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3,034,845

DISPENSING APPARATUS FOR LOW-TEMPERATURE STORAGE CONTAINERS

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3 Sheets-Sheet 1

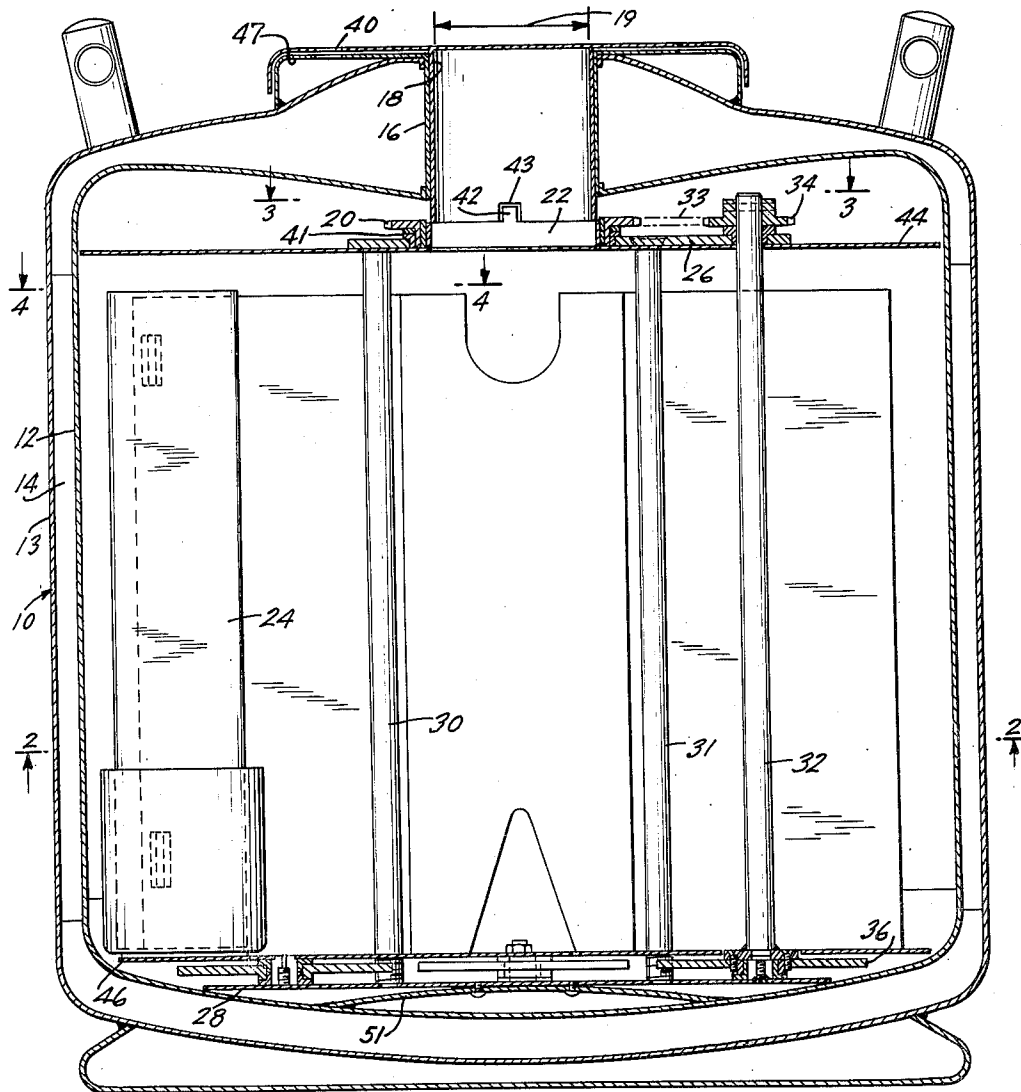


FIG. 1

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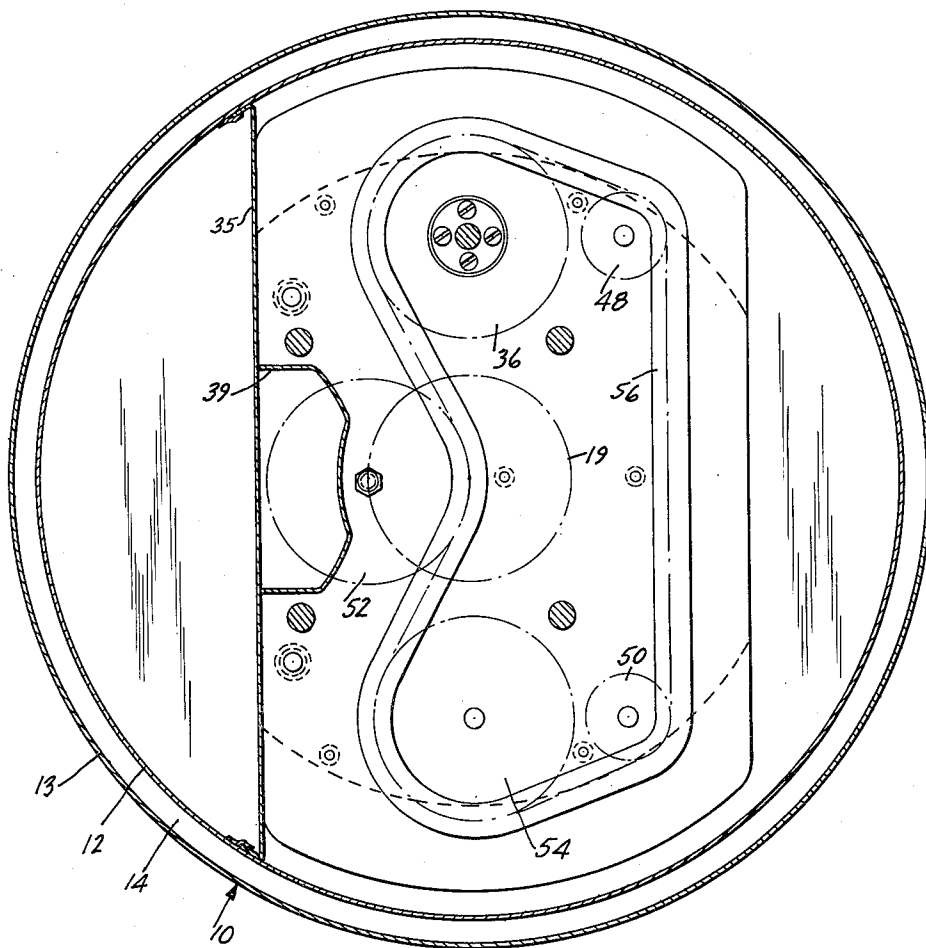
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FIG. 2



