to seal the diaphragms in uniform edge contact and the other, to act as an inertia member to prevent the delicately mounted diaphragms from chattering, and thereby cause false alarms.

The foregoing, and other features of advantage will be apprehended as the herein description proceeds, and it is obvious that modifications may be made in the structure herein, without departing from the spirit hereof or the scope of the appended claims.

In the drawing,

Fig. 1 is a transverse sectional view of the present diaphragm construction, enlarged over life-size to better show the details thereof, this diaphragm structure as viewed from the top, being round, as is customary in this type of device; and

Figs. 2, 3, 4 and 5, are enlarged, fragmentary sections of modified rim assemblies showing the manner in which the diaphragm discs are bound together in operative assembly.

As in Fig. 1, the complete structure comprises two substantially similar diaphragm discs 1 and 2, these preferably being concentrically convoluted, can be made from the same dies, in manuf-

acture, and reversed in assembly. The only difference in these diaphragms, is that the lower one 2, has a bore therein to be press-fitted upon the tapered face of flanged extension 12 on the bushing or base 10.

The bushing 10 is bored as at 11, and communicates between the interior of the spaced diaphragms and the bore 19 of the threaded coupling D, said spud 10 being press-fitted into said bore 19.

The lower diaphragm 2, is, by means of the edge of its central bore, seated upon the taper face 21 of coupling D, and then a ductile lead washer 13 is overlaid upon the diaphragm with its bore in registry with the bore 22 in coupling D, and the bushing 10, with its taper faced flange 12 is tightly pressed down to a seat, thus compressively holding diaphragm 2 in its desired operative position in an air-tight manner.

The coupling D, on its top face, is provided with an upstanding circular shoulder 21, which receives thereon a bored circular guard plate 20, which is press-fitted upon said shoulder 21, to guard the exposed face of diaphragm 2 against injury. This guard plate is positioned adjacent diaphragm 2, but is spaced far enough distant therefrom so as not to interfere with the action of said diaphragm.

The coupling D at its upper end 15 is of cylindrical cross-section, and immediately below this cylindrical section is a hexagonal portion 14 and 17, bifurcated by a groove 16, and the lower end of the coupling is provided with a reduced threaded end 18.

The hexagonal portion 14—17 is used to permit the use of a wrench when fitting the device in operative position.

The groove 16 is provided for the purpose of holding the completed instrument, by means of a forked yoke, not shown, in said groove in the seat of a special testing device, in which there are no threads, so that the threaded end 18 is not used to lock the diaphragm in the testing machine, but the yoke is used to rapidly hold and release diaphragms during the inspection and testing thereof at the factory.

The two circular diaphragms, or discs 1 and 2, as in Figs. 1 and 2, are firmly clamped together at their peripheral edges by an outer double flanged annulus comprised of two outer clamping flanges 4 and 5 which are, preferably integral with the outer rim portion 6.

In assembling the discs, and after having assembled disc 2, as previously described, to coupling D, a compressive washer 8 is placed upon

flange 5, and this is done before the closing down of the top flange 4, this being indicated by the dot and dash lines E, Fig. 1.

Then the ring, with washer 8 therein is brought up around the edges of disc 2, then another compressible washer 9 is placed upon the top face of disc 2, then the top disc 1 is dropped into the clamp ring upon the washer 9 and finally a compressible washer 7 is placed upon the disc 1 and the flange 4 clamped down upon the assembly, as in Fig. 2, compressively effecting an air tight assembly of the peripheral edges of the discs 1 and 2.

In Fig. 3, the assembly is substantially the same as that described for Figs. 1 and 2 except that the inner washer 9 is not used, and the two peripheral edges of the discs 1 and 2 are contacted as at A, and the sealing effected by the washers 7 and 8 only.

In Fig. 4 the central washer 9 only is used with the discs 1 and 2 separated, and thus an effective seal is created when the clamp ring is finally closed down directly over the two discs.

In Fig. 5 there is shown a modified form of disc assembly in which the lower disc, as viewed in said Fig. 5 is of sufficiently larger diameter than disc 1, to provide for an integral clamp ring portion 4-5-6. Washers 7 and 8 are used and the central packing washer 9 is not used bringing the contacting edge of disc 1 between washers 7 and 8, as at B. Further, the integral flange portion 4 of disc 2 is flanged over the inside vertical edge of washer 7, as shown at C, thus stiffening the inner periphery of washer 7.

