United States Patent

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[72] Inventor **William S. Martin**
Copynsfield, Westerham, Kent, England

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[33] **Great Britain**
[31] **47601/67 and 51758/67**

[54] **DEVICES FOR VENTING GASEOUS AND/OR VAPOROUS MEDIA**
8 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **137/493.3,** 98/119, 137/512.2, 137/527, 137/527.8
[51] **Int. Cl.** **F16k 17/19**
[50] **Field of Search** 137/512.1, 527, 527.2, 527.4, 527.6, 527.7, 512, 512.2, 513, 493, 493.1, 493.2, 493.8, 493.9; 98/119; 220/44

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Primary Examiner—William F. O'Dea
Assistant Examiner—William H. Wright
Attorney—Michael S. Striker

ABSTRACT: A vent device for venting a gaseous and/or vaporous medium into the atmosphere, in particular for venting such a medium from a generally enclosed liquid container when liquid is entering the container, said vent device providing a vent orifice arranged for flow therethrough of the medium being vented, and comprising means for varying the cross-sectional area of the orifice in response to the volumetric rate of flow of the medium being vented, said cross-sectional area increasing with increasing flow rate of the medium and decreasing with decreasing flow rate of the medium.

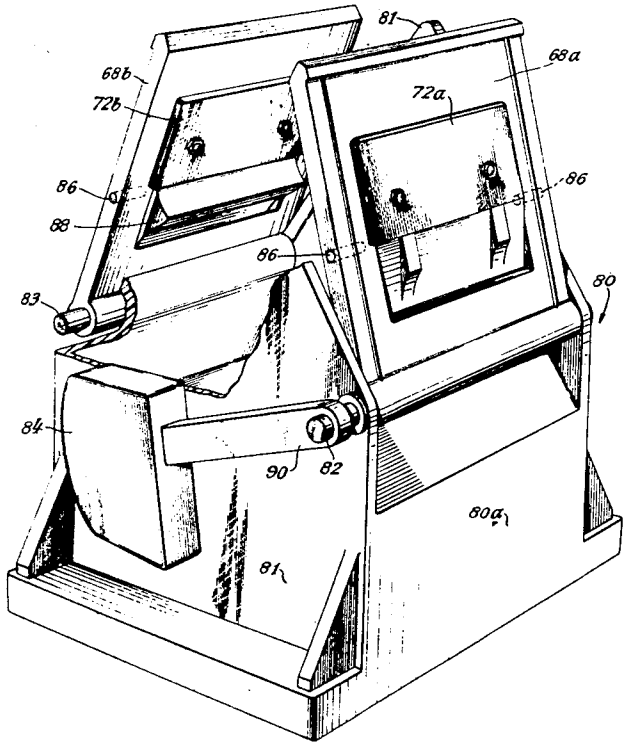


Fig.1.

