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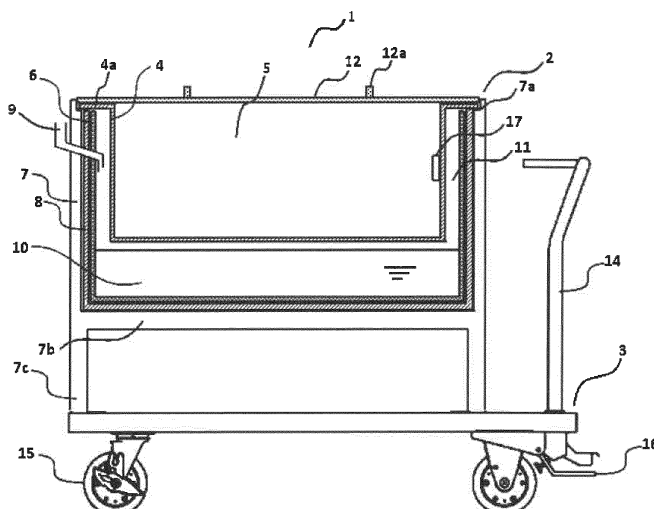
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(54) **MOBILE LOW-TEMPERATURE WORKTABLE**

(57) Discloses is a movable workbench making it possible to perform a work under low temperature, for example, such as -80°C or below, with the work place changed. The movable workbench comprises: a worktable comprising a workspace forming member for providing a workspace for a work at low temperature and a refrigerant-reservoir for reserving a refrigerant, and disposed on a base with a moving member; the workspace forming member comprising a side wall and a bottom wall so as to provide a workspace with an upper surface

opening; the upper surface of the workspace being open on the upper side of the worktable; the refrigerant-reservoir accommodating the bottom wall of the workspace forming member so that a gas phase in the workspace is cooled when the refrigerant is provided in the refrigerant-reservoir and the bottom wall of the workspace forming member is subsequently cooled; and the moving member disposed on a bottom surface of the base so that the worktable is movable with the refrigerant-reservoir filled with the refrigerant.

[Figure 2-1]



Description**TECHNICAL FIELD**

[0001] The present invention relates to a movable workbench that provides a workspace for a work at a low temperature, more specifically, relates to a movable workbench, wherein a worktable having a workspace forming member for providing a workspace for a work under a low temperature and a refrigerant-reservoir for reserving a refrigerant is placed on a base equipped with moving member, and wherein the workspace forming member has a side wall and a bottom wall to provide a workspace with an open upper surface, the upper surface of the workspace is opened on the upper side of the worktable, the refrigerant-reservoir is inside the worktable so as to receive the bottom wall of the workspace forming member from the lower side and let the gas phase in the workspace be cooled when the refrigerant is provided in the refrigerant-reservoir, and the base is provided with a moving member at the lower part so that the worktable can be moved with the refrigerant-reservoir filled with the refrigerant.

BACKGROUND ART

[0002] Works at low temperature are generally carried out in a cold room. In the case of works that do not require a large space, a cold insulation box containing a refrigerant, ice, dry ice, or the like is prepared to perform the works in this cold insulation box.

[0003] A low temperature chamber has an advantage, making it possible to secure a sufficient workspace and to perform a work under sufficient temperature control when performing the work at a low temperature.

[0004] However, the installation of the low temperature chamber accompanies a large economic burden, and the temperature in the low temperature chamber is limited to upper than about -50°C during the work, if the worker's safety is taken into account. Therefore it is difficult to operate the work in the low temperature chamber, for example, at -80°C or below.

[0005] Although the cold insulation box has an advantage that the work place can be relocated when performing the work at a low temperature, making it difficult to work under sufficient temperature control and limiting the workspace.

[0006] Even if dry ice is used as a refrigerant, it is difficult to work at a low temperature such as -80°C or below using the cold insulation box because the sublimation temperature of dry ice is -79°C.

[0007] A low temperature workbench for processing food at a low temperature, which is kept at a low temperature by the cold air ventilated from the cooling device on the workbench, has been known (Patent Document 1).

[0008] This workbench is a fixed type, therefore the work place can't be changed. And it is not applicable to the work to be operated at low temperature such as -80°C

or below.

[Prior Art Documents]

5 [Patent Documents]

[0009] [Patent Document 1] Japanese Patent Application Publication No. H11-235150

10 SUMMARY OF INVENTION

[Problem to be Solved by Invention]

15 **[0010]** The objective of the present invention is to provide a movable workbench making it possible to perform a work under low temperature, for example, such as -80°C or below, with the work place changed.

[Means to Solve the Problem]

20 **[0011]** As a result of intense studies addressed to the above objective, the present inventors succeeded in developing a movable workbench having a structure in which a worktable having a workspace forming member for providing a workspace with an open upper surface, and a refrigerant-reservoir placed to cool the workspace from the bottom side are placed on a base equipped with moving member to make it possible to carry out a work while the work place is changed. Thus the present invention includes the following:

1. A movable workbench comprising;
a worktable comprising a workspace forming member for providing a workspace for a work at low temperature and a refrigerant-reservoir for reserving a refrigerant, and disposed on a base equipped with a moving member,
the workspace forming member comprising a side wall and a bottom wall so as to provide a workspace with an upper surface opening,
the upper surface of the workspace being open on the upper side of the worktable,
the refrigerant-reservoir accommodating the bottom wall of the workspace forming member so that a gas phase in the workspace is cooled when the refrigerant is provided in the refrigerant-reservoir and the bottom wall of the workspace forming member is cooled, and
the moving member disposed on a bottom surface of the base so that the worktable is movable with the refrigerant-reservoir filled with the refrigerant.
2. The movable workbench according to 1 above further comprising;
a temperature measuring member in the workspace so that the temperature of the workspace can be sensed during the work under low temperature, and
a temperature display member to display the temperature measured by the temperature measuring

member.

3. The movable workbench according to 2 above, further comprising;

a temperature recording member functioning to record the temperature measured by the temperature measuring member.

