

Feb. 2, 1965

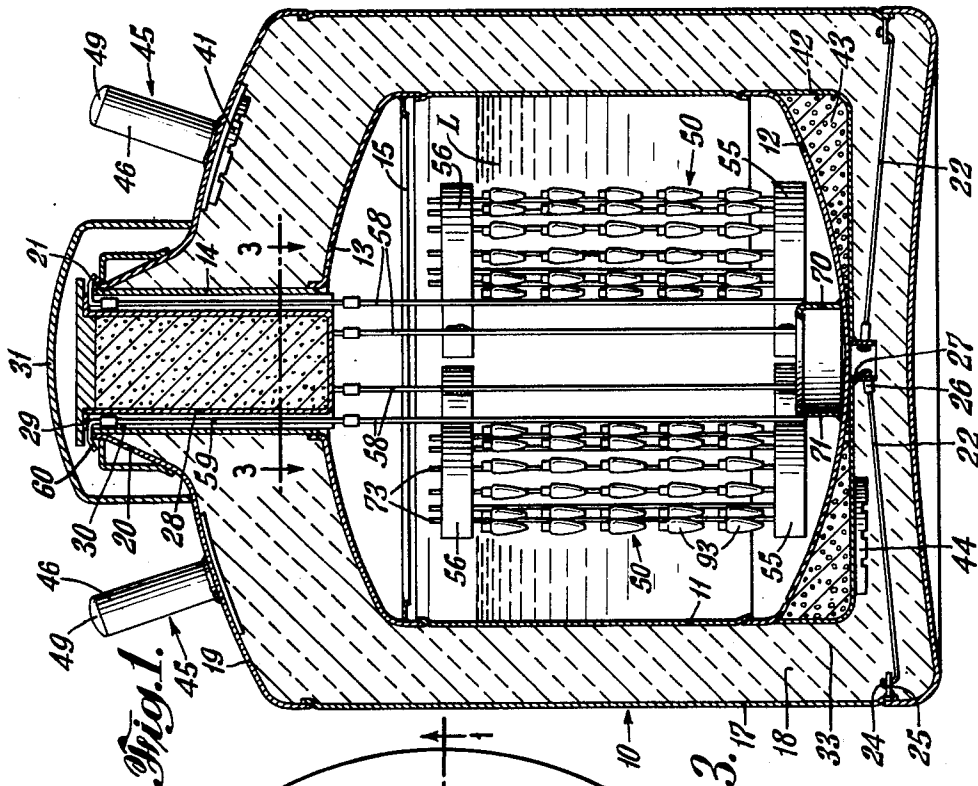
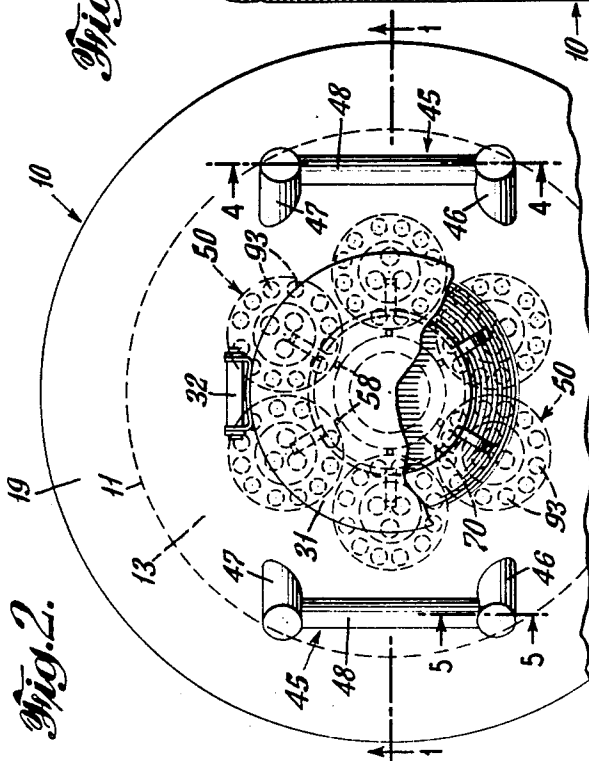
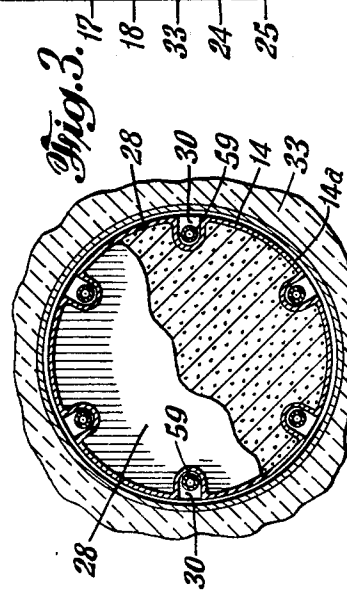
W. E. PERKINS

