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CLOSURE CAP ASSEMBLY FOR INDICATING LIQUID LEVEL

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Fig. 1

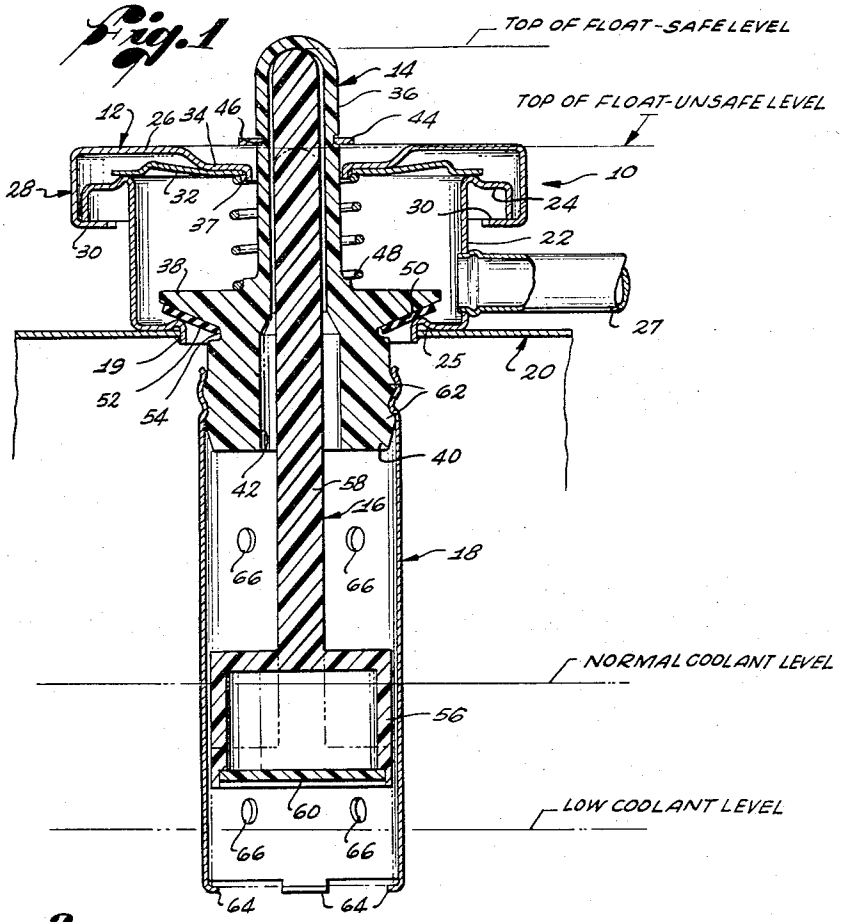


Fig. 3

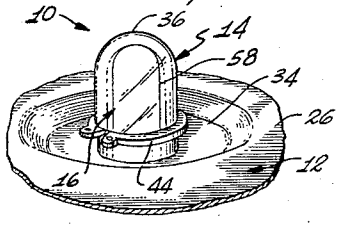
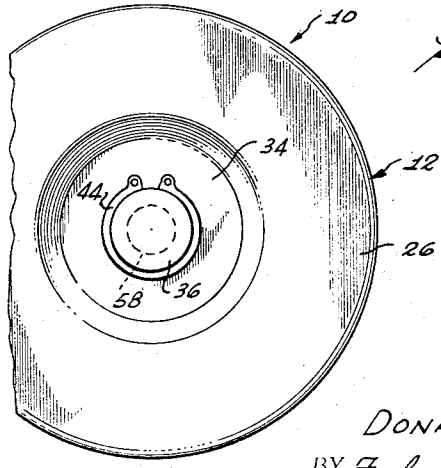


Fig. 2



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CLOSURE CAP ASSEMBLY FOR INDICATING LIQUID LEVEL

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ABSTRACT OF THE DISCLOSURE

An automobile radiator closure cap assembly which includes a poppet valve releasing pressure within the radiator when a predetermined pressure is reached. The valve carries a depending shroud and a transparent dome which projects above the top of the cap. A coolant level responsive float within the shroud has its indicating end projecting into the transparent dome.

This invention relates to a removable closure cap assembly embodying visual means for indicating liquid level in closed containers and, more particularly, to a cap assembly of this type for pressurized containers, such as automobile radiators.

It has become common practice in recent years to pressurize automobile cooling systems. This has the advantage of raising the boiling point of the coolant, which, in turn, enables it to absorb more heat per unit volume, as well as reduces the incidence of coolant-loss by boiling it out. In addition, it minimizes the loss by evaporation under normal operating conditions. The result is a safer and more efficient system.