4. The movable workbench according to any one of 1 to 3 above, wherein a side wall and a bottom wall of the refrigerant-reservoir is heat-insulated from outside world by a heat insulating member.

5. The movable workbench according to any one of 1 to 4 above, wherein the refrigerant reserved in the refrigerant-reservoir is liquid nitrogen.

6. The movable workbench according to any one of 1 to 5 above, wherein a lid is further provided for closing an open upper surface of the workspace.

7. The movable workbench according to any one of 1 to 6 above, wherein a stopper is provided for fixing the moving member so as to prevent a move of the base.

8. The movable workbench according to 7 above further comprising a fastener interlocked with the stopper,

wherein the fastener is capable to lock the lid to the worktable in a state that the open upper surface of the workspace is closed by the lid when the fixation of the moving member by the stopper is released, and the lock is to be released when the moving member is fixed by the stopper.

9. The movable workbench according to any one of 1 to 8 above, wherein a handle to be gripped by a worker is further provided.

10. The movable workbench according to 9 above, wherein handles are provided on both a rear side and a front side thereof.

11. The movable workbench according to any one of 1 to 10 above, wherein a warning generating member is further provided so that the warning generating member is capable of issuing a warning when the temperature measured by the temperature measuring member is out of a preset temperature.

12. The movable workbench according to any one of 1 to 11 above, wherein the moving member is a caster.

13. A movable workbench comprising;

a worktable 2 comprising a workspace forming member 4 for providing a workspace 5 for a work at low temperature and a refrigerant-reservoir 6 for reserving a refrigerant, and disposed on a base 3 equipped with a moving member 15,

the workspace forming member 4 comprising a side wall and a bottom wall so as to provide a workspace 5 with an upper surface opening,

the upper surface of the workspace 5 being open on upper side of the worktable 2

the refrigerant-reservoir 6 accommodating the bottom wall of the workspace forming member 4 so that a gas phase in the workspace 5 is cooled when the

refrigerant is provided in the refrigerant-reservoir 6 and the bottom wall of the workspace forming member 4 is subsequently cooled, and the moving member 15 disposed on a bottom surface of the base 3 so that the worktable 2 is movable with the refrigerant-reservoir 3 filled with the refrigerant.

EFFECT OF INVENTION

[0012] The present invention enables to carry out a work under low temperature, for example, at -80 °C or below with the work place changed.

BRIEF DESCRIPTION OF DRAWINGS

[0013]

[Fig. 1-1] Fig. 1-1 illustrates an external side view of a movable workbench of example 1.

[Fig. 1-2] Fig. 1-2 illustrates an external front view of a movable workbench of example 1.

[Fig. 1-3] Fig. 1-3 illustrates an external top view of a movable workbench of example 1.

[Fig. 2-1]

Fig. 2-1 illustrates a partial cross-sectional view of a movable workbench of example 1 in a plane perpendicular to the longitudinal centerline, in a state that a workspace is closed by a lid. In the figure, casing 7, workspace 5, liquid nitrogen 10, and gap 11 are shown as cross-sectional views, except lid 12, workspace forming member 4, refrigerant-reservoir 6, heat insulating member 8, duct 9, and legs 7c.

[Fig. 2-2] Fig. 2-2 illustrates a partial cross-sectional view of a movable workbench of example 1 in a plane perpendicular to the lateral centerline, in a state that a workspace is closed by a lid. In the figure, casing 7, workspace 5, liquid nitrogen 10, and gap 11 are shown as cross-sectional views, except lid 12, workspace forming member 4, refrigerant-reservoir 6, heat insulating member 8, duct 9, and legs 7c.

MODE FOR CARRYING OUT THE INVENTION

[0014] In the present invention, the term "a workspace for a work at a low temperature" means a space filled with a gas phase lower than the outside air to carry out a work in a low temperature environment cooler than the outside air. In most cases, the gas phase is air, or a mixture of air and a vaporized refrigerant reserved in a refrigerant-reservoir. In the present invention, the term "low temperature" means a temperature of approximately -51 °C or below, and in the case of using liquid nitrogen (boiling point: 196 °C) as a refrigerant, means a temperature of roughly -100 °C or below, for example, -120 °C or below, -130 °C or below. The temperature range is adjusted depending on the nature of a work, for example, at -51 to -200°C, at -80 to -200°C, at -100°C to -180°C, at -120°C to -180°C, at -130°C to -180°C, at -130°C to

-185°C, or the like as desired.

[0015] The workspace is provided on the upper side of a worktable as a concave space whose upper surface is open so that workers can easily work. As the specific gravity of a gas phase cooled to a temperature lower than outside air becomes greater than that of the outside air, the cooled gas phase remains in this concave space, resulting in the workspace kept at a low temperature. The workspace is substantially a rectangular space delimited by a workspace forming member having a side wall and a bottom wall and an open upper surface. The workspace forming member is preferably formed using a material that maintains its strength even at a low temperature lower than -100 °C, for example, a stainless steel material, a titanium alloy, or the like. The stainless steel material and the titanium alloy are also suitable as materials for preventing rust due to dew condensation caused by temperature change. Materials whose surfaces are rust-proofed by fluorine processing or the like are also suitable as a material for forming the workspace forming member.

[0016] A refrigerant-reservoir is provided below the bottom wall of the workspace forming member so as to receive the bottom wall from the lower side. The refrigerant-reservoir is disposed such that when the refrigerant is provided therein, the bottom wall and the side wall of the workspace forming member are cooled so that the gas phase (air) in the workspace is to be cooled to a desired low temperature. The refrigerant-reservoir may be substantially formed by a side wall and a bottom wall, and the upper side may be opened. In the same way as the workspace forming member, the refrigerant-reservoir is preferably formed using a material that maintains strength even at a low temperature close to -100°C and does not rust.

