Feb. 23, 1943. C. W. SHAW 2,311,971

SEMI-SEALED CLOSURE AND VENTING DEVICE

Filed Nov. 9, 1938

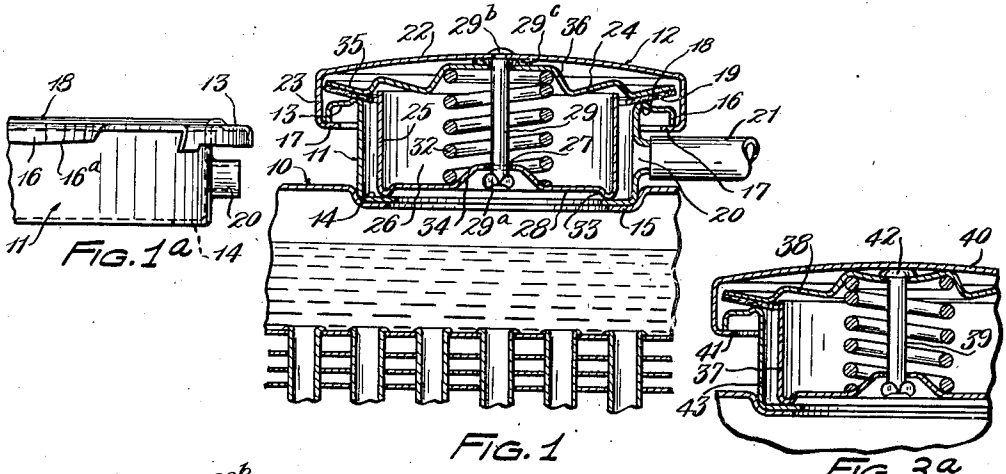


FIG. 1a

FIG. 1

FIG. 3a

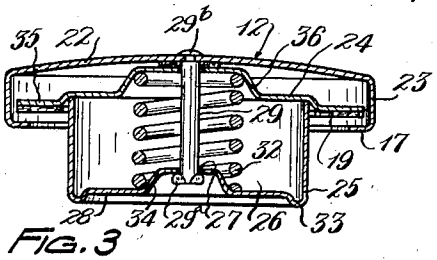


FIG. 3

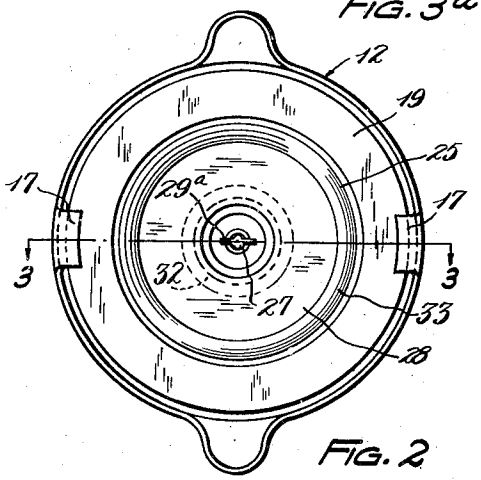


FIG. 2

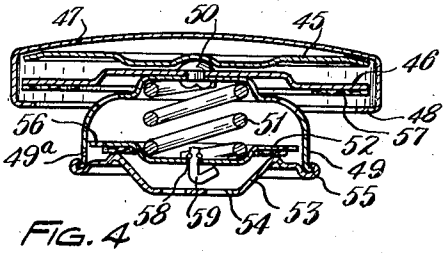


FIG. 4

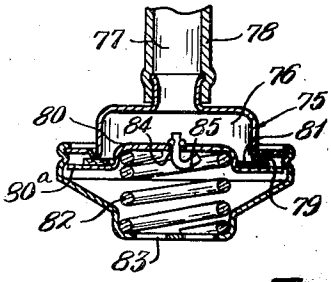


FIG. 6

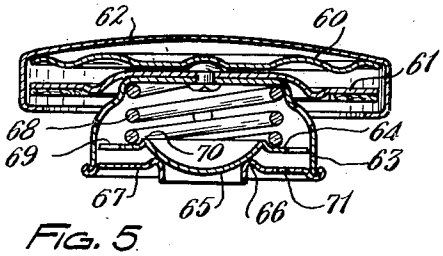


FIG. 5

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SEMISEALED CLOSURE AND VENTING DEVICE

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7 Claims. (Cl. 220—44)

This invention relates to venting and closure devices for fluid containers, and more particularly to venting and closure devices which are well suited for use on the radiators of internal combustion engine cooling systems and on various other tanks.

