

COLD STORAGE BODY

The present invention relates to a cold storage body for cooling foods, pharmaceuticals and the like, adapted to be used in a refrigerator or a refrigerator car in which no thermodynamically-operated refrigerating machine is provided.

Heretofore, as a cold storage body of the kind described above, a cooling medium rendered to be in the state of ice or dry ice by extracting heat from the cooling medium which is kept in the liquid or gaseous state at the normal temperature is used in the loose state or in bulk, or two kinds of substances are used which are stored in the separate places from each other, and they are mixed with each other when they are used for cooling purpose by virtue of the chemical reaction thereof so as to generate cold.

One well known cold storage body comprises in general a viscous cold storage medium hermetically sealed in a soft or rigid plastics vessel. Such a cold storage body has the following difficulties due to the plastics vessel.

(a) Since the thermal conductivity of the plastics vessel is low, a long time is required for freezing the cold storage medium contained in the plastics vessel, and the cooling effect obtained by

the cold storage medium is rather slow. Therefore, an excessive number of cold storage bodies must be prepared in order to ensure positive cooling of the articles to be kept in the cooled state, because the
5 time required for freezing the cold storage bodies is too long.

(b) The soft or thin plastics vessels are liable to be damaged or broken and the durability of such vessels is low. Further, as a common difficulty
10 inherent in the vessels made of plastics material, the climate-resisting property or temperature and humidity-resisting property and light resistance of such vessels are low and they are liable to be subjected to ageing and change in quality so that they
15 are not suitable for use over a long time period.

(c) Since the plastics material has cold shortness or low temperature brittleness, the vessels made of the plastics material cannot be used as the
20 vessel of a cold storage body for use in the low temperature range such as -15°C - -25°C . Further, it has disadvantages in achieving rapid freezing of the cold storage medium therein at a low temperature.

(d) A plastics vessel is liable to be soiled and difficulties arise in washing and sterilization
25 with hot water, because the vessel is softened by the hot water.

(e) In case of the soft plastics vessel, the outer shape of the vessel is easily varied and is unstable even though a cold storage medium in the gelled state is used, and, therefore, it is
5 inconvenient in treatment.

The present invention aims at avoiding the above described difficulties inherent in the prior art cold storage bodies.

The object of the present invention is, therefore,
10 to provide a novel and useful cold storage body which can be manufactured at a low cost so that fresh foods, frozen foods and the like can be efficiently and conveniently stored, transported and delivered with the foods being maintained in the highest quality,
15 thereby permitting the energy required to be lowered greatly while effective quality control is obtained.

The present invention provides a cold storage body comprising a hermetically sealed vessel made of a thin metallic material in which a cold storage
20 medium of an appropriate amount is enclosed, with a space within said vessel not filled with said cold storage medium being filled with a compressed gas of an appropriate pressure such that the vessel can withstand the expansion and contraction of the cold storage
25 medium, said cold storage medium comprising a base fluid to which additional components are added so as to predetermine the melting point and the viscosity of said cold storage medium.

The liquid cold storage medium is preferably of low viscosity and can be hermetically sealed in a canister by means of a cover which is curled together with the peripheral edge of the canister, the space
5 in the vessel not filled with the cold storage medium being filled with an inert gas such as N_2 , CO_2 or the mixture thereof pressurized to an appropriate pressure.

The vessel is preferably formed of thin sheet aluminium alloy.

10 The cold storage medium preferably comprises water as its base fluid to which the additional regulating components are added.

The vessel may comprise a cylindrical canister member with its one end closed and the other end
15 opened and a cover member with its peripheral edge being curled together with the peripheral edge of the open end of the cylindrical canister member so as to achieve hermetic sealing of the vessel.

Alternatively, the vessel may comprise an
20 extruded profiled hollow canister member of aluminium alloy and a pair of cover members each hermetically sealed to the respective end of the canister member.

Further, the wall of the vessel may be formed with a plurality of parallel ridges so as to enhance
25 the strength of the vessel while an improved cold-transmitting property is obtained.

The extruded hollow canister member is preferably provided with a plurality of parallel reinforcing ribs integrally formed in the hollow space thereof so as to enhance the strength of the vessel while improving its cold-transmitting property.

The compressed gas preferably comprises inactive gas, such as N_2 , CO_2 so as to obtain a corrosion-resisting property of the cold storage body.