[0017] As the refrigerant-reservoir is disposed below the bottom wall of the workspace forming member so as to substantially receive the bottom wall from the lower side, a gap is generated between the surface of the refrigerant and the bottom wall of the workspace forming member. When the refrigerant is provided in the refrigerant-reservoir, the bottom wall and the side wall of the workspace forming member are cooled by the refrigerant. In addition, since the gap is filled with the vaporized refrigerant, the bottom wall and the side wall of the workspace forming member are also cooled by this evaporated refrigerant. By cooling the workspace forming member, the air in the workspace is also cooled. By immersing the bottom wall (and additionally the side wall) of the workspace forming member in the refrigerant, it is possible to cool the gas phase (air) in the workspace more efficiently. As the cooled gas phase (air) has a higher specific gravity than that of the outside air, it is kept in the concave workspace, and as a result, the air in the workspace is cooled more and more.

[0018] A ventilation hole may be provided in the side wall and / or the bottom wall of the workspace forming member so that a low temperature gas phase accumulated in the gap between the surface of the refrigerant

and the workspace forming member can flow into the workspace through the ventilation hole. By influx of the low temperature gas phase from the ventilation hole, the gas phase in the workspace may be efficiently cooled.

[0019] Though there is no particularly limitation as to the refrigerant provided in the refrigerant-reservoir, the examples include liquid nitrogen, and ethanol to which dry ice is added. When liquid nitrogen is provided as a refrigerant, the temperature in the workspace can be cooled down at -160°C or below, for example, -180°C or below, which make it possible to carry out a work continuously for a long time at low temperatures such as -130°C or below, -160°C or below, or the like.

[0020] An inlet for injecting a refrigerant is provided in the refrigerant-reservoir. There are no particular limitations as to the shape, position, or the like of the inlet as long as the refrigerant can be injected into the refrigerant-reservoir. The open upper side of the refrigerant-reservoir may be used as the inlet. A duct that leads into the refrigerant-reservoir and penetrates to the outside of the worktable may be provided and the outside opening of this duct may be used as the inlet for the refrigerant. In the case where the opening on the outside of the duct is used as the inlet, this inlet can serve as an outlet for the vaporized refrigerant. Further, an openable and closable lid may be provided at the inlet to prevent evaporation of the refrigerant from the inlet by closing the lid except for the operation time to inject the refrigerant.

[0021] When liquid nitrogen is provided in the refrigerant-reservoir as a refrigerant, the liquid nitrogen is warmed by the outside air and vaporized. When the amount of liquid nitrogen decreases to a certain amount or less due to vaporization, it becomes difficult to keep the gas phase (air) in the workspace at low temperature. Therefore, in order to keep the gas phase (air) in the workspace at a low temperature for a long time, it is preferable to insulate the refrigerant-reservoir from the outside. At this time, it is preferable that the workspace forming member is simultaneously insulated from the outside.

[0022] The insulation of the refrigerant-reservoir and the workspace forming member from the outside is achieved by disposing a heat insulating material between the outside of the worktable, and the side and bottom walls of the refrigerant-reservoir and the side wall of the workspace forming member. There are no particular limitations as to the heat insulating materials applicable as the material of the heat insulating member, but foamed plastic such as polystyrene foam is preferably used as a heat insulating member.

[0023] The heat insulating member is disposed, for example, so as to fill a gap formed by the refrigerant-reservoir and the casing when the refrigerant-reservoir is housed in the casing. In this case, it is preferable that the heat insulating member is fixed to the refrigerant-reservoir so as to cover the outside of the side wall and the bottom wall of the refrigerant-reservoir, or fixed to the casing so as to cover the inside wall surface of the casing accommodating the refrigerant-reservoir. Though, the

heat insulating member may not be fixed to any of them. In addition, it is possible to provide the casing with a function as a heat insulating member by forming a casing with a member having a cavity and made of stainless steel, titanium, or the like, and accommodating a heat insulating material in this cavity. Likewise, the refrigerant-reservoir may be provided with a function as a heat insulating member.

[0024] The heat insulating member may be made of stainless steel, titanium, or the like, and have a cavity filled with air or depressurized to near vacuum. Here, a gas in the cavity or a cavity itself acts as a heat insulating member. In this case, it is possible to provide the casing with a function as a heat insulating member by forming a casing with a member having a cavity filled with air or depressurized to near vacuum, and made of stainless steel, titanium, or the like. Likewise, the refrigerant-reservoir may have a function as a heat insulating member. A stainless steel member having a cavity depressurized to near vacuum is particularly suitable as a heat insulating member for insulating the refrigerant-reservoir from the outside. In the present invention, the term "heat insulation" means a reduction in heat transfer or thermal conduction by the physical and chemical properties of the heat insulating material.

[0025] In the present invention, the workspace forming member and the refrigerant-reservoir, integrated together to form a worktable, are mounted on a base having a moving member, so as to be movable in a state that the refrigerant-reservoir is filled with a refrigerant. A caster can may preferably used as the moving member.

The workspace forming member and the refrigerant-reservoir are, for example, mounted on a base having a moving member and accommodated in the casing, integrated together to form a worktable, so that the refrigerant-reservoir substantially receives the workspace forming member from the bottom. When a duct is installed, this duct penetrates the heat insulating member and the casing (or the casing integrated with the heat insulating member) and connects the outside of the worktable and the refrigerant-reservoir.

[0026] When mounting the worktable on the base having the moving member, the worktable is fixed to the base with a fastener to prevent it from falling from the base. However, the base and the worktable may be integrally formed. For example, the casing of the worktable may be formed integrally with the base, and the workspace forming member and the refrigerant-reservoir may be accommodated in the casing. Even when the base and the casing are integrally formed as such, by regarding the casing integrated with the base as a part of the worktable, that may be considered as a movable workbench as a whole, wherein the worktable is mounted on the base having a moving member.

[0027] The movable workbench of the present invention is the workbench for a work at a low temperature. Therefore, it is preferable that it can be confirmed that the workspace is kept at low temperature while working

at low temperature. For this reason it is preferable to dispose a temperature measuring member in the workspace so that the temperature of the workspace can be sensed. By displaying the temperature measured by the temperature measuring member on the temperature display member, a worker can perform a work while checking the temperature displayed on the temperature display member. In order to manage the working process, it may be required to record the temperature measured by the temperature measuring member. Therefore, a temperature recording member incorporating a memory for recording the temperature measured by the temperature measuring member may be provided. By providing the temperature recording member, the measured temperature can be recorded over time.

