

United States Patent

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[54] PRESSURE INDICATOR

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169/31, 340/373

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73/390, 406, 409, 299, 388; 340/366, 373

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[57]

ABSTRACT

A device for indicating pressure within a pressure vessel comprises a housing having a depression forming interior sidewalls and a bottom wall, window pane means closing an open end of the depression, an elastomeric diaphragm fitted within the housing depression and sealed between the window pane means and the bottom wall to define with the window pane a sealed chamber containing air to form air spring means urging the diaphragm away from the window. Passage-way means direct a pressure source to be measured to a side of the diaphragm opposite the air spring. Upon a sufficient increase in pressure of the source, the elastomeric diaphragm flexes toward the window pane to operate indicating means in the sealed chamber to move the indicating means to a position visible through the window pane, thereby indicating an increase in pressure.

14 Claims, 9 Drawing Figures

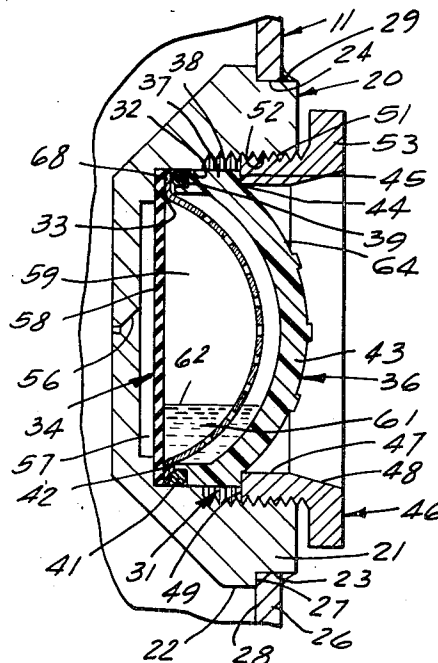


Fig. 2

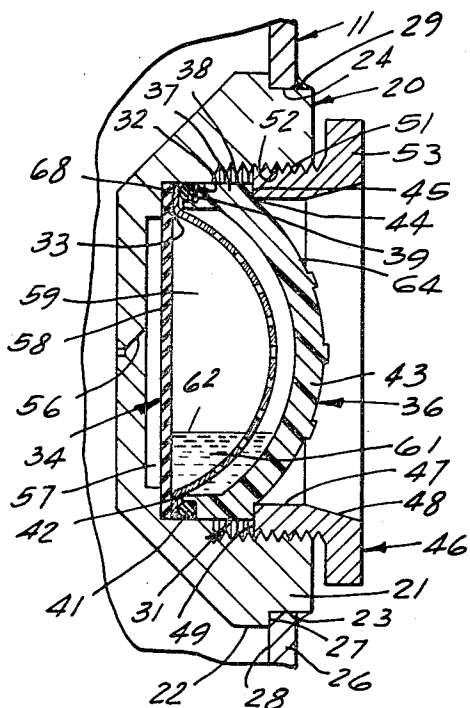


Fig. 3

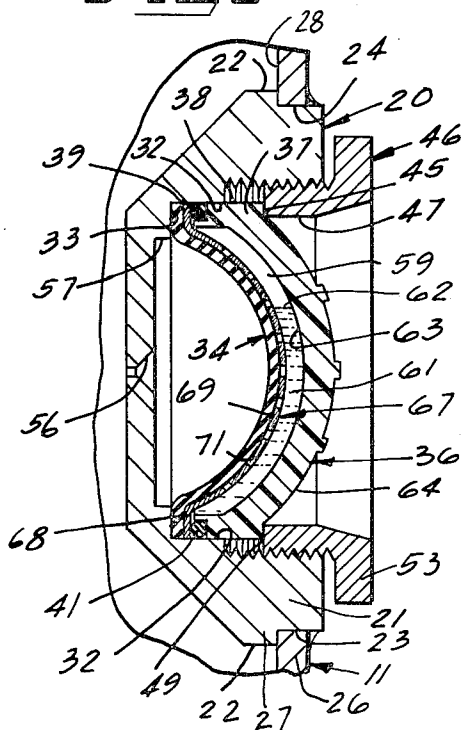


Fig. 1

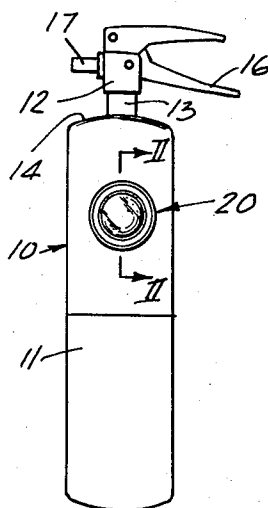


Fig. 4

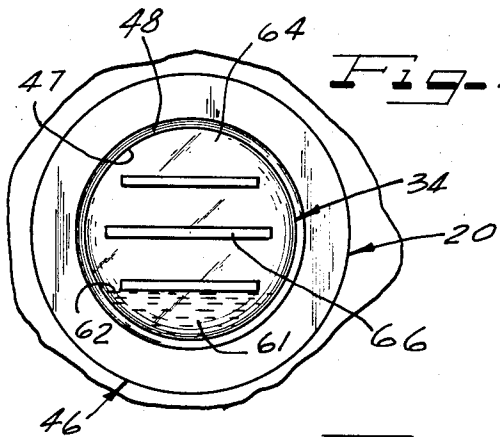
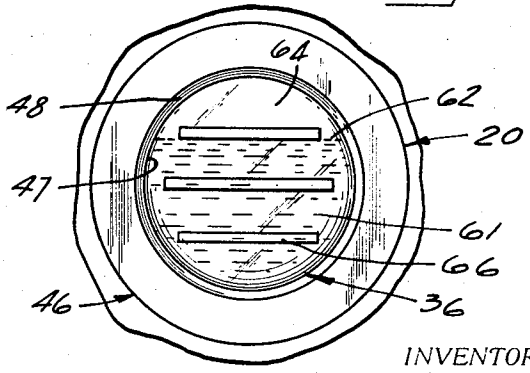


