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(54) **Title:** COLD ROOM COMBINATION VENT AND LIGHT

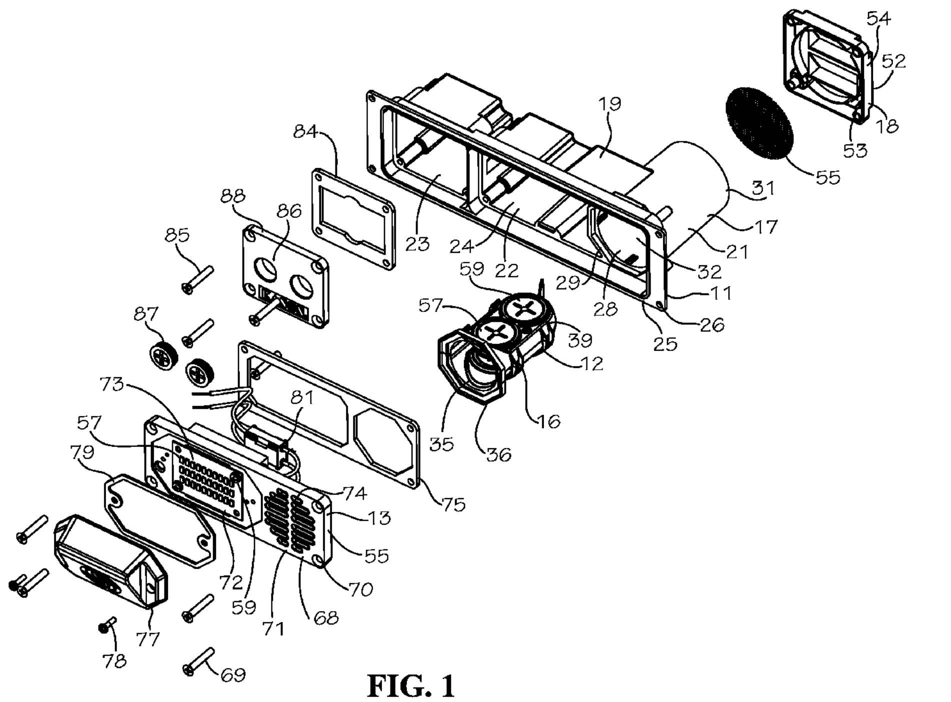

FIG. 1

(57) **Abstract:** A combination light and pressure relief vent (10) is disclosed which includes a housing (11), a valve assembly (12), and a light assembly (13). The housing include a multi-radial positionable valve body (16), port tube (17), and an outside louver (18). The valve assembly includes a low positive pressure exhaust valve (57), a high positive pressure exhaust valve (59), a low negative pressure intake valve (61), and a high negative pressure intake valve (62). The light assembly includes a heat sink casing (68) which defines a heat chamber (37) and which includes a projection (80) extending into the heat chamber. The casing is coupled to an LED module (57) wherein heat generated by the LED module is transferred through the casing to the heat chamber to warm the valve assembly.

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COLD ROOM COMBINATION VENT AND LIGHT

TECHNICAL FIELD

This invention relates to pressure relief vents used on temperature controlled enclosures such as walk-in freezers and refrigerators.

BACKGROUND OF THE INVENTION

Many temperature controlled commercial enclosed spaces need to be equipped with pressure relief ports or vents which are sometimes referred to as ventilators or ventilator ports. This is particularly true where the sealed space is subjected to temperature related air volume variations that must be relieved, such as a cold room.

Cold rooms typically have a neutral air pressure. To achieve the neutral air pressure the cold room is fitted with passive ports or vents. However existing passive pressure relief ports, meaning those without fans or blowers, have often permitted unwanted air migration where there is no significant pressure differential. With walk-in freezers this air intrusion may cause undesirable condensation and frosting. Frosting is a substantial problem that occurs when ambient warm air drawn into a low temperature chamber releases significant amounts of moisture relative to the change in dew point of the air at high and low temperatures. Air is drawn through the port after each door opening cycle wherein the warm air that entered the enclosure cools and contracts within the cold environment of the enclosure. If venting does not occur, a partial vacuum results within the enclosure which makes it difficult to reopen the door. In extreme cases, the enclosures can even collapse.

A temperature rise in the enclosure between cooling cycles, and especially during a defrost cycle, creates a need to vent air to the exterior to prevent pressure buildup. Again, failure to vent this pressure, with adequate relief capacity, can cause the chamber to rupture.

Passive pressure relief ports are in wide commercial use today. Large structures require the movement of a large amount of air to equalize the pressure between the interior and the exterior of the enclosure. Existing commercial use vents can be either a large sized vent or a gang of small sized vents. This large amount of air movement carries with it a large amount of moisture. This moisture can condense almost immediately upon contact with the cold air and cold surfaces of the enclosure. If this occurs, a large ice block may form on the interior wall, which may eventually block the inflow of air through the port. This large ice block may also pose a potential danger to someone should it fall from the wall and strike the person. Also, the use of large vents within small rooms causes a low velocity flow of air to enter the room. This low velocity air flow is more susceptible to freezing the moisture within the airflow upon entering the cold room.

Another problem with cold rooms is that high negative pressure may be dangerous as the warm air entering the cold room enters the cold room with the entrance of a person. The entering warm air subsequently cools and creates a negative pressure within the cold room as it condenses. This negative pressure may hold the door in a closed position until the pressure within the room normalizes. A person within the cold room may become panicked when unable to open the door. Today's vents alleviate small amounts of incoming warm air, but are inadequate to deal quickly with large volumes of warm air associated with multiple door entries or large sliding doors.

Another problem is the icing of certain valves associated with vents of cold rooms. Moisture entering the cold room may condense as ice upon the valves, thereby preventing them from functioning properly. One solution to this problem has been to simply chip the ice off the valve or remove it with the use of a heat gun. These solutions are time consuming and inadequate as it may damage the vent, cause bodily injury, and be only effective once the problem is discovered. As such, some vents have included resistive heaters. However, should the heater fail, the problem will go unresolved until the vent heater is repaired.

Yet another problem with some static valves has been that they operate and are adjusted to open at a select pressure gravitationally by adjusting the weight of a movable valve portion (poppet valve), i.e., the valves are gravitationally set and operated by their own weight, as shown in U.S. Patent No. 6,176,776. However, large air movements, such as wind or even a door closing, may cause the valve to open or flutter. This fluttering of the valve may cause it to open unnecessarily when a need for ventilation does not truly exist. The opening may also cause the valve to remain open for more time than necessary, thereby creating an icing of the valve which increases over time due to the valve remaining in an open condition.

The adjusting of the pressure by having different sized weights also increases costs associated with the vent. The different sizing of components increases the amount of inventory a supplier must carry, increase the number of components required to assemble the vent, and creates a potential for mistakenly utilizing the wrong component.

Lastly, a problem with these gravity valve devices has been that they are designed to operate in only one orientation, as they are mounted to operate with the valve positioned vertically. As such, an installer may need to inventory different models for different orientations of the valve housing based on its mounted orientation, thereby increasing expenses for the installer.

Accordingly, it is seen that a need exists for a pressure release vent that prevents the formation of ice, which is easily mounted in different orientations, and which allows for different amounts of air flow. It thus is to be provision of such a vent that the present invention is primarily directed.

SUMMARY OF THE INVENTION

In a preferred form of the invention a cold room vent comprises a main housing mountable to a cold room structure, a valve housing coupled to the main housing, the valve housing having a receiver with a select shape, and a valve assembly coupled to the valve housing. The valve assembly has a valve body which includes a gravity biased first pressure valve. The valve body has a mounting flange configured to be received within the valve housing receiver, the mounting flange having a select shape corresponding to the select shape of the receiver to enable the mounting flange to be received within the valve housing at a plurality of different angular orientations relative to the valve housing receiver. With this construction, the main housing may be mounted in a plurality of different angular orientations relative to a mounting surface, and wherein the valve assembly may be oriented in a plurality of different angular orientations with respect to the valve housing and main housing so that the first pressure valve may be oriented vertically in each of the plurality of different angular orientations of the main housing.

BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 is an exploded, perspective view of a cold room vent and light that embodies principles of the invention in its preferred form.

Fig. 2 is a perspective view of a portion of the cold room vent and light of Fig. 1.

Fig. 3 is a top, cross-sectional view of the cold room vent and light of Fig. 1.

Fig. 4 is an exploded, perspective view of a portion of the cold room vent and light of Fig. 1.

Fig. 5 is a cross-sectional view of a portion of the cold room vent and light of Fig. 1, shown venting positive pressurization of a cold room.

Fig. 6 is a cross-sectional view of a portion of the cold room vent and light of Fig. 1, shown venting negative pressurization of a cold room.

DETAILED DESCRIPTION

With reference next to the drawings, there is shown a combination light and pressure relief ventilator or vent 10 in a preferred form of the invention, referred to hereinafter simply as vent. The vent 10 is used with a temperature controlled enclosure, such as a freezer, refrigerator or other cold room, all of which are referred collectively herein as cold room.

The vent 10 includes a mount or main housing 11, a valve assembly 12, and a light assembly 13. The housing 11 includes a thermal valve body 16, a port tube 17, and an outside louver 18. The housing 11 is typically mounted to the wall of the cold room with the port tube 17 mounted to the inside surface of the wall and the outside louver 18 mounted to the outside surface of the wall. The port tube 17 has a top wall 19 and a bottom wall 20. The housing 11 is typically made of a plastic material or the like.

The housing port tube 17 includes a generally cylindrical valve housing portion 21 adjacent to a generally rectangular portion 22. The port tube 17 also has an ancillary electrical conduit portion 23 adjacent the rectangular portion 22. The port tube 17 also has an outwardly extending peripheral mounting flange 25 having four mounting holes 26 therethrough which receive mounting screws. The cylindrical portion 21 has a first opening 28 which includes an octangular receiver 29, and a second opening 31 oppositely disposed from the first opening 28 to form a channel 32 therebetween. The cylindrical portion 21 is configured to telescopically house or receive the valve assembly 12 within the channel 32, as described in more detail hereinafter.

The valve body 16 has a central tube portion 34 having an air passage opening 35 surrounded by an outwardly extending, octangular, peripheral mounting flange 36 sized and shaped to removably nest within and in register with the octangular receiver 29 of the housing cylindrical portion 21 in several orientations as described in more detail hereinafter. The valve body 16 defines an interior heat chamber 37 therein. The valve body 16 has a top wall 39 with a first low positive pressure exhaust port 40 therethrough, and a second high positive pressure exhaust port 41 therethrough. The first low positive pressure exhaust port 40 is the same size and shape or configuration as the second high positive pressure exhaust port 41. The valve body 16 also has a bottom wall 43 with a first low negative pressure intake port 44 therethrough, and a second high negative pressure intake port 45 therethrough. The first low negative pressure intake port 44 is the same size and shape or configuration as the second high negative pressure intake port 45. Each port 40, 41, 44 and 45 has a central bar 47 with a valve mounting hole 48 therein. The top wall 39 is removably coupled to the bottom wall 43 and secured thereto through manually actuated clasps or clamps 50, for ease of opening and disassembling the valve assembly 12.

The outside louver 18 has an outwardly extending mounting flange 52 with mounting holes 53 therein through which mounting screws extend to couple the louver 18 to the outside surface of the cold room. The louver 18 includes a drip deflecting hood 54 and a screen 55 therein to prevent the entrance of dirt, foreign object, insects or other pests.

The valve assembly 12 is coupled to and may be considered to be a portion of the valve body 16. The valve assembly 12 includes a first low positive pressure exhaust valve 57 having a mounting stem 58 extending through the valve mounting hole 48 of the first low positive pressure exhaust port 40, a second high positive pressure exhaust valve 59 having a mounting stem 58 extending through the valve mounting hole 48 of the second high positive pressure exhaust port 41, a first low negative pressure intake valve 61 having a mounting stem 58 extending through the valve mounting hole 48 of the first low negative pressure intake port 44, and a second high negative pressure intake valve 62 having a mounting stem 58 extending through the valve mounting hole 48 of the second high negative pressure intake port 45. Valves 57, 59, 61 and 62 are all considered to be air flow control valves and all include, in addition to the stem, a conventional configuration with a head. The end of the stem of each valve 57, 59, 61 and 62 is coupled to one or more circular weights 64 through a mounting screw 65 which gravitationally bias each valve towards a closed position. The weight or mass of each weight 64 determines the pressure necessary to move the valve 57, 59, 61 and 62 from a closed position to an open position, illustrated by the comparison of open positioned valve 57 in Fig. 5 and closed positioned valve 57 in Fig. 6. Each combination valve, valve mounting stem, weight and seat should be consider a valve assembly or valve sub-assembly. As used herein, the terms gravity operated, gravity biased, gravity actuated, gravitationally, gravitationally biased, or the like is intended to denote the biasing force, actuation, or movement of a valve which is generally dependent upon weight to reset the valve to a closed position, as opposed to a spring loaded valve which uses a spring biasing force to reset the valve to a closed position.

The difference in the mass or weight of the weights 64 allows the valves 57, 59, 61 and 62 to be the same construction, size, shape or configuration to aid in manufacturing, inventory and installation, yet allows for different opening pressures for each, i.e., first low positive pressure exhaust valve 57 and first low negative pressure exhaust valve 61 open first due to the biasing weight being less than that of the second high positive pressure exhaust valve 59 and second high negative pressure exhaust valve 62, depending upon whether there is a positive or negative pressure change within the cold room.

The light assembly 13 includes a rectangular shaped LED heat sink plate or casing 68 which is configured to telescopically fit within the mounting flange 25 of the valve body 16, so as to enclose and thereby form the heat chamber 37 through the combination of the casing 38, port tube 17 and valve body 16. The casing 68 is preferably made of a high thermally conductive metal, such as aluminum. The casing 68 is maintained in position by casing mounting screws 69 passing through mounting holes 70. The casing 68 has an exterior front wall or surface 71, to which is mounted an LED module 72 containing a plurality of LED diodes 73. The front wall or surface 71 includes air passages, vent openings, or vents 74 therethrough. A gasket 75 is position between the casing 68 and the front surface port tube 17. A transparent or translucent lens or lens cover 77 is coupled to the front surface 71 of the casing to cover the LED module 72 through lens cover mounting screws 78. A lens gasket 79 is positioned between the lens cover 77 and the front surface 71. An LED driver 81 is electrically coupled to the LED module 72. The LED driver 81 is positioned within the housing rectangular portion 22 and coupled to a source of electric current, such as a conventional A.C. line.

The heat sink casing 68 also includes an interior or rear surface 76 opposite from the front surface 71. The rear surface 76 has a large, trapezoidal or pyramid-shaped projection or projecting portion 80 which extends from between two adjacent vent openings 74 and through air passage opening 35 and at least partially into the heat chamber 37, as specifically into the valve body 16, as shown in Fig. 3. The projecting portion 80 extends or tapers down from the heat sink casing 68 from the rear surface between two adjacent vent openings 74 to a position distal the heat sink casing 68, so that airflow through the vent openings is directed onto the projecting portion 80.

An electrical cover plate 83 is coupled to and encloses the electrical conduit portion 23 of the port tube 17 with a gasket 84 positioned therebetween. The cover plate 83 is maintained in position by mounting screws 85. The cover plate 83 includes two conduit openings 86 which are fitted with removable plugs 87.

In use, the vent 10 is mounted to the wall of a cold room with the port tube 17 mounted to the interior surface and the outside louver 18 mounted to the exterior surface of the cold room wall. The vent 10 allows for a flow of air both into and out of the cold room to ambience through dual stage venting of pressure changes within the cold room. Should the cold room door be opened and a small amount of air is introduced into the cold room (small volume) and subsequently condense to create a negative pressure, the first low negative pressure intake valve 61 overcomes the gravitational biasing force of its weights 64 to move to an open position (as shown by the valve position in Fig. 6) allowing air through the first low negative pressure intake port 44, through valve body opening 35, and through casing air passages 74 into the cold room. Thus, the opening of the first low negative pressure intake valve 61 allows the entrance, flow, or passage of a small volume of air into the cold room to offset the condensing of the small volume of warm air which creates a negative pressure. The first low negative pressure intake valve 61 commences opening at a negative pressure level of at least or approximately 0.3 inches of water. The valve allows a flow rate of 2.5 CFM at 0.3 inches of water.

