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(54) **EUTECTIC REFRIGERATION SYSTEM**

(57) Eutectic refrigerating unit (100) designed to cool foodstuffs or other perishable products transported in vehicles, particularly electric vehicles, but more generally vehicles powered by any means (for example diesel, petrol, gas, methane or other). The evaporating unit is encased in a specifically insulated box-shaped enclosure (104), for example made of ABS, so that the condition of low heat and therefore low temperature (accumulated frigories) inside the box-shaped enclosure may be made use of to cool the inside of the insulated chamber in the load compartment when required. The assembly comprises a set of closed hollow elements (103), preferably in the shape of a parallelepiped, in which a eutectic liquid or fluid is contained, and is brought to a low temperature before the vehicle begins its journey. Associated with the closed hollow elements are open hollow elements (105), preferably one for each of the closed hollow elements, which share a wall and exchange refrigerants. Air flows through the open hollow elements and is then appropriately circulated in the insulated chamber, cooling it. This makes it possible to keep the temperature inside the insulated load compartment constant or nearly constant even without any refrigeration equipment fitted to the vehicle.

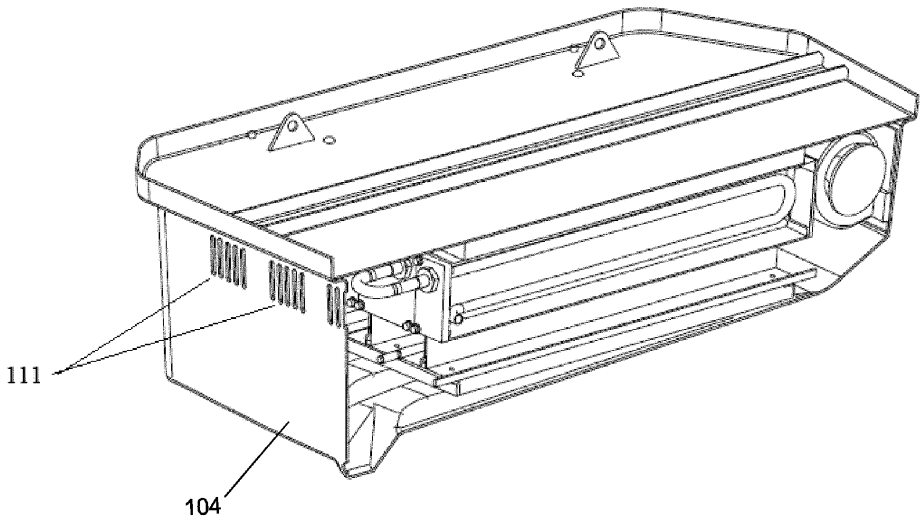

FIG. 2C

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a eutectic refrigeration unit intended to refrigerate foodstuffs or other perishable products transported in vehicles powered by electricity, diesel, petrol, gas, methane or some other source.

STATE OF THE ART

[0002] Many different types of perishable goods are transported every day, for example from the place of production to the place of distribution. Most of these are foodstuffs, such as fruit, vegetables, meat, fish, milk, dairy products, frozen foods, all products that are sensitive to ambient temperature, at which they undergo changes that cause them to deteriorate.

[0003] In addition to foodstuffs, pharmaceuticals, ornamental plants and flowers, and others, are also types of merchandise that deteriorate as a result of thermal shocks and the temperature of the external environment.

[0004] In order to be able to transport perishable goods properly, i.e. to ensure that they also do not deteriorate during transport, there is therefore a need to use suitable vans and vehicles that are able to maintain the temperature required for their proper storage, depending on the type of goods being transported to their destination.

[0005] Insulated vehicles in which thermal insulation for the products transported is ensured by an insulated chamber installed inside the load compartment are therefore commercially available. The insulated compartment avoids the exchange of temperature between the outside and inside, and the structure thus provided makes the van specifically intended for the transport of perishable goods that must be kept at a certain temperature, such as fruit, vegetables, milk and its derivatives, eggs and ornamental plants.

[0006] There are also refrigerated vans, in which a refrigeration system is added to keep the temperature inside the load compartment not only controlled but also constant, for foodstuffs such as meat, fish products or fresh pasta.

[0007] The provision of a refrigeration system on board a van certainly improves the quality of temperature maintenance suitable for the transport of perishable goods, but it requires an expensive and cumbersome accessory consisting of the condenser-compressor refrigeration system, which is either connected to the vehicle's engine or independently driven. Furthermore, in electric vehicles, use of some of the electric charge stored in the batteries to refrigerate the load compartment has an adverse effect on the vehicle's range, a problem that is very much felt in vehicles of this type that depend on the availability of recharging equipment along the route. Italian patent application 102020000032666 from the same applicant as the present application describes a system based on the use of a eutectic fluid. The system in Italian application 102020000032666 offers advantages through its ease of construction, but there is still room for improvement as regards the efficiency of the system for exchange of cold between the eutectic fluid and the load compartment.

OBJECT OF THE INVENTION

[0008] The object of the present invention is to provide a eutectic refrigeration unit that at least partly overcomes the disadvantages of systems in the known art.