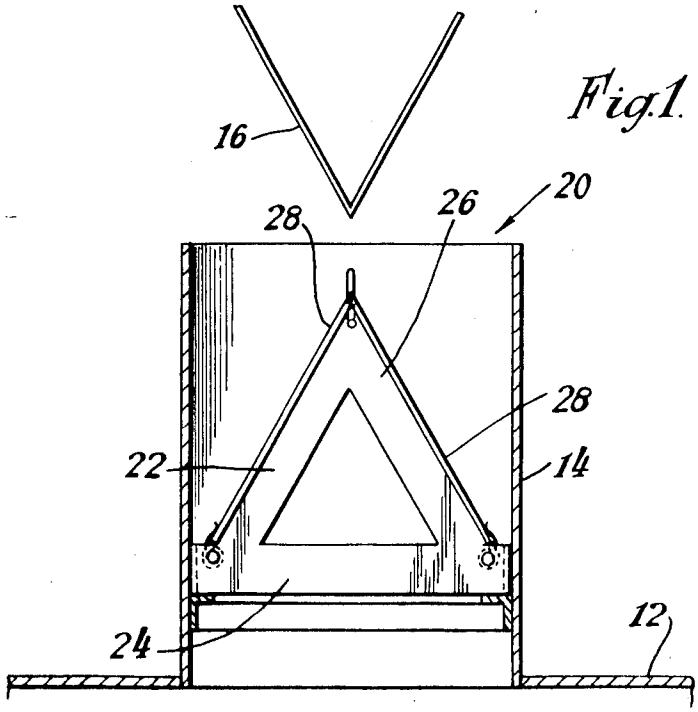
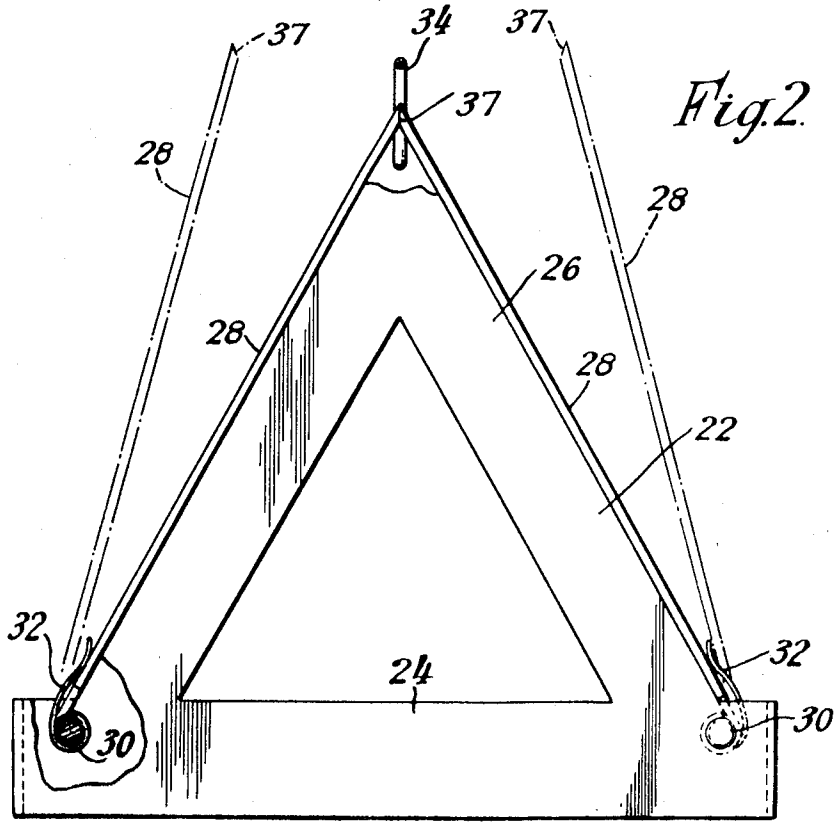
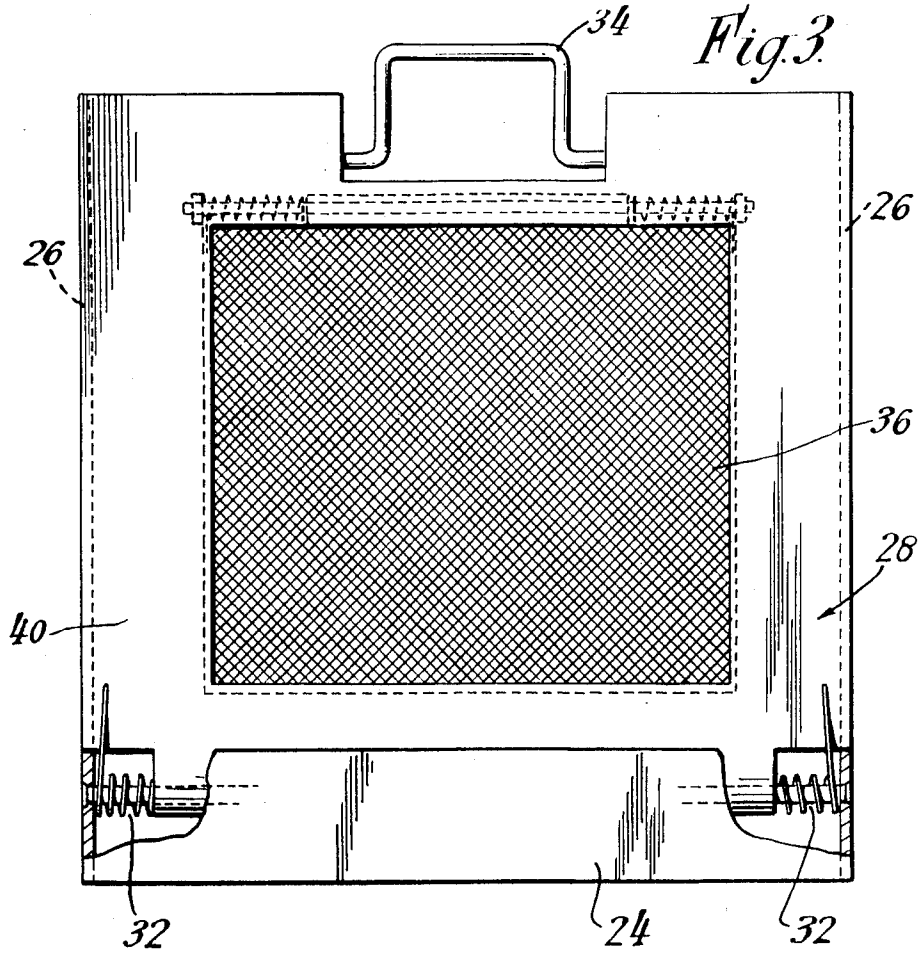


Fig.2.



