United States Patent [19]

Vold et al.

[11] **3,871,188**

[45] **Mar. 18, 1975**

[54] **DEMOUNTABLE TRANSPORTATION REFRIGERATION UNIT**

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[73] Assignee: **Thermo King Corporation,** Minneapolis, Minn.

[22] Filed: **Sept. 7, 1973**

[21] Appl. No.: **395,314**

[52] **U.S. Cl.** **62/298,** 62/323, 62/263, 62/262, 62/448, 62/419

[51] **Int. Cl.** **F25d 19/00**

[58] **Field of Search** 62/323, 449, 450, 448, 62/263, 298, 299, 302, 262

[56] **References Cited**

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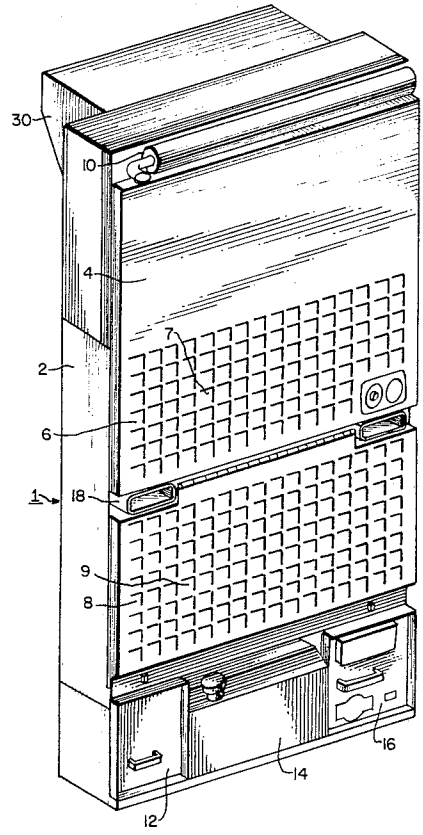
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Primary Examiner—William J. Wye
Attorney, Agent, or Firm—C. F. Renz

[57] **ABSTRACT**

This invention relates to a transportable refrigeration unit which is to be removably secured to the exterior of an enclosed storage compartment to be refrigerated. A main frame is provided with means to receive an evaporator coil and evaporator associated intake and discharge nozzle ducts, a condenser, and a compressor in a substantially vertical alignment with respect to one another. The evaporator discharge duct is adapted to extend through an aperture in the storage compartment when the main frame is removably attached to the compartment, whereby air passing through the evaporator coil may be circulated through the ducts and into the storage compartment.

2 Claims, 6 Drawing Figures



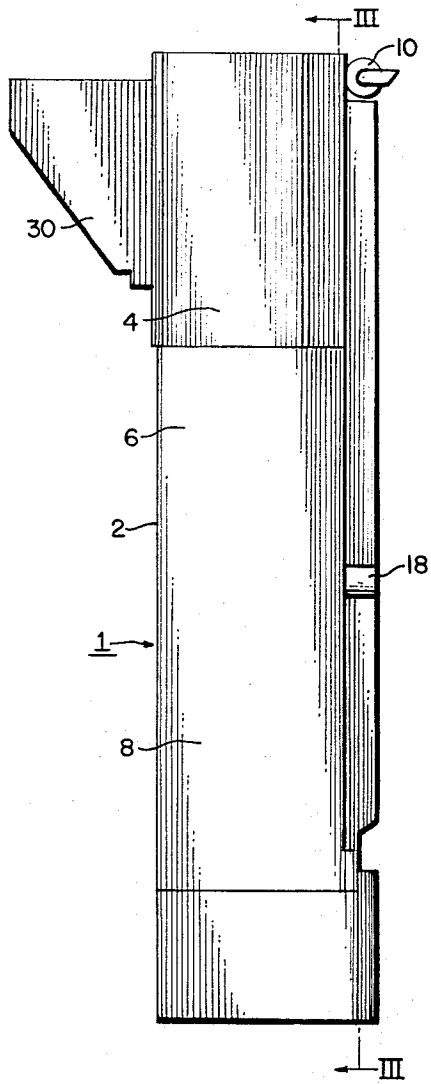


FIG. 2.