SUMMARY OF THE INVENTION

[0009] According to the present invention there is provided a eutectic refrigerating unit for refrigerating foodstuffs or other perishable products transported in motor vehicles, that is intended to be placed inside the insulated load compartment of a vehicle and is characterised in that it comprises a set of closed hollow elements in fluid communication with one another in series, the closed hollow elements being intended to contain and circulate a eutectic fluid within them; a plurality of open hollow elements adapted to let air passing through them, each of the plurality of open hollow elements being associated with and adjacent to at least one of the set of closed hollow elements; a box-shaped enclosure within which is enclosed the set of closed hollow elements and the open hollow elements so as to maintain the cold generated by the cooled eutectic fluid, the box-shaped element being provided with slits (or louvres or slots) for the passage of air in and out; ventilation means associated with said box-shaped enclosure and controllable by a microprocessor associated with means for sensing the temperature within said load compartment, in which the ventilation means are intended to be operated and controlled by the microprocessor so as to draw air from the load compartment into the box-shaped element through the inlet slits, causing air to circulate in the open hollow elements and air to be discharged from the box-shaped element into the load compartment through the outlet slits, thereby controlling the temperature in the load compartment.

[0010] In a preferred embodiment of the present invention, the tubular circuit is a coil flowing through the closed hollow elements. The coil can be connected to a refrigeration device for extracting heat from said eutectic fluid and bringing it to a low temperature, the refrigeration device comprising a condenser - compressor - external filter assembly located outside the vehicle, to which the tubular coil circuit can be connected by means of pipes having quick couplings. The eutectic fluid is preferably cooled to a temperature of -33°C.

[0011] In one possible embodiment the ventilation means may consist of one or more fans associated with the box-shaped enclosure and operating cooperatively with the inlet and exit slits, the temperature sensing

means may consist of a digital thermostat located for example in the driver's cab of the vehicle and connected to sensors located within said insulated load compartment.

[0012] In a preferred embodiment, the box-shaped enclosure is made of a plastics material, for example ABS, and comprises an upper casing, a front closure panel, two side closure panels, two rear uprights for wall mounting of the unit, four corner uprights and a lower water collection tank. Two thermally insulating panels, an upper and a lower respectively, with said upper thermally insulating panel pierced by slits, two thermally insulating panels, a front and rear respectively, with said front thermally insulating panel having slits at the top and openings at the bottom, and two thermally insulating panels at the sides may be located between said box-shaped enclosure and said plurality of closed hollow elements (103). The thermally insulating panels may, for example, be made of polyurethane.

[0013] In a possible alternative embodiment, the entry and exit slits may be fitted with adjustable, microprocessor-controlled opening/closing systems.

[0014] According to another aspect of the present invention, there is provided a method of using the eutectic refrigeration unit described above, the refrigeration unit being installed in a vehicle, the method comprising the steps of: refrigerating the eutectic fluid prior to use of the vehicle; and controlling the temperature within the load compartment by means of the microprocessor. The step of completely defrosting the system before it is periodically refrigerated may also be envisaged, so that the unit also has optimum efficiency when subsequently used.

[0015] According to a further aspect of the present invention, there is provided a vehicle for transporting perishable goods comprising the refrigeration unit described above.

[0016] One of the advantages of the eutectic refrigeration unit according to the present invention is that it is not cumbersome and does not require complex devices for its operation in the van, such as plug-in connectors/disconnectors to the engine, independent drive systems, etc.

[0017] Furthermore, the eutectic refrigeration unit according to the present invention is practical and simple to use, but makes it possible to maintain temperatures suitable for the storage of perishable products within the insulated vehicle compartment.

BRIEF DESCRIPTION OF THE FIGURES

[0018] An embodiment will in particular be described below with specific but not limiting reference to the plate of drawings in which

Figure 1 depicts a preferred embodiment of the eutectic refrigeration unit which is the subject of the present invention;

Figures 2a-2c show details of the unit in Figure 1;

Figure 3 shows the assembly in the previous figures installed in a van with an insulated load compartment;

Figure 4 diagrammatically illustrates a refrigeration device that can be connected to the eutectic refrigeration unit in the previous figures.

DETAILED DESCRIPTION

[0019] With reference to the attached set of drawings, Figure 1 shows eutectic refrigeration unit 100 suitable for refrigerating foodstuffs or other perishable products transported by vehicles powered by electricity, diesel, petrol, gas, methane or some other source.

[0020] Eutectic refrigeration unit 100 is intended to be installed inside the insulated load compartment V of a vehicle 300 (see Figure 3).

[0021] According to a preferred embodiment of the present invention, unit 100 comprises assembly 101, shown in Figure 2a, comprising a set of hollow elements 103 held together substantially in parallel by means, for example, of interlocking guides formed in the hollow elements themselves. Hollow elements 103 are closed so as to contain a eutectic fluid (for example a refrigerant fluid). Pipes, preferably made of copper or aluminium, run inside them in fluid communication with each other, in series with each other, through tubular fittings 107 (shown in Figure 2b) which depart from one end of an element 103 and connect to the end of a subsequent element 103. A gas (for example freon or nitrogen) at a very low temperature may be caused to flow through these pipes, which are essentially joined into an uninterrupted coil (serpentine), to cool the eutectic fluid. This cooling operation is carried out when the vehicle is stationary (for example overnight) by connecting the coil to an external machine.

[0022] Hollow elements 103 preferably have a parallelepiped shape, which allows for easy arrangement in series (side by side), but other shapes are possible.

[0023] Each of the hollow elements 103 is associated with an open hollow element 105 which functions as an air channel. In a preferred embodiment, there is one-to-one correspondence between the closed hollow elements and the open hollow elements, i.e. each closed element has its own open element with which it shares a wall of the parallelepiped (through which the heat exchange takes place), but the possibility of other configurations is not ruled out, with for example one open hollow element being associated and exchanging heat with two or more closed hollow elements; conversely, several open elements may be in contact with a single closed element.

[0024] Assembly 101 of elements 103/105 is then enclosed within a box-shaped enclosure (104), as shown in Figure 1, which enables it to be installed and substantially operate, as will become clear below.

