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FLUID ACTUATED VISUAL INDICATOR

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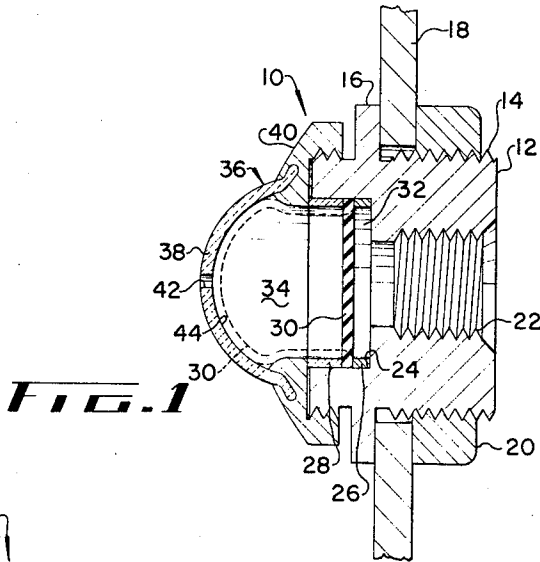


FIG. 1

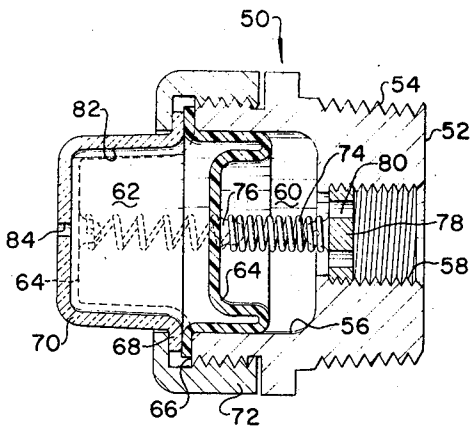


FIG. 2

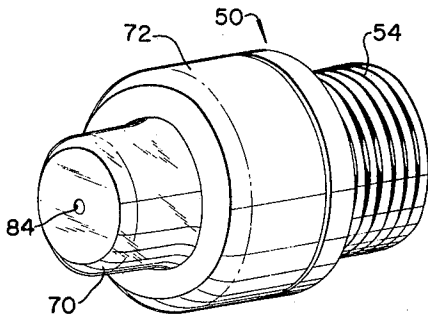


FIG. 3

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## FLUID ACTUATED VISUAL INDICATOR

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2 Claims

### ABSTRACT OF THE DISCLOSURE

An indicator device comprising a casing divided into two chambers by a flexible diaphragm element. One chamber of the casing comprises a window having a bowl or hemispherical shape. Under the urging of pressure fluid conducted to the opposing chamber, the flexible diaphragm is forced against the surface of the bowl shaped window to give an omnidirectional visual display.

### BACKGROUND OF THE INVENTION

In pressure fluid systems visual indicators which are operated on directly by the fluid used in the system are often preferred for indicating or displaying a pressure condition commensurate with a specific function or position of a machine element. Fluid actuated indicators are highly reliable and generally less costly than types which require electric power, and they are ideal for use in environments where explosives substances are present.

An example of a pressure fluid actuated visual indicator is disclosed in U.S. Patent 3,372,501 issued to G. B. Greene. The construction of the indicator disclosed by Greene requires a plate element to carry the indicia since the diaphragm disclosed is not capable of conforming to the shape of the translucent window. Furthermore, the indicator of Greene does not provide omnidirectional visibility in a 180° hemispherical field of view but requires almost direct viewing along a line of sight nearly perpendicular to the plane of the window. Display or indicator devices in the prior art also require the translucent characteristic of the window as disclosed in the Greene patent or the window must be of a primarily planar shape to prevent the indicia from being visible in the indicator "off" position and thereby giving a false reading. Both of these characteristics of window design limit visibility in the actual "on" position thereby making the prior art devices less effective in attracting the human visual senses.

### SUMMARY OF THE INVENTION

The present invention provides a visual indicator device which is actuated directly by pressure fluid operating on a stretchable diaphragm or the like which comprises an indicia viewable through a bowl shaped or concave window when the indicator is in the "on" position. A particular advantage of the present invention is the provision of an indicator device having omnidirectional viewing characteristics in a 180° hemispherical field. The invention also provides for an actuating diaphragm which is stretchable or deformable to conform to the shape of a bulbous or bowl shaped window thereby making the indicator capable of greater visibility than known devices.

