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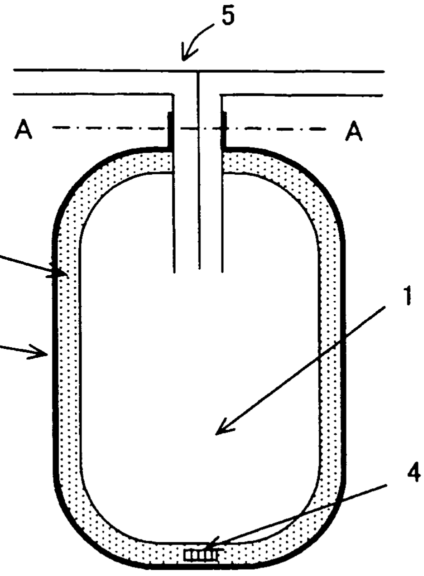
(54) Insulated container and method of manufacturing the same

(57) The present invention provides an insulated container capable of reducing manufacturing costs, obtaining a sufficient heat insulating effect, and capable of being applied to various installation spaces having different shapes, and a method of manufacturing the same. The insulated container, which stores a liquid at a maintained temperature, includes: an internal container (1) which stores the liquid therein and includes a liquid inlet (5) and a liquid outlet (5); a sheet-like covering material (3) which houses the internal container (1); and an insulated space which is provided between the covering material (3) and the internal container (1) and is filled with a heat insulating material (2) and a gas adsorbent (4) to be decompressed. In the insulated container, a filler (6) is provided to a joint section (7) between the covering material (3) and the internal container (1).

FIG. 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an insulated container for storing a liquid at a maintained temperature, and a method of manufacturing the same. In particularly, the present invention relates to an insulated container for storing a long life coolant (LLC) for a vehicle engine at a maintained temperature, and a method of manufacturing the same.

Description of the Related Art

[0002] In recent years, improvement in fuel efficiency is expected as global energy saving and environmental measures, and a cold start pattern at the start of an engine (fuel consumption at start of engine) is modeled as an indicator of a fuel consumption mode.

[0003] Up to now, there is known a method in which a long life coolant (LLC) for a vehicle engine is stored in the insulated container at the maintained temperature, and the LLC whose temperature is maintained is circulated through the engine when starting the engine, thereby promoting warming-up of the engine (JP 2006-104974 A).

[0004] In addition, as a similar method of maintaining the temperature of a liquid within a container, there is known a method in which a bag is formed using a metal foil or a laminated film having a metal vapor deposition portion, a heat insulating material having voids formed therein is provided at an inner side of the bag, and a vacuum heat insulating material for decompression and sealing is formed around the container (JP 2002-058604 A).

[0005] In order to improve the fuel consumption when starting the engine, the insulated container for a vehicle engine is required to have a high thermal insulating performance for maintaining the temperature of the LLC, which is raised by preheating of the engine, until re-start of the engine, and there is a need to reduce manufacturing costs. In order to install the insulated container in an engine compartment, there is a strong demand for space saving and adaptability to various engine compartments having different shapes.

[0006] In the insulated container disclosed in JP 2006-104974 A, an insulated space which is in a vacuum state is provided between an internal container made of a metal and an external container made of a metal, and the internal container and the external container are integrally formed through welding or a spinning process.

[0007] However, in a case where the internal container and the external container are made of a metal such as stainless steel, the manufacturing costs are increased, and heat is easily conducted from a metal joint section between the internal container and the external container, due to a heat bridge effect, which makes it difficult to obtain a sufficient heat insulating effect. In addition, stainless steel whose thickness is as thin as 1 mm or less is used so as to control the heat bridge, and the shape of the container is limited to a cylindrical shape so as to prevent deformation of the container due to a difference between the internal pressure and the atmospheric pressure, which limits design of the container which is formed into a shape suitable for an installation space, and also limits types of vehicles onto which the container is mounted.

[0008] On the other hand, in an insulation structure disclosed in JP 2002-058604 A, a plate-like vacuum heat insulating material is formed, and then the vacuum heat insulating material is wound around a side surface of the container. Accordingly, a gap (air space) is liable to be formed between the container and the vacuum heat insulating material. Further, in a case where an internal container to be housed in the container has a columnar shape, it is difficult to apply the insulation structure to the insulating container with a high thermal insulating performance which is required for the insulated container for a vehicle engine, because of heat loss from gaps formed between mating surfaces at end portions of the vacuum heat insulating material which is wound around the side surface of the container, or joint sections between a cover portion, a bottom portion, and a side surface portion.

SUMMARY OF THE INVENTION

[0009] The present invention has been made in view of the above-mentioned problems, and an object of the present invention is to provide an insulated container capable of reducing manufacturing costs, obtaining a sufficient heat insulating effect, and being applied to various installation spaces having different shapes, and a method of manufacturing the same.

[0010] In order to attain the above-mentioned object, according to a first aspect of the present invention, there is provided an insulated container which stores a liquid at a maintained temperature, including: an internal container which includes a liquid inlet and a liquid outlet and stores the liquid; a sheet-like covering material which houses the internal container; and an insulated space which is provided between the internal container and the covering material and is filled with a heat insulating material and a gas adsorbent to be decompressed.

[0011] In the insulated container according to a second aspect of the present invention, the internal container is made of stainless steel or a resin, and the covering material is a laminated film including an adhesive layer.

[0012] According to a third aspect of the present invention, the insulated container further includes a filler which is provided to a joint section between the internal container and the covering material.