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FIG. 3

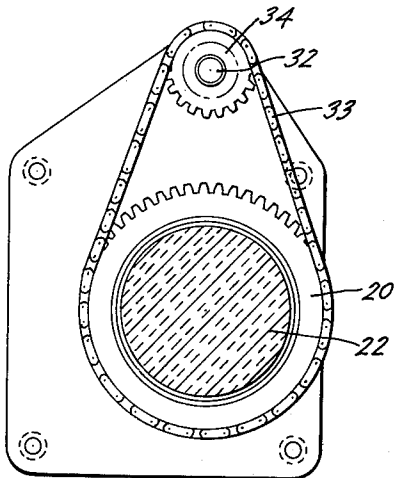


FIG. 5

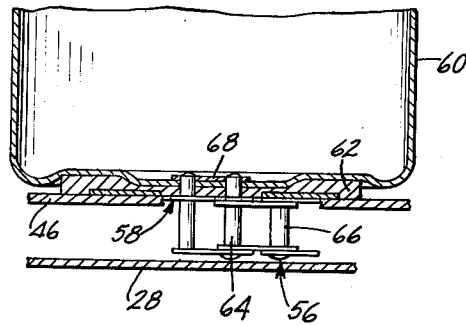
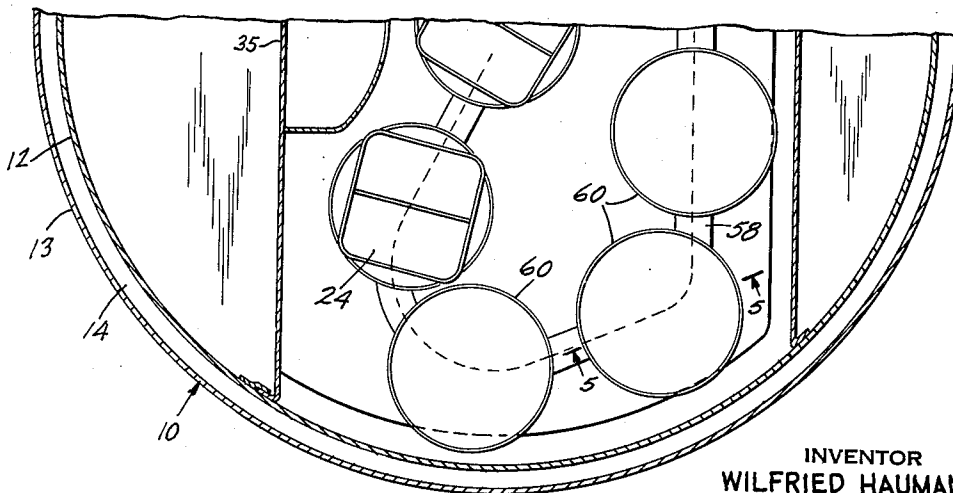


FIG. 4



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DISPENSING APPARATUS FOR LOW-TEMPERATURE STORAGE CONTAINERS

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9 Claims. (Cl. 312-268)

The present invention relates to an apparatus for conveniently storing and dispensing low-temperature products. It relates more particularly to an apparatus for conveniently storing receptacles containing low-temperature preserved products wherein the size of the outlet of the container through which the products are inserted and removed is kept to a minimum thereby keeping the heat leak to the container to a minimum.

There is considerable commercial activity in the low-temperature storage of perishable products such as bovine semen and biologicals. Present refrigerated storage containers generally use either liquid nitrogen or solid carbon dioxide-alcohol mixtures with liquid nitrogen being the preferred refrigerant. Prior storage vessels for this service often utilized two main apparatus variations for handling the stored material. One of the most widely used apparatus consists of a storage receptacle with an elongated handle which may be hooked over the edge of the storage container inlet to position the receptacles. By use of this device, a maximum of about six receptacles, each having about the same diameter as the container inlet, may be stored. Consequently, there is a considerable amount of otherwise useful storage space in the container not being utilized for product storage.

If a larger inlet is provided in the container to accommodate more receptacles, each having a diameter substantially smaller than the inlet, heat leak through the container inlet can become prohibitive. The use of handles for the storage receptacles also introduces an additional heat leak path which increases the evaporation loss of the refrigerant.

Another apparatus variation utilized is a "Lazy Susan" type rotating tray with an offset container opening. This arrangement allows a greater number of receptacles to be stored, but it has the accompanying disadvantage though of requiring some form of activating mechanism transversing the container wall for operating the rotating tray, and thus introduces additional heat leak. In general, this species of container also requires a relatively large container inlet to provide access to more receptacles in order to obtain maximum utilization of the available storage space.

It is therefore an object of the invention to provide a low-temperature apparatus for storing biologicals capable of facilitating the transferring of said materials to and from the apparatus with a minimum amount of heat leak to the refrigerated storage area. A further object is to provide an efficient refrigerating apparatus which permits external manipulation for the purpose of positioning the internally stored materials.

In the figures:

FIG. 1 is a vertical view in cross section of a double-walled storage container embodying the conveyor apparatus of the invention;

FIG. 2 is a view in cross section taken along line 2-2 of FIG. 1;

FIG. 3 is a view on an enlarged scale taken along line 3-3 of FIG. 1;

FIG. 4 is a fragmentary view on an enlarged scale and in cross section taken along 4-4 of FIG. 1; and

FIG. 5 is a cross-sectional view taken along line 5-5 of FIG. 4.

In brief, the invention contemplates a refrigerating container 10 having an inner vessel 12 with a shell 13

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outwardly spaced therefrom to define an insulating space 14. A neck tube 16 centrally positioned in the top of said container supportably extends between said vessel and shell providing an access port 19 to the vessel interior. An insulated actuating element 18 is slidably received in said neck tube and is provided with suitable means for engaging a rotatable drive member 20 positioned beneath the neck tube, said member having a central bore 22 sufficiently large to permit passage of the low-temperature receptacles 24 during ingress and egress thereof.