[0025] According to a preferred embodiment of the present invention, the eutectic evaporating unit (also

called the refrigerating unit) comprising the assembly 101 and the box-shaped enclosure is suitable for refrigerating foodstuffs or other perishable products transported in electric, diesel, petrol, gas, methane or otherwise powered vehicles. The refrigeration unit is intended to be installed inside the load compartment of insulated vehicles (see Figure 3). According to a preferred embodiment of the present invention, assembly 101 comprises a set of 8 hollow elements 103, preferably of drawn aluminium alloy or plastics or stainless steel materials. The number of hollow elements 103 may of course be different and be adapted to the different needs and dimensions of the load compartment. Preferably, as already mentioned, each hollow element 103 has a corresponding open hollow element 105, but other configurations are possible and the number of hollow elements 103 and open hollow elements 105 may also be different. In a preferred embodiment, each pair comprising a hollow element 103 and an open hollow element 105 will be made using a die, where the two parts - one that will contain the eutectic fluid/fluid and one that will remain empty and open to allow the passage of air - are made by extrusion. The set of pairs of closed hollow elements 103 and open hollow elements 105 are coupled together with closed elements 103 housing the eutectic refrigerant fluid, with the latter being located in the upper part and open elements 105 in the lower part. Air circulates in open elements 105.

[0026] When the system is in operation, the suitably cooled (for example to -33°C) refrigerant liquid or fluid (eutectic fluid) transfers the frigories previously accumulated, for example during overnight charging, to the metal walls (made of aluminium, for example) which in turn transmit them to the air circulating in the open hollow elements; the air then forced to circulate in the load compartment/refrigeration chamber cools its temperature. More specifically, the air that is forced through hollow elements 105 is cooled by the refrigerant fluid. The box-shaped enclosure is provided with inlet vents or slits 111 and outlet vents or slits 109: the air is circulated by means of one or more fans that draw it from the load compartment into open hollow elements 105, where it cools in contact with the wall that divides open hollow element 105 from the corresponding closed hollow element 103 (with the refrigerant fluid) and is then fed into the load compartment through outlet vents/ slits 109. Once in the load compartment, the cooling power is transmitted from the cooled air to the environment of the load compartment. In a preferred embodiment of the present invention, the fans are placed inside the box-shaped element, but this does not rule out the fans being external and connected to the inlet slits (the fans are not shown in the figures).

[0027] Within the chambers where the eutectic refrigerant fluid is located there is the refrigerant circuitry, made, for example, of copper or aluminium; a refrigerant gas can circulate in the circuitry within the assembly 101 of closed hollow elements 103, passing from one closed hollow element 103 to the next by means of connecting pipe 107. Normally, the coil circuitry is kept closed and empty. During pre-use cooling operations, it is connected to external machinery through the nozzle of the first coil assembly and the nozzle of the last coil assembly. The machinery, shown in Figure 4, causes a gas (for example Freon R504) to flow at a very low temperature that cools the eutectic fluid.

[0028] In the lower part where the cold air circulates, there are the resistances for defrosting the system after hours of operation (the detail of the resistances is not shown in the figures). During the daily use of refrigerated vehicles the doors are opened and closed several times. Moisture entering the cell can create frost in the air passages. The heating elements are used to defrost the air passages before recharging at night.

[0029] The refrigerating unit includes an ABS cover. The vacuum or injection-moulded enclosure may be fitted with a condensate drain hole at the rear. Thermal insulation panels (for example 4 in number) may be provided to ensure effective thermal insulation of the aluminium tubes. The thermal insulation panels may be made of polyurethane or any other thermally insulating material. In a preferred embodiment of the present invention, a digital thermostat placed in the driver's cab determines the desired temperature in the insulated chamber or insulated vehicle based on the output of sensors fitted in the refrigerated compartment. An external assembly with hoses and quick couplings is connected to cool the eutectic fluid contained in the extruded piping. Connection is for example brought about through the use of a lever system using known quick-release couplings that allow rapid connection and disconnection of assembly 100 and the recharge device, ensuring a gastight seal even when disconnected. The recharging device comprises a condenser, a compressor, a fan, a filter and various accessories for defrosting assembly 100 and cooling it.

[0030] The box-shaped enclosure is preferably made of plastics, although other materials cannot be ruled out; in a preferred embodiment of the present invention the box-shaped enclosure is made of ABS.

[0031] Figure 2c shows a cross-section of cooling unit 100 and a pair of elements 103/105, showing the coil inside closed hollow element 103.

[0032] In a preferred embodiment of the present invention, thermally insulating panels are located between the box-shaped enclosure and assembly 101 at the top and bottom respectively, with two thermally insulating panels at the front and rear respectively, and two thermally insulating panels at the sides, in order to ensure effective thermal insulation of assembly 101 of closed hollow elements 103 and open hollow elements 105.

[0033] In a possible embodiment of the present invention, insulating panels are located all around the evaporating assembly, on its four sides.

[0034] By way of non-limiting example, the thermally insulating panels may be made of, for example, polyurethane. It is understood that any other effectively thermally insulating material may be used as a substitute.

[0035] The thickness of the thermally insulating material used will be decisive for a longer service life of the cooling function of unit 100.

[0036] Associated with the box-shaped enclosure are ventilation means consisting of one or more fans. The fans cause a flow of air through the box-shaped enclosure. Air enters the enclosure through a series of slits 111; the air exits via exit slits 109. Figure 1 shows air exit slits 109, while Figure 2c shows the inlet slits through which the cooled air is fed back into the cargo area. For ease of description we have indicated the inlet slits as 111 and the exit slits as 109, but it is obvious that the direction of air flow may be different and the inlet slits may act as the exit and vice versa.

