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(54) **CONTAINER FOR PHASE-CHANGE MATERIAL**

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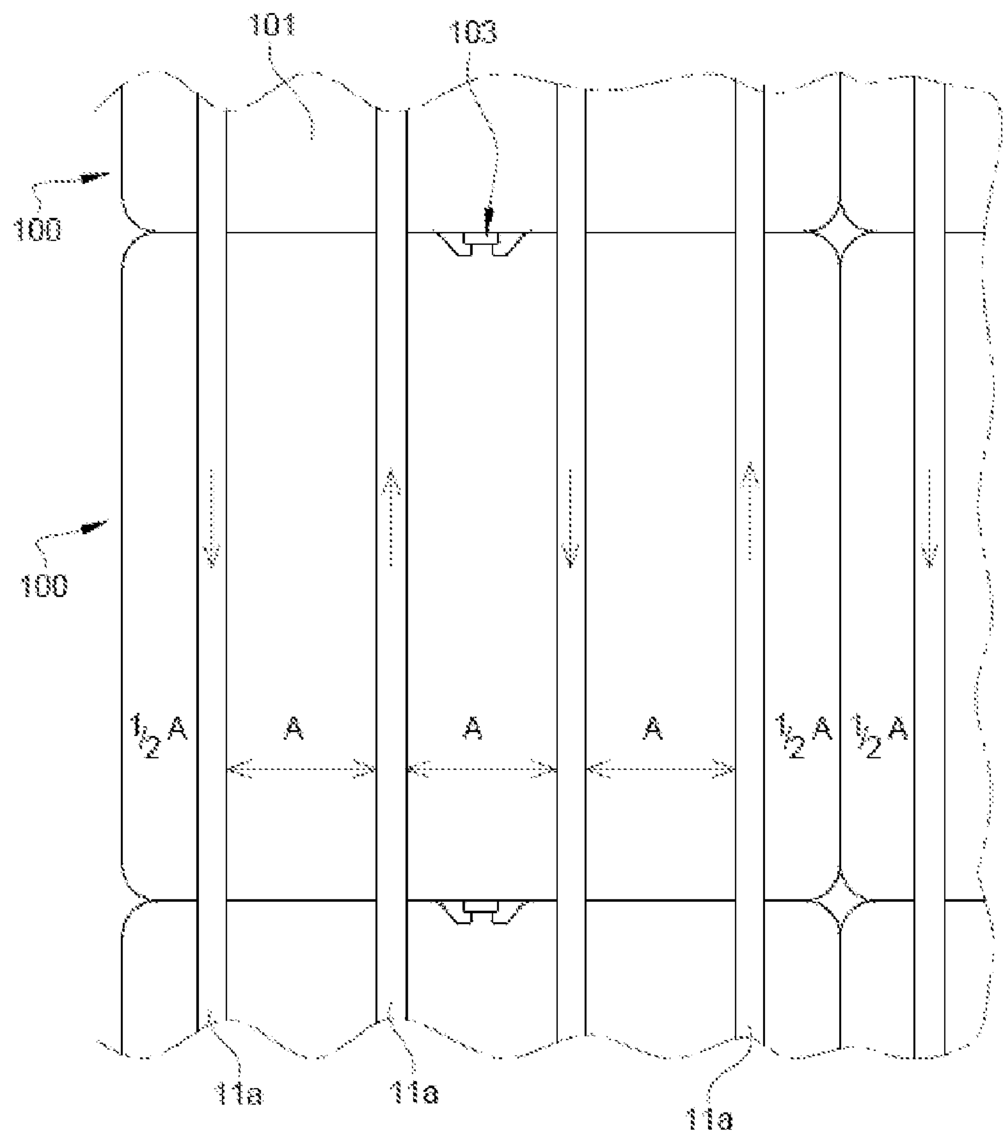
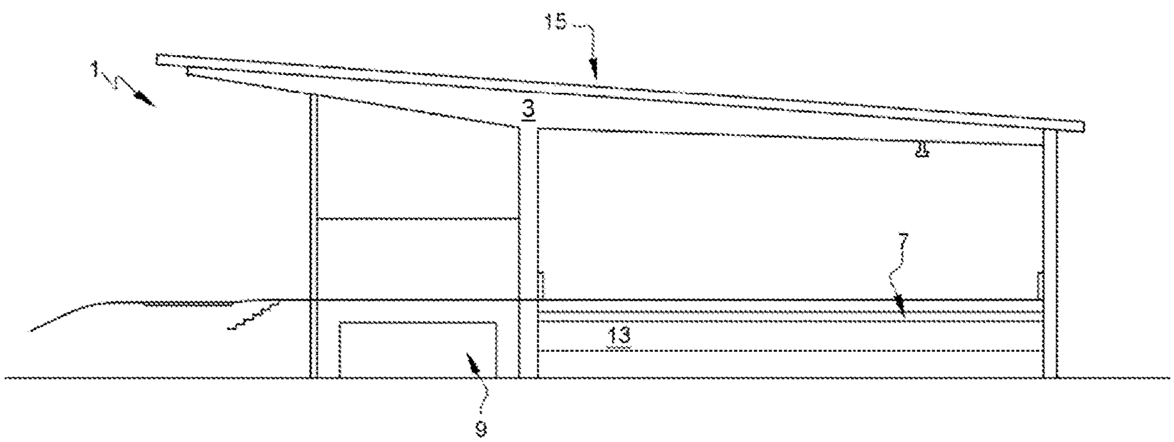
(57) **ABSTRACT**

The present disclosure relates to a container (**100**) for a phase change material, wherein said container is characterized in that it comprises:

