May 11, 1965 D. M. CLAEYS 3,182,630

PRESSURE RESPONSIVE INDICATOR

Filed Sept. 9, 1963

Fig. 1

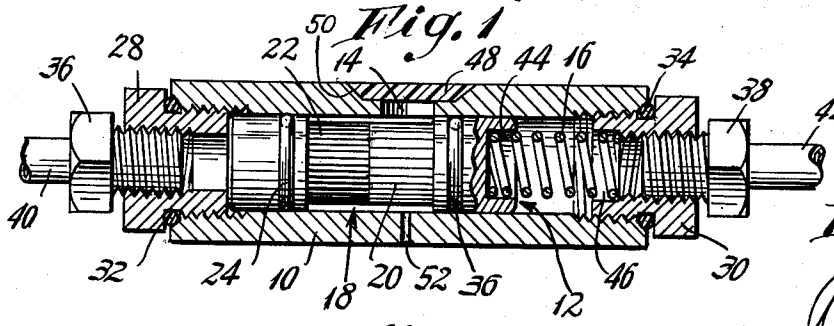


Fig. 3

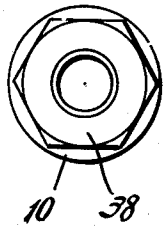


Fig. 2

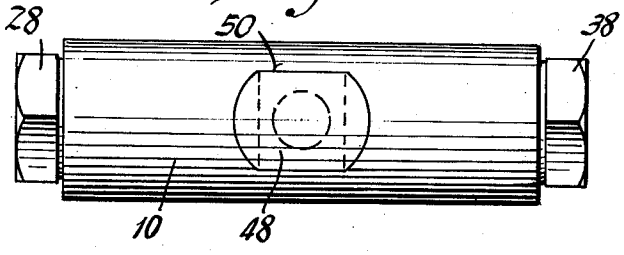


Fig. 4

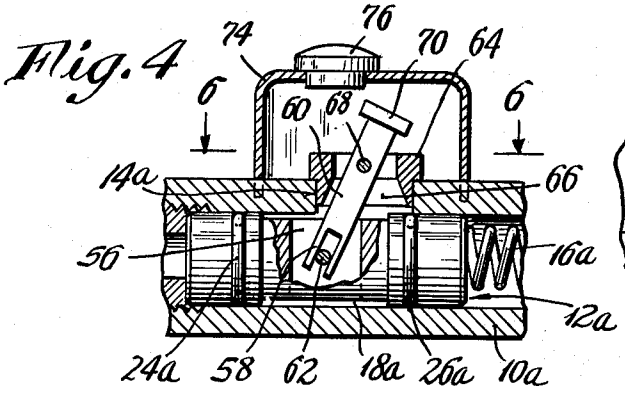


Fig. 6

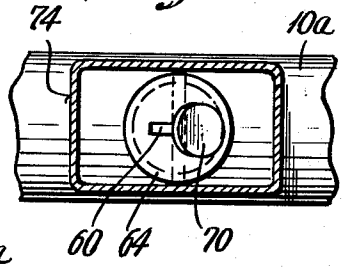
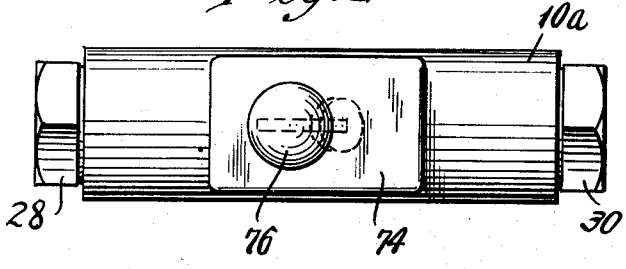


Fig. 5



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PRESSURE RESPONSIVE INDICATOR

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This invention relates to pressure responsive indicators, and more particularly to indicators of this type which incorporate a piston and cylinder action.