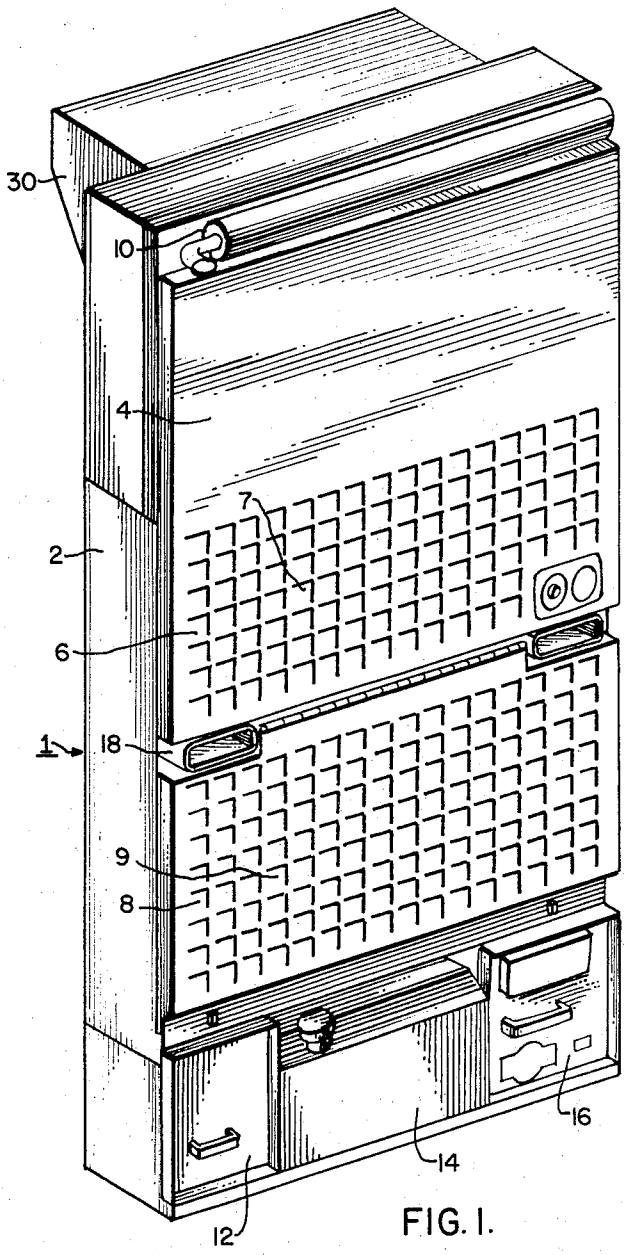


FIG. 1.