The present invention will be further described, by way of example, with reference to the accompanying drawings, in which:

Fig.1 is a longitudinal sectional view showing a first embodiment of the cold storage body having a thin aluminium vessel;

Fig.2 is a perspective view of the body of Fig.1;

Fig.3 is a fragmentary sectional view of the body, showing the curled sealing portion of the vessel of Fig.1;

Fig.4 is a fragmentary sectional view showing the configuration of the bottom portion of the vessel of Fig.1;

Fig.5 is a fragmentary sectional view showing the configuration of the peripheral wall of the vessel of Fig.1;

Fig.6 is a schematic sectional view showing the process of compressively filling the vessel of Fig.1

with an inert gas for producing the cold storage body of Fig.1;

Fig.7 is a perspective view showing a second embodiment of cold storage body of the present invention having a flat rectangular vessel;

Fig.8 is a cross-sectional view of the body of Fig.7;

Fig.9 is an exploded perspective view showing an alternative form of the cold storage body of Fig.7;

Fig.10 is a fragmentary sectional view showing the opening in the cover member of Fig.9 hermetically sealed by a sealing cap;

Fig.11 is a perspective view showing the modified form of the vessel of Fig.9;

Fig.12 is a fragmentary sectional view showing the configuration of the fin formed in the wall of the vessel of Fig.11;

Fig.13 is a perspective view showing a further modified form of the vessel of Fig.9;

Fig.14 is a fragmentary perspective view showing the provision of a reinforcing member in the vessel of Fig.9;

Fig.15 is a fragmentary perspective view similar to Fig.14 but showing a modified form of the reinforcing member of Fig.14;

Fig.16 is a cross-sectional view showing the extruded vessel of the third embodiment of the cold

storage body of the present invention;

Fig.17 is a side view of the cold storage body of Fig.16;

Fig.18 is a cross-sectional view taken along
5 line 18 - 18 in Fig.17; and

Figs. 19 to 23 are cross-sectionanl views showing various modifications of the configuration of the vessel of Fig.16.

With reference to Figs. 1 to 4 showing the first
10 embodiment of the present invention, the vessel is made of thin aluminium sheet and comprises a cylindrical canister member 1 with one end closed and the other end opened, the peripheral edge of which is sealingly curled together with the peripheral edge of a cover
15 member 2.

The cold storage medium 3 enclosed within the vessel comprises water as its base liquid and additional components for predetermining the melting point and
the viscosity of the base liquid.

20 The space 4 within the vessel not filled with the cold storage medium 3 is filled with a pressurized inert gas, such as N_2 , CO_2 or a mixture thereof, so as to enhance the ability of the vessel to withstand expansion and contraction of the cold storage
25 medium, and prevent the wall of the vessel from being deformed.

The thickness of the wall of the aluminium canister member 1 is equal to or less than 2 mm and, as shown in Figs. 3 to 5, parallel ridges or corrugations 1a and a recessed deformation 1b are formed in the canister member 1, while a recessed deformation 2a is formed in the cover member 2, thereby permitting the strength of the vessel to be increased.

It is clear that the vessel of the cold storage body of the present invention has a superior thermal conductivity in comparison with the prior art vessel made of plastic material, so that the cold storage medium 3 can be frozen in far shorter time than that required for freezing the cold storage body of the prior art, and also the cooling effect of the cold storage body of the present invention is far more rapid in comparison with that of the prior art cold storage body.

Since the strength of the vessel of the cold storage body of the present invention at a low temperature is higher in comparison with that of the prior art cold storage body having a plastics vessel, the cold storage body of the present invention can conveniently and effectively refrigerate frozen foods and the like at a low temperature, such as in the range of -15°C to -25°C . Further, the vessel of the cold storage body of the present invention is far

superior in its corrosion resisting properties and climate resisting properties in comparison with the prior art plastics vessel so that a high durability is ensured by the vessel of the cold storage body of
5 the present invention.

Further, since the vessel is made of aluminium, it has a tendency not to be solid, while it can be kept clean by hot water washing and mechanical washing and the like.

10 As described previously, the cold storage medium 3 is of a liquid storage medium of a low viscosity having water as its base liquid, and the regulation of the melting point can be effected by adjusting the contents, blending and amount of the additional
15 components, so that the melting point can be designed so as to meet with the purpose of using the same. For example, the melting point may be selected as follows according to the use.