[0013] In the insulated container according to a fourth aspect of the present invention, the heat insulating material is an inorganic fiber selected from the group consisting of glass wool, rock wool, and a ceramic fiber, and the gas adsorbent includes calcium oxide, a barium-lithium alloy, and cobalt oxide.

[0014] According to a fifth aspect of the present invention, there is provided a method of manufacturing an insulated container which stores a liquid at a maintained temperature, the insulated container including: an internal container which includes a liquid inlet and a liquid outlet and stores the liquid inside thereof; and a sheet-like covering material which houses the internal container and forms an insulated space between the internal container and the sheet-like covering material, the method including: filling a heat insulating material and a gas adsorbent in the insulated space to be decompressed; and providing a filler to a joint section between the covering material and the internal container to join the covering material and the internal container to each other.

[0015] According to a sixth aspect of the present invention, there is provided a method of manufacturing an insulated container which stores a liquid at a maintained temperature, the insulated container including: an internal container which includes a liquid inlet and a liquid outlet and stores the liquid inside thereof; and a sheet-like covering material which houses the internal container and forms an insulated space between the internal container and the sheet-like covering material, the method including: filling a heat insulating material and a gas adsorbent in the insulated space to be decompressed; and preheating an inner side of a joint section between the covering material and the internal container which are joined to each other to thermally weld the joint section. In this case, the preheating can be performed by employment of a heating method using a space heater, a heating method with heated air, or the like.

[0016] According to aspects of the present invention, the following effects can be obtained.

(1) The internal container and a vacuum heat insulating layer are integrally formed with the sheet-like covering material, thereby making it possible to form a high efficiency vacuum heat insulating layer. As a result, for example, leakage of heat from the interior of the container, which contains the LLC and is disposed in an engine compartment for vehicle, is reduced, thereby obtaining an effect in which a fuel efficiency of an automobile is improved, and the fuel efficiency at the time of starting the engine is especially improved.

(2) In addition, because the internal container and the vacuum heat insulating layer are integrally formed with the sheet-like covering material, the present invention can be applied to internal containers having various shapes, and the internal container can be designed and the heat insulating layer can be formed so as to correspond to any type of installation spaces. For example, even in such a limited space as an engine compartment for vehicle, it is possible to design to install the insulated container for storing the LLC at the maintained temperature.

(3) Further, a stainless steel container is used as the internal container, and an inexpensive laminated film is used as the covering material, thereby making it possible to reduce the manufacturing costs to a large extent.

(4) The filler is provided to the joint section between the internal container and the covering material, thereby making it possible to form the insulated space with ease and reliability.

(5) The inner side of the joint section of the internal container is preheated, thereby reliably heat-sealing the internal container and the covering material with each other.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] In the accompanying drawings:

FIG. 1 is a cross-sectional diagram illustrating an example of an insulated container according to the present invention;

FIG. 2 is a cross-sectional diagram illustrating another example of the insulated container according to the present invention;

FIG. 3 is a cross-sectional diagram illustrating a joint section between an internal container and a covering material, which is provided with a filler (cross-sectional diagram taken along the line A-A of FIG. 1 in which overlapped portion of covering material is omitted);

FIG. 4 is a cross-sectional diagram illustrating an example of a shape of the filler;

FIG. 5 is a cross-sectional diagram illustrating another example of a shape of the filler;

FIG. 6 is a cross-sectional diagram illustrating another example of a shape of the filler;

FIG. 7 is a schematic diagram of a laminated film serving as the covering material;

FIG. 8 is an explanatory diagram illustrating a method of joining the joint section between the internal container and the covering material;

FIG. 9 is an explanatory diagram illustrating preheating of the joint section between the internal container and the covering material; and

FIG. 10 is a graph illustrating measurement results of Example 1 and Comparative Example 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Examples of an insulated container according to an embodiment of the present invention are illustrated in FIGS. 1 and 2. According to the embodiment of the present invention, an internal container 1 and a vacuum heat insulating layer are integrally formed by the use of a sheet-like laminated film 3 serving as a covering material. Accordingly, the insulated container according to the present invention can be applied to various internal containers 1 having different shapes, and a high efficiency vacuum heat insulating layer can be formed. FIG. 3 is a cross-sectional diagram illustrating a joint section 7 between the internal container 1 and the covering material 3, which is provided with a filler 6. It should be noted that, in FIG. 1, an overlapped portion of the covering material 3 is omitted, but the overlapped portion of the covering material 3 as illustrated in FIG. 3 is left with a certain length so as to maintain airtightness.

[0019] In order to achieve the structure, according to the present invention, the sheet-like laminated film 3 is directly thermally welded to a liquid inlet/outlet 5 of the internal container 1 so as to maintain a vacuum state of the heat insulating layer. At a triple point at which two laminated films 3 and the internal container 1 are in contact with each other, a gap is liable to be formed, which makes it difficult to maintain the vacuum state. For this reason, in the present invention, the filler 6 is used to enable thermal welding without forming the gap. The filler 6 is produced using a thermoplastic resin, which is made of the same material as or a different material from an adhesive layer 11 of the laminated film 3 and is melted at the time of thermal welding to fill in the gap. And the filler 6 is formed as a protrusion obtained by processing the joint section 7 of the internal container 1; or is obtained by joining, to the joint section 7 of the internal container 1, a structure which is made of a different material and is capable of controlling generation of the gap. FIGS. 4 to 6 each illustrate an example of the shape of the filler 6.