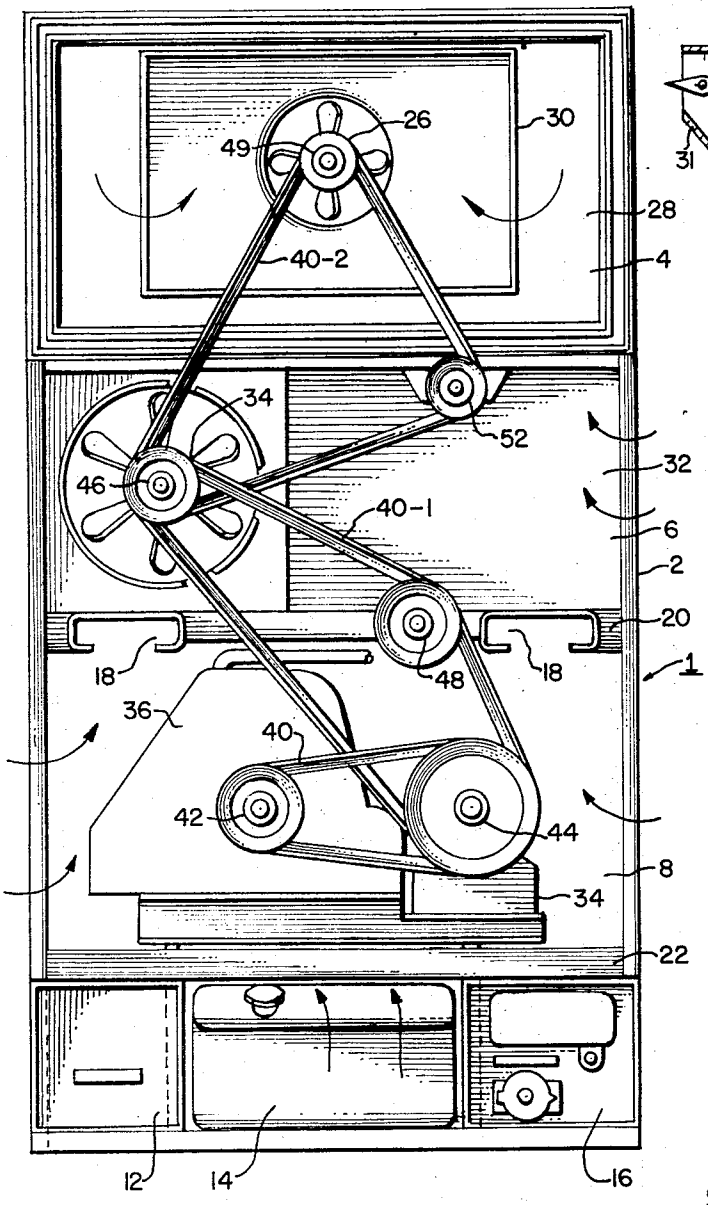

49
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40-1
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FIG. 3.

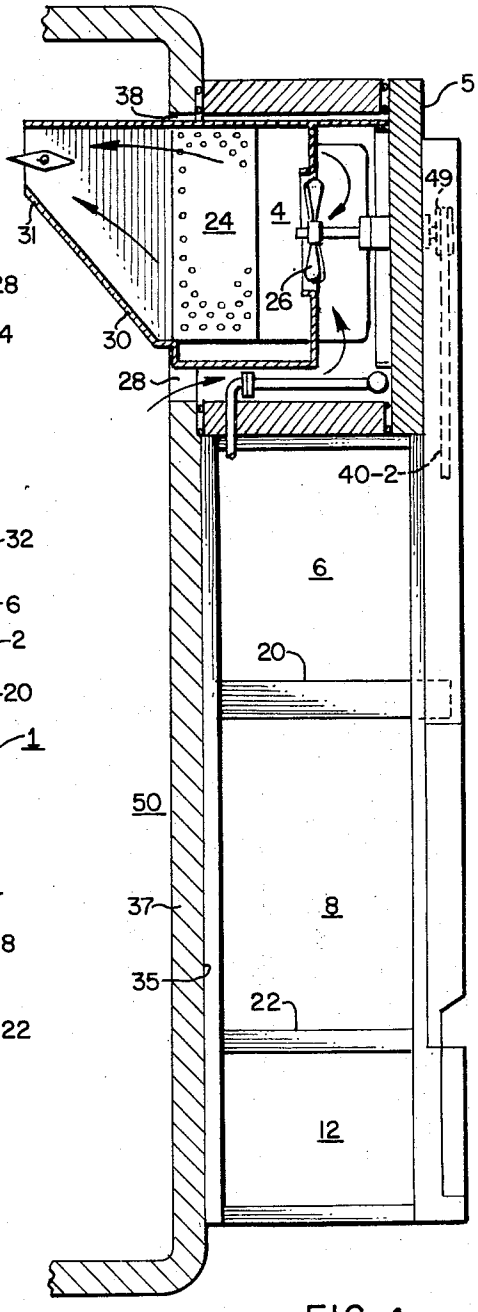

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FIG. 4.