— 0°C vegetable, daily delivered foods,
20 noodles
-5°C fresh fish, meats
-15°C .. frozen foods
-25°C .. ices

The degree of filling the vessel with the cold
25 storage medium 3 must be so selected with respect to the volume of the space 4 that the volume of the

space 4 be made equal to or more than 15% of the total volume of the vessel so that no deformation or breakage of the aluminium vessel can occur by the increase in volume of the liquid cold storage medium
5 3 as it is being frozen.

The inert gas enclosed in the vessel may be of any kind of inert gas insofar as it will not cause a change in quality or corrosion of the aluminium vessel or the coating thereon as well as the change
10 in quality of the cold storage medium, and, in practice, N_2 , CO_2 of a mixture thereof are preferably used, because they are easily and economically available without requiring any expensive processing equipment.

By virtue of enclosing the inert gas in the
15 space 4 after removing air from the vessel and the cold storage medium, any additional regulating components in the cold storage medium will not be subjected to change in quality even though they are of the oxidizable nature, so that the cooling effect
20 of the cold storage body of the present invention can be maintained for a long period of time. Further, the oxidized inner surface of the aluminium vessel has a corrosion preventing effect, thereby positively reducing the danger of corrosion even though the
25 coating on the inner surface of the vessel has deficiencies such as pin-holes.

Several test results of the cold storage body of the present invention will be given below.

Test I

After the liquid cold storage medium adjusted to
5 have a viscosity of 4CP and a melting point of -5°C
was subjected to aerating by using a de-aerator, the
temperature of the cold storage medium was adjusted
to 20°C and the medium was placed in a carbonator in
which it was mixed with agitated CO_2 gas having a
10 gauge pressure of 2 kg/cm^2 , and then it was transferred
to a filling machine by means of which a predetermined
amount of the medium was poured into the cylindrical
canister member 1 of the aluminium vessel of 250 ml
and the peripheral edge of the cover member 2 was
15 sealingly curled together with the peripheral edge
of the open end of the canister member 1 while CO_2
gas was being blown into the canister member 1.

The cold storage body having the aluminium vessel
thus produced could not be deformed by usual external
20 forces, even though the canister member was pressed
by the fingers of the experimenter, and it was proved
in practicability tests that the above described cold
storage body had sufficient strength.

Test II

25 The liquid cold storage medium adjusted to have
the desired nature was supplied to a filling machine

in which 220 ml of medium was poured into a container member of an aluminium vessel of 250 ml, and, thereafter, liquefied nitrogen was fed from a supply nozzle therefor into the canister member before the cover

5 member was sealingly applied to the canister member by a curling operation, then the canister member was supplied to a curling machine so as to sealingly apply the cover member to the canister member.

The amount of the liquefied nitrogen poured into
10 the vessel was so controlled by adjusting the flow rate and the pouring time thereof that the internal gauge pressure of the vessel after the cover member was sealingly applied to the canister member was 2 kg/cm^2 .

15 Fig.6 shows the method of filling the vessel with pressurized inert gas.

In Fig.6, a tank 5 contains liquefied nitrogen. The liquefied nitrogen in the tank 5 is fed continuously or discontinuously to a hermetically closed
20 chamber 6 through a conduit 7 at the flow rate as regulated by a solenoid valve 8 provided in the conduit 7. A conveyor belt 9 is passed through the chamber 6 by means of a plurality of guide rollers 10. The canister members 1 each containing therein the
25 predetermined amount of the cold storage medium 3 having the adjusted nature are continuously fed

successively through the chamber 6 so that the liquefied nitrogen is poured into the respective canister member 1 by an appropriate amount as regulated by the solenoid valve 8. The liquefied nitrogen
5 poured into the canister member 1 purges air existing in the space 4 out of it as a portion of the liquefied nitrogen vapourizes. A cover member 2 is sealingly applied to the thus prepared canister member 1 in a curling machine during the time an appropriate amount
10 of the liquefied nitrogen is still left in the space 4 in the liquefied state.