3,168,362

THERMALLY INSULATED BULK STORAGE CONTAINER

Original Filed April 26, 1956

3 Sheets-Sheet 1



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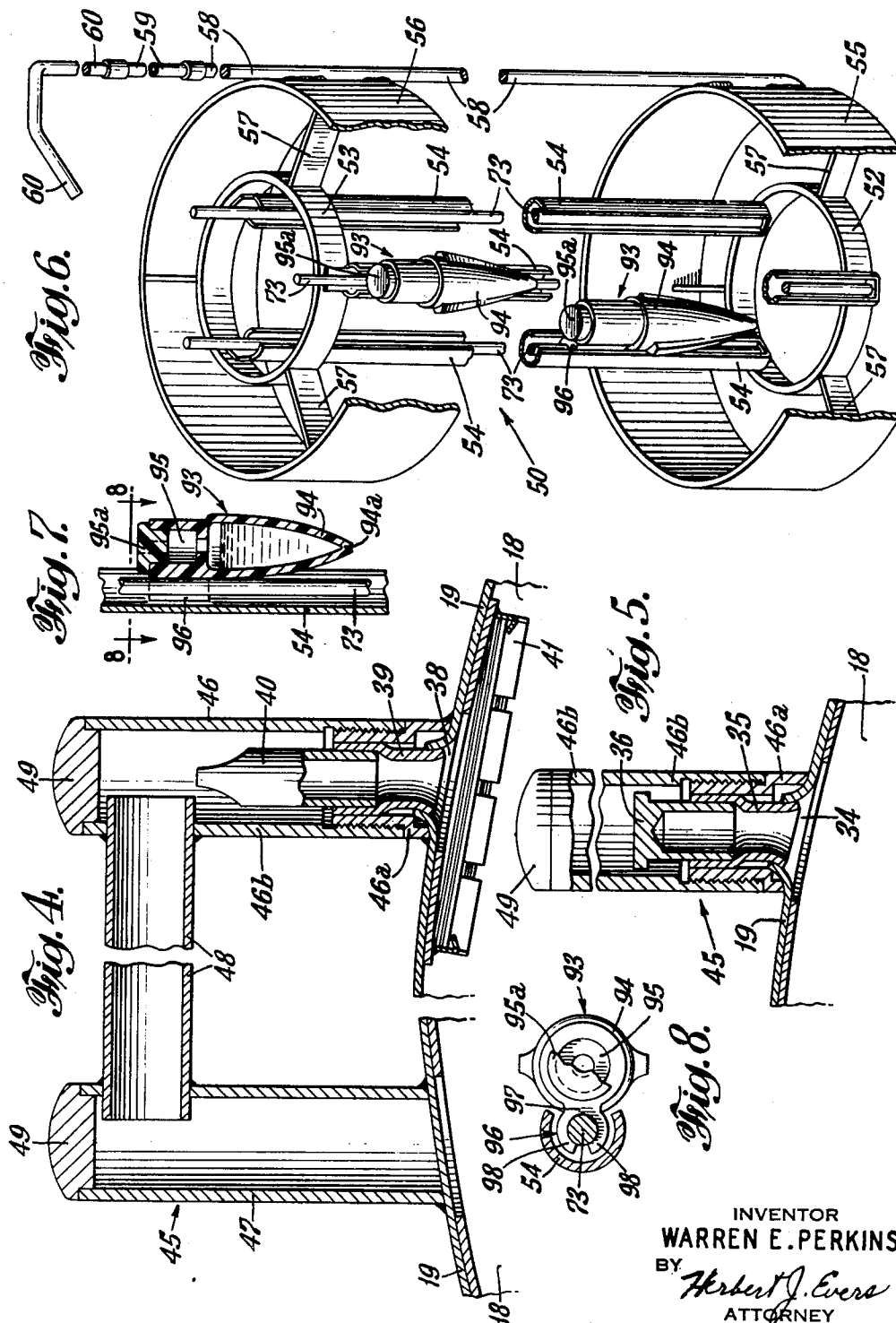
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3 Sheets-Sheet 3

Fig. 9.

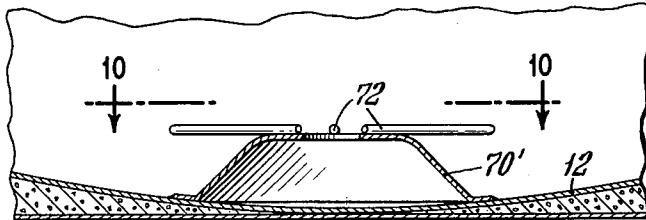
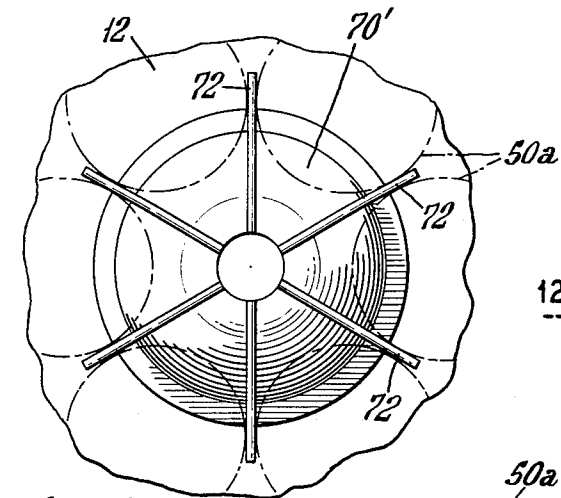


Fig. 10.

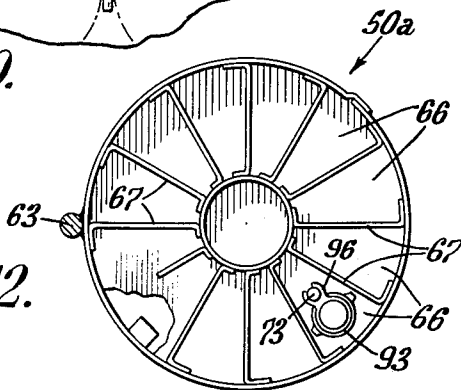


Fig. 12.