[0037] The temperature sensing means may for example consist of a thermostat, for example of the digital type, which may be located in the driver's cab of the vehicle and be connected to sensors located in insulated load compartment V, in suitable positions appropriate for optimally detecting the temperature of the load compartment.

[0038] For cooling the eutectic fluid contained in assembly 101 of closed hollow cylinders 103, the assembly can be connected to a cooling device 400 (Figure 4) without removing assembly 100 from the vehicle.

[0039] Connection may be made through a pair of hoses using known quick-connect couplings, which allow quick connection and disconnection of the unit 100 to (and from) refrigeration unit 400.

[0040] Refrigeration device 400 comprises, for example, a condenser - compressor - external filter unit, all of a known type and therefore not described in further detail.

[0041] The operation and mode of application of eutectic refrigeration unit 100 is now described according to a preferred embodiment of the present invention, by way of example and without limitation. Refrigeration device 400 is independent and is put into operation when the vehicle is stationary, to cool the eutectic fluid, for example overnight, so that it can then release the frigories during vehicle movements. In one possible configuration, refrigeration unit 400 remains on the ground, for example in the garage after the vehicle is parked, but there is nothing to prevent it from being transported by the vehicle itself, perhaps incorporated into the body of the vehicle, for example on the roof of the load compartment; in this way, in the case of long journeys, perhaps of several days, refrigeration unit 400 can be put into operation when the vehicle is stationary during stops, for example by connecting it to an external power source.

[0042] First of all it is necessary to specify the following: according to the definition in the Treccani dictionary, a frigorie is defined as the amount of heat that must be withdrawn from a kilogram of water in order to decrease its temperature by 1°C; in other words, to give a body one frigorie is to subtract one calorie from it. More generally, however, calories are used in the context of both the generation and the absorption of heat. Frigories, on the other hand, are only used in relation to refrigeration. Thus, while it can be said that a refrigerating appliance produces *n frigories* or that it absorbs *n* calories, it is not normal to say that a heating appliance absorbs *n* frigories: instead, it is said that it produces *n* calories.

[0043] In the present case, for the sake of clarity, the term "frigories" (units of refrigeration) conventionally "provided" to unit 100 will be used to actually indicate the calories withdrawn from the eutectic fluid. For the same reason, the term "accumulation" of frigories in unit 100 will be improperly used in order to simplify and clarify the description.

[0044] Initially provision is made for total defrosting of the system before it is periodically refrigerated, so that unit 100 will also be satisfactorily efficient in subsequent use.

[0045] Eutectic refrigeration unit 100 is then connected to refrigeration device 400 using the connection pipes and quick couplings, without removing it from vehicle 300. The refrigerant gas will then be fed into the coils running inside hollow elements 103, causing the eutectic fluid to cool within the hollow elements.

[0046] In a preferred embodiment of the present invention, by activating refrigeration device 400, the eutectic fluid is cooled to a temperature of -33°C. This temperature is the one which, from tests carried out, has provided optimum results, but this value should not be understood to be limiting and other temperatures may instead be set and reached.

[0047] Once the eutectic fluid has cooled down, unit 100 is disconnected from unit 400 and vehicle 300 can be used to transport foodstuffs, such as fruit, vegetables, meat, fish, milk, dairy products, frozen foods, and other products that are sensitive to ambient temperature at which they can undergo changes that cause deterioration, such as pharmaceutical products, ornamental plants and flowers.

[0048] A box-shaped enclosure, made for example of steel, aluminium, ABS or other materials, allows the eutectic fluid's accumulated frigories to be stored over time and used only when necessary, as described below.

[0049] The digital thermostat in the driver's cab of vehicle 300 allows the temperature in load compartment V to be checked where the sensors are positioned. This thermostat is equipped with processing capabilities and includes a microprocessor that receives the data detected by sensors located inside load compartment V and controls operation of the ventilation means inside the box-shaped enclosure.

[0050] When the temperature in load compartment V needs to be restored to the necessary values pre-set on the thermostat, the thermostat's microprocessor activates the ventilation means (comprising one or more fans) which, drawing air from the environment of load compartment V through the slits 111, pass it through the open hollow elements 105, cooling it and then feeding it back into load compartment V through exit slits 109.

[0051] This system makes it possible to maintain a constant low temperature in load compartment V of vehicle

300 without having an active refrigeration unit on the vehicle.

[0052] In a further embodiment, inlet slits (111) and exit slits (109) may be equipped with closing means, also operable and adjustable by the thermostat's microprocessor, so that when the ventilation means are not in operation the frigories generated by the cooling system are kept longer.

[0053] The advantage of adopting the eutectic refrigeration unit according to the present invention is obvious.

[0054] In vehicles powered by an internal combustion engine there is no need for compressors connected to the engine, with complex ducting arrangements to bring the refrigerating fluid into the load compartment.

[0055] The advantage is particularly obvious when the eutectic refrigeration unit according to the present invention is fitted to vehicles with electric or hybrid drive. In this case there is in fact a need to provide an electric motor to drive the active refrigerating unit, a motor which takes the electrical energy required for traction away from the batteries.

[0056] This energy drain therefore leads to a substantial reduction in the range and performance of electric or hybrid drive vehicles.

[0057] By contrast, this drain does not occur when the eutectic refrigerating unit according to the present invention is adopted, although proper preservation of the transported products, at least for the time required for their distribution, is still ensured.

[0058] A further advantage of the present invention is that it provides a device that is well suited to the design of insulated load compartments and that is able to withstand the operating conditions resulting from the low temperatures produced inside them.

[0059] In addition, the device according to the present invention may be installed and made operational in all vehicles with insulated load compartments, both those newly manufactured and those already in operation, which can thus be easily equipped with a system that solves the problems described above.