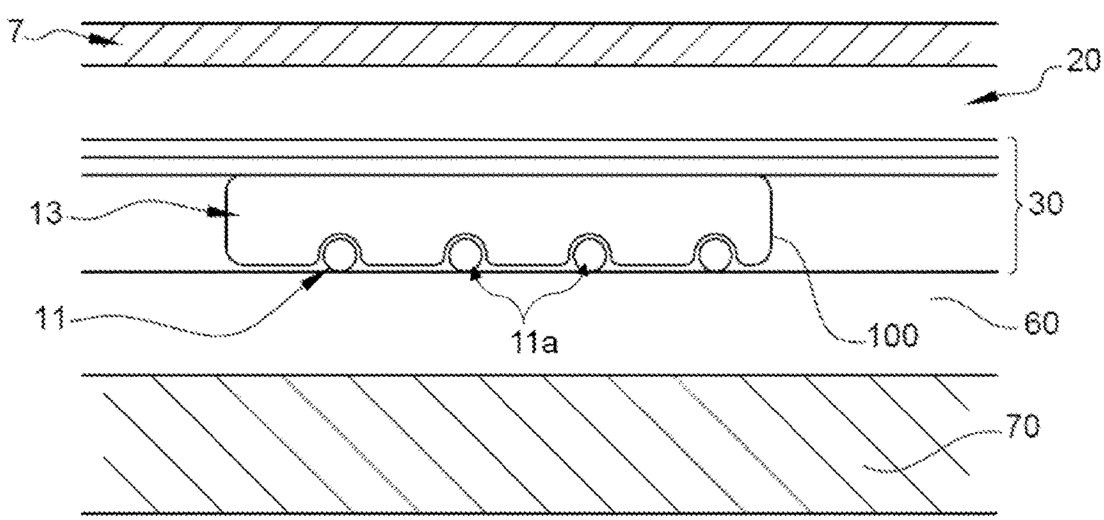
- a closed shell (**101**) where a filling opening (**103**) is arranged;
- a phase change material nested in said shell (**101**);
- one or several recesses (**105**) designed to receive a conduit for refrigerant fluid.

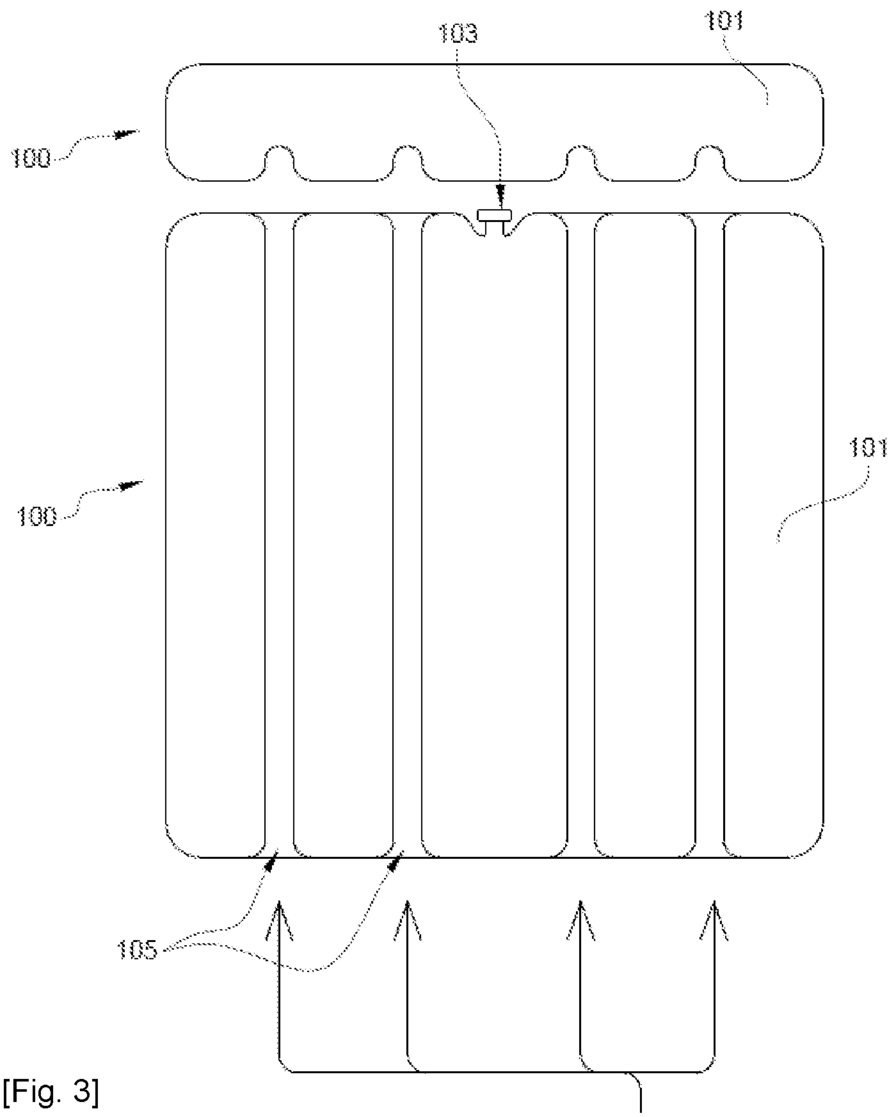


[Fig. 1]

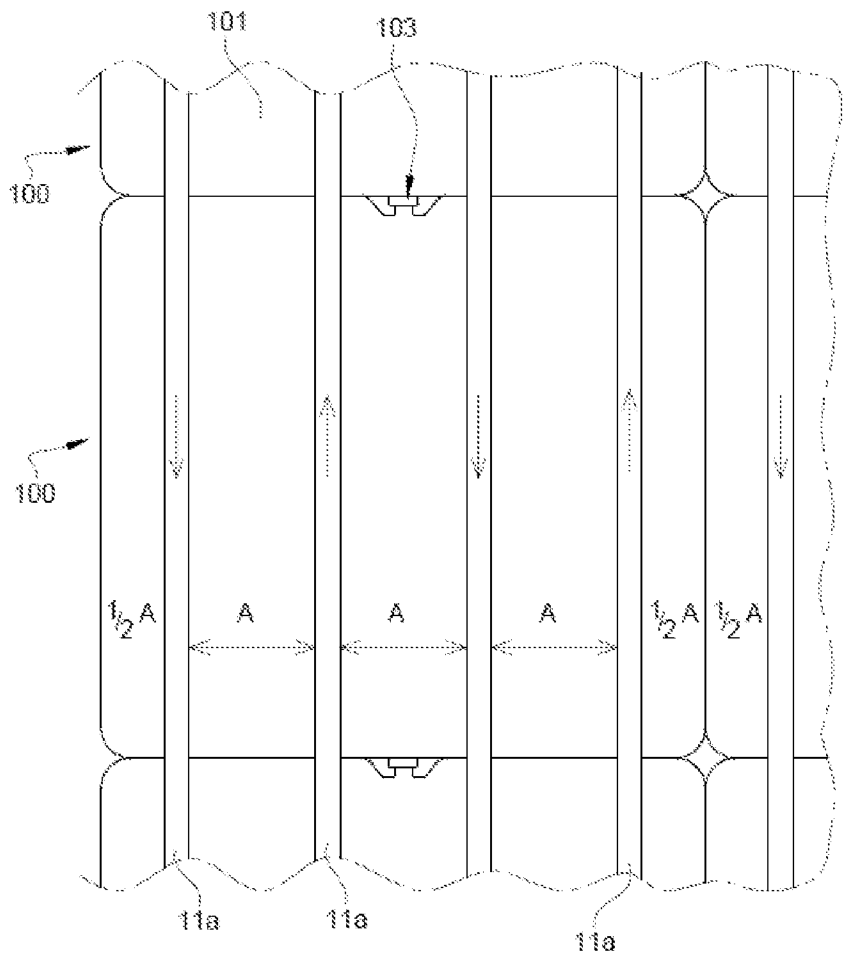


[Fig. 2]



