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COVERING HOOD FOR TANK BREATHER VALVES

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**Fig. 1**

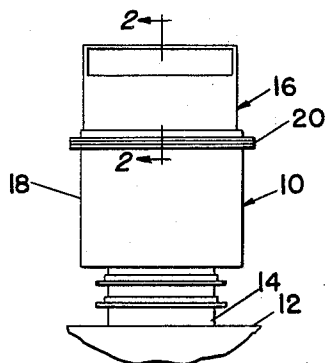


**Fig. 2**

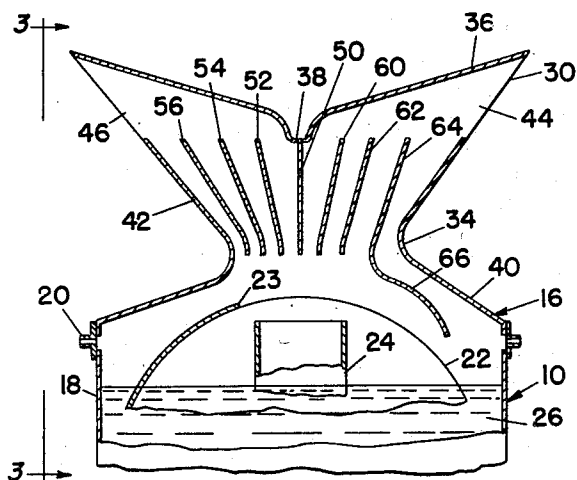


**Fig. 3**

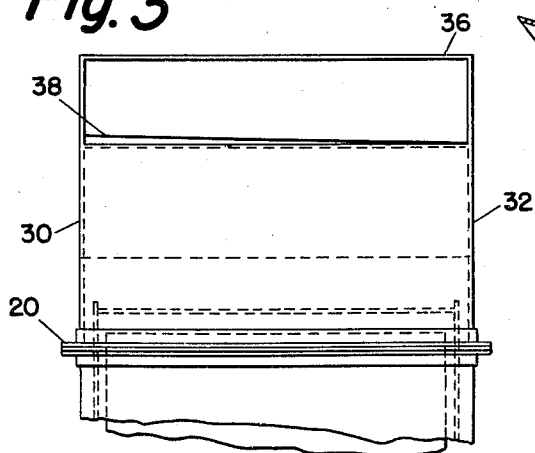
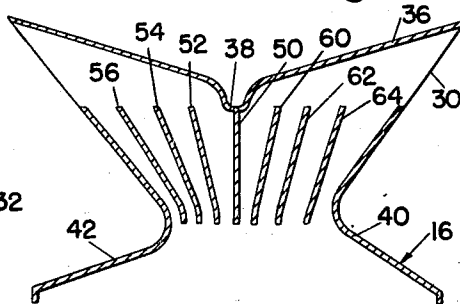


**Fig. 4**



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1

2,864,397

## COVERING HOOD FOR TANK BREATHER VALVES

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3 Claims. (Cl. 137—248)

This invention relates, in general, to storage tank breathing mechanisms, and particularly to hoods or covers for pressure venting valve mechanisms of the type used as tank breathing devices.

Vent valves are designed and used for the purposes of preserving the storage vessels on which they are mounted against pressure strains, and secondary to husband the contents by conserving the volatile constituents. Undue pressure or vacuum conditions existing in the vessel must be relieved to prevent explosion or collapse. Uncontrolled pressure reliefs are wasteful in that they do not conserve the volatile constituents, which is of prime importance, particularly in the storage of volatile petroleum products.

In meeting these operating requirements, relief valves of many types have been suggested, with more or less success. Among the most successful is the oscillating, liquid sealed valve adapted to rotate in one direction to open the breathing conduit for either pressure or vacuum relief such as disclosed in my Patent No. 2,715,909, issued August 3, 1955. It is for valves of this type specifically, and for pressure relief valves in general, that the hood element disclosed herein is designed as an improvement.

Generally the operating characteristics of the oscillating relief valve referred to depend upon the operating pressure and its control, and upon the freedom from obstruction which might interfere with the valve capacity. An object of this invention is to provide means for minimizing the external interference tending to obstruct the flow of gases through the valve.

It will be evident to those versed in the art that the mentioned obstruction may take many forms. One of these is the back pressure caused by changing the direction of the relief gases under protecting hoods. This could be eliminated by removing the hoods entirely. However, the presence of small animals, bugs and the possible accumulation of water, ice and snow on the top of the sealing liquid makes a covering essential. It is the principal object of this invention to provide a hood or cover which will reduce the accessibility of the valve mechanism to bugs and small animals, shed water and snow from the valve chamber, and reduce the back pressure of relieved and relieving gases during the venting operation.