In some instances, such as a construction shown in Figs. 1 and 2, the central washer 9, may be of metal so as to further add to the weight of the perimeter of the diaphragm, and thus act as a circumferential balance and vibration dampener, without loss of efficiency.

The upper diaphragm 1, at its center is provided with a riveted on electrical contact point 23 having a platinum facing 3, which may be welded to the surface of the contact point. This point may be provided with a riveting teat or extension 24, which extends through a centrally located rivet hole in disc 1, Fig. 1, and through the bore of a rivet washer 25, and is then riveted over the said rivet washer 25. This form of construction further adds to means for the prevention of inner strains and distortion of the disc, as the riveting strain is taken up directly by the rivet washer.

The points of advantage of the foregoing construction are, irregular annealing of the discs 1 and 2 is eliminated because they are mechanically locked or clamped together, and are not soldered, therefore the metal of the discs when stamped, convoluted and assembled uniformly retain their natural resilience.

The method of assembly further prevents distortion as the parts are struck together in a closing die thereby obtaining multiple assemblies which are, substantially all uniform in action and structure.

It is possible in varying sized diaphragms for different duties to counterweight the perimeters thereof for dampening the different natural oscillatory periods, and thus obtain a more satisfactory action when in an aero-tube circuit.

In one form of use these diaphragms may be connected to an aero-circuit as above described and connected into an open, fire alarm, electric circuit with the open contact of the electric cir-

cuit located adjacent the contact member 23 on disc 1, but not in electrical contact therewith. Normal surging of the discs 1 and 2 will therefore not send fire alarms, but a sudden, sustained rise of pressure in the aero-system will cause the discs 1 and 2 to expand, to an extent that will close contact 23 said open circuit contact and cause the electric circuit, of which the diaphragm is a part, to send an alarm, in the customary manner.

As thus constructed it will be seen that the diaphragm discs are suspended upon the coupling D, for free action. The coupling being anchored solidly in operative position holds the two assembled resilient discs in free suspension through their compounded resilient connection by reason of the weighted connected perimeters and the attachment of the lower disc 2 to the coupling.

Having thus described the invention what is claimed is:

1. The combination of a metallic air operated apparatus comprising a pair of diaphragms having outer boundary margins, a washer disposed between said margins to provide a space between the diaphragms, one of said diaphragms having therein an opening, and there being a tubular coupling communicating with said space through the opening, said coupling including a pair of members which embrace the associated diaphragm around the margin of the opening; clamping means including another washer, and means integral with one of said margins and extending therefrom, said second means having a flange extending inwardly over the second mentioned washer, and an inner stiffening edge portion on said flange, said portion being engaged against the associated washer at the inner circumferential face thereof.

2. An air-pressure-operated device for air-expansion-tube alarm systems, said device comprising a coupling having a bore and a flared inclined seat around the bore; an inner diaphragm having intra-marginal annular corrugations thereon, a central opening and a tapered portion around said opening tightly fitting said seat and forming a recess; a tubular bushing in said bore and carrying a heavy strong flared flange clamping against said tapered portion and disposed approximately within said recess; an outer corrugated diaphragm over the inner diaphragm; means securing the margins of the diaphragms airtightly together; and a contact carried on the central portion of the outer diaphragm; said flaring seat and flange having the new functions of disposing the flange approximately entirely between the inner and outer planes of the inner diaphragm, thus economizing space and allowing small volume between the diaphragms, thereby promoting sensitivity; said flange and seat having the further function of engaging the diaphragm with a wedging force, thereby increasing the air-tightness of the fit, and the further function of bracing the diaphragm at the seat.

3. An air-pressure-operated device comprising a coupling having a bore and an outwardly flared inclined seat around the bore; an inner diaphragm having intra-marginal annular corrugations thereon, a flat outer margin, a central opening and a tapered portion around said opening fitting said seat and merging into the adjacent corrugation; a tapered lead washer fitted on said tapering portion; a tubular bushing force-fitted in said bore and having a heavy strong flared flange fitted tightly against said washer and disposed approximately within the inner and

outer planes of the diaphragm substantially flush with the top face of the corrugations of the inner diaphragm and clamping said seat, washer, diaphragm and flange air-tightly together; an outer diaphragm disposed over the inner diaphragm and having a flat central portion, annular corrugations therearound, and an outer flat margin; means securing said margins airtightly together; and a contact carried on said central portion; the flaring seat and flange having the new functions of disposing the flange approximately entirely between the inner and outer planes of the inner diaphragm, economizing space, allowing small volume between the diaphragms, promoting sensitivity; said flange and seat having the further function of engaging the diaphragm and washer with a wedging force, thereby increasing the air-tightness of the fit, said tapering diaphragm portion having the further function of bracing the diaphragm at the seat to prevent portions thereof from buckling when the diaphragm is flexed.

