April 25, 1967 L. A. HEATON 3,315,487

REFRIGERATING APPARATUS FOR BOATS AND AUTOMOBILES

Filed July 2, 1965 2 Sheets-Sheet 1

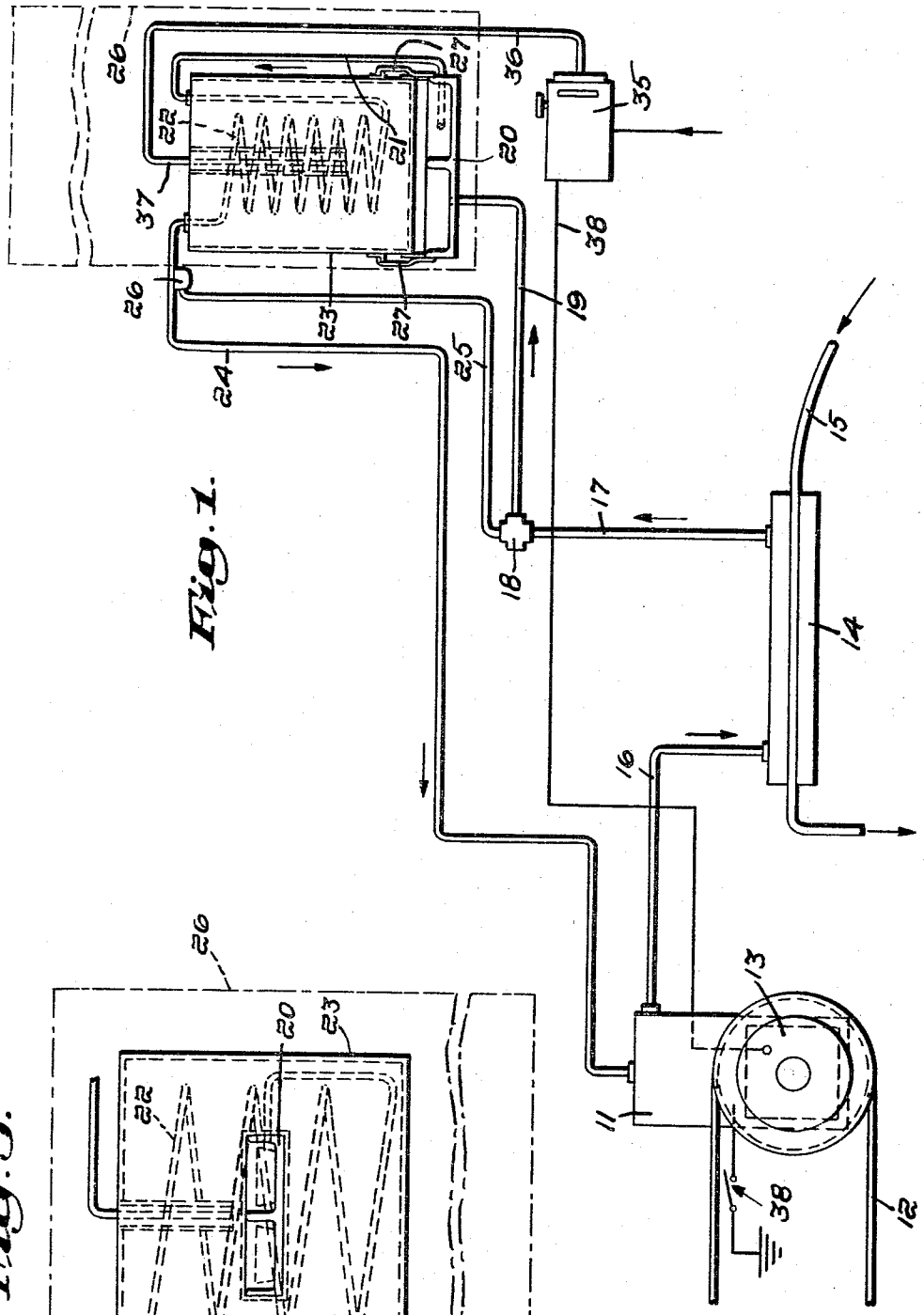


Fig. 1.

Fig. 3.

