March 19, 1968 C. H. PEEK ET AL 3,374,323

PRESSURE RESPONSIVE DEVICE FOR ACTUATING AN ALARM

Filed April 7, 1966 2 Sheets-Sheet 1

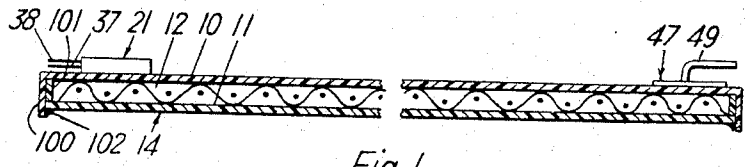

Fig. 1.

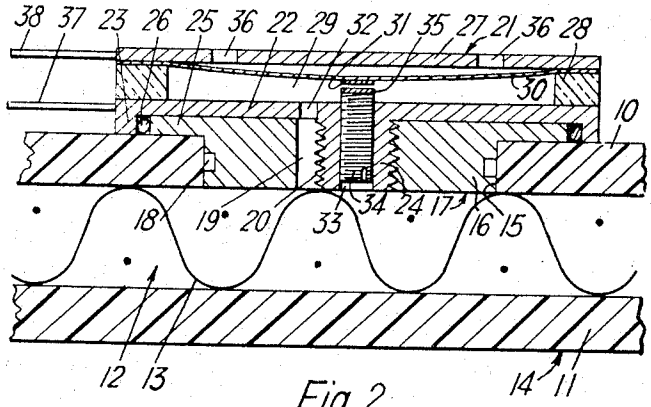

Fig. 2.

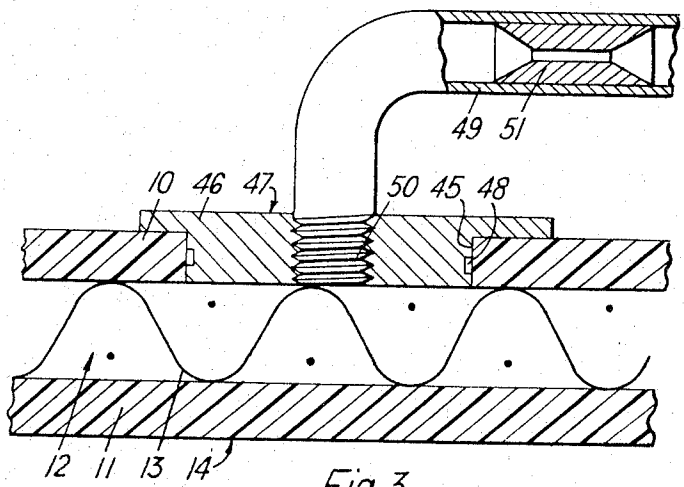

Fig. 3.

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PRESSURE RESPONSIVE DEVICE FOR ACTUATING AN ALARM

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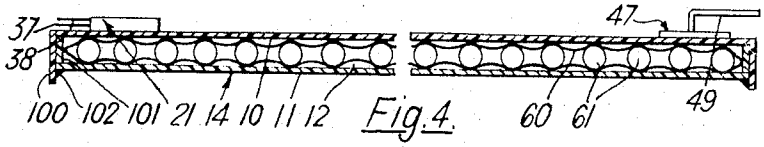

Fig.4.

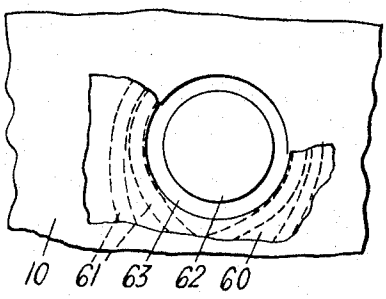

Fig.5.

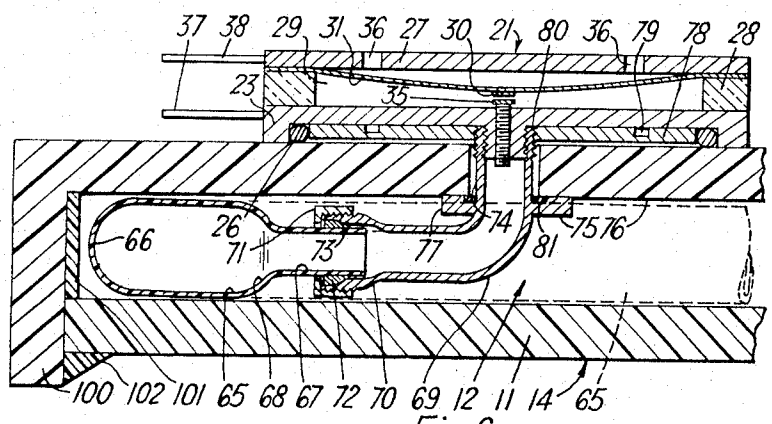

Fig.6.