A conveyor assembly positioned within the vessel 12 comprises an upper plate 26 and lower plate 28 spaced apart by a plurality of columns such as 30 and 31. A spindle 32 terminally journaled in said plates respectively is provided at the upper end with a driven member 34 to receive transmitted motion from the rotatable member 20.

A lower sprocket 36 fixed to the other end of said spindle 32 engages an endless chain 56 which is guidably positioned in the lower section of the vessel and provided with means for accommodating a plurality of receptacles 24, which receptacles may thereby be conveyed horizontally through the vessel. The chain at one point is guided directly beneath the access port 19 to permit upward removal of said receptacles through the neck tube 16.

According to the invention, the insulated container 10, as shown in FIG. 1, is preferably small enough to be carried about by hand and thereby facilitate dispensing the refrigerated products such as bull semen, by maintaining it in a cooled condition up to the point of usage. The spaced vessel 12 and shell 13 are usually made of a metal such as aluminum or stainless steel and may be of welded construction with gas-tight seams for retaining a vacuum in the inter-wall space 14. Insulating characteristics of the composite closure is greatly fostered by providing the space 14 with a material such as opacified insulation of the type described in U.S. Patent 2,967,152 and copending application Serial No. 597,947, L. C. Matsch, filed July 16, 1956. A combination of straight vacuum with polished wall surfaces is also found to be effective in avoiding heat leak, but not to the desired degree which the aforementioned opacified insulations are.

The vessel 12 and shell 13 are preferably spaced and maintained apart with a minimum amount of direct contact therebetween to avoid the aforementioned heat leak which most readily follows a metallic path. In this respect, the elongated neck tube 16 generally comprises a thin-walled cylindrical member, and end fastened to said vessel and shell in openings provided therefor. Neck tube 16 is preferably constructed of stainless steel, which is characterized by excellent structural strength and low thermal conductivity, although other materials such as a phenol formaldehyde thermosetting plastic resin may also be used. Said tube is provided with a sufficient wall thickness to assure structural support and rigidity between the vessel and shell. The neck tube bore is relatively small in comparison to the container diameter thereby providing a minimum path for heat leak and reducing the amount of heat flow into the vessel when the top element 18 is removed. For larger size containers, additional strength may, of course, be had for the inner shell by use of supplemental members interposed in space 14, in supporting relationship to said shell and vessel.

The inside diameter of the neck tube 16 defines the only access port 19 to the vessel interior and is, of course, sufficiently large to permit passage of the receptacles which are transferred to or from the vessel by way of said port. Also, a liquefied gas, such as liquid nitrogen, is introduced into the vessel interior through the access port. In addition, the vessel interior may be partitioned

by panel 35 as illustrated in FIGS. 2 and 4 into compartments to accommodate a solid type refrigerant, such as carbon dioxide, adjacent the vessel outer walls, with the low-temperature product in the center. It is found convenient to provide a chute 39 communicating with one of the remote compartments into which a suitable funnel can be inserted for supplying the solid material to the vessel.

The partition 35 is an important feature of the present apparatus. Specifically, some of the industry still uses solid carbon dioxide refrigerant. It is also desirable that this type of refrigerant could be used in a given storage container in case of a lack of supply of the liquid refrigerant. In this case, the partition prevents solid carbon dioxide agglomerates from interfering with the action of the chain 56 and its attached receptacles. An additional plate may be positioned on the opposite side of the conveyor apparatus and serve the same purpose as the partition 35.

Most uses of solid carbon dioxide use a carbon dioxide-alcohol mixture. In this respect the space beneath the plate 28 provides a path for travel of the solid carbon dioxide-alcohol "slush" from one side of the container to the other. In addition, this space provides a circulatory path for carbon dioxide vapor which permits a uniform temperature distribution to be obtained throughout the refrigerant bath. Liquid alcohol is also free to circulate throughout the inner vessel by means of small holes in the partition.