INVENTOR
WILLIAM STEPHEN MARTIN
BY
Michael S. Striker
ATTORNEY

Fig.3



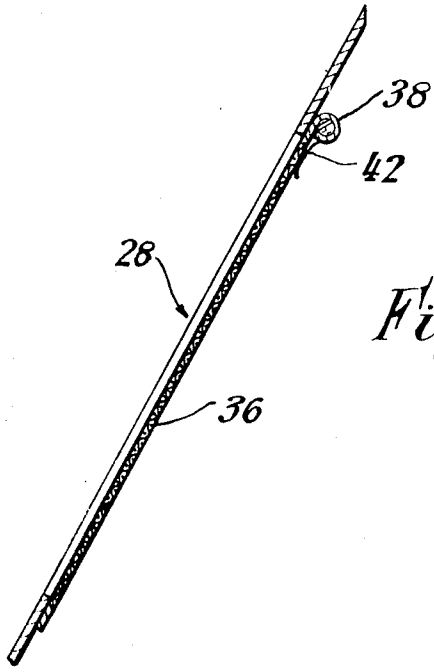


Fig.4

INVENTOR
WILLIAM STEPHEN HARTIN

BY Marcel S. Striker
ATTORNEY

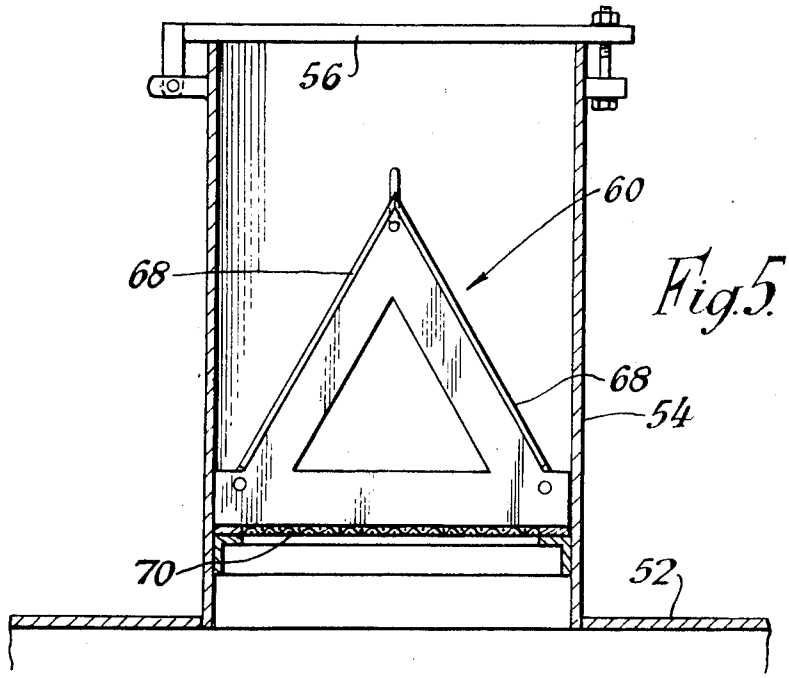
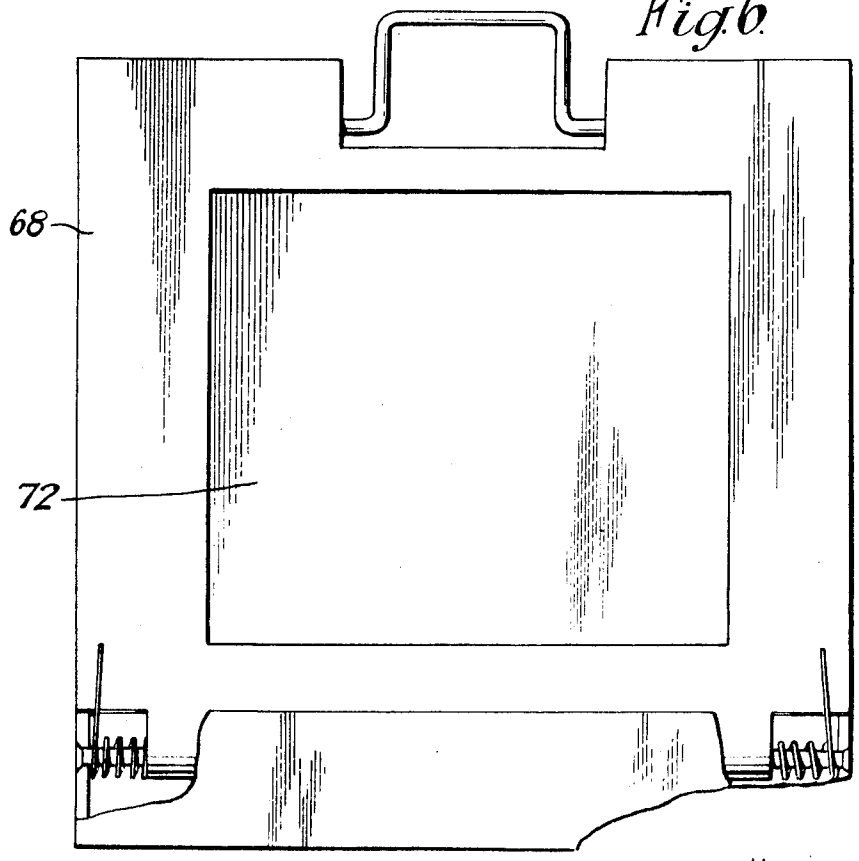