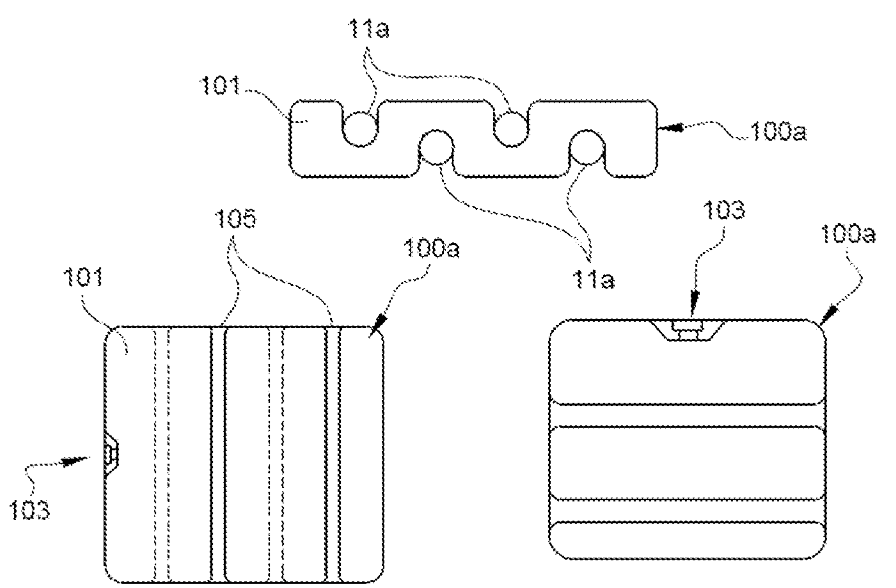


[Fig. 3]

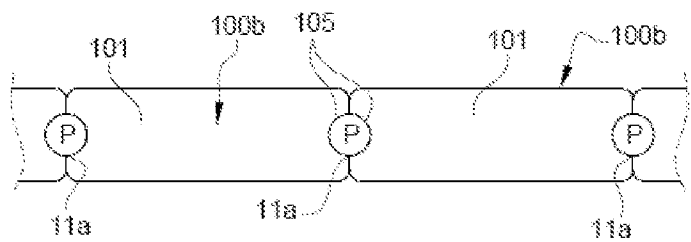

101
103
100
100
½ A
A
A
A
½ A
½ A
11a
11a
11a

[Fig. 4]

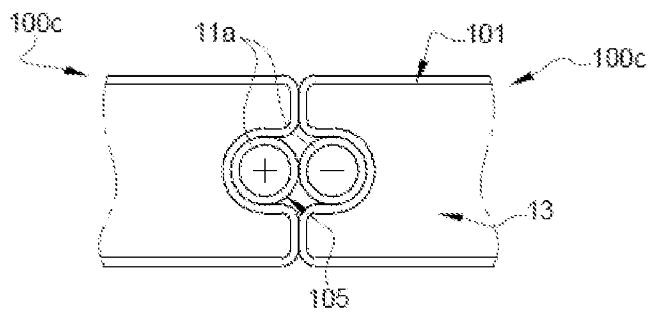
[Fig. 5]


11a
101
100a
105
100a
101
11a
103
100a
103

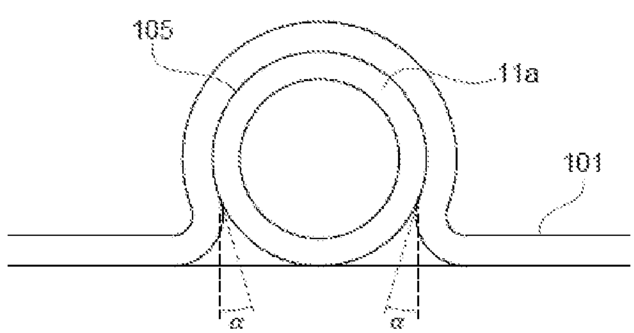
[Fig. 6]



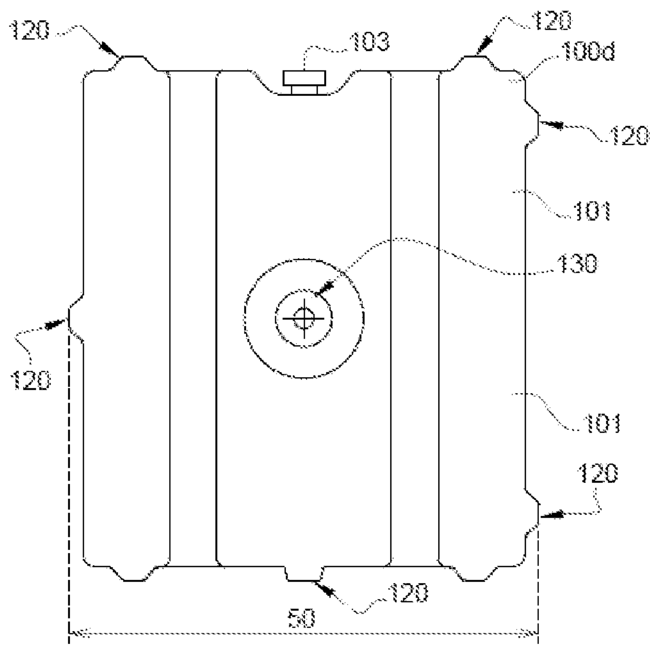
[Fig. 7]



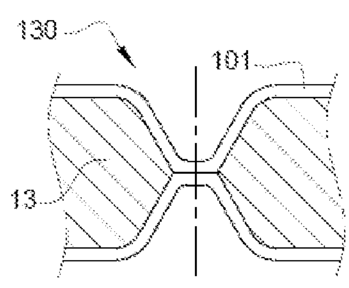
[Fig. 8]