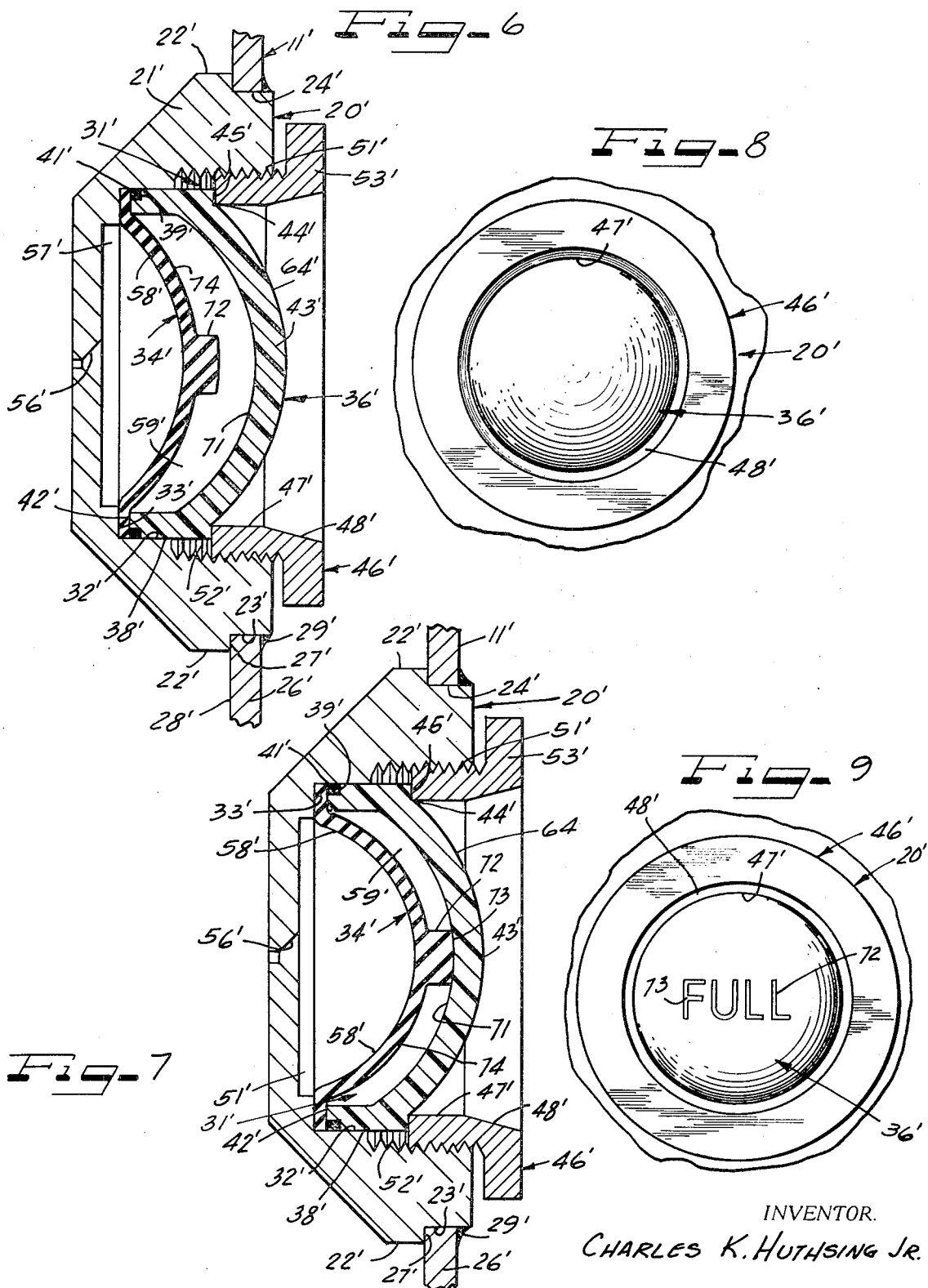
Fig. 5



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PRESSURE INDICATOR

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of Application Ser. No. 828,468, filed May 28, 1969.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to pressure indicators, and more particularly refers to an inexpensive device for indicating pressure within small pressure vessels, such as cylinders containing pressurized materials.

2. Description of the Prior Art

Numerous pressure indicating devices have been proposed heretofore, and the prior art includes devices for indicating a specific pressure over a given range or for indicating that a pressure is above or below a preselected value.

With a fire extinguisher utilizing pressurized chemical fire extinguishing material and other small pressurized containers it may be necessary, for safety purposes, to have an indication of whether the material contained within the container is at a sufficient pressure to be properly discharged or at a dangerous overcharged pressure. Most fire extinguishers of the pressurized chemical type have usually been equipped with a standard Bourdon tube type pressure indicator having a dial divided into appropriate ranges to indicate the pressure of the fire extinguishing material.

The prior art has not provided a simply constructed and inexpensive device for indicating pressure within a vessel or container and which may be sealed into an appropriately formed aperture of a sidewall of the pressure vessel.

SUMMARY OF THE INVENTION

A pressure indicator constructed in accordance with the principles of the present invention includes a housing having a substantially cylindrical depression forming cylindrical, interior sidewalls and a bottom wall, means forming a lens or window pane closing an open end of the depression, an elastomeric diaphragm fitted within the housing depression and sealed between the window pane means and the bottom wall to define with the window pane means a sealed chamber containing air to form spring means urging the diaphragm away from the window pane. Indicating means are contained within the sealed chamber and move in response to flexing of the diaphragm toward the window pane means to a position visible through the window pane means to indicate pressure above a preselected value.