[0060] Finally, another advantage of the present invention is that the device can be constructed as a simple but efficient form of construction, which is cost-effective to build and fit to insulated load compartments.

Claims

1. Eutectic refrigerating unit (100) for refrigerating foodstuffs or other perishable products transported in motor vehicles, intended to be placed inside the insulated load compartment (V) of a vehicle (10) and **characterised in that** it comprises:

   a plurality of closed hollow elements (103) adapted to contain a eutectic fluid;
   a plurality of open hollow elements (105), adapted to let air passing through them, each of the plurality of open hollow elements (105) being associated with and adjacent to at least one of the plurality of closed hollow elements (103) and each of the plurality of closed hollow elements (103) being associated with and adjacent to at least one of the plurality of open hollow elements (105);
   at least one part of the closed hollow elements having inside it a tubular circuit adapted to contain a refrigerant gas and let it flowing, the circuit comprising an inlet terminal and an outlet terminal, the inlet and outlet terminals adapted to be connected to an external device for the introduction of a refrigerant gas;
   a box-shaped enclosure (104) within which the plurality of closed hollow elements (103) and open hollow elements (105) are enclosed, so as to maintain the frigories generated by the eutectic fluid, the box-shaped enclosure being provided with a plurality of inlet slits and a plurality of exit slits;
   ventilation means associated with said box-shaped enclosure, the ventilation means being controllable by a microprocessor associated with temperature sensing means within said load compartment (V), in which the ventilation means are arranged to be operated and controlled by the microprocessor so as to draw air from the load compartment into the box-shaped enclosure through the inlet slits to circulate air in the open hollow elements (105) and exhaust air from the box-shaped enclosure to the load compartment through the outlet slits, thereby regulating the temperature in the load compartment.

2. Eutectic refrigeration unit according to claim 1, wherein the tubular circuit is a coil running through closed hollow elements (103).

3. Eutectic refrigeration unit according to claim 2, comprising a refrigeration device (400) which may be connected to said tubular coil circuit for extracting heat from said eutectic fluid and bringing it to a low temperature, the refrigeration device (400) comprising a condenser - compressor - external filter unit located outside the vehicle, to which the tubular coil circuit can be connected by means of pipes equipped with quick couplings.

4. Eutectic refrigeration unit according to any one of the preceding claims, in which the ventilation means comprise one or more fans associated with the box-shaped enclosure and operate in cooperation with the inlet and exit slits (109 and 111), the temperature sensing means comprising a digital thermostat located in the driver's cab of the vehicle and being connected to sensors located within said insulated load compartment (V).

5. Eutectic refrigeration unit according to any one of the preceding claims, in which said eutectic fluid is cooled to a temperature of -33°C.

6. Eutectic refrigeration unit according to any one of the preceding claims, in which said box-shaped enclosure is made of a plastics material, for example ABS, and comprises an upper casing, a front closing panel, two side closing casings, two rear uprights for wall mounting of the unit, four corner uprights and a lower water collection tank.

7. Eutectic refrigeration unit according to any one of the preceding claims, wherein between said box-shaped enclosure and said plurality of closed hollow elements (103) there are arranged two thermally insulating panels at the top and bottom respectively, with said top thermally insulating panel crossed by slits two thermally insulating panels at the front and rear respectively, with said front thermally insulating panel bearing slits at the top and openings at the bottom, and two thermally insulating panels at the sides.

8. Eutectic refrigeration unit according to claim 7, in which said thermally insulating panels are made of polyurethane.

9. Eutectic refrigeration unit according to any one of the preceding claims, in which the inlet and exit slits are provided with microprocessor-controllable, adjustable closing/opening systems.

10. Method of using the eutectic refrigeration unit according to any one of the preceding claims, the refrigeration unit being installed in a vehicle, comprising the steps of:

    - refrigerating the eutectic fluid before using the vehicle;
    - controlling the temperature inside the load compartment by means of the microprocessor.

11. Method according to claim 10, in which the system is completely defrosted before it is periodically refrigerated, so that the unit is always optimally efficient even in subsequent uses.