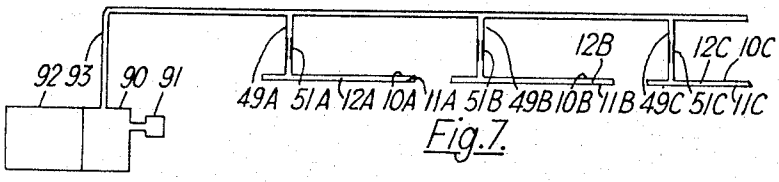

Fig.7.

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PRESSURE RESPONSIVE DEVICE FOR ACTUATING AN ALARM

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7 Claims. (Cl. 200—83)

ABSTRACT OF THE DISCLOSURE

A pair of panels defining a heremtically sealed cavity placed under a controlled air pressure and having a switching means associated therewith which is responsive to a predetermined change in the air pressure to actuate an external circuit such as a relay alarm system.

This invention relates to alarm apparatus.

The present invention is alarm apparatus comprising two panels sealingly united together and entrapping therebetween a space or cavity wherein the pressure is less than atmospheric and holds inoperative a switch device in an electric circuit incorporating alarm means, said switch device being adapted to react to operate the alarm means on equalization of the pressures.

The present invention is also alarm apparatus comprising two panels or laminations entrapping therebetween a space or cavity wherein the pressure is less than atmospheric and holds inoperative in an electrical circuit incorporating alarm means a switch device adapted to react to operate the alarm means on increase by a predetermined amount of the pressure in said space or cavity, said switch device comprising a pair of plates spaced apart at their peripheries by an insulating and sealing medium, one of said plates having a central outwardly-projecting stud providing an axial tapped through opening for adjustment of a threaded pin terminating in the space between the plates in a contact opposing another contact proud of a diaphragm secured at its periphery adjacent the other plate by said medium.

One of the panels may be a window and the other a strip of glass sealingly united together at the periphery of the strip with a space or cavity between the two, a small hole in the panel or the strip locating the switch device. Such a window could form part of a door, or could form a door such as a showcase door.

The two panels could form a partition wall, a window, a door, a floor, or a ceiling, or could be incorporated in a wall, a window, a door, a floor, or a ceiling.

The panels may be sheets of polyvinyl chloride or other plastics material, or ferrous or non-ferrous metal, and the sealing together of the panels may be effected by heating, soldering, welding, adhesive, cement or other sealant, depending on the material or materials used.

Where one of the panels is a strip there is no need to provide spacing means between the panels to keep the panels separated under vacuum, but if the areal dimensions of both panels are such that further support is desirable to keep the panels separated under vacuum spacing means in the form of small spacer elements may be disposed between the panels, preferably in a uniform pattern. The spacer elements are preferably bonded to at least one of the panels, and they may have openings therein defining between the panels spaces in which air is trapped on evacuation of air from between the panels, thus affording further support to the panels. The spacer elements could be of disc-shape of say ⅛" diameter and 3/100" thick. They may be of, say, PVB (a name applied in the trade to a sealing material which is a polyvinyl

butyl resin containing, as a plasticiser, triethylene glycol di-2-ethyl butyrate) or of Teflon or Makrolon. Teflon is a trade name for polytetrafluoroethylene and Makrolon is a trade name for a thermoplastic polycarbonate of 4,4¹-dihydroxy-diphenyl-2,2-propane (biphenol A).

The spacer elements could be replaced by wire netting, porous rigid foam material, or porous, corrugated sheet material, or one or more of the panels may be dimpled thus to obviate the need for spacer elements or wire netting. Where desirable a combination of any two or all three of the spacing means aforesaid may be used.