Should the cold room door be opened and a large amount of air is introduced into the cold room (high volume), both the first low negative pressure intake valve 61 and the second high negative pressure intake valve 62 sequentially overcome the biasing forces of their weights 64 to each move to their open positions allowing the flow of air therethrough and subsequently through valve body opening 35 and casing air passages 74, as shown by the arrows in Fig. 6. The opening of both the first low negative pressure intake valve 61 and the second high negative pressure intake valve 62 allows the entrance or passage of a large volume of air into the cold room in a very fast manner to offset the condensing of the large volume of warm air which creates a large negative pressure. The second high negative pressure intake valve 62 may be thought of as a second stage valve when a large amount of air is needed to be taken in to relieve the pressure within the cold room. The process commences with the first low negative pressure intake valve 61 opening as previously described. With the high volume of air, the second high negative pressure intake valve 62 then commences opening at a negative pressure level of at least or approximately 0.8 inches of water. The second high negative pressure intake valve 62 allows a flow rate of 18 CFM at 0.8 inches of water. The quick equalization of the pressure through the opening of both intake valves 61 and 62 prevents the cold room door from being stuck closed due to a large negative pressure within the cold room, which minimizes the potential of one panicking due to the inability to temporarily open the door.

As the room equalizes from the experience of the high negative pressure, the second high negative pressure intake valve 62 will first return to its seated position once the air pressure returns to a level below approximately 0.8 inches of water. The air pressure within the cold room continues to rise by air passing through the first low negative pressure intake valve 61 until the pressure reaches approximately 0.3 inches of water, wherein the first low negative pressure intake valve 61 will also move to its closed position. The end results is a cold room which is generally at a neutral pressure after the entrance of a large volume of warm air and its subsequent condensing upon cooling.

When a positive pressure occurs within the cold room, the first low positive pressure exhaust valve 57 overcomes the biasing force of its weights 64 when a small amount of positive pressure exists within the cold room (as shown by the valve position in Fig. 5). The first low positive pressure exhaust valve 57 opens at a positive pressure level of at least or approximately 0.3 inches of water. The first low positive pressure exhaust valve 57 allows a flow rate of 2.5 CFM at 0.3 inches of water. The cold room may experience positive pressure when one slams a door shut or when the air therein warms, such as when the cold room is going through a defrost mode. This positive pressure may prevent the full closing of the refrigerator door.

Should the cold room door be slammed or defrost mode activated so as to create a large positive pressure within the cold room (high volume), both the first low positive pressure exhaust valve 57 and the second high positive pressure exhaust valve 59 sequentially overcome the biasing forces of their weights 64 to each move to their open positions allowing the flow of air through casing air passages 74, valve body opening 35, exhaust valves and out louver 18, as shown by the arrows in Fig. 5. The opening of both the first low positive pressure exhaust valve 57 and the second high positive pressure exhaust valve 59 allows the exit or exhausting of a large volume of air from the cold room in a very fast manner to offset the introduction or expansion of the large volume of air which creates a large positive pressure. The second high positive pressure exhaust valve 59 may be thought of as a second stage valve when a large amount of air is needed to be exhausted relieve the positive pressure within the cold room. The process commences with the first low positive pressure exhaust valve 57 opening as previously described. With the high volume of air, the second high positive pressure exhaust valve 59 then commences opening at a positive pressure level of at least or approximately 0.8 inches of water. The second high positive pressure exhaust valve 59 allows a flow rate of 18 CFM at 0.8 inches of water. The quick equalization of the pressure through the opening of both exhaust valves 57 and 59 allows the cold room door to close properly by eliminating the positive pressure within the cold room.

As the room equalizes from the experience of the high positive pressure, the second high positive pressure exhaust valve 62 will first return to its seated position once the air pressure returns to a level of approximately 0.8 inches of water. The air pressure within the cold room continues to drop by air passing through the first low positive pressure exhaust valve 57 until the pressure reaches approximately 0.3 inches of water wherein the first low positive pressure exhaust valve 57 will also move to its closed position. The end results is a cold room which is generally at a neutral pressure after the entrance of a large volume of air or expansion of air within the cold room.

Thus, the flow or venting of air into the cold room is controlled by at least two negative pressure intake valves while the flow of air out of the cold room is controlled by two positive pressure exhaust valves.

The vent is preferably designed so that the LED module 72 is always energized to provide constant light within the cold room. The use of LED lights facilitates this due to their low power consumption. The heat generated by the constantly illuminated LED module 72 thermally passes through the heat sink casing 68, i.e., the LED module is in thermal communication with the LED heat sink casing 68. This heating of the LED heat sink casing 68 constantly warms the air within the interior heat chamber 37 of the port tube 17, and specifically within the valve body 16, and thus warms the exhaust valves 57 and 59 and intake valves 61 and 62. The warming of the valves prevents the formation of ice upon the valves which would prevent them from properly opening or closing, i.e., prevents the valves from freezing in place within their respective ports. It should be noted that this heating is economical as the cold room should be constantly illuminated regardless.

The projecting portion 80 extends into the interior heat chamber 37 and specifically into the valve body 16 through valve body opening 35 to warm the air to a higher degree, as the air passes over a larger warmed surface area of the heat sink casing 68.

The octangular shape of the valve body mounting flange 36 allows the valve body 16 to be positioned or repositioned within the octangular receiver 29 in any of the eight positions (radial or angular orientations) in which the mounting flange 36 fits or is register within the receiver 29. These eight positions are eight different radial orientations relative to the octangular receiver, port tube, or main house, as the valve body may be rotated about an axis extending longitudinally along the center of the valve body, i.e., set at different radial or angular orientations. This flexibility in mounting the valve body 16 relative to the port tube 17 allows the port tube 17 to be mounted in a variety of different radial or angular orientations or positions while still allowing the valve assembly 12 to properly gravitationally actuate by positioning the valve body 16 in a horizontal position depicted in the drawings. For example, the port tube 17 may be positioned horizontally with the top wall 19 facing upwardly as shown in the drawings. Alternatively, the port tube 17 may be positioned horizontally with the top wall 19 facing downwardly (inverted from the depiction in the drawings), here the housing 11 would be mounted in an inverted position compared to the drawings, so that the valve body actually has the top wall positioned on the top, as shown in the drawings, which is also true of the other orientations describer hereinafter. Alternatively, the port tube 17 may be positioned vertically with the top wall 19 oriented vertically and facing to the right (turned 90 degrees counterclockwise from the depiction in the drawings). Alternatively, the port tube 17 may be positioned vertically with the top wall 19 oriented vertically and facing to the left (turned 90 degrees clockwise from the depiction in the drawings. Also, the port tube 17 or may be positioned to any of the four positioned between these horizontal or vertical positions (turned at 45 degree angles from the just described four positions). With each of the eight positions (angular orientations) of the port tube mounting flange 36, the port tube mounting flange 36 is still positioned to be nested within the octangular receiver 29 with the valve body 16 oriented horizontally, as depicted in the drawings, so that the gravitational valves are still oriented vertically for proper gravitational actuation upon a change in air pressure.

It should be understood that other shapes of flanges and receivers may also be designed which may provide more or less multi-radial varied positions. For example, a square flange and receiver would provide four multi-radial orientations for the mounting of the port tube 17 and consequently relative mounting multi-radial positions of the valve body 16. Thus, the receiver 29 and mounting flange 36 may be considered to have a multi-radial symmetrically shape as they each have a shape which allows for different radial angles or different radial nesting therebetween.

The first low positive pressure exhaust valve 57, the second high positive pressure exhaust valve 59, the first low negative pressure intake valve 61, and the second high negative pressure intake valve 62 all have the same size and shape or configuration so that any valve may be fitted to any related port 40, 41, 44 and 45. This reduces inventory needs, reduces the cost of manufacturing, and eases the maintenance of the vent 10.

