

[54] VENT APPARATUS

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[22] Filed: Apr. 19, 1972

[21] Appl. No.: 245,436

[52] U.S. Cl. 137/493.2, 137/512.2, 137/525.1,
220/44 C

[51] Int. Cl. F16k 15/16

[58] Field of Search .. 137/102, 493.2, 493.6, 512.2,
137/525, 525.1; 220/44 A, 44 C

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[57] ABSTRACT

Apparatus for venting gasoline tanks for snowmobiles, chain saws, yard or garden tractors, and the like, which comprises a tubular fitting that is mounted on the outside of the tank in communication with the interior of the tank, and a check-relief valve assembly mounted in the outer end of the fitting to allow air to enter the tank and excessive gas vapor pressures to escape from the tank, but which will prevent discharge of liquid gasoline. The valve assembly includes a resilient unitary valve element that has a duck bill portion, and means are provided to urge the lips of the duck bill portion together so that an effective liquid gasoline seal is provided but which will not interfere with venting of the tank.

7 Claims, 5 Drawing Figures

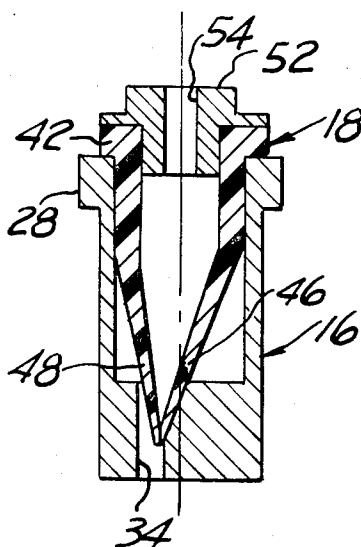


FIG. 1

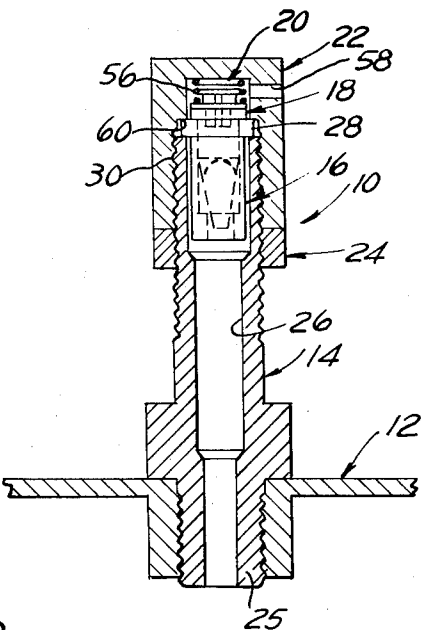


FIG. 5

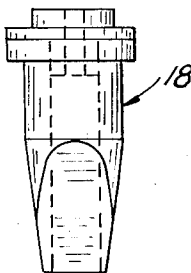


FIG. 2

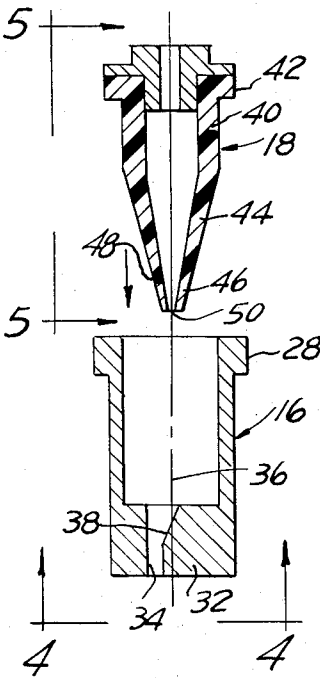


FIG. 3

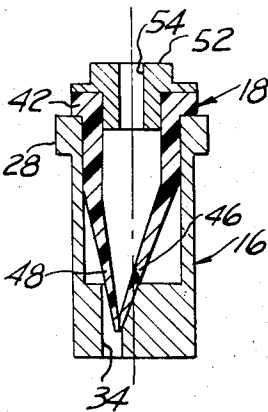
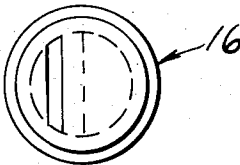