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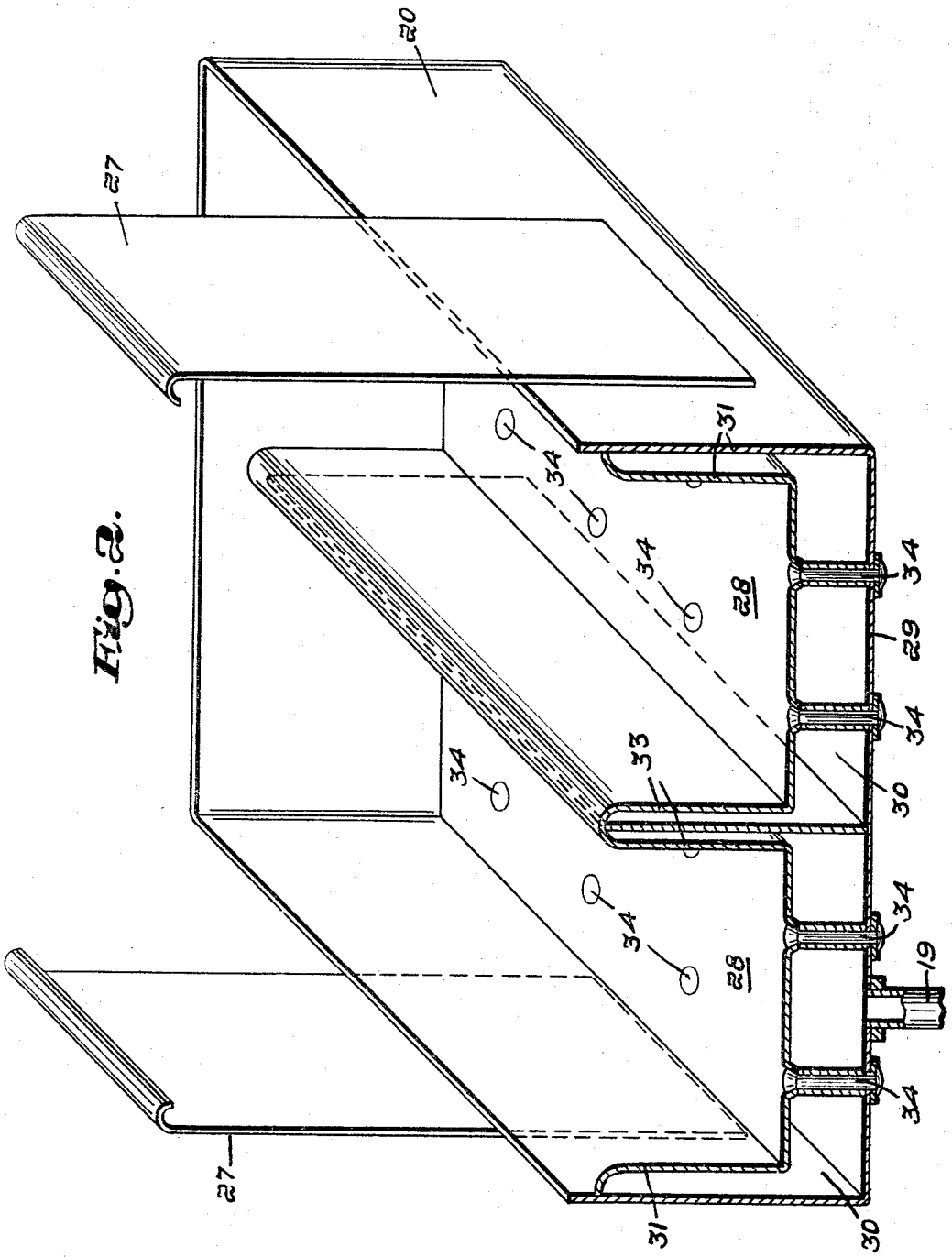


Fig. 2.

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REFRIGERATING APPARATUS FOR BOATS AND AUTOMOBILES

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1 Claim. (Cl. 62—226)

This invention relates to refrigerating apparatus and pertains more particularly to refrigerating apparatus for motor boats and for automobiles such as camping vehicles.

The principal purpose of the invention is to provide a compact and relatively inexpensive refrigerating system which may be easily installed in connection with the usual ice box of a cruising sailboat, with the ice box or refrigerator of a power cruiser, or with the ice box or refrigerator of an automobile designed for family cruising and camping, and which comprises a compressor unit operated by the marine engine or the engine of the motor vehicle.