It should be understood that as an alternative, the flange receiver 29 and corresponding mounting flange 36 may be of a shape, such as circular, to allow the flange 36 to be rotated relative to the receiver 29 and maintained in its relative radial position be a screw or other coupler.

It should be understood that the combination of a light and vent also reduces cost and labor as both features are achieved through the mounting of a single unit which includes both functions.

It should also be understood that the light assembly is considered to be a heat assembly, as the light assembly creates heat. However, as an alternative to the LED light source shown in the preferred embodiment, the vent may include other types of commonly known heat assemblies, such as an electrically resistive element or non-LED light sources.

It should be understood that the projection 80 and the removable feature of the valve body with the receiver 29 and flange 36 of the present invention may be used with non-gravitational actuated valves.

It thus is seen that a vent is now provided which avoids the formation of ice on the vent valves and allows for both small and large amounts of air venting. Though it has been described in detail in its preferred form, it should be realized that many modifications, additions and deletions, in addition to those specifically recited herein, may be made without departure from the spirit and scope of the invention as set forth in the following claims.

CLAIMS

1. A cold room vent comprising:

a housing mountable to a cold room structure, said housing having a first pressure intake port and a second pressure intake port;

a gravity biased first pressure intake valve mounted to said first pressure intake port having a first weight which allows the opening of said gravity biased first pressure intake valve at a first air pressure level, and

a gravity biased second pressure intake valve mounted to said second pressure intake port having a second weight which allows the opening of said gravity biased second pressure intake valve at a second air pressure level greater than said first air pressure level,

whereby the gravity biased first pressure intake valve opens the first pressure intake port at a first air pressure level and the gravity biased second pressure intake valve opens the second pressure intake port at a second air pressure level.

2. The cold room vent of claim 1 wherein said gravity biased first pressure intake valve is the same size and shape as said gravity biased second pressure intake valve.

3. The cold room vent of claim 1 further comprising a first pressure exhaust port and a second pressure exhaust port;

a gravity biased first pressure exhaust valve mounted to said first pressure exhaust port having a first weight which allows the opening of said gravity biased first pressure exhaust valve at a first air pressure level, and

a gravity biased second pressure exhaust valve mounted to said second pressure exhaust port having a second weight which allows the opening of said gravity biased second pressure exhaust valve at a second air pressure level greater than said first air pressure level,

whereby the gravity biased first pressure exhaust valve opens the first pressure exhaust port at a first air pressure level and the gravity biased second pressure exhaust valve opens the second pressure exhaust port at a second air pressure level.

4. The cold room vent of claim 3 wherein said gravity biased first pressure exhaust valve is the same size and shape as said gravity biased second pressure exhaust valve.

5. The cold room vent of claim 3 wherein said gravity biased first pressure exhaust valve, said gravity biased second pressure exhaust valve, said gravity biased first pressure intake valve, and said gravity biased second pressure intake valve all have the same size and shape.

6. A cold room vent comprising:

a housing mountable to a cold room structure, said housing having a first pressure exhaust port and a second pressure exhaust port;

a gravity biased first pressure exhaust valve mounted to said first pressure exhaust port having a first weight which allows the opening of said gravity biased first pressure exhaust valve at a first air pressure level, and

a gravity biased second pressure exhaust valve mounted to said second pressure exhaust port having a second weight which allows the opening of said gravity biased second pressure exhaust valve at a second air pressure level greater than said first air pressure level,

whereby the gravity biased first pressure exhaust valve opens the first pressure exhaust port at a first air pressure level and the gravity biased second pressure exhaust valve opens the second pressure exhaust port at a second air pressure level.

7. The cold room vent of claim 6 wherein said gravity biased first pressure exhaust valve is the same size and shape as said gravity biased second pressure exhaust valve.

8. The cold room vent of claim 6 further comprising a first pressure intake port and a second pressure intake port;

a gravity biased first pressure intake valve mounted to said first pressure intake port having a first weight which allows the opening of said gravity biased first pressure intake valve at a first air pressure level, and

a gravity biased second pressure intake valve mounted to said second pressure intake port having a second weight which allows the opening of said gravity biased second pressure intake valve at a second air pressure level greater than said first air pressure level,

whereby the gravity biased first pressure intake valve opens the first pressure intake port at a first air pressure level and the gravity biased second pressure intake valve opens the second pressure intake port at a second air pressure level.

9. The cold room vent of claim 8 wherein said gravity biased first pressure intake valve is the same size and shape as said gravity biased second pressure intake valve.

10. The cold room vent of claim 8 wherein said gravity biased first pressure exhaust valve, said gravity biased second pressure exhaust valve, said gravity biased first pressure intake valve, and said gravity biased second pressure intake valve all have the same size and shape.

11. A cold room vent comprising:

a housing mountable to a cold room structure, said housing having a first pressure intake port and a second pressure intake port, a first pressure exhaust port and a second pressure exhaust port;

a gravity biased first pressure intake valve mounted to said first pressure intake port having a first weight which allows the opening of said gravity biased first pressure intake valve at a first air pressure level;

a gravity biased second pressure intake valve mounted to said second pressure intake port having a second weight which allows the opening of said gravity biased second pressure intake valve at a second air pressure level greater than said first air pressure level;

a gravity biased first pressure exhaust valve mounted to said first pressure exhaust port having a first weight which allows the opening of said gravity biased first pressure exhaust valve at a first air pressure level, and

a gravity biased second pressure exhaust valve mounted to said second pressure exhaust port having a second weight which allows the opening of said gravity biased second pressure exhaust valve at a second air pressure level greater than said first air pressure level,

whereby the gravity biased first pressure intake valve opens the first pressure intake port at a first air pressure level and the gravity biased second pressure intake valve opens the second pressure intake port at a second air pressure level, and whereby the gravity biased first pressure exhaust valve opens the first pressure exhaust port at a first air pressure level and the gravity biased second pressure exhaust valve opens the second pressure exhaust port at a second air pressure level.

12. The cold room vent of claim 11 wherein said gravity biased first pressure intake valve is the same size and shape as said gravity biased second pressure intake valve.

13. The cold room vent of claim 11 wherein said gravity biased first pressure exhaust valve is the same size and shape as said gravity biased second pressure exhaust valve.

14. The cold room vent of claim 11 wherein said gravity biased first pressure exhaust valve, said gravity biased second pressure exhaust valve, said gravity biased first pressure intake valve, and said gravity biased second pressure intake valve all have the same size and shape.

15. A cold room vent comprising:

a main housing mountable to a cold room structure;

a valve housing coupled to said main housing, said valve housing defining an interior heat chamber;

a valve assembly coupled to said valve housing, and

a light assembly coupled to said valve housing, said light assembly having thermally conductive heat sink plate with an external surface and an internal surface in fluid communication with said interior heat chamber, said internal surface having an outwardly extending projection extending into said interior heat chamber, said light assembly also including a light source coupled to and in thermal communication with said exterior surface of said thermally conductive heat sink plate,

whereby heat generated by the light source is thermally conducted to the thermally conductive heat sink plate wherein the projection provides a surface area to transfer the heat to the interior heat chamber to warm the valve assembly.

16. The cold room vent of claim 15 wherein said heat sink plate includes at least one vent opening extending from said external surface to said internal surface positioned directly adjacent said projection.

17. The cold room vent of claim 15 wherein said projection tapers down from a position proximal said internal surface to a position distal said internal surface.

18. The cold room vent of claim 15 wherein said projection is trapezoidal in shape.

19. The cold room vent of claim 15 wherein said valve assembly includes a gravity biased first pressure intake valve having a first weight which allows the opening of said gravity biased first pressure intake valve at a first air pressure level, and

a gravity biased second pressure intake valve having a second weight which allows the opening of said gravity biased second pressure intake valve at a second air pressure level greater than said first air pressure level.

20. The cold room vent of claim 19 wherein said valve assembly further comprises a gravity biased first pressure exhaust valve having a first weight which allows the opening of said gravity biased first pressure exhaust valve at a first air pressure level, and

a gravity biased second pressure exhaust valve having a second weight which allows the opening of said gravity biased second pressure exhaust valve at a second air pressure level greater than said first air pressure level.