The housing has a cylindrical outer periphery sized to sealingly fit within an appropriately formed aperture in a sidewall of a pressure vessel, such as a fire extinguisher cylinder containing pressurized chemical fire extinguishing material. Passageway means providing fluid communication between an interior of the pressure vessel and a side of the diaphragm opposite the sealed chamber are formed within a bottom wall of the housing and may include an orifice centrally disposed through a bottom wall of the housing depression. If desired, the pressure indicator housing means may include an appropriately formed coupling member en-

gaging a fitting formed on the pressure vessel and providing fluid communication to the side of the diaphragm opposite the sealed chamber.

The pressure required to flex the elastomeric diaphragm outwardly toward the window pane means depends upon the flexibility of the diaphragm and pressure of air contained within the sealed chamber and forming an air spring urging the diaphragm inwardly away from the window pane means. When a pressure indicator constructed in accordance with the principles of the present invention is utilized to indicate the amount of pressure contained within a fire extinguisher, the elastomeric diaphragm and air spring means may be designed so that the diaphragm flexes outwardly toward the window pane means whenever the pressure within the fire extinguisher equals a pressure resulting from the extinguisher containing a sufficient amount of pressurized fire extinguishing material to properly function. On the other hand, the indicator should be designed to return to a normal, non-indicating position in response to a decrease in pressure resulting from the fire extinguishing material being sufficiently discharged to render the extinguisher inoperable.

