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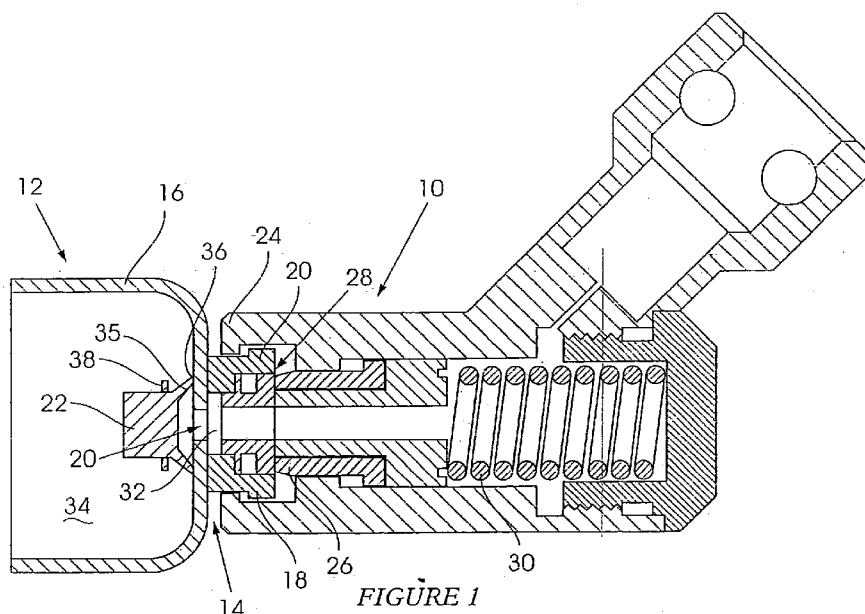
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(54) Title: A PRESSURE INDICATING DEVICE



(57) Abstract: The invention provides an indicator mechanism for a hydraulic valve of a hydraulically inflated device which includes a body which has a bore through which a fluid flows from a source to an interior of the device and which is configured to deform, when a fluid pressure from the source reaches a predetermined level.

A PRESSURE INDICATING DEVICE

BACKGROUND OF THE INVENTION

5 [0001] This invention relates to a mechanism for indicating that a hydraulically inflated device for support of an excavation has been sufficiently inflated to be adequately supportive.

[0002] A hydraulically inflated device for support of an excavation includes, for example, a device such as a preload or pre-stressing device (also known as an energiser) which preloads a support between a hanging and a foot wall in a mine working, and a hydraulically inflated anchor or tendon (hereinafter referred to as "a hydraulically inflated device").

10 [0003] It often happens however that the hydraulically inflated device is inadequately inflated so that device is not sufficiently supportive.

[0004] Mechanisms which indicate that a hydraulically inflated device has been inflated to a predetermined pressure, to provide pre-load positional or friction fit support, are known. These mechanisms, when incorporated in a hydraulic valve of the device, generally have, as
15 an indicator, pin or shaft which is co-axially located in the fluid bore of the valve. The pin moves axially outwardly when a predetermined pressure has been reached. A problem with the indicator of this configuration is that the pin tends to obstruct the fluid bore.

[0005] The invention aims to at least partially address the aforementioned problems.

SUMMARY OF INVENTION

20 [0006] The invention provides an indicator mechanism for a hydraulic valve of a hydraulically inflated device which includes a body which has a bore through which a fluid flows from a source to an interior of the device and which is configured to deform, when a fluid pressure from the source reaches a predetermined level.

[0007] The source may be a filler device. The filler device may be connectable to the body with the bore in communication with a counterpart fluid bore of the device.

[0008] The body may have an attachment collar to facilitate clamping attachment of the filler device to the body.

5 **[0009]** In a first aspect of the invention, the body may include a deformable formation at or about which the body deforms.

[0010] The formation may be an annular groove. The annular groove may be formed in an outer wall surface of the body. In this way, when the fluid pressure reaches the predetermined level, the groove is axially compressed into at least partial closure.

10 **[0011]** The groove may include a gel-like coloured indicatory material which is extruded from the groove when the groove is compressed.

[0012] Alternatively, the annular groove may be formed in a face of the body, towards a perimeter edge of the face. When the fluid pressure reaches the predetermined level, a perimeter section of the face breaks away from the body or deforms or moves relatively to
15 the body, about the annular groove.

[0013] In another aspect of the invention, the body may include a holed member that is complementarily dimensioned to locate within a recessed portion of the bore.

[0014] The member may include a locating member to locate and hold the member in the recess.

20 **[0015]** Preferably, before any deformation of the body or member, an outer end of the member is flush with an end of the body.

[0016] The outer end may present a colour coded indicator. The colour of the indicator may represent the predetermined pressure at which the preload device may be loaded.

[0017] The member may be made of a resiliently deformable material such that, when the fluid pressure reaches the predetermined level, the member compresses, retracting into the recessed portion.