21. A cold room vent comprising:

a mount mountable to a cold room structure;

a valve body coupled to said mount, said valve body defining a heat chamber having an air passage entrance opening;

at least one valve coupled to said valve body;

a thermally conductive heat sink plate mounted closely adjacent said valve body, said heat sink plate having a front surface and a rear surface facing said valve body, said rear surface having a projection extending through said air passage entrance and into said heat chamber, and

a light source coupled to and in thermal communication with said heat sink plate,

whereby heat generated by the light source is thermally conducted to the thermally conductive heat sink plate wherein the projection transfers heat to the heat chamber to warm the at least one valve.

22. The cold room vent of claim 21 wherein said heat sink plate includes at least one vent opening extending through said heat sink plate and positioned directly adjacent said projection.

23. The cold room vent of claim 21 wherein said projection tapers down from a position proximal said rear surface to a position distal said rear surface.

24. The cold room vent of claim 21 wherein said projection is trapezoidal in shape.

25. The cold room vent of claim 21 wherein said at least one valve includes a gravity biased first pressure intake valve having a first weight which allows the opening of said gravity biased first pressure intake valve at a first air pressure level, and

a gravity biased second pressure intake valve having a second weight which allows the opening of said gravity biased second pressure intake valve at a second air pressure level greater than said first air pressure level.

26. The cold room vent of claim 24 wherein said at least one valve further comprises a gravity biased first pressure exhaust valve having a first weight which allows the opening of said gravity biased first pressure exhaust

valve at a first air pressure level, and

a gravity biased second pressure exhaust valve having a second weight which allows the opening of said gravity biased second pressure exhaust valve at a second air pressure level greater than said first air pressure level.

27. A cold room vent comprising:

a mount mountable to a cold room structure;

a valve housing coupled to said mount, said valve housing defining a heat chamber having an air passage entrance opening;

at least one valve coupled to said valve housing;

a thermally conductive heat sink plate mounted closely adjacent said valve housing air passage entrance opening, said heat sink plate having a front surface and a rear surface facing said valve housing, said heat sink plate having a plurality of vent openings therethrough, said heat sink plate also having a projection extending from said rear surface between two said vents of said plurality of vents and into said heat chamber, and

a heat source coupled to and in thermal communication with said heat sink plate,

whereby heat generated by the heat source is thermally conducted to the thermally conductive heat sink plate wherein the projection transfers heat to the heat chamber to warm the at least one valve.

28. The cold room vent of claim 27 wherein said projection tapers down from a position proximal said rear surface to a position distal said rear surface.

29. The cold room vent of claim 27 wherein said projection is trapezoidal in shape.

30. The cold room vent of claim 27 wherein said at least one valve includes a gravity biased first pressure intake valve having a first weight which allows the opening of said gravity biased first pressure intake valve at a first air pressure level, and

a gravity biased second pressure intake valve having a second weight which allows the opening of said gravity biased second pressure intake valve at a second air pressure level greater than said first air pressure level.

31. The cold room vent of claim 30 wherein said at least one valve further comprises a gravity biased first pressure exhaust valve having a first weight which allows the opening of said gravity biased first pressure exhaust valve at a first air pressure level, and

a gravity biased second pressure exhaust valve having a second weight which allows the opening of said gravity biased second pressure exhaust valve at a second air pressure level greater than said first air pressure level.

32. The cold room vent of claim 27 wherein said heat source is a light source.

33. The cold room vent of claim 32 wherein said light source is an LED light source.

34. A cold room vent comprising:

a main housing mountable to a cold room structure;

a valve housing coupled to said main housing, said valve housing having a receiver with a select shape, and

a valve assembly coupled to said valve housing, said valve assembly having a valve body and a gravity biased first pressure valve, said valve body having a mounting flange configured to be received within said valve housing receiver, said mounting flange having a select shape corresponding to said select shape of said receiver to enable said mounting flange to be received within said valve housing at a plurality of different angular orientations relative to said valve housing receiver,

whereby the main housing may be mounted in a plurality of different angular orientations relative to a mounting surface, and wherein the valve assembly may be oriented in a plurality of different angular orientations with respect to the valve housing and main housing so that the first pressure valve may be oriented vertically in each of the plurality of different angular orientations of the main housing.

35. The cold room vent of claim 34 wherein said valve assembly includes a plurality of gravity biased pressure valves.

36. The cold room vent of claim 34 wherein said valve body includes a top wall and a bottom wall oppositely disposed from said top wall, and wherein said first pressure valve is mounted to said top wall, and wherein said cold room vent further comprises a second pressure valve mounted to said bottom wall.

37. The cold room vent of claim 36 wherein said first pressure valve is a pressure exhaust valve.

38. The cold room vent of claim 37 wherein said second pressure valve is a pressure intake valve.

39. The cold room vent of claim 34 wherein said valve body defines an interior heat chamber, and wherein said cold room vent further comprises a thermally conductive heat sink plate with an external surface and an internal surface in fluid communication with said interior heat chamber.

40. The cold room vent of claim 39 further comprising a heat source in thermal communication with said thermally conductive heat sink plate.

41. The cold room vent of claim 40 wherein said heat source is a light source.

42. The cold room vent of claim 39 wherein said heat sink plate includes at least one vent opening through said heat sink plate.

43. A cold room vent comprising:

a vent mount mountable to a cold room structure;

a valve body removably coupled to said vent mount, said valve body having an air passage therethrough with an air passage entrance opening, said valve body being mountable to said vent mount in a plurality of different radial orientations relative to said vent mount, and

at least one pressure valve coupled to said valve body.

44. The cold room vent of claim 43 wherein said vent mount includes a flange receiver having a multi-radial configuration, and wherein said valve body has a mounting flange having a multi-radial configuration corresponding with said multi-radial configuration of said flange receiver.

45. The cold room vent of claim 43 wherein said valve body mounting flange is nested within said flange receiver in a plurality of radial positions.

46. The cold room vent of claim 43 wherein said valve body includes a top wall and a bottom wall oppositely disposed from said top wall, and wherein said top wall includes a first said pressure valve, and wherein said bottom wall includes a second said pressure valve.

47. The cold room vent of claim 46 wherein said first pressure valve is a pressure exhaust valve.

48. The cold room vent of claim 47 wherein said second pressure valve is a pressure intake valve.

49. The cold room vent of claim 43 wherein said valve body defines an interior heat chamber, and wherein said cold room vent further comprises a thermally conductive heat sink plate with an external surface and an internal surface in fluid communication with said interior heat chamber.

50. The cold room vent of claim 49 further comprising a heat source in thermal communication with said thermally conductive heat sink plate.

51. The cold room vent of claim 50 wherein said heat source is a light source.

52. The cold room vent of claim 49 wherein said heat sink plate includes at least one vent opening through said heat sink plate.

53. A cold room vent comprising:

a main housing mountable to a cold room structure;

a valve housing coupled to said main housing, said valve housing having a multi-radial symmetrically shaped receiver, and

a valve assembly coupled to said valve housing, said valve assembly having a valve body and a gravity biased first pressure valve, said valve body having a multi-radial symmetrically shaped mounting flange configured to be received within said multi-radial symmetrically shaped receiver,

whereby the main housing may be mounted in a plurality of different radial angles relative to a mounting surface, and wherein the valve assembly may be oriented in a plurality of different radial angles with respect to the valve housing and main housing so that the first pressure valve may be oriented vertically in each of the plurality of different radial angles of the main housing.

54. The cold room vent of claim 53 wherein said valve body defines an interior heat chamber, and wherein said cold room vent further comprises a thermally conductive heat sink plate with an external surface and an internal surface in fluid communication with said interior heat chamber.

55. The cold room vent of claim 54 further comprising a heat source in thermal communication with said thermally conductive heat sink plate.

56. The cold room vent of claim 54 wherein said heat sink plate includes at least one vent opening through said heat sink plate.

