

[54] **PRESSURE-RESPONSIVE APPARATUS**

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[22] Filed: **Apr. 21, 1971**

[21] Appl. No.: 135,913

[52] U.S. Cl..... 116/70, 73/419, 169/23

[51] **Int. Cl.** **G011 19/12**

[58] **Field of Search**..... 116/70, 34 R, 117;
269/20, 22, 21, 48.1, 52; 73/93, 409, 419;
137/228; 169/23, 30, 31

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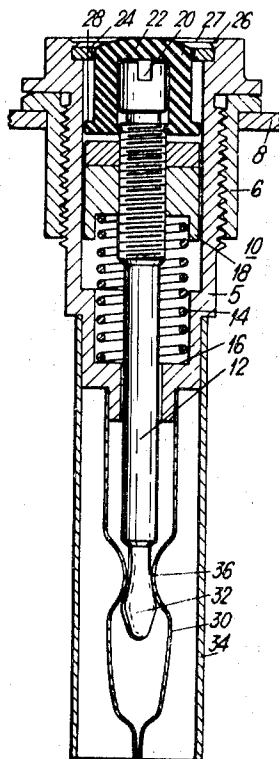
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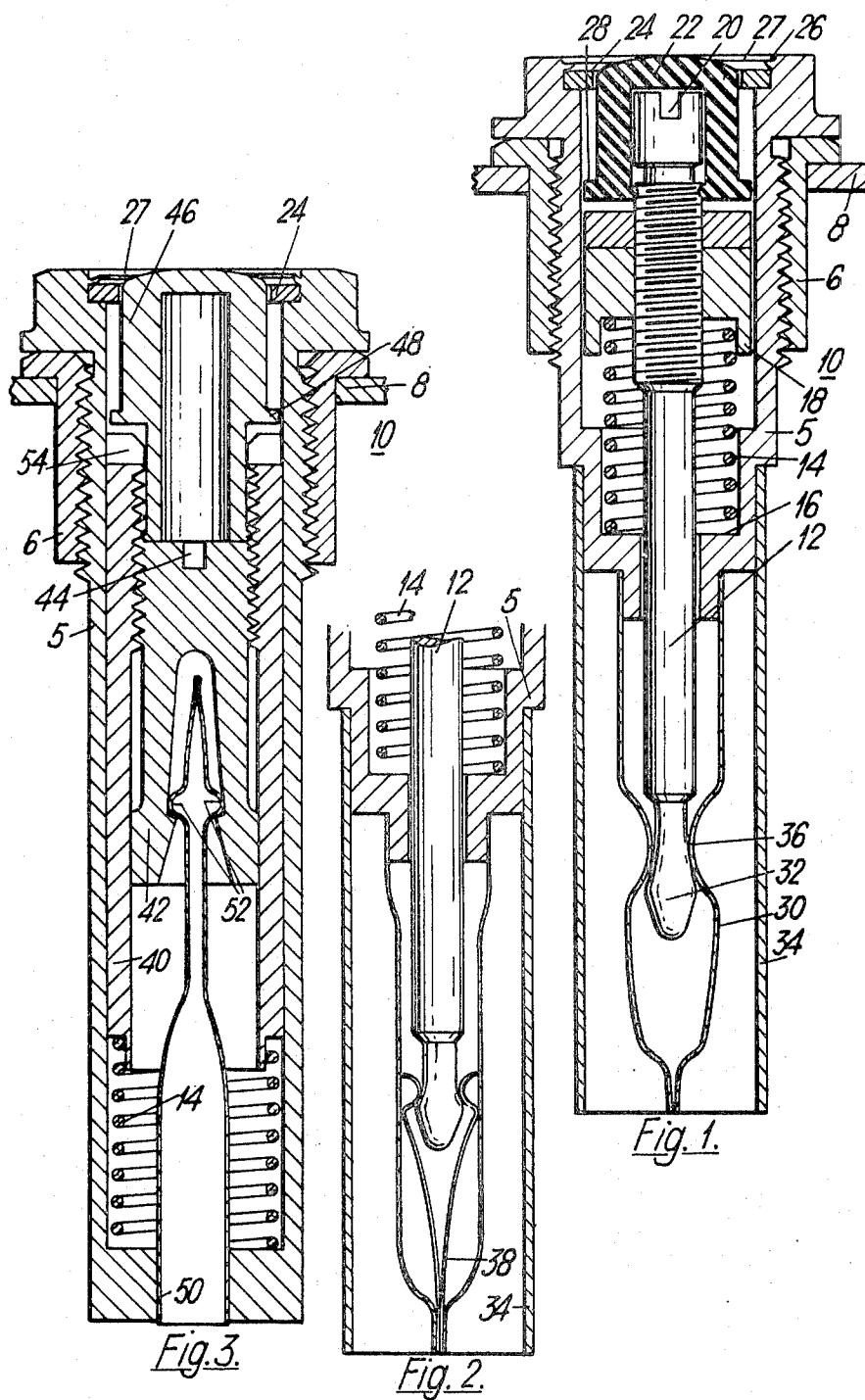
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[57] **ABSTRACT**