[0018] The member may include a deformable element at or about which the member deforms.

[0019] The element may be an annular slot in a side wall of the member which at least partly closes, when the fluid pressure reaches the predetermined level, to cause the member to axially compress and retreat into the recessed portion, into a depressed position.

[0020] Alternatively, the element may be a shear flange which breaks from the member, when the fluid pressure reaches the predetermined level, to cause the member to retreat into the recessed portion, into a depressed position.

[0021] The mechanism may include a seal, sealingly located between the holed member and the annular recess, to prevent the fluid from flowing on an outer side of the member.

[0022] The depressed position of the member may be maintained by wedge action of the member within the recess.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The invention is further described by way of examples with reference to the accompanying drawings in which:

Figure 1 is a view, in longitudinal section, of a filler device connected, at a valve, to a preload device;

Figure 2 is a sectional side view of an indicator mechanism according to a first aspect of the invention illustrating a holed member before depression within a body of the mechanism;

Figure 3 is a sectional side view of the indicator mechanism of Figure 2 with the holed member in a depressed position;

Figure 4 is a sectional side view of an indicator mechanism according to a second aspect of the invention illustrating a holed member before depression within a body of the mechanism;

Figure 5 is a sectional side view of the indicator mechanism of Figure 4 with the holed member in a depressed position;

5 Figure 6 is a sectional side view of an indicator mechanism according to a third aspect of the invention illustrating a holed member before depression within a body of the mechanism;

Figure 7 is a sectional side view of the indicator mechanism of Figure 6 with the holed member in a depressed position;

10 Figure 8 is a sectional side view of an indicator mechanism according to a fourth aspect of the invention illustrating a holed member before depression within a body of the mechanism;

Figure 9 is a sectional side view of the indicator mechanism of Figure 6 with the holed member in a depressed position;

Figure 10 is a sectional side view of an indicator mechanism according to a fifth aspect of the invention illustrating a grooved face of the connector body;

15 Figure 11 is a sectional side view of the connector body of Figure 10 illustrating an outer part of the face severed from the connector body;

Figure 12 is a sectional side view of an indicator mechanism according to a sixth aspect of the invention illustrating a circumferentially grooved attachment collar of the connector body;

20 Figure 13 is a sectional side view of the grooved attachment collar of Figure 12 in a depressed position; and

Figure 14 is a sectional side view of the indicator mechanism of Figure 2, illustrating an indicator device located within the holed member.

DESCRIPTION OF PREFERRED EMBODIMENTS

25 **[0024]** Figure 1 of the accompanying drawings illustrates a filler nozzle 10, of a filler device which supplies a fluid to a preload device 12 (shown in partial transverse section), which clamps to the device at a hydraulic valve 14.

[0025] The preload device 12 can be any preload device of conventional manufacture. The device has a housing wall 16, made of a ductile steel metal such as a suitable mild steel, and is expandable or inflatable in the axial direction of an associated mine prop (not shown) by ingress of a fluid, such as water, under pressure.

5 **[0026]** The water enters an interior 34 of the device 12 through the valve 14.

[0027] The hydraulic valve 14 has an exterior connector body 18 with an attachment collar 20 which provides an undercut surface against which an engagement formation 24 of the filler nozzle 10 can act when clamping the nozzle to the valve. The body is located over a valve hole 20 formed in the wall 16 of the device 12. A valve seal is located on an opposed side of the hole. The valve seal 22 can be any appropriate conventional seal.

10 **[0028]** The body has a fluid bore 32 through which the water flows from the filler nozzle 10, through the hole 20, to the interior 34 of the device. The water pressure causes a skirt 35 of the valve seal to lift away from a valve seat, where the skirt abuts an inner surface of the wall 16, allowing the water to flow into the interior 34. Outflow of water is prevented as the valve seal is biased towards the valve seat 36 by a valve spring 38.

15 **[0029]** A discharge device 26 of the filler nozzle 10 is biased against a body face 28 under action of a spring 30 to impart, on the face 28, a counterpart force to that acting on the collar 20 by the formation 24.

20 **[0030]** What has been described above is not novel and is merely described to give context to the invention.

[0031] Figure 2 illustrates an indicator mechanism 40 in a first embodiment of the invention which includes the body 18 with a stepped annular recess 41 formed in the body face 28 in which is located an indicator member 42. The annular recess is complementarily

dimensioned to the indicator member ensuring that the member fits snugly within its confines.

[0032] In this embodiment, the indicator member 42 is manufactured from a suitable plastics material.

5 **[0033]** The member 42 has a centrally located axial hole 44 which is in register with at least part of the fluid bore 32 to provide a continuous channel through which water can flow, from the filler device to the interior 34. The member further includes a locating flange 46 which snugly locates the member within the recess and which, on an outer facing side, presents a member face 48.

10 **[0034]** A shear flange 50 is provided, inwardly spaced from the locating flange 46. The flange 50 abuts a step 52 of the annular recess 40 to hold the member face 48 substantially flush with the body face 28.

