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TILTABLE HEAT EXCHANGER

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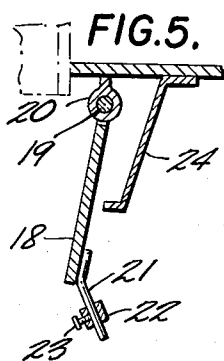
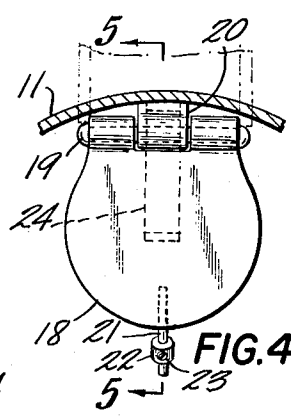
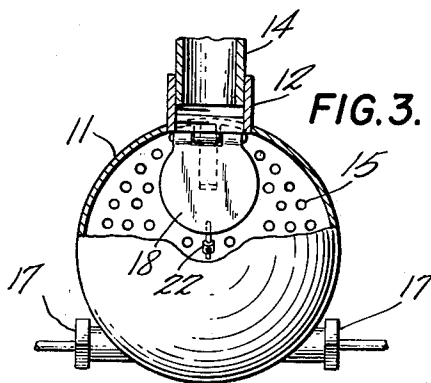
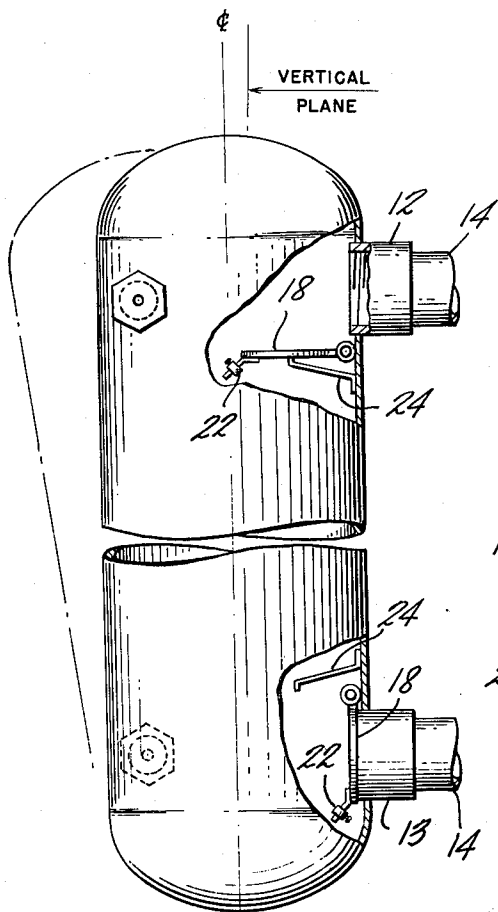
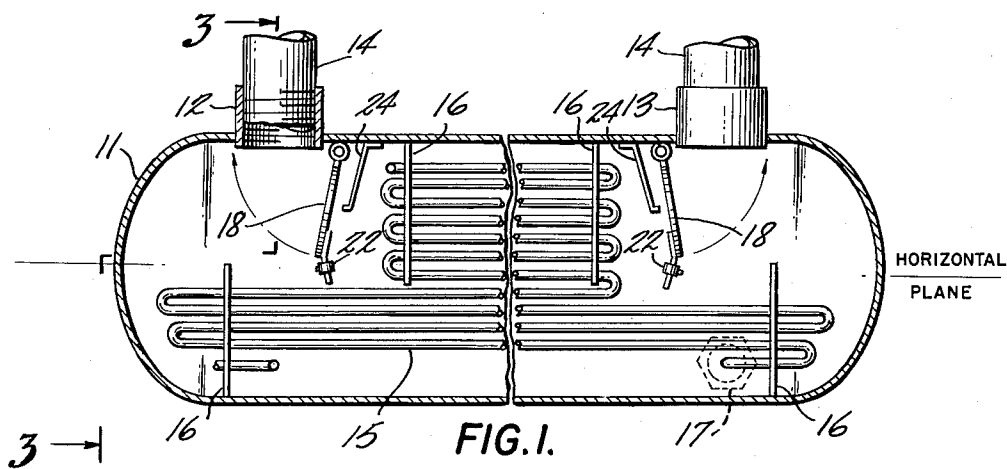


FIG. 2.

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1

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TILTABLE HEAT EXCHANGER

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This invention relates to a tiltable heat exchanger, and more particularly to a heat exchanger having a plurality of ports equipped with gravity actuated flap valves which operate automatically to vent a port at an upper level and prevent the liquid within the heat exchanger from draining out of a port at a lower level when the heat exchanger is tilted.

In one conventional type of heat exchanger, a fluid is brought into out-of-contact heat exchange relationship with a liquid within a chamber of the heat exchanger. In heat exchangers of this type, the chamber is provided with a port through which the liquid is introduced into the chamber of the heat exchanger and through which vapors are exhausted.