Thus, an appropriate pressure above the atmospheric is generated in the space 4 of the vessel, because the liquefied nitrogen left in the space 4 after
15 application of the cover member 2 to the canister member continues to vapourize so as to increase the internal pressure in the space 4 to about 2 kg/cm^2 , preferably to 1.85 to 2.15 bar.

Figs. 7 and 8 show the second embodiment of the
20 present invention, in which a rectangular cover member 11 is sealingly applied to the flat rectangular canister member 12 by a curling operation. The cover member 11 as well as the canister member 12 is formed with a plurality of parallel ridges 11a and 12a as shown so
25 as to increase the strength of the vessel while the cold transmitting property is improved by increasing

the surface area of the vessel due to the provision of the ridges.

The outer configuration may be in the form of a polygon, ellipse or any other shape according to the use and the place in which it is used. This embodiment has the advantage in comparison with the first embodiment in that the former has a larger cold transmitting area while the size can be made greater.

Figs. 9 to 15 show some modifications of the above described second embodiment, making it possible to increase the size far greater.

In Fig. 9, the canister member 13 is made of thin aluminium sheet having formed therein a plurality of parallel ridges 13a by a roll-forming operation with the opposite side edges being welded together at 13b after the sheet is bent into the desired form in cross-section. The cover member 14 is produced by deep drawing operation so as to form a side wall having similar ridges 14a to those of the trunk member 13 and a pair of pouring openings 14b. The bottom member 15 is of the same configuration as that of the cover member 14 provided with ridges 15a but having no openings.

The cover member 14 and the bottom member 15 are sealingly welded to the open ends of the canister member 13. After the liquid cold storage medium of

low viscosity is poured into the thus-formed vessel together with the introduction of the appropriate amount of inert gas, the respective openings 14b are sealed by means of caps 16 as shown in Fig.10.

5 Figs. 11 and 12 show a modification of the vessel of Fig.9, wherein the canister member 17 is formed with a plurality of fins 17a instead of ridges such as shown in Fig.9 for increasing the strength as well as the cold transmitting property.

10 Fig.13 shows a further modification of the canister member 18 wherein a reinforcing configuration 18a in lattice form is imparted to the side wall of the canister member 18.

15 Fig.14 shows a reinforcing spacer 18b placed in the interior space of the canister member 18 for preventing deformation or panelling thereof. The spacers 18b are secured to the side walls of the canister member 18 by appropriate means, such as spot welding.

20 Fig.15 shows an alternative form of the reinforcing spacers 18c. The dove-tail shaped ends of the spacer 18c are securely fitted in the complementary dove-tail shaped grooves formed in the side walls of the canister member 18.

25 The spacers 18b and 18c permit free flow of the cold storage medium in the vessel so that the cold transmitting effect is not diminished.

Figs. 16 to 23 show the third embodiment of the present invention wherein the canister member of the vessel is formed by an extruded profiled aluminium member instead of the aluminium sheet as in the case of the previously described embodiments.

In Fig.16, the canister member 19 is formed by an extruded profiled aluminium member having a plurality of cold-transmitting property-improving fins 19a in the outer surface while a plurality of reinforcing and cold-transmitting property-improving ribs 19b are formed in the interior of the canister member 19.

The opposite ends 19c and 19d of the respective ribs 19b are cut out by an appropriate amount as shown in Fig.17 and a cover member 20 having longitudinal stepped shoulders or spigots 20a, 20b and pouring openings 20c (see Fig.18) and a bottom member 21 having similar longitudinal stepped shoulders or spigots 21a, 21b are sealingly fitted in the upper and lower open ends of the canister member 19, respectively, and welded thereto, for example, with a clearance 19e being kept between the cover member 20 and the upper end each of the ribs 19b as well as between the bottom member 21 and the lower end each of the ribs 19b as shown in Fig.18 so as to permit free flow of the cold storage medium in the vessel.

A plug 22 is sealingly fitted in each of the openings 20c after the cold storage medium and the inert gas of the appropriate amount have been introduced in the vessel.

5 Fig.19 shows a modified form of the canister member shown in Fig.16. The canister member 23 shown in Fig.19 has a plurality of cold-transmitting property-improving fins 23a on the outer surface thereof and a plurality of reinforcing and cold-transmitting
10 property-improving ribs 23b in the interior of the canister member 23, the ribs 23b being offset with respect to the fins 23a as shown.