[0028] On the movable workbench, a warning generating member may be further provided so as to be capable of issuing a warning when a temperature measured by the temperature measuring member rises above a preset temperature so that the work can reliably be performed at a low temperature. For example, in the case that an work to be operated at -130°C or below is performed, if the warning generating member is set so as to give a warning when the temperature exceeds -135°C , the warned worker can suspend the work and wait until the temperature of the workspace sufficiently declines. In this way, it is possible to avoid performing work at the temperature not lower than the preset temperature. In the case that the movable workbench has a lid, by closing the lid during the suspension of the work, it is possible to reliably suppress the temperature of the workspace from exceeding the set temperature and to efficiently cool the workspace. The warning can be performed by means such as a visual display, a light emission signal, and / or a sound output, but a buzzer sound is effective.

[0029] The movable workbench of the present invention is intended to be used by accommodating an extremely low temperature refrigerant such as liquid nitrogen. Therefore, it is preferable to dispose a member for securing worker's safety on the movable workbench. As a member for ensuring such safety, for example, a stopper capable of fixing the moving member may be provided so as to prevent unintended movement of the movable workbench during the worker is working. Such a stopper is preferably the kind that is easy for a worker to operate. When the moving member is a caster, a preferable example is a foot brake. In addition, in the case that the movable workbench has a handle for a worker to grasp, a grip portion for operating the stopper may be provided on the handle so that the stopper can be operated by hand. The grip portion is interlocked with the stopper by a wire, and when the wire is pulled upward by grasping the grip portion, the stopper is moved to a position where the stopper can fix the caster. The grip portion is locked by a fastener at a position where the wire is kept to be pulled upward, and the work is performed in this state. When moving the movable workbench, by releasing this lock and returning the grip portion to the original position,

the stopper moves to a position where the stopper releases the caster.

[0030] A lid for closing an open upper surface of the workspace may be provided on the movable workbench so that the temperature of the gas phase in the workspace is kept low on the move. As it is possible that the gas phase and the outside air in the workspace have been mixed resulting a rise of temperature in the workspace on the move of the movable workbench, by closing the upper surface of the workspace with the lid, such the rise of temperature in the workspace can be prevented. In addition, when the work is temporarily interrupted during the work, it is possible to reliably keep the workspace at the low temperature by closing the lid and efficiently cool the temperature in the workspace that has been raised during the work.

[0031] In the case where a lid is provided on the movable workbench, it is possible to prevent the worker from operating the work while forgetting to fix the moving member by employing a configuration in which the lid can be opened only when the moving member is fixed by the stopper, thus safety of the movable workbench is further improved. For example, a fastener for a lid is provided on a worktable or a base so that the lid is locked to the worktable by this fastener not to be opened and closed when the stopper is in a position to release the moving member, and the lid is unlocked to the worktable to be opened and closed when the stopper is in a position to fix the moving member.

[0032] The movable workbench of the present invention may be provided with a handle to be gripped by the worker as described above. When one handle is provided on the movable workbench, the movable workbench has a shape resembling a handcart. At this time, the side provided with the handle is referred to as the rear side, and the opposite side as the front side. The handles may be provided on both sides of the movable workbench. In this case, the rear side and the front side are not distinguishable of the movable workbench, but for convenience it is possible to distinguish between the rear side and the front side. As the worker can grip the handle and push the movable workbench by hands so that the movable workbench can be moved to the place where the work is carried out, the efficiency of the work increases.

[0033] A function to adjust the height of the worktable may be added to the movable workbench according to the physique of the worker, the type of work, or the like. Such a function is realized by, for example, providing a leg-attached platform capable of extending and contracting a leg on the upper side of the base, mounting a worktable on the leg-attached platform, and placing a jack in a gap between the lower surface of a base part of the leg-attached platform and the base so that the jack supports the lower surface of the base part of the leg-attached platform. By manipulating the jack in the upward direction, the base part of the leg-attached platform is pushed upward and moves, and the legs of the leg-attached platform are extended, and accordingly the worktable moves

upward. When the jack is operated in the downward direction, the base part of the leg-attached platform moves downward due to the weight of the worktable and the legs of the leg-attached platform contract, and accordingly the worktable moves downward. By operating the jack in this way, the height of the worktable can be adjusted by the worker as desired.

EXAMPLES

[0034] Although a movable workbench of the present invention is described in further detail below with reference to examples, it is not intended that the present invention be limited to those examples.

[Example 1]

[0035] As shown in figures 1-1 to 2-2, the movable workbench 1 of the present embodiment is that in which the worktable 2 is mounted on the base 3. The worktable 2 includes the workspace forming member 4 forming the workspace 5, a refrigerant-reservoir 6 reserving a refrigerant, and a casing 7 accommodating the workspace 5 and the refrigerant-reservoir 6. The inside of the casing forms a substantially rectangular parallelepiped space, and the inside of the side wall and bottom wall of the casing 7 is covered with the heat insulating member 8 made of foamed plastic. The upper side of the casing 7 is open. In the casing 7, a refrigerant-reservoir 6 is installed. The refrigerant-reservoir 6 has a substantially rectangular parallelepiped shape and its upper side is open so that the side wall and the bottom wall thereof are surrounded by the heat insulating member 8 in close proximity, and a substantially rectangular parallelepiped space for reserving a refrigerant is inside of it. In the casing 7, the workspace forming member 4 is further installed. The workspace forming member 4 forms inside a substantially rectangular parallelepiped space by the side wall and the bottom wall whose upper surface is open. This space serves as the workspace 5 for performing a work at a low temperature. A flange 4a extends outward from the upper end of the side wall of the workspace forming member 4. The flange 4a rests on the step 7a provided on the inner side of the upper end of the side wall of the casing and the end of the flange 4a is in contact with the side wall of the casing 7. By this flange 4a, the workspace forming member 4 is prevented from moving in the lateral direction in the casing 7, and is supported to form a space between the bottom wall of the workspace forming member 4 and the bottom wall of the refrigerant-reservoir 6. The refrigerant is reserved in this space.