The insulated actuating member 18 according to the invention serves a dual purpose. Said member is not only registered in the neck tube 16 central bore to provide a thermal barrier, but it is also operably associated with said bore to be manually rotatable therein. An indicator plate 40, or similar identifying means is fixed to the upper end of member 18 and normally rests on the neck tube 16 upper edge thereby providing means for immediately identifying the relative position of receptacles within the vessel. A similar stationary plate 47 fixed to the shell top cooperates with the rotatable plate as will be hereafter noted.

The double-walled container, as here disclosed, is not of itself unique in the art although the utilization of actuating member 18 as a low-thermally conductive plug is an important and essential feature of the invention. The lower edge of said member is provided with means for detachably engaging the rotatable drive member 20. For instance, the latter, as shown in FIGS. 1 and 3, may be a sprocket, rotatably positioned by a low friction lateral retaining means such as a ring bearing 41, to the upper surface of plate 26. A projecting tab 42, extending from the drive sprocket 20 is slidably received in a corresponding cut out or groove 43 in the bottom end portion at the outer periphery of the rotatable member 18 whereby rotational movement of said member will be transmitted to the drive sprocket. It is understood that these members are only operably engaged when the rotatable member is properly positioned within the neck tube, and that said member is usually removed only when the conveyor is properly aligned within the access port for transferring a low-temperature receptacle.

Plate 26, as shown in FIG. 1, is supportably positioned in the vessel upper section by a plurality of columns 30 and 31. A lateral positioning plate 44 or similar outwardly extending means is provided to stabilize the conveyor mechanism and avoid lateral movement with respect to vessel 12, and to prevent the rack assemblies, not shown, that house the biologicals in the receptacles 24, from being thrown from the receptacles when the container is jostled up and down. The lower plate 28 provides a base for the conveyor assembly. It is bolted to the dished member 51 which is in turn fastened, preferably by welding to the lower surface of the vessel interior. The spindle 32 extends vertically between the plates 26 and 28, and is journaled in suitable bearings adjacent

the ends thereof. The sprocket 34 pinned to the upper end of the spindle outward of plate 26, is aligned with the rotatable drive sprocket 20 to properly accommodate an endless chain 33 looped thereabout for transmitting rotational movement to the spindle 32. While I have here provided a chain transmission, it is understood that satisfactory results are also obtainable by use of gears or other power transmitting means to impart rotation motion from the actuating element 18 to spindle 32. The rotational direction of the respective transmission components is, of course, important as the conveyor, which will be hereafter described, should be progressed a particular distance with relation to the rotation of the actuating element 18 in order that the indicator plate 40 may give an accurate visible indication of the respective receptacles 24 in the vessel.

Referring to FIGS. 1, 2 and 4, it may be seen that the conveyor assembly lower section comprises essentially the base plate 28 which is downwardly spaced from a scuff plate 46 upon which the cups 60 rest and may slidably progress. A plurality of sprockets, notably 36, 48, 50, 52 and 54, are horizontally located and journaled to the base plate 28 or between said plate and scuff plate 46, to provide the conveyor guide. It should be mentioned that I have found it beneficial in most instances of journaled parts, to provide bearings of a non-metallic type such as polytetrafluoroethylene, self-lubricating bushings. Bushings of this type are preferred in order to avoid galling of surfaces which might normally occur at the low-operating temperatures encountered in the present apparatus. The respective sprockets are disposed as illustrated in FIG. 2 to guide the endless conveyor chain 56 in a prescribed path through the vessel.

Sprocket 36 is pinned to the lower end of spindle 32 and may be rotated, to provide the power to the conveyor chain 56. The remaining sprockets function primarily as idlers and merely maintain the conveyor in proper operating position. As seen in FIG. 2, for properly storing the various receptacles, the conveyor or chain 56 is generally guided adjacent the vessel walls but at one point, idler 52 urges the conveyor inwardly to approximately the center of vessel 12 whereby the receptacles may be brought consecutively directly beneath the access port 19 indicated on this figure as a dash-dot circle. An idler sprocket 52 may be provided with means for laterally adjusting the tension in the chain 56.