Figs. 20 to 23 show various modifications of the canister member made of an extruded profiled member.

15 The vessels of Figs. 20 to 23 have the cross-sectional configuration making it possible to stack a plurality of the cold storage bodies of the same cross-sectional configuration upon each other in
—closely arranged relationship to each other, thereby
20 permitting space to be greatly saved.

The fins and ridges may be provided only on one side of each modification described above.

As described above, the cold storage body of the present invention comprises a thin aluminium vessel
25 in which a liquid cold storage medium of a low viscosity is enclosed with a space within the vessel

25
not filled with the cold storage medium being filled with a pressurized inert gas so as to maintain appropriate superatmospheric pressure in the vessel, so that deformation or damage of the vessel which
5 might be caused by external force is positively avoided, while the danger of corrosion which might be caused in the vessel is positively prevented, thereby ensuring a convenient and effective cooling effect to be given to foodstuff and the like to be kept cold for a long
10 period of time.

By preparing the cold storage bodies having various melting points, appropriate ones can be used conveniently according to the nature of the objects to be cooled.

15 The time required for delivering cold foods by using the cold keeping delivery cars is in general 2 to 3 hours. However, it might be a far longer time under some circumstances. In such a case, the cold storage body of the present invention can be used
20 advantageously so as to keep cold for a long time.

Since the second embodiment of the present invention is provided with a plurality of ribs and fins by roll-forming the thin aluminium sheet of the vessel, a large cold-transmitting area is obtained so
25 as to increase the thermal efficiency thereof while sufficient strength is obtained to resist against the

expansion and contraction of the cold storage medium.

Further, in the third embodiment of the present invention, the canister member is formed by an extruded profiled member in which a plurality of fins and ribs are formed, thereby ensuring a high thermal conductivity and a sufficient strength resisting against the deformation or damage thereof.

Further, since the cold storage body of the present invention is of the type in which a relatively large amount of the cold storage medium is enclosed in the relatively large size of the vessel thereof, the handling and the maintenance of the cold storage body are easy and it is relatively simply used at low cost according to the use of the cold storage body, while the energy saving effect is remarkable.

Further, the cold storage bodies of the present invention can be easily selectively used in an efficient manner by preparing the cold storage bodies in suitably classified groups according to the size and the melting point of the same following the object to be cooled thereby, regardless of the fact that it is formed to be of the stationary type or the portable type, while it is superior in its corrosion resisting properties, to climate-resisting properties as well as the durability thereof so that the durability is ensured for a long period of time.



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Thus, the positive maintenance thereof is made possible while it exhibits superior effectiveness in economy, hygiene and safety.



CLAIMS

1. A cold storage body comprising a hermetically sealed vessel made of a thin metallic material in which a cold storage medium of an appropriate amount is enclosed, with a space within said vessel not filled with said cold storage medium being filled with a compressed gas of an appropriate pressure such that the vessel can withstand the expansion and contraction of the cold storage medium, said cold storage medium comprising a base fluid to which additional components are added so as to predetermine the melting point and the viscosity of said cold storage medium.
2. A cold storage body according to claim 1, wherein said cold storage medium comprises water as its base fluid to which said additional regulating components are added.
3. A cold storage body according to claim 2, wherein said vessel comprises a cylindrical canister member with one end thereof closed and the other end thereof opened, and a cover member with its peripheral edge being curled together with the peripheral edge of said open end of said cylindrical canister member so as to achieve a hermetic seal of said vessel.
4. A cold storage body according to claim 1, wherein said vessel comprises an extruded profiled hollow canister member of aluminium alloy and a pair of cover members each hermetically sealed to a respective end of said canister member.



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5. A cold storage body according to claim 4, wherein said extruded hollow canister member is provided with parallel reinforcing ribs integrally formed in the hollow space thereof.

5 6. A cold storage body according to any of claims 1 to 5, wherein said vessel is formed of thin sheet aluminium alloy.

7. A cold storage body according to claim 6, wherein the wall of said vessel is formed with a
10 plurality of parallel ridges.

8. A cold storage body according to any of claims 1 to 7, wherein said compressed gas comprises inactive gas, such as N_2 , CO_2 or a mixture thereof.

9. A cold storage body constructed and adapted
15 to be used substantially as herein described with reference to and as illustrated in the accompanying drawings.