With the above and other objects in view, all of which will be further disclosed in the course of the following description, the invention consists in combining in a single unit a plurality of passageways designed to co-operate with the vented gases as they are transmitted through the valve by speeding the relieving gas movement to and from the valve venting conduit in the pressure and vacuum relief operations. This form of the invention is directed to use, generally, with any form of relief valve. In another form of structure, the vanes forming the passageways are constructed and positioned to recover the entrained sealing liquid particles and re-

2

turn them to the body of the sealing liquid for use with liquid sealed valves. The vanes are covered, in both instances, by a sloping roof designed to give a minimum of obstruction to the movement of the relieving gases, shed rain and snow clear of the valve chamber, and further protect the valve interior from obstruction by living bodies, dusts and moisture which could transform to ice.

In the accompanying drawings the selected forms of apparatus accomplishing the objects of this invention are illustrated by various figures in which the parts are similarly designated.

Figure 1 is an elevational view of the device in operating position;

Figure 2 is an elevational sectional view of one form of the particular invention taken along lines 2—2 of Figure 1;

Figure 3 is an elevational view of Figure 2 taken as indicated by lines 3—3 on that figure;

Figure 4 is an elevational sectional view of an alternate form of the invention showing modification of the internal structure of Figure 2 for general use.

Valves of this general class, where there is conflict in operating characteristics caused by dual requirements of vacuum and pressure conditions, are generally over designed in favor of better operation for pressure relief. This is accepted as good practice due to the greater volume requirement in the relief of pressure conditions over vacuum conditions, and to the greater urgency of pressure relief because of higher intensity. There is a limitation of the extent to which the pressure relieving condition can be favored, however, as it is a necessary requirement that the vacuum condition be fully met to avoid tank collapse. Further, the relieving gas, normally atmosphere, in addition to supplying the necessary pressure balance, forms a protective blanket over the volatiles, and in subsequent pressure operations forms the bulk of the relieved material, further conserving the volatile constituents. Hence the valve mechanism and the hood particularly described here, although it is designed to emphasize pressure relief as a controlled safety maneuver, is also constructed to admit the vacuum relieving gases without undue obstruction as a balanced requirement. It will be evident that the hood of this invention aids and abets these operations.

It will be immediately evident to those versed in the art that a typical nozzle constructed as indicated by well known mathematical formula would readily solve the problem of passing relieving gases to and from the valve with minimum turbulence and resulting obstruction to valve capacity. Further, such a structure, of necessity very long in longitudinal dimension, would further bar small animals and could be shielded to keep out bugs. Such a solution would, however, extend the physical height of such a relief valve beyond all practical limits and subject the device to wind stresses which would overcome its otherwise practical construction. Therefore it is necessary to try to capture the principles of the nozzle for efficient passage of the relieving gases, in two directions in this case, and also keep the dimensions within practical limits.

Both the illustrated forms of the invention indicate a solution to these problems of nozzle characteristics and dimensional limitations. As will be described more fully in the later detailed discussion of the hoods, a plurality of nozzles are formed by properly positioned vanes or baffles within the body of the hood. The intervening spaces, so formed by the vanes, are shaped to give the desired nozzle effect. Further, the length of these nozzle areas, as limited by the height of the vanes, is selected to give the most advantageous gas passing action within

reasonable structural, dimensional limitations. In this manner the desired operating characteristics are obtained within practical physical limitations.

Referring now to Figures 1 and 2, a relief valve of the liquid sealed type, broadly designated by the numeral 10, is mounted on the storage vessel 12 by connection with a manhead assembly 14. The hood portion 16 of this invention, and specifically designed for this type of valve, is attached to the body 18 of the valve 10 by the flanged connection 20. Within the valve body 18, the oscillating valve member 22, Figure 2, is shown in venting position with trailing edge 23 raised relative to the venting conduit 24 and clear of the sealing liquid 26. It will be understood that the valve member 22 is normally in sealing position covering the venting conduit 24 by completing the seal with the liquid 26. This particular form of valve, noted by patent number above, is specifically referred to here as it is well known in the art and is one form of breather valve with which the hood of this invention cooperates to improve its operating characteristics. However, it will be understood that this hood, and its alternate form later to be described, can be used with other types of relief valves, improving their operations by use of the same operating principles.