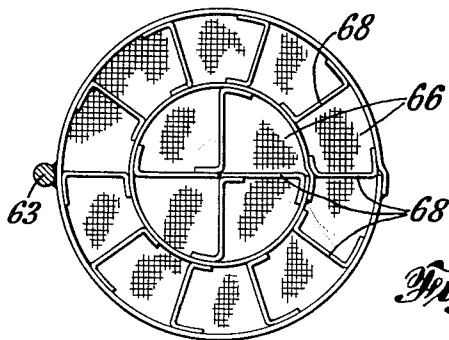
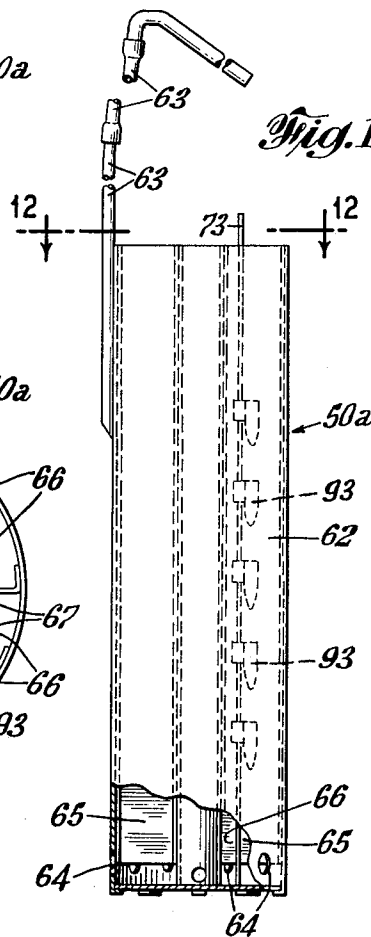


Fig. 13.

Fig. 11.



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THERMALLY INSULATED BULK STORAGE CONTAINER

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Continuation of abandoned application Ser. No. 580,898, Apr. 26, 1956. This application Feb. 1, 1962, Ser. No. 172,052

15 Claims. (Cl. 312-214)

This is a continuation application of my pending application Serial No. 580,898, entitled "Thermally Insulated Bulk Storage Container," filed April 26, 1956, now abandoned.

This invention relates to an improved container for the storing and conveying of perishable commodities, and more particularly concerns a portable container for the conservation of products which must be held at low temperatures for substantial periods of time.

In the past, several difficulties have been encountered in the conservation and conveyance of low temperature products, for example, perishable commodities such as whole blood, pharmaceuticals, enzymes, semen, living tissues, or other biological specimens, which must be held at low temperatures for sustained periods of time.

One of the important difficulties concerns the provision of a light-weight, portable storage container capable of being easily handled for shipment by modern transportation, including automotive passenger car. Another problem is the provision of a compact transporting container for maintaining the stored product for a considerable length of time at the low temperature necessary to avoid spoilage.

Still another problem involves the provision of a portable container having a relatively large opening to adapt it for use in the conveyance of packaged liquid products, as well as solid products of various shapes and sizes, which cannot be simply introduced and withdrawn as can a free-flowing fluid.

Yet another problem involves the efficient utilization of the storage capacity, so that a maximum amount of material may be assembled and stored in an orderly arrangement in the container without damage by squeezing or packing down.

Such problems are very difficult to solve in portable-type containers, primarily because the heat leak problem is exceptionally critical in small vessels. The ratio of surface area to storage volume in small containers is very large compared to the large stationary-type, conventional storage containers. In addition, the efficient utilization of space for product storage places a severe limit on the volume available for the refrigerant.

In the present process for storing and shipping perishable commodities in small quantities, such as bull semen for the artificial insemination of cattle, the semen is shipped in ampules refrigerated by direct immersion in water and ice. The difficulty with using solid refrigerant is that it restricts the mobility of any mechanical equipment or parts that might be used inside the container. Furthermore, much of the stored semen may be wasted by spoilage due to the short term virility of semen at such relatively warm temperatures.

If the semen material could be stored in frozen condition, and transported in portable containers at very low temperatures, such as liquid air or liquid nitrogen temperatures, the material would retain its potency indefinitely, and there would be little or no wastage. The prime advantage of such a system is, of course, that close scheduling of individual semen ampule shipments will no longer be required. Another advantage is that a full and complete selection of different breeds and strains

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may be made available at all times, independently of the time the semina of such breeds and strains were collected.

In order that such a refrigerated container have the requisite portability, and still operate with maximum efficiency and economy, it is necessary that certain inherent problems in design and construction be overcome.

To illustrate by way of example the difficulties that are inherent in the provision of a portable low temperature container, suppose for example that it is desired to store several hundred ampules of semen specimens by immersing them in a bath of liquid nitrogen. Assuming that the contents must be stored in a double-walled container at liquid nitrogen temperature (-320° F.) for about four weeks without an excessive volume of refrigerant, and without replenishment of refrigerant, this will require the provision of a highly efficient insulation such as, for example, a high vacuum polished metal surface system, or a suitable insulating material in vacuum system. This will mean that a major path of heat transmission into the container will be through the neck tube of the container and other supporting members. Assume further that the height of the container does not exceed 22 inches, in order that the container may fit in the rear trunk compartment of an automobile.

To more fully appreciate the problem involved in fulfilling the above conditions, it should be pointed out that using a conventional small diameter, thin-walled neck tube to support the inner container inside the outer shell, the contribution of the neck tube to the overall heat transmission will be of such magnitude that attainment of a four week refrigerant holding time without replenishment of refrigerant will be of all intents and purposes, impossible to achieve. Obviously for large neck tube openings, even greater heat leaks will be experienced, since a significant portion of an otherwise well insulated area is thus replaced by an uninsulated opening. As a consequence, refrigeration losses by all modes of heat transfer will be considerably greater.

It is, therefore, an important object of the present invention to provide an improved portable container having a sufficiently low rate of heat transfer to enable perishable products such as semen and the like to be stored in the refrigerated state at lower temperatures and for longer periods of time than has heretofore been possible.