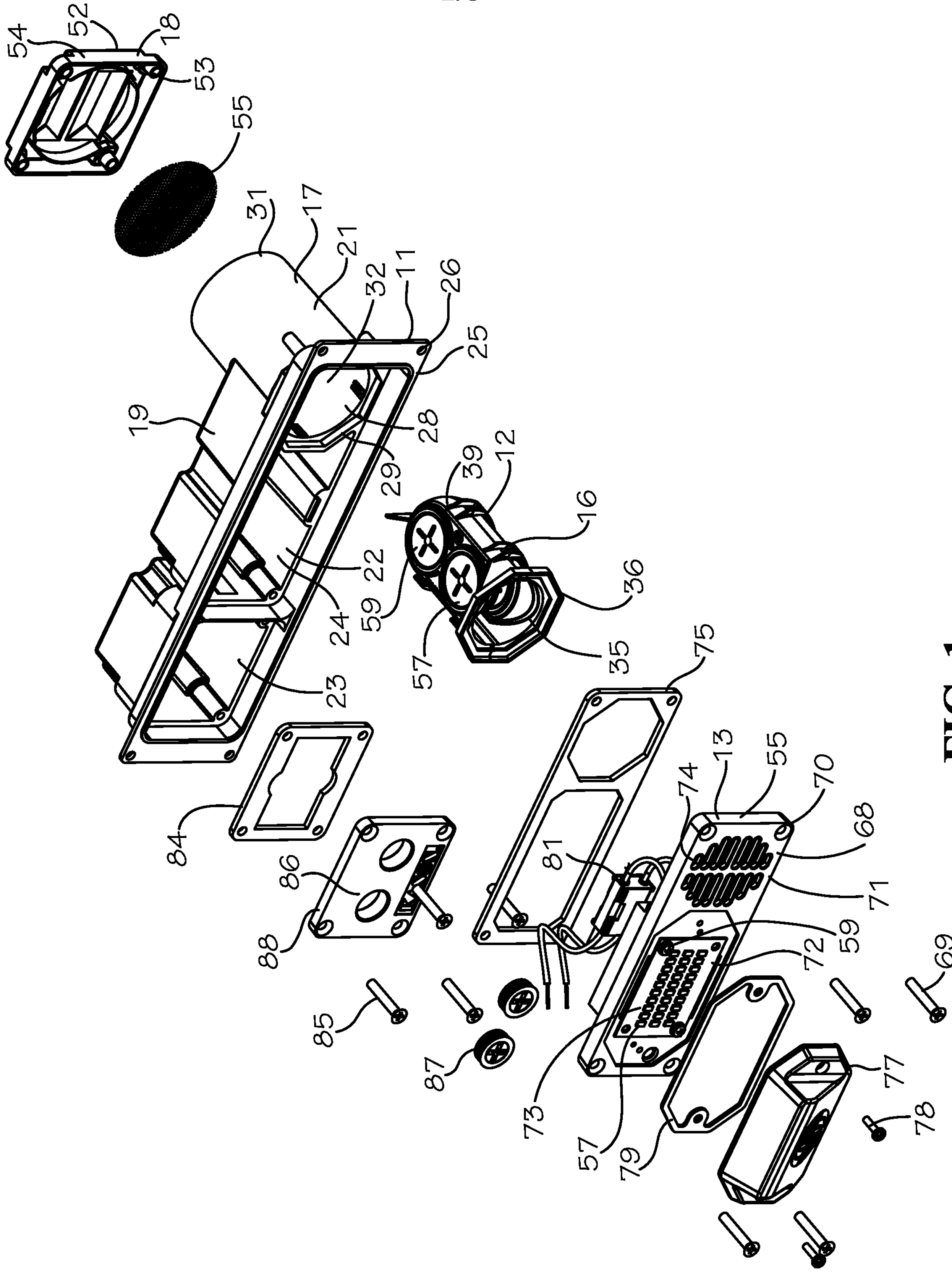
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FIG. 1