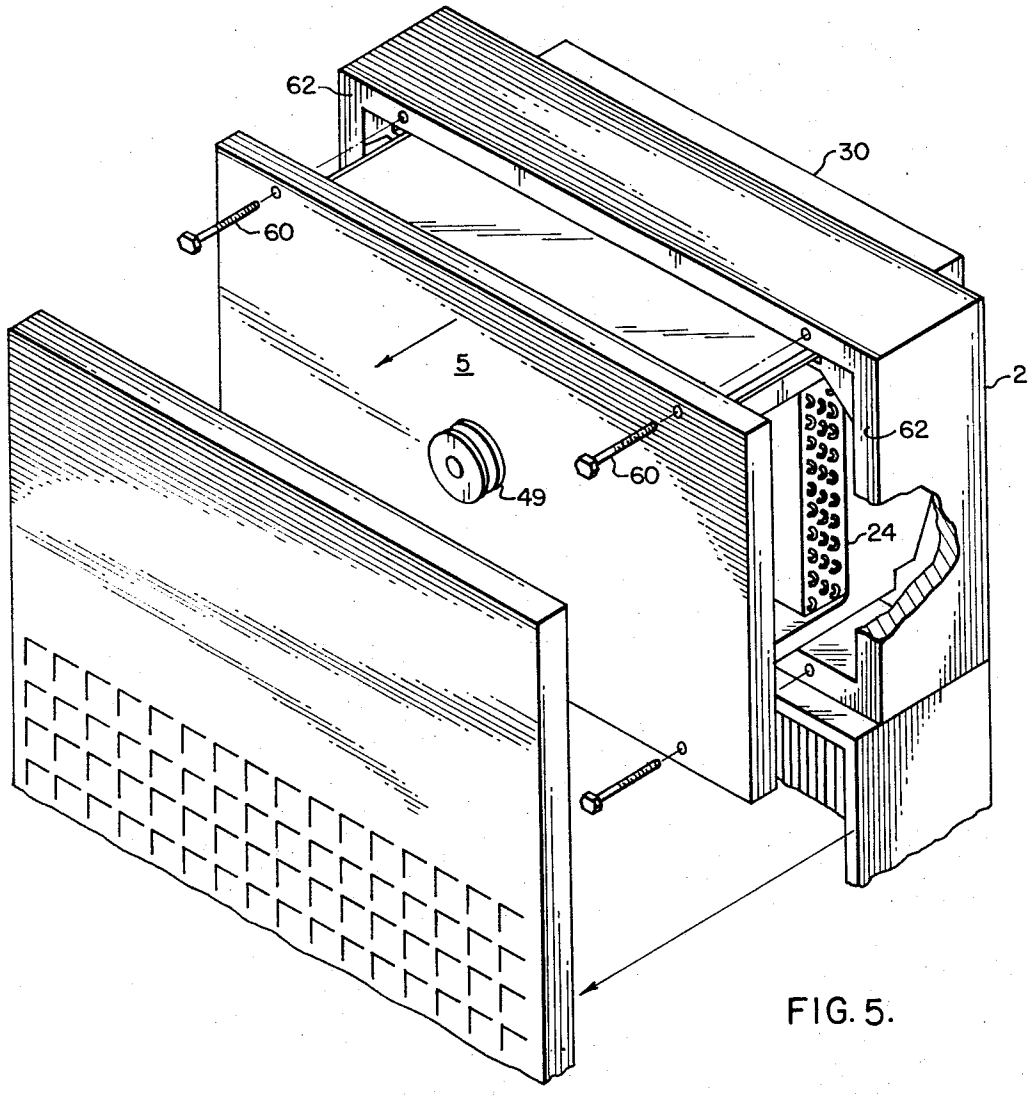
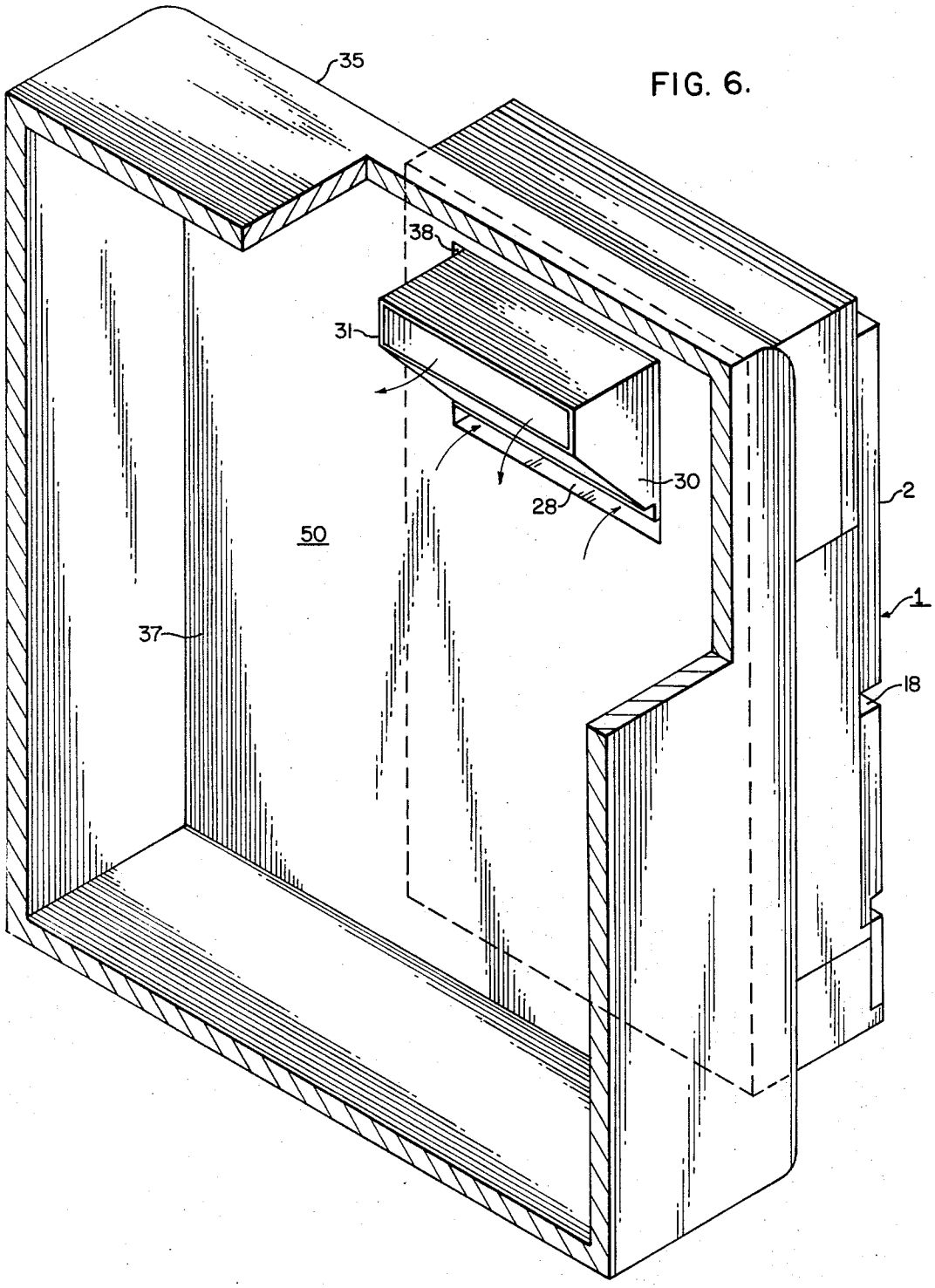