[0020] Next, the internal container 1 whose material is made of a metal or a resin is used. In view of heat insulating properties, the internal container 1 is desirably made of a metal having a large heat capacity, and particularly, the internal container 1 is desirably made of stainless steel having low heat conductivity. However, in a case where manufacturing costs have to be further reduced, or the internal container whose shape is difficult to make of a metal, the internal container 1 can be made of a resin. The resin is selected and used from the group consisting of acrylonitrile butadiene styrene copolymer (ABS), acrylonitrile styrene copolymer (AS), EEA resin (EEA), epoxy resin (EP), ethylene vinyl acetate polymer (EVA), ethylene vinyl alcohol copolymer (EVOH), liquid crystal polymer (LCP), MBS resin (MBS), melamine formaldehyde (MMF), polyamide (PA), polybutyrene terephtalate (PBT), polycarbonate resin (PC), polyethylene (PE), polyethylene terephatlate (PET), tetrafluoroethylene perfluoroalkyl vinyl ether polymer (PFA), plyimide (PI), polymethylmethacrylate (PMMA), polyacetal resin (POM), polypropyrene (PP), polyphtalamide (PPA), polyphenylenesulfide resin (PPS), polystyrene (PS), polytetrafluoroethylene (PTFE), polyurethane (PU), polyvinyl alcohol (PVA), polyvinyl chloride (PVC), and polyvinylidene chloride (PVDC). However, because the resin has larger gas permeability than a metal, in a case where the resin is selected as the material of the internal container, a gas barrier layer is desirably formed to control the gas permeability, and a metal layer is suitably formed by plating. As a result, a degree of vacuum of the vacuum heat insulating layer can be maintained for a long period of time.

[0021] FIG. 7 is a schematic diagram of the laminated film 3 serving as the covering material. The laminated film 3 has a multi-layer structure including a protective layer 8, a protective layer (base material layer) 9, a gas barrier layer 10, and an adhesive layer 11 which are formed in the stated order. In particular, the adhesive layer 11 is desirably made of ethylene vinyl alcohol copolymer, nylon, polyvinyl alcohol, polyvinylidene chloride, and polyester, which can be adhered to an adhesive layer or a metal surface and have low gas permeability. Particularly, ethylene vinyl alcohol copolymer is suitably used. Further, in order to prevent leakage of a gas from an interface between the adhesive layer 11 and the gas barrier layer 10 to the heat insulating layer, a metal vapor deposition layer is formed in advance on one surface of a film made of ethylene vinyl alcohol copolymer, which is effective in maintaining the degree of vacuum.

[0022] The thickness of the laminated film according to the embodiment of the present invention is not particularly limited as long as the laminated film can be produced without any inconveniences. For example, the thickness may be set to 45 to 120 μm, and preferably 60 to 100 μm.

[0023] A gas permeation rate of the laminated film according to the embodiment of the present invention is not particularly limited as long as the degree of vacuum of the insulated space can be maintained during a desired time period. For example, the oxygen permeation rate, which is measured using JIS-K7126-1, may be 1.1 x 10^{-11}m^3/m^2·s·MPa or lower, and preferably 1.1 x 10^{-12}m^3/m^2·s·MPa or lower.

[0024] In the embodiment of the present invention, a decompressed space formed in an insulated space is controlled to be a pressure lower than the atmospheric pressure (decompressed state) so as to improve heat insulating properties. For example, the pressure may be set to 0.01 to 100 Pa, and preferably 0.1 to 10 Pa.

[0025] A known insulating material can be used as an insulating material to be included in the insulated space. Examples of the insulating material include an organic porous body such as polystyrene foam, a compact including ceramic powder such as calcium silicate, silica, or alumina, and an inorganic fibrous insulating material made of glass wool, rock wool, or a ceramic fiber. In particular, it is desirable to use glass wool which has an average fiber diameter of 5 μm or smaller, and whose adsorption moisture is removed in a high temperature atmosphere. The insulating material may be used singly, or a combination of two or more insulating materials may be used.

[0026] When the heat insulating layer is used for a long period of time, there is a fear that the degree of vacuum will be lowered by a gas generated from the heat insulating material 2, a gas permeating the resin of the joint section, or the like. In order to prevent lowering of the degree of vacuum, it is necessary to use an adsorbent 4 for adsorbing the gas provided inside the heat insulating layer. It is desirable to use, as the adsorbent 4, calcium oxide which mainly adsorbs water, a barium-lithium alloy which mainly adsorbs oxygen and nitrogen, and cobalt oxide which mainly adsorbs hydrogen. In a case where the adsorbents are individually used to be provided in the heat insulating layer, there arises a problem in that the barium-lithium alloy adsorbs water generated from the heat insulating material, and a capability of adsorbing hydrogen and nitrogen is lowered, which is not intended in the present invention. Therefore, it is suitable to employ a three-layered structure (not shown) including a barium-lithium alloy layer serving as an intermediate layer, a calcium oxide layer, and a cobalt oxide layer.

[0027] In order to thermally weld the laminated film 3 to the internal container 1, there is used a sealer which is formed into the shape of the liquid inlet/outlet 5 which corresponds to the joint section 7 of the internal container 1. In the case of using the internal container 1 made of a metal, a sheet made of the same material as the adhesive layer 11 is desirably wound around the internal container joint section 7 in advance so that the adhesive layer 11 can be thermally welded to the internal container joint section 7 with ease and a distance between the internal container 1 and an aluminum foil serving as the gas barrier layer 10 is increased to thereby increase a heat resistance of the joint section 7. In this case, the heat resistance is increased as an amount of sheet to be wound becomes larger. However, because an amount of gas permeating the resin of the adhesive layer 11 is increased according to a thickness of the sheet, the amount of sheet to be wound is desirably 50 μm or less.