Another object of the present invention is to provide in a low temperature storage container, a low thermally conductive opening for affording easy access into the container for storing unitized or bulky solids, as well as liquids, at low boiling liquefied gas temperatures for sustained periods of time.

Still another object of the present invention is to provide in a low temperature storage container employing as a refrigerant a low boiling liquefied gas, an improved neck tube construction in combination with a close fitting neck tube plug for utilizing the sensible refrigeration in the escaping refrigerant vapors to reduce the net flow of conductive heat along said tube.

Yet another object of the invention is to provide in a storage container for holding products at low temperature, improved means for more effectively utilizing the available storage space.

A further object of the present invention is to provide an ampule-handling container having a high ampule storage capacity, wherein the ampules may be quickly and conveniently handled and assembled into groups without unduly exposing the container contents to harmful higher temperatures.

A further object of the invention is to provide an improved ampule of liquid-impermeable, resinous material, which is not greatly embrittled at low temperatures,

and which can be provided with clip portions to facilitate handling thereof.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a view in vertical cross-section of an improved container embodying the principles of the present invention, also shown is a means for holding units of low-temperature products within the container storage area;

FIG. 2 is a plan view of the container shown in FIG. 1 with a portion broken away to show underlying parts;

FIG. 3 is a sectional view of the container neck plug taken along line 3—3 in FIG. 1;

FIG. 4 is a sectional view of one of the handles of the container taken along line 4—4 in FIG. 2;

FIG. 5 is a fragmentary sectional view of one of the handles taken along line 5—5 in FIG. 2;

FIG. 6 is a perspective view of an exemplary ampule basket employed in the container shown in FIG. 1;

FIG. 7 is a vertical sectional view of a typical ampule shown attached to an ampule holding rod;

FIG. 8 is a horizontal sectional view taken along the line 8—8 in FIG. 7;

FIG. 9 is a fragmentary sectional view of the lower half of the inner container, showing a modification of a basket positioning means;

FIG. 10 is a detail plan view of the modified positioning means taken along the line 10—10 of FIG. 9;

FIG. 11 is a detail elevational view, partly in section, illustrating a modified ampule-holding basket;

FIG. 12 is a detail plan view of the modified basket taken along the line 12—12 of FIG. 11; and

FIG. 13 is a view similar to FIG. 12 showing a modified form of basket 11.

To attain the above objects, use is made in the present invention of highly efficient insulation, such as, for example, a high vacuum-polished metal surface system or a suitable insulating material. According to the broad aspects of the invention, a heat insulated vessel is partly filled with a liquefied gas material, such as liquid nitrogen, which acts as a refrigerant for the storage of products at low temperatures. The invention will be described in connection with a portable container having approximately 25 liters storage capacity for storing frozen ampules of bull semen, but it is to be understood that the same principles apply, regardless of the size of the portable container and the nature of the specific material which is stored. The ampules are conveniently grouped and arranged in ampule-holding baskets, which are immersed in the refrigerant of the container. Each basket contains a number of ampule-holding rods, which may be conveniently and individually inserted in, or removed from its associated basket without withdrawing the basket completely from the container, and without disturbing the remaining holding rods in the basket. Each ampule basket is readily accessible from the neck of the container without disturbing or requiring a major re-arrangement of adjoining ampule baskets.

Double-walled container

In FIG. 1 is shown a liquefied gas holding container or double-walled liquid cylinder 10 embodying the principles of the present invention. The double-walled container comprises an inner vessel 11 made from an impervious metal such as stainless steel. This metal is found to resist embrittlement at the low refrigerant temperatures normally encountered when the refrigerant L is such as liquid nitrogen. The inner vessel is generally cylindrically shaped, having at its lower end a dished bottom wall 12, and at its upper end an annular shoulder portion 13, which terminates in an elongated, tubular supporting neck 14. A splash plate 15 may be welded to the inner wall near the top of the vessel 11. The inner vessel 11 is surrounded by a gas-tight shell or jacket 17 of suitable metal-

lic material, which completely encompasses the inner vessel to provide an intervening evacuable insulating space 18 which functions to afford substantial resistance to heat leakage therethrough.

The outer shell 17 includes a shoulder portion 19, and a tapering neck portion 20 which supports the inner vessel 11 at the upper end of its neck 14 by an annular sealing weld joint 21, said joint constituting the lip of the container 10.

For ease of portability and transportation, it is desirable to restrict the weight of the container, and to dimension the container so that it can be carried in the trunk of a car. I have found that in a 25 liter container, an inner and outer vessel diameter of 14 inches and 18 inches, respectively, and an overall container height of 22 inches are most satisfactory. For a larger portable container where manual handling is not essential, i.e. having a volume on the order of about 640 liters, an inner and outer vessel diameter of 42 inches and 48 inches, respectively, and an overall container height of 46 inches have been found to be suitable.

It is to be understood, however, that the invention is not limited to the above dimensions, and that the specific dimensions employed are determined by the conditions to which the container is to be subjected.

Any suitable means for stabilizing and centering the inner vessel 11 in the jacket 17 may be used, an example of a preferred embodiment being illustrated in FIG. 1. The inner vessel 11 is centered and held against side sway at its lower end by means of radial rods or spokes 22, made of high tensile strength, low-heat-conductive material such as stainless steel. Each spoke is provided with a hooked outer end 24 adapted to fit into an apertured lug 25 which may be welded to the inside wall of the shell 17. A screw nipple 26 serves to join the inner end of each spoke 22 to a metal ring 27. The latter is welded to the bottom of the inner vessel 11, and provides means for adjusting the tension in each spoke to properly space one vessel within the other.

A metallic cup-shaped cap 31 is pivotally secured to the shoulder 19 by a hinge connection 32, see FIG. 2, so that the cap may be swung into closed position over the lip 21, and in engagement with the shoulder 19 in the manner indicated in FIG. 1.