15 **[0035]** Moreover, the member 42 includes a locating member 68, which locates and holds the member within the recess, preventing the member from falling out of the recess when the device is tipped or tilted to one side. In this particular embodiment, the member 68 is a pair of barbed projections which project from the shear flange 50. The barbed projections can be spring 69 biased towards an inner wall of the recess.

[0036] The member face 48 can be colour coded to represent a particular load threshold of the particular indicator mechanism.

20 **[0037]** A force is imparted on the member face 48 by a leading end of the discharge device 26 (see Figure 1). This force increases proportionally to the increasing fluid pressure necessary to maintain the water flow into the preload device 12 as it inflates.

[0038] When a particular level of force is reached at the member face, equivalent to a predetermined preload pressure of the device 12, the shear flange 50, by design, breaks along a junction between the flange and the member 42 thereby detaching from the member. With the shear flange 50 no longer supporting the member, with the member face 48 in flush orientation with the body face 28, the member is depressed inwardly with an inner portion 54 of the member leading into the bore 32 (see Figure 3). The member is maintained in the depressed position by a wedging action of the body of the member within the bore. The plastics material making up the member resiliently deforms to aid the wedging action.

[0039] To aid in this wedge action, the inner portion 54 can be slightly inwardly tapered.

[0040] In this depressed position (illustrated in Figure 3), the indicator member 42 is a visible indication that a predetermined pressure or load has been attained within the preload device 12 as the pressure exerted on the member face 48 is substantially equivalent to the pressure within the preload device.

[0041] The mechanism 40 includes a member seal 70, located in a seal seat 72 formed between the inner wall of the recess 41 and an annular groove 74 in an outer surface of the inner portion 54. The seal prevents flow of the fluid past the outer surface of the member 42.

[0042] Figure 4 and Figure 5 illustrate a second embodiment of the invention. In describing this, and later, embodiments, reference numerals used to describe features of the first embodiment are used to describe similar features found in this, and later described, embodiments.

[0043] In this embodiment, the indicator mechanism 40B has, on the indicator member 42, a shear flange 50 which overlaps and abuts the body face 28 (see Figure 4). In this configuration, the member face 48 is not flush with the body face 28.

[0044] When the predetermined pressure, exerted on the member face 48, is reached, the shear flange shears from the member 42 (see Figure 5) allowing a remaining part of the member to travel into the annular recess 32, to a depressed position and to remain in this position by wedge action.

5 **[0045]** The indicator member 42, in the depressed position, is a visible indicator that the predetermined pressure within the preload device 12 has been reached.

[0046] Again, the inner portion 54 of the member can be inwardly tapered to aid in wedging the member within the recess thus holding the member therein.

10 **[0047]** Figure 6 and Figure 7 illustrate a third embodiment of the invention. In this embodiment, an indicator mechanism 40C includes an indicator member 42 which is made from a resiliently deformable material. The indicator member has an annular slot 56 in an outer surface of the member which divides the member into an outer component 58 and an inner component 60, joined by a bridge 62. The inner component rests on the base 52 of the annular recess 41.

15 **[0048]** When the pressure applied to the member face 48 reaches a predetermined pressure, the bridge, which forms a zone of relative weakness, buckles and compresses, in a permanent manner, to cause closure of the annular slot 54, moving the outer portion inwardly towards the inner portion 58.

20 **[0049]** The axial compression of the member into the depressed position is a visible indication that a predetermined pressure has been attained.

[0050] Figure 8 and Figure 9 illustrate a fourth embodiment of the invention. In this embodiment, the indicator mechanism 40D has a member 42 which is made of a rigidly porous material which, when compressed, permanently remains in the compressed state as

air, from air-filled voids 64, escapes the material allowing the voids to collapse (see Figure 9).

5 [0051] The material can be chosen for its specific tolerance to load. By changing the compositional parameters of the material making up the indicator member 42, the member can be constituted to resist compressive forces up to a predetermined value.

[0052] In this embodiment, once a predetermined pressure, exerted on the member face 48, is reached, the indicator member 42 permanently compresses (see Figure 9) to retreat into the annular recess to a depressed position.

10 [0053] Figures 10 and 11 illustrate a fifth embodiment of the invention. In this embodiment, the connector body 18 does not have the indicator mechanism 42 situated within a recess 41. Instead the indicator mechanism is a peripheral section 68 of the face which is radially separated therefrom by a circular groove 66 formed in the face 28 and which is undercut by the undercut surface of the attachment collar 20.

15 [0054] The peripheral section severs from the body when a predetermined pressure is exerted on the face-28.

[0055] Figures 12 and 13 illustrate a sixth embodiment of the invention. The indicator mechanism 42 in this embodiment is a channel 70 circumferentially formed in an outer surface of the attachment collar which closes, when a predetermined pressure is exerted on face 28, to provide a visible indication of attainment of that pressure.