FIG. 4



VENT APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to vent apparatus, and especially to apparatus of this character which is used in conjunction with venting of gasoline tanks for snow-

mobiles, chain saws, garden or yard tractors, or the like. It is known to use vent apparatus for these purposes wherein a resilient unitary check-relief valve element of the duck bill type is employed as one of the components. The duck bill valve elements generally have proved to be effective in this arrangement, but problems have arisen in connection with their use. These problems arise initially during the manufacture of the unitary duck bill element when it is desired to provide structures having uniform characteristics in the lips of the element. Manufacturing conditions often prevent these objectives from being met. To provide a proper check valve, the lips of the duck bill must remain closed to the contents of the tank that is being vented. Due to manufacturing problems, some of the duck bill elements in their unstressed state will have their lips spaced apart a small amount, and such spacing is found to create undesirable and sometimes dangerous leakage problems. For example, if a fuel tank is full and is subjected to vibrations, the gasoline may creep through the duck bill element and out of the vent apparatus where it may be exposed to heat from the engine, resulting in the creation of a dangerous fire or explosive condition.

SUMMARY OF THE INVENTION

The present invention is directed to improvements in vent apparatus of the foregoing character wherein undesirable leakage through the duck bill portion of the valve element is eliminated. A vent apparatus is provided which has a fitting defining a vent passageway that is adapted to be mounted in communication with a fuel tank, and a resilient unitary valve element having a tubular body portion and a duck bill portion extending from the tubular body portion is located in the fitting. The tubular body portion is mounted in the passageway so that the duck bill portion extends toward the one end of the fitting, and means are provided in the passageway engaging one of the lips of the duck bill portion to an extent necessary to maintain the lips together. The means is arranged so that it will not interfere with venting of air into the enclosure.

According to a preferred form of the present invention, vent apparatus is provided comprising a fitting defining a vent passageway, a valve element holder mounted in said passageway having means defining a transverse slot or a radially offset throughway, a resilient unitary valve element having a tubular body portion with a peripheral flange that is seated in sealing relation on said holder and a duck bill portion extending from said tubular body portion toward one end of the fitting. The duck bill portion has lips that fit into the slot or offset throughway, and one of the lips is urged against the other lip by one wall of the slot. Biasing means urge the valve element toward one end of the fitting at its seated position, and the biasing means is responsive to a pressure above a selected magnitude from the direction of said one end to allow the valve element to unseat so that fluid can flow through said passageway around said duck bill portion from said one end to

the other end of the fitting. The lips of the duck bill are out of engagement with the other wall of the slot so that fluid can flow in one direction through the duck bill portion when the fluid pressure at said other end is greater than at said one end.

Thus, a vent apparatus is provided which will allow air to be vented into a fuel tank, as the need arises, and which will prevent gasoline from leaking therefrom through the duck bill portion. The vent apparatus is also constructed and arranged so that if vapor pressures of undesirably high magnitudes form within the fuel tank, the resilient valve element can be unseated from its holder to allow escape of the undesirable vapor pressures. If such unseating occurs, the duck bill portion will be returned to its position in the slot by the biasing means after the excessive vapor pressures are dissipated. Accordingly, it is one of the objects of the present invention to provide an improved vent apparatus.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a longitudinal section through a vent apparatus embodying the present invention and showing a fragmentary portion of a tank on which the vent apparatus is mounted;

FIG. 2 is an enlarged exploded view in section of the resilient unitary valve element and the holder therefore that are components of the vent apparatus, and showing a component of the spring biasing means positioned in the valve element;

FIG. 3 is a view similar to FIG. 2, but showing the components in their assembled positions;

FIG. 4 is an end view of the holder as seen in the direction of the lines 4—4 of FIG. 2; and

FIG. 5 is a side elevational view of the valve element and the components of the spring biasing means as seen in the direction of the lines 5—5 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

The vent apparatus 10 is shown mounted in the top wall of an enclosure or fuel tank 12 over an opening therein. The vent apparatus 10 includes a fitting 14, a valve element holder 16, a resilient unitary valve element 18, biasing means 20, a vent cap 22 and a jam nut 24.