The intervening space 18 may be filled with a low-conductive-thermal insulation, such as highly efficient vacuum-polished-metal surface and or a suitable powder insulating material 33. For insulation filling purposes, the shoulder 19 may be provided with an opening 34, see FIG. 5, for the reception of a short base fill tube or nipple 35, which may be capped by a metal plug 36, made of brass or the like.

To reduce heat leak from the outside to the body of the liquid refrigerant in the vessel 11, the shoulder 19 is provided with an opening 38, see FIG. 4, for receiving a nipple 39 having a metal evacuation tube 40 through which the insulation space defined by the container walls may be exhausted. Depending upon the type of insulation that is employed, and the degree of insulation desired, the pressure within the insulation space should be reduced to a value below 300 microns Hg, and preferably below 100 microns Hg. After exhaustion, the tube 40 is suitably crimped and soldered or welded to effectively seal the vacuous space 18. A filter 41 securely placed over the opening 38, prevents the migration of insulation powder during evacuation.

As shown in FIG. 1, the absolute pressure within the intervening space 18 may be further reduced and maintained at a low value by attaching an adsorbent container or blister 42 to the lower wall 12 of the inner vessel 11. The blister may contain an adsorbent material 43, for example, a zeolitic molecular sieve, either natural or synthetic such as disclosed in United States Patent No. 2,883,243. A filter or screen 44 provided in the blister ensures the retention of the adsorbent in the event the

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insulation powder is removed; it also prevents migration of the powder into the adsorbent blister.

Referring particularly to FIGS. 4 and 5, protection of the projecting insulation fill tube 35 and the evacuation tube 40 from damaging blows or tampering is provided by handles 45, which completely conceal the tubes from view, and thereby provide the container with a neat appearance. Each handle 45 comprises a pair of spaced, upwardly extending tubular arms 46, 47 which are welded at the lower end to the shoulder 19. Each arm is provided at its upper end with suitable registering openings for receiving a horizontal bail member 48. A cap 49 seals each of the arms 46, 47 from the entry of dust or other matter. The arm 46 is divided into two tubes, 46a and 46b, provided with complementarily threaded ends. The end portion of tube 46a is undercut to receive the lower threaded end of tube 46b, so that in assembly the outer surfaces of tubes 46a and 46b are flush mounted with respect to each other. The joints of the handle 45 with the arms 46, 47 may be secured as by silver brazing to hold the handle parts in assembled position. The handle may thus be assembled without applying heat near the vacuum-tight sealed joints of tubes 35 and 40.

Neck tube

As a feature of the invention, the neck tube 14 of the container is constructed in certain critical proportions to satisfy commercial needs and conditions which might be encountered in the use of the container. Primarily, the neck tube should have an access opening or passage large enough for easy ingress and egress of the perishable commodity, yet presenting a small enough heat-conductive path to obstruct the flow of heat. It should support the weight of the inner container and contents, and yet be thin enough to provide a heat path of exceptionally small cross-sectional area. It should also be long enough to provide a lengthened heat path, while at the same time restricting the overall height of the container so that the latter may fit inside the trunk of a car. It should be strong enough to resist stresses and strains in all positions including side position.

Obviously, optimum neck tube dimensions must consider all the above-mentioned factors. Considering for example the previously-mentioned 25 liter container, a 6 inch long neck tube made from a metal possessing high strength and relatively low conductivity such as "Hastelloy" steel, and having a diameter of 3 inches and a wall thickness of 0.010 inch, would be admirably suited to fulfill the above needs. For a larger container having a 640 liter capacity, a 12 inch long neck tube having a diameter of 15 inches and a wall thickness of 0.010 inch would be satisfactory.

Referring to FIGS. 1 and 3, a thin-walled-plastic dummy stopper or neck plug 28, filled with a low heat conductive medium such as powder, fits loosely inside the neck tube 14. The adjacent walls of said neck tube and plug define an annular channel or clearance 14a of approximately $\frac{1}{16}$ inch on the diameter. This clearance is sufficiently wide to permit passage of refrigerant vapors upwardly therethrough, and yet sufficiently restricted in opening that the said vapors will sweep both of said walls as they flow upwardly. The plug 28 is provided as shown, with an elongated cylindrical body having an outer surface disposed contiguous with, but spaced slightly from the neck tube wall. The cylindrical body is provided at its upper end with a flange 29 having a diameter slightly greater than the neck tube diameter to supportingly hold the plug in position within the neck tube.

When, as shown in FIG. 1, the product holding means are supported in the refrigerating compartment by elongated handles 58 extending to the neck tube upper lip, these handles are positioned adjacent the neck tube wall. To accommodate said handles, longitudinal grooves 30 may be formed about the circumference of the plug 28.

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These grooves are peripherally evenly spaced and small enough to define with the handle a slight passage for refrigerant vapors. Also, when this type of handle is employed, the plug flange 29 will rest on the upper or bent portion 60 of the handle 58 affording a circumferential vent opening for vapors. When, of course, the product holding means are not supported on the neck tube upper lip, the flange 29 may be adapted to be spaced from the neck tube to provide the necessary peripheral venting passage at the plug upper end.

The provision of the neck plug 28 to occupy the majority of the free space in the neck tube 14 is both desirable and necessary for obtaining maximum advantage in the present invention. The primary function of the plug 28, as mentioned, is to cause the refrigerant vapor, which is evolved due to unavoidable heat leak, to channel or flow upwardly close to, and in contact with the metal surface of the neck tube 14 and the handles 58 when this type of handle is employed. The vapor thereby absorbs any heat which otherwise would be conducted down the neck tube 14 and handles 58, and in so doing is itself warmed to essentially atmospheric temperature. In this manner, the sensible refrigeration in the refrigerant vapor is recovered and the net heat conducting characteristic of the neck tube is effectively reduced. This permits the use of a large diameter access tube 14 without incurring serious heat losses, and thus results in minimum refrigerant consumption while still permitting a greater portion of the container storage volume to be utilized.

