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LOW HEAT LEAK STRUCTURAL SUPPORT

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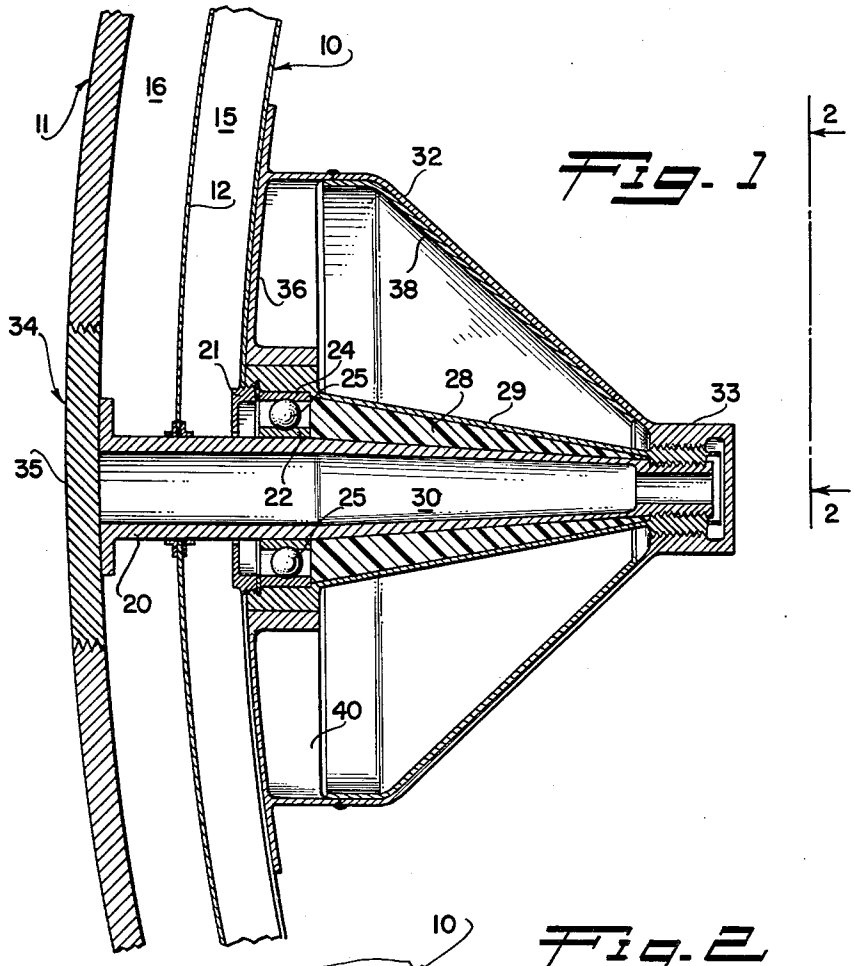


Fig. 1

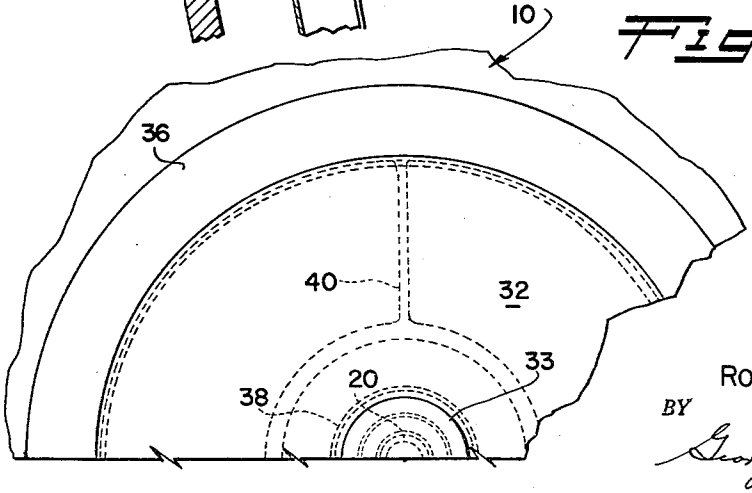


Fig. 2

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LOW HEAT LEAK STRUCTURAL SUPPORT

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1 Claim. (Cl. 220—15)

This invention pertains to a container for fluids having a temperature greatly different from the ambient temperature. More particularly, it pertains to low heat leak support means for a container of liquids having extreme temperatures.

Where it is necessary to contain a liquid of either a very high or very low temperature, it becomes imperative to minimize heat transfer between the liquid and the surrounding areas. This is particularly true where a cryogenic fuel having a temperature in the range of 400 degrees below zero Fahrenheit is used in a high speed aircraft which will be subjected to external temperatures in the range of 400 degrees above zero. This 800 degree temperature difference is compounded where space limits the physical size of any insulating materials carried in the craft.

Many good insulating materials are available but none are sufficiently strong to support the weight of the container and the liquid therein. Other materials have sufficient strength to support the weight of the container and the liquid but have relatively poor insulating properties. Among these structurally strong materials some have a high heat transfer co-efficient and others a low heat transfer co-efficient. By selecting materials from the group having a low heat transfer co-efficient and constructing support structure such that any heat transfer would have to travel a long path there will be a minimum heat transfer.