The fitting 14 is externally threaded at its one end 25 for threadedly connecting it to the tank 12, and it is externally threaded at its other end for receiving the vent cap 22 and jam nut 24. The fitting 14 and vent cap 22 provide a closure member which has a passageway 26 for venting the tank 12. The holder 16, which is cup-shaped in the disclosed embodiment, has a peripheral

lip 28 seated on the other end 30 of the fitting 14. The cup-shaped holder 16 has a bottom wall 32 which closes the passageway 26 except for a transverse slot or offset throughway 34 which is offset to one side of the axis 36 of the cup-shaped holder 16. For a purpose to be described, the transverse slot or throughway 34 has one wall or projection 38 which is inclined to the axis 36 and intersects the axis as can be seen in FIG. 2.

The resilient unitary valve element 18 has a tubular body portion 40 with a peripheral flange 42 that is seated in sealing relationship on the peripheral lip 28. The valve element 18 also has a duck bill portion 44 which is an extension of the tubular body portion 40 and defines a pair of lips 46 and 48. As can be seen in FIG. 2, the duck bill portion 44 may have been manufactured with its lips 46 and 48 slightly spaced apart as at 50 when the duck bill portion 44 is in its unstressed state. This small spacing 50 may be the result of imperfect manufacturing operations, or it may be the result of other conditions affecting the valve element 18.

The resilient unitary valve element 18 is dimensioned relative to the valve element holder 16 so that the lips of the duck bill portion will extend into the transverse slot or throughway as can be seen best in FIG. 3. When inserted in this manner the one lip 46 will be biased by the one wall or surface 38 into engagement with the other lip 48 so as to close the small gap 50. Thus, the one inclined wall or surface 38 forms a means in the passageway 28 for engaging the lip 46 to urge it into engagement with the other lip 48. Furthermore, if the valve element 18 should be axially displaced, in a manner to be described, to release excessive vapor pressure within tank 12, the inclined wall surface 38 will guide the lips back to the position shown in FIG. 3 in response to the action of biasing means 20.

The spring biasing means 20 includes the spring retainer 52 which is adapted to seat on the peripheral flange 42 as seen in FIG. 3. The spring retainer 52 has a central duct 54 for the passage of vent air. Also forming a part of the spring biasing means 20 is the compression coil spring 56 which fits over the spring retainer 52 and is held in a state of compression between the vent cap 22 and the spring retainer 52. Thus, the spring biasing means 20 functions to retain the resilient unitary valve element 18 in the position shown in FIG. 3. However, the resilient unitary element 18 can be displaced axially upward relative to the holder 16 in the event that vapor pressure from within the tank 12 becomes excessively great and passes upward through the passageway 26 and slot 34 into the interior of the cup-shaped holder 46 and acts against the under surface of the resilient unitary valve element 18 to urge it upward. When this occurs, the peripheral flange 42 will be displaced away from the peripheral lip 28 and the pressure of the vapor will be sufficient to allow it to pass between the resilient unitary valve element 18 and the inner wall of the cup-shaped holder 16 to escape beyond the valve element 18 and out of the vent duct 58 in the vent cap 22.

Conversely, when gasoline is withdrawn from the fuel tank 12 so that a pressure drop occurs within the tank, air can be vented through the duct 52 and into the interior of the resilient unitary valve element 18 for passage between the lips 46 and 48, and via the passageway 26 to the interior of the fuel tank 12.

For maintaining the cup-shaped holder 16 in place, the vent cap 22 has an internal shoulder 60 which can

engage the top surface of the peripheral lip 28 for clamping the latter between the top edge of the other end 30 of the fitting 14 and the annular shoulder 60. This arrangement allows the spring biasing means 20 to yield and permit upward movement of the valve element 18 as previously described, to release vapor pressures that may build up in the fuel tank 12. Preferably, the spring biasing means 20 is constructed so that outward venting of the vapor pressures will occur when the pressure differential between atmosphere and the interior of the fuel tank 12 is approximately two pounds per square inch. It is found that venting of air into the tank 12 can occur through the lips 46 and 48 when the exterior atmospheric pressure exceeds the pressure within the tank 12 by approximately $\frac{1}{4}$ to $\frac{1}{2}$ pounds per square inch pressure.