The direction in which the conveyor 56 progresses is dependent upon the rotation of spindle 32 which, as previously mentioned, is associated with the actuating element 18, so that positioning of the receptacles within the vessel is accurately indicated by the relative positions of plates 47 and 40. The endless conveyor 56 as illustrated in FIG. 5 in accordance with the invention is preferably a length of roller chain fastened at the ends to define a loop about the respective sprockets. The chain is so positioned by the said sprockets to be guided through an opening or channel 58 formed in the scuff plate 46. At spaced intervals along the chain, suitable means is provided for engaging or receiving the lower portion of a receptacle 24 and maintaining it in a vertical position.

I have found that a relatively simple method is to provide a plurality of cups 60 having a top opening approximately that of the access port 19, which cups may be fastened to the chain 56 at equi-spaced intervals. The cups may be fixed to the conveyor in any of several ways, but I have found that a relatively simple means consists of providing the underside of said cup with a shoe 62 which straddles channel 58 and bears against the scuff plate 46 surface. The shoe is preferably fabricated of a material characterized by a low coefficient of friction and resistance to low temperatures, for example, polytetrafluoroethylene is found to function satisfactorily for this purpose. A pair of connecting pins 64 and 66 extending upward from the chain 56 and providing an extension thereto, extends through said shoe 62 and the wall of cup

60. The pins are then fastened to a pad 68 to utilize the assembly. This permits the cup and receptacle to be drawn along the conveyor path as a unit with a minimum of friction due to drag against the scuff plate.

Referring to FIG. 4, with a plurality of cups 60 fixed to the conveyor 56, it is seen that a major portion of the vessel useable cooling space may be occupied by the various receptacles when disposed in said cups, which, heretofore described, may be advanced along the conveyor path to pass consecutively beneath the access port 19. Also the cross-sectional shape of the receptacle 24 need not necessarily conform with the cup top opening. It is understood that any sized receptacle may be carried by a particular cup so long as the receptacle may be passed through the access port.

In normal operation, the container may be provided with a low-temperature refrigerant such as liquid nitrogen which is introduced to the inner vessel storage area through the access port 19. For storing the semen containing receptacles some identification may be applied to each receptacle as it is inserted in a conveyor cup, at the same time a corresponding identification may be made on the stationary identification plate 47.

This identification can then be noted through an appropriate slot or opening in plate 40 as the slot aligns itself with the identification. To advance the conveyor for receiving another receptacle, the actuating member 18 is inserted in the neck tube and slowly rotated until proper engagement is made with the drive sprocket 20. A further rotation now advances the conveyor sufficiently to align the slot in plate 40 with the next identification on plate 47. This places an unoccupied cup beneath the access port 19 for receiving the next receptacle. This procedure may be followed until the conveyor cups are all occupied at which time the activating member will have made a single complete revolution and be at its original positions.

The depressed head portion of the vessel 12 as shown in FIG. 1 permits a longer neck tube to be utilized in this container which, because of its use in the industry has an overall height limitation. This head construction further tends to minimize the heat leak to the container through the neck tube.

It will be understood that the apparatus as herein described represents a single embodiment and may be changed or modified without departing from the spirit or scope of the invention.

What is claimed is:

1. An apparatus for storing and dispensing low-temperature materials comprising a heat-insulated container, having a storage area, an access port in the top wall thereof communicating with said storage area, a removable actuating element operably received in said port providing a closure thereto, a low-temperature material conveyor positioned in the lower portion of said area, said conveyor comprising an endless chain guideably retained in a continuous path which passes directly beneath said access port, and transmission means connecting said conveyor with said actuating element whereby said chain may be progressed along said path in response to rotative movement of said actuating element.

2. An apparatus for storing and dispensing low-temperature materials comprising a heat-insulated container having a storage area, an elongated access port in the top wall thereof communicating with said storage area, a low-thermally conductive rotatable actuating element operably received in said port providing a removable closure thereto, a conveyor adaptable to receive low-temperature materials guideably positioned in the lower portion of said storage area defining a substantially horizontal continuous path which passes at one point directly beneath said access port, and transmission means connecting said conveyor with said actuating element such that rotative movement externally applied to said element will advance said conveyor along said continuous path in response to said externally applied rotative movement.

3. An apparatus substantially as described in claim 2 wherein a point on said conveyor may be advanced completely around said continuous path in response to a complete rotative turn of said rotatable element.