4. An air-pressure-operated device for air-expansion-tube alarm systems, said device comprising a seat; an inner diaphragm having intramarginal annular corrugations thereon, a flat outer margin, a mid-portion mounted on said seat; an outer diaphragm disposed over the inner diaphragm and having flat central portion, and outer margin and corrugations therebetween; compressible packing washers on both sides of said margin of one of the diaphragms the other diaphragm being formed into a flange extending over said washers to the inner edge of one of the washers; and an electric-switch contact carried on the outer face of said central portion; said diaphragms being very light, thin, delicate and highly elastic and having a natural oscillation frequency and easily set in oscillation; the weight of the washers being predetermined and selected relative to the weight and frequency of the diaphragms to neutralize and damp said oscillation, thus forming a floating non-frictional damping means.

5. An air-pressure-operated device for air-expansion-tube alarm systems, said device comprising a coupling having a bore and a seat around the bore; an inner diaphragm having intramarginal annular corrugations thereon, a flat outer margin, a central opening and a portion around the opening mounted on said seat; an outer diaphragm disposed over the inner diaphragm and having flat central portion, and outer flat margin and corrugations therebetween; compressible washers against the outer faces of said margins; a metal washer between the margins; a double flanged annulus clamping said washers and margins together; and an electric-switch contact carried on the outer face of said central portion; said diaphragms being very light, thin, delicate, highly elastic and vibratory, and having a natural oscillation frequency easily set in oscillation by usual extraneous vibrations to cause chattering; the combined weights of said washers and annulus being predetermined and selected relative to the weight and frequency by the diaphragms to neutralize and damp said oscillations,

thereby to prevent said chattering; said margins being free of holes or solder whereby inertia, at the margins, and the elasticity of the diaphragms are uniform; the metal washer having the additional function of providing stiffness to said margins.

6. An air-pressure-operated device for air-expansion-tube alarm systems, said device comprising a coupling having a bore and a seat around the bore; and inner diaphragm having intramarginal annular corrugations thereon, a flat outer margin, a central opening and a portion around the opening mounted in press fitted relation on said seat; an outer diaphragm disposed over the inner diaphragm and having flat central portion, and an outer flat margin and corrugations therebetween; a metal washer between said margins; a double-flanged annulus clamping said margins and washer airtightly together; and an electric-switch contact carried on the outer face of said central portion; said diaphragms being light, thin, delicate and highly elastic; said margins being free of holes or solder whereby inertia, at the margins, and the elasticity of the diaphragms are uniform.

7. An air-pressure-operated device comprising a coupling having a bore and an outwardly flared inclined seat around the bore; an inner diaphragm having intramarginal annular corrugations thereon, a central opening and a tapered portion around said opening fitting said seat and merging into the adjacent corrugation; a soft washer fitted on said tapering portion; a bushing secured in said bore and having a flared flange clamping said washer tightly on said tapered portion; an outer diaphragm disposed over the inner diaphragm; and means securing the margins of the diaphragms airtightly together; said flange and seat having the function of engaging the diaphragm and soft washer with a wedging force, thereby increasing the air-tightness of the fit, and the further function of bracing the diaphragm at the seat to prevent portions thereof from buckling when the diaphragm is flexed.

8. An air-pressure-operated device for air-expansion-tube alarm systems, said device comprising a coupling having a bore and a flared inclined seat around the bore; an inner diaphragm having intramarginal annular corrugations thereon, a central opening and a tapered portion around said opening tightly fitting said seat and forming a recess; a tubular bushing in said bore and carrying a heavy strong flared flange clamping against said tapered portion and disposed approximately with said recess; an outer corrugated diaphragm over the inner diaphragm; means securing the margins of the diaphragms airtightly together; and a contact carried on the central portion of the outer diaphragm; said flaring seat and flange having the new functions of disposing the flange approximately entirely between the inner and outer planes of the inner diaphragm, thus economizing space and allowing small volume between the diaphragms, thereby promoting sensitivity.

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