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CRYOGENIC STORAGE AND INSULATION MEANS

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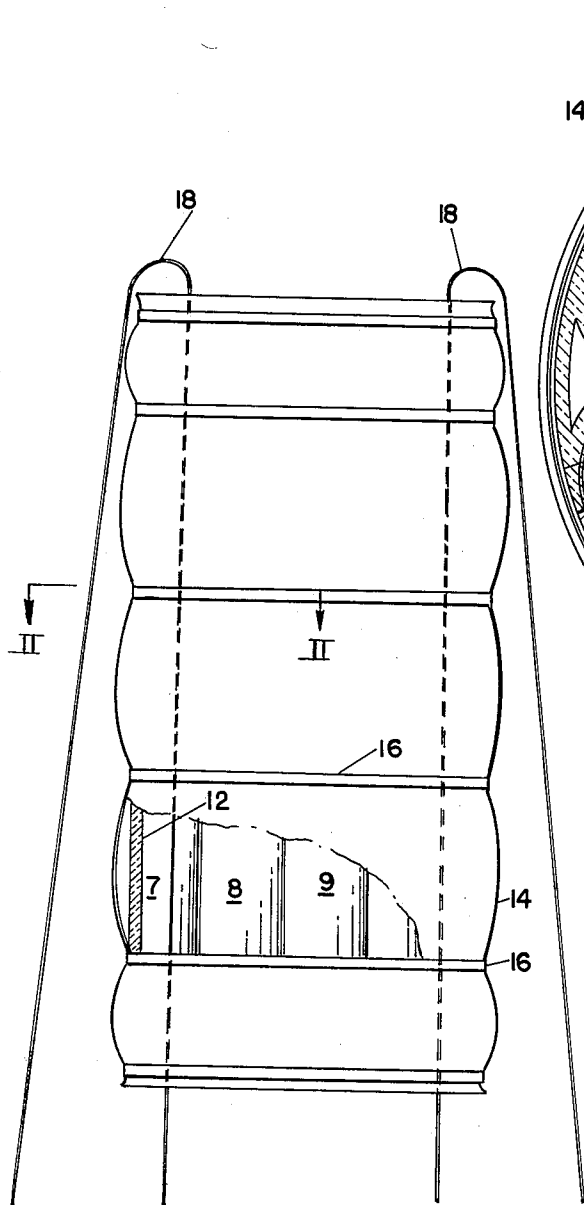


FIG. 1

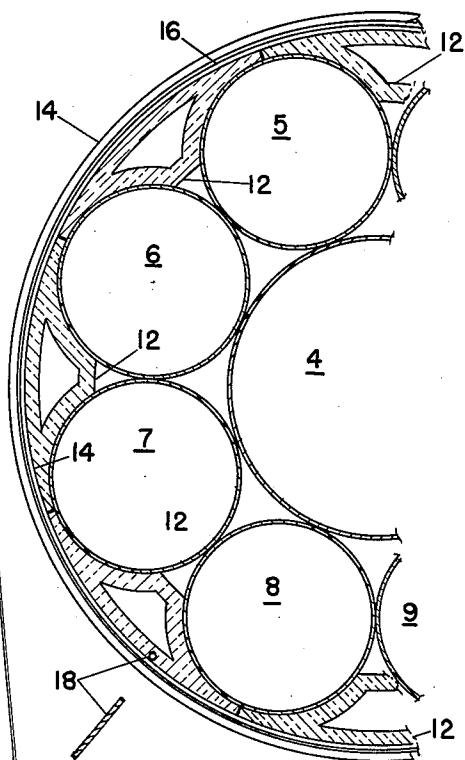


FIG. 2

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CRYOGENIC STORAGE AND INSULATION MEANS

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5 Claims. (Cl. 295—6)

This invention relates to thermal insulation means for tanks containing liquids of very low boiling temperatures and is particularly adapted, for example, for insulating groups or clusters of tanks containing such materials.

Some of the modern missile propellants now in use must be stored and handled while maintaining temperatures of hundreds of degrees below the freezing temperature of water, and in many instances the propellant temperatures are below the liquefying or freezing temperature of air, and this has heightened the need for new and improved insulation means for use therewith.

Accordingly, the primary object of the invention is to provide a more economical and convenient insulation for tanks containing materials having extremely low boiling points to prevent boil-off and maintain the material in liquid form and to prevent air liquefaction and the formation of ice on the surfaces of the tank.

Another object of the present invention is to provide an improved insulation as aforesaid, which is non-bulky, lightweight, and easily handled.

Another object is to provide a novel insulation casing structure for tanks as aforesaid, which is easily positioned and subsequently jettisoned or otherwise removed, as may be required.

