Aug. 18, 1953 G. F. SULFRIAN ET AL 2,648,953

LIQUID HELIUM CONTAINER WITH INSERTABLE HEAT EXCHANGER

Filed June 22, 1951

Fig. 1

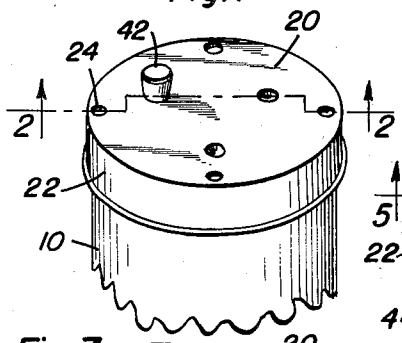


Fig. 2

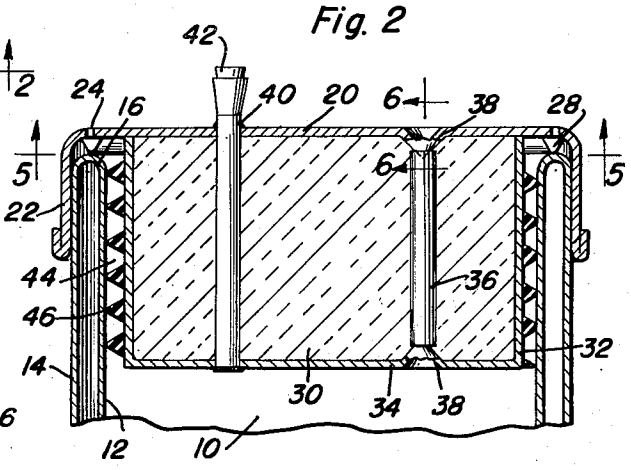
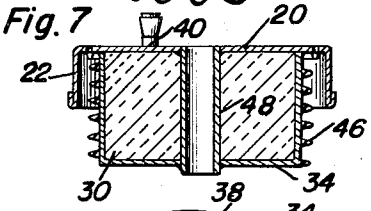


Fig. 7



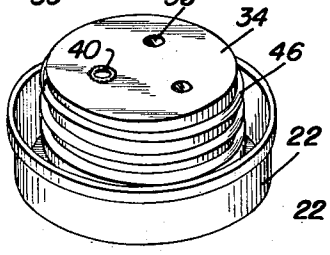


Fig. 4

Fig. 3

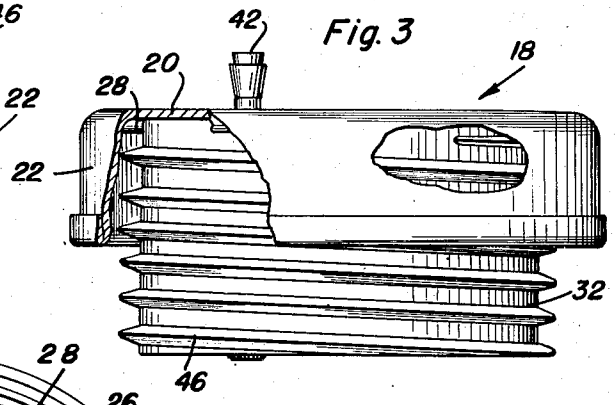


Fig. 5

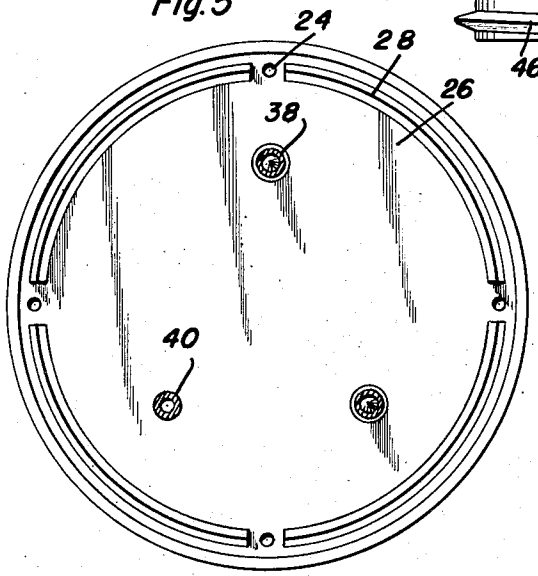
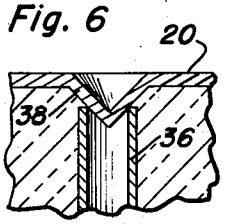


Fig. 6



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Patented Aug. 18, 1953

2,648,953

UNITED STATES PATENT OFFICE

2,648,953

LIQUID HELIUM CONTAINER WITH INSERTABLE HEAT EXCHANGER

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Application June 22, 1951, Serial No. 232,996

4 Claims. (Cl. 62—1)

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This invention relates to an insertable cap for use with a liquid gas container to reduce heat leak into the container.

The primary object of the invention is to provide an insertable heat exchanger cap for use with an open mouth Dewar vessel which will materially reduce heat leaks due to all three modes of heat transfer, namely conduction down the side walls and down the air volume, convection between the surface of the liquid gas and the atmosphere, and radiation.

Yet another object is to provide a cap of the character described which is relatively simple in design and construction yet very efficient for its intended purpose.

These together with various ancillary objects and features of the invention which will later become apparent as the following description proceeds, are attained by the device, a preferred embodiment of which has been illustrated by way of example only in the accompanying drawings, wherein:

Figure 1 is a perspective view of the cap shown assembled on the open end of a dewar vessel;

Figure 2 is a sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a perspective view of the cap per se, parts being broken away to show details of construction;

Figure 4 is an inverted perspective view of the cap;

Figure 5 is a sectional view taken on the line 5—5 of Figure 2;

Figure 6 is a sectional view taken on the line 6—6 of Figure 2; and

Figure 7 is a sectional view through a modification of the cap.