4. In an insulated container for storing and dispensing low-temperature materials, the combination therewith which comprises said container having an access port in the top portion thereof providing access to the container storage area, a low-thermally conductive, elongated actuating element received in said port having one end thereof outwardly protruding from said container, the other end extending into said storage area to operably engage a rotatable drive member and transmit rotational motion thereto when said element is fully inserted in said access port, means for transmitting said motion to an endless conveyor guideably positioned in the lower section of said storage area, said conveyor being disposed to define a horizontal continuous path through said storage area in such a manner that said path passes at one point vertically beneath the access port, and means on said conveyor for accommodating said low-temperature materials whereby said materials may be horizontally guided along said path in said storage area and consecutively positioned beneath the access port for removal thereof in response to rotative movement of said actuating element.

5. In an insulated container for storing and dispensing low-temperature materials the combination therewith which comprises said container having a single access port in the top portion thereof providing access to the container storage area, a removable, low-thermally conductive actuating element slidable and rotatably received in said port, the lower portion thereof extending into said storage area and operably engaging a rotatable member having a center bore approximately as large as said access port positioned adjacent to and coaxial with said access port, means for transmitting rotational movement from said member to an endless conveyor guideably positioned in the lower portion of said storage area having means associated therewith for receiving said low-temperature materials, said conveyor horizontally disposed in an endless path, one point of which passes directly beneath said access port whereby rotational movement imparted to the actuating element will progress said received low-temperature materials consecutively beneath said access port for transfer therethrough.

6. In an insulated container for storing and dispensing low-temperature materials which comprises said container having a single elongated access port in the top portion thereof providing access to the container storage area, a low-thermally conductive actuating element operably received in said elongated port providing a closure therefor, said element having the lower end extending into the storage area and the other end protruding external to the container, said one end slidably engaging a rotatable container, said one end slidably engaging a rotatable movement thereto, and being disengageable therefrom when said element is withdrawn from the access port, an endless conveyor means guideably positioned in the lower portion of said storage area and adaptable to receive said low-temperature materials, means for transmitting motion from said rotatable member to said conveyor, and guide means for positioning said conveyor in a continuous path through said storage area which passes at one point beneath said access port, whereby said conveyor may be progressed along said path in response to rotational movement applied to the protruding portion of said actuating element.

7. A low-temperature storage and dispensing apparatus including a thermally insulated container having a top opening substantially smaller than the container diameter and providing access to the storage area, an elongated, low-thermally conductive actuating element slidable and rotatably received in said top opening providing a closure thereto, the upper portion thereof protruding from said container, the lower portion having engaging

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means thereon and extending into said storage area and a conveyor assembly positioned in said storage area comprising, horizontally spaced plates, a rotatable member associated with the uppermost of said plates and operably engaged to receive rotational motion from said actuating element, a spindle extending intermediate said plates for transmitting said received rotational motion to an endless chain positioned upwardly adjacent the lower of said plates, guide means for directing said endless chain in a horizontal path through said storage area, said path being disposed to pass beneath said access port, and means associated with said endless chain for receivably accommodating storage receptacles containing low-temperature materials whereby said receptacles may be moved along said path and progressively positioned beneath said access port in response to rotational movement applied to the portion of said actuating member external of the container.

8. An insulated apparatus substantially as described in claim 7 wherein the endless chain may be progressed one complete circuit along said continuous path in response to a complete rotation of the actuating element.

9. In an insulated container for storing and dispensing low-temperature materials the combination therewith which comprises said container having a single elongated access port in the top portion thereof providing access to the container storage area, said area provided with

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compartments for separately containing a refrigerant and low-temperature materials to be stored, at least one of said compartments disposed remote from said access port and adapted to receive a refrigerant therethrough another of said compartments adapted to store said low-temperature materials, conveying means in said other compartment for disposing said low-temperature materials at predetermined positions, said means comprising a conveyor chain horizontally positioned in the compartment and being guidably disposed in a horizontal endless path, means associated with said chain for receiving materials to be stored, transmission means for progressing said chain along said endless path, said transmission means in operable engagement with a removable rotative member slidably retained in said access port and upwardly extending therefrom, whereby said chain may be progressed along said endless path in response to rotative movement imparted to the portion of said rotative member extending upwardly from the access port.

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