Heretofore the cooling systems of internal combustion engines have been provided, either with a permanently open relatively large area vent and overflow connection to atmosphere, or have been sealed against communication with atmosphere up to a predetermined positive or negative pressure value. Both of these types of cooling systems are subject to disadvantages which the present invention seeks to overcome. In the first mentioned system, that is, the system having the relatively large area vent opening, a substantial loss frequently occurs in the cooling liquid and in the more or less volatile anti-freeze solutions which may be contained in the system. In the sealed cooling system, such loss of cooling fluid and volatile anti-freeze solution is effectively prevented but a more costly closure device embodying pressure and vacuum relief valves has been necessary for properly and safely sealing the system. This sealed type of cooling system is also subject to pressure conditions which alternate frequently between positive and negative values and this has a deteriorating effect on the radiator and other parts of the system.

The present invention seeks to overcome these disadvantages by providing a closure device for an internal combustion engine cooling system, or other fluid containing tank or structure, which embodies a normally open but restricted vent passage placing the interior of the system or tank in communication with atmosphere at all times and which also embodies a pressure relief valve for quickly relieving excess pressure in the system to atmosphere through a much larger vent opening whenever the pressure in the system or tank increases to a predetermined or abnormal pressure value.

Another object of my invention is to provide a closure device of simple and economical construction embodying such a normally open restricted vent passage and such a pressure relief valve.

My invention may be further briefly summarized as consisting in certain novel combinations and arrangements of parts hereinafter described and particularly set out in the appended claims.

In the accompanying sheet of drawings,

Fig. 1 is a partial vertical sectional view taken through the upper portion of the radiator of an internal combustion engine cooling system and showing one form of my venting and closure device applied thereto;

Fig. 1*a* is a partial side elevation of the filler neck;

Fig. 2 is a bottom plan view of the closure cap showing the same detached from the filler neck;

Fig. 3 is a vertical sectional view taken through the closure cap as indicated by line 3—3 of Fig. 2;

Fig. 3*a* is a partial vertical sectional view showing cap structure similar to that of Fig. 1 but with the parts differently connected;

Fig. 4 is a vertical sectional view taken through another closure cap embodying my invention;

Fig. 5 is a vertical sectional view taken through still another form of closure cap embodying my invention; and

Fig. 6 is a sectional view taken through a closure device of my invention intended for use with the vent and overflow pipe of a vehicle radiator or other tank.

More detailed reference will now be made to the accompanying drawing for the purpose of further describing the construction and arrangement of my venting and closure device and its intended manner of use on the radiators of internal combustion engine cooling systems or other tanks. However, before proceeding with such more detailed description, it should be understood that my invention may be embodied in various other devices and forms of construction than those herein specifically disclosed.

In Fig. 1 of the drawing I show a tank 10 having my venting and closure device applied thereto. The tank shown in this instance is the radiator of a vehicle cooling system, although my venting and closure device may be applied to various other tanks and liquid containers.

My venting and closure device comprises, in general, a filler neck 11 and a closure cap 12 applied thereto. The filler neck may be of the usual form comprising a metal sleeve having an outturned flange 13 at its outer end and an inturned flange 14 at its inner end. The neck may be connected with the tank 10, as by soldering or welding, with the flange 14 seating against a recessed or flanged portion 15 surrounding the opening of the tank wall. The flange 14 of the neck forms an inner seat or sealing surface with which a valve or other

portion of the closure cap has sealing engagement, as will be presently explained. The outturned flange 13 at the outer end of the neck may carry circumferentially spaced depending lugs 16, the lower edges of which are tapered or inclined to form locking cams 16a with which the inturned lugs or fingers 17 of the closure cap cooperate to provide a quick-detachable bayonet joint of the type familiar to those skilled in this art. The neck flange 13 may also have circumferentially spaced slots or openings therein adjacent the lugs 16, as shown in Fig. 1a, to permit the fingers 17 to engage and follow the cam surfaces. An annular bead 18 formed in the neck flange 13 provides the outer end of the neck with a sealing surface or seat against which the gasket 19 of the closure cap may be pressed. At a point between the inner and outer seats or sealing surfaces 14 and 18, the neck is provided with a relatively large area vent opening 20 with which one end of a vent and overflow pipe 21 leading to atmosphere is connected.