Product holding means

In order to more efficiently utilize the container storage capacity, different embodiments of product holding means may be employed. One such means is shown in the figures, and has been previously mentioned in relation to the neck tube 14 and plug 28 arrangement, a fuller description of this holder follows. As shown in FIG. 1, there is provided a number of product holder units or ampule-holding baskets 50. In this device, all the parts of the basket are immersed in, and are in direct contact with the liquid refrigerant L. Each of the baskets 50 comprises primarily means for suspending the product holding ampules in such a manner as to fit the maximum number of ampules into a particular storage compartment.

The product holding means is positioned in said compartment by the elongated handle 58 having the formed upper end 60 to supportingly engage the container. As shown in FIG. 6, the handle arrangement is such that when in the supported position, the perishable products will be disposed outwardly and toward the compartment walls. Keeping said product holders away from the neck tube, permits any of said devices to be inserted or removed without disturbing those already positioned.

As illustrated in FIGS. 1 and 6, each of the baskets 50 comprises a pair of vertically spaced lower and upper rings 52, 53 made of medium gage sheet metal, such as stainless steel, which is not greatly embrittled at low temperatures. The rings 52, 53 are disposed in axial alignment with each other, and are maintained in vertically spaced relation by a plurality of generally U-shaped channel members or guide slots 54 welded or bolted thereto. The channel members 54 are adapted to slidably receive therein, ampule holding rods or canes 73 to be described hereinafter for the handling of small quantities of ampules.

Any number of channels 54 may be provided, and any arrangement of channels may be formed. For example, the channel 54 may be attached to the inside surfaces of the rings 52, 53, 55 or 56, so that its channel opening faces radially inwardly, or channel 54 may be attached to the outer surface of the rings 52, 53 to face radially outwardly, a combined arrangement of radially inwardly and radially outwardly facing channel openings being illustrated herein.

Surrounding each of the rings 52, 53 is a concentrically disposed circular outer ring wall 55, 56, respectively,

which is held in assembly with the inner ring by means of radially connecting bars 57 welded thereto. An elongated basket handle 58, which is welded at its lower and medial portions to the outer surfaces of the lower and upper ring walls 55 and 56, respectively, is provided at its upper end with a hollow, thin, tubular section 59, see FIGS. 1 and 6, which in assembly with the neck tube 14 is disposed within the neck tube plug groove 30 and adjacent the inner wall of the neck tube to restrict the flow of conductive heat therealong. This hollow section may be filled with a low conductive material, such as a phenolic resin or powdered silica, to impart added rigidity and to prevent buckling of the thin round tube. Attached to the tubular section 59 and forming the upper end of the handle 58 is a terminal arm 60, which is permanently bent or hooked so as to overlie the lip 21, and support the plug flange 29 when the basket 50 is spaced inside the periphery of the container 11.

In FIGS. 11, 12 and 13 is shown another embodiment of an ampule basket 50a of the closed type, wherein only the outer wall surfaces of the basket may be in direct contact with the refrigerant L. The basket 50a comprises a blind end tubular body 62 of sheet metal having secured to the body, as by welding, a connecting handle 63 similar to the handle 58 in basket 50. In this condition the basket 50a may be employed in the storage of bulk items of various sizes and shapes. It is not necessary to exclude the refrigerant from inside the basket 50a, apertures 64 may be provided, if desired, in the bottom portion of the tubular body 62. Such apertures will prevent the basket from floating, and will afford means for the circulation of refrigerant L inside.

To separate the contents of the container into readily identifiable units, the basket 50a may be suitably divided by means of partition walls into a number of elongated chambers 66 for the reception of ampule canes. These compartments 66 may be formed either by a smooth-walled diametral partition 65, as shown in FIG. 11, by radial walls 67 as indicated in FIG. 12, or by short wall segments 68, as shown in FIG. 13, the single partition 65 being preferred.

An alternative form of ampule holding basket may comprise a nest of cane-receiving tubes (not shown), each adapted to individually receive an ampule cane 73. The nest of tubes may be firmly banded together and a handle secured to the bands to form a unitary basket assembly.

As shown in FIG. 1, a number of ampule holding baskets are disposed inside the inner container, each basket being preferably constructed with the same outer ring diameter, so as to be loosely received through the opening in the neck tube 14, and positioned inside the container to accommodate the maximum number of ampules.

For example, when assembled within the container 11, the baskets 50 are preferably stored in the large diameter portion of the container about a center space disposed directly below the opening in the neck tube 14. Referring to FIG. 2, for the most effective utilization of available storage space, six maximum sized baskets having a diameter slightly smaller than the neck tube diameter may be held. These baskets are circularly arranged in the large diameter portion of the container about the center portion. A larger or smaller number may of course be provided if so desired. For this purpose, and referring to FIGS. 1, 9 and 10, the bottom wall 12 of the inner container 11 is provided with an annular supporting platform or pedestal 70, 70', which is securely attached to said bottom wall. The outer ring 55 of each of the surrounding baskets 50 extends slightly below the upper surface of the pedestal 70, being supportingly held at this level by the engagement of the radially outwardly pointing hooked end 60 of the handle 58 with the lip 21. As a result, the ring 55 is in proximity with the side surface 71 of the pedestal 70, thereby limiting the extent to which the basket 50 may sway.