[0036] The duct 9 is installed so as to penetrate the casing 7, the heat insulating member 8, and the refrigerant-reservoir 6. The duct 9 has openings at the outside of the casing 7 and the inside of the refrigerant-reservoir 6. The opening of the duct provided 9 on the outside of the casing 7 serves as an inlet for injecting the refrigerant into the refrigerant-reservoir 6. The opening on the out-

side of the casing 7 is placed at the position above the opening of the inside of the refrigerant-reservoir 6 so that the refrigerant flows into the refrigerant-reservoir 6 when the refrigerant has been injected. When the liquid nitrogen is provided in the refrigerant-reservoir 6 as the refrigerant, this duct also functions as an outlet for vaporized liquid nitrogen.

[0037] Figures 2-1 and 2-2 show a state in which the liquid nitrogen 10 is reserved as a refrigerant in the refrigerant-reservoir 6. The liquid nitrogen 10 reserved in the refrigerant-reservoir 6 cools the bottom wall and the side wall of the workspace forming member 4 above the liquid surface. Further, the gap 11 between the refrigerant-reservoir 6 and the workspace forming member 4 is filled with the nitrogen gas vaporized from the liquid nitrogen. Since nitrogen is vaporized at about -195°C under atmospheric pressure, the bottom wall and the side wall of the workspace forming member 4 are also cooled by this vaporized nitrogen.

[0038] In figures 1-1 to 2-2, the open upper surface of the workspace 5 is closed by the lid 12. In this state, the lower surface of the edge of the lid 12 rests on the step 7a provided on the inner side of the upper end of the side wall of the casing, and the end of the lid 12 is in contact with the side wall of the casing 7, resulting in that the lid 12 is prevented from moving in the horizontal direction, and the workspace is shut off from the outside air. The handle 12a is provided on the lid 12. The lid 12 is generally closed when the movable workbench 1 is moved, because the gas phase and the outside air in the workspace 5 possibly may mix and the temperature in the workspace 5 may rise. When working in the workspace 5, the worker grips the handle 12a and removes the lid 12 to open the upper surface of the workspace 5. When the temperature in the workspace 5 rises above a predetermined temperature during the work, the worker temporarily stops the work and closes the lid 12, then after confirming that the temperature of the inside of the workspace 5 becomes lower than the predetermined temperature, the lid 12 is removed and the work is resumed.

[0039] The legs 7c are disposed at the four corners of the bottom plate 7b of the casing 7. In the present embodiment, the legs 7c are regarded as a part of the casing 7. The legs 7c are fixed at the lower end of them to the upper surface of the base 3 with fasteners and the worktable 2 as a whole is fixed to the base 3 with these fasteners. The base 3 is a member having a substantially rectangular shape, when watching from upper side. On the upper surface of one side of the base, the vertical rods 13 extending upwardly from the base in a substantially vertical direction are provided near both ends thereof, and the horizontal bar 14 is passed between the vertical bars 13. This horizontal bar is used as a handle when a worker pushes and moves the movable workbench 1 by hand. For convenience, the side on which the handle is provided is referred to as the rear side of the movable workbench 1, and the opposite side as the front side.

[0040] The caster 15 is provided as a moving member

at the four corners of the lower surface of the base 3. On the rear caster, the foot brake 16 is provided as a stopper so that the caster can be fixed. While working in the workspace 5 or the injecting refrigerant into the refrigerant-reservoir 6, the caster 15 is fixed by the foot brake 16 so that the movable workbench 1 do not move unintentionally while working, resulting in the improvement of the safety of the work.

[0041] The temperature measuring member 17 is provided in the workspace 5, and the temperature measured by the temperature measuring member is displayed on a liquid crystal screen of the temperature display member 18 attached to the horizontal bar 14 of the handle. In the temperature recording member 20, a memory capable of recording the temperature measured by the temperature measuring member 17 is incorporated. The recorded temperature can be read out. Consequently, as it can be verified later on that the performed work was carried out at the low temperature, the movable workbench 1 is particularly suitable for a work requiring process control.

In addition, the warning generating member 19 that issues a buzzer sound when the temperature measured by the temperature measurement member 17 exceeds a predetermined temperature is provided adjacent to the temperature display member 18.

[0042] Hereinafter, as an example of the work using the movable workbench 1, a work for handling frozen cells is presented. This working step is a step for transferring frozen cells for medical use stored in a freezing bag from a storeroom to a transport vehicle.

[0043] At first, liquid nitrogen as a refrigerant is injected from the opening of the movable workbench 1 into the refrigerant-reservoir 6 while the lid 12 closed. In order to prevent the movable workbench 1 from moving while liquid nitrogen injected, the caster 15 is fixed by the foot brake 16. After completion of the injection of the liquid nitrogen, the foot brake 16 is released, and the movable workbench 1 is moved to vicinity of a cell storage container containing frozen cells with the handle 14 grasped.

[0044] The caster 15 is fixed by the foot brake 16 and confirmed is that whether the temperature displayed on the temperature display member 18 is lower than a predetermined temperature or not. After confirming that the displayed temperature has been equal to or lower than the predetermined temperature, the warning generating member 19 is activated so that a buzzer sound is emitted when a temperature equal to or higher than the predetermined temperature is sensed by the temperature measuring member 17. Further, the temperature recording member 20 is activated so that the temperature during the work is recorded.

[0045] The lid 12 is removed, and the frozen cells contained in the freezing bag are taken out from the cell storage container and transferred to the workspace 5. After confirming the lot of frozen cells and that the freezing bag is not broken in the workspace 5, the lid 12 is closed. Then the foot brake 16 is released, the movable workbench 1 is moved by pushing with the handle 14

grasped, and brought alongside a carrier of a transport vehicle for transporting frozen cells. The caster 15 is fixed by the foot brake 16, and the lid 12 is removed. The frozen cells are taken out from the workspace 5, and the cells are transferred to a container for transporting cells which has been cooled to a predetermined temperature in advance.