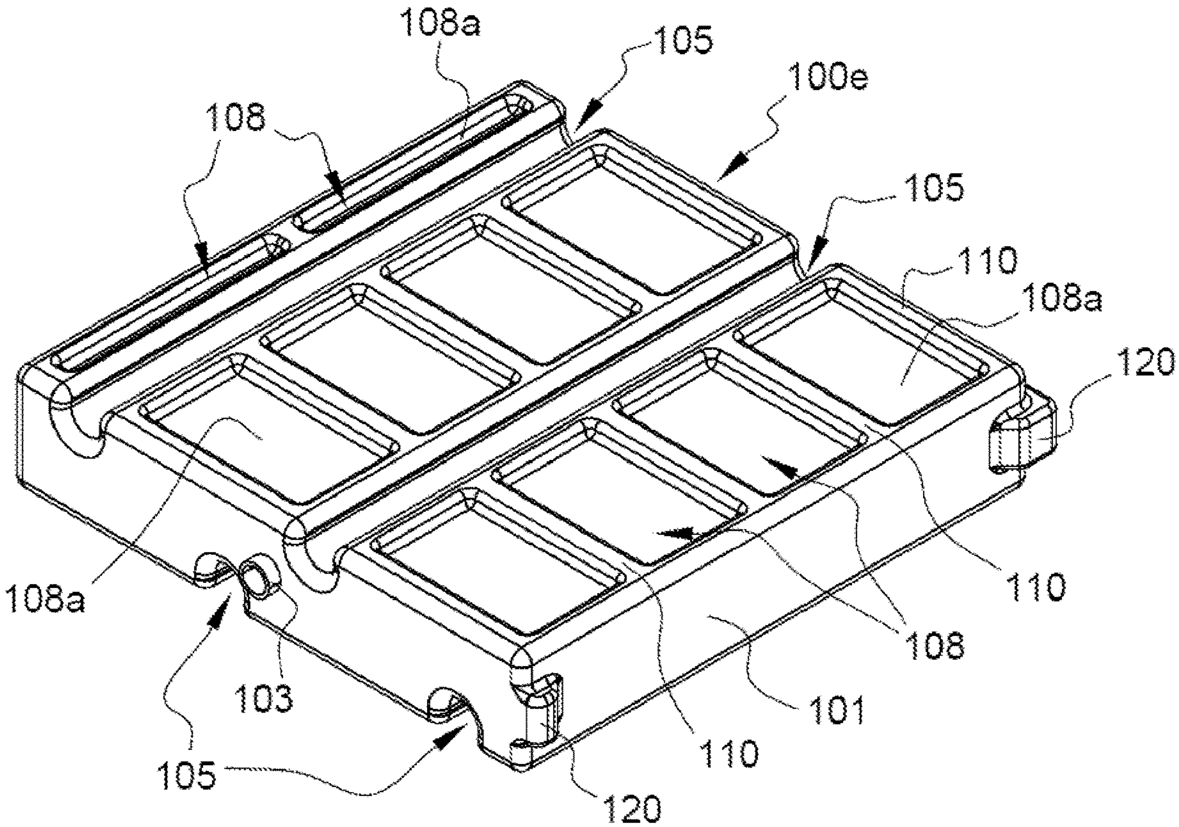
[Fig. 9]



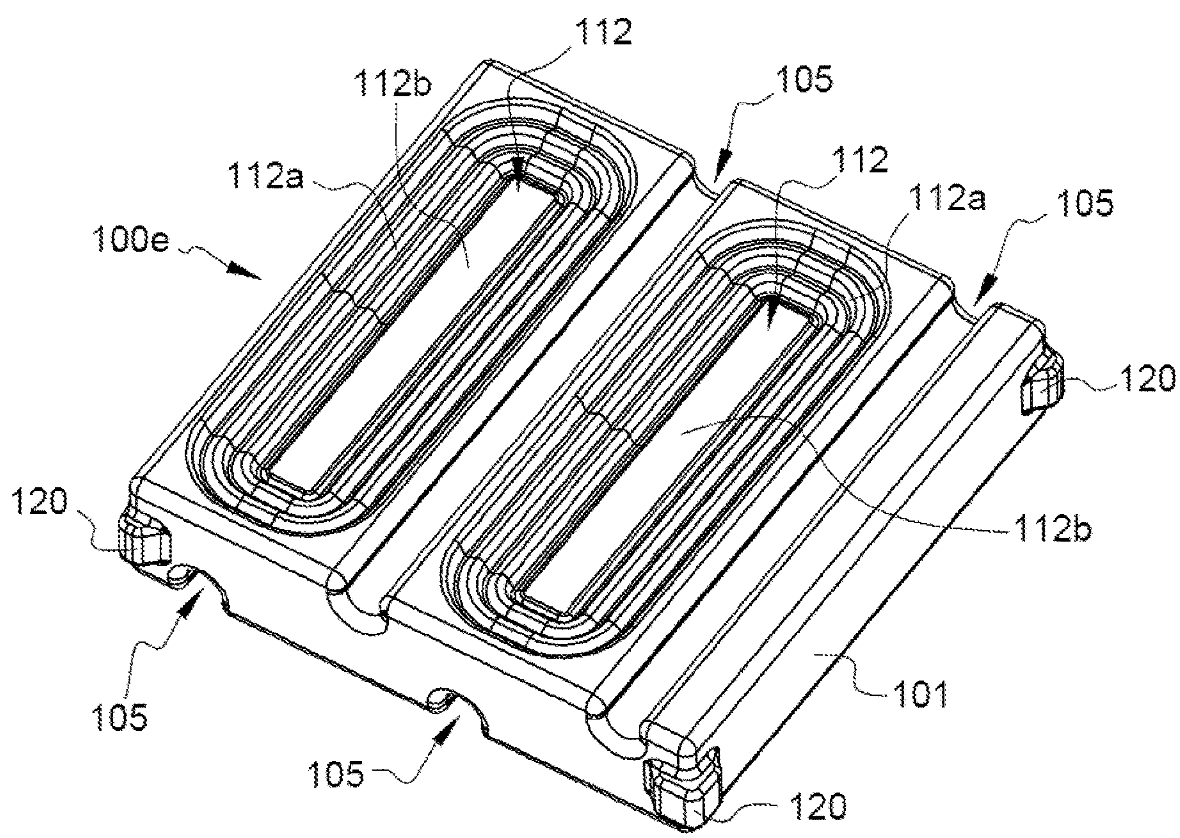
[Fig. 10]



[Fig. 11]


108a
105
100e
108
105
110
108a
120
108a
103
105
110
108
110
101
120

[Fig. 12]


112
112b
105
112a
112
112a
105
100e
120
112b
120
101
105
105
120

CONTAINER FOR PHASE-CHANGE MATERIAL

[0001] The present disclosure relates to the field of containers for phase change materials and of their use to manufacture refrigerated enclosures, volumes and/or surfaces.