A pressure indicator responsive to the pressure within a fire extinguisher vessel comprises a hollow housing sealed to the vessel wall and extending inwardly of the vessel. The inner end of the housing is sealed off by attachment to the open end of a closed-off flexible-walled tube so that the pressure difference between the inside and outside of the vessel is applied across the wall of the tube. A member, slidably mounted within the housing, is spring-urged into a position in which it protrudes outwardly of the vessel. The movable member and the flexible-walled tube are provided with profiles which engage when the pressure difference applied across the wall of the tube is above a predetermined minimum and, when so engaging, hold the movable member within the housing. When the pressure difference falls, the engaging profiles release and the movable member then protrudes out of the vessel.

2 Claims, 3 Drawing Figures





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PRESSURE-RESPONSIVE APPARATUS

The invention relates to pressure responsive apparatus and more particularly to pressure indicators responsive to the pressure within fluid vessels.

According to the invention, there is provided apparatus responsive to pressure difference, comprising a movable member, biasing means mounted for acting on the member, and releasable locking means in the form of a hollow flexible-walled member which, when the said pressure difference lies to one side of a datum pressure difference and is applied between its interior and its exterior, flexes to lock the movable member in a position in which a biasing force is exerted on the movable member by the biasing means and which, when the pressure difference changes to the other side of the datum value, flexes to release the movable member which thereupon moves under the action of the biasing force to provide an indication that the pressure difference is on the said other side of the datum value.

According to the invention, there is also provided apparatus responsive to the pressure difference between the inside and the outside of a pressure vessel, comprising a rigid housing sealingly secured in a wall of the vessel so that its interior is open to the outside of the vessel and that it extends inwardly of the vessel, a member movable within the housing, spring means in the housing for acting on the member and tending to bias the member from a first position to a second position, a hollow flexible-walled member sealingly attached to that end of the housing which is inwardly of the vessel such that one side of its flexible wall is subjected to the pressure within the vessel and the other side thereof is subjected to the pressure within the housing, the flexible-walled member being provided with locking means arranged to engage the movable member in the first position when the pressure difference across the wall of the flexible-walled member exceeds a predetermined minimum value and to release the movable member when the said pressure difference becomes less than the predetermined value whereby the energy in the spring means impels the movable member to the second position to provide an indication that the pressure difference has fallen below the predetermined minimum value.

Pressure indicators embodying the invention, and for use in fire extinguishers, will now be described by way of example only, with reference to the accompanying drawings in which:

FIG. 1 is a cross-section through one of the pressure indicators;

FIG. 2 is a cross-section through part of a modified form of the pressure indicator of FIG. 1; and

FIG. 3 is a cross-section through another of the pressure indicators.

The pressure indicators to be described are for use in fire extinguishers of the type which comprise a vessel containing a fire extinguishant under pressure. When a trigger or similar means on the extinguisher is actuated by an operator, the extinguishant is ejected under pressure. The pressure indicators to be described respond to the pressure within the vessel and provide a positive signal when the pressure falls below a predetermined minimum. Thus, the pressure indicators indicate when the pressure of the extinguishant is so low that the extinguisher is no longer useful. The pressure may, for example, fall as the result of very slow leakage over a long

period of time. Alternatively of course, the pressure will fall below the predetermined minimum when the extinguisher is used.

The pressure indicator of FIG. 1 comprises a cylindrical housing 5 which is fixed by a threaded collar 6 into a wall 8 of the extinguisher vessel so as to extend into the interior 10 of the vessel. The collar 6 is arranged to prevent leakage of pressure through the opening in the wall 8 from the vessel.