Where it is necessary to circumvent an obstacle projecting from a surface to which apparatus according to the invention is to be applied, for example a light rose on a ceiling or an electric switch on a wall, the two panels sandwich a bag of nylon, polyvinylchloride, or other plastics material capable of supporting a vacuum of up to six or seven inches of mercury. The bag is held open by a porous foam sheet or by suitably positioned porous pipes, or by other means such as a corrugated sheet of porous plastics material, all with the object of ensuring that the bag will not collapse under vacuum. Manifestly, the bag closes off the space between the panels where confronting the obstacle.

It will be manifest that, because of the vacuum in the space between the panels, the diaphragm is in contact centrally with the plate. The closed switch completes a circuit which holds inoperative a relay controlling an alarm system, but immediately the vacuum is destroyed the switch opens and releases the relay, whereby the alarm is operated.

The invention can be used in ceilings, walls, floors, windows and doors, indeed anywhere subject to entry by force from without.

Embodiments of the invention will now be described, by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a sectional view of two panels united together, positively spaced apart, with the outer of the two mounting a switch device and providing for communication of a pipe with the cavity between the panels;

FIG. 2 is a similar view, on an enlarged scale, particularly illustrating the switch device;

FIG. 3 is a view similar to FIG. 2, but particularly illustrating the pipe communication with the cavity;

FIG. 4 is a view similar to FIG. 1, illustrating a modification;

FIG. 5 is a plan view illustrating the use of the FIG. 4 construction;

FIG. 6 is a sectional view at right angles to that of FIG. 4 and to an enlarged scale, illustrating another modification; and

FIG. 7 is a diagrammatic illustration of an installation where several double-panel structures are connected in series to a single vacuum pump and reservoir.

Referring now to the drawings, throughout which like parts are denoted by like reference numerals, two panels **10** and **11** of polyvinyl chloride or other plastics material entrap therebetween a space or cavity **12** in which is located spacing means in the form of wire netting **13**. The panels are of convenient size for the purpose intended and are tailored to suit the surface or part-surface to which the composite structure is to be applied, the outside surface **14** of the inner panel **11** being then adjacent to the first-mentioned surface or part-surface and being adhered thereto in any convenient manner. The panel **10** has a peripheral flange **100** which fits about the panel **11** and a sealing compound such as epoxy-polysulphide is provided between the panels at the peripheries thereof as shown at **101**, and also externally of the panel **11** between same and the flange **100** as shown at **102**.

Referring now particularly to FIG. 2 the outer panel **10** has a hole **15** formed therein and the tapped stem **16** of a bush **17** is located in said hole. The stem **16** has a peripheral groove **18** and the latter assists adhesion of the stem to the hole surround by means of a suitable adhesive or cementing compound such as Araldite (registered trademark). A longitudinal groove **19** is formed in the stem adjacent the tapped opening **20** and extends completely through the bush.

The switch device **21** comprises a disc-shaped base plate **22** with a peripheral flange **23** and a central threaded stud **24** which screws into the tapped opening **20**. The dimensions of the base plate **22** and the head **25** of the bush **16** are such that a small clearance is left between the flange **23** and the periphery of the head, and an O-ring seal **26** coated with silicone grease is compressed in said clearance as the switch device is screwed into position. An outer circular plate **27** is held in spaced and parallel relation to the base plate **22** by an annular ceramic spacer **28** which both seals the space **29** between the plates and locates in position a diaphragm **30** which has a central contact **31** of precious metal such as platinum proud of its surface opposed to the base plate **22**. A hole **32** is provided in the base plate **22** and is aligned with the groove **19** so that the switch space **29** communicates with the space or cavity **12**.

The stud **24** has a central tapped opening **33** with a fine thread and in this is engaged a threaded pin **34** at whose end opposed to the diaphragm is a contact **35** also of precious metal such as platinum. The pin **34** enables adjustment of the setting of the switch device. The plate **27** has two small holes **36** therein for engagement by a suitable tool when assembling the switch device **21** to the bush **17**. Care must be taken that the tool engages only to a limited extent in the holes **36** to avoid damage to the diaphragm **30**. Two brass pins **37** and **38** extend from the base plate **22** and outer plate **27**, respectively, and these serve for connecting the switch device to a relay controlling an alarm system.

