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(54) **HEAT-INSULATED STORAGE CONTAINER AND METHOD FOR DESIGNING A HEAT-INSULATED STORAGE CONTAINER**

(71) Applicant: **VIESSMANN CLIMATE SOLUTIONS SE**, Allendorf (DE)

(72) Inventors: **Christian BECKER**, Varsberg (FR); **Jean-Jacques FIACRE**, Saint-Avold (FR)

(73) Assignee: **VIESSMANN CLIMATE SOLUTIONS SE**, Allendorf (DE)

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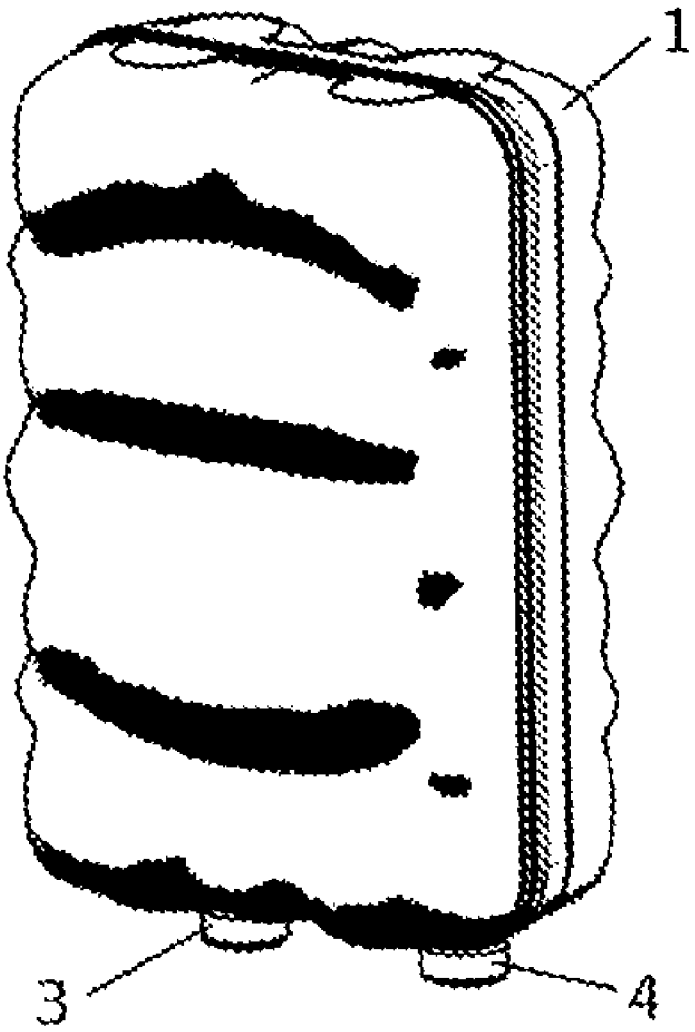
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(57) **ABSTRACT**

A storage container and a method for designing same, including a wall that forms the storage container and has an inner face and an outer face, and an insulation layer that rests against the outer face of the wall, encloses the storage container and has different thicknesses in different regions of the wall. The insulation layer is thicker in a region that has an above-average temperature difference between the inner face and the outer face of the wall than in a region that has a smaller temperature difference between the inner face and the outer face of the wall.