The housing 5 is open-ended and incorporates a slidable control member 12 and a compression spring 14. One of the ends of the spring 14 bears on a shoulder 16 of the housing 5, and its other end bears against an adjusting member 18 which is threaded on to the member 12 and is a loose sliding fit within the housing 5.

At its upper end, the control member 12 is provided with a screwdriver slot 20 which is covered by a plunger 22. The latter may be made of brightly coloured plastics material, for example, and is attached to the member 12 by engaging the upper end of the thread thereon. It is arranged to be a clearance fit within a circlip 24 which is snapped under an inwardly projecting flange 26 at the upper open end 27 of the housing 5. The plunger 22 has a flange 28 at its lower end which cannot pass through the circlip 24 and thus co-operates with the circlip to prevent removal of the plunger 22.

At the lower, stepped end of the housing 5, a thin walled tube 30 is sealingly secured which effectively closes off the lower end of the housing and into which the control member 12 extends. This end of the member 12 is provided with a knob-like portion 32 which engages with indentations formed in the wall of the tube 30.

A protective cover 34, having an open lower end, is attached to the housing 5 and extends around the tube 30.

From the above, it will be seen that the interior of the thin walled tube 30 is subjected to atmospheric pressure which is admitted through the interior of the housing 5. The exterior of the tube 30, is however, subjected to the pressure within the vessel 10. In operation, therefore, and assuming that the pressure within the vessel is above the predetermined minimum, the tube 30 will be compressed by the pressure difference between its interior and exterior and the indentations 36 will engage the knob-like portion 32 of the member 12 and hold it in the position illustrated with the spring 14 compressed.

After use or long storage, the pressure of the fluid within the vessel 10 will be reduced thereby reducing the pressure differential between the interior and exterior of the tube 30. Once the pressure difference reaches the predetermined minimum, the security of the connection between the indentations 36 and the knob-like portion 32 of the control member 12 will be reduced to a point at which it can no longer hold the member 12 against the bias of the spring 14. The control member 12 is thus projected rapidly upwards, carrying the plunger 22 with it, until the flange 28 of the plunger engages the underside of the circlip 24. The plunger 22 now protrudes through the opening 27 and thus immediately provides a visible indication that the pressure within the extinguisher is no longer satisfactory.

When the fire extinguisher has been recharged (if it be of the rechargeable type), the pressure indicator can be reset merely by depressing the plunger 22, until the

knob-like portion of the control member 12 again engages the indentations 36, whereupon the control member 12 is held in the position illustrated.

It will be appreciated that the predetermined minimum pressure at which the control member 12 is projected upwards is determined by the compressive force exerted by the spring 14. This force can be set, when the pressure indicator is being assembled, by rotating the control member 12, using the slot 20. Such rotation determines the axial position of the adjusting member 18 along the control member 12. Thereafter, the plunger 22 is placed in position and the assembly completed by snapping in the circlip 24. The circlip 24 prevents the plunger 22 from being afterwards removed, and thus prevents unauthorised adjustment of the critical pressure.

In FIGS. 2 and 3, items corresponding to items in FIG. 1 are similarly referenced.

FIG. 2 shows a modification in which the tube 30 is not provided with indentations 36. Instead, a spring clip 38 is mounted within the tube 30 so as to engage and hold the knob-like portion 32, in the same manner as the indentations 36, when the pressure difference between the interior and exterior of the tube 30 is sufficient.

In the arrangement of FIG. 3, the housing 5 is longer than in the arrangement of FIG. 1 and is of constant internal diameter. A hollow rigid adjusting tube 40 is freely slidable within the housing 5, and compression spring 14 acts between this member and the lower end of the housing 5 to urge the tube 40 upwards. At its upper end, the tube 40 is internally threaded and engages a partially bored member 42 whose upper end has a screwdriver slot 44. A plunger 46, which may be made of brightly coloured plastics material for example, is a press fit into the adjusting tube 40, in the space above the member 42. Like the plunger 22 of FIG. 1, the plunger 46 has a flange, 48, which, in co-operation with the circlip 24, prevents complete removal of the plunger 46.

A thin walled hollow tube 50 is sealingly attached in a hole through the lower end of the housing 5 and extends upwardly into the bore of the member 42. The tube 50 has protuberances 52 which engage ridge means within the member 42 as shown.