In FIGS. 10 and 11 are illustrated a modified form of pedestal 70' in which the rotational movement or side sway of the baskets may be further minimized by the provision of a spider construction comprising radially extending spokes 72, which are secured at their inner ends to the top of the pedestal 70', and extend radially outwardly in equal angular spacing between the surrounding baskets 50a.

Ampule and ampule holding rod

To effect removal or insertion of a group of ampules from the ampule holding basket 50, each of the channels 54 is adapted to slidably receive an elongated ampule holding rod or cane 73, to which are attached one or more glass or plastic ampules 93, preferably made of a substantially liquid impermeable plastic such as polyethylene. The cane 73 may be made of metal or plastic, either as a solid rod or hollow tube. The ampules 93 are vertically spaced along said rod, either inside the inner rings 52, 53, or between the inner rings and the outer rings 55, 56, according to whether the channel 54 is facing inwardly or outwardly, and are prevented from dislodgement by means of suitable clips as described hereinafter.

According to one aspect of the invention, a plastic ampule 93 may comprise a hollow, elongated, blunt nosed, bullet-shaped body 94 provided with a hollow cylindrical chamber 95 for receivably accommodating the end of an insemination tube therein. The ampule is preferably filled and sealed from the nose end 94a. To remove the contents, the ampule is punctured in chamber wall 95a by the insemination tube, and the semen forcibly discharged into the insemination tube by squeezing the hollow body 94. Securement of each of the ampules 93 to the cane 73 is accomplished preferably by means of an integral clip portion 96 joined to the side of the ampule chamber 95 by a narrow integral neck portion 97 therebetween, said clip portion 96 having arcuate arms 98 adapted to conformably grip the cane 73, and fit in dovetail fashion in the channel 54, so that rotational or lateral movement of the ampule with respect to the channel is restricted, and only longitudinal movement may be effected. For purposes of illustration, the ampule holding rod 73 and the arms 98 are shown as being rounded; but the rod 73 is preferably of rectangular or polygonal section, and the arms 98 correspondingly shaped to embrace the rod to prevent relative turning. Any number of ampules may be secured to the cane, a cane constructed to hold about five ampules being preferred and illustrated herein.

From the above description it will be seen that the present invention provides an improved portable container having a sufficiently low rate of heat transfer to enable perishable commodities such as bull semen to be stored in the refrigerated state for longer periods of time than has heretofore been possible. Using as a refrigerant a low boiling liquefied gas, such as liquid nitrogen, a perishable product may be stored therein indefinitely, and refrigeration need not be replenished frequently. An improved neck tube access opening automatically relieves gas pressure in the container, and reduces the net flow of conductive heat along the tube, thereby permitting the use of a large diameter neck tube in comparison to the storage volume of the container.

In conjunction with the neck tube construction, a material handling device of the offset basket type affords means for effectively utilizing a large storage volume through a given diameter neck tube opening. The arrangement of the material handling devices provides for ready removal, insertion or replacement of an entire ampule holding basket or individual cane and ampule group whenever it may be necessary.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of the present invention.

What is claimed is:

1. In a system for storing products at low temperatures over prolonged periods of time, a thermally insulated vessel for holding a supply of low boiling liquefied gas in thermal association with low temperature products in said vessel, a centrally located access opening in said vessel upper wall for the insertion and removal of said products from said vessel, said access opening comprising a thin-walled elongated neck tube; a removable neck tube plug supported from said access opening and having a body portion loosely fitting within said neck tube such that adjacent walls of said neck tube and said body portion define an unobstructed annular channel for the upward passage of refrigerant vapors in contact with said adjacent walls; and product holding means held inside the vessel being upwardly removable therefrom and displaceable in the vessel to an offset position with respect to said access opening for utilizing storage space in the vessel which is normally inaccessible from said opening, said product holding means having an elongated handle extending through said annular channel adjacent the inner wall of said neck tube.

2. In a system for storing products at low temperatures over prolonged periods of time, a thermally insulated vessel for holding a supply of low boiling liquefied refrigerant gas in thermal association with low temperature products in said vessel, a centrally located access opening in the top portion of said vessel for the insertion and removal of products comprising a thin-walled elongated neck tube, product holding means having an elongated handle extending upwardly through the neck tube and supported on the neck tube upper edge, said product holding means being upwardly removable through said neck tube opening and displaceable in the vessel to an offset position with respect to said access opening thereby effecting maximum utilization of the storage and capacity of said vessel, and a plug supportably received in said neck tube to define an annular channel between the adjacently positioned walls of said plug body and neck tube for the upward passage of vapors of the liquefied refrigerant gas and longitudinal grooves formed into the plug outer surface, said grooves being adapted to loosely receive an elongated handle of said product holding means.

3. In a system for storing products at low temperatures over prolonged periods of time, a thermally insulated vessel for holding a supply of low-boiling liquefied gas in thermal association with the low temperature products in said vessel, a large centrally located access opening in said vessel for the insertion and removal of said products from said vessel, said access opening comprising a thin-walled, elongated cylindrical metallic neck tube; a removable neck tube plug supported from said access opening and having a body portion loosely fitting within said neck tube such that adjacent walls of said neck tube and said body portion define an unobstructed annular channel for the upward passage of refrigerant vapors in contact with said adjacent walls; and a product holding means inside said vessel being upwardly removable from and radially movable in the vessel to an offset position with respect to said access opening for utilizing storage space in the vessel which is normally inaccessible from said opening, said product holding means having an elongated handle extending through said annular channel adjacent the inner wall of said neck tube.