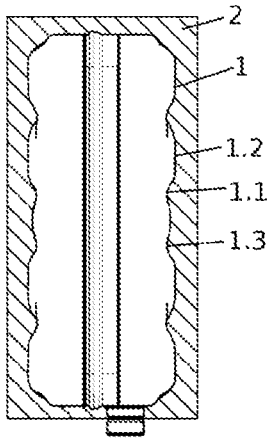


Figure 1

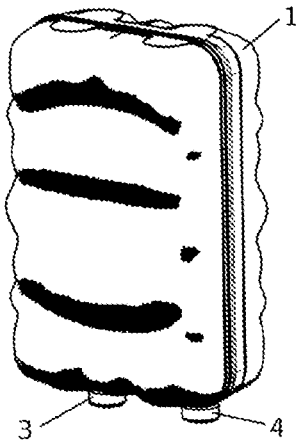


Figure 2

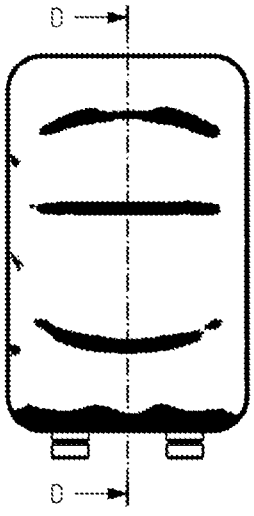


Figure 3

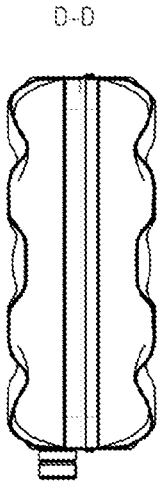


Figure 4

HEAT-INSULATED STORAGE CONTAINER AND METHOD FOR DESIGNING A HEAT-INSULATED STORAGE CONTAINER

[0001] The invention relates to a heat-insulated storage container according to the preamble of claim **1** and a method for designing a heat-insulated storage container according to the preamble of claim **8**.

[0002] A heat-insulated storage container of the type mentioned in the introduction is generally known per se, so that it does not require any specific written proof. Such a heat-insulated storage container which is provided for receiving heating circuit medium (i.e. generally water) consists of a wall that forms the storage container and has an inner face and an outer face, and an insulation layer that rests against the outer face of the wall, encloses the storage container and is configured to have different thicknesses on different regions of the wall. When designing such a heat-insulated storage container (initially considered in very general terms) the thickness of the insulation layer that rests against the wall of the storage container, that has an inner face and an outer face, and encloses this storage container is regularly specified.

[0003] The object of the invention is to improve a heat-insulated storage container of the type mentioned in the introduction. In particular, a storage container which is optimized in terms of heat insulation technology is intended to be provided.

[0004] In terms of the subject matter, this object is achieved with a heat-insulated storage container of the type mentioned in the introduction by the features set forth in the characterizing part of claim **1**. In terms of the method, the object is achieved by the features set forth in the characterizing part of claim **8**.

[0005] In terms of the subject matter, therefore, it is provided according to the invention that the insulation layer is configured to be thicker on a region that has an above-average sized temperature difference between the inner face and the outer face of the wall than on a region that has a smaller temperature difference between the inner face and the outer face of the wall, wherein naturally in this case it is a temperature difference which is present during the operation, in particular during the stationary operation, of the storage container. In terms of the method, it is provided according to the invention that a region of the wall that has an above-average sized temperature difference between the inner face and the outer face of the wall during the operation of the storage container is determined, and a greater thickness of the insulation layer is specified on the determined region than on any other region of the wall.

[0006] In other words, the storage container according to the invention is thus characterized in that the thickness of the insulation layer is configured such that it is designed to be based on the heat flow through the wall of the storage apparatus. Depending on the purpose of use of the storage container or depending on the heat flow, different temperature differences can occur on different regions of the wall. These regions are selectively determined—which can be implemented for the person skilled in the art—by practical tests or even by a computer simulation—which for a person skilled in the art can also be implemented by corresponding simulation knowledge. If these regions are identified, a particularly thick insulation layer is provided there in order to compensate for the temperature differences or to make the temperature differences more uniform over the entire wall as a result. A storage container which is configured or designed in such a manner is more advantageous in terms of heat technology than a storage container in which no consideration has been given to the regions which are particularly at risk of large temperature differences.

[0007] After attaching the insulation layer, which is preferably carried out by foaming the storage container, in order to obtain a storage container which has a surface which is as smooth as possible on the outside and thus can be easily handled in terms of geometry or relative to its further installation, it is also particularly preferably provided—which will be explained below in more detail—that the wall is configured to be curved in a concave manner on the outside and correspondingly curved in a convex manner on the inside on the regions that have an above-average temperature difference in order to receive the thicker insulation layer. This measure also leads to a storage container which is particularly stable in terms of pressure.

[0008] Moreover, it is also particularly preferably provided, which will be explained below in more detail, that the storage container is configured as a defrosting buffer or buffer tank of a heat pump (see for example the buffer tank according to DE 10 2018 102 670 A1) and is arranged in the housing of the heat pump itself, in particular a heat pump provided for installation in the interior of a building. The storage container according to the invention, which is or can be very compact due to its special design or shape, is particularly well suited therefor.