In one embodiment of the present invention, indicating means contained within the sealed chamber include a colored liquid partially filling the sealed chamber whenever the diaphragm is in the normal, unflexed position. Upon an increase in pressure causing the diaphragm to flex outwardly toward the window pane means, a volume of the sealed chamber is decreased, thereby pushing an upper liquid level or surface of the colored liquid upwardly along an inside surface of the window pane means to indicate increases in pressure. The window pane means may include appropriately positioned markings or indicia vertically spaced along a surface thereof to indicate various pressures within the pressure vessel.

To prevent the flexible diaphragm from contacting the window pane means and thus cause disproportionate movement of the liquid level within the sealed chamber, a foranimous member is interposed between the diaphragm and the window pane means to limit and control flexing of the elastomeric diaphragm.

Another form of the present invention contemplates providing indicating means moving in response to increases in pressure and including a frosted surface formed on the window pane means and facing inwardly of the sealed chamber and raised indicia projecting from a surface of the elastomeric diaphragm inwardly of the sealed chamber. Normally the raised indicia are out of contact with the frosted surface, and thus, the window pane appears blank when viewed from the outside. Upon a sufficient increase in pressure, the elastomeric diaphragm including the raised indicia flexes to a position wherein the raised indicia intimately contact the inside frosted surface of the window pane means, thereby rendering the raised indicia visible through the window pane.

A pressure indicator including the last mentioned indicating means is particularly adapted to indicate pressures above or below a preselected value. In reference to fire extinguishers, the preselected value, controlled by flexing characteristics of the diaphragm and pressure within the sealed chamber, is a pressure resulting

from the fire extinguisher containing a sufficient amount of pressure to properly function.

Accordingly, it is a primary object of the present invention to provide a device for indicating pressure within a pressure vessel and including an elastomeric diaphragm movable toward and away from a window pane means in response to changes of a measured pressure in a manner to operate indicating means disposed within a sealed chamber defined between the diaphragm and the window pane means.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the present invention will be readily apparent from the following description of preferred embodiments thereof, taken in conjunction with the accompanying drawings, although variations and modifications may be affected without departing from the spirit and scope of the novel concepts of the disclosure, and in which:

FIG. 1 is a side elevational view of a fire extinguisher incorporating a pressure indicator constructed in accordance with the features of the present invention;

FIG. 2 is an enlarged sectional view taken approximately along line II-II of FIG. 1 and illustrating a pressure indicator of the present invention with an elastomeric diaphragm thereof in an unflexed position;

FIG. 3 is an enlarged sectional view similar to FIG. 2 and illustrating the indicator of FIG. 2 with an elastomeric diaphragm thereof in a flexed position;

FIGS. 4 and 5 are enlarged elevational views respectively illustrating outward appearances of the indicator when the elastomeric diaphragm is in the positions shown in FIGS. 2 and 3;

FIG. 6 is an enlarged sectional view similar to FIG. 2 and illustrating an alternative embodiment of the present invention with an elastomeric diaphragm thereof in an unflexed position;

FIG. 7 is an enlarged sectional view of the indicator of FIG. 6 and illustrating the elastomeric diaphragm in a flexed position; and

FIGS. 8 and 9 are enlarged elevational views respectively illustrating outward appearances of the indicator of the alternative embodiment when the diaphragm is in the positions shown in FIGS. 6 and 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, there is shown a fire extinguisher 10 including a cylinder 11 containing a pressurized fire extinguishing material and mounting an outlet control valve 12. The cylinder 11 may be constructed of two halves telescoped together and sealed by brazing or other suitable sealing means. The outlet control valve 12 threadingly engages an appropriately formed fitting 13 brazed or otherwise sealed into an aperture formed in an upper domed wall 14 of the cylinder 11. The outlet control valve 12 has a manually operable actuating handle 16 by means of which the supply of fire extinguishing material within the cylinder 11 may be selectively released. Accordingly, when open, the outlet valve 12 will permit the pressurized fire extinguishing material to discharge through an outlet orifice 17.

For safety purposes, it is necessary to have an indication of the pressure within the cylinder 11. A pressure

indicator 20 is mounted on the fire extinguisher 10 in a manner to indicate pressure within the cylinder 11.