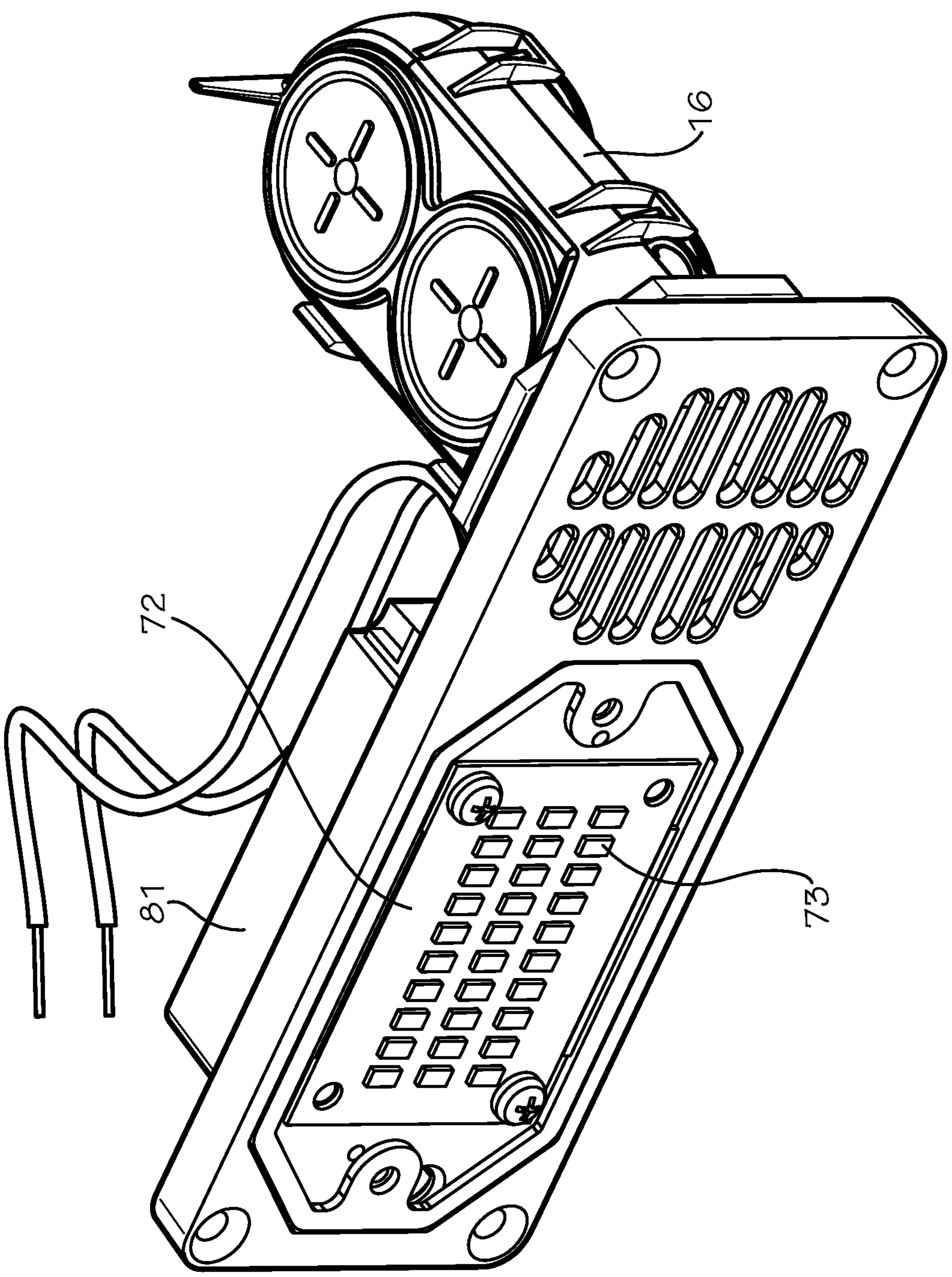

FIG. 2

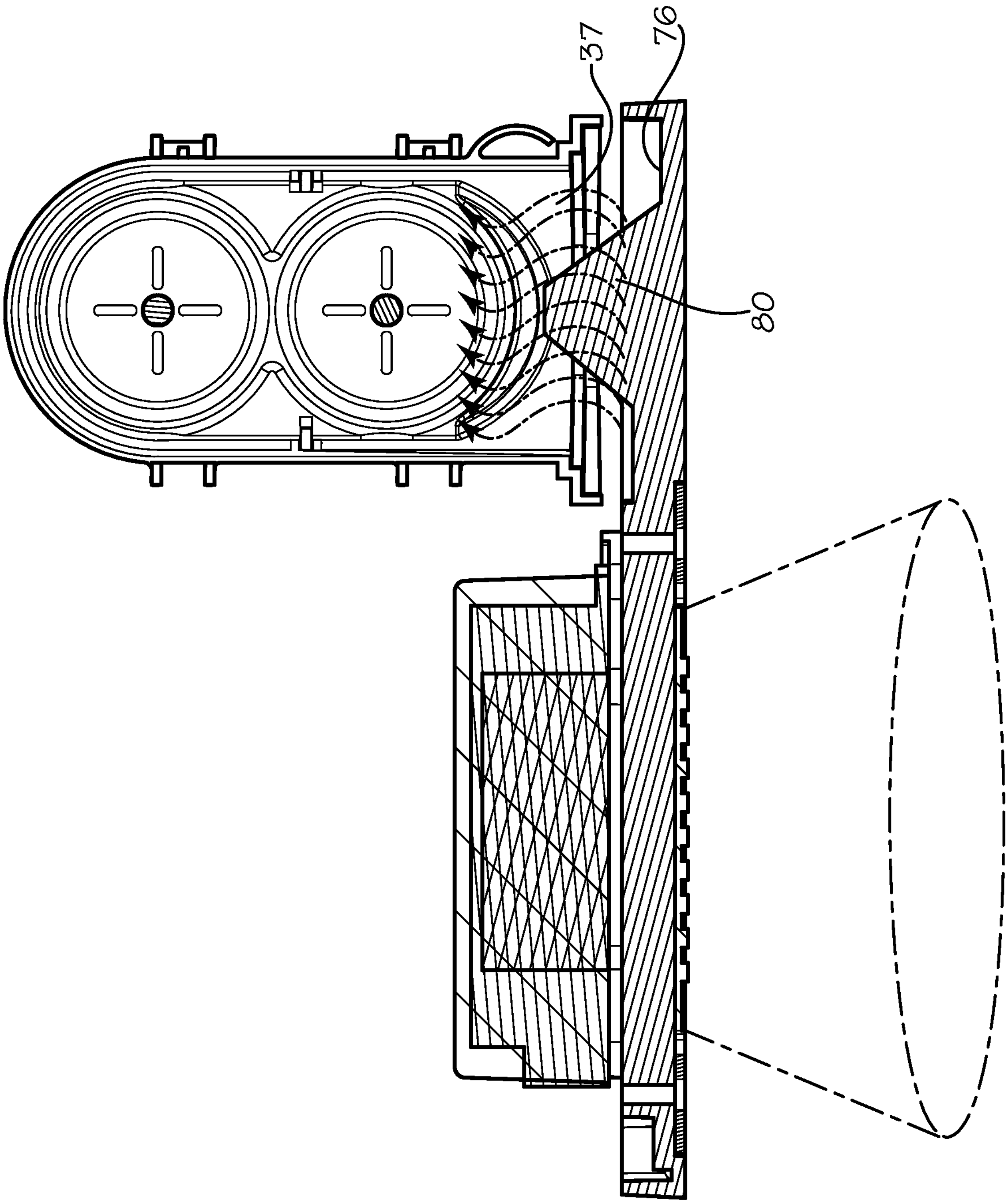

FIG. 3

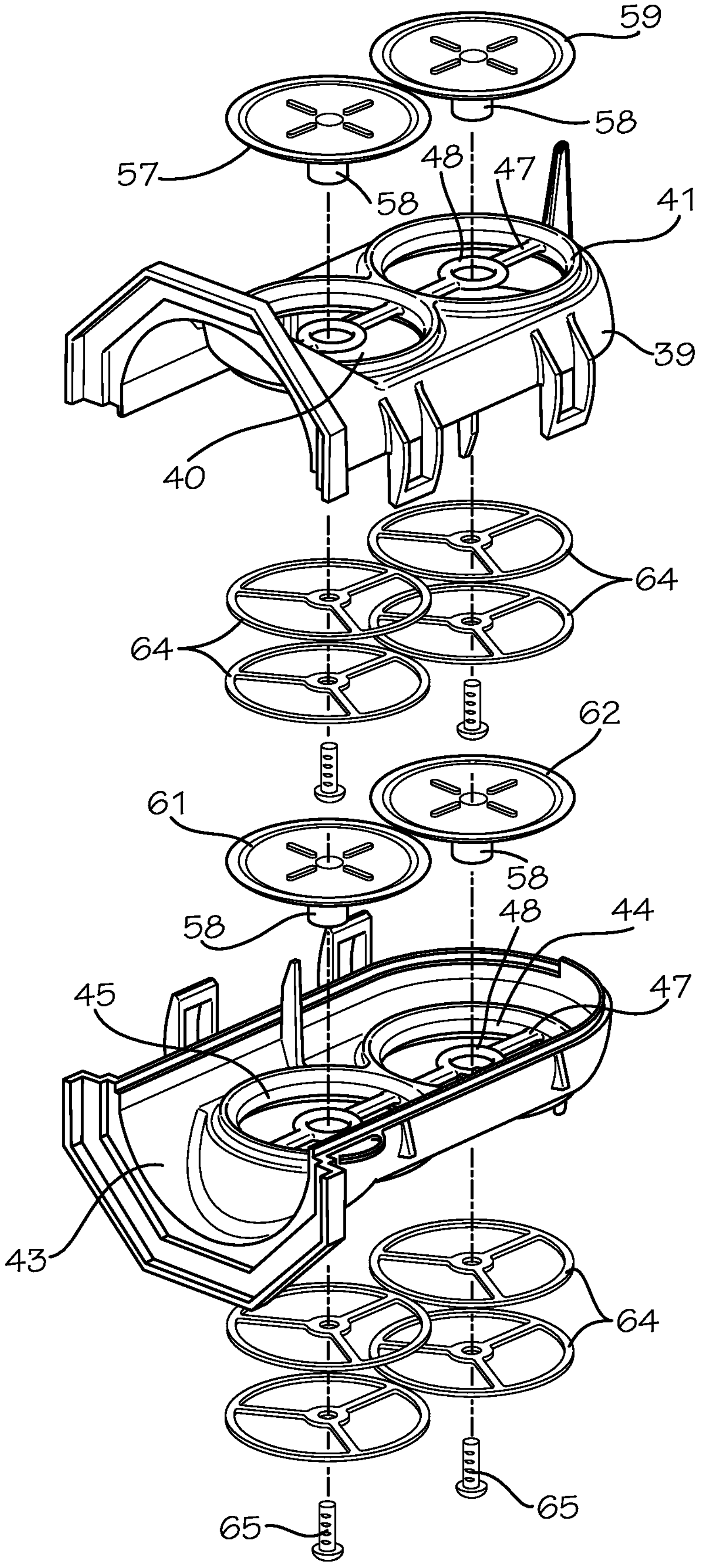

FIG. 4

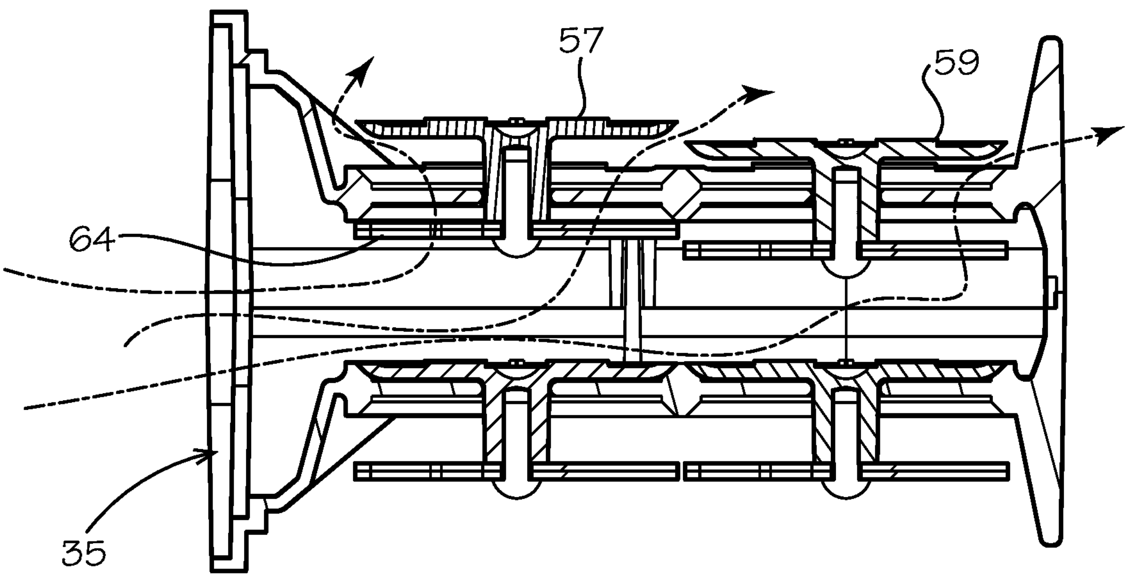

FIG. 5

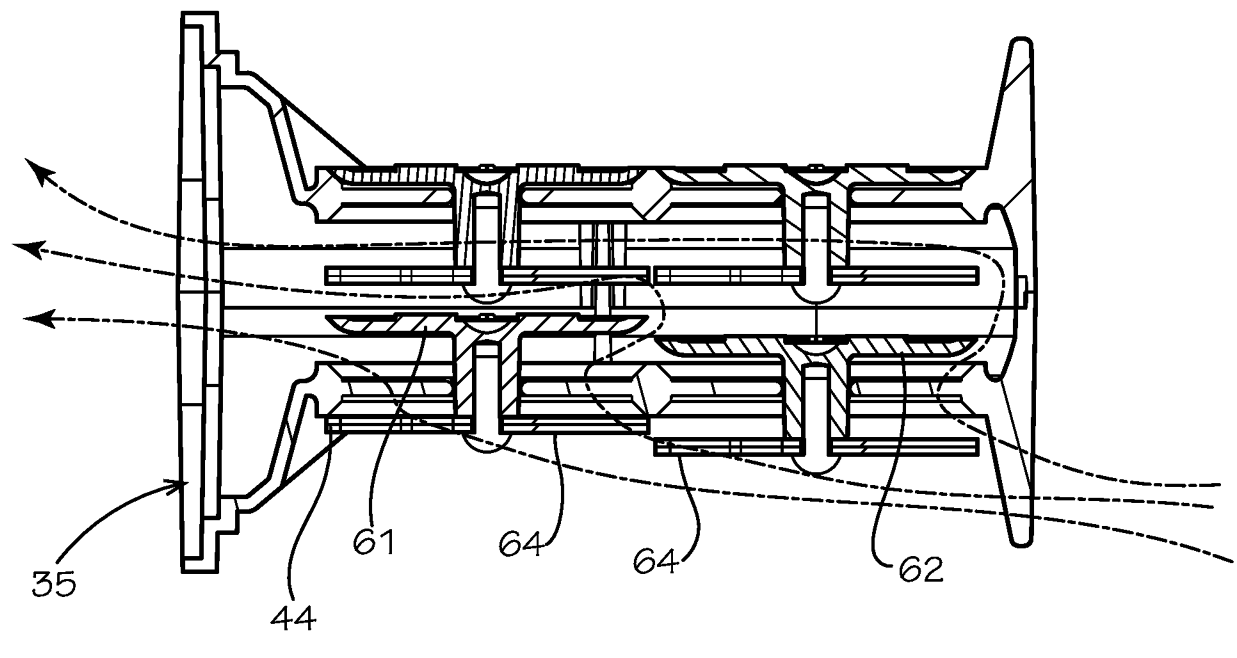

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 19/38184

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - F25D 17/04, F25D 29/00 (2019.01)
CPC - F25D 17/04, F25D 29/00, F25D 17/005, F25D 17/042, F25D 17/045, F25D 17/047, F25D 2317/067, F25D 2317/0671, F25D 2317/0672

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
See Search History Document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
See Search History Document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History Document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2017/113809 A1 (Qingdao Haier Joint Stock Co Ltd) 6 July 2017 (06.07.2017) Entire document especially pages 9-10 and figs. 1-3 and 9	1-14
A	DE 19814999 A1 (Hemstedt Dieter) 19 November 1998 (19.11.1998) Entire document especially pages 5-6 and figs. 1-5	1-14
A	US 6,286,326 B1 (Kopko) 11 September 2001 (11.09.2001) Entire document	1-14
A	US 3,813,896 A (Lebahn) 4 June 1974 (04.06.1974) Entire document	1-14
A	US 2004/0060319 A1 (Wood) 1 April 2004 (01.04.2004) Entire document	1-14
A	KR 100960717 B1 (Kong Jin Co. LTD) 31 May 2010 (31.05.2010) Entire document	1-14
A	US 2015/0168046 A1 (Denso Corporation) 18 June 2015 (18.06.2015) Entire document	1-14
A	US 2012/0159974 A1 (Han et al.) 28 June 2012 (28.06.2012) Entire document	1-14

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 October 2019	07 NOV 2019

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 19/38184

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-14 drawn to a cold room vent comprising two pressure exhaust and exhaust ports and weights.

Group II: Claims 15-33 drawn to a cold room vent comprising an interior heat chamber, a light assembly and a thermally conductive heat sink.

Group III: Claims 34-56 drawn to a cold room vent comprising a mounting flange having a select shape to enable a plurality of different angular orientations.

-*-Continued in Supplemental Box-*-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-14

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

-*-Supplemental Box - Box III - Observations where unity of invention is lacking-*-

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

SPECIAL TECHNICAL FEATURES

Group I has the special technical features of a first pressure exhaust port and a second pressure exhaust port, a first pressure exhaust port and a second pressure exhaust port, and a first and second weight which allows the opening of gravity biased pressure valves at an air pressure level, not required by Groups II or III.