Fig.5

Fig.6



INVENTOR
WILLIAM STEPHEN MARTIN

BY
Michael S. Striker
ATTORNEY

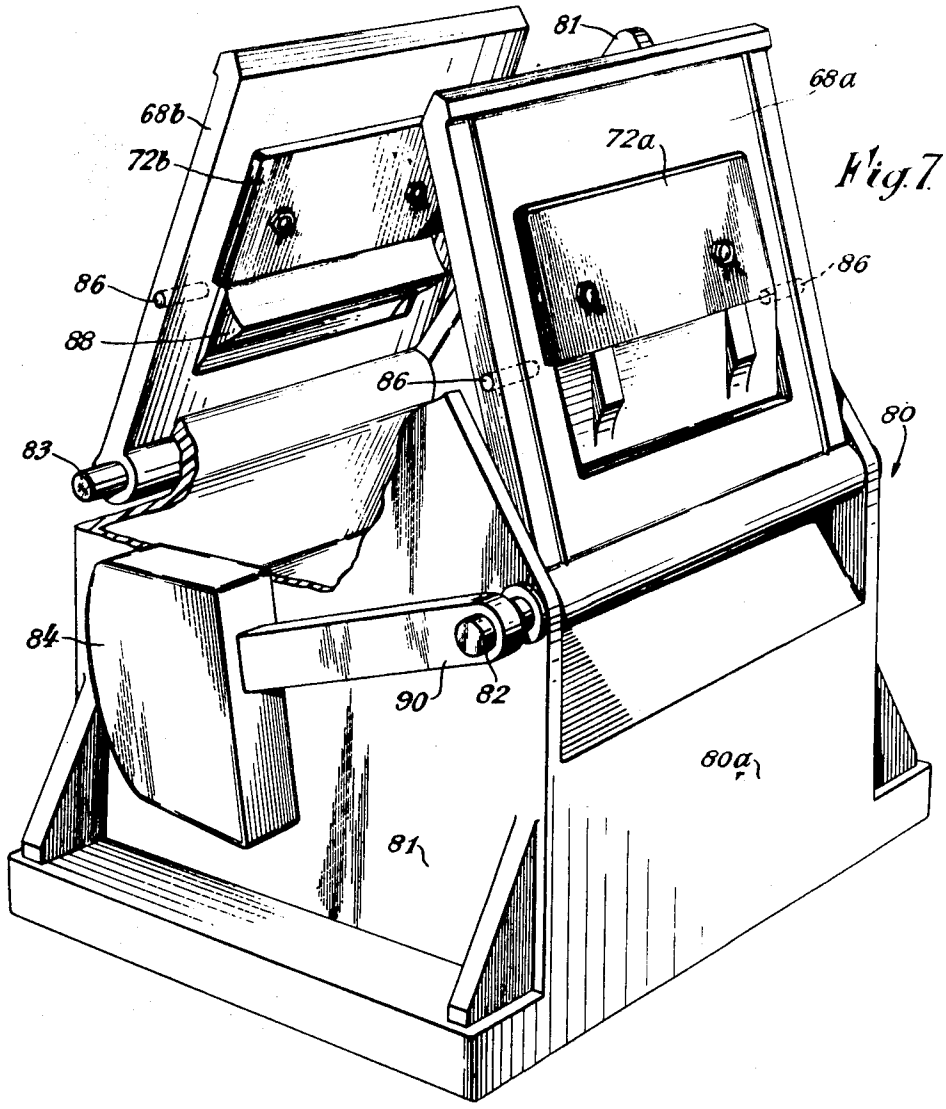
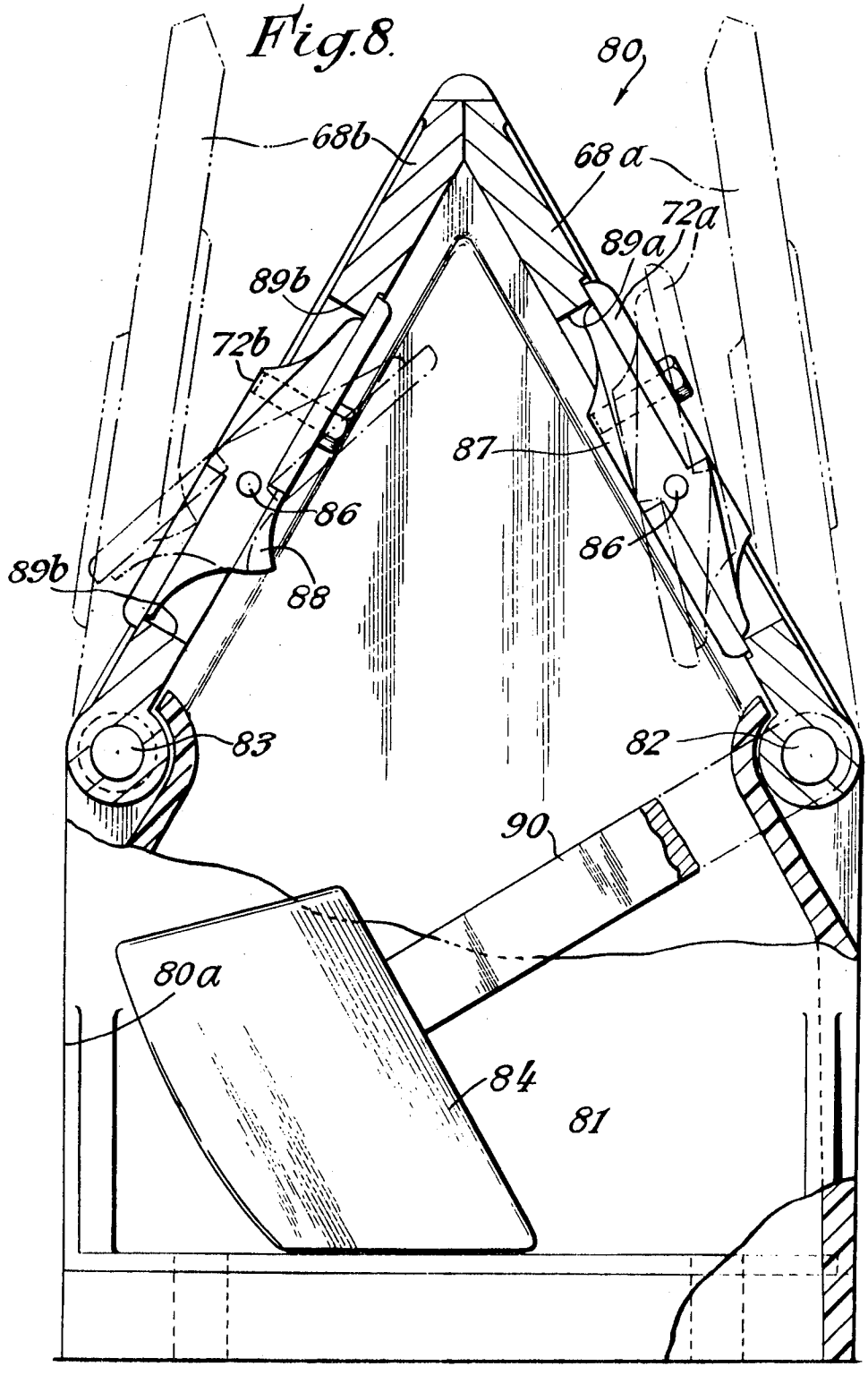