In accordance with the principles of one embodiment of the present invention, the pressure indicator 20 as illustrated in detail in FIGS. 2 through 5, inclusive, includes a substantially cup-shaped housing 21 having a cylindrical outer wall 22 characterized by a reduced diameter portion 23 sized to snugly fit within an aperture 24 formed within a sidewall 26 of the cylinder 11. The reduced portion 23 forms an annular shoulder 27 having an arcuate configuration in top plan view formed complementary to a curvature of an interior surface 28 of the cylinder sidewall 26. To prevent leakage of the fire extinguishing material contained within the cylinder 11, the housing 21 is sealed into the aperture 24 by means of brazing, welding or other means as at 29. The housing 21 has a centrally formed depression or bore 31 characterized by an interior, cylindrical sidewall 32 and a bottom wall 33.

Actuating means for the pressure indicator 20 include an elastomeric diaphragm 34 composed of rubber-like material and sized to snugly fit within the cylindrical sidewall 32 and abut against the bottom wall 33.

An open end of the depression 31 is sealingly closed by means forming a window pane or lens 36. The window pane 36 has an annular rim portion 37 characterized by a cylindrical outer wall 38 sized to snugly fit within the cylindrical depression sidewall 32. The rim portion 37 is characterized by a circumferential notch 39 receiving an O-ring seal member 41 and configured to permit the seal ring, in an uncompressed condition, to extend outwardly beyond the cylindrical sidewall 38 and a bottom wall portion 42 of the rim 37, thereby enabling the O-ring seal 41 to be compressed into sealing engagement with abutting wall surfaces. The window pane means 36 also includes a centrally disposed, domed portion 43 bulging outwardly of the depression 32 and composed of substantially transparent material. The domed portion 43 has an outer peripheral edge as at 44 terminating inwardly of the cylindrical sidewall 38, thereby forming an annular, peripheral shoulder portion providing an engagement surface 45 for retaining means.

Retaining means holding the window pane means 36 and the elastomeric diaphragm 34 in sealed assembly within the depression 32 of the housing 20 include a retaining nut or ring 46 having a central throughbore 47 sized coterminous with the outer peripheral edge 44 of the domed portion 43 and characterized by an outwardly flared section 48. An annular bottom wall 49 of the retaining ring 46 abuts against the annular engagement surface 45 of the window pane means 36. The retaining ring 46 has an externally threaded portion 51 threadingly engaging complementary internal threads 52 on the housing depression sidewall 32, thereby clamping the window pane means 36 and the elastomeric diaphragm 34 between the retaining means 46 and the depression bottom wall 33 and squeezing the O-ring 41 into sealing engagement with surrounding wall surfaces.

Means enabling grasping of the retaining ring 46 may include circumferential flats formed on a radially outwardly offset portion 53 and arranged to be engaged by an appropriate wrench, or appropriately formed slots

or apertures arranged to be engaged by a spanner wrench or the like.

In order to provide fluid communication between an interior of the cylinder 11 and the pressure indicator 20 for transmitting pressures within the cylinder to the indicator, the bottom wall 33 of the housing 20 has a centrally disposed orifice 56 opening from the cylinder interior into a recess 57 defining with the elastomeric diaphragm 34 in an unflexed position, as illustrated in FIG. 2, a pressure chamber disposed adjacent an inwardly facing side surface 58 of the diaphragm.

Spring means counteracting pressure within the cylinder 11 and urging the diaphragm 34 away from the window pane means 36 and toward the unflexed position include pressurized gas, such as air, contained within a sealed chamber 59 defined by the diaphragm, the depression sidewall 32 and the window pane means 36. Thus, a preselected pressure which will cause the diaphragm 34 to flex outwardly toward the window pane means 36 is dependent upon flexing characteristics of the diaphragm and pressure within the sealed chamber 59.

It is contemplated by the first embodiment of the present invention that an indicating means moving in response to flexing of the elastomeric diaphragm 34 include an opaque or colored fluid as at 61 partially filling the sealed chamber 59. Whenever pressure within the cylinder 11 increases above the preselected value, the diaphragm 34 flexes outwardly toward the window pane means 36, as illustrated in FIG. 3, to reduce a volume of the sealed chamber 59, thereby moving the liquid level as at 62 upwardly along an inside face surface 63 of the window pane means 36. Thus, the liquid level 62 moves upwardly within the pressure indicator 20 in response to increases in pressure within the cylinder 11 above the preselected value.