Still another advantage of the invention resides in the provision of a diaphragm comprising resilient means to retract the indicia from view when the pressure fluid signal is off. Yet another advantage of the visual indicator disclosed herein is the provision of an indicia carrying diaphragm which is substantially retractable in the indicator "off" position thereby permitting the use of a clear transparent window with omnidirectional viewing characteristics without any danger of giving erroneous

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"on" signals when the indicia carrying diaphragm is actually in the "off" position.

The present invention provides for a fluid actuated visual indicator which is simple in construction, compact, and requires a minimum number of parts to perform the intended function. Other objects and advantages will be appreciated upon reading the description of the preferred embodiments.

### BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional view of an embodiment of a fluid actuated visual indicator comprising a stretchable diaphragm element.

FIG. 2 is a sectional view of an alternate embodiment of a fluid actuated visual indicator comprising a flexible rolling diaphragm element.

FIG. 3 is a perspective view of the embodiment shown in FIG. 2.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a preferred form of the fluid actuated visual indicator is generally designated by the numeral 10. The indicator 10 comprises a casing member 12 having an externally threaded portion 14 and a circumferential shoulder 16 for making the indicator adaptable to be mounted in an instrument panel 18 or other suitable display module. As can be seen in FIG. 1, the indicator 10 is secured to the panel 18 by a nut 20. Obviously, the external configuration of the casing 12 could be modified to suit other means of mounting. The casing 12 is provided with a partially threaded conduit 22 opening into a cylindrical recess 24 formed in the casing. Securely clamped within the cylindrical recess 24 between annular rings 26 and 28 is a flexible diaphragm element 30 which divides the space formed by the recess 24 into a chamber 32 in communication with the threaded conduit 22 and a chamber 34. The diaphragm 30 is sealingly clamped by the rings 26 and 28 and against the wall of the recess 24 to prevent pressure fluid admitted to the chamber 32 from leaking into the chamber 34. The assembly of the annular rings 26 and 28 and the diaphragm element 30 is retained in the recess 24 by a cover member 36 which comprises a window 38 having a bulbous or bowl shaped surface geometry. The window 38 is formed integral with a threaded bezel 40 threadedly secured to the casing 12. The window 38 is preferably constructed of impact resistant transparent plastic or other suitable light admitting material. Although the present invention contemplates an indicator in which the viewing window is completely transparent, a translucent or so-called frosted material may be used as in certain prior art devices. The chamber 34 formed between the cover member 36 and the diaphragm element 30 is vented to the ambient pressure via a small orifice 42 in the window 38.

A particularly advantageous aspect of the present invention depends on the construction of the flexible diaphragm element 30 which in the embodiment of FIG. 1 is formed of a stretchable or distendable material such as latex rubber or the like. In the relaxed condition shown by the solid lines defining the planar disk shape, the diaphragm element 30 is retracted into the recess 24 of the casing 12 substantially to prevent any appearance from an external point of view that the indicator is "on." However, with the admission of pressure fluid, into the chamber 32 by way of suitable conduit means (not shown) connected to the threaded conduit 22, pressure forces will stretch the diaphragm element to conform to the shape of the window 38 as shown by the dashed line. With the distended diaphragm element 30 lying against the inner surface 44 of the window 38, the diaphragm

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will be clearly viewable and will represent the "on" condition of the indicator. Venting of pressure fluid from the chamber 32 will permit the elastic memory of the diaphragm element 30 to provide for retraction to the "off" position where it resumes the planar shape illustrated by the solid lines.

The visibility of the indicator 10 is particularly enhanced by the provision of the bulbous or bowl shaped window 38 having a 180° hemispherical field of view. By providing a stretchable material for the diaphragm element 30 which is virtually completely conformable to the inner surface 44 of the window 30, the shape of the window itself can be such as to maximize the viewing angle of the indicator.

The visibility of the indicator 10 can, of course, be further enhanced by the choice of color of the diaphragm element 30, and fluorescent type paint or other highly reflective coatings may also be used. Suitable indicia in the form of numbers or lettering may also be embossed on the diaphragm for specific applications of the indicator.

An alternate embodiment of a fluid actuated visual indicator is illustrated by the sectional view of FIG. 2 and the perspective view of FIG. 3 and is generally designated by the numeral 50. The indicator 50 comprises a casing 52 having an externally threaded portion 54 for threadedly attaching the indicator 50 to a panel, tool, or machine element (not shown) in a complementary threaded bore. The casing 52 comprises a cylindrical recess 56 communicating with the exterior of the indicator 50 by way of the threaded conduit 58. The cylindrical recess 56 is divided into chamber 60 and 62 by a flexible diaphragm element 64 commonly known as a rolling diaphragm. The diaphragm element 64 is sealingly clamped between the end face 66 of the casing 52 and a flange portion 68 of a cover member comprising a modified bulbous window 70 which in turn is secured to the casing 52 by a threaded retaining nut 72.