20 [0056] Figure 14 illustrates a indicator device 76, which is a subsidiary preload indicator to the indicator member 42, and which is described with reference to the indicator mechanism 40 of the first embodiment.

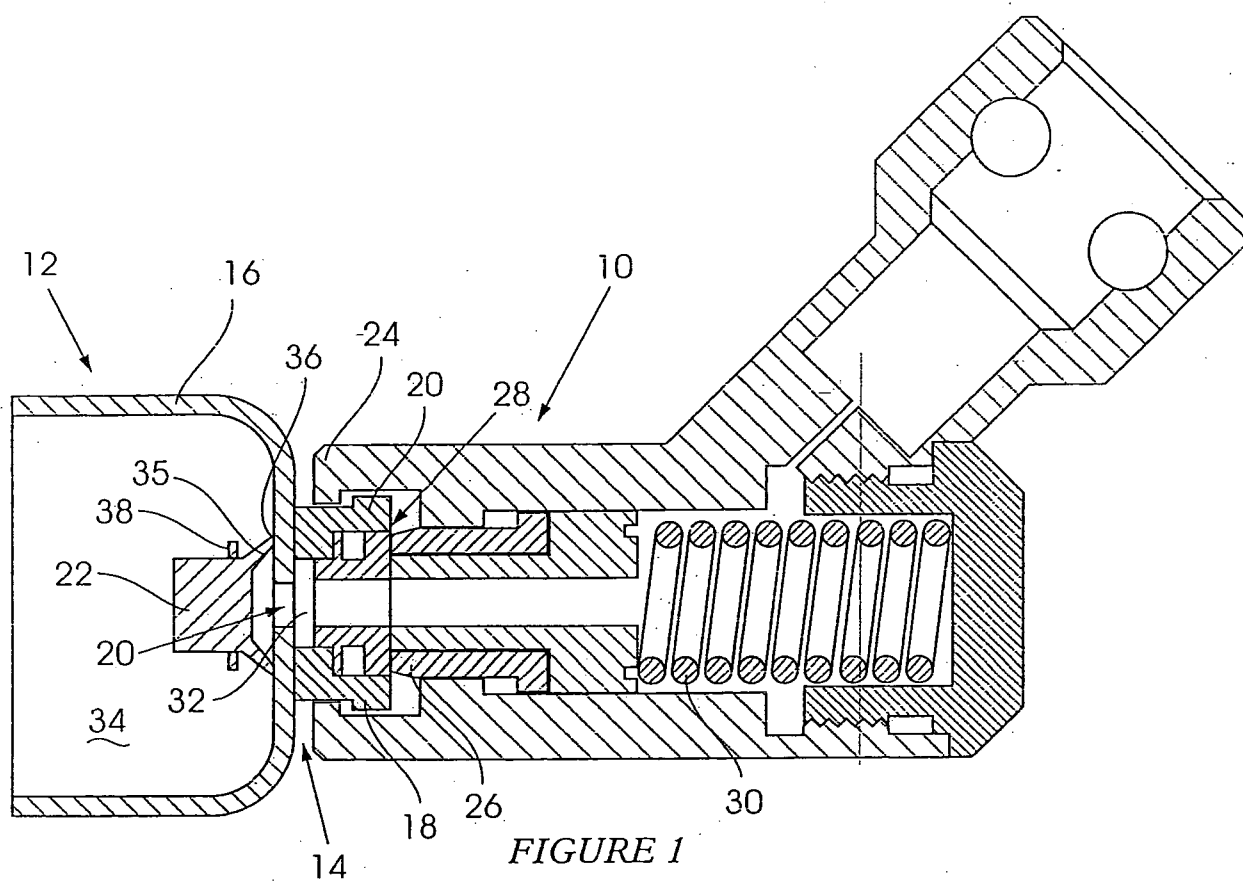
[0057] The indicator device is a tubular structure which is located within the hose 44 of the member. The device has, at an inner end, a foot 78 which abuts a base of the fluid bore 32 to support the device 76 in position. The indicator device can be made of a coloured material which contrasts the device over the body 18.