FIG. 5.

FIG. 6.



DEMOUNTABLE TRANSPORTATION REFRIGERATION UNIT

CROSS REFERENCES TO RELATED APPLICATIONS

So far as known, this application is not related to any pending patent application.

BACKGROUND OF THE INVENTION AND PRIOR ART

Transportable refrigeration units have been equipped with apparatus to insure that a vehicle storage compartment will remain sufficiently chilled during the transit of a perishable cargo. It has become necessary to arrange the apparatus of the refrigeration unit within the vehicle storage compartment so as to occupy a minimum amount of the storage space. Examples of patents which disclose transportable refrigeration units and economical arrangements of the refrigeration apparatus within the cargo carrying storage compartment are as follows:

2,735,277	A. R. Clark	Feb. 21, 1956
2,630,687	R. D. Acton	March 10, 1953.

However, in the aforementioned patents as with other known conventional transportable refrigeration units, the fact that the refrigeration apparatus including the evaporator coil is disposed within the vehicle storage compartment inherently results in a less than completely efficient use of the storage compartment.

Another difficulty with conventional transportable refrigeration units having refrigeration apparatus disposed within the storage compartment occurs in the event that the storage compartment is filled with cargo and a component of the refrigeration apparatus within the cargo space is in need of repair or replacement. In order to effect such repairs, it may become necessary to unload the storage compartment to gain access to the defective part thus resulting in loss of time and the possibility that a perishable cargo could become damaged due to its removal from the refrigerated unit.

It is therefore desirable and is an object of this invention to supply a removably securable transportable refrigeration unit that provides for a unique and efficient arrangement of the refrigeration apparatus in relation to the vehicle storage compartment to maximize usable cargo space, improve the ease in operator monitoring, and facilitate installation or removal of components in the event maintenance or repair is required.