The window 70 is preferably formed of the same transparent material as the window 38 of the indicator 10 shown in FIG. 1. The generally bulbous surface geometry of the window 70 is modified, however, to more readily provide for complete conforming of the rolling diaphragm element 64 against the inner surface 82 of the window in the indicator "on" position represented by the dashed line.

The diaphragm element 64 is suitably made of a flexible material such as neoprene but is not required to be stretchable or distendable in the sense that the diaphragm 30 is. Retraction of the diaphragm 64 into the recess 56 to be in the indicator "off" position is provided by resilient means such as the coil spring 74 attached to the diaphragm 64 at the tab 76 and to the casing 52 by way of the spring retainer plate 78 which is threadedly retained in the conduit 58. The diaphragm 64 may also be molded with an elastic memory tending to bias the diaphragm in the retracted or "off" position whereby the spring 74 could be eliminated.

Actuation of the indicator 50 to turn "on" is similar to the indicator 10 of FIG. 1. Pressure fluid admitted to the chamber 60 by way of the conduit 58 and the openings 80 in the plate 78 will force the diaphragm 64 to conform to the inner surface 82 of the window 70. Venting of the chamber 60 by suitable means (not shown) in the fluid system to which the indicator is connected will permit the spring 74 to retract the diaphragm 64 into the recess 56 corresponding to the "off" position. The chamber 62 is vented to the ambient pressure by way of the orifice 84 in the window 70. As can readily be seen, the indicator 50 also presents a greater field of view than prior art devices due to the diaphragm 64 being conformable to the shape of window 70 which has a 180° hemispherical field of view. As in the embodiment of FIG. 1 suitable high visibility indicia may be placed on the diaphragm 64 using light reflective substances to further enhance the effectiveness of the indicator 50.

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The indicators 10 and 50 are basically operable to turn "on" in response to a pressure differential across the diaphragm elements, and in response to no difference in pressure across the diaphragms to turn "off." It can therefore be readily appreciated that rather than venting the chambers 34 and 62 on the respective indicator 10 and 50 to atmosphere as the preferred embodiments disclose that, as in certain prior art devices, suitable conduit means could be provided to be in communication with any point in a fluid system where it would be desired to give indication of a change in pressure. Therefore, the indicators could readily be modified for use in any fluid system where differential pressures are present and indication of the same is desired.

It will also be obvious to those skilled in the art that the pressure sensitivity of the indicator 10 can be varied by altering the thickness of the diaphragm 30 and in the indicator 50 by substituting various retraction springs for the spring 74.

What is claimed is:

1. A visual indicator comprising:

a casing including a recessed portion;

a cover member mounted on said casing over said recess, said cover member comprising a window having a light admitting surface of substantially bulbous configuration;

a flexible rolling diaphragm comprising indicia means mounted within said recess and forming therewith a chamber;

conduit means in said casing in communication with said chamber for admitting pressure fluid thereto to exert pressure force on said rolling diaphragm; and said rolling diaphragm being operable in response to pressure force exerted thereon to conform to said light admitting surface of said window whereby said indicia means is viewable from at least a hemispherical field of view.

2. The invention set forth in claim 1 wherein:

said rolling diaphragm is of a flexible material formable to have an elastic memory, and said diaphragm is formed with an elastic memory operable to retract said diaphragm away from said window and into said recess in said casing in response to the venting of pressure fluid from said chamber.

#### References Cited

##### UNITED STATES PATENTS

1,846,311	2/1932	Clare	116—34
2,417,449	3/1947	Rubin	116—34
2,424,801	7/1947	Crabbe et al.	
2,563,786	8/1951	James	116—114
2,618,977	11/1952	Hottenroth	73—409
2,669,707	2/1954	Ehrman.	
2,827,122	3/1958	Clark.	
2,948,151	8/1960	Astl	73—406
3,066,527	12/1962	Stein.	
3,075,615	1/1963	Thomas.	
3,111,930	11/1963	Zipper	116—34
1,893,473	1/1933	Hueber et al.	92—132 XR
3,134,445	5/1964	Hotchkiss	116—70 XR
3,200,787	8/1965	Darnell	116—70
3,241,514	3/1966	Grimland	116—70
3,246,624	4/1966	Loowther	116—70
3,335,694	8/1967	Dwyer et al.	116—70

##### FOREIGN PATENTS

275,467 6/1914 Germany.

LOUIS J. CAPOZI, Primary Examiner

U.S. Cl. X.R.

73—406; 92—98