[0002] The present disclosure also relates to refrigerated surfaces made of several containers according to the invention. Said refrigerated surfaces made of said containers are advantageously used to create floors, walls, partitions, etc. for example in artificial skating rink, cold rooms . . . .

[0003] As a reminder, an artificial skating rink is constituted of a closed building, such as a tent or a dome built on a slab designed to be covered with ice. Thus, said slab covered with ice (which means frozen water) makes it possible to do any kind of skating, curling, ice hockey, etc.

[0004] Several types of artificial skating rinks comprising tiles made of various materials, including refrigeration devices to cool enough water spilt on the tile to turn it to ice.

[0005] In some known achievements, the tiles are mounted on a layer that incorporates conduits for circulation of a refrigerant fluid set as a network and connected to a cooling unit that circulates the refrigerant fluid through said circuits.

[0006] In order to limit the unavoidable losses of cold from the cooling units, it is known to thermally isolate the tile by providing, between said tile and the primary ground, a layer of thermal isolating material, since its absence leads to too much loss. In some cases, it is known to have hot water circulate under this isolating layer to prevent the primary ground from freezing.

[0007] However, in spite of these measures, the artificial skating rinks known in the state of the art are characterized by important heat losses that require the constant functioning of powerful cooling units night and day, hence costly. In addition, it is hard to maintain the ice in good condition, since its upper surface is in contact with ambient, often wet air of the skating rink, because of the presence of skaters who may warm up the surface when moving along, and of the audience that warms up the ambient air.

[0008] Moreover, ice skating and its derivatives (hockey, figure skating, etc.) is more and more appreciated around the world, and more and more skating rinks re built around the world, in particular in some Asiatic countries.

[0009] Unfortunately, as previously mentioned, a skating rink requires much permanent energy to maintain much water as ice, so that people can skate on it.

[0010] This constraint is all the heavier in countries with hot and/or tropical climates, where the outdoor temperature are usually higher than 20° C. and rarely less than 0° C.

[0011] Think as well about the cold rooms that require much energy to refrigerate volumes, where perishable goods are stored at low temperature. Thus, similarly, these drawbacks and problems for skating rinks also apply to cold rooms. This is all the more important in the case of cold rooms than the foodstuff inside is fragile and may get lost if the temperature is not maintained stable over time.

[0012] The present disclosure can also be used for the thermal management of data centers, for example by using phase change materials with higher melting temperatures.

[0013] One of the purposes of the present disclosure is notably to propose an economical storage means to store phase change materials and make their integration easier into slabs, walls or ceilings, in particular to build skating rinks or cold rooms and for their transport or handling. On one hand, in skating rinks, the invention also makes it possible to maintain the quality of the ice of the skating surface and, on the other hand, to optimize the conservation of perishable goods that are stored inside. All that while limiting the power consumption of these installations.

[0014] Said invention can thus be presented as a container for phase change materials, comprising:

[0015] a closed shell where a filling opening is arranged;

[0016] a phase change material nested in said shell;

[0017] one or several recesses designed to receive a conduit for refrigerant fluid.

[0018] The at least one recess in the shell allow a contact between the conduits of refrigerant fluid and the shell of the container, which optimizes the thermal transfers between the phase change material in the shell and the refrigerant fluid that circulates through said conduits.

[0019] The refrigerant fluid through said conduits is that of a secondary system that transfers frigories to the phase change material inside the containers.

[0020] In addition, it should be noted that said fluid of the secondary system does not change of phase in the working conditions of the invention and can be cooled by the fluid of a primary refrigerant system, considering that the fluid of the primary system is designed to change of phase.

[0021] The thermal exchanges between the different fluids of the primary and secondary systems are made through a dedicated heat exchanger (generally called «chiller»). It should be noted that a phase change material (PCM) is any material capable to change of physical state within a restricted range of temperature, for example around −15° C.

[0022] It should be noted that a refrigerant fluid is a fluid that allows the implementation of a thermodynamic cycle. It can be pure or a mix of pure fluids as a liquid phase, a gas phase or a mix of both according to the temperature and the pressure thereof. The fluid absorbs heat at low temperature and low pressure, then releases heat at higher temperature and pressure, for example during a change of physical state.

[0023] According to a possible feature, said shell where the phase change material is located comprises a «gas blanket» that makes it possible to manage without any notable warping the change of volume consecutive to the phase change of said material.

[0024] It is also possible to add an exhaust valve in the upper part of the container (which is notably connected to the gas blanket of said shell). Said exhaust valve comprises a vent that is, for example, connected through a conduit to the valves of other containers (this creates a network of the valves of said containers at their respective vents).

[0025] This system of vents, whether networked or not, is particularly useful to limit the rise of pressure of the gas blanket at the first solidification of the phase change material inside the shell of the container.

[0026] It is advantageous too to use a calibrated valve at the exhaust and intake to restrict the «breathing» (i.e. the gas exchanges between the inside and the outside of the shell) of the container in normal mode when there is little change of volume of the phase change material in the shell.

[0027] According to another possible feature, the phase change material has a melting temperature between −5° C. and −25° C., preferably between −10° C. and −20° C.

[0028] According to another possible feature, said refrigerant fluid contains glycol (pure or diluted) or any other suitable refrigerant fluid such as salted water, ammonia, etc.

[0029] Indeed, the used refrigerant fluid must not freeze at a temperature less or equal to the melting temperature of the phase change material.

[0030] According to another possible feature, said recesses are directly shaped in the shell of said container.

[0031] Directly shaped in the shell means that the shell was shaped to create one or several recesses designed to receive one or several refrigerant fluid conduits.

[0032] According to another possible feature, said shell is made of a plastic, a polymer or a metal.

[0033] According to another possible feature, said container has substantially the shape of a plate, a tile or a brick.

[0034] The container according to the invention can has different shapes adapted according to its purpose, as a tile or a plate for assembly as a floor or a ceiling, as a brick for assembly as a wall or a partition.

[0035] According to another possible feature, said container has a main extension plane.