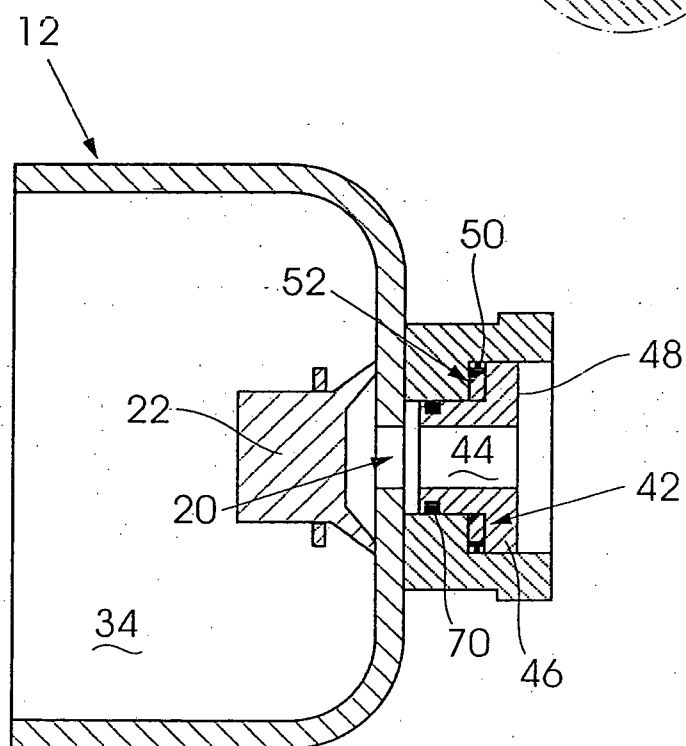
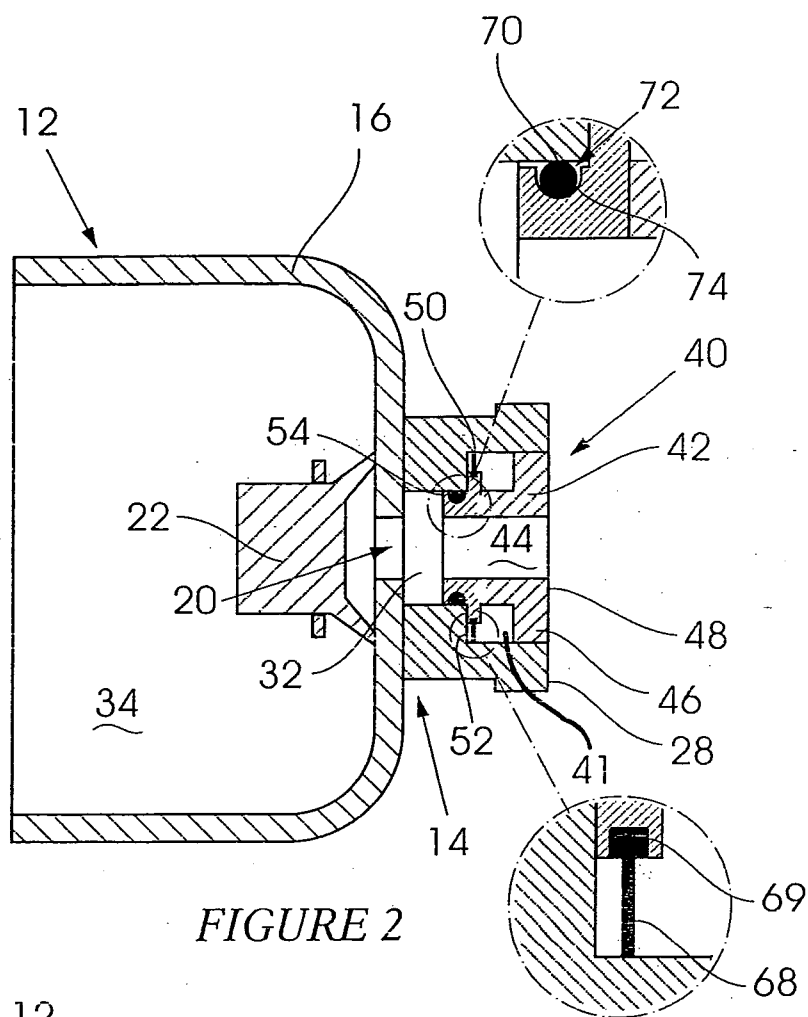
- 5 **[0058]** When a predetermined preload pressure is reached at the member face 48, the new flange recess from the member, allowing the member 42 to move inwardly into a depressed position (see Figure 3 illustrating the member 82 in the depressed position). In the depressed position, the member 42 exposes a substantial portion of the length of the device 76 as a visual indication of the attainment of the predetermined preload pressure.

CLAIMS

1. An indicator mechanism for a hydraulic valve of a hydraulically inflated device which includes a body which has a bore through which a fluid flows from a source to an interior of the device and which is configured to deform, when a fluid pressure from the source reaches a predetermined level.
2. An indicator mechanism according to claim 1 wherein the body includes a deformable formation at or about which the body deforms.
3. An indicator mechanism according to claim 2 wherein the formation is an annular groove.
4. An indicator mechanism according to claim 3 wherein the annular groove is formed in an outer wall surface of the body.
5. An indicator mechanism according to claim 4 wherein the groove includes a gel-like coloured indicatory material which is extruded from the groove when the groove is compressed.
6. An indicator mechanism according to claim 4 wherein the annular groove is formed in a face of the body.
7. An indicator mechanism according to claim 1 wherein the body includes a holed member that is complementarily dimensioned to locate within a recessed portion of the bore.
8. An indicator mechanism according to claim 7 wherein the member includes a locating member to locate and hold the member in the recess.