The closure cap 12 may comprise a hollow or cup shaped cap body 22 having a transverse or disk-like top wall and a depending marginal flange or annular skirt 23 which carries the inturned locking fingers 17. The closure cap also includes a resilient disk 24 which is connected with, or retained in, the hollow cap body and a hollow member or valve 25 depending from the underside of such disk and cooperating therewith to form a vent chamber 26.

The cup member or valve 25 has a substantially centrally disposed opening or aperture 27 in its transverse bottom wall 28 and may be connected with the cap body and disk as by means of an axially extending pin 29 extending through such opening or aperture. A coiled compression spring 32 disposed in the chamber 26 and surrounding the pin 29 engages the disk and transverse wall 28 and normally tends to separate the valve and disk. Such separating movement is limited by a head or retaining means 29a on the inner end of the pin which also prevents the latter from being withdrawn from the opening 27. The outer end of the pin may extend through an opening of the disk and may be connected with the top wall of the cap body by a riveted portion or retaining head 29b thereon. If desired a washer 29c may be disposed between the disk and cap body.

The transverse wall 28 of the valve 25 may have an annular bead 33 formed thereon which sealingly engages the inner seat 14 of the neck and is yieldingly pressed thereagainst by the spring 32 when the closure cap is applied to the neck. The transverse wall 28 may also have an axial projection 34 thereon which serves as a centering means for the lower end of the spring 32.

The resilient disk 24 may have a shallow recess formed in the underside thereof into which the open upper end of the valve 25 extends. Outwardly of such recess, the disk may be provided with an annular marginal flange 35 which forms a seat for the gasket 19 and presses the same against the gasket seat 18 of the neck. Adjacent its center the disk 24 may have an axially extending recessed portion 36 which receives and centers the upper end of the compression spring 32.

To provide my closure device with the above mentioned normally open restricted vent passage I form the opening or aperture 27 of the valve 25 of a size or diameter somewhat larger than the connecting pin 29 which extends therethrough. The space between the pin and the edge of this opening provides a normally open restricted vent passage which connects the interior of the tank 10 with the vent chamber 26. The latter chamber is always in free and unrestricted communication with the atmosphere through the open upper end of the valve 25, the opening 20, and the vent and overflow pipe 21. Thus, in the construction just described it will be seen that the pin 29 forms a restricting or metering element for the vent opening 27 of the tank 10. The restricted vent opening thus provided connects the interior of the tank with atmosphere at all times and permits relatively slow equalization of pressures on opposite sides of the transverse wall 28 of the valve 25 but is of such restricted area that it prevents loss of any appreciable amount of liquid or anti-freeze solution from the tank.

When the closure cap 12 is applied to the filler neck and locked thereon by relative rotation in the usual manner, the gasket 19 is pressed into sealing engagement with the gasket seat 18 by the resiliency of the disk 24 and, simultaneously, the valve 25 is sealingly pressed against the inner seat 14 by the action of the spring 32. The flexing of the resilient disk causes the same to spring away from the open upper end of the valve 25, as shown in Fig. 1, so that a free vent passage leading to opening 20 and the overflow pipe 21 will be provided. It will also be seen that each time that the closure cap is applied to or removed from the filler neck and each time that the valve 25 is lifted by pressure in the tank, relative movement of the pin 29 in the opening 27 will take place and this will tend to keep the restricted vent from becoming clogged.

Although the area of the restricted vent opening provided by the aperture 27 is sufficient for a relatively slow equalization of pressures between the interior of the tank and atmosphere, its area is insufficient to relieve a sudden pressure condition which may occur in the tank 10 as the result of boiling of the cooling liquid. When such a condition occurs in the tank the pressure acts on the relatively large area presented by the valve 25 and lifts the same off the seat 14 thus permitting a free flow of liquid or vapor to atmosphere through the opening 20 and the overflow pipe 21. The area of the restricted vent passage may be sufficiently small that when boiling of the cooling liquid first starts or when boiling thereof occurs at a slow rate, a pressure may build up in the tank prior to the lifting of the valve 25. This pressure build-up will result in a corresponding rise in the boiling point of the cooling liquid so that the advantages of a fully sealed cooling system may be realized to some extent.

It will be seen from the foregoing description, and the construction of my closure and venting device as illustrated in Figs. 1 to 3 of the drawing, that this device is of very simple and economical construction and when applied to a vehicle radiator or other tank provides an efficient venting and closure means.