[0028] In addition, at the triple point at which two laminated films 3, 3 and the internal container 1 are in contact with each other, a gap is liable to be formed. Accordingly, the filler 6 is desirably provided thereto in advance. As described above, the filler 6 is obtained by: joining a rod made of the same material as the adhesive layer 11 of the laminated film 3 to the joint section 7; joining a rod made of the same material as the internal container 1 to the joint section 7; or joining a protrusion obtained by processing the joint section 7 of the internal container 1 or a rod made of a different material to the joint section 7 (see FIG. 3). Specifically, the filler may have a shape of a circular cross-section as illustrated in FIG. 4, have a shape of a triangular cross-section as illustrated in FIG. 5, or may be formed on an entire peripheral surface of the joint section as illustrated in FIG. 6. However, the present invention is not limited thereto.

[0029] The glass wool 2 is wound around the internal container 1 to which the filler 6 is formed. The amount of the glass wool 2 to be wound in this case is determined depending on a thermal insulating performance required for the insulated container (which will be described in detail in Example 2).

[0030] As illustrated in FIG. 8, with respect to the liquid inlet/outlet 5 of the internal container 1 around which the glass wool 2 is wound, between the two laminated films 3, 3 with adhesive layers 11 (FIG. 7) facing each other the internal container 1 is provided at a position where the fillers 6 are positioned at the triple points and these are thermally welded with the sealer.

[0031] The sealer has a high heat-resistance rubber 12 made of fluorine which is molded into the shape of the joint section, and includes a ribbon-like metal heater 13 and a glass cloth 14 that are provided on the high heat-resistance rubber 12. As heat-sealing conditions for the sealer, a state where the laminated films 3 are pressed onto the internal container 1 is maintained for 6 seconds or more at a temperature which is 20°C higher than a melting point of the adhesive layer 11. Note that, in a case of using the internal container 1 made of a metal, the heat conductivity and the heat capacity of the internal container 1 are large when only the heater of the sealer is used. This makes it difficult to set the temperature of the laminated films 3 at the internal container joint section 7 to be equal to a fusion bonding temperature of the adhesive layer. Accordingly, it is necessary to preheat the internal container joint section 7 by using an auxiliary heater (see FIG. 9). In the preheating illustrated in FIG. 9, a heated air nozzle 15 is inserted to the inner side of the internal container joint section 7, and a heated air 16 is introduced into the inside thereof to heat the internal container joint section 7. However, the present invention is not limited thereto, and a heating system such as an electric heater can also be used.

[0032] The internal container 1 and the laminated films 3, 3 are heat-sealed, and then both surfaces of the laminated films 3, 3 are thermally welded. Also in this case, in the same manner as described above, the state where the laminated films 3, 3 are pressed onto the internal container 1 is maintained for 6 seconds or more at a temperature which is 20°C higher than the melting point of the adhesive layer 11. The both surfaces of the laminated films 3, 3 are heat-sealed to form the laminated films 3, 3 into a bag shape. After that, the getter material 4 serving as a gas adsorbent is filled therein.

[0033] In this state, the container thus obtained is put in a vacuum chamber, and an interior of the chamber is evacuated and internal pressure thereof is set to 10 Pa or lower. A bottom portion of the container, which is the remaining side to be sealed, is heat-sealed under the above-mentioned conditions to form the vacuum heat insulating layer. The interior of the chamber is evacuated so that the heat conductivity of the heat insulating material is lowered, and an amount of heat radiated from the interior of the insulated container is reduced. The heat propagating in the interior of the fiber heat insulating material is a sum of heat propagating through a gas, heat propagating through a solid, and heat propagating by means of radiation. The internal gas is eliminated by decompression, thereby suppressing the heat propagating through the gas, lowering the entire heat conductivity, and reducing the radiated heat amount.

(Example 1)

[0034] An example of a manufacturing method for the insulated container according to the present invention will be described in detail below, but the present invention is not limited thereto.

[0035] As the internal container 1, there was used a rectangular parallelepiped container which was made of polyethylene and had an internal volume of about 2.6 L and a coating thickness of 8 mm. On one surface of the internal container 1, the liquid inlet/outlet 5 having an outer diameter of 18.5 mm, an inner diameter of 13 mm, and a height of 30 mm was provided. In addition, at a position of the liquid inlet/outlet 5, which was 10 mm apart from an upper surface of the liquid inlet/outlet 5, the filler 6 made of a polyethylene resin having a height of 10 mm as illustrated in FIG. 5 was formed. An ABS resin was formed on the surface of the internal container 1 excluding the portion on which the filler 6 is provided. After that, an electroless nickel plating layer was formed and then an electrolytic copper plating layer was formed to thereby obtain the gas barrier layer.

[0036] As the covering material 3, there was used a laminated film having a multi-layer structure including a polyethylene terephatlate layer (having a thickness of 12 μm) serving as the protective layer 8, a nylon layer (having a thickness of 15 μm) serving as the protective layer 9, an aluminum foil (having a thickness of 6 μm) serving as the gas barrier layer 10, and a polyethylene resin layer (having a thickness of 50 μm) serving as the adhesive layer 11.

[0037] White wool manufactured by ASAHI FIBER GLASS Co., Ltd. was used as the fiber heat insulating material 2, and COMBO3GETTER manufactured by SAES Getters was used as the gas adsorbent 4 (getter material).