Other objects and advantages of the invention will appear from the detailed description hereinbelow and the accompanying drawings wherein:

FIG. 1 is an elevational view, partially broken away, of a cluster of propellant-containing tanks with the insulation of the invention applied thereto; and

FIG. 2 is a fragmentary sectional view taken substantially along line II—II of FIG. 1.

Referring now to the drawings, a cluster of tanks including a centrally disposed fuel tank 4 and oxidizer tanks such as 5, 6, 7, 8, 9, etc. designed to store material at extremely low temperatures, is arranged for use as a fuel package for a missile. Such a clustering arrangement of cylindrical tanks leaves void spaces therebetween as shown in FIG. 2, and heretofore a major problem when using such clusters has been that the atmosphere in these voids cools and forms condensate which freezes and thus forms objectionable deposits on the sides of the tanks.

In accord with the present invention, molded units of insulation 12 made from material such as, for example, "Styrofoam" are shaped to complement the tank wall forms and substantially fill the voids around the outside of the outer row of tanks. This assembly is then covered by a fluid-impervious bag 14. One very suitable material for forming the bag is Mylar, although, of course, any other suitable impervious yet pliable material may be employed. At the top and bottom ends of the tank cluster the bag 14 is folded over and sealed and is provided with necessary cut-outs, such as for fuel lines, etc., and locally pressure-sealed such as by pressure sensitive tape or the like. Retention straps 16 of stainless steel or other suitable material are then strapped around the assembly so that the tank cluster package may be handled as a single unit. The atmosphere is then purged from within the bag and is replaced by helium gas. Because helium will not liquefy at the temperature at which the liquids are stored, the problems previously encoun-

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tered with respect to condensation and ice formation within the bag are eliminated. The insulation 12 minimizes heat transfer to the packaged propellant as well as protecting the bag from the low temperature of the tank cluster, and thus the likelihood of formation of ice on the outside of the bag is also eliminated.

Another feature of the arrangement of the invention is that the entire insulation mechanism may be jettisoned with utmost facility and speed. This is accomplished by provision of ripcord cables 18—18 which run inside the straps 16 and the bag 14 as shown and are attached to suitable anchors or pull devices (not shown) so that whenever desired the entire insulation arrangement may be stripped from the tank cluster; the insulation units 12 simply falling away when the bag 14 is ruptured. The material used for the ripcord cables, and the number of cables to be used may, of course, be varied to suit the circumstances.

Thus, it will be appreciated that the insulation arrangement of the invention minimizes heat transfer and avoids boil-off losses of the stored liquid, as well as condensation accretions within and upon the package. Also, it will be apparent that the insulation means of the invention is extremely light in weight and easily jettisoned, which is, of course, of prime consideration in many cases and particularly in the case of missile installations.

Although only one form of the invention has been shown and described in detail, it will be understood that a number of modifications and changes may be made therein without departing from the spirit of the invention or the scope of the appended claims.

We claim:

1. Insulation means for a container of low boiling point fluid comprising, a heat insulating material substantially enveloping said container, a fluid-impervious casing enclosing said insulating material, a charge of helium gas replacing the air previously within said casing, and ripcord means attached to said casing for ripping the latter to free said container from said insulation means.

2. Insulation means for a cluster of containers of low boiling point fluid, said means comprising a plurality of slabs of heat insulating material disposed against the outside of said containers, a fluid-impervious casing enclosing said insulating material, strap means girthwise encircling said cluster and said casing, and a charge of helium gas replacing the air previously within said casing, and ripcord means attached to said casing for ripping the latter and breaking said strap means to free said containers from said casing and straps and insulation.

3. Insulation means for a cluster of cylindrical shaped containers of low boiling point fluid, said means comprising a plurality of slabs of heat insulating material interfitting with and substantially enveloping the perimeter of said cluster of containers, a fluid-impervious flexible casing enclosing said insulating material, strap means encircling said casing to limit the flexing thereof and to retain said slabs in insulating position, and a charge of gas having a boiling point lower than the lowest temperature prevailing replacing the air previously within said casing.

4. Insulation means for a container of low boiling point fluid, said means comprising slabs of heat insulating material cooperating to substantially envelop said container, a fluid-impervious flexible casing enclosing said insulating material, strap means encircling said casing to limit the flexing thereof and to hold the assembly, and a charge of gas having a boiling point lower than the lowest temperature prevailing replacing the air previously within said casing.

5. Insulation means for container means holding low boiling point fluid, said insulation means comprising a sheath of heat insulating material surrounding the con-

tainer means, fluid-impervious casing means enclosing said insulating material, said heat insulating material being of sectional form and held in place by said casing means, and means for destroying said casing means to release said insulating material and permit the same to fall away from the container means, said casing means being filled with a gas having a boiling point lower than the lowest prevailing temperature of the assembly.

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