Fig. 7

INVENTOR
WILLIAM STEPHEN MARTIN
BY
Michael S. Striker
ATTORNEY

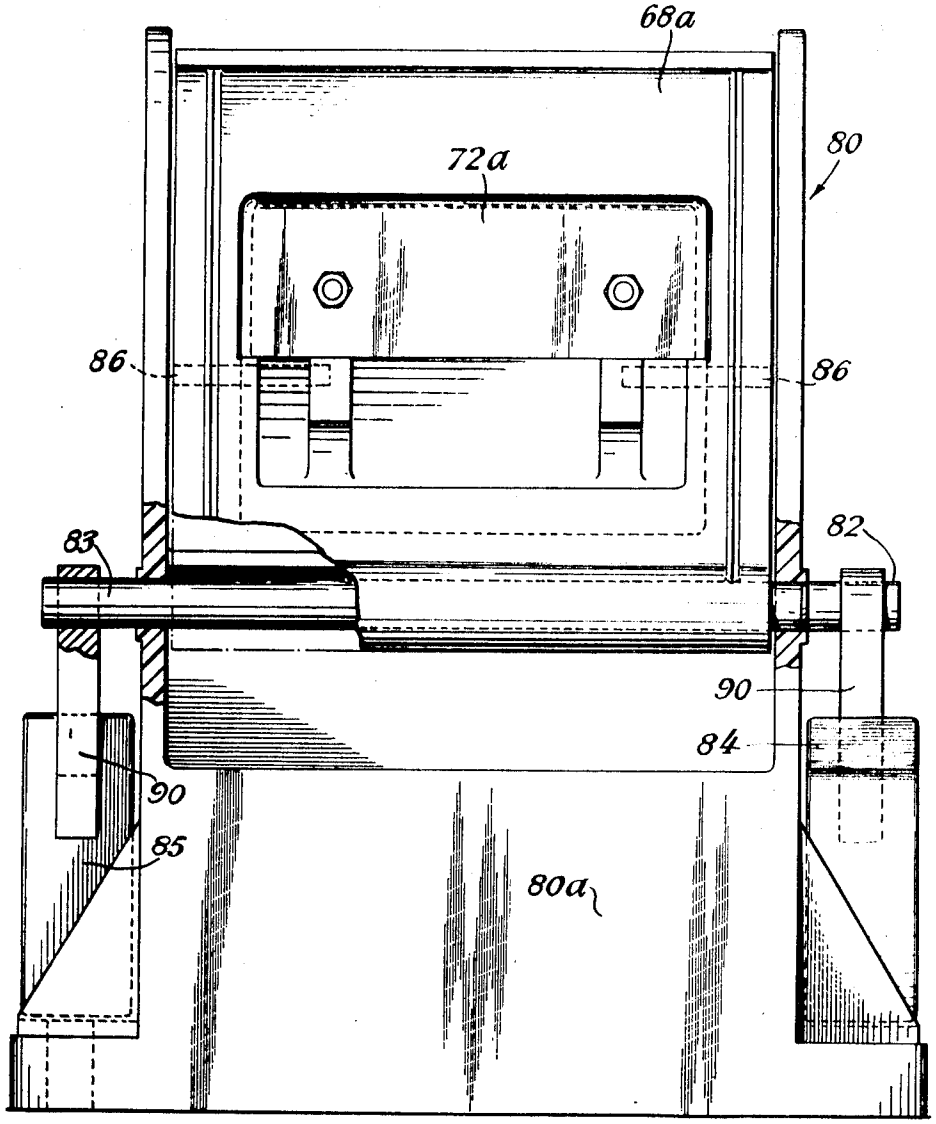
Fig. 8.