An object of the invention is to provide a novel and improved pressure responsive indicator of the piston and cylinder type, which is characterized by the simplest possible and least costly construction, involving not only the least number of parts but also the least number of movable parts, while at the same time retaining great durability and a maximum reliability of performance and functioning, as well as having a potentially long useful life.

Another object of the invention is to provide an improved pressure responsive indicator as above set forth, which provides easily read and unmistakable indications.

A feature of the invention resides in the provision of an improved pressurer esponsive indicator in accordance with the foregoing, which is small and compact, light in weight, and easily installed and placed in operation as well as being easily serviced when this is necessary.

Other features and advantages will hereinafter appear.

In the drawings accompanying this specification, similar characters of reference are used to designate like components throughout the several views, wherein:

FIG. 1 is an axial sectional view of an improved pressure responsive indicator as provided by the invention.

FIG. 2 is a top plan view of the indicator device of FIG. 1.

FIG. 3 is an end elevational view of the indicator.

FIG. 4 is a fragmentary axial sectional view of a pressure responsive indicator, illustrating a modification of the invention.

FIG. 5 is a top plan view of the indicator device of FIG. 4.

FIG. 6 is a horizontal fragmentary sectional view, taken on the line 6—6 of FIG. 4.

Referring first to FIGS. 1–3, the indicator device illustrated therein is of especially simple construction involving essentially a cylinder member 10, a movable "free" piston member designated generally by the numeral 12, and a window or side opening 14 provided in a side wall of the cylinder member 10 to enable normal and displaced positions of the piston member to be observed, said piston member having suitable indicia for thereby indicating various conditions to which the piston responds. These conditions comprise pressure differentials, and the construction of FIGS. 1–3 is, so far as I am aware, the simplest possible means for indicating the occurrence of a pressure differential. I also provide, in conjunction with the cylinder 10 and piston 12, a piston biasing means in the form of a simple helical compression spring 16 which effects an automatic resetting of the displaced piston at such time that the pressure differential is removed or else becomes sufficiently reduced. Except for the spring 16 the piston 12 may be considered as a "free" piston, since it does no work.

By the present invention, fluid pressures are applied to the opposite ends of the free piston member 12, and when a sufficient differential exists to cause a left-to-right movement of the piston against the restoring action of the spring 16, the movement and new position of the piston may be observed through the window 14.

The invention provides sealing means at the two ends of the free piston, and also provides an indicator portion on the piston intermediate the said sealing means. Such indicator portion may have bands of different colors, or may be provided with other kinds of indicia. As illustrated in FIG. 1, the intermediate portion 18 of the piston 12 has one half of its length coated to provide a light color 20 and the remaining half coated to provide a dark color 22.

The sealing means disposed beyond the ends of the intermediate portion 18 of the piston 12 comprise rubber or equivalent O-rings 24, 26 carried in suitable annular recesses or grooves in the piston. Preferably, as shown in FIG. 1, the intermediate portion 18 of the piston is of reduced diameter, whereas the two end portions carrying the O-rings 24, 26 fit the interior walls or bore of the cylinder 10 in a fairly snug manner but not tight enough to retard free movement of the piston.

For the purpose of introducing liquid under pressure into the cylinder 10, threaded fittings 28, 30 are provided, screwed into the opposite cylinder ends, such fittings being preferably made fluid tight by means of O-rings 32, 34 which they respectively carry. Attached to the fittings 28, 30 may be hydraulic bushings 36, 38 respectively, by which pipe lines or tubes 40, 42 are fastened to the ends of the cylinder 10.

The compression spring 16 which biases the piston 12 has its ends disposed in suitable recesse 44, 46 located one in the adjoining end of the piton 12 and the other in the inner end of the fitting 30.

To cover the side opening 14 in the cylinder 10 while at the same time enabling a view to be had of the cylinder interior and specifically the indicator portions 20, 22 of the piston 12, a transparent lens or cover member 48 is provided, secured in a shallow recess 50 provided in the outer wall of the cylinder 10 and surrounding the side opening 14 thereof. The cover member 48 may be of suitable transparent plastic, cemented or otherwise attached to the cylinder, as will be readily understood.

