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(54) **AUTONOMOUS REFRIGERATED CONTAINER FOR STORAGE AND THERMOSTATTED
TRANSPORT OF PRODUCTS**

(57) Fully autonomous refrigerated containers, which includes a gascooled magnetic refrigeration system (3), powered by a set of electrical batteries (4) integrated into the structure of the container, which are powered by two independent energy generation systems, a

system based on wind turbines (6), and a piezoelectric generator system operated using vibrations and/or aerodynamics. The invention foresees a reduction in thermal loss by including magnetic seals in its access doors by way of a paramagnetic rubber perimeter lining profile (8).

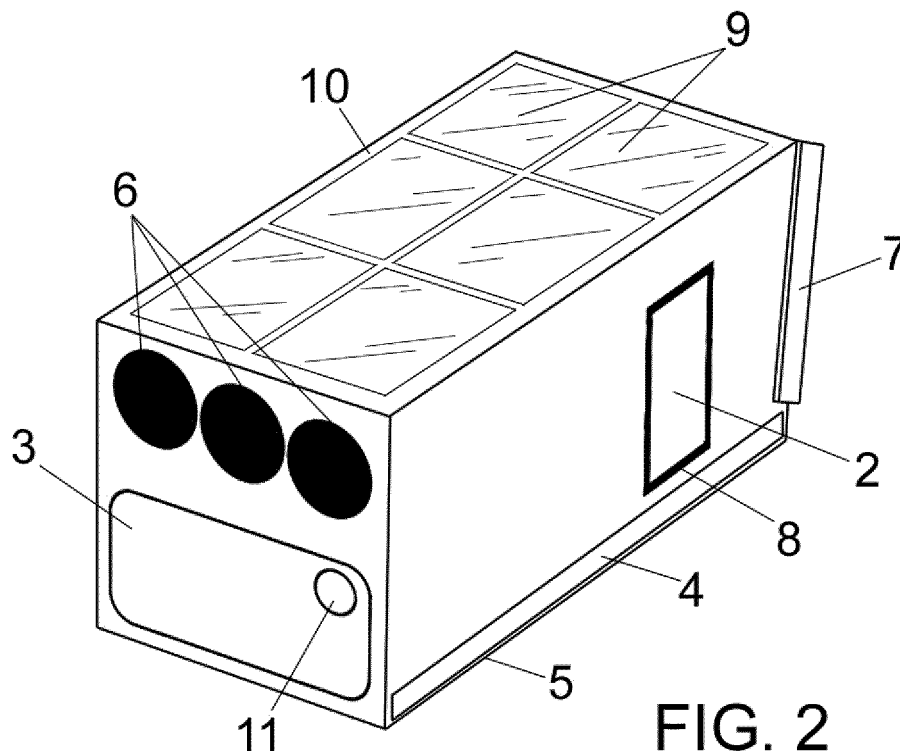


FIG. 2

Description

[0001] Autonomous refrigerated container for the thermostatted storage and transport of products.

FIELD OF TECHNOLOGY

[0002] This invention concerns an autonomous refrigerated container for the thermostatted storage and transport of products, which can be used fixed, connected to the body of a vehicle or independently as a container of the type used in rail and maritime transport, which offers optimal services in the sense of thermal insulation, the refrigeration system used, and energy autonomy.

[0003] Therefore, the purpose of the invention is to provide a container able to operate autonomously, with minimum energy consumption thanks to optimal refrigeration and insulation, with energy generation and storage media specifically designed so as not to interfere with the normal operation/use of the container.

BACKGROUND OF THE INVENTION

[0004] The scope of the practical application of the invention concerns known vehicles with containers for the thermostatted transport of products that include refrigeration systems, particularly magnetic refrigeration systems.

[0005] This technique can be used to achieve extremely low temperatures, as well as temperature ranges such as those used in normal refrigerators. Therefore, if this system is compared with traditional refrigeration systems, magnetic refrigeration is safer, quieter, more compact and more efficient, in addition to the fact that not using gases that are harmful to the ozone layer is better for the environment.

[0006] In this sense, patent CN107031490A can be mentioned, which describes a lorry with a magnetically refrigerated compartment.

[0007] The refrigeration system is powered electrically by the electrical circuit associated with the vehicle's alternator, so this solution does not apply to containers that are fully autonomous, such as those used in rail and maritime transport, as well as road transport in cases where the container must sometimes be disconnected from the vehicle transporting it.