12. Vehicle for the transport of perishable goods comprising a refrigerating unit according to any one of claims 1-9.

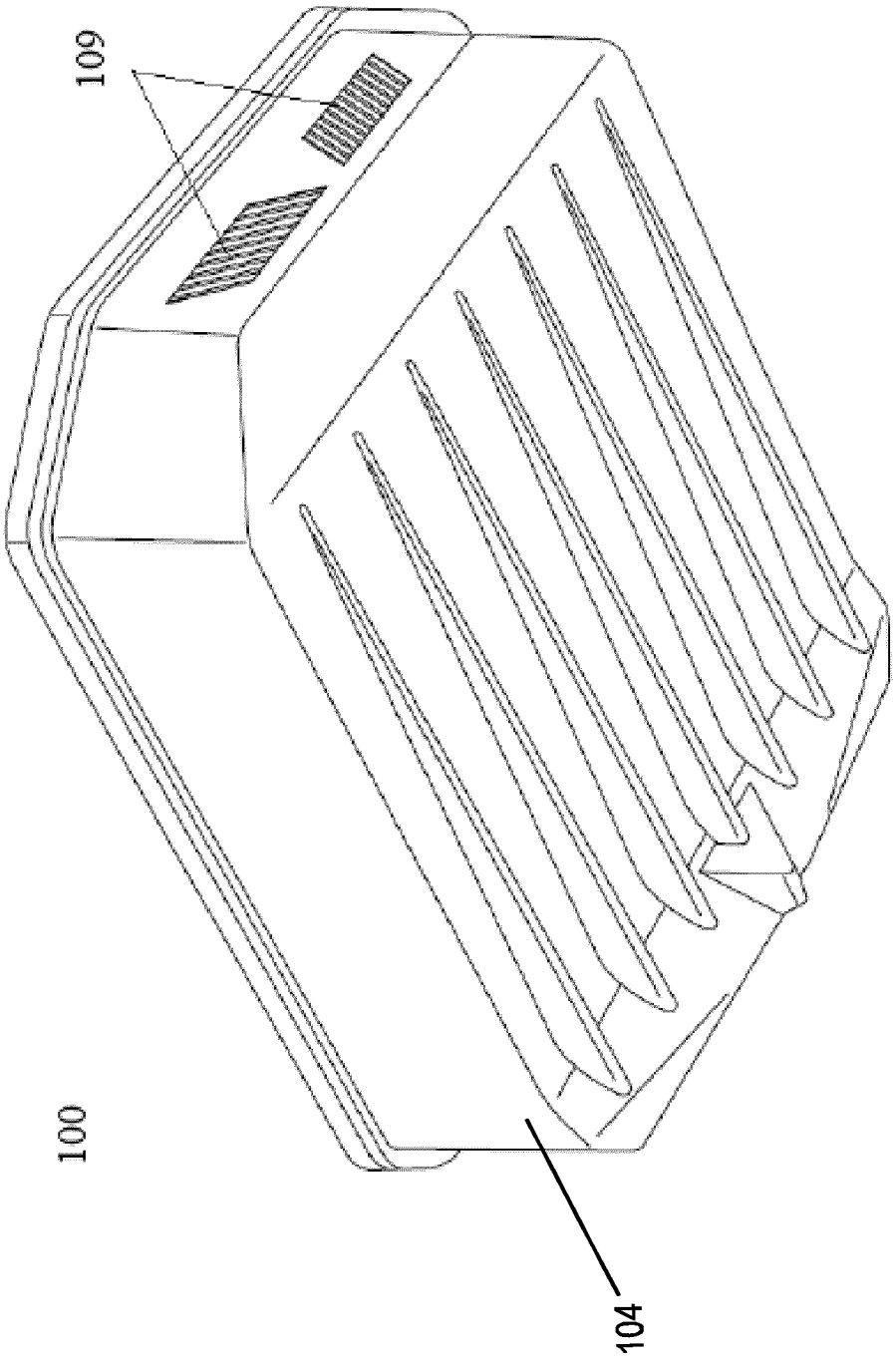

FIG. 1

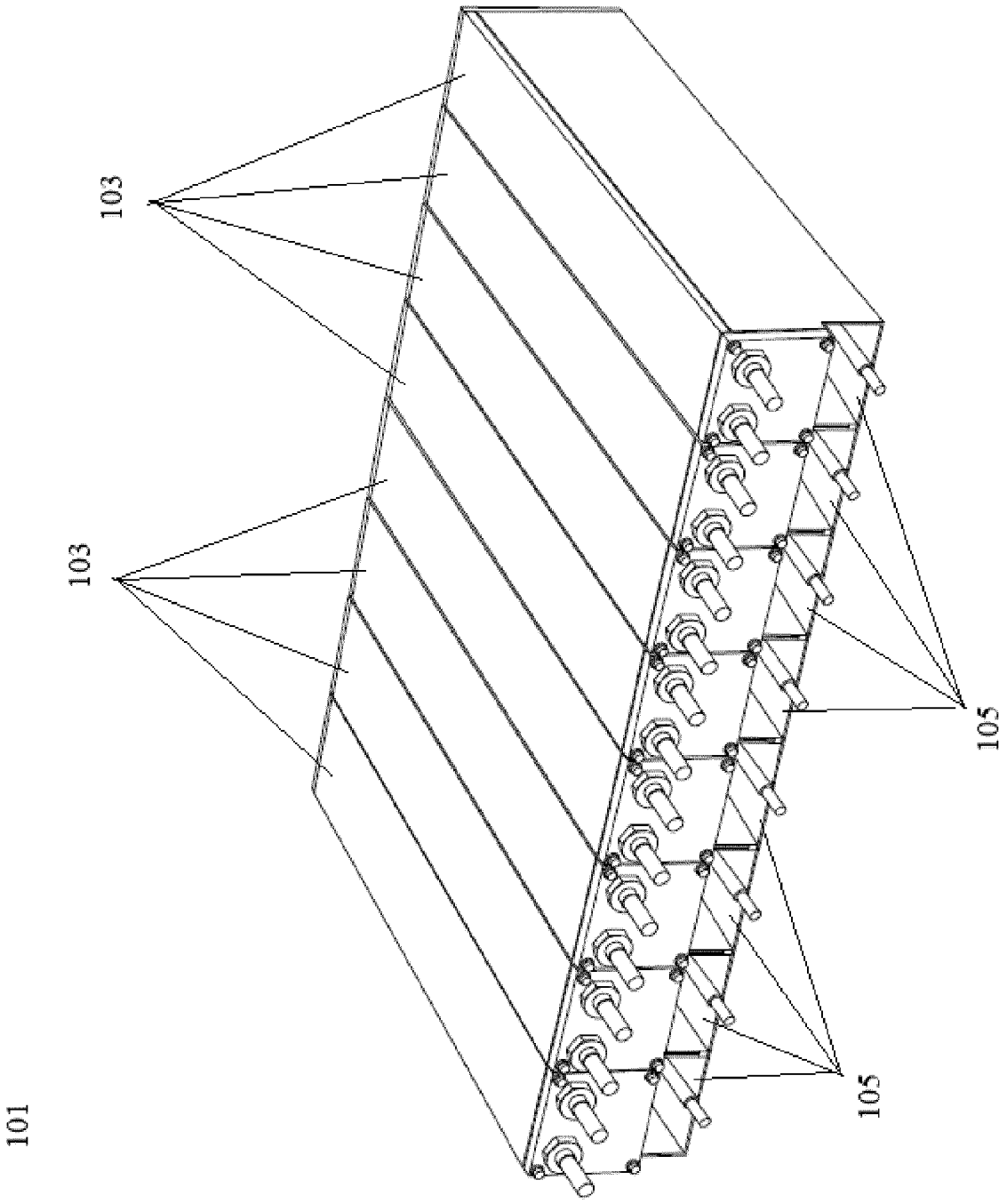