Normally, when no pressure differential or when but a slight pressure differential exists on the opposite ends of the piston 12, the latter will occupy the position shown in FIG. 1 wherein the light colored portion 20 of the piston is visible through the opening 14. This position will be maintained under those conditions where the fluid pressure in the line 40 is approximately the same as the fluid pressure in the line 42. However, if due to some circumstance the fluid pressure in the line 40 becomes greater than the fluid pressure in the line 42, the piston 12 will respond by shifting an extent from left to right, depending on the increase in the fluid pressure and the strength of the opposing or return spring 16. If the lines 40, 42 are connected across a liquid filter or strainer device, the rise in pressure in the line 40 might be occasioned by the strainer or filter becoming clogged. If the clogging of the strainer is sufficiently great, the increase in liquid pressure in the line 40 will be sufficient to completely shift the piston 12 to its rightmost position, wherein the darkly colored portion 22 of the piston will be visible in the window 14 of the cylinder. Thus, the indicator device will apprise a viewer of the fact that the filter or strainer is clogged and requires cleaning or replacement. As soon as the increased pressure in the line 40 is removed, as by replacement or cleaning of the filter or strainer, the return spring 16 will shift the piston 12 to its leftmost position as seen in FIG. 1, whereby the indicator will again show a balanced or substantially balanced pressure condition, indicating a clean or normally functioning filter or strainer.

It will now be understood that I have provided, as seen in FIGS. 1–3, a pressure responsive indicator device of

the utmost simplicity, involving not only relatively few parts but also the fewest number of movable parts. In the present instance, the piston **12** constitutes a movable part, and the return spring **16** constitutes a movable part. These are the only two movable parts of the entire construction. Not only is the indicator extremely simple, but the relatively few parts may be economically fabricated and assembled, resulting in a low manufacturing cost. In addition to the foregoing, the construction provides for great reliability and durability, and the indicator device is capable of an extended period of use without the likelihood of failure, or without requiring servicing.

Any slight leakage of fluid past the sealing O-rings **24, 26** may escape from the cylinder **10** by flowing out through a small vent opening **52** provided at a location opposite the side opening **14**.

Another embodiment of the invention is illustrated in FIGS. 4–6. This embodiment is in many respects similar to that already described above, but provides a somewhat different indicator device comprising a pivoted arm having a movable indicator portion which is located at the exterior of the cylinder part of the indicator. As shown, a cylinder **10***a* movably carries a piston **12***a* having sealing O-rings **24***a*, **26***a*. A piston biasing spring **16***a* normally holds the piston **12***a* in the leftmost position shown.

The portion **18***a* of the piston **12***a* which is located intermediate the O-rings **24***a*, **26***a* has a diametric slot **56** in which the bifurcated end **58** of an indicator lever **60** is disposed. The piston **12***a* has a pin **62** which is engaged in the slot of the bifurcated lever end **58**. Carried in a side opening **14***a* of the cylinder **10***a* is a mounting fitting **64** having a through slot **66**, through which the pivoted indicator arm **60** passes. A pivot pin **68** carried by the fitting **64** passes through the indicator arm **60**, and constitutes the axis of the arm. At its outer end, the indicator arm **60** has an enlargement or head **70** which may be suitably colored or otherwise provided with indicia.

With the above construction, the indicator arm **60** will normally occupy the sloping position shown in FIG. 4, and upon shifting of the piston **12***a* from the left to the right, the arm **60** will be pivoted counterclockwise to an oppositely tilted position.