Figures 2 and 3 of the drawing illustrate the details of the hood used with liquid sealed valves. It comprises a body portion the two end walls 30 and 32 of which are shaped to position the flange connection 20 at the bottom and then form a constricted section at 34. Above this, and extending to the top 36, the shape of the end walls is caused to flare, producing a two horned or winged effect. Side walls 40 and 42 complete the body portion by covering the constricted section 34 extending from the lower, flared portion at the flange connections 20 to the upper flared portion, and are terminated to form the vent openings 44 and 46 respectively in cooperation with the top or roof 36. Although this is a preferred form of construction, it will be evident that the constricted section can be obtained by an arrangement of baffles set in a housing, or body portion as it is termed, of any cross section.

Within this body portion of the hood 16 formed by the ends 30 and 32, as connected by the side walls 40 and 42, is placed a plurality of vanes or baffles. From both Figures 2 and 3 it will be evident that the vanes or baffles extend between the ends 30 and 32 to which they are fastened, and by means of position and curvature start at the constricted portion 34 and flare outwardly as they extend upwardly to stop in line with the openings 44 and 46 made by side walls 40 and 42 and the top 36.

A central vane 50 is arranged vertically to divide the vaned sections into similar halves, and is connected to the under side of the top at depressed portion 38. This divides the operating volumes of the hood 16 into two halves substantially equal and similarly formed. It will be evident that this central vane, forming part of the preferred structure of this application, can be omitted by shifting the complete vane structure to either side of center and still produce an operating device based on the disclosed principles.

In Figure 2, the left, vaned portion is divided by three vanes 52, 54 and 56 into four passageways for guiding the venting gases. The lower ends of these vanes are placed on equal spacing and are bent to present a guiding face substantially in the direction of gas movement relative to the lower or flanged portion of the hood. At the top of the vanes, the increased space due to the flared outline of the ends 30 and 32 followed by the wall 42 is substantially divided into four equal spaces. Thus the upper ends of the vanes form a fan-like passageway section, the openings being small at the bottom, large at the top, with the direction of gas movement proportioned, controlled and directed to follow a curvature to and from the hood opening 46. As indicated previously, the spaces between the vanes thus form a nozzle-like structure. The positioning of the vanes and their length is determined in accordance

with the mathematical principles governing nozzle design. By dividing the hood passageway volume into a plurality of separate nozzles as formed by the vanes, the structure is shortened to a practical height and still retains the nozzle effect.

The right, vaned portion of the hood 16 is similarly divided by a like number of vanes 60, 62 and 64 designed and positioned for like nozzle effect. With the exception of an extension 66 attached to the bottom of vane 64 and the same being led down into the flange portion of the hood 16, these vanes are similar in all respects. This lower portion of vane 64, number 66, is extended downwardly and curved to interrupt the entrained sealing liquid particles initially picked up by escaping pressure gases when the valve edge 23 breaks the seal. From this explanation it will be evident that the rotational movement of the valve member 22 is counterclockwise for all venting operations, thus directing the initial relief from and to the right vanes section of hood 16.

Reference again to the drawing will show that the vaned structure is apportioned as above described, similarly for each section, but the whole hood structure, although centrally aligned with the vent conduit 24, is offset and flared to emphasize the right portion as the more serpentine pathway. By the term "more serpentine" is meant, the curvature of the flared portion at 34 on the right of the hood, combined with the vane extension 66, is adjusted to require the vent gases to travel a path with more frequent and abrupt curvatures. Initially, the rotating valve edge 23 will break the liquid surface a little to the right of vane extension 66, as we look at Figure 2. A pressure condition will entrain particles of the sealing liquid in the outward movement of the gas. Entrainment is not a problem in the vacuum condition of normal operation because the pressure settings and resultant velocities are then limited to values which can carry liquid droplets only short distances. Under pressure relieving conditions, the escaping gas will bubble the sealing liquid just as the valve member 22 breaks the liquid surface with the trailing edge 23. The escaping gases will move to the right and upwardly between the side wall 40 and the vane extension 66 carrying liquid particles with it. This gas flow is obstructed and the pathway direction changed as it moves upwardly through the hood. At each change of direction the entrained moisture particles are released on the interfering surfaces and drip back to the body of the sealing liquid. Under the vacuum relief condition the droplets picked up as lip 23 clears the fluid surface are dropped into the body of the liquid before the relieving air can reach the entrance to the venting conduit 24.

Reference to Figure 2 in view of what has been said above relative to the escaping gas and entrained sealing liquid particles will show the liquid to be picked up in the initial venting movement only. This takes place, as stated above, below the space between the side wall 40 and the vane extension 66. As the valve member lifts further, the escaping gas will contact the under-side of vane extension 66 and again be deflected.