[0046] If a buzzer sound is issued from the warning generating member 19 during the work, the work is immediately interrupted and the lid 12 is closed. And then the work is resumed when the temperature in the workspace 5 becomes lower than the predetermined temperature. After finishing the work, the temperature recorded in the temperature recording member 20 is retrieved, and the record is checked to confirm that whether the work has been performed at the predetermined temperature or below, and saved for management.

INDUSTRIAL APPLICABILITY

[0047] According to the present invention, a workbench can be provided that makes it possible to accomplish a work to be carried out at a low temperature, for example, at -130°C or below, while changing the work place. Works that need such low temperatures include, for example, a work to handle frozen cells for medical use.

REFERENCE SIGNS LIST

[0048]

- 1 movable workbench
- 2 worktable
- 3 base
- 4 workspace forming member
- 4a flange
- 5 workspace
- 6 refrigerant-reservoir
- 7 casing
- 7a step
- 7b bottom plate
- 7c leg
- 8 heat insulating member
- 9 duct
- 10 liquid nitrogen
- 11 gap
- 12 lid
- 12a handle
- 13 vertical bar
- 14 horizontal bar (handle)
- 15 moving member (caster)
- 16 foot brake
- 17 temperature measuring member
- 18 temperature display member
- 19 warning generating member
- 20 temperature recording member

Claims

1. A movable workbench comprising;
a worktable comprising a workspace forming member for providing a workspace for a work at low temperature and a refrigerant-reservoir for reserving a refrigerant, and disposed on a base equipped with a moving member,
the workspace forming member comprising a side wall and a bottom wall so as to provide a workspace with an upper surface opening,
the upper surface of the workspace being open on the upper side of the worktable,
the refrigerant-reservoir accommodating the bottom wall of the workspace forming member so that a gas phase in the workspace is cooled when the refrigerant is provided in the refrigerant-reservoir and the bottom wall of the workspace forming member is cooled, and
the moving member disposed on a bottom surface of the base so that the worktable is movable with the refrigerant-reservoir filled with the refrigerant.
2. The movable workbench according to claim 1 further comprising;
a temperature measuring member in the workspace so that the temperature of the workspace can be sensed during the work under low temperature, and a temperature display member to display the temperature measured by the temperature measuring member.
3. The movable workbench according to claim 2, further comprising;
a temperature recording member functioning to record the temperature measured by the temperature measuring member.
4. The movable workbench according to any one of claims 1 to 3, wherein a side wall and a bottom wall of the refrigerant-reservoir is heat-insulated from outside world by a heat insulating member.
5. The movable workbench according to any one of claims 1 to 4, wherein the refrigerant reserved in the refrigerant-reservoir is liquid nitrogen.
6. The movable workbench according to any one of claims 1 to 5, wherein a lid is further provided for closing an open upper surface of the workspace.
7. The movable workbench according to any one of claims 1 to 6, wherein a stopper is provided for fixing the moving member so as to prevent a move of the base.
8. The movable workbench according to claim 7 further comprising a fastener interlocked with the stopper,

wherein the fastener is capable to lock the lid to the worktable in a state that the open upper surface of the workspace is closed by the lid when the fixation of the moving member by the stopper is released, and the lock is to be released when the moving member is fixed by the stopper. 5

9. The movable workbench according to any one of claims 1 to 8, wherein a handle to be gripped by a worker is further provided. 10

10. The movable workbench according to claim 9, wherein handles are provided on both a rear side and a front side thereof. 15

11. The movable workbench according to any one of claims 1 to 10, wherein a warning generating member is further provided so that the warning generating member is capable of issuing a warning when the temperature measured by the temperature measuring member is out of a preset temperature. 20

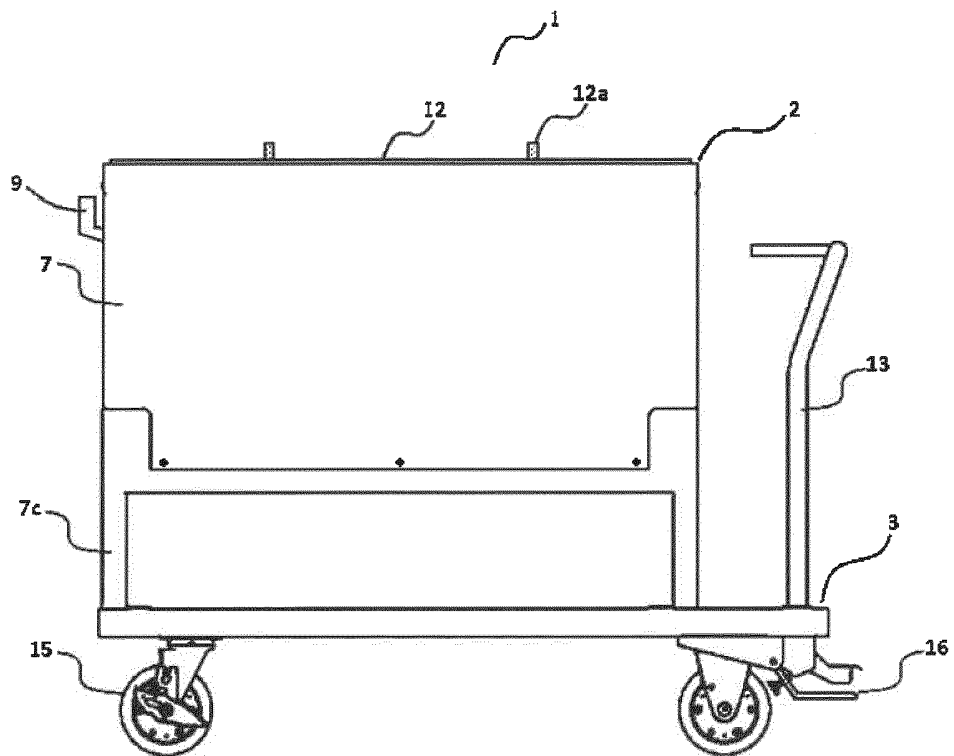
12. The movable workbench according to any one of claims 1 to 11, wherein the moving member is a caster. 25