[0008] It should be noted that the inclusion of certain known energy generation systems in the containers would involve components that might have an extremely negative effect on the aerodynamics of the vehicle, resulting in it consuming more fuel, and these could affect the normal operation of the containers themselves by not allowing doors to open fully, stacking, cargo handling, etc.

[0009] In addition, the solution given in patent CN 107031490A presents another series of limitations or technical problems to be solved, including:

- This type of container presents thermal sealing losses affecting its doors and areas providing access to the inside of the container. These losses, although not problematic (beyond the cost overrun) when the container's refrigeration system is connected to the vehicle transporting and powering it, represent a loss of autonomy in the case of an autonomous container.
- The refrigeration system uses water as a coolant, which has a limited capacity for heat transfer.

EXPLANATION OF THE INVENTION

[0010] The autonomous refrigerated container for the thermostatted supply and transport of products set out in the invention proposes to satisfactorily solve the problem previously mentioned in each of the aspects discussed, and is particularly applicable to rail and lorry transport although its use on ships is also possible with its batteries fully charged including, ultimately, an auxiliary charging system with a connection to an external network.

[0011] Therefore, based on the conventional structure of this type of container, which includes a rectangular prismatic body with an internal chamber to hold the products to be transported under thermostatted conditions, including thermal insulation panels, one or more access doors, and a refrigeration system integrated into the container itself. The invention has the particular feature that said refrigeration system is embodied in a magnetic refrigeration system cooled by a cooling fluid, and powered electrically by a set of electrical batteries that are also integrated into the structure of the container.

[0012] These electrical batteries are charged by a double energy generation system comprising a series of wind turbines integrated into the front and rear of the container, together with an energy generation system based on piezoelectric generators, associated with flaps that fold due to the effect of the wind. The base of the container can also be produced with a low, double bottom between which a system of piezoelectric generators would be integrated, which are responsible for absorbing the vibrations transmitted to the container during the journey and for transforming them into electrical energy for recharging said batteries.

[0013] In line with another of the characteristics of the invention, the doors providing access to the inside of the container may include magnetic seals, specifically a paramagnetic rubber perimeter lining that provides an optimal thermal seal for the chamber and prevents heat losses through these seals.

[0014] Optionally, in addition to the two aforementioned electrical generation systems, the roof of the container may include a series of photovoltaic solar panels that supply the battery system, thus increasing container autonomy.

[0015] Finally, particularly in cases where the containers are stacked with others of the same type, such as in

maritime transport where the energy generation system remains partially or completely unused due to the presence of adjacent containers, the container will include a safety system for connection to an external electricity network belonging to the ship, train or lorry, so that the container can continue to operate if the batteries are drained at any point.

DESCRIPTION OF THE DRAWINGS

[0016] In addition to the description provided and to ensure a better understanding of the characteristics of the invention, in accordance with a preferred practical example thereof, a set of plans are provided as an integral part of said description that represent the following by way of illustration and not limitation:

Figure 1 - shows a schematic perspective view of an autonomous refrigerated container for the thermostatted supply and transport of products in line with the purpose of this invention.

Figure 2 - shows a view similar to that of Figure 1 corresponding to a second version of the container.

PREFERENTIAL VERSION OF THE INVENTION

[0017] Given the figures provided, and specifically Figure 1, which is the preferred version of the invention, it can be seen that the autonomous refrigerated container for the thermostatted supply and transport of products is based on the conventional structure of a refrigerated container, which includes a rectangular prismatic body (1) with an internal chamber to hold the products to be transported under thermostatted conditions, including thermal insulation through a series of lined panels accessed through one or more doors (2) and with a refrigeration system (3) integrated into the front-rear part of the container.

[0018] Based on this conventional structure, the refrigeration system (3) is to be a magnetic refrigeration system cooled by a cooling fluid such as a gas (helium, for example).

[0019] This refrigeration system is powered by a set of electrical batteries (4) integrated into the base (5) of the container, laid out horizontally to ensure a minimal effect on its charging capacity.

[0020] As mentioned, the electrical batteries (4) are powered by two independent energy generation systems.

[0021] The first of the systems involves a series of wind turbines (6) integrated into the front and top area of the container, which is usually in contact with the wind when the container is transported by lorry and by train, and that has no negative effect of the aerodynamics of the container.

[0022] The second of the planned generation systems involves an energy generation system based on piezo-

electric generators.