At this point the escaping gas, no longer being directed into contact with the sealing liquid, will be free of entrained liquid particles and will escape through the vane spaces without contacting droplets deposited in the original gas escape passage formed by wall 40 and vane extension 66. Otherwise deposited droplets would be swept out and not recovered. The nozzle effect becomes active and as the escaping gas entering the constricted nozzle portion is moved to the increased areas energy recovery takes place as the gas escapes. This facilitates the gas movement and removes any back pressure at the venting conduit which would tend to interfere with valve operation and movement of the vented gases.

In contrast with this pressure relief condition where the pressure of the storage vessel exceeds atmospheric pressure causing a venting action, the reverse condition

arises where a vacuum condition must be relieved. There is no requirement for the recapture of entrained sealing liquid particles as the opening pressure differentials are low and the velocity of the relieving atmosphere moving from outside the hood into the storage vessel is too low for objectionable liquid entrainment. It will be evident that this reverse movement, although not accelerated as in the pressure venting operation, will not be obstructed either. The vanes are terminated at sufficient distance above the valve-relief conduit locus and are so directed relative to the direction of movement of the relieving gas as to prevent obstructing turbulence of the relieving atmosphere. Consequently, the vacuum relief action is one of controlled and directed relief gas movement started by the valve operation and conducted to the valve locus by the hood. As noted this action is the less demanding of the two conditions requiring relief. It is provided for, however, and considered here as a controlling factor in the design of such protective coverings.

In view of the above description and discussion of the hood especially designed for liquid sealed valves of the rotating type, the more general form of the device for use with other type valves will be readily understood. Figure 4 shows a hood 16 with ends 30 and 32, and side-walls 40 and 42, or similar arrangement as described above, constructed as already described for Figures 2 and 3. A similar roof or top 36 forms opening 44 and 46 in conjunction with the side walls 40 and 42, and the ends 30 and 32 (Fig. 3). The internal structure divided into right and left halves by a centrally disposed vane 50, extending from end 30 to end 32 and vertically from a line across the constricted portion 34 to the depression 38 in the top, is the same. Within the two halves of the hood as divided by this vane 50, spaced vanes 52, 54 and 56, on the left, and 60, 62 and 64 on the right, form like nozzle-shaped spaces flaring outwardly and upwardly. The vane extension 66, however, is not included in this form of the device as it is intended for use with valves where there is no need to recapture entrained drops of the sealing liquid.

Operation of this form of the hood of this invention is limited, therefore, to rapidly relieving pressures and vacuum with minimum turbulence and resulting back pressures. As described above for the hood form of Figure 2, the nozzle effect formed by the vanes permits the pressured gases to be speedily passed through to larger volumes with a resulting velocity head conversion assisting the relieving gas movement. A favorable result is also obtained in the reverse movement for vacuum relief as above indicated.

Two forms of the device illustrating the application of the disclosed venting principles have been shown. Modifications of size, shape, number of pathways, relative proximity with other elements, shift of vane structure to present differently positioned pathways, and like changes, will be immediately evident. It is the intention of the

inventor that such changes and substitutions be covered by the scope of the spirit of this invention being limited only by the claims appended to and forming a part of this application.

What is claimed is:

1. A hood for use with a liquid seal pressure and vacuum relief valve mounted to move generally across the path of relieving gases comprising in combination with the valve, a body for the passage of relieving gases therethrough, said body constricted transverse the direction of movement of said valve providing a reduced passage for the relieving gases, a plurality of vanes extending lengthwise of the body constriction, said vanes positioned in spaced relationship in the constricted passage and flared apart in the portion of the body above the constriction forming a plurality of successive passages for said relieving gases during the operating movement of the valve, and a roof supported by the body spaced above said vanes leaving a passage for the movement of the relieving gases.

2. A hood for use with a liquid seal pressure and vacuum relief valve mounted to move generally across the path of relieving gases comprising in combination with said valve a body portion including spaced apart vertical end walls, side walls extending between said end walls forming a constricted section therebetween for the passage of relieving gases, a roof extending between the end walls and forming gas transmitting apertures with said side walls, a vertical vane connecting said end walls and extending from the constricted section upwardly to engage the roof dividing the roof portion of the hood into separate operating halves relative to the valve movement, a plurality of vanes in each of said halves extending from the constricted section upwardly in flaring relation to said vertical vane and to each other terminating to form the bottom of a gas transmitting passage above the vanes leading to the side wall apertures.

3. The hood and valve combination of claim 2 further characterized by the vane initially contacted by the relieved gases being extending downwardly through the constricted section in spaced and flaring relation with the side wall of the body portion forming an initially receptive passage for escaping pressure gases.

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