SUMMARY OF THE INVENTION

A transportable refrigeration unit is disclosed which may be removably secured to the exterior of an enclosed cargo carrying compartment to be refrigerated. The unit, which is to be belt driven, includes an evaporator coil, an evaporator fan, evaporator associated intake and discharge nozzle ducts, a condenser, a compressor, and a main frame. The main frame has means to receive the evaporator coil and the associated intake and discharge ducts, the condenser, and the compressor in substantially vertical alignment with respect to one another. The discharge duct nozzle is adapted to extend through an aperture of the storage compartment when the main frame is removably attached to the outside of the compartment. Air passing through the evaporator coil may be circulated to and from the cargo through the intake and discharge ducts by means of the evaporator fan.

By virtue of the unitary frame construction and the disposition of the refrigeration apparatus on the exterior of the compartment, the vertically aligned evaporator coil and associated ducts, evaporator fan, condenser and compressor may all be removed from the exterior of one storage compartment to be mounted on the exterior of a different storage compartment as an entire unit and all within a single main frame. Likewise, with the unit disposed at a point on the exterior of the storage compartment, valuable cargo carrying space can be preserved within the compartment. Also, if desired, only the evaporator, the evaporator fan, and the associated intake and discharge ducts which is supported on a unit frame, may be removed from the main frame without disturbing the cargo in the event repair or replacement of the evaporator coil or the evaporator fan is desired.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric view of the transportable refrigeration unit of the instant invention;

FIG. **2** is a side elevation of the transportable unit of FIG. **1**;

FIG. **3** is a sectional view taken along lines 3—3 of FIG. **2**;

FIG. **4** is a partial cross sectional view of the transportable unit showing the evaporator compartment in relationship to the vehicle storage container and to the storage container wall;

FIG. **5** shows another feature of the instant invention, the removability of the entire evaporator unit assembly from the main frame of the transportable unit; and

FIG. **6** is an isometric view showing the positional relationships between the transportable unit main frame and the unit evaporator discharge duct to the interior of the vehicle storage container.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to FIGS. **1** and **2** of the drawings, the front and side of a transportable refrigeration unit assembly **1** is shown which is to be removably secured in any suitable manner (not shown) to the exterior of an enclosed vehicle container that may be used for storing and transporting a perishable commodity. The assembly **1** includes a main frame **2** that comprises (and as will be explained in more detail hereinafter) an evaporator compartment **4** having an associated discharge duct **30**, a condenser compartment **6** having a grill member **7** through which high velocity heated air may be exhausted by means of a condenser fan (not shown), and a compressor compartment **8** having a grill member **9** for also exhausting high velocity heated air. An exhaust muffler **10** of conventional design and utility is disposed conveniently atop evaporator compartment **4**, as shown. Disposed at the bottom of frame **2** is a battery **12** for providing power to electrical controls, a fuel tank **14** for storing fuel to be supplied to the main source of mechanical power, and an engine control box **16** containing the electrical control circuits for operating the refrigeration unit **1**. A pair of fork lift prong receptacles **18** are suitably positioned between the condenser and compressor compartments **6** and **8** to enable the unit **1** to be maneuvered into position relative to the storage compartment (not shown).

Referring to FIGS. 3 and 4, evaporator compartment 4 is shown comprising an evaporator coil 24 (shown in FIG. 4), an evaporator fan and motor 26, and evaporator associated intake and discharge ducts 28 and 30 respectively, all attached to an evaporator unit frame panel 5. Condenser compartment 6, which is mounted upon a tray 20 of main frame 2, comprises a condenser 32 and a condenser fan and motor 34. The compressor compartment 8, which is mounted upon a tray 22 of frame 2, includes a compressor 34 and a source of mechanical power which, in the preferred embodiment, is an internal combustion machine 36, such as a self-contained gasoline driven engine.

In accordance with the instant invention, the evaporator coil 24 and associated intake and discharge ducts 28 and 30, the condenser 32, and the compressor 34 are arranged in substantially vertical alignment with respect to one another when in the assembled relationship in frame 2. When frame 2 is removably attached to the exterior 35 of the vehicle container wall 37, only the discharge duct 30, which is tapered so as to form an exit nozzle 31, is adapted to be extended through an aperture 38 formed in the storage container wall 37 and into the interior of the enclosed storage container, designated generally by the numeral 50 and shown in greater detail in FIG. 6.