It is an object of this invention to provide a container and support means therefor to contain a liquid having extreme temperatures. It is another object of this invention to provide a container and support means therefore for a liquid having an extreme temperature which will provide for minimum heat transfer between the liquid and exterior of the container. It is another object of the present invention to provide a support means for a container which has strong structural features, takes up minimum space and has a long heat leak path. It is another object of the present invention to provide a support for a container containing liquids having extreme temperatures which is comprised of materials having a low heat transfer co-efficient and which has a long heat leak path. It is another object of this invention to provide a structural support for a container having great strength, light weight, a low heat transfer co-efficient and a long heat leak path to provide an insulation between the interior and the exterior of the container.

Further advantages and objects of the invention will become apparent from a reading of the following specification especially when taken in conjunction with the appended drawing wherein like numerals indicate like elements.

FIGURE 1 is a cross sectional view of the support showing the container and exterior framework;

FIGURE 2 is a view taken on lines 2—2 of FIGURE 1.

A vacuum is one of the better known insulators. However, even though a vacuum is used for insulation purposes, if the container or area being insulated has any weight, other means must be provided to support that weight. Other materials such as foamed plastic do have property for supporting a small weight but will not provide sufficient support for a heavy liquid. Some material of sufficient strength to support an appreciable weight must be used. Among those materials having sufficient

strength are those which have a low co-efficient of heat transfer. One of the better materials for this purpose from a point of view of cost, availability, and ease of use, is stainless steel. However stainless steel by itself does not provide a sufficient insulation between hot and cold areas to minimize heat transfer. This heat transfer can be minimized by providing a support having a long heat leak path from one temperature extreme to the other and being comprised of the material having a low heat transfer co-efficient. This invention provides the optimum combination of a structurally strong support comprised of a material having a low co-efficient of heat transfer and used in such a manner that a long heat leak path is provided in a small space and so that additional insulating materials may be used.

The container 10 is spaced inwardly from an outer shell 11 which could be any supporting framework. An intermediate wall 12 is shown to exemplify the versatility of this invention. Wall 12 may partition areas 15 and 16 in which there may be a vacuum or various insulating materials such as gases having increasing boiling temperatures where a cryogenic liquid is carried in container 10 or gases having decreasing boiling temperatures in case the liquid in container 10 is of a higher temperature than the ambient outside of the supporting shell 11. An elongated structural beam 20 extends from the exterior shell 11 to the interior of container 10. A primary support is provided at the point that beam 20 passes through the wall of container 10 comprised an inner bearing race 22 fixed to beam 20 and an outer bearing race 24 fixed to the wall of container 10 with ball bearings 25 therebetween to provide for minimum contact between the beam 20 and the wall structure of container 10. This minimum contact provides for minimum heat transfer from the beam 20 to the wall 10 of the container and its contents or vice versa. The fewer the number of balls 25, the less the contact area.

Surrounding the inner part of beam 20 is a layer of foamed plastic 28 or other insulating material contained in shell 29 to aid in insulating beam 20 from the interior of container 10. The space 30 on the interior of beam 20 may also be evacuated or filled with an insulating material. The inner end of beam 20 is attached to cone member 32 through the usual threaded structure on the interior of cap 33. Beam 20 is tapered inwardly to facilitate removal through opening 34 in the shell 11 which is closed by cap 35.

The cone member 32 is spaced from member 20 and its surrounding insulation so that the only substantial heat transfer contact that member 20 has with the liquid inside container 10 is through the cap 33. The base of cone member 32 is fixed in a fluid tight relationship to the interior walls of container 10 in a circular area spaced radially from the ball bearing primary support 25 so as to isolate the point of contact at cap 33 and beam 20. Cone 32 is shown reinforced by member 38 on its interior surface. The distance from balls 25 through race 24 along wall 36 provides an additional long heat leak path from beam 20 to the walls of container 10.

The structure shown and described has been found effective to insulate very cold fluids from extreme heat such as would be found in a space vehicle where liquid gases are used as fuel at temperatures somewhere below 400° F. in environments which would raise the temperature of shell 11 to well above 400° F. I wish not to be restricted to the specific details shown in the appended drawings but claim as my invention the combinations and their equivalents as set out in the appended claim.

I claim:

Means to contain liquids comprised of an outer shell, an inner container of a smaller exterior dimension than

the outer shell and spaced uniformly inwardly from the outer shell, an elongated conical beam comprised of a low heat transfer material having a fastening means on its outer end mating with like fastening means on the outer shell and extending perpendicularly through the wall of the inner container into its interior a substantial distance, a bearing race about the conical beam where it passes through the wall of the inner container, a bearing race fixed to the wall of the inner container about the conical beam, ball bearings comprised of low heat transfer material between the races, a cone member comprised of a low heat transfer material having its apex threaded to the inner end of the elongated conical beam and its base fixed to the interior wall of the inner container in a fluid type relationship.

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