From the above, it will therefore be seen that the interior of the tube 50 is subjected to the pressure within the fire extinguisher, while the exterior of the tube 50 is subjected to atmospheric pressure, which pressure is applied through the opening 27 in the housing. Provided this pressure difference is sufficient (that is, provided that the pressure of the fire extinguishant is above the predetermined minimum), the tube 50 is expanded so that the protuberances 52 engage the ridge means within the member 42 and hold this member, and thus the tube 40, in the position illustrated. Therefore, the plunger 46 is held below the level of the opening 27. When the pressure of the fire extinguishant falls below the predetermined minimum, however, the tube 50 tends to collapse. The locking engagement between the protuberances 52 and the member 42 is thus weakened, and the compressive force of the spring 14 forces the members 40 and 42 upwards until the shoulder 48 on the plunger 46 engages the underside of the circlip 24. The plunger 46 is thus now protruding from the opening 27 and gives an immediate visual warning that

the pressure within the extinguisher is below the predetermined minimum.

If the extinguisher be of the rechargeable type, then, after recharging, the apparatus can be reset by pressing the plunger 46 inwardly of the opening 27. The pressure difference between the interior and the exterior of the tube 50 causes the protuberances 52 to engage with the member 42 so as to hold the apparatus in the position illustrated, against the force of the spring 14.

The predetermined minimum pressure at which the apparatus operates can be adjusted while the apparatus is being assembled. Before the plunger 46 and the circlip 24 are fitted, the position of the tube 40 on the member 42 is adjusted by means of the screwdriver slot 44, the tube 40 being prevented from rotating during this process by means of wings 54. When the relative position of the adjusting tube 40 on the member 42 corresponds to the desired operating pressure, the plunger 46 is press-fitted into the tube 40 and the circlip 24 is then snapped into position. Thereafter, the plunger 46 cannot be removed, and unauthorised adjustment of the predetermined operating pressure is thus prevented.

The thin walled tubes 30, 50 can be constructed of various suitable materials and can simply, for example, be composed of the well known Bourdon type tubing or thin plastics material. It will be seen that tubes 30, 50 are, in both embodiments, protected by being partially enclosed with a concentric guard.

The pressure indicators described are particularly suitable for sensing the pressure within a fire extinguisher, since they are relatively less expensive and less bulky than a pressure gauge, for example, which could not be fitted economically to a simple fire extinguisher. It will be appreciated, however, that the pressure indicators described can be fitted to other pressure vessels and can be modified to respond to an increase of pressure difference instead of a decrease.

In the modification, the plunger 22 or 46 may be arranged to operate an electrical alarm circuit, such as incorporating a micro switch positioned to be operated by the ejected plunger, for example.

What is claimed is:

1. Apparatus responsive to pressure difference between the pressure inside the vessel of a pressurized fire extinguisher and the pressure outside the vessel, comprising

a rigid housing sealingly secured in the vessel wall to extend inwardly of the vessel with its interior open to the outside of the vessel,

a hollow flexible-walled tube closed off at one end, defining at least one indentation in its wall, and mounted inside the vessel with its other end sealingly secured to that end of the housing which is inwardly of the vessel so as to close off the housing from the pressure within the vessel, whereby the outside of the tube is subjected to the pressure within the vessel and the inside of the tube is subjected to the pressure within the housing,

a member slidably mounted within the housing so as to extend inwardly of the said tube, the surface of the movable member defining a recess matching the said indentation in the wall of the flexible tube so that a pressure excess on the exterior of the tube causes its flexible wall to flex whereby its indentation lockingly mates with the recess in the slidable

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member when the latter is in a predetermined position,
biasing means in the housing and acting on the slidable member and adapted to overcome the locking action between the mating indentation and recess when the said pressure excess falls below a predetermined limit and then sliding the member towards the outside of the vessel, and
means on the slidable member arranged to provide a visible indication when the member has been slid-
den towards the outside of the vessel by the biasing

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means.
2. Apparatus according to claim 1, including an intermediate member adjustably attached to the movable member and through the intermediary of which the biasing means acts on the movable member, the intermediate member being adjustable relative to the movable member so as to determine the biasing force exerted by the biasing means when the movable member is held by the flexible-walled member in the locking position.

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