FIG. 2A

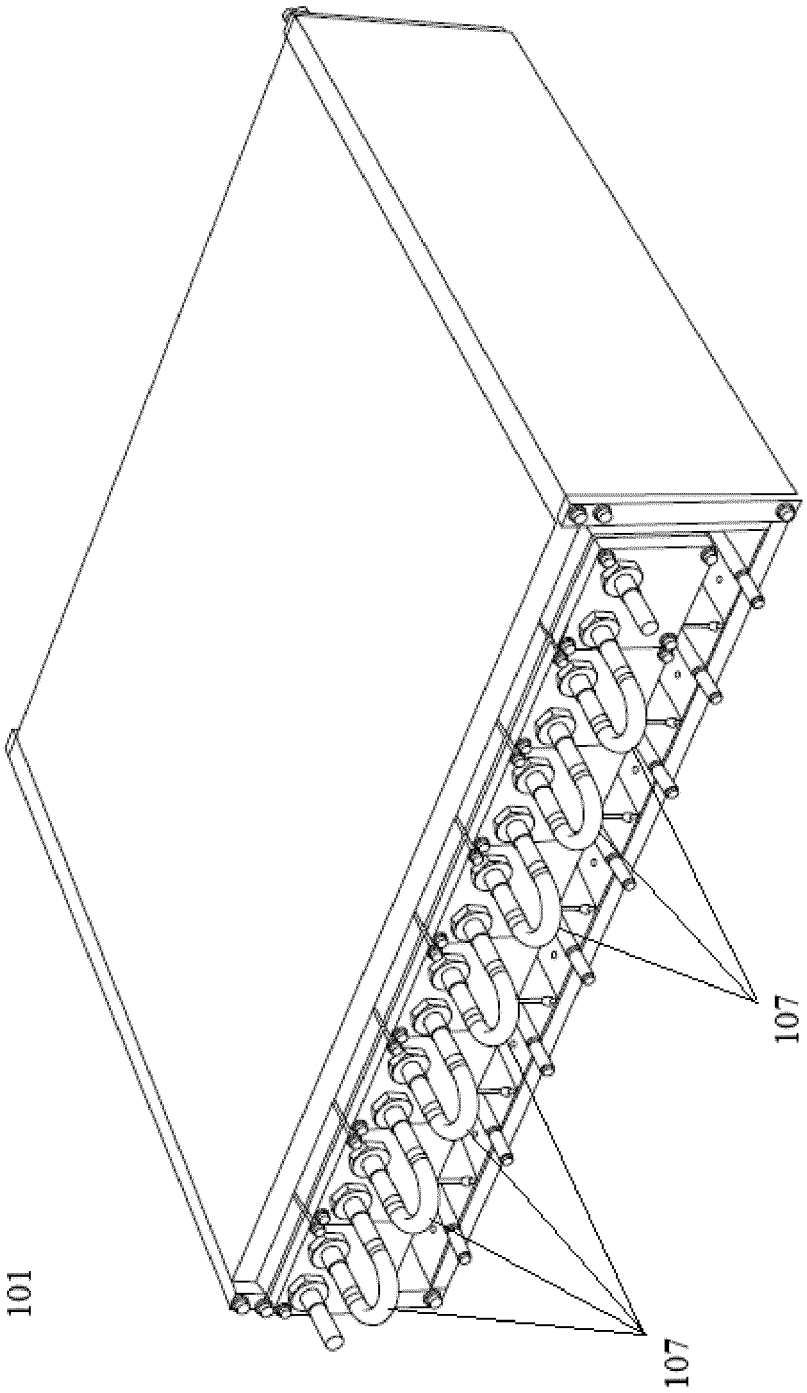

FIG. 2B

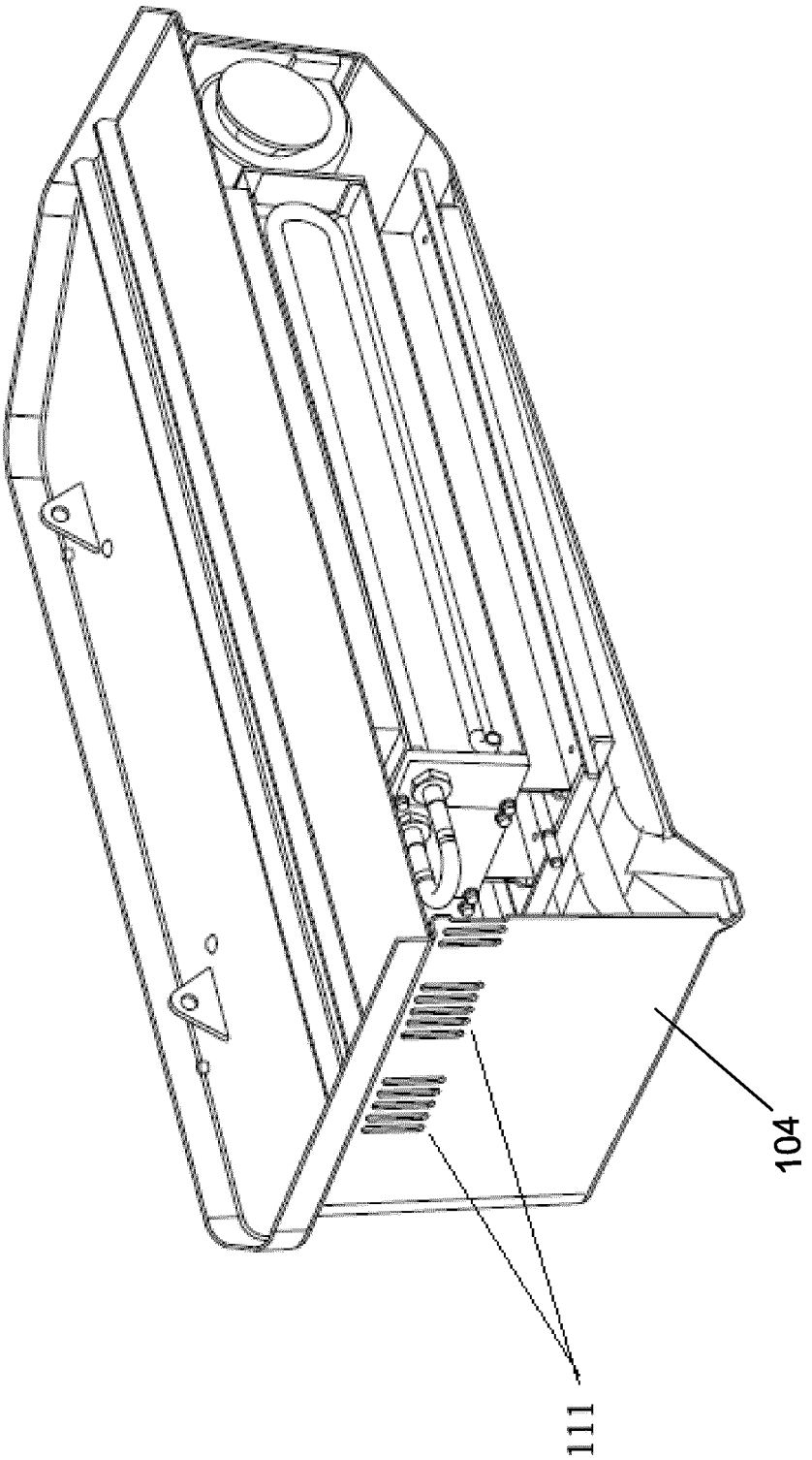

FIG. 2C

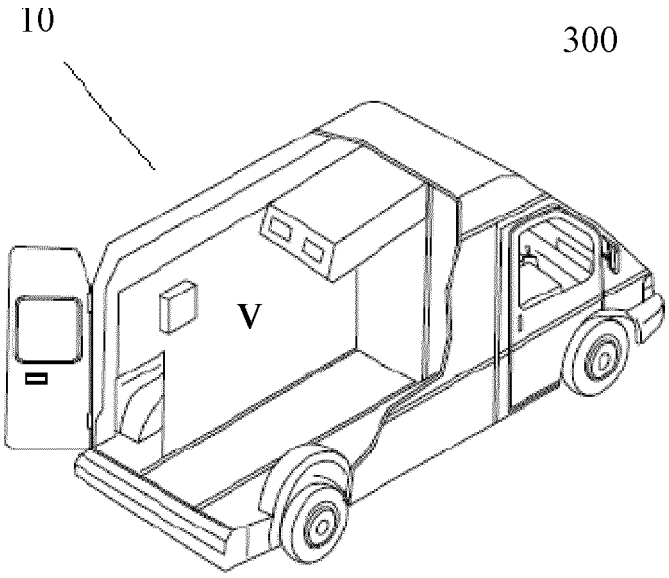

FIG. 3