Indicia of the pressure within the cylinder 11 may be carried on an outer surface 64 of the window pane means 36. The indicia may include vertically spaced stripes or raised, opaque strips as at 66. With particular reference to use of the pressure indicator 20 with a fire extinguisher, the strips 66 may be three in number, as illustrated in FIGS. 2 through 5, inclusive, and labeled to indicate the condition of the fire extinguishing material, for example, from top to bottom, — "overcharged," "operable" and "discharged."

In order to prevent the elastomeric diaphragm 34 from flexing into contact with the inside wall 63 of the window pane means 36 and thereby causing disproportionate movement of the liquid 61 within the sealed chamber 59, a foraminous spacer 67 is interposed between the window pane means 36 and the elastomeric diaphragm 34. The spacer 67 has an annular, peripheral portion 68 clamped between the diaphragm 34 and the seal ring 41 and a centrally disposed domed portion 69 having a plurality of apertures as at 71. The domed portion 69 is spaced inwardly of the inside surface 63 of the window pane 36 and has a curvature substantially complementary to the curvature of the domed portion 43. As the elastomeric diaphragm 34 flexes outwardly in response to increases in pressure within the cylinder 11, the liquid 61 on a side of the spacer 67 adjacent the diaphragm is pushed through the plurality of apertures 71, and upwardly along the inside wall surface 63 of the window pane 36.

In accordance with an alternative embodiment of the present invention, as illustrated in FIGS. 6 through 9, inclusive, the liquid-type indicating means of the first embodiment is replaced by an indicating means presenting a visible indicia whenever pressure within the cylinder 11 exceeds a preselected value, for example a value indicating sufficient pressurized fire extinguishing material contained within the cylinder 11 to render the fire extinguisher operable. With the exception of the indicating means, the pressure indicator 20' of this embodiment of the present invention is identical to the indicator 20 of the first embodiment, and thus, similar elements are identified with like reference characters to which a prime has been added.

The indicating means of this embodiment of the present invention include a frosted inwardly facing surface 71 formed on the domed portion 43' of the window pane means 36', thereby rendering the domed portion 43' substantially translucent, and projections or raised portions as at 72 on the diaphragm 34' projecting toward the inwardly facing, frosted surface 71 and spaced therefrom whenever the diaphragm is in an unflexed or relaxed position.

Due to the translucence of the domed portion 43' of the window pane means 36', the raised portions 72 on the diaphragm 34' are not visible through the window pane unless the raised portions are moved into intimate contact with the frosted surface 71. Thus, upon increases in the pressure within the cylinder 11' above a preselected value, the raised portions 72 on the elastomeric diaphragm 34' are moved into intimate contact with the frosted surface 71, thereby rendering the raised portions 72 visible through the window pane 36' to indicate that pressure within the cylinder is above the preselected value. To enhance visibility of the projections 72 through the window pane 36', the frosted surface 71 may be coated with a silicone grease and outwardly projecting face surfaces as at 73 of the raised portions 72 may be brightly colored.

When the pressure indicator 20' is utilized to indicate amounts of pressure contained within a fire extinguisher, the pressure within the sealed chamber 59' and the flexing characteristics of the diaphragm 34' are arranged so that the raised portions 72 are held into intimate contact with the frosted surface 71 whenever a sufficient amount of pressure is contained within the cylinder 11' to render the extinguisher operable. Also, the raised projections 72 may be configured to form the word "FULL", as illustrated in FIG. 9.

If desired, the projections 72 may be replaced by indentations (not shown) formed in an outwardly facing surface 74 of the diaphragm 34'. With that arrangement, the preselected pressure value flexes the diaphragm 34' into intimate contact with the frosted surface 71 so that only the indented portions appear frosted while surrounding areas of the surface 74 are visible through the window pane means 36'.

From the foregoing description, it should be noted that all embodiments of the present invention include indicating means moving to a visible position to indicate pressures within a pressure vessel above preselected values in response to outward flexing of an elastomeric diaphragm.