13. A movable workbench comprising;
 a worktable 2 comprising a workspace forming member 4 for providing a workspace 5 for a work at low temperature and a refrigerant-reservoir 6 for reserving a refrigerant, and disposed on a base 3 equipped with a moving member 15, 30
 the workspace forming member 4 comprising a side wall and a bottom wall so as to provide a workspace 5 with an upper surface opening, 35
 the upper surface of the workspace 5 being open on upper side of the worktable 2
 the refrigerant-reservoir 6 accommodating the bottom wall of the workspace forming member 4 so that a gas phase in the workspace 5 is cooled when the refrigerant is provided in the refrigerant-reservoir 6 and the bottom wall of the workspace forming member 4 is subsequently cooled, and 40
 the moving member 15 disposed on a bottom surface of the base 3 so that the worktable 2 is movable with the refrigerant-reservoir 3 filled with the refrigerant. 45

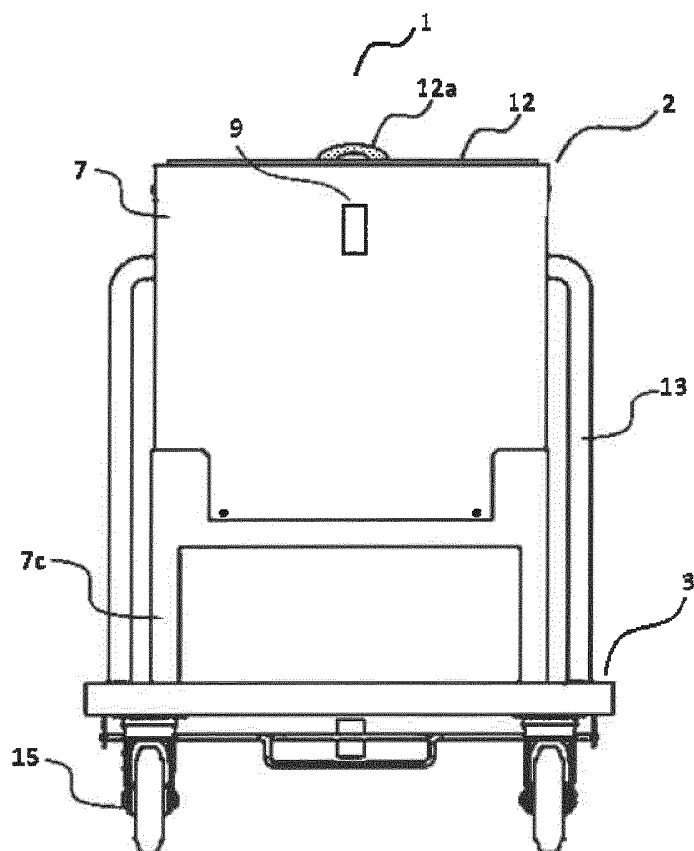
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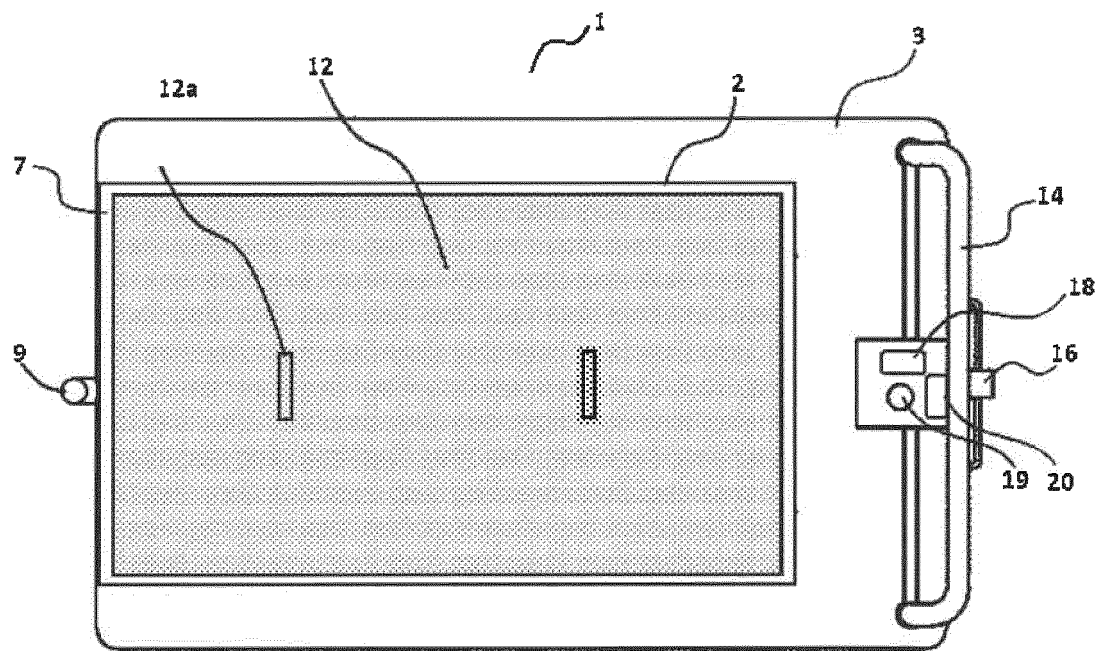
[Figure 1-1]