Referring now to FIG. 6, frame 2 is shown removably secured to the exterior 35 of storage container 50. By virtue of a unitary construction of frame 2 and fork lift prong receptacles 18, when desirable, the vertically aligned refrigeration apparatus shown in FIG. 3 may be removed from the exterior of one storage container to be repaired or to be relocated upon the exterior of another storage container as an entire unit and all within the single frame 2. In the instant invention, frame 2 is to be nose mounted upon a vehicle container but may be disposed at any convenient point on the exterior of the storage container so that only tapered discharge duct 30 extends through an aperture 38 in the storage container wall 37 and into storage container 50. Cooled air being circulated through the evaporator coil may be discharged into storage compartment 50 by means of the evaporator fan. Thus, valuable cargo space may also be preserved for more efficient use.

The apparatus of the transportable refrigeration unit 1 shown in FIG. 3, is adapted to be entirely belt driven by engine 36. A first drive belt 40 is connected between a clutch pulley 42 on engine 36 and a pulley 44 on compressor 34. A second drive belt 40-1 is connected between compressor pully 44 to a pulley 46 of the condenser fan motor 34 by way of an idler pulley 48. A third drive belt 40-2 is then connected from condenser fan motor pulley 46 to evaporator fan motor pulley 49 by way of alternator pulley 52. Engine 36 may operate and, by means of drive belt 40, can function to operate compressor 44 for the purpose of circulating refrigerant throughout the system in a well known manner. As the condenser motor and fan 34 become operative, low velocity cooling air from the atmosphere outside of the transportable unit 1 (illustrated best by arrows around the condenser compartment 6 and the compressor compartment 8 and between the battery 12, fuel tank 14, and control box 16) is drawn into the unit to be passed over condenser 32 and around engine 36 and compressor 34 for the purpose of cooling the apparatus. High velocity heated air is then expelled back into the outside atmosphere through the grill members previously described in reference to FIG. 1.

When evaporator motor and fan 26 become operative, relatively warm air from within the storage container 50 is drawn into the evaporator compartment 4 through intake duct 28, whereby it is passed through the evaporator coil 24 and circulated back into container space 50 through the associated evaporator discharge duct 30. If the cargo container and refrigerator unit are located at a source of electric power, the engine 36 is disconnected through clutch pulley 42 and the motor 46 of the condenser fan drives the other units through the aforesaid belt drives.

Another feature of the instant invention is shown in FIG. 5. To permit greater accessibility to the evaporator coil 24 and to the evaporator fan (not shown) in the event repair should become necessary, the evaporator coil 24 and the discharge duct 30 together with the evaporator fan apparatus are attached to the evaporator panel unit frame 5 and to the back 62 of the main frame 2. The evaporator unit frame 5 is removably secured to the back 62 of main frame 2 by any suitable means such as by a bolt arrangement 60 as shown, and by removing only the evaporator panel unit frame member 5 and the evaporator drive belt 40-2 (not shown) from pulley 49 the entire evaporator unit assembly may be removed from the main frame 2 for a desired access to the evaporator coil assembly without the necessity of first unloading or disturbing the storage container as was previously required.

We claim:

1. A transportable refrigeration unit to be removably secured to the exterior of an enclosed storage compartment to be refrigerated comprising, an evaporator coil, evaporator coil fan means, an evaporator compartment having a circulated air intake opening, an evaporator associated discharge duct, said discharge duct having dimensions which are less than that of the intake opening and arranged to extend within said air intake opening in relatively concentric relationship therewith and through an aperture of said storage compartment when the refrigeration unit is removably attached thereto, a condenser, a compressor, a main frame, said main frame having means adapted to support said evaporator compartment and discharge duct, said condenser, and said compressor in a substantially vertical alignment with respect to one another and including a subframe removably secured to said main frame and adapted to support only said evaporator coil, evaporator fan means, evaporator compartment, and evaporator associated discharge duct, whereby circulated air passing through the evaporator coil may be circulated from the air intake opening through the evaporator coil and discharge duct and the subframe may be removed without disturbing the contents of the storage compartment or the main frame of the refrigeration unit should repair or replacement of the subframe components become necessary.

2. The invention of claim 1 in which said main frame is provided with a pair of fork lift prong receptacles suitably positioned to enable the refrigeration unit to be maneuvered into position relative to an enclosed storage compartment.

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