[0023] These piezoelectric generators will be associated with folding flaps (7) moved by the wind that operate the piezoelectric generators mentioned to obtain energy that is stored in the electrical batteries (4).

[0024] These flaps will preferably be located in line with the rear vertical edges of the container so as not to become an obstacle when opening and closing the doors, or when handling the container itself when hoisting and positioning it.

[0025] Alongside this, the base (5) of the container may have a dual layer structure, with a low, double bottom, vertically movable, between which a system of piezoelectric generators would be integrated that is responsible for absorbing the vibrations transmitted to the container during the journey and for transforming them into electrical energy to charge said batteries (4).

[0026] All the doors (2) providing access to the inside of the refrigeration chamber of the container will include magnetic seals by way of a paramagnetic rubber perimeter lining (8) to provide the optimal thermal seal of the chamber and prevent heat losses through these seals.

[0027] In line with Figure 2, a second practical version of the invention has been planned in which the container also has a series of photovoltaic panels (9) installed on its roof (10), through which the system of electrical batteries is also supplied.

[0028] Finally, as a safety system, the container will have means of connection (11) to an external electrical network which will obviously only be used in exceptional circumstances when the remaining energy generation and storage systems are insufficient for keeping the refrigeration system (3) permanently operational.

Claims

1. Autonomous refrigerated container for the thermostatted supply and transport of products, of the type that includes a rectangular prismatic body (1) with an internal chamber to hold the products to be transported under thermostatted conditions, including thermal insulation through a series of lined panels accessed through one or more doors (2) and with a refrigeration system (3) integrated into the structure of the container, with the following structural characteristics:

a) the refrigeration system (3) is a magnetic refrigeration system cooled by a cooling fluid.

b) the refrigeration system (3) is powered by a set of electrical batteries (4) integrated into the structure of the container,

c) the electrical batteries (4) are powered by two independent energy generation systems, a system based on wind turbines (6), and a piezoelectric generator system operated using vibrations and/or aerodynamics.

d) The doors (2) accessing the inside of the refrigeration chamber of the container include magnetic seals by way of a paramagnetic rubber perimeter lining profile (8).

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2. Autonomous refrigerated container for the thermostatted supply and transport of products, according to claim 1, **characterised by** the fact that the fluid used in the magnetic refrigeration system (3) is a gas. 10

3. Autonomous refrigerated container for the thermostatted supply and transport of products, according to claim 1, **characterised by** the fact that the piezoelectric generators are connected to folding flaps (7) at the front side area of the container and moveable in the wind. 15

4. Autonomous refrigerated container for the thermostatted supply and transport of products, according to claim 1, **characterised by** the fact that the piezoelectric generators are connected to the base (5) of the container based on a dual layer structure, with a double bottom that can be moved vertically, and that provide a method for absorbing vibrations transmitted to the container during the journey and the transforming of these vibrations into electrical energy to charge the electrical batteries (4). 20 25

5. Autonomous refrigerated container for the thermostatted supply and transport of products, according to claim 1, **characterised by** a series of photovoltaic solar panels (9) installed on its roof (10) to power the electrical battery system. 30 35

6. Autonomous refrigerated container for the thermostatted supply and transport of products, according to claim 1, **characterised by** the fact that the electrical batteries (4) include a means of connection (11) to an external electrical network. 40

7. Autonomous refrigerated container for the thermostatted supply and transport of products, according to claim 1, **characterised by** the fact that the electrical batteries (4) are integrated into the base (5) of the container, laid out horizontally. 45