While heat exchangers of this type are suitable when operated in fixed orientation with the ground, they are unsatisfactory for installation in ships or aircraft which do not always hold to a level course. For example, if a conventional heat exchanger of the type described were to be mounted in an airplane, a substantial quantity of the liquid would drain out of the chamber through the port or ports thereof if the airplane were to go into a steep dive or climb. This situation cannot be satisfactorily remedied simply by closing off the port or ports when the liquid is not being introduced into the chamber because there must still be provision for permitting steam or other gases that collect inside of the chamber to escape.

The principal object of this invention is to provide a heat exchanger which can be satisfactorily operated at different orientations with respect to the ground.

This object is achieved in the present invention by a heat exchanger having a liquid chamber provided with at least two normally open ports spaced apart near opposite ends of the chamber and equipped with gravity actuated valves for the ports which operate automatically to close the port at the lower level and open the port at the higher level when the exchanger is tilted endwise to a steep angle. Thus, no liquid is lost through the lower port and the upper port continues to permit filling or venting of the chamber.

For a complete understanding of the present invention, reference can be made to the following detailed description and to the accompanying drawings, in which:

FIGURE 1 is a view partially in section of a heat exchanger constructed according to the invention;

FIGURE 2 is a view partially in section of the heat exchanger in a tilted position;

FIGURE 3 is a view taken along the line 3-3 of FIGURE 1;

FIGURE 4 is an enlarged view of the hinged cover shown in FIGURE 3; and

FIGURE 5 is a view taken along the line 5-5 of FIGURE 4.

The structure shown in FIGURE 1 includes a relatively long shell 11 having a port near each end through which a liquid can be introduced into the chamber within the shell. The ports are defined by internally threaded collars 12 and 13 adapted to receive the threaded ends of conduits 14. A tube bank 15 through which another fluid passes in a tortuous path in out-of-contact heat exchange relationship with the liquid in the chamber is

2

fastened internally within the shell 11 by a plurality of braces 16. The inlet and discharge ends of the tube bank are connected to a pair of couplings 17 which are in communication with the source of fluid to be circulated through the tube bank. In describing the heat exchanger herein, it will be assumed that a coolant is introduced into the shell 11 to receive heat from a fluid at higher temperatures flowing through the tube bank 15.

As best shown in FIGURES 4 and 5, a gravity actuated flap valve 18 is hinged within the shell 11 adjacent each of the ports by a bracket 20 and a pin 19 which is inserted through eyes formed in the flap valve and the bracket. The flap valves are hinged to opposite sides of their respective ports in such fashion that the hinge for a particular flap valve is on the side of the port opposite the nearest end of the shell, or stated another way, on the side of the port nearest the center of the shell.

An angular rod 21 having an adjustable weight 22 fastened to it by a screw 23 is welded to the free end of each flap valve 18 for the purpose of adjusting the speed at which the flap valves will open and close. The rod 21 attached to the end of each flap valve 18 is bent at an angle so that the weight 22 will provide a turning movement about the axis of rotation of the flap valve even when the flap valve is in closed position. In this manner, a tight fit is maintained which insures against leakage. The position of the weight 22 is made variable so that the magnitude of this turning movement and the rapidity with which the flap valves respond can be varied. The angular disposition of the rod 21 also enables the weight to be carried by the flap valve laterally offset from the inner side of the flap valve when the flap valve is in closed position. This disposition of the weight shifts the center of gravity of the flap valve to insure closing of the flap valve even when the heat exchanger is tilted to positions short of a vertical position. A stop 24 may be welded to the shell 11 behind each flap valve to prevent the flap valve from opening too far and contacting the tube bank.

During the operation of the apparatus as a heat exchanger, the couplings 17 are fastened to a source of fluid to be cooled and the collars 12 and 13 are fastened to coolant conduits. When the heat exchanger is in the normal horizontal position as shown in FIGURE 1, both of the flap valves 18 are open and allow the coolant to enter the chamber within shell 11 or to permit venting of the chamber within the shell. The coolant in the shell is usually automatically maintained at the proper level by means which are not relevant to this invention. If from this horizontal position the heat exchanger is tilted to the position shown in FIGURE 2, the lowermost flap valve closes automatically by gravity, preventing loss of the fluid from the shell through the port at the lower level. However, the uppermost flap valve remains open to permit steam or other vapors to be vented.

While a particular embodiment of the present invention has been shown and described for purposes of illustration, it is apparent that changes and modifications may be made without departing from this invention in its broader aspects. Therefore, the invention described herein is not to be construed as limited to the specific embodiment described, but is intended to encompass all modifications thereof which come within the scope of the following claims.

I claim:

1. A tiltable heat exchanger comprising a housing having a chamber for a liquid therein, at least two ports spaced apart in the upper region of the chamber, a gravity-actuated flap valve for each of the ports, means hingedly mounting the flap valves for the ports to said

shell adjacent opposite sides of their respective ports in such fashion that the hinge for each flap valve is on the side of the port opposite the nearest end of the shell, whereby when the shell is tilted endwise the force of gravity will pivot the flap valve for the port at the lower level to closed position, maintaining the flap valve for the port at the upper level open, and a weight carried by each of the flap valves, each weight being adjustable with respect to the hinged mounting for the flap valve.

2. A tiltable heat exchanger as set forth in claim 1 in which the adjustable weight is carried by the hinged flap valve beyond the free end thereof.

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