I claim:

1. A pressure indicating device in pressure communication with a pressure vessel, said device comprising a housing having a depression forming a bottom wall and interior side walls; a window pane means closing the open end of said housing; a resilient diaphragm fitted within said housing depression, said diaphragm being sealed between said window pane means and said bottom wall and defining a first sealed chamber with said window pane means and said interior side walls; a spacer means mounted within said chamber operable to keep said diaphragm in predetermined spaced relation with said window pane means; passageway means providing said pressure communication between said pressure vessel and one side of said diaphragm opposite said first chamber; an indicating means in said first chamber acted on by said diaphragm in response to a change in pressure within said vessel and movable to a position where, in cooperation with said spacing means, it is visible through said window pane means to indicate pressure within the vessel.

2. A device for indicating pressure as defined in claim 1 and further characterized by said indicating means including fluid contained within, and partially filling, said first chamber and moving upwardly along an inside wall surface of said window pane means in response to action by said diaphragm in response to a change in pressure within said vessel.

3. A device for indicating pressure as defined in claim 1 and further characterized by said indicating means including a frosted surface formed on said window pane means and confronting said resilient diaphragm; and wherein said spacing means and said indicating means includes raised portions on said diaphragm projecting toward said frosted surface and movable by changes in pressure within the vessel into contact therewith to be visible through said window pane means.

4. A device for indicating pressure as defined in claim 2 and further characterized by said pane means having a substantially transparent, outwardly domed central portion; and indicia means on said domed portion to indicate pressure levels.

5. A device for indicating pressure as defined in claim 2 and further characterized by said spacing means forming a foraminous member interposed between said diaphragm and said window pane means in a manner to prevent said diaphragm from flexing into contact with said window pane means.

6. A pressure indicator device in pressure communication with a pressure vessel, said device comprising a housing means having a closed chamber means therein, said chamber means being bounded in part by a translucent viewing means and in part by a first side surface of a resilient diaphragm; said resilient diaphragm having a second side surface in said pressure communication with said pressure vessel and subject to the pressure in said vessel; a spacer means mounted within said chamber operable to keep said first side surface of said diaphragm in predetermined spaced relation with said viewing means; an indicating means in said chamber being acted on by said diaphragm in response to a change in pressure within said vessel to move to a position where it visibly indicates a change of pressure

within said vessel.

7. A pressure indicating device according to claim 6 wherein said indicating means includes fluid within said first chamber which is movable in response to movement of said diaphragm to a position where it is visible through said viewing means.

8. A pressure indicating device in accordance with claim 7 wherein said spacer means includes a foraminous member in said chamber interposed between said diaphragm and said viewing means in a spaced relation with said viewing means to prevent said diaphragm from flexing into contact with said viewing means.

9. A pressure indicating device according to claim 6 wherein said viewing means has a frosted interior surface and wherein said spacing means and said indicating means includes a raised portion on said first side surface of said diaphragm and raised portion being movable in response to an increase in pressure within said vessel into contact with said frosted surface so as to be clearly visible through said viewing means.

10. A pressure indicating device according to claim 9 wherein said raised portion has a frosted surface contacting legible indicia configuration.

11. A pressure indicating device in pressure communication with a pressurized vessel, said device comprising a housing having a closed chamber means therein, said chamber means being bounded in part by a viewing means and in part by a first side surface of a resilient diaphragm, said viewing means having an inside frosted surface, said resilient diaphragm having a second side surface in pressure communication with a pressure vessel and subject to the pressure in said vessel, said first side surface of said resilient diaphragm having raised indicia means thereon whereby when said diaphragm is acted on by said pressure in said vessel and said indicia means is brought into contact with said frosted surface said indicia means will be clearly visible through said viewing means.

12. A pressure indicating device according to claim 11 wherein said frosted surface is coated with a silicone grease means.

13. A pressure indicating device according to claim 11 wherein said chamber is sealed and has therein a spring means.

14. A pressure indicating device in pressure communication with a pressurized vessel, said device comprising a housing having a closed chamber means therein, said chamber means being bounded in part by a viewing means and in part by a first side surface of a resilient diaphragm, said viewing means having an inside frosted surface, said resilient diaphragm having a second side surface in pressure communication with a pressure vessel and subject to the pressure in said vessel, said first side surface of said resilient diaphragm having indicia means thereon, said indicia means comprising indentations in said first side surface whereby when said diaphragm is acted on by said pressure in said vessel to flex it into engagement with said frosted surface the indented portions will appear frosted and the surrounding areas will be visible through the viewing means so that the indicia will be clearly visible.

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