INVENTOR
WILLIAM STEPHEN MARTIN

BY
Mabel S. Strider
ATTORNEY

Fig. 9



INVENTOR
WILLIAM STEPHEN MARTIN
BY Mabel S. Stiles
ATTORNEY

DEVICES FOR VENTING GASEOUS AND/OR VAPOROUS MEDIA

This invention relates to a vent device for use in venting a gaseous and/or vaporous medium into the atmosphere. In particular, but not exclusively the invention relates to a vent device for venting a gaseous and/or vaporous medium from a liquid container.

When a noxious gaseous or vaporous medium has to be discharged into the atmosphere, for example the flue gas from a boiler or furnace, it is customary to discharge the medium into the atmosphere at a considerable height from the ground, for example, in the case of a boiler or furnace, by employing a high chimney stack. The cost of providing means for discharging a noxious gaseous and/or vaporous medium into the atmosphere at a great height above the ground is very considerable, and one object of he present invention is to provide a simple and inexpensive vent device which avoids the necessity for discharging the noxious medium into the atmosphere at a great height above the ground.

Again, when liquid is entering a generally enclosed liquid container, provision must be made for venting displaced air or other gaseous medium to the atmosphere. For example, this must be done when petroleum produces are entering land-based storage tanks and also when they are entering oil tanker ships. In venting containers for petroleum products or other inflammable liquids, it is important that the linear velocity of the gaseous medium being vented is sufficient to avoid hazardous accumulation of inflammable liquid, vapor or gas entrained in the gaseous medium being vented.

Further objects of the present invention are to provide an improved method of, and an improved device for, venting a generally enclosed liquid container.

According to the invention a rent device for venting a gaseous and/or vaporous medium into the atmosphere comprises a vent orifice arranged for flow therethrough of the medium being vented, and means for varying the cross-sectional area of the orifice in response to the volumetric rate of flow of the medium being vented, said cross-sectional area increasing with increasing flow rate of the medium and decreasing with decreasing flow rate of the medium.

According to a further aspect of the invention, a vent device adapted for use in venting a generally enclosed liquid container when liquid is entering the container is adapted to provide a vent orifice arranged for flow therethrough of the gaseous and/or vaporous medium being vented, and comprises means for varying the cross-sectional area of the orifice in response to the volumetric rate of flow of the medium being vented, said cross-sectional area increasing with increasing flow rate of the medium and decreasing with decreasing flow rate of the medium.

The invention also provides a container assembly comprising a generally enclosed liquid container and a vent device as set out in the last preceding paragraph.

Also according to the invention, in a method of venting a generally enclosed liquid container while a liquid is being fed into the container, a vent device providing an orifice of variable cross section is arranged to control the pressure within the container so that the linear velocity of venting gaseous and/or vaporous medium leaving the container through the vent device does not fall below a predetermined minimum.

The invention will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a sectional side elevation of parts of a container embodying the invention,

FIG. 2 is an enlarged view of a vent device of the assembly,

FIG. 3 is a front view corresponding to FIG. 2,

FIG. 4 is a side view of certain parts of the vent device

FIG. 5 is a view corresponding to FIG. 1 of a second container assembly embodying the invention,

FIG. 6 is a front view corresponding to FIG. 5,

FIG. 7 is a perspective view, with parts broken away, of a further vent device in accordance with the invention,

FIG. 8 is a partially sectioned side elevation of the vent device of FIG. 7, and

FIG. 9 is a partly sectioned end view of the vent device of FIG. 7.