[0038] Around the container made of polyethylene serving as the internal container 1, the glass wool was coated with a thickness so as to reach a position of the lower surface of the filler 6 provided to the liquid inlet/outlet 5 of the internal container 1. The density of the glass wool in this case was about 0.25 g/cm^2 with respect to a surface area of the internal container 1. Next, the adhesive surfaces of two laminated films serving as the covering materials 3 are positioned to face the fillers 6 provided to the liquid inlet/outlet 5 of the internal container 1. Then, the position of the joint section 7 was adjusted so as to obtain the temperature of 160°C with the sealer as illustrated in FIG. 8, and was pressurized for 6 seconds. After that, side surfaces of the laminated films serving as the covering materials 3 were pressurized for 6 seconds at the temperature of 160°C to be heat-sealed with a typical sealer in the same manner as described above. The two covering materials 3 (laminated films) thus heat-sealed with the internal container 1 were thermally welded on three sides thereof excluding the bottom portion, to be formed into a bag shape. In addition, the container was left for 24 hours in an oven at the temperature of 120°C to evaporate the water contained in the glass wool.

[0039] After the water was evaporated, the container thus contained was carried in the chamber with an argon atmosphere, and one getter material (about 7 g) serving as the gas adsorbent 4 was provided from the bottom portion at which the covering material 3 was opened, and then the interior of the chamber is decompressed to 10 Pa. Then, the opened portion of the covering material 3 was joined to be sealed by using a heater provided in the vacuum chamber. In this manner, the insulated container having a vacuum heat insulating layer having a thickness of 10 mm was produced. The method described above is Example 1.

[0040] Hot water of about 100°C was poured into the insulated container according to Example 1, was left for about 10 minutes, and then displaced. The hot water of about 100°C was poured into the insulated container again, a thermo-couple was inserted from the liquid inlet/outlet, and the liquid inlet/outlet was closed with a rubber stopper. By setting a time point at which the water temperature within the insulated container became 95°C as a start, the water temperature was continuously measured for 12 hours.

(Comparative Example 1)

[0041] According to Comparative Example 1, there was employed an insulated container having a duplex tube structure made of a metal, in which a stainless plate having a thickness of about 0.5 mm is used for the internal container and the external container, and a vacuum heat insulating layer was provided between the internal container and the external container. The liquid inlet of the insulated container according to Comparative Example 1 has an insulation structure with a cover material, which suppresses radiation of heat from the liquid inlet. Hot water of about 100°C with the same volume as Example 1 was poured into the insulated container according to Comparative Example 1, left for 10 minutes, and then discharged. Hot water of about 100°C was poured into the insulated container again, the thermo-couple was inserted in the insulated container, and then the liquid inlet was closed. By setting a time point at which the water temperature within the insulated container became 95°C as a start, the water temperature was continuously measured for 12 hours.

(Measurement Results)

[0042] Measurement results according to Example 1 and Comparative Example 1 are shown in FIG. 10.

[0043] In Example 1, the hot water of 95°C (contained in the insulated container according to the present invention) was maintained at about 83°C after the hot water was left for 12 hours, while in Comparative Example 1, the hot water of 95°C was maintained at about 78°C after the hot water was left for 12 hours. As a result, it has been proved that the insulated container according to Example 1 has a heat insulation property equal to or higher than that of Comparative Example 1. It should be noted that, in the insulated container used in Comparative Example 1, which has a duplex tube structure made of a metal and is a commercially available thermos type container, the internal container and the external container are each formed of a stainless steel plate having a thickness of about 0.5 mm, and a vacuum heat insulating layer is provided between the internal container and the external container. In addition, the liquid inlet of the insulated container according to Comparative Example 1 has the insulation structure, which suppresses radiation of heat from the liquid inlet.

(Example 2)

[0044] Next, a specific example in which the amount of the glass wool 2 to be wound is determined based on the heat insulating performance required for the insulated container will be described as Example 2.

[0045] For example, water of 95°C was poured into each of insulated containers respectively including a vacuum heat insulating layer having a winding amount of 0.25 g/cm^2 with a thickness of 10 mm, a vacuum heat insulating layer having a winding amount of 0.13 g/cm^2 with a thickness of 5 mm, and a vacuum heat insulating layer having a winding amount of 0.38 g/cm^2 with a thickness of 15 mm, and the insulated containers were left for 12 hours to measure the water temperature thereof. As a result, the water temperature of the insulated container with the thickness of 5 mm was about 70°C, that of the insulated container with the thickness of 10 mm was about 78°C, and that of the insulated container with the thickness of 15 mm was about 82°C.

(Example 3)

[0046] Example 3 shows examples of combinations of the materials for the insulated container according to the present invention, but the present invention is not limited thereto.

Example (A)

[0047]

Inner vessel: stainless steel
Filler: stainless steel (processing)
Adhesive layer: ethylene-vinyl alcohol copolymer

Example (B)

[0048]

Inner vessel: stainless steel
Filler: ethylene-vinyl alcohol copolymer
Adhesive layer: ethylene-vinyl alcohol copolymer

Example (C)

[0049]

Inner vessel: polyethylene
Filler: polyethylene
Adhesive layer: polyethylene

Example (D)

[0050]

Inner vessel: polypropyrene
Filler: polypropyrene
Adhesive layer: polypropyrene

Example (E)

[0051]

Inner vessel: ABS resin
Filler: ABS resin (processing) + metal coating film
Adhesive layer: ethylene-vinyl alcohol copolymer

[0052] The insulated container according to the present invention can be used as an insulated container for storing a liquid at a maintained temperature, and particularly, can be applied to an insulated container for storing a long life coolant (LLC) for a vehicle engine. In addition, the insulated container according to the present invention can be used as an insulated container such as an electric pot, or a cold-insulation container for liquid gas or the like.