[0009] In terms of the subject matter, it is particularly preferred in all of the above that the insulation layer is configured to be thicker on the region or on those regions on which the inner face of the wall is colder than the outer face of the wall during the operation of the storage container. In terms of the method, therefore, it is particularly preferably provided that a mode of operation of the storage container is selected in which the inner face of the wall is colder than the outer face of the wall, in order to determine the above-average sized temperature difference. These measures are thus based, in particular, on a mode of operation of the storage container in which the outer face of the wall could fall below the dew point and thus condensate could form. When using the storage container in a heat pump, this is in particular the so-called cooling mode, i.e. the mode in which the heat pump is used for cooling the building.

[0010] Other advantageous developments are found in the dependent claims.

[0011] The heat-insulated storage container according to the invention or the method according to the invention is explained in more detail hereinafter, for the design thereof including its advantageous developments according to the dependent claims, with reference to the illustrated representation of a preferred exemplary embodiment.

[0012] In the drawings

[0013] FIG. **1** shows in section the storage container according to the invention together with its insulation layer;

[0014] FIG. **2** shows in perspective the storage container according to FIG. **1** without its insulation layer;

[0015] FIG. **3** shows in a front view the storage container according to FIG. **2**; and

[0016] FIG. **4** shows in section the storage container according to FIG. **3** along the cutting line D-D.

[0017] The storage container which is shown in the figures firstly consists in the known manner of a wall **1** that forms the storage container and has an inner face and an outer face,

and an insulation layer **2** that rests against the outer face of the wall **1**, encloses the storage container and is configured to have different thicknesses on different regions **1.1**, **1.2** of the wall **1**.

[0018] Said wall **1** preferably consists of a metallic material.

[0019] It is also preferably provided that the storage container is formed from two half-shells which are adapted to one another.

[0020] The storage container also preferably has a supply connection **3** and a discharge connection **4** (see in particular FIG. **2**).

[0021] When designing such a storage container, a thickness of an insulation layer **2** (or the insulation layer) that rests against a wall **1** (or the wall) of the storage container, that has an inner face and an outer face, and encloses the storage container is specified in the known manner.

[0022] Considered in terms of the subject matter, it is thus essential for the storage container according to the invention that the insulation layer **2** is configured to be thicker on a region **1.1** that has an above-average sized temperature difference between the inner face and the outer face of the wall **1** than on a region **1.2** that has a smaller temperature difference between the inner face and the outer face of the wall **1**.

[0023] Considered in terms of the method, it is essential for the storage container according to the invention that a region **1.1** of the wall **1** that has an above-average sized temperature difference between the inner face and the outer face of the wall **1** during the operation of the storage container is determined, and a greater thickness of the insulation layer **2** is specified on the determined region **1.1** than on any other region **1.2** of the wall **1**.

[0024] Regarding the shape, it is also particularly preferably provided that the wall **1** is configured to be curved in a concave manner on the outside and to be correspondingly curved in a convex manner on the inside on the region **1.1** that has an above-average sized temperature difference in order to receive the thicker insulation layer **2**.

[0025] It is also particularly preferably provided that the wall **1** is configured to be curved, in particular wave-shaped, on a region **1.3** that has a container internal pressure of above-average size, in order to increase the pressure stability of the storage container, or in that a region **1.3** of the wall **1** that has a container internal pressure of above-average size is determined in order to avoid a deformation, wherein the exact determination and design of said regions **1.1**, **1.2** and **1.3** are correspondingly considered in the context of the aforementioned computer simulation.

[0026] As mentioned in the introduction, it is also particularly preferably provided that the storage container is arranged in a housing of a heat pump, in particular a heat pump provided for installation in the interior of a building. Alternatively, in other words: according to the invention a heat pump is provided with a housing and a storage container of the described type which is arranged therein. It is particularly preferably provided that the storage container is configured as a defrosting buffer of a heat pump, or the heat pump, i.e. in particular serves to provide heat for defrosting an iced-up evaporator. In this context, it is also particularly preferably provided that the storage container has a storage volume of less than 30 litres, preferably of less than 20 litres, particularly preferably of less than 16 litres. For a design which is as compact as possible, it is also further preferably provided that the insulation layer **2** enclosing the storage container has a cuboidal shape on the outside.