The container assembly shown in FIGS. 1 to 4 comprises a land-based, generally enclosed, storage tank 12 for petroleum liquids. The tank 12 comprises an upwardly extending steel venting trunk 14 of rectangular cross section over which a V-sectioned rain guard 16 extends. The assembly also comprises a vent device 20 removably secured in the trunk 14 and adapted for use in venting the tank 12 when liquid is entering the tank.

The vent device 20 is arranged to prevent the linear velocity of venting air or other gaseous medium leaving the tank 12 from falling below a predetermined minimum value when liquid is entering the tank 12 through an inlet (not shown). The vent device 20 comprises a framework 22 which comprises a lower rectangular portion 24 arranged to fit in the trunk 14 and two upwardly extending triangular portions 26. The device 20 also comprises two flaps 28 which extend upwardly from hinges 30 which are mounted in the portion 24 of the framework 22. In a rest condition of the device 20 the flaps 28 rest on the triangular portions 26 and are in contact with each other along upper edges 37 thereof; the upper edges of the flaps meet at an angle of not more than 60° in this condition. The device also comprises springs 32 which urge the flaps 28 about their hinges 30 into the rest condition.

When liquid is entering the tank 12 the pressure of venting gaseous and/or vaporous medium causes the flaps 28 to move about their hinges 30 (as shown in chain lines in FIG. 2) against the action of the springs 32 to provide a vent orifice between the upper edges 37 thereof through which the venting medium flows; the extent of movement of the flaps 28 depends upon the volumetric flow rate of the venting medium which itself depends upon the rate of entry of liquid into the tank 12; thus the cross-sectional area of the orifice varies in response to the rate of entry of liquid into the tank 12, the cross-sectional area increasing with increasing rate of liquid entry and decreasing with decreasing rate of liquid entry. The strength of the springs 32 is such that the linear velocity of venting medium leaving the tank 12 through the orifice does not fall below a predetermined minimum value, for example does not fall below 30 meters per second. It will be realized that the venting medium is accelerated in passing between the flaps 28.

The vent device 20 also comprises a handle 34 to facilitate its removal from the trunk 14.

Each flap 28 comprises a wire mesh flame screen 36 which extends downwardly from a hinge 38 (FIG. 4) which is mounted on a rectangular frame portion 40 of the flap 28; the screen 36 is urged against the frame portion 40 by a spring 42. The flame screen 36 permits entry of air into the trunk 14 in the closed condition of the flaps 28 when liquid is being emptied from the tank 12, through an outlet (not shown). Should the flame screen 36 become blocked, for example by wax or grease, then atmospheric pressure will cause it to open against the action of the spring 42 to permit air to enter the tank 12 as it is being emptied.

The container assembly shown in FIGS. 5 and 6 comprises a generally enclosed cargo tank 52 of an oil tanker ship. The tank 52 comprises an upwardly extending trunk 54 for example about 2 meters high on which is mounted an openable hinged cover 56 which is watertight when closed. A vent device 60 is removably secured in the trunk 54.

The vent device 60 resembles the vent device 20 (FIGS. 1 to 4) in many respects and is described insofar as it differs therefrom.

The vent device 60 comprises flaps 68 corresponding to the flaps 28 but each flap 68 comprises a hinged member 72 (FIG. 6) which is solid and impermeable but otherwise corresponds in construction and arrangement to the flame screens 36. However, a removable flame screen 70 is included in the trunk

54 below the device 60. When it is required for liquid to enter the tank 52, the cover 56 is opened and the device 60 then operates in the same manner as the device 20 of FIGS. 1 to 4. When it is required to empty the tank 52, the cover 56 is opened and atmospheric pressure causes the member 72 to open against the action of their springs to permit air to pass downwardly into the tank 52.

A breathing port (not shown) may be provided in the trunk 54 between the cover 56 and the vent device. The vent device may be so positioned in the trunk 54 that, in the closed position of the cover 56, the flaps 68 are held in their closed position either by the cover or some means (not shown) attached to the cover.

FIGS. 7 to 9 show a preferred embodiment of a vent device in accordance with the invention. This vent device, which is generally designated by the numeral 80, is generally similar to the vent device 60 of FIGS. 5 and 6, the main difference between the two devices being that the device of FIGS. 7 to 9 is provided with counterweights in place of the springs of the device 60. The same reference numerals have been used in FIGS. 7 to 9 to designate those items which are similar to items of the vent device 60.

The vent device 80 comprises a hollow framework 80*a* having two opposed sidewalls 81 which at their upper ends are of triangular configuration. The two flaps 68*a* and 68*b* are secured to spindles 82, 83, respectively, these spindles being journaled in the sidewalls 81. Counterweights 84, 85 are secured to the spindles 82, 83 respectively in order to urge the flaps 68*a* and 68*b* to their rest condition shown in FIG. 8.