On the space or cavity **12** being evacuated to provide therein a vacuum of the order of, say, 2.5 inches Hg, the diaphragm **30** is pulled and the contacts **31** and **35** close together. This locks the relay and the alarm system is inoperative. When the vacuum drops below a predetermined value, say 2 inches Hg, the diaphragm **30** flexes outwardly and pulls the contact **31** from the contact **35** breaking the electrical circuit and releasing the relay, thus operating the alarm system.

The function of the wire netting **13** or other spacing means is to prevent inward collapse of the panels when the space **12** is evacuated.

Referring now particularly to FIG. 3, the outer panel **10** has a second hole **45** formed therein and the tapped stem **46** of a second bush **47** is located therein. The stem **46** has a peripheral groove **48** and the latter assists adhesion of the stem to the hole surround by means of a suitable adhesive compound or cementing compound such as Araldite. A pipe **49** has a threaded end **50** by means of which it is screwed into the tapped opening in the bush **47**, and the pipe **49** serves for evacuating the space or cavity **12**. A flow-restricting sleeve **51** is fitted into the pipe **49** close to the threaded end of the latter and this enables the evacuating pump to compensate for any slight loss of vacuum due to leakage at the junction between, on the one hand the bush **47** and the panel **10**, and, on the other hand the pipe end **50** and the bush **47**.

Referring now particularly to FIGS. 4 and 5, the cavity or space **12** between the panels **10** and **11** is occupied by a bag **60** of nylon or other plastics material which will support a vacuum of not less than 6 inches Hg. Flexible porous pipes **61** within the bag **60** prevent collapse of the bag under vacuum. This construction is especially useful when an obstacle is to be negotiated on a ceiling, wall, or the like, and referring particularly to FIG. 5, a light switch **62** is shown on a wall **63**. The bag **60** is shaped to fit about the light switch **61** and, of course, the panels **10** and **11** have suitable openings cut therein. The edges of the bag walls about the shaped openings therein are sealed together and the space between the switch **62** and the double-panel structure is filled with a sealing material such as epoxy-polysulphide. It will be noted in FIG. 5 that the pipes **61** are bent to pass round the holes in the bag **60**. The bag **60** may have an eyelet therein adjacent the longitudinal groove **19** in the stem **16** of the bush **17**, but alternatively and preferably the connection with the switch **21** is effected in the manner now to be described with reference to FIG. 6.

In FIG. 6 the pipes **65** are of nylon and are not porous and are clipped between the panels **10** and **11** with the ends of the pipes interconnected by return-bends **66**. The vacuum is in the pipes **65** and one end pipe is connected to the switch **21** and the other either blanked off or connected to an external pipe **49** in the same manner as will now be described for the connection to the switch **21**. The appropriate end pipe **65** is formed adjacent its free end **67** with a neck **68** leading into a reduced diameter. The reduced-diameter end **67** is coupled to a pipe elbow **69** which includes a coupling part **70** engaged by a screw nut **71** acting on an olive **72** which engages the wall of said end on tightening of the nut **71** and deforms said wall as indicated at **73**. The other limb of the elbow **69** extends through a small hole **74** provided therefor in the panel **10** and is both externally threaded and internally tapped at its free end **80** besides having an intermediate peripheral ledge **75** with an out-turned flange **77** which butts against the inner surface **76** of the panel **10**. A lock ring **78** is screwed on to the free end **80** of the limb **69** externally of the panel **10**, and has slots **79** which are engaged by a peg spanner when this is being done. The remainder of the construction is as described with reference to FIG. 2 save only that a second O-ring seal **81**, coated with silicone grease and located by the flange **77** is compressed between the ledge **75** and the surface **76**. Manifestly, a groove such as **19** (FIG. 2) and a hole such as **32** (FIG. 2) are provided in the FIG. 6 construction, although not seen, to enable communication between the switch space **29** and the cavity **12** between the panels **10** and **11**.

In the adaption of the pipe connection to the switch just described to the FIGS. 4 and 5 embodiment of the invention, the eyeletted hole in the bag **60** is traversed by the pipe elbow **69** and the eyelet is engaged between the flange **77** and the surface **76**.

In the diagrammatic illustration in FIG. 7, several double-panel structures **10A** and **11A**, **10B** and **11B**, and **10C** and **11C** are connected in series to a vacuum reservoir **90** with which is associated a pressure-sensitive switch **91** adapted to switch on a motorised vacuum pump **92** if the vacuum in the main pipe **93** falls below a predetermined value and switch off the pump when the vacuum regains the predetermined value. As can be seen branches **49A**, **49B** and **49C**, with flow-restricting sleeves **51A**, **51B** and **51C** fitted therein, communicate with the cavities **12A**, **12B** and **12C** between the various pairs of panels.