[0027] As already set forth above, finally—and in particular when used in a heat pump in cooling mode—in order to avoid the formation of condensate between the wall **1** and the insulation layer **2**, it is particularly preferably provided that the insulation layer **2** is configured to be thicker on the region **1.1** on which the inner face of the wall **1** is particularly cold relative to other regions **1.2** and colder than the outer face of the wall **1** during the operation of the storage container, or that a mode of operation of the storage container is selected in which the inner face of the wall **1** is colder than the outer face of the wall **1**, in order to determine the above-average sized temperature difference on a (specific) region **1.1** (and relative to other regions **1.2**).

[0028] As can be seen in all of the above, said temperature difference can be positive or negative depending on the mode of operation of the storage container, i.e. externally cold and internally warm (for example heating mode of the heat pump) or externally warm and internally cold (for example cooling mode of the heat pump).

[0029] Finally, relative to the aforementioned condensation, it is preferably provided that the insulation layer **2** is configured to be at least sufficiently thick that no point of the wall **1** falls below the dew point or that no condensation occurs thereon.

List of reference signs

1	Wall
1.1	Region
1.2	Region
1.3	Region
2	Insulation layer
3	Supply connection
4	Discharge connection

1: A heat-insulated storage container, comprising a wall (**1**) that forms the storage container and has an inner face and an outer face, and an insulation layer (**2**) that rests against the outer face of the wall (**1**), encloses the storage container and is configured to have different thicknesses on different regions (**1.1**, **1.2**) of the wall (**1**),

wherein

the insulation layer (**2**) is configured to be thicker on a region (**1.1**) that has an above-average sized temperature difference between the inner face and the outer face of the wall (**1**) than on a region (**1.2**) that has a smaller temperature difference between the inner face and the outer face of the wall (**1**).

2: The heat-insulated storage container according to claim **1**,

wherein

the wall (**1**) is configured to be curved in a concave manner on the outside and correspondingly curved in a convex manner on the inside on the region (**1.1**) that has an above-average sized temperature difference, in order to receive the thicker insulation layer (**2**).

3: The heat-insulated storage container according to claim **1**,

wherein

the wall (**1**) is configured to be curved on a region (**1.3**) that has a container internal pressure of above-average size, in order to increase the pressure stability of the storage container.

4: The heat-insulated storage container according to claim **1**,

wherein

the insulation layer (**2**) enclosing the storage container has a cuboidal shape.

5: The heat-insulated storage container according to claim **1**,

wherein

this storage container is arranged in a housing of a heat pump, in particular a heat pump provided for installation in the interior of a building.

6: The heat-insulated storage container according to claim **1**,

wherein

this storage container is configured as a defrosting buffer of a heat pump.

7: The heat-insulated storage container according to claim **1**,

wherein

the insulation layer (**2**) is configured to be thicker on the region (**1.1**) on which the inner face of the wall (**1**) is particularly cold relative to other regions (**1.2**) and colder than the outer face of the wall (**1**) during the operation of the storage container.

8: A method for designing a heat-insulated storage container, in which a thickness of an insulation layer (**2**) that rests against a wall (**1**) of the storage container, that has an inner face and an outer face, and encloses the storage container is specified,

wherein

a region (**1.1**) of the wall (**1**) that has an above-average sized temperature difference between the inner face and the outer face of the wall (**1**) during the operation of the storage container is determined, and a greater thickness of the insulation layer (**2**) is specified on the determined region (**1.1**) than on any other region (**1.2**) of the wall (**1**).

9: The method according to claim **8**,

wherein

a region (**1.3**) of the wall (**1**) that has a container internal pressure of above-average size is deter-mined and is configured to be curved in order to avoid a deformation.

10: The method according to claim **8**,

wherein

a mode of operation of the storage container is selected in which the inner face of the wall (**1**) is colder than the outer face of the wall (**1**), in order to determine the above-average sized temperature difference on a region (**1.1**).

* * * * *