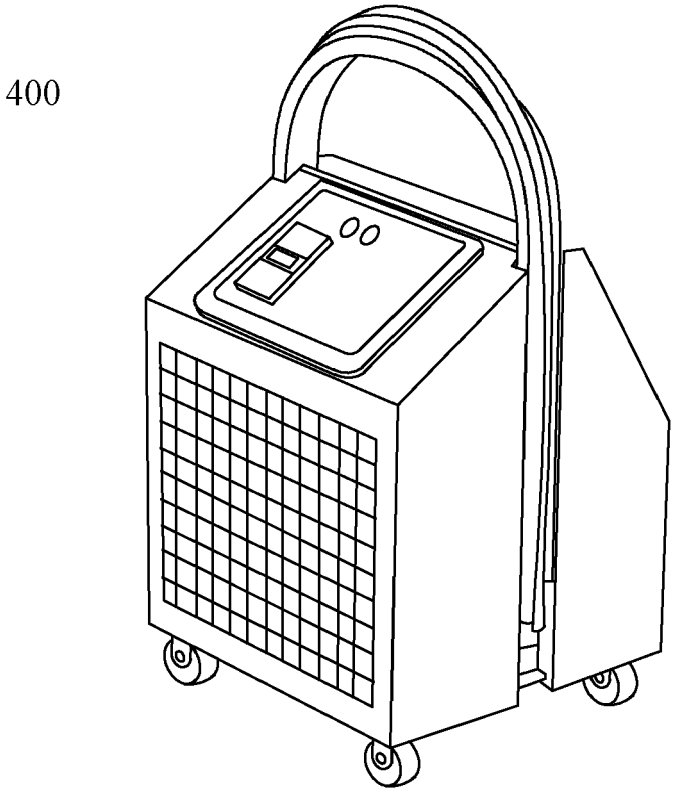

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 9503

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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