In order to enable the new tilted position of the indicator arm **60** to be observed, and to utilize such tilted position as an indication, a housing **74** is provided on the cylinder **10***a*, such housing having an opening fitted with a viewing lens **76** placed in a location such that normally, for the FIG. 4 position of the lever **60**, the indicating head **70** thereof is not visible through the lens **76**. However, when the indicator arm **60** is swung counterclockwise in response to left to right movement of the piston **12***a*, the indicating head **70** will be brought into view below the lens **76**, thereby providing an indication that an appreciable pressure differential exists between the two ends of the piston **12***a*.

The construction of FIGS. 4–6 involves an additional moving part in the form of the indicator arm **60**, as compared with the structure of FIGS. 1–3. Under some circumstances it might be desirable to incorporate such additional movable part, especially where certain readout conditions are required which would not be fulfilled by the use of the indicator portions **20, 22** of the piston **12**. The embodiment of FIGS. 4–6 is also characterized by relatively few parts, by a sturdy construction, by extreme simplicity, and by functional reliability.

Variations and modifications may be made within the scope of the claims, and portions of the improvement may be used without others.

I claim:

1. A compact, small-diameter cylindrical indicator device comprising, in combination:

(*a*) an elongate cylinder having a length greatly in excess of its bore,

(*b*) a solid cylindrical piston movable in the cylinder between two positions,

(*c*) said piston having substantially similar axially spaced cylindrical bearing portions at its two ends, which have a combined length substantially in excess of the piston diameter and which closely slidably fit the piston,

(*d*) shouldered end stop threaded into the ends of the cylinder and engageable with the ends of the piston, to prevent movement of the latter beyond the said two positions

(*e*) sealing rings clamped by the end stops between shoulders thereof and the ends of the cylinder, effecting a sealing of the cylinder ends

(*f*) one of said end stops having a central through bore and an annular shoulder in said bore

(*g*) means for yieldably holding the piston in, and for moving the piston to one of said positions, said means including a compression coil spring having one end engaged with the said annular shoulder in the bore of the end stop

(*h*) fluid fittings at both ends of the cylinder for introducing fluid into the two ends of the same to subject the opposite ends of the piston to oppositely acting fluid pressures,

(*i*) an indicator device actuated by the piston, providing indications of the positions of the same in the cylinder thereby to indicate the pressure differential acting on the piston,

(*j*) said cylinder having a window in its side substantially midway of the ends, to enable a portion of the piston to be viewed,

(*k*) said indicator device comprising indicia on the said portion of the piston, said indicia being visible through the window for at least one position of the piston,

(*l*) said piston having two annular resilient sealing means disposed one at each of its two ends,

(*m*) the indicia-carrying portion of the piston being of reduced diameter and being disposed intermediate the said annular sealing means,

(*n*) said cylinder having a vent opening in its side wall, disposed in a location which places it intermediate the two sealing means for all positions of the piston.

2. An indicator as in claim 1, wherein:

(*a*) the cylinder includes an opening in its side wall comprising the said window,

(*b*) said window further comprising a transparent member extending across the said opening,

(*c*) the exterior of the cylinder being wholly cylindrical,

(*d*) the cylinder having a recess around the said window opening, and

(*e*) the transparent window member being disposed in said recess and having its outer surface flush with that of the exterior of the cylinder, said outer window surface constituting a continuation of the exterior cylindrical surface of the cylinder.

3. An indicator as in claim 1, wherein:

(*a*) the indicator device comprises an arm pivoted on and extending externally of the cylinder, said arm being pivotally connected to the piston to be actuated thereby and having indicia on a portion external to the cylinder,

(*b*) a housing is provided on the cylinder, enclosing the said arm,

(*c*) said housing having a window enabling the indicia on the arm to be viewed for one position of the piston.

4. An indicator as in claim 3, wherein:

(*a*) the cylinder has an opening in its side wall, through which the said arm extends,

(*b*) a mounting fitting is provided, carried by the cylinder in the side wall opening thereof, said fitting having a slot in which the arm is disposed, and

(*c*) a pivot pin passes through the arm and mounting fitting, said pin constituting the pivotal axis of the arm.

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