Instead of having the pin 29 extend through, or connect directly with, the cap body for connecting the disk 24 and the valve 25 therewith as shown in Fig. 1, I may provide the arrangement shown in Fig. 3a in which a corresponding valve 37 is connected with a resilient disk 38 by the pin 39 and the disk is retained in the cap body 40 by the locking fingers 41 of the latter. The upper end of the pin may have a head or enlargement 42 thereon above the disk, that is, between the disk and the top wall of the cap body. In addition to serving as a connecting or retaining means, the head 42 of the pin also forms a localized bearing

portion which engages the transverse wall of the cap body 40 substantially centrally thereof and permits rocking and rotation of the cap body relative to the disk when the closure cap is being applied to the filler neck 43.

In Fig. 4 of the drawing I have shown another form of construction for the cap member of my venting and closure device. In this form of construction a pair of resilient disks 45 and 46 are retained in the hollow cap body 47 by the locking fingers 48 thereof. A hollow valve cage 49, of circular or other desired shape, extends in depending relation to the disk 46 and is pivotally connected therewith by means of the centrally disposed rivet 50. The cage 49 may comprise a dome-shaped member 49a which houses a coiled compression spring 51 and a relief valve 52 of relatively large area. The cage may include a transverse bottom wall 53 having one or more openings 54 therein and connected with the member 49a by means of the annular bead 55. The valve 52 may have circumferentially spaced marginal lugs 56 thereon for centering it in the cage. The spring 51 may also be centered by having its ends extend into axial recesses provided respectively in the valve and the upper end of the cage.

When this form of my closure cap is applied to a filler neck, such as the neck 11 of Fig. 1, the gasket 57 is pressed against the gasket seat 18 by means of the resilient disk 46 and the annular bead 55 is pressed against the inner seat 14 by the resiliency of the disk 45. If a pressure condition occurs in the radiator or tank the valve 52 will be lifted against the action of the spring 51 to relieve such pressure quickly to atmosphere through the overflow pipe 21.

At other times the radiator or tank is vented to atmosphere through a normally open but restricted vent passage. This restricted vent passage may be formed by providing the valve 52 with an opening or aperture 58 therein and reducing the area of such opening or aperture by a metering pin or element 59 extending therethrough. This metering pin may be of a shape to be retained against withdrawal from the opening 58 and also to be freely movable in such opening to prevent clogging thereof.

Fig. 5 of the drawing shows another form of construction for the cap member of my venting and closure device. This closure cap is generally similar to that of Fig. 4 in that a plurality of resilient disks 60 and 61 is provided in the cap body 62 and a depending hollow cage 63, of circular or other desired shape, is pivotally connected with the disk 61. In this form of construction, however, the relief valve 64 has a convex substantially spherically-shaped central portion 65 which rockably engages the seat 66 of the transverse wall 67 of the cage. This enables the valve to center or adjust itself on the seat so that an effective seal is more likely to occur at this point when the valve is pressed against its seat by the spring 68. The valve may have spaced lugs 69 around its edge which center it in the cage while the spaces between the lugs permit the passage of fluid. The spring 68 may be centered by having its upper end extend into an axial recess of the cage and its lower end engage the projection 70 on the valve.

A normally open restricted vent is also provided and may be in the form of a small aperture 71 in the transverse wall 67 of the cage 63 rather than in the valve 64 although this opening may be formed in the valve if desired, as shown in Fig. 4.

Instead of, or in addition to, providing a restricted vent and a relief valve in the closure cap and filler neck, I may provide the lower end of the vent and overflow pipe with an attachment having such a restricted vent and relief valve incorporated therein. An attachment device of this character is shown in Fig. 6 of the drawing and may comprise a hollow sheet metal structure 75, of circular or other desired shape, having a chamber 76 therein and a hollow stem 77 or other suitable means for connecting the device with the vent and overflow pipe 78 with such pipe in communication with the chamber 76. The structure 75 may be formed with an annular sealing surface or valve seat 79 therein and may house a relief valve 80 of relatively large area with a gasket 81 thereon and which is adapted to be pressed against the seat 79 by the compressison spring 82. The structure 75 may have one or more relatively large openings 83 therein outwardly of the relief valve and leading directly to atmosphere. The valve may have spaced lugs 80a around its edge for centering it in the structure 75 while the spaces between the lugs permit the passage of fluid when the valve is lifted. The spring 82 may be centered by having its ends engage in axial recesses provided respectively in the valve and the end wall of the structure 75.

When a pressure condition occurs in the radiator or tank and is communicated through the pipe 78 to the chamber 76, it acts upon the relief valve 80 and lifts the same from the seat 79 against the action of the spring 82. The excess pressure is thus quickly relieved or vented to atmosphere through the openings 83.