[0036] Main extension plane refers to the fact that the container has two extension dimensions (or directions) very large relatively to the third one.

[0037] According to another possible feature, said recesses are grooves in the surface of said container.

[0038] Said grooves can be manufactured onto the main faces (or opposite faces to the main extension plane) an/or onto the lateral sides of the container.

[0039] According to another possible feature, said grooves are regularly spaced on said container.

[0040] It is important that the thermal transfers between the phase change material and the refrigerant fluid are as homogenous as possible.

[0041] According to another possible feature, said grooves are positioned, for example alternatively, on opposite faces of said container.

[0042] According to another possible feature, said one or several reception recesses have a retention angle.

[0043] The retention angle notably improves the contact between the fluid conduit and the shell, while making it possible to fit and maintain the conduit into its recess.

[0044] According to another possible feature, the container according to the invention has an embossed aspect on at least one of its faces.

[0045] In other words, according to a possible feature, the container has an alternating pattern of protrusions and recesses on at least one of its faces.

[0046] According to another possible feature, the container comprises, on at least one of its faces, deformable structures that are designed to warp under the effect of a change of state of the phase change material.

[0047] According to a feature of an embodiment, the container has a preset maximum volume that corresponds to a maximum bulk of the container. Preferably, the deformable structures are designed to warp under the effect of a change of state of the phase change material, so that the container has an instantaneous volume variable in time according to the warps of the deformable structures, wherein the instantaneous volume is not more than the maximum preset volume that corresponds to the maximum bulk of said container.

[0048] In other words, the deformable structures are able to warp and change the «instantaneous» volume of the container under the effect of a change of state of the phase change material, wherein the maximum volume of the container is invariable and a maximum limit for the instantaneous volume of the container.

[0049] It should be noted that instantaneous volume is the volume of the container at a given moment.

[0050] According to another possible feature, deformable structures comprise at least one bellow and/or a low density foam.

[0051] According to another possible feature, the deformable structures comprise at least one plane surface recessed from the terminal surface of the container, wherein said at least one bellow is designed to allow the movement of the plane surface toward the terminal surface until a limit that corresponds to the terminal surface of said container.

[0052] In other words, the plane surface can move to the terminal surface without protrude from the terminal surface of said container.

[0053] The present invention also relates to a refrigerated surface, characterized in hat it comprises an assembly of containers as described above.

[0054] The present invention also relates to a skating rink and a cold room comprising containers as described above.

[0055] The invention shall be better understood, and other goals, details, features and advantages shall appear more clearly in the following description of specific embodiments of the invention, which are introduced only for information and non-restrictively, with reference to the appended picture, where:

[0056] FIG. **1**, referenced as [FIG. **1**], is a very schematic cross-sectional view of a skating rink according to the invention;

[0057] FIG. **2**, referenced as [FIG. **2**], is a schematic cross-sectional view of a first embodiment, called direct mode, of the skating rink slab of FIG. **1**;

[0058] FIG. **3**, referenced as [FIG. **3**], is a lateral schematic view from below of a container according to a first embodiment of the invention;

[0059] FIG. **4**, referenced as [FIG. **4**], is an assembly of several containers of FIG. **3** to create a refrigerated surface;

[0060] FIG. **5**, referenced as [FIG. **5**], is a front schematic view and from different sides of a container according to a second embodiment of the invention;

[0061] FIG. **6**, referenced as [FIG. **6**], is a lateral schematic view of a container according to a third embodiment of the invention;

[0062] FIG. **7**, referenced as [FIG. **7**], is a front and lateral schematic view of a container according to a fourth embodiment of the invention;

[0063] FIG. **8**, referenced as [FIG. **8**], is a front and lateral schematic view of a container according to a variant of embodiment of the invention;

[0064] FIG. **9**, referenced as [FIG. **9**], is a front schematic view of a container according to a variant of embodiment of the invention;

[0065] FIG. **10**, referenced as [FIG. **10**], is an enlarged detail view of an embodiment of the container of FIG. **9**;

[0066] FIG. **11**, referenced as [FIG. **11**], is a perspective schematic view from above of a container according to a fifth embodiment of the invention;

[0067] FIG. **12**, referenced as [FIG. **12**] is a view from below of the container of [FIG. **11**].

[0068] The [FIG. **1**] is then a schematic cross-sectional view of a skating rink **1** according to the invention.

[0069] Said skating rink **1** is an artificial covered skating rink comprising a closed building **3** and a slab designed to be covered with ice **7**. Said skating rink **1** notably comprises:

- **[0070]** a refrigeration device **9** connected to a refrigerating network **11** though which a refrigerating fluid flows, such as glycol or glycoled water;
- **[0071]** a phase change material **13** linked to said refrigeration device **9** through said refrigerating network **11**.

[0072] Said phase change material **13** is notably designed to maintain the ice on the slab at a temperature less than the melting temperature of the ice, typically ca. 0° C. To do so, said phase change material **13** has a melting temperature between −5° C. and −25° C., preferably between −10° C. and −20° C.

[0073] Said skating rink **1** advantageously comprises photovoltaic panels **15** (or solar panels) and a battery to store electrical energy. Said photovoltaic panels **15** are located on the roof of the building **3** of the skating rink **1** or are integrated in a solar roof.

[0074] For example, the refrigeration device **9** is a set of heat exchangers, pump(s), compressor(s) and conduits **11** a of the cooling network **11** that allows to perform a thermodynamic cycle (such as a Carnot cycle, a Rankine cycle, etc.), where there is an exchange of calories between the inside and the outside of the skating rink **1**. The pump and the compressor of said refrigeration device **9** notably circulates the refrigerant fluid through said heat exchangers and the conduits **11***a*.

[0075] More specifically, the refrigeration device **9** is designed to evacuate calories outward so that the refrigerant fluid best captures the calories of the tile **5**, notably when said refrigeration fluid flows through the conduits **11***a* in the slab.

[0076] On the other hand, said panels **15** can power supply to the various power-consuming elements of the skating rink **1**, in particular the refrigeration device **9** and sub-elements. In addition, if the power production of the panels **15** is more than the power consumption of the skating rink, said storage battery is designed to store the power remainder for future use, for example at night.

[0077] The [FIG. **2**], is a schematic cross-sectional view of the slab of the skating rink **1**.

[0078] Then, said slab comprises:

- **[0079]** a first support layer **20** designed to be coated with ice **7**;
- **[0080]** a second layer **30** comprising said phase change material **13**.