4. In a system for storing products at low temperatures over prolonged periods of time, a thermally insulated vessel for holding a supply of low-boiling liquefied gas in thermal association with the low temperature products in said vessel, a large access opening centrally located in the top portion of said vessel for the insertion and removal of products supported on a product holding means in said vessel, said access means comprising a thin-walled, elongated metallic neck tube, rotatable and upwardly removable product holding means inside said vessel in supported relation to said neck tube, said product holding

means having an elongated handle extending upwardly through said neck tube and being supportably held at the tube upper edge, said product holding means being rotatable in said vessel from the space immediately below said opening to a position offset from the access of said opening thereby effecting maximum utilization of the storage and capacity of said vessel, and a plug supportably received in said metallic tube to define a narrow annular space between said plug and said tube for the upward passage therethrough of vapors of the liquefied gas, and longitudinal grooves formed on the plug outer surface adapted to circumferentially position respective elongated handles of the product holding means with respect to said vessel neck tube.

5. In a system substantially as defined in claim 3 wherein the diameter of the plug is slightly less than the diameter of the neck tube to define an annular channel having a width of approximately $\frac{1}{16}$ of an inch.

6. In combination with a low temperature storage container having a large diameter interior and a central opening in said container top for affording access into said large diameter interior, a product handling device comprising a plurality of elongated generally tubular baskets, each having an outer diameter slightly smaller than the diameter of said container opening and loosely receivable therein, a low conductive handle secured to the outer cylindrical surface of each of said baskets, and extending vertically upwardly therefrom through said central opening, an inwardly bent outer end on each of said handles for positioning same, said baskets being adapted to be displaced into an offset position in the large diameter portion of said container, a low heat conductive plug received in said central opening and spaced inwardly therefrom to define an annular channel therebetween, said plug having longitudinal grooves formed into the outer surface of said plug and adapted to receive a low conductive handle whereby said handle ends supportingly engage the edge of said opening, thereby effecting maximum utilization of the storage capacity of said large diameter interior, and stabilizing means for maintaining said baskets in vertical position when said baskets are in offset position.

7. In combination with a low temperature storage container having a large diameter interior and a central opening in said container top for affording access into said large diameter interior, a product handling device comprising a pair of axially spaced inner rings, a pair of outer rings radially spaced from the inner rings and of a lesser diameter than said central opening, a plurality of longitudinal channel members secured to said pair of inner rings, brace bars extending between and fixed to said inner and outer rings to hold the same in spaced relation, a longitudinal member secured to the outer of said rings extending vertically upward therefrom a distance sufficient to pass through said central opening, a laterally inwardly extending handle portion on the end of said longitudinal member for positioning same in relation to said central opening, and ampule holding rods longitudinally slideably receivable in the channel members, whereby said handle portion supportingly engages the edge of said opening, thereby providing for a plurality of said devices and displacement of them in offset position for effecting maximum utilization of the storage capacity of said large diameter interior.

8. In combination with a low temperature storage container having a large diameter interior and a central opening in said container top for affording access into said large diameter interior, a product handling device comprising a plurality of generally tubular baskets, each having an outer diameter slightly smaller than the diameter of said container opening and loosely receivable therein, a low conductive handle secured to the outer cylindrical surface of each of said baskets, and extending vertically upward therefrom through said central opening, an inwardly bent outer end on each of said handles for positioning the same, said baskets being adapted to be dis-

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placed into an offset position in the large diameter portion of said container, whereby said handle ends supportingly engage the edge of said opening, thereby effecting maximum utilization of the storage capacity of said large diameter interior, and stabilizing means for maintaining said baskets in vertical position when said baskets are in the offset position, said stabilizing means comprising a plurality of spokes in fixed relation to said container, and extending radially between said baskets in the offset position, thereby limiting the sway movement of said baskets.

9. A system for storing products at low temperatures over prolonged periods of time which comprises: a thermally insulated vessel having a refrigerating compartment for holding a supply of low boiling liquefied gas in thermal association with such products and having a neck tube in the top thereof providing an access opening into the refrigerating compartment; a removable neck tube plug supported from said access opening and having a body portion loosely fitting within said neck tube such that adjacent walls of said neck tube and said body portion define an unobstructed annular channel for the upward passage of refrigerant vapors in contact with said adjacent walls; and product holding means supported in said refrigerating compartment including an elongated handle connected thereto and extending through said annular channel adjacent the inner wall of said neck tube and supportably engaging the container.

10. A system according to claim 9 wherein a longitudinal groove is formed in the outer surface of the neck tube plug body portion to accommodate said elongated handle extending through said access opening and to define with said elongated handle a slight passage for refrigerant vapors.

11. A system according to claim 9 wherein said elongated handle is constructed to position said product holding means toward the wall of said refrigerating compartment when supportably engaging the container.

12. A system according to claim 9 wherein the annular channel had a width of approximately $\frac{1}{16}$ inch.

13. A system according to claim 9 wherein said product holding means comprises an elongated basket disposed outwardly and toward the wall of said refrigerating com-

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partment by an elongated handle having a formed upper end to supportably engage the container.

14. A system according to claim 9 wherein a section of said elongated handle is constructed of low heat conductive material.

15. A system for storing products at low temperatures over prolonged periods of time which comprises: a thermally insulated vessel having a refrigerating compartment for holding a supply of low boiling liquefied gas in thermal association with such products and having a neck tube in the top thereof providing an access opening into the refrigerating compartment; a plurality of product holding means disposed outwardly and toward the wall of said refrigerating compartment by elongated handles extending through the access opening adjacent the inner wall of said neck tube and having formed upper ends to supportably engage the container; and a removable neck tube plug having a body portion with a plurality of grooves formed in the circumference thereof to accommodate said elongated handles fitting within said neck tube such that the adjacent walls of said neck tube and said body portion define an annular channel to permit passage of refrigerant vapors upwardly therethrough in contact with said adjacent walls and said elongated handles.

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