9. An indicator mechanism according to claim 6 or 7 wherein the member is made from a resiliently deformable material such that, when the fluid pressure reaches the predetermined level, the member compresses, retracting into the recessed portion.
10. An indicator mechanism according to claim 7 or 8 wherein the member includes a deformable element at or about which the member deforms.
11. An indicator mechanism according to claim 10 wherein the element is an annular slot in a side wall of the member which at least partly closes, when the fluid pressure reaches the predetermined level, to cause the member to axially compress and retreat into the recessed portion.
12. An indicator mechanism according to claim 10 wherein the element is a shear flange which breaks from the member, when the fluid pressure reaches the predetermined level, to cause the member to retreat into the recessed portion.
13. An indicator mechanism according to any one of claims 7 to 12 which includes a seal, sealingly located between the holed member and the annular recess.





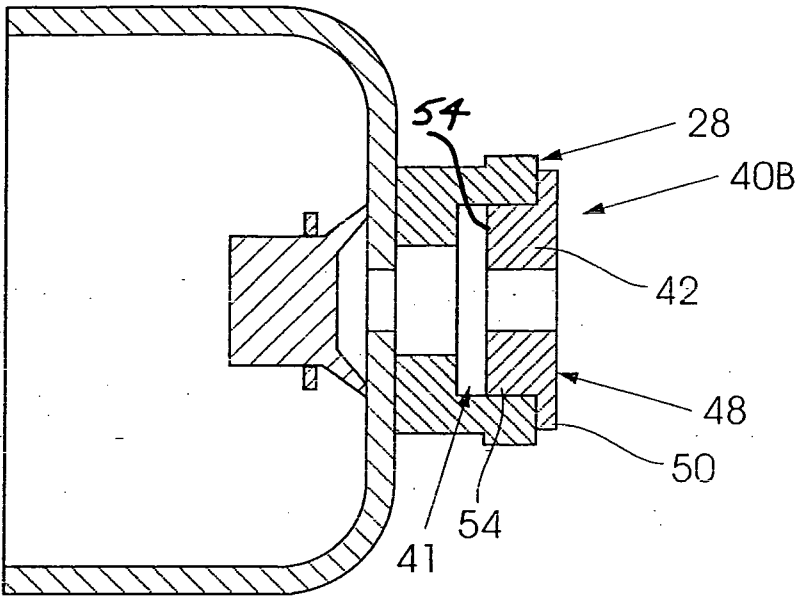


FIGURE 4

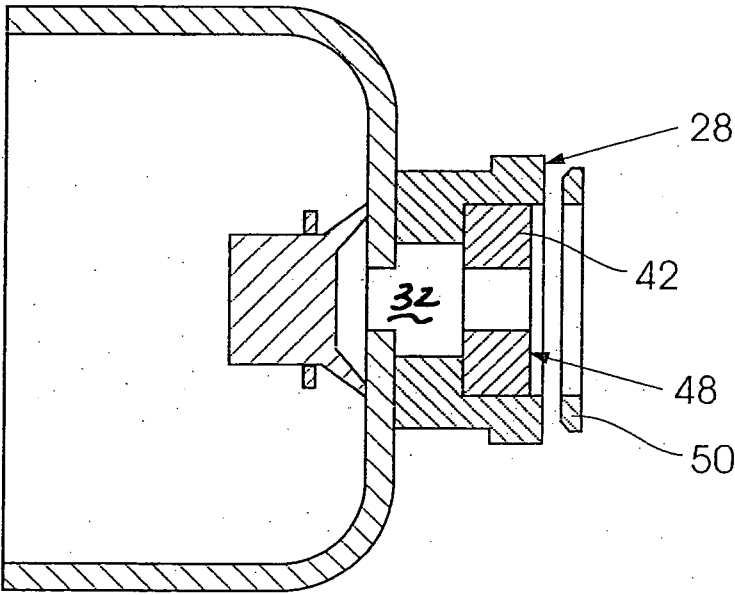


FIGURE 5

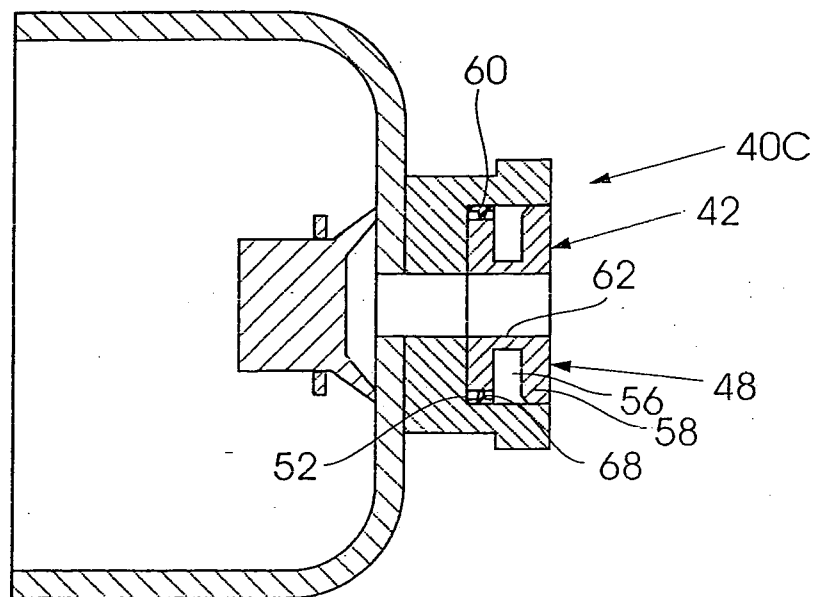


FIGURE 6

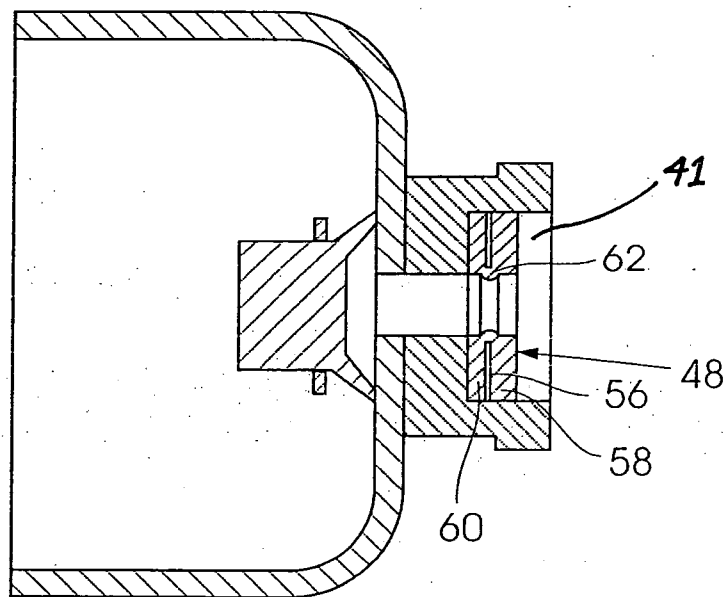


FIGURE 7

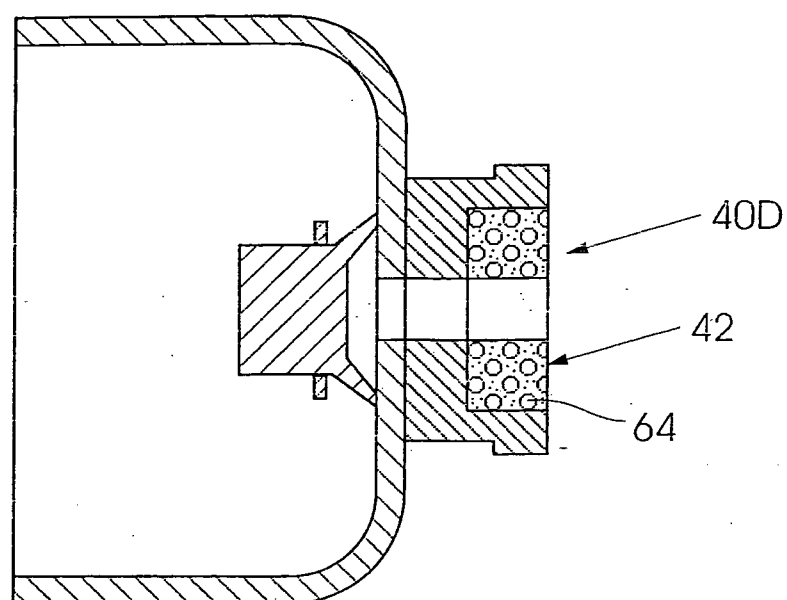


FIGURE 8

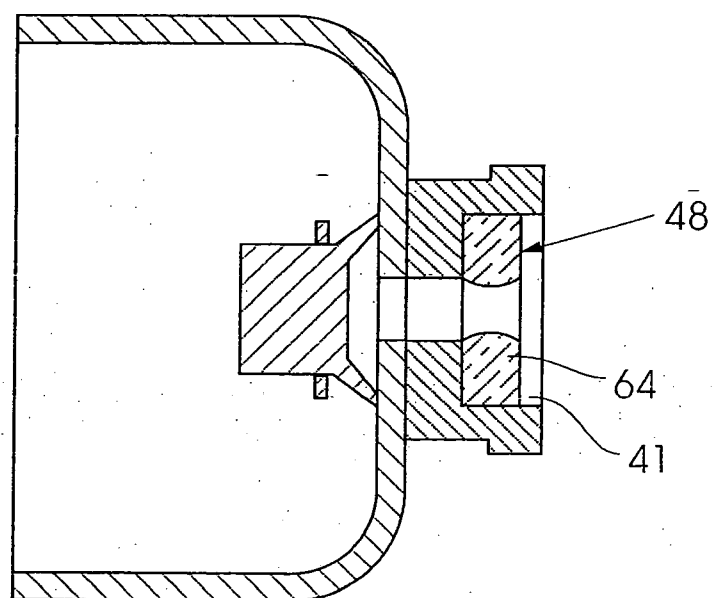


FIGURE 9

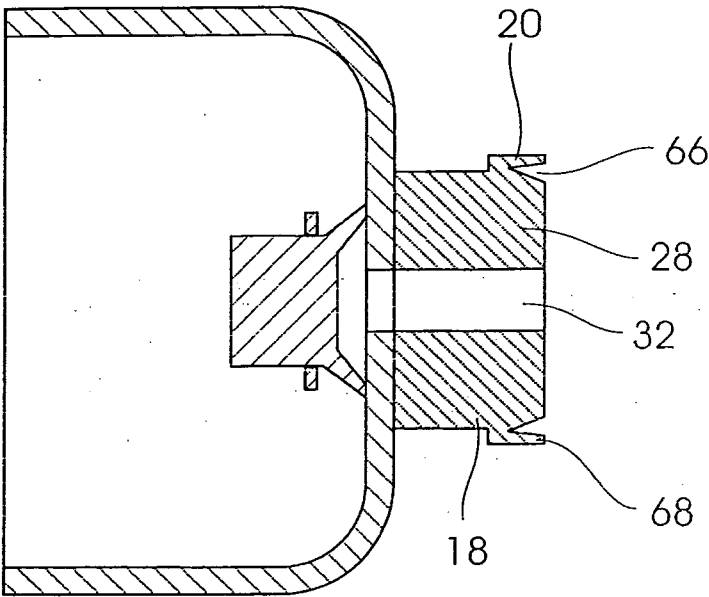


FIGURE 10

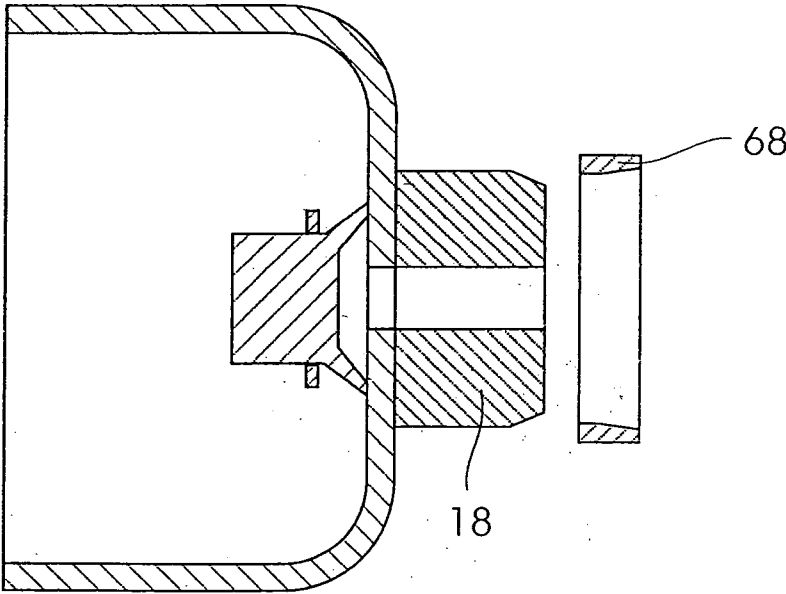


FIGURE 11

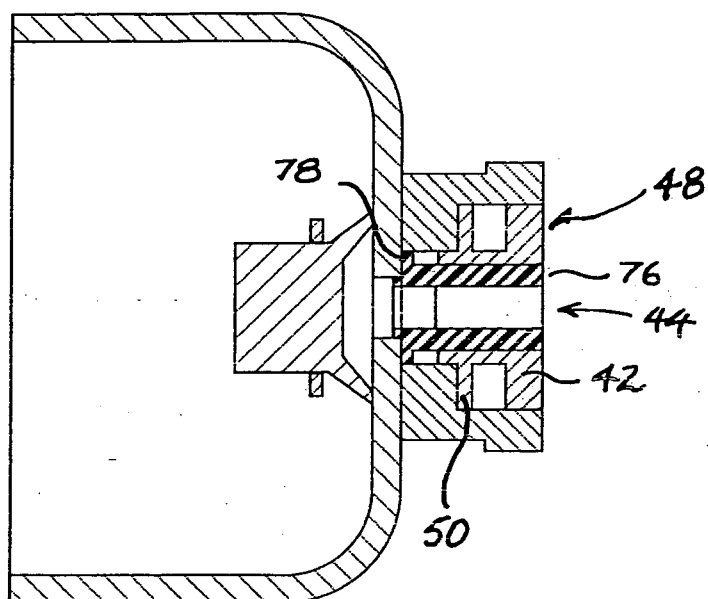


FIGURE 14