It is claimed:

1. Vent apparatus for an enclosure comprising a fitting defining a vent passageway and adapted to be mounted so that one end is in communication with said enclosure, a resilient unitary valve element positioned for limited axial movement in said fitting and having a tubular body portion and a duck bill portion extending from said tubular body portion, said tubular body portion being mounted in said passageway so that the duck bill portion extends toward said one end of the fitting, and means projecting transversely in said passageway into engagement with only one of the lips of the duck bill portion so that said one lip is deflected sufficiently to urge the lips continuously together without interfering with the permitted limited axial movement of said valve element, the other lip of the duck bill portion being disengaged except for engagement with said one lip, said valve element being adapted to be moved axially toward the other end of said fitting to allow venting through said passageway around said valve element.

2. Vent apparatus comprising a fitting defining a vent passageway, said fitting being adapted to be connected at one end to an enclosure for venting the same and being externally threaded at its other end, a cup-shaped holder having a peripheral lip seated on the other end of said fitting and having its bottom portion in said passageway, said bottom portion defining a throughway offset to one side of the axis of the cup-shaped element, a resilient unitary valve element having a tubular body portion with a peripheral flange that is seated on said peripheral lip, and a duck bill portion extending from said tubular body portion into said cup-shaped holder, the lips of said duck bill portion fitting into said throughway and one of said lips being urged against the other lip by one surface of the offset throughway, the other lip being in engagement only with said one lip, and a vent cap threadedly connected to said other end of the fitting.

3. Vent apparatus that is defined in claim 2, wherein spring means are operatively positioned between said cap and said valve element for maintaining a selected pressure against axial displacement of said valve element.

4. Vent apparatus that is defined in claim 3, wherein said vent cap includes an internal shoulder that seats on said peripheral lip to clamp the lip between said other end of the fitting and said internal shoulder.

5. Vent apparatus comprising a fitting defining a vent passageway, a valve element holder mounted in said passageway and having means defining a transverse slot, a resilient unitary valve element having a tubular

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body portion with a peripheral flange that is seated in sealing relation on said holder and a duck bill portion extending from said tubular body portion toward one end of the fitting, said duck bill portion having lips that fit into said slot, one of said lips being urged against the other lip by one wall of said slot, biasing means urging said valve element toward said one end to its seated position and responsive to a pressure above a selected magnitude from the direction of said one end to allow said valve element to unseat so that fluid can flow through said passageway around said duck bill portion from said one end to the other end of said fitting, the ends of said lips being out of engagement with the other wall of said slot so that fluid can flow from said other end to said one end through said duck bill portion when the fluid pressure at said other end is greater than at said one end.

6. Vent apparatus that is defined in claim 5, wherein said one wall of the throughway is inclined to and intersects the axis of the cup-shaped holder.

7. Vent apparatus for a fuel tank having an opening comprising a closure member for closing said opening defining a vent passageway, a valve element holder

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mounted in said passageway and having means defining an offset throughway, a resilient unitary valve element having a tubular body portion with a peripheral flange that is seated in sealing relation on said holder and a duck bill portion extending from said tubular body portion toward the inner end of the closure member, said duck bill portion having lips that fit into said throughway, one of said lips being urged against the other lip by one surface of said throughway, biasing means urging said valve element toward said inner end to its seated position and responsive to a pressure above a selected magnitude from the direction of said inner end to allow said valve element to unseat so that fluid can flow through said passageway around said duck bill portion from said inner end toward the outer end of said closure member, the ends of said lips being out of engagement with other surfaces of said throughway so that fluid can flow from said outer end toward said inner end through said duck bill portion when the fluid pressure at said outer end is greater than at said inner end.

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