[0081] This embodiment is called «direct mode», because the first layer **20** directly lays on the second layer **30**, which means that there is no intermediary layers between the first **20** and second **30** layers.

[0082] The second layer **30** comprises a layer of phase change material **13** with conduits **11** a of the refrigerant network **11** across it.

[0083] On the other hand, the first layer **20** is made of a material designed to be inserted between a layer of ice and the second layer **30**. In addition, a thermal isolating layer **60** is advantageously set under the second layer **30** in order to thermically isolate the slab from the outside, such as the floor **70**.

[0084] More specifically, the phase change material **13** is nested inside a container **100** according to the invention. The [FIG. **3**] and [FIG. **4**] illustrate a first embodiment of the container **100** according to the invention. More specifically, the [FIG. **3**] is a lateral very schematic view and from below of a container **100**, while the [FIG. **4**] is a view from below of several containers **100** of the [FIG. **3**] in lifting position.

[0085] Thus, said container **100** for phase change material comprises:

- **[0086]** a closed shell **101** where a filling opening **103** is arranged;
- **[0087]** a phase change material **13** nested inside said shell **101**;
- **[0088]** one or several recesses **105** designed to receive a conduit **11** a for refrigerant fluid.

[0089] For example, the shell **101** of said container **100** is made of a plastic, a polymer and/or a metal. Furthermore, the shell **101**, where the phase change material **13** is located, is designed to contain a «gas blanket» to adapt without any notable warp the change of volume resulting from the phase change of said material **13**.

[0090] More specifically, the recesses **105** designed to receive said conduits **11***a* for refrigerant fluid are grooves, which means notches at the surface of the shell **101** of said container **100**.

[0091] Thus, these grooves **105** are located on only one face of said container **100** and extend, in the mode illustrated at [FIG. **3**] and [FIG. **4**], on the length of said container **100** and are regularly spaced (for example by a distance A) from each other. Each of these grooves **105** is designed to receive a conduit **11***a* for refrigerant fluid, wherein the insertion of a conduit **11***a* into a groove **105** is made, for example, by force fitting.

[0092] Said grooves **105** are preferably (directly) manufactured in the shell **101** by conformation, which means no matter is added or removed to create these grooves, but the shell **101** is only specially shaped during its manufacture. It notably makes it possible to retain a substantially constant thickness of the shell and to prevent hot spots and/or thermal bridges during thermal transfers between the phase change material and the refrigerant fluid.

[0093] In a first embodiment, said container **100** has substantially the shape of a plate or a tile, but could have any shape suitable to create refrigerated surfaces, for example the shape of a brick. However, it should be noted that the shape of the container according to the invention is advantageously elongated and has a main extension plane.

[0094] Thus, the tile or plate shape makes it possible to quickly assemble several containers **101** to generate a refrigerated surface, for example one of the layers that constitute the tile of an artificial skating rink.

[0095] The container according to the invention can has different shapes adapted according to its purpose, as a tile or a plate for assembly as a floor or a ceiling, as a brick for assembly as a wall or a partition.

[0096] The [FIG. **5**] illustrates a second embodiment of a container **100***a* according to the invention. Thus, the identical or similar elements have the same references and won't be described anew.

[0097] Contrarily to the first embodiment, the container **100***a* has grooves **105** on both sides of the shell **101**. More specifically, said grooves **105** are manufactured alternately on opposite faces of said container **100***a*. Said grooves **105** are also regularly spaced from each other.

[0098] Advantageously, the fluid through the conduits **11***a* comes from two independent refrigerant systems. This makes it possible to dose the direct thermal input, on one hand to the layers above the container **100***a,* such as the ice layer, and on the other hand to the phase change material stored in said container **100***a*.

[0099] More specifically, to store more frigories in the phase change material **13**, the flow of refrigerant fluid through the conduits **11***a* under the container is preferential.

[0100] At the same time, to influence the temperature of the layers above the container (notably because of the gas blanket), they are warmed up or cooled down thanks to the conduits **11** a above the container **100***a* (then, it is possible to play on the temperature of the ice layer above the container).

[0101] The [FIG. **6**] and [FIG. **7**] respectively illustrate a third and a fourth embodiment of a container, respectively **100***b* and **100***c,* according to the invention. Thus, the identical or similar elements have the same references and won't be described anew.

[0102] The containers **100***b* and **100***c* comprise recesses or grooves **105** on the lateral faces of the shell (a lateral face is the thickness of said container), while extending in the main extension plane (or length) of said container **100***b* and **100***c*.

[0103] More specifically, the container **100***b* comprises grooves **105** designed to receive a part of the conduit **11***a,* while the groove of another adjacent container **100***b* receives the other part of said conduit **11***a*. Thus, the fluid conduit **11***a* is surrounded by two adjacent containers **100***b* (in contact with said containers).

[0104] Relatively to the container **100***c,* the recess **105** is configured, on one hand, to receive a conduit **11***a* and, on the other hand, to have said conduit **11***a* in contact with the conduit **11***a* of an adjacent container **100***c*.

[0105] This so that said conduits **11***a* of each container **100***c* is in contact with their respective container **100***c* and with the conduit **11***a* of the adjoining container, in order to improve the thermal transfers between the phase change material **13** and the refrigerant fluid that flows through said conduits **11***a*. Advantageously, the refrigerant fluid in the adjoining conduits **11***a* flows counter-current relatively to one another.

[0106] In a variant illustrated at the [FIG. **8**] that can apply to any embodiment above, the one or several recesses **105** to receive sad conduit **11***a* have a retention angle α. A retention angle is a narrowing of the open part of the recesses or grooves **105**, so that a fluid conduit **11***a* cannot easily go out of its recess and in order to improve the contact between the shell **101** of the container and the refrigerant fluid conduits **11***a*.

[0107] In another variant illustrated in the [FIG. **9**] that can apply to any embodiment and variant above, the shell **101** comprises protrusions **120** on the lateral faces of the container **100***d*.

[0108] These protrusions **120** make it possible to leave some space between adjoining or assembled containers **100***d,* in order to leave concrete intrude between the containers to create an homogenous concrete slab (that entraps the containers **100***d* and the fluid conduits **11***a*).

[0109] Said container **100***d* can also comprise a reinforcement **130**, more specifically illustrated at the [FIG. **10**], which is made of the junction of the walls of the opposite faces of the shell **101** of the container **100***d*. Such a reinforcement makes notably possible to rigidify the container.