Group II has the special technical features of an interior heat chamber, a light assembly, said light assembly having thermally conductive heat sink plate with an external surface and an internal surface in fluid communication with said interior heat chamber, said internal surface having an outwardly extending projection extending into said interior heat chamber, said light assembly also including a light source coupled to and in thermal communication with said exterior surface of said thermally conductive heat sink plate, whereby heat generated by the light source is thermally conducted to the thermally conductive heat sink plate wherein the projection provides a surface area to transfer the heat to the interior heat chamber, not required by Groups I or III.

Group III has the special technical features of a mounting flange, said mounting flange having a select shape corresponding to said select shape of said receiver to enable said mounting flange to be received within said valve housing at a plurality of different angular orientations relative to said valve housing receiver, not required by Groups I or II.

COMMON TECHNICAL FEATURES

The only technical features shared between Groups I-III is a cold room vent comprising:
a main housing mountable to a cold room structure;
a valve housing coupled to said main housing;
a valve assembly coupled to said valve housing, said valve assembly having a gravity biased first pressure valve, which does not provide any contribution over the prior art as it is anticipated by US 3,813,896 A to Lebahn (hereinafter 'Lebahn').

Lebahn teaches a cold room vent (26 - "air vent", 39 - "pressure relief valve", figs. 1 and 2; col 1, ln 60-64; col 2, ln 14-47) comprising:
a main housing (See fig. 2; see portion of air vent 26 that engages inner wall 10, insulation 18 and valve housing 30) mountable to a cold room structure (10 - "inner walls", fig. 1; col 1, ln 60-64 - "walk-in freezer unit");
a valve housing (30 - "valve housing", fig. 2) coupled to said main housing (See fig. 2; col 2, ln 37-42; col 3, ln 6-12);
a valve assembly (28, 39 - "relief valve", fig. 2) coupled to said valve housing (See fig. 2), said valve assembly having a gravity biased first pressure valve (col 2, ln 53 - col 3, ln 3, 24-40).

As the common features were known in the art at the time of the invention, they cannot be considered special technical features that would otherwise unify the groups.

Therefore, Groups I-III lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.