The flaps 68*a* and 68*b* are provided with hinged members 72*a* and 72*b*, respectively, which are hinged to their respective flaps by means of pivots 86. The hinged members 72*a*, 72*b* are provided with counterweights 87, 88, respectively, which urge the hinged members into their rest condition shown in full lines in FIG. 8. In their rest condition the hinged members 72*a* and 72*b* close associated apertures 89*a* and 89*b*, respectively in the flaps 68*a*, 68*b*, respectively.

The vent device 80 may replace the vent device 60 in the container assembly shown in FIGS. 5 and 6. When used in this assembly, the flaps 68*a*, 68*b* assume the positions shown in chain lines in FIG. 8, against the action of the counterweights 84, 85, when liquid is entering the tank 52. When the tank 52 is being emptied, the hinged member 72*b* pivots into the position shown in chain lines in FIG. 8, against the action of the counterweight 88, to allow air to enter the tank 52. The hinged member 72*a* provides an overpressure relief when the flaps 68*a*, 68*b* are in their rest condition. If an overpressure arises in the tank 52, the hinged member 72*a* can pivot into the position shown in chain lines, against the action of the counterweight 87, to allow relief of the overpressure.

A removable flame screen (not shown), similar to the flame screen 70 of FIGS. 5 and 6, may be provided in the framework 80*a* of the vent device 80.

The framework, flaps and hinged members of the vent device 80 may be made of a reinforced plastics material, for example a polyester plastics reinforced with glass fiber. The shafts 82, 83 and the pivots 86 may be made of stainless steel and the counterweights 84, 85 may be made of lead. The link 90 connecting each counterweight 84, 85 to its associated shaft may be made of mild steel.

In one embodiment of the vent device shown in FIGS. 7 to 9, the parts of the device were so dimensioned that when the tank 52 was being filled with liquid at the maximum filling rate, the gaseous and/or vaporous medium vented from the device had a velocity of approximately 100 meters per second, and a velocity of approximately 30 meters per second when tank was being finally topped up at a reduced rate filling. The flaps 68*a*, 68*b* assumed their rest condition when the pressure in the tank 52 fell below 0.25 pounds per square inch (gauge) (0.0175 kg./cm.^{2} (gauge)). The hinged member 72*a* was arranged to open at a pressure of 1.5 p.s.i. (gauge) (0.105 kg./cm.^{2} (gauge)), and the hinged member 72*b* was arranged to open when an under pressure of at least 0.5 p.s.i. (gauge) (0.035 kg./cm.^{2} (gauge)) existed in the tank 52. When this particular vent device was employed to vent gaseous and/or vaporous medium from a tank being filled with petroleum, it was not necessary to provide a flame screen on, or in association, with the device since the velocity of the flame front in petroleum vapors is considerably less than the minimum linear velocity of the vented medium provided by the vent device.

Although the above description with reference to the drawings emphasized the use of vent devices with generally enclosed containers for liquids, it will be appreciated that the vent device in accordance with the invention may be used in other situations where it is desired to vent a gaseous and/or vaporous medium into the atmosphere. Thus, for example, the vent device shown in FIGS. 7 to 9 could be mounted permanently at the upper end of a duct leading the flue gases from a boiler. When used in this way, the vent device would vent the noxious fumes from the boiler at a considerable velocity from the duct, so avoiding the necessity of providing the boiler with a tall chimney stack. When used in this manner, it may not be necessary to provide the hinged member 72*b*, the flap 68*b* then being a plain flap. It may be desirable to retain the hinged member 72*a* as a pressure relief valve.

What I claim is:

1. A vent device for venting a gaseous and/or vaporous medium into the atmosphere comprising a framework; a vent orifice arranged in the framework for flow therethrough of the medium being vented; two flaps pivotally mounted on said framework for varying the cross-sectional area of the orifice in response to the volumetric rate of flow for the medium being vented, said cross-sectional area increasing with increasing flow rate of the medium and decreasing with decreasing flow rate of the medium; biasing means associated with said flaps for urging them into a position in which they close said orifice; an aperture in at least one of said flaps; a pivoted member mounted in said one flap; and further biasing means for urging said pivoted member into a position in which it closes said aperture.

2. A vent device as claimed in claim 1, in which said pivoted member is arranged to open against the action of its biasing means in response to a predetermined excess pressure within said framework.

3. A vent device as claimed in claim 1, in which said pivoted member is arranged to open said aperture against the action of its biasing means in response to a predetermined underpressure in said framework.

4. A vent device as claimed in claim 1, in which said pivoted member comprises a flame screen.

5. A vent device as claimed in claim 1, comprising a flame screen mounted in said framework.

6. A container assembly comprising a generally enclosed liquid container, a duct for venting gaseous and/or vaporous medium from the container and a vent device as claimed in claim 1 mounted in said duct.

7. A container assembly as claimed in claim 6, in which said vent device is removably mounted in said duct.

8. A container assembly as claimed in claim 6, comprising an operable closure device for said duct.