These advantages, particularly as regards the conservation of coolant, are reduced, if not totally lost, if the system is opened to the atmosphere when the engine is at operating temperature or above. Should this occur, coolant escapes through the opening. In practice, this frequently occurs at filling stations where an attendant removes the radiator cap to check the level of the coolant. This also poses a serious safety hazard, since, if the attendant is not extremely careful, he can be burned by the escaping gas and liquid.

Before lost coolant can safely be replaced, the system temperature must be allowed to drop at least a few degrees, which obviously takes time. As a consequence, the cap is frequently replaced by a hurried attendant and the automobile is driven away with the coolant supply depleted. This, of course, decreases the efficiency of the system. Moreover, even if the coolant is replaced, this is still an unsatisfactory situation. Besides the potential safety hazard, the coolants commonly used comprise mixtures of water and other compounds or liquids other than water, the latter of which are generally relatively costly.

In view of the foregoing, it is a primary object of the invention to provide an improved removable closure cap assembly which obviates the problems of the prior art.

A more specific object is to provide an improved closure cap assembly for a container which enables the liquid level in the container to be quickly and easily determined by visual inspection from the exterior without removal of the cap assembly.

A further object is to provide a cap assembly of the type described especially adapted for safe and effective use on a pressurized container, such as an automobile radiator.

A related object is to provide a cap assembly of this type further characterized in that it automatically relieves excess pressure in the container.

Another object is to provide a cap assembly of the type described which is highly economical from the standpoint of conserving the liquid stored in the container.

It is another object to provide an improved closure cap assembly for a container embodying visual means for indicating the liquid level therein, which assembly is strong and durable and trouble-free in operation.

A still further object is to provide an improved closure cap assembly capable of accomplishing all of the foregoing objects, yet which is relatively simple in construction and readily adapted to be manufactured at low cost.

These and other objects, features and advantages of the invention will be better understood from the following detailed description, taken in conjunction with the accompanying drawing in which:

FIGURE 1 is a vertical sectional view of a cap assembly constructed in accordance with the invention and installed on a conventional automobile radiator;

FIGURE 2 is a partial top plan view of the assembly shown in FIGURE 1; and

FIGURE 3 is a perspective view of the externally visible portion of the cap assembly of the invention when installed, as in FIGURE 1.

Referring to the drawing and in particular to FIGURE 1, reference numeral **10** designates the cap assembly of the invention. It includes, generally, a cap **12**, a domed poppet **14**, a float assembly **16** and a protective shroud **18**. These are assembled together and adapted for sealing engagement on a pressurized container to afford a visual indication of the liquid level and to relieve excess pressure in the container.

As noted above, the cap assembly **10** of the invention finds advantageous use on an automobile radiator and, for this reason, it is described as especially adapted therefor. In FIGURE 1, the assembly is shown as installed on a conventional radiator **20** having a top opening **19** and a filler neck **22** with a flanged lip **24** at its upper end. The filler neck is configurated to provide an upwardly facing lip **25** adjacent the junction with the opening **19**. An overflow pipe **27** vents the filler neck to the exterior. The cap assembly **10** may also be used to advantage in a variety of other applications and, therefor, the detailed description of this particular adaption is not intended to be limitative.

The cap **12** is arranged for locking engagement on the flanged lip **24** of the filler neck **22**. It includes, in series, a central lid **26**, a depending skirt **28** and inturned locking flanges **30** at diametrically opposed positions on the skirt. Portions (not shown) of the flanged lip **24** are slotted to receive the flanges **30** as the cap is positioned for installation. The flanges then engage under the lip upon rotation of the cap into locking engagement, as illustrated in FIGURE 1. Preferably, the cap **12** is formed of a strong, durable and corrosion resistant metal.

An annular spring-like seal **32** is disposed between the cap **12** and lip **24** and serves to prevent liquids and gases which get into the filler neck **22** from escaping through its top opening. The seal **32** is, in effect, cantilevered from the cap adjacent its inner periphery by virtue of engaging the underside of the depressed central portion **34**. Adjacent its outer periphery, the seal engages in continuous, forceful contact with the lip **24**. Tolerances in the various parts are accommodated and sealing is assured because of the yieladble flexing of the seal upon such forecful contact.

The material forming the seal **32** must retain its spring qualities even after repeated flexing attendant with frequent installation and removal of the cap assembly, and remain impermeable to gases and liquids. It has been found that these requirements are met by forming the seal **32** of a metal, such as the spring-tempered, Phosphor bronze.