Specific reference is now made to the drawings. In the several views in the accompanying drawings and in the following specification reference characters indicate corresponding elements throughout.

Indicated generally at 10 is a Dewar vessel for retaining liquid gases, such as helium, hydrogen and nitrogen, the vessel having inner and outer walls 12 and 14 interconnected at the upper open end of the vessel to provide an annular edge 16. The cap of the instant invention is shown at 18 and comprises an upper wall 20 having a depending annular wall 22 which is preferably beaded or crimped at its lower free edge, the annular wall being adapted to bear against the outer vessel wall 14 adjacent the upper vessel edge 16. Circumferentially spaced breather apertures 24 are provided through the upper wall adjacent the

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annular depending wall 22 and secured to the inner surface 26 of the upper wall between the apertures are resilient frictional strips or pads 28, preferably fabricated of rubber, the strips being adapted to bear directly on the upper edge 16 of the vessel as shown clearly in Figure 2.

Spot welded or otherwise secured to the inner surface 26 of the upper wall is a hollow container or plug 30 of substantially cylindrical shape having an annular wall 32 and a bottom wall 34. The container or plug is evacuated and filled with a suitable heat insulating material such as "Santocel," asbestos, cork, magnesia, fuller's earth, and so forth. To lend rigidity to the plug vertical metallic tubes 36 are positioned in the plug and retained on the lower wall 34 thereof and the upper wall 20 by means of preferably conical detents 38 received in the upper and lower ends of each tube 36, the detents being struck from the lower plug wall 34 and upper cap wall 20. A feeder tube 40 may be extended through the plug and secured to the lower wall 34 and upper wall 20, a suitable stopper 42 being provided for the end of the feeder tube extending beyond the cap.

It will be noted that the diameter of the annular wall 32 of the plug is less than the internal diameter of the Dewar vessel so that when the plug is inserted through the open upper end of the vessel an annular space 44 is provided between the inner wall 12 of the vessel and the annular wall of the plug. To prevent heat leak through this space, a resilient frictional band 46 preferably fabricated of rubber, is secured on the outer surface of the annular wall 32 of the plug, the band frictionally engaging the inner vessel wall 12. A band spirally arranged on the annular wall 32 is preferred to provide a tortuous bearing contact with the inner vessel wall 12 as well as a tortuous obstacle in the annular space 44. The modification shown in Figure 7 is substantially the same as the cap already described except that the brace tubes 36 in the plug are dispensed with and instead a single open ended tube 48 is employed to allow access to the refrigerant within the container, the tube being secured as by spot welding to the upper cap wall 20 and lower plug wall 34.

The manner of securing the present cap on the open end of a liquid gas container will be obvious from the drawing. The cap serves to reduce heat leaks into the container as follows. In an ordinary open mouth Dewar vessel conduction heat leaks occur down the inner walls 12 and down the air volume across the vessel be-

tween the inner walls. The present device reduces these leaks but causes the efflux of gas to interchange with the inner side wall 12 allowing less heat to be conducted down the side wall to the liquid gas or refrigerant in the vessel. The air volume is bridged or plugged by an insulating material thus minimizing conduction loss. Convection losses are minimized since the present cap forces the efflux of gas to convect between the surface of the liquid gas or refrigerant and the bottom wall 34 of the plug and, as these two surfaces are substantially isothermal, the losses are much less than if the gas were allowed to convect between the refrigerant and the atmosphere. Radiation losses are minimized in much the same manner because the insulation acts as a radiation shield and very little atmospheric temperature radiation reaches the lower wall 34 of the plug. As this surface 34 has a temperature of the same order of magnitude as the liquid gas or refrigerant, radiation losses are minimized.

In view of the foregoing description taken in conjunction with the accompanying drawings it is believed that a clear understanding of the device will be quite apparent to those skilled in this art. A more detailed description is accordingly deemed unnecessary.

It is to be understood, however, that even though there is herein shown and described a preferred embodiment of the invention the same is susceptible to certain changes fully comprehended by the spirit of the invention as herein described and the scope of the appended claims.

Having described the invention, what is claimed as new is:

1. In combination with a double-walled liquid gas container open at its upper end, a cap to reduce heat leak comprising a heat exchanger having an upper wall and a depending annular wall engaging the outer wall of the container at its upper end, a hollow plug filled with a heat insulating material depending from the upper wall and having an annular wall spaced from said first-mentioned annular wall, a spirally arranged resilient heat insulating band carried by the annular wall of said plug and engaging the inner wall of the container at its upper end, said band defining a spiral passage between the annular wall of said plug, said upper wall having vent openings communicating with said spiral passage.

2. The combination of claim 1 and a further resilient heat insulating band carried by the upper wall in the space between said two annular walls and engaging the upper edge of the container.

3. A cap adapted for use with a liquid gas container to reduce heat leak thereinto comprising a heat exchanger including an upper wall and a depending annular wall adapted to engage the outer surface of a container, a hollow plug depending from said upper wall and including an annular wall spaced from said first mentioned annular wall, a filling of heat insulating material in said hollow plug, a band of resilient heat insulating material carried by said annular wall of said plug and adapted to engage the inner upper surface of a container, said upper wall having space vent holes opening into the space between said annular walls, and pads of resilient heat insulating material carried by said upper wall between said vent holes and extending into the space between said annular walls, said pads adapted to engage the upper edge of a container.

4. The combination of claim 3 wherein said band of resilient heat insulating material is spirally mounted on the annular wall of said hollow plug.

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