[0110] Said reinforcement **130** is advantageously located at the center of the container **100***d,* on one hand, and is fitting inside said shell **101**, on the other hand. This reinforcement **130** can also be applied (or integrated) to any of the embodiments and variants of the container above.

[0111] Said reinforcement **130** has substantially the shape of a double cone, wherein said cones are linked together at their tip, with the respective base of each of said cones on one of the faces of said container **100***d* (more clearly visible at the FIG. **10**).

[0112] The [FIG. **11**] and [FIG. **12**] illustrate a fifth embodiment of a container **100***e* according to the invention, wherein said FIGS. **11** and **12** are perspective schematic views of said container **100***e,* respectively from above and from below. Thus, the identical or similar elements have the same references and won't be described anew.

[0113] Said container **100***e* comprises, like the other embodiments and variants described above, a shell **101**, a filling opening **103**, recesses **105** where may be set conduits **11***a,* protrusions **120**, etc.

[0114] However, said container **100***e* comprises recesses or nooks **108**, advantageously on the upper face of the container **100***e*. The upper face is the face turned toward the ice layer **7**, and on which are lain one or several intermediary materials between the container **100***e* and the layer **7**, such as concrete.

[0115] The reinforcements **108** are advantageously plane surfaces **108***a,* so that the intermediary material can best conform to the shape of the container **100***e,* thus optimize the thermal exchange surfaces between the container **100***e* and the ice layer **7** through said intermediary material.

[0116] Each reinforcement **108** is separated from the other ones by one or several protrusions **110**. Said protrusions **110** notably make it possible to maintain and minimize the volume of the gas blanket in the phase change material **13**, since the phase change material does not fill the upper part of said protrusions **110**. The reinforcements **108** and the protrusions **110** show advantageously an embossed pattern, i.e. an alternance of recesses and protrusions.

[0117] Said container **100***e* also comprises, on one of its faces, preferably on the lower face of the container **100***e,* one or several deformable structures **112**, advantageously comprising a bellow **112***a* (it is also possible to talk of an accordion shape for the bellow **112***a*).

[0118] These deformable structures make it possible to the container **100***e* to warp when there is a change of the physical state of the state change material **13**, notably when it passes from a liquid state to a solid state (and when there is an increase of its volume).

[0119] It should be noted that the lower face is the face opposite to the ice layer **7** (and to the upper face of the container). More specifically, the deformable structures **112** have a plane surface **112***b* set back from the surface of the shell or the terminal surface of the container **100***e,* more specifically from the lower face. Thus, the bellows **112***a* link at least partially the plane surface **112***b* to the terminal surface of the container **100***e*.

[0120] Thus, a plane surface **112***b* set back from the terminal surface of the container **100***e* is configured to move, thanks to the bellows **112***a,* under the action of an increase of volume of the phase change material inside the container **100***e,* notably toward the terminal surface (or the shell of the container). However, the bellows **112***a* are configured, so that the plane surface **112***b* cannot protrude from the terminal surface of the container **100***e*.

[0121] Moreover, the volume between the plane surface **112***b* and the terminal surface of the container is advantageously filled with a (not illustrated) low density foam, such as a closed cell low density foam. Thus, when installing the container **100***e,* the volume of the foam does not fill with various materials, such as concrete, sand, etc., which allows the deformable structure **112** to warp by compressing the foam, although said container **100***e* is entrapped between various layers of materials, such as the first layer **20** and the thermal isolating layer **60**.

[0122] Thus, the deformable structures **112** prevent the total congestion of the container **100***e* from varying when the phase change material **13** it contains changes of physical state (by volume increase), wherein a change of congestion may have dramatic consequences to the layers on the container **100***e,* notably on the ice layer **7**.

[0123] It shall also be noted that the recesses **108** and/or the deformable structures **112** can apply to any embodiment or variant previously described.

[0124] Furthermore, it shall also be noted that the refrigeration device **9** is configured to have at least two operating modes:

- **[0125]** a first operating mode, called «day mode», where the excess calories are stored and/or removed into the phase change material **13** and/or by the heat exchangers of said refrigeration device;
- **[0126]** a second operating mode, called «night mode», where the air above the slab is best cooled thanks to the air-conditioning system, and where the frigories in the phase change material make it possible to keep the ice on said slab at a temperature less than its melting temperature.

[0127] In the second operating mode, the at least one pump and compressor of said refrigeration device **9** are stopped to minimize the power consumption of the skating rink.

[0128] Thus, the night mode makes it possible to store frigories in the phase change material, which can be used later, for example in the day, when people skate on the slab and it is not possible to cool enough air above the surface to skate.

[0129] Said working modes of said device **9** can also apply to a cold room, where partitions, the floor or the ceiling comprise or are made of an assembly of containers according to the invention, wherein this assembly creates a refrigerated surface.

1. A container for a phase change material, wherein said container is characterized in that the container comprises:

a closed shell where a filling opening is arranged;

a phase change material nested inside said shell;

one or several recesses designed to receive a conduit for refrigerant fluid.

2. The container according to claim **1**, characterized in that said one or several reception recesses are shaped directly in the shell of said container.

3. The container according to claim **2**, characterized in that said shell is made of a plastic, a polymer and/or a metal.

4. The container according to claim **2**, characterized in that the container has substantially the shape of a plate, a tile or a brick.

5. The container according to claim **2**, characterized in that said one or several recesses are grooves manufactured at the surface of said container.

6. The container according to claim **5**, characterized in that said grooves are regularly spaced on said container.

7. The container according to claim **5**, characterized in that said grooves are located on opposite faces of said container.

8. The container according to claim **2**, characterized in that the one or several reception recesses have a retention angle α.

9. The container according to claim **2**, characterized in that the container has an embossed aspect on at least one of its faces.

10. The container according to claim **2**, characterized in that the container comprises an alternation of recesses and embossed patterns on at least one of its faces.

11. The container according to claim **2**, characterized in that the container comprises deformable structures on at least one of the container's faces, which are designed to warp under the effect of a change of state of the phase change material.

12. The container according to claim **11**, characterized in that the deformable structures comprise at least one bellow and/or a low density foam.

13. The container according to claim **12**, characterized in that the deformable structures comprise at least one plane surface recessed from the terminal surface of the container, wherein said at least one bellow is designed to allow the movement of the plane surface toward the terminal surface until a limit that corresponds to the terminal surface of said container.

14. A structure characterized in that the structure comprises an assembly of containers according to claim **2**.

15. (canceled)

16. (canceled)

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