Claims

1. An insulated container which stores a liquid at a maintained temperature, **characterized by** comprising:

   an internal container (1) which includes a liquid inlet (5) and a liquid outlet (5) and stores the liquid;
   a sheet-like covering material (3) which houses the internal container (1); and
   an insulated space which is provided between the internal container (1) and the covering material (3), is filled with a heat insulating material (2) and a gas adsorbent (4) and is decompressed.

2. An insulated container according to claim 1, **characterized in that**:

   the internal container (1) is made of one of stainless steel and a resin; and
   the covering material (3) comprises a laminated

film including an adhesive layer.

3. An insulated container according to claim 1 or 2, **characterized by** further comprising a filler (6) which is provided at a joint section (7) between the internal container (1) and the covering material (3).

4. An insulated container according to any one of claims 1 to 3, **characterized in that**:

   the heat insulating material (2) comprises an inorganic fiber selected from the group consisting of glass wool, rock wool, and a ceramic fiber; and the gas adsorbent (4) comprises calcium oxide, a barium-lithium alloy, and cobalt oxide.

5. A method of manufacturing an insulated container which stores a liquid at a maintained temperature,

   the insulated container **characterized by** comprising:

      an internal container (1) which includes a liquid inlet (5) and a liquid outlet (5) and stores the liquid inside thereof; and
      a sheet-like covering material (3) which houses the internal container (1) and forms an insulated space between the internal container (1) and the sheet-like covering material (3),

   the method **characterized by** comprising:

      filling a heat insulating material (2) and a gas adsorbent (4) in the insulated space to be decompressed; and
      providing a filler (6) at a joint section (7) between the covering material (3) and the internal container (1) to join the covering material (3) and the internal container (1) to each other.

6. A method of manufacturing an insulated container which stores a liquid at a maintained temperature,

   the insulated container **characterized by** comprising:

      an internal container (1) which includes a liquid inlet (5) and a liquid outlet (5) and stores the liquid inside thereof; and
      a sheet-like covering material (3) which houses the internal container (1) and forms an insulated space between the internal container (1) and the sheet-like covering material (3),

   the method **characterized by** comprising:

      filling a heat insulating material (2) and a gas adsorbent (4) in the insulated space to be decompressed; and
      preheating an inner side of a joint section (7) between the covering material (3) and the internal container (1) which are joined to each other to thermally weld the joint section (7).