Centrally received by the cap **12** is the poppet **14**, the latter having an elongated, hollow dome **36** that projects

upwardly through an opening in the central portion 34 of the cap. There is a close sliding fit between these parts in order to allow for some relative movement. To enhance the bearing contact, the central portion 34 of the cap is spun over, as at 37. At the lower end of the dome 36, the poppet has a radially enlarged flange 38, which, in turn, joins a sleeve-like connecting portion 40 that continues to the lower end of the poppet. As may be seen in FIGURE 1, a continuous passage 42, closed at its upper end and open at its lower end, is provided in the poppet. In the illustrative case, the passage is of increased diameter adjacent its lower end.

In use, it is important that visual access be afforded through the portion of the dome 36 projecting upwardly of the lid 26 of the cap. To accomplish this, at least this portion is formed of a transparent material. Moreover, for convenience of manufacture, the entire poppet 14 is here formed of the same transparent material.

The transparency charcteristic of the poppet 14 must not deteriorate under prolonged exposures to high temperatures. In addition, it must be sufficiently strong to withstand rough handling, as is likely to be encountered in use. These requirements are satisfied by forming the poppet of various plastics, such as polyester resin, which not only have the desired physical properties, but are readily adapted to economical forming methods.

The cap 12 and poppet 14 are retained in assembly with one another by a split ring 44 receivable in a circumferential groove 46 in the dome at a location vertically spaced above the flange 38. The ring 44 is engageable with the upper surface of the central portion 34 of the cap to limit downward movement of the poppet with respect to the cap. The poppet is yieldably urged in this direction by a compression spring 48 disposed around the dome 36 and between the cap 12 and flange 38. Thus, the spring 48 yieldably urges the poppet 14 downwardly relative to the cap. In addition, the spring 48 contacts the seal 32 and maintains it in operative position by urging it adjacent its inner periphery into contact with the cap.

As is conventional with modern automobile radiators, primary sealing is provided at the lip 25 adjacent the junction of the filler neck 22 with the top opening 19 in the radiator 20. To accomplish sealing at this location, the poppet 14 is formed with a frusto-conical seat 50 on the underside of the flange 38. In order to enhance the seal, an annular gasket 52, preferably formed of a resilient, deformable sealing material, is provided on the poppet in full-face engagement with the seat. The gasket 52 is maintained in assembly with the poppet by making it slightly smaller in internal diameter than the outer diameter of the portion 40 and providing the poppet with a circuferential groove 54 for receiving the same at the inner edge of the seat. Assembly is accomplished by simply stretching the gasket around the lower portion 40 of the poppet.

A visual indication of the fluid level in the radiator is afforded by the float assembly 16. It includes a float 56 and an upwardly projecting indicating rod 58 that is slidably received in the passage 42 in the poppet 14. For convenience of manufacture, the rod 58 is here formed integral with the upper end of the float 56. The float, in turn, comprises any suitable member which is buoyant in liquids commonly used as coolants. In the illustrative case, it is formed as a hollow, cup-shaped member with integral top and side walls and having a flat disc 60 press fit in a recess in its lower end. The float assembly, like the poppet, is advantageously formed of plastic.

The float assembly 16 is protected and retained in operative association with the other elements of the cap assembly by the shroud 18. Referring to FIGURE 1, it may be seen that the shroud 18 comprises an elongated, cylindrical member rigidly connected to the lower portion 40 of the poppet and projecting downwardly therefrom. Connection is achieved by cooperating ridges and grooves on the parts, as illustrated at 62 in FIGURE 1.

The shroud 18 has an inside diameter at least slightly greater than the maximum outside diameter of the float 56 in order to allow for vertical movement of the latter. At its lower end, the shroud 18 has a plurality of angularly spaced and inwardly projecting fingers 64 which are engageable with the lower end of the float 56 to limit its downward movement.

The length of the float assembly 16 and shroud 18 is correlated to the combined length of the poppet 14. Preferably, in the lowermost operating position of the float 56, the upper end of the indicating rod 58 is approximately aligned with the lower end of the locking ring 44 on the dome 36. In this manner, the locking ring 44 may be used as an index of the lower end of the safe liquid-level range. Further, it is preferred that the float assembly 16 be free to move upwardly until the rod 58 contacts the top of the dome 36, as shown in full lines in FIGURE 1. To prevent liquid from being trapped between the adjacent surfaces of the float 56 and shroud 18, a plurality of apertures 66 are provided in the shroud.

In installing the cap assembly 10 for use, its lower end is inserted through the filler neck 22 into the radiator until the seat 50 on the poppet carrying the gasket 52 engages the lip 25. Downward pressure is then applied to compress the spring 48 slightly and enable the cap 12 to be rotated into tight locking relationship with the flanged lip 24. This causes the poppet 14 to move slightly upwardly relative to the cap 12, as indicated in FIGURE 1, wherein the locking ring 44 is shown spaced slightly away from its normal position of engagement with the upper surface of the portion 34 of lid 26. During such installation, the spring seal 32 also engages in sealing relationship the top of the lip 24.