Double-panels forming part of alarm apparatus according to the invention may be fitted to walls, ceilings or floors by either adhesive or any other suitable and known method. Double-panels fitted to walls and ceilings may be covered by tiles or a layer of a plastics material, or have any other suitable surface finish. Double-panels fitted to floors may be made of steel or other strong material and covered by cork or other suitable covering material.

We claim:

1. Alarm actuating apparatus comprising:

(a) first and second panels impervious to air;

(b) means interspacing said panels in parallel relationship and sealingly uniting them together along a closed peripheral path to define between said panels a hermetically sealed cavity;

(c) means communicating with said cavity for establishing a predetermined air pressure less than atmospheric pressure in said cavity;

(d) a housing mounted on one of said panels;

(e) openings extending through said housing and one of said panels;

(f) a diaphragm mounted in said housing with one face in communication with said cavity through two of said openings and the other face in communication with atmosphere through another of said openings, a first electrical contact mounted on said diaphragm, a fixed adjustable second electrical contact mounted in said housing in alignment with said first contact, said diaphragm being movable in response to changes in said predetermined air pressure between a position wherein said contacts engage and a position wherein said contacts do not engage; and

(g) means on said housing for connecting an alarm means to said contacts, said alarm means adapted to be actuated upon said diaphragm attaining one of said positions.

2. Alarm actuating apparatus as set forth in claim 1, wherein said housing comprises:

(a) first and second electrically conducting plates of similar areal dimensions and electrically connected to said alarm means;

(b) an insulating and sealing spacer joining said plates at their peripheries and securing said diaphragm to said first plate; and

(c) said first and second plates each having an opening formed therein.

3. Alarm actuating apparatus as set forth in claim 2, wherein said switching means further comprises:

(a) a bush having a tapped stem which partially plugs said two openings;

(b) a threaded stud projecting from one of said plates and engaging in said tapped stem, said stud having an axial tapped bore opening into said housing and into said cavity; and

(c) a threaded pin engaging in said tapped bore and having an end entering said chamber, said second contact being mounted on said end.

4. Alarm actuating apparatus as set forth in claim 1, further comprising an envelope of plastics material substantially filling said cavity, the interior of the envelope being in communication with said means for establishing said predetermined air pressure and with said one face of the diaphragm, and porous means in said envelope for preventing collapse of the envelope when evacuated.

5. Alarm actuating apparatus as set forth in claim 1, further comprising a closed system of interconnected non-porous rigid pipes maintaining said panels in spaced relation, means connecting said system of pipes with one face of said diaphragm, and means connecting said system of pipes to said means for establishing said predetermined air pressure.

6. Alarm actuating apparatus as set forth in claim 1, wherein said means to establish a predetermined air pressure comprises a pipe entering one of said openings, and means for evacuating said cavity through said pipe, a flow restricting sleeve in said pipe, and a pressure sensitive switch communicating with said pipe and energizing said means for evacuating said cavity when the vacuum in the pipe falls below a predetermined level.

7. Alarm actuating apparatus comprising two panels sealingly united together to define therebetween a cavity wherein the pressure is less than atmospheric, a switch device adapted to operate an alarm means on increase by a predetermined amount of the pressure in said cavity, said switch device comprising a pair of plates mounted on said panels, an insulating and sealing medium spacing said plates apart at their peripheries to form a switch space, said switch space being in communication with said cavity, a central outwardly projecting stud in one of said plates and providing an axial tapped through opening, a threaded pin adjustably mounted in said opening and terminating in the space between the plates in a first contact, and a diaphragm secured at its periphery adjacent the other plate by said medium and mounting another contact at a position opposite said first contact, said diaphragm being movable responsive to a pressure increase in said cavity to open said contacts.

References Cited

UNITED STATES PATENTS

1,684,530	9/1928	Bast	340—229
1,974,779	9/1934	Lupold et al.	340—240
1,986,479	1/1935	Lowe et al.	340—240 X
2,972,132	2/1961	Putney	340—240 X

FOREIGN PATENTS

706,159	6/1931	France.
563,348	11/1932	Germany.

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