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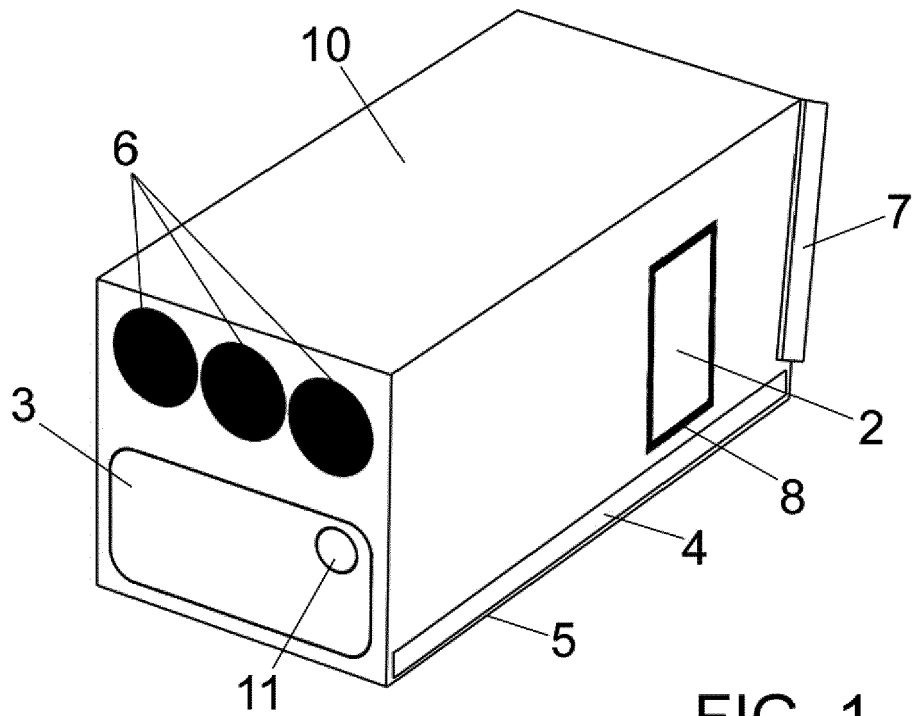


FIG. 1

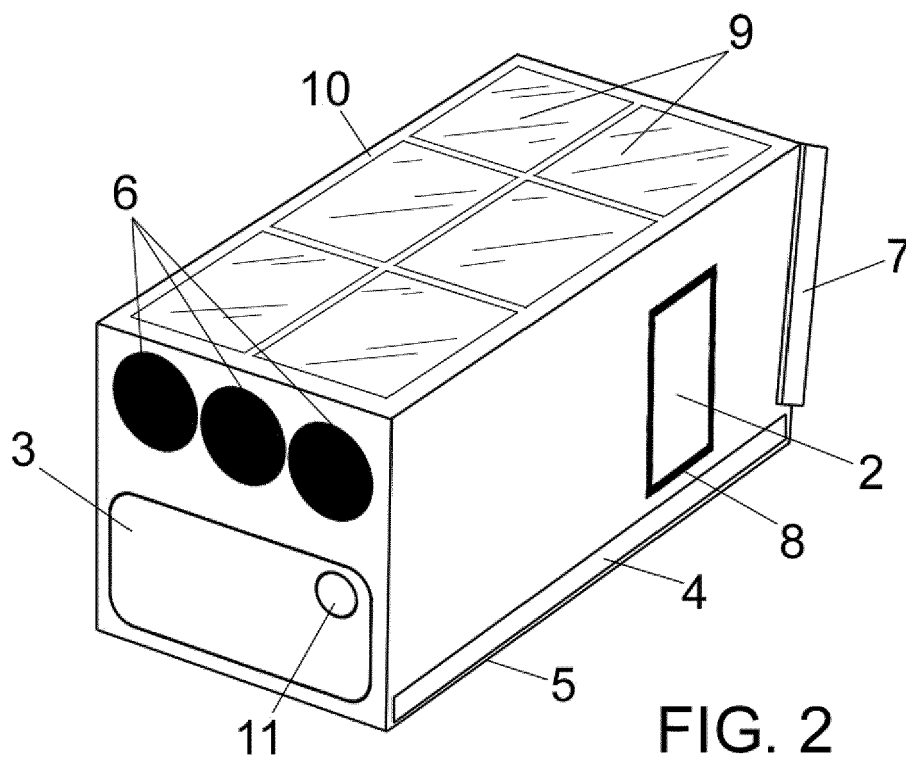


FIG. 2



EUROPEAN SEARCH REPORT

Application Number

EP 22 38 2110

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EPO FORM 1503 03.82 (P04C01)

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X	US 2018/274843 A1 (LOMBARDO MARY TERESA [US] ET AL) 27 September 2018 (2018-09-27) * abstract; figures 1-5 * * paragraphs [0027], [0028] * -----	1-7	INV. F25B21/00 F25B27/00 F25D11/00
X	US 2017/261237 A1 (HIGH DONALD R [US] ET AL) 14 September 2017 (2017-09-14) * abstract; figures 1-7 * * paragraphs [0018], [0020] * -----	1-7	
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			TECHNICAL FIELDS SEARCHED (IPC)
			F25B F25D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 12 July 2022	Examiner Yousufi, Stefanie
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 38 2110

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