With the cap assembly so installed, the liquid level in the radiator is indicated provided it is within the safe range bounded by the phantom "normal" and "low" lines in FIGURE 1 and corresponding to the positions of the float assembly 16 shown in full and phantom lines in that figure. Should the liquid level be higher than that indicated by the "normal" line in FIGURE 1, the rod 58 simply abuts the upper end of the dome 36 to limit upward movement of the float assembly 16. On the other hand, if the liquid level goes below the safe range, the rod 58 drops below the top of the locking ring 44. As long as the liquid level is within this safe range, the upper end of the rod 58 is clearly visible within the portion of the dome 36 above the locking ring 44. Thus, a person viewing the installed cap assembly can easily tell at a glance whether the coolant level is within a safe range. To facilitate such a determination, the rod 58 may be formed of or coated with a bright colored material.

It will be appreciated that the construction and operation of the cap assembly is such that there is virtually no need to remove it under normal operating conditions. As a result, the safety hazard present when a person removes a conventional cap from a radiator of an engine which is at operating temperature or above is eliminated. Further, coolant is conserved as compared to a situation where a conventional cap is used, since none is lost in checking the level. Moreover, since the radiator is sealed under normal conditions, the loss of coolant by evaporation is minimal.

It is also significant to note that the spring-urged poppet 14 also serves as a safety valve. Should the pressure within the radiator 20 exceed the biasing force of the spring 48, the poppet 14 is yieldably urged upwardly to relieve excess pressure by bleeding off gas or liquid between the seat 50 and lip 25 and eventually out the overflow pipe 27. When pressure within the radiator drops down to a safe level, the spring 48 acts to urge the poppet back into seated position. By appropriate selection of a spring, the cap assembly can be calibrated to relieve pressure at any desired level, normally within the range of 7 to 12 p.s.i.g.

In the event it is necessary to remove the cap assembly,

as when adding coolant, this may be quickly and easily accomplished by simply rotating the cap **12** and removing it in the same manner as a conventional cap. The construction of the cap is such that upon removal the various elements remain assembled with one another.

While one embodiment of the invention has been illustrated and described in considerable detail, it will be understood that this is only by way of illustration and that various changes in the details of the construction and arrangement of the various elements may be made without departing from the spirit and scope of the invention.

I claim:

1. A closure cap assembly for a container having an upwardly facing filler neck vented to the exterior and an internal shoulder adjacent its juncture with the container, comprising:

a cap having a central lid portion, a peripheral skirt portion and means on said skirt portion formed to retain association with the filler neck;

an elongated, hollow viewing dome carried by said cap and disposed centrally thereof and oriented generally vertically with a portion projecting above said lid portion, said dome being closed at its upper end and open at its lower end and having at least its upwardly projecting portion formed of a transparent material.

valve means carried by said viewing dome at vertical spacing below said lid portion, said valve means and said viewing dome movable relative thereto, said means being movable away from said lid portion to engage in sealing relationship with the internal shoulder at the juncture of the filler neck and container and being movable toward said lid portion out of such relationship;

spring means carried by said cap member yieldably urging said valve means away from said lid portion;

a float carried by said cap member and arranged for limited vertical movement relative thereto in response to changes in liquid level in the container; and

indicator means on said float projecting upwardly into said dome and movable therein, said indicator means being movable in accordance with float movement to provide a visual indication of fluid level in the container.

2. The subject matter of claim **1** including means on said cap and on said viewing dome for limiting such movement of said valve means away from said lid portion.

3. A closure cap assembly for a container having an upwardly facing filler neck vented to the exterior and an internal shoulder adjacent its juncture with said container, comprising:

a cap having a central lid portion, a peripheral skirt portion and means on said skirt portion formed to retain association with said filler neck;

a poppet carried by said cap and having a transparent, hollow viewing dome at one end with at least a portion thereof projecting upwardly of said lid portion and a valve seat adjacent its opposite end engageable in sealing relationship with the internal shoulder on the filler neck, said poppet being arranged for limited vertical movement relative to said cap;

spring means carried by said cap and yieldably resisting such movement of said poppet; and

a float assembly carried by said cap and arranged for vertical movement relative thereto in response to changes in liquid level in the container, said float assembly having an upwardly projecting indicating rod slidably receivable in said viewing dome.

4. The subject matter of claim **3** including a protective shroud secured to said poppet and extending downwardly therefrom around said float assembly;

and means on said shroud limiting the movement of said float assembly downwardly relative to said cap.

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