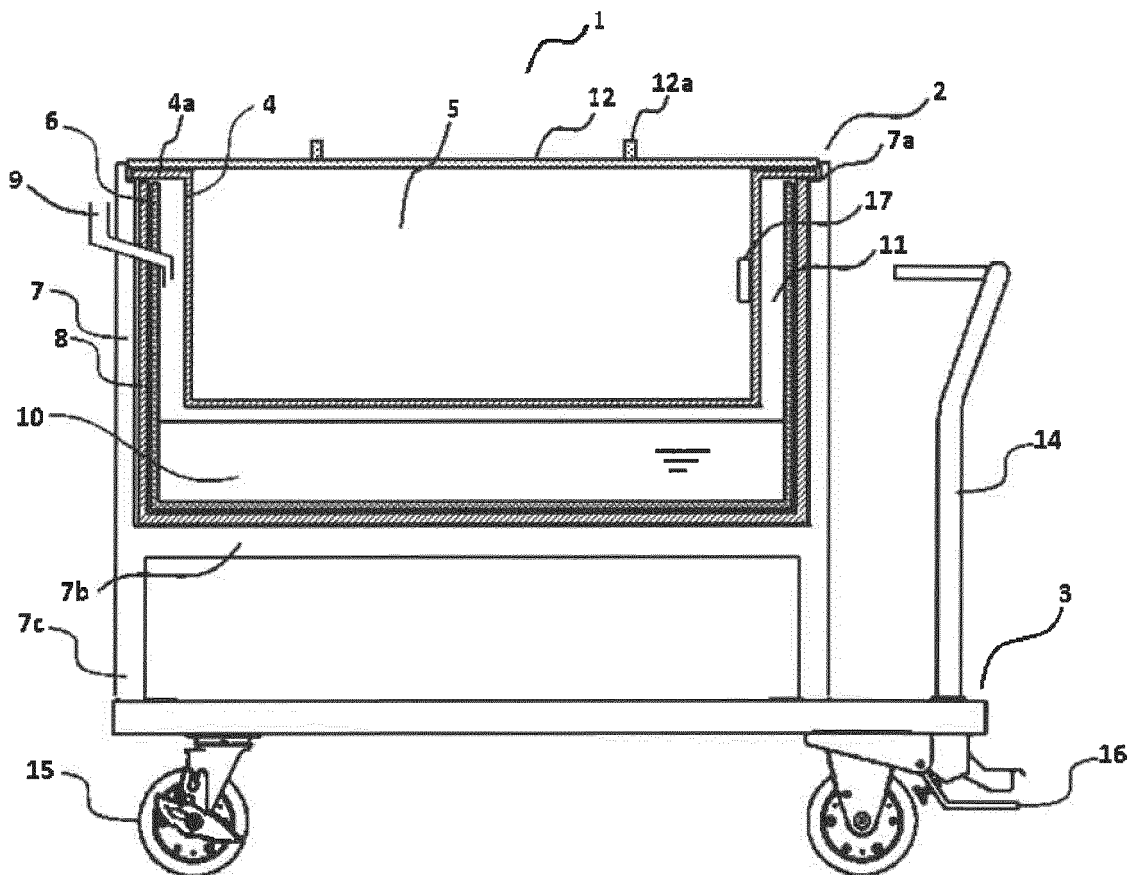
[Figure 1-2]



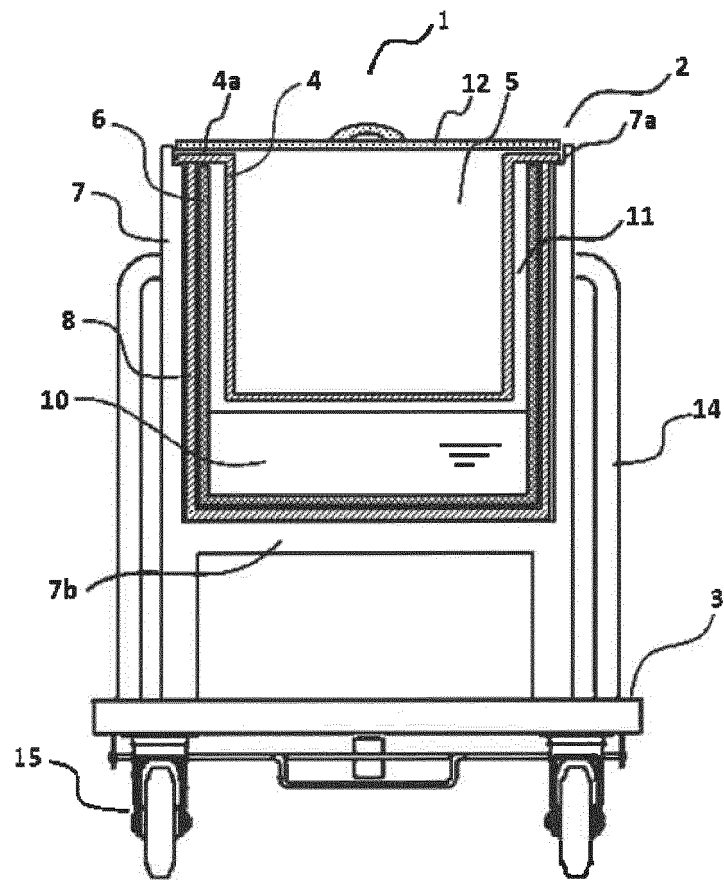
[Figure 1-3]



[Figure 2-1]



[Figure 2-2]



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/086319

A. CLASSIFICATION OF SUBJECT MATTER
F25D3/10(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F25D3/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2017
Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y A	US 6205794 B1 (John G. BROTHERS), 27 March 2001 (27.03.2001), column 2, line 26 to column 4, line 5; fig. 1, 2 & WO 2001/009557 A1	1-7, 9-13 8
Y A	JP 2000-51627 A (Shin-Ei Sangyo Co., Ltd.), 22 February 2000 (22.02.2000), paragraph [0005]; fig. 1, 2 (Family: none)	1-7, 9-13 8

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
10 February 2017 (10.02.17)

Date of mailing of the international search report
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Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/086319

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 103104/1981 (Laid-open No. 10719/1983) (Matsushita Refrigeration Co.), 24 January 1983 (24.01.1983), specification, page 3, line 10 to page 6, line 5; fig. 1, 2 (Family: none)	2-7, 9-12
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REFERENCES CITED IN THE DESCRIPTION

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