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TITLE: REFRIGERATED AIR FREIGHT CONTAINER

FIELD OF THE INVENTION

- 5 The present invention relates to refrigerated freight containers to be carried by aircraft. In particular, the invention relates to such containers wherein the contents of the container may be refrigerated while the container is both within the aircraft and while the container is on the ground in transit to or from an aircraft.

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BACKGROUND OF THE INVENTION

A number of attempts have been made to produce a refrigerated aircraft freight container which will operate while in an aircraft and while in transit on the ground.

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United States patent 3,889,486 to Grayson W. Hinckley discloses a removable refrigeration system which uses dry ice. Insulation panels line the interior surfaces of the cargo container and support each other so that no connections between the panels and the cargo container are necessary. The panel lining the door of the cargo container is forced against the other insulation panels by the force used to close the door of the cargo container, forming an enclosed space sealed from the atmosphere. A box carrying dry ice is carried in a corner of the enclosed space and is insulated from the bulk of the enclosed space. Inlet and outlet ports allow air to flow over the box. A slidable cover is provided over the outlet port to regulate the amount of air flowing around the box.

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United States patent 4,276,752 to Peter R. Modler, et. al. discloses an insulated container with an insulated bunker which includes a heat exchanger portion located within one of the to corners of the freight container. The bunker holds a coolant, such as dry ice. Vapour from the coolant is vented to the outside of the container.

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United States patents 5,473,908 and 5,819,550 to Louis P. Saia and Russell Andrews discloses transportable containers which are cooled by the boiling off of a liquid refrigerant.

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United States patent 5,491,979 to Harald Kull et. al. discloses a refrigerated food trolley for an aircraft. The trolley has a heat exchange surface directly connected to a coolant flow circuit in the trolley. When the trolley is parked in a parking space for example in an aircraft galley, the heat exchange surface of the trolley is in heat exchange contact with a heat exchanger connected to a central refrigerant circuit in the aircraft.

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United States patent 5,369,960 to Hans-Juergen Mueller, et. al. discloses an insulated container including a coolant circuit, which circuit is connected to a source of coolant fluid within the aircraft.

In contrast, the present invention seeks to provide a refrigerated aircraft freight container which can be used both in an aircraft and removed from the aircraft, and which does not need to be charged with solid or liquid refrigerants.

- 5 The present invention also seeks to provide a refrigerated aircraft freight container which does not require connections to a refrigerant source mounted in the aircraft.

SUMMARY OF THE INVENTION

- 10 The present invention accordingly provides a refrigerated air freight container which includes:-
- an insulated housing having an interior region;
- a refrigerator unit which is mounted on the housing for refrigerating the interior region of the housing, which refrigerator unit includes:
- 15 an electrically powered compressor which operates at a given power supply voltage and frequency
- evaporator means and
- condenser means; and
- the refrigerated air freight container further including at least one voltage and frequency
- 20 converter which converts received power at one of several voltages and at one of several frequencies to power at a voltage and frequency required to drive the compressor and which is constructed and arranged to receive airplane generated power in flight and ground generated electrical power on the ground, said converter being constructed and arranged to convert the airplane generated power and the ground generated power to
- 25 power at the voltage and frequency required to drive the compressor.

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PREFERRED FEATURES OF THE INVENTION

Preferably, the first voltage which is received by the voltage converter may be within a range of voltages.

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Preferably that range of voltages includes 240 volts and 115 volts.

Preferably, the first frequency which is received by the voltage converter may be within a range of frequencies.

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Preferably, the second voltage and frequency may be direct current.

It is also preferred that the refrigerator unit is removably mounted on the housing.

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BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an isometric view of a refrigerated air freight container according to one embodiment of the present invention.

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Figure 2 is a cross-sectional view of the insulated housing of Figure 1.

Figure 3 shows a detail of the connection between the insulated housing and the refrigerator unit of Figure 1.

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Figure 4 shows details of the internal configuration of the refrigerator unit of Figure 1.

In order that the invention may be more readily understood, preferred embodiments of it will now be described with reference to the drawings.

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DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Figure 1 shows a refrigerated air freight container 1.

5 The container 1 includes an insulated housing 2 and a refrigerator unit 3. In the present embodiment of the invention, the refrigerator unit 3 is readily detachably mounted to the insulated housing 2 as described below.

10 In alternative preferred embodiments of the invention, the refrigerator unit 3 is permanently attached to the insulated housing 2.

15 The insulated housing 2 according to the embodiment of Figures 1 to 3 includes insulated side, bottom and top walls configured to generally conform to the shape required of a standard airfreight container. One end wall includes doors 4 which are kept closed by the latching mechanism 6.

20 There is a rectangular opening 7 in the top of the insulated housing 2. The peripheral edges 8 of the opening are countersunk at 9. A peripheral ledge 11 extends from the refrigerator unit 3 for supporting the refrigerator unit 3 on the countersunk edges 9. A deformable seal 12 retains the refrigerator unit 3 firmly in place in the opening 7 and aids in the insulation of the interior of the housing 2 from the external environment. Preferred materials for the seal 12 include butyl rubber and silicon rubber.

25 The mounting of components within the refrigerator unit 3 is shown in Figure 4. According to the present embodiment of the invention, the refrigerator unit 3 includes two refrigeration circuits. There are two condensers 11 and two electrical components boxes 12 mounted within the refrigerator unit 3. There are two evaporators (not illustrated) and two fans (not illustrated) mounted on the underneath side of the refrigeration unit 3.

30 Valving (not illustrated) allows either or both of the condensers 11 to supply refrigerant to either or both of the condenser/evaporator pairs. Both of these refrigeration circuits are used for freezing, and only one of these circuits is used for chilling.

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The present embodiment of the invention has two electrical power inlets. The first of these is adapted to plug into the Australian standard 240 volt / 50 Hz mains power supply. The second of these power inlets is adapted to plug into the aircraft standard three phase 115 volt / 400 Hz power supply. The supply from this second power inlet is
5 rectified, and the rectifier supplies power to two independent converters. The converters each output power at 240 volts / 50 Hz. Each of the converters powers one refrigeration circuit.

According to alternative preferred embodiments of the invention (not illustrated) the
10 invention has only one electrical power inlet. The supply from this one inlet is rectified and converted to an appropriate voltage and frequency to power the refrigeration circuits.

CLAIMS

1. A refrigerated air freight container which includes:-
an insulated housing having an interior region;
5 a refrigerator unit which is mounted on the housing for refrigerating the interior region
of the housing, which refrigerator unit includes:-
an electrically powered compressor which operates at a given power supply voltage and
frequency
evaporator means and
10 condenser means; and
the refrigerated air freight container further including at least one voltage and frequency
converter which converts received power at one of several voltages and at one of several
frequencies to power at a voltage and frequency required to drive the compressor and
which is constructed and arranged to receive airplane generated power in flight and
15 ground generated electrical power on the ground, said converter being constructed and
arranged to convert the airplane generated power and the ground generated power to
power at the voltage and frequency required to drive the compressor.
2. A refrigerated air freight container as claimed in Claim 1 wherein the range of
20 voltages of the power received includes 240 volts and 115 volts.
3. A refrigerated air freight container as claimed in Claim 1 or 2 wherein the range
of frequencies of the power received includes 400Hz, 60Hz and 50Hz.

4. A refrigerated air freight container as claimed in Claim 1, 2 or 3 wherein the voltage and frequency required to drive the compressor is 240 volts at 50Hz.
- 5 5. A refrigerated air freight container as claimed in any one of Claims 1-4 wherein the refrigerator unit is removably mounted on the housing.