FIG.1

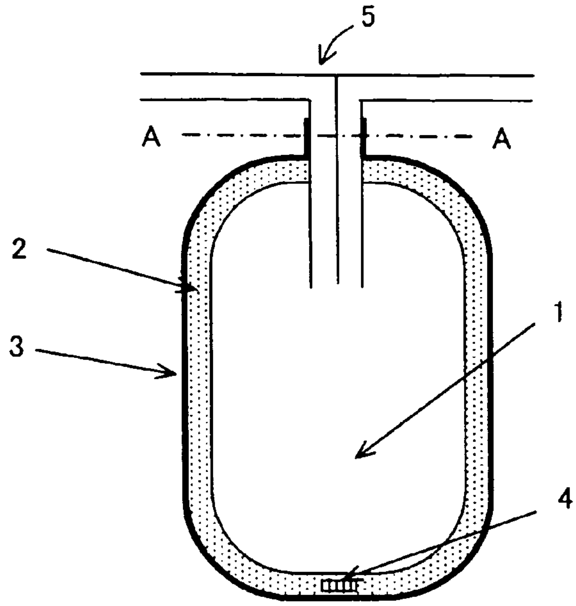


FIG.2

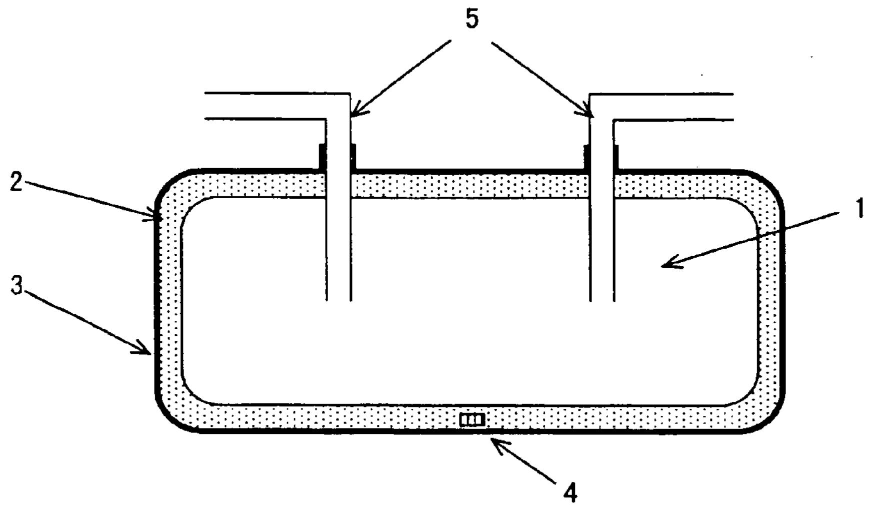


FIG.3

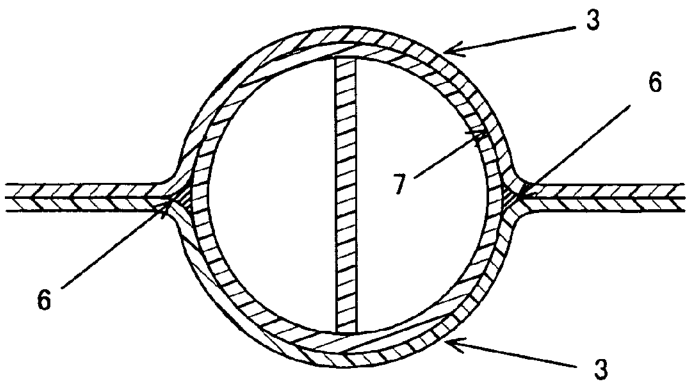


FIG.4

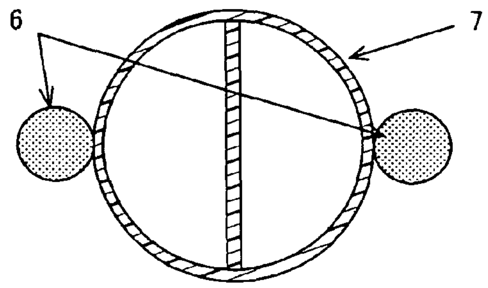


FIG.5

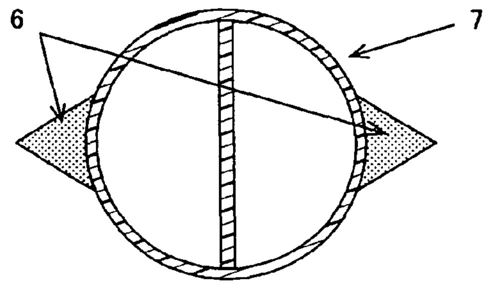


FIG.6

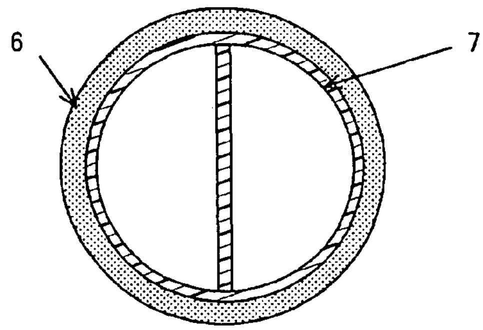


FIG.7

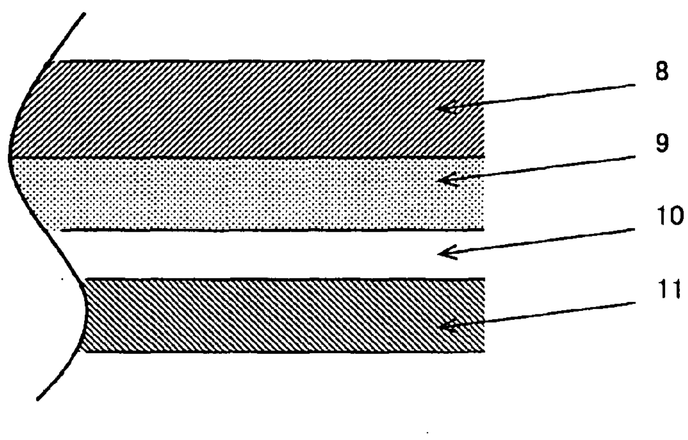


FIG.8

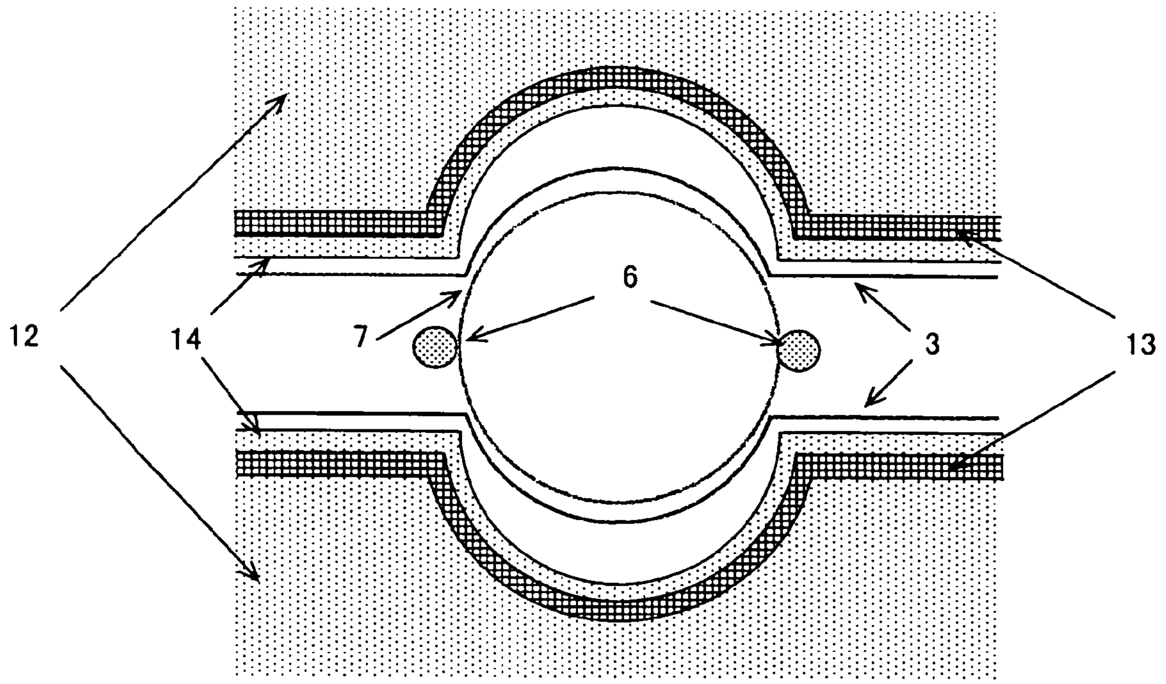


FIG.9

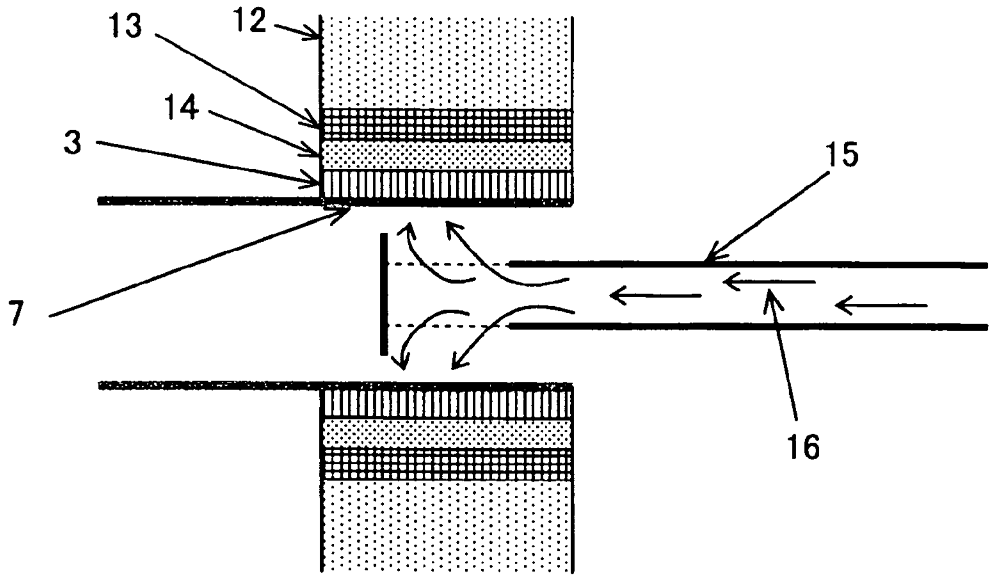
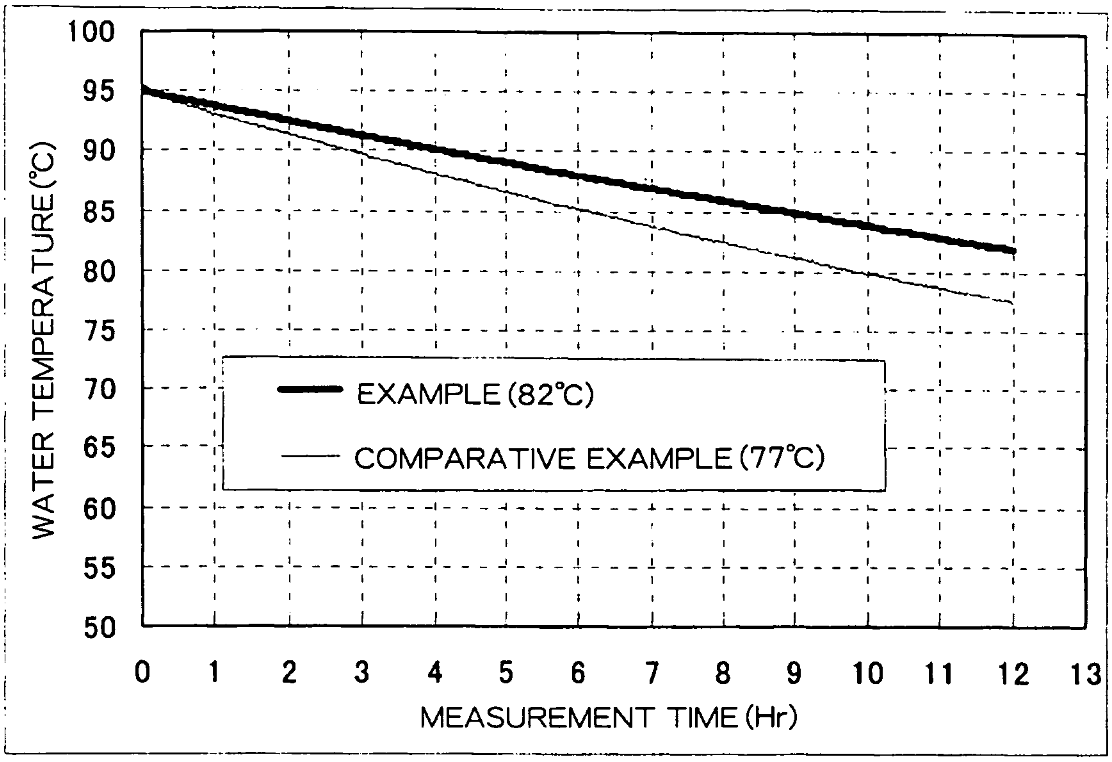


FIG. 10


100
95
90
85
80
75
70
65
60
55
50
WATER TEMPERATURE (℃)
0 1 2 3 4 5 6 7 8 9 10 11 12 13
MEASUREMENT TIME (Hr)
EXAMPLE (82℃)
COMPARATIVE EXAMPLE (77℃)

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EUROPEAN SEARCH REPORT

Application Number
EP 07 01 8975

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The present search report has been drawn up for all claims

2

Place of search	Date of completion of the search	Examiner
The Hague	19 December 2007	Verdelho, Luís

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