To provide a normally open restricted vent passage for connecting the radiator or tank with atmosphere at all times, I may form the valve 80 with an aperture or opening 84 therein and reduce or restrict the area of such opening by a freely movable metering element or pin 85 extending therethrough.

It will be seen from the foregoing description and the accompanying drawing that all of the closure and venting devices herein disclosed are of simple construction and embody a minimum number of parts of the kind which can be readily produced by stamping or forming operations. It will also be seen that all of these devices embody a relief valve for quickly relieving excess pressure to atmosphere and a normally open but restricted vent passage which connects the interior of the radiator or tank with atmosphere at all times and produces what may be conveniently termed a "semi-sealed" condition in the radiator or tank. All of these devices effectively close and seal the radiator or tank against loss of cooling liquid or anti-freeze solution except when an excessive pressure condition exists such as must be quickly relieved if damage to the radiator or tank is to be avoided.

While I have illustrated and described my improved venting and closure device in a somewhat detailed manner, it will be understood, of course, that I do not wish to be limited to the precise constructions and arrangements of parts herein disclosed, but regard my invention as including such changes and modifications as do not constitute a departure from the spirit of the invention and the scope of the appended claims.

Having thus described my invention I claim:

1. A closure and venting device of the char-

acter described, comprising a hollow metal body having a valve seat thereon and an opening on one side of said seat leading to atmosphere, a relief valve in the body engaging said seat and adapted to be lifted by pressure acting thereon for relieving excess pressure to atmosphere, said valve having an opening therethrough, and a metering pin extending into the latter opening, said pin being smaller than said latter opening and of a size relative thereto to reduce said latter opening to a vent of relatively restricted area and said pin being shiftable in said latter opening to prevent clogging thereof.

2. A closure device for the radiator of a motor vehicle comprising a neck having axially spaced inner and outer seats thereon and an opening leading to atmosphere from between said seats, a cap adapted to be releasably connected with the neck and having portions engageable with the respective seats when the cap is applied to the neck, the portion engageable with the inner seat comprising a relief valve adapted to be lifted by pressure in the radiator acting thereon for relieving excess pressure to atmosphere, said valve having an opening therethrough, and a metering pin extending into said valve opening, said pin being of a size to reduce the valve opening to a vent of relatively restricted size and being shiftable in the valve opening to prevent clogging of said vent.

3. In a closure of the character described, a hollow cap body, a resilient disk retained therein, a cup member cooperating with said disk to form a vent chamber and having an opening in its bottom wall communicating with such chamber, and a metering pin restricting said opening and serving as a connecting means between said cup member and said disk.

4. In a closure of the character described, a cap body, a resilient disk in said body, an axially depending hollow member having a transverse wall spaced from said disk and provided with a vent opening, a compression spring in said hollow member and extending between and engaging said disk and transverse wall, and an axially extending connecting pin extending through said cap body, disk, and transverse wall substantially centrally thereof for connecting said cap body, disk and hollow member and permitting relative axial movement between the hollow member and disk, said pin restricting the area of said vent opening and being movable therein during said relative axial movement.

5. In a closure of the character described, a cap body, a resilient disk in said body, an axially depending hollow member having a transverse wall spaced from said disk and provided with an opening therethrough, a compression spring in said hollow member and extending between said disk and transverse wall, and an axially extending connecting pin for said disk and hollow member and permitting relative axial movement therebetween, said pin extending through said opening and restricting the area thereof.

6. In a closure of the character described, a cap body, a resilient disk in said body, an axially depending hollow member having a transverse wall spaced from said disk, a compression spring in said hollow member and extending between said disk and transverse wall, and an axially extending pin connecting said disk and transverse wall substantially centrally thereof and permitting relative axial movement between the hollow member and disk, said pin having an enlargement thereon above said disk providing a localized bearing portion for engagement with the cap body.

7. A closure for use on a filler neck having spaced outer and inner seats and an atmosphere connection therebetween, comprising a cap body adapted for releasable connection with the neck, a disk in the cap body for cooperation with the outer seat, an axially depending hollow structure having a transverse wall spaced from the disk and engageable with the inner seat when the closure is applied to the neck and adapted to be lifted therefrom for relieving excessive pressure to atmosphere, a compression spring in said hollow structure and extending between and engaging said transverse wall and disk, said transverse wall having a vent opening therein, and an axially extending connecting pin for said disk and hollow structure and permitting relative axial movement therebetween, said pin extending through said opening and restricting the area thereof.

CLARENCE W. SHAW.