A particular object of the invention is to provide mechanical refrigerating apparatus having a food storage compartment which may be cooled to a temperature of approximately 36°–40° F. by operating the compressor for approximately 20 minutes and maintained at food storage temperature for at least 24 hours; and a freezing compartment for ice cubes or the like which may be cooled to a temperature of approximately 15° F. by operating the compressor for about 10 minutes, and maintain frozen ice cubes for many hours without reactivating the compressor.

A further object involves the construction of the freezing compartment which may be installed within or closely adjacent the food storage compartment and which is preferably formed with a flat bottom having spaced double walls and double, spaced side walls, so that the compressed and liquified refrigerant may circulate between the double walls of the frozen compartment and "boil" therein to ensure rapid freezing of the ice cubes therein.

These and other advantages of the improved refrigerating system will become apparent from the following description of the recommended embodiments of the invention, as illustrated on the accompanying drawings; but it will be understood that the structural details of said embodiments may be varied to suit particular conditions without departing from the essence of the invention, as set forth in the appended claim.

In the drawings,

FIG. 1 is a diagrammatic view of the improved refrigerating system as installed in an auxiliary sailboat having a conventional ice box for food storage, and a standard marine engine;

FIG. 2 is an enlarged sectional perspective view of the freezing compartment as shown in FIG. 1; and

FIG. 3 is an elevation of a modified arrangement in which the freezing compartment is located centrally of the brine tank in the food storage compartment of the ice box.

In the form chosen for the purpose of illustration in FIG. 1, the refrigerating apparatus comprises a compressor unit **11** driven by a belt **12**, or otherwise, from the auxiliary marine engine (not shown) of the cruising sailboat through a standard electro-magnetic clutch **13**, a receiver-condenser **14** which is cooled by sea water of the engine cooling system passing through a by-pass pipe line **15** suitably associated with the condenser; conduits **16** and **17** connected respectively between the compressor and the condenser, and between the condenser and an expansion valve **18**; a conduit **19** leading from the expansion valve to the double walled freezing compartment **20**; a conduit **21** leading from the freezing compartment to the coils **22** of a eutectic brine tank **23**; and a conduit **24** leading from said coils back to the compressor **11**.

The compressor is preferably a high speed standard unit, turning at 1500 to 2500 r.p.m. as sold under the trade name "York" or "Tecumseh," absorbing from 4 to 7 horsepower; and the clutch **13** is designed to cooperate with the selected compressor, such as a standard unit marketed under the trade name "Borg-Warner." The thermostatic expansion valve **18** is also a conventional and available unit for refrigerating systems; and that valve is wired by line **25** to a thermostatic control **26** adjacent the brine tank.

The refrigerant circulated through this flooded system is preferably Freon 12 which has a freezing point at 22½° below zero F. at zero pressure; and the anti-freeze liquid in the "brine" tank is preferably a 15% by weight solution of propylene glycol in water, which is non-toxic and non-corrosive.

The gaseous Freon, compressed in the compressor **11** circulates through conduit **16** as a high pressure, superheated vapor, but is liquified in the condenser **14** and loses pressure at the expansion valve **18**, so that it is fed to the freezing compartment **20** as a relatively low pressure liquid and/or very wet gas. As the liquid or wet gaseous refrigerant circulates through the spaced double walls of the compartment **20**, it absorbs heat therefrom and "boils," quickly reducing the temperature of the freezing compartment and freezing the water in the ice cube trays (not shown) located therein.

The refrigerant then circulates as a wet gas from the freezing compartment, through conduit **21** to the coils **22** in the "brine" tank **23**. The coils **22** are preferably spaced no more than 2 inches apart so that the anti-freeze solution in the tank becomes solidly frozen within 20 to 30 minutes after the compressor starts operating. The tank **23** is preferably of stainless steel and occupies a space in the ice box, indicated by broken lines **26**, which would normally be occupied by a block of ice placed in the food storage compartment of the box. The precise location of the tank depends upon the size and shape of the interior of the ice box in which it is installed.

The food freezing compartment is preferably made of copper, and it is desirable that the ice trays placed therein be also of copper to ensure rapid heat transfer.

As shown in FIG. 1 and to enlarged scale in FIG. 2, the freezer compartment is mounted by suspension straps **27** or otherwise against the bottom of tank **23**, so that it helps to keep the tank liquid frozen; whereas, in FIG. 3, the compartment **20** is suitably installed in the center of the tank. Other locations are obviously possible, but it is desirable that the freezing compartment be disposed close to or within the tank **23**, and in such a position that ice cube trays may be slid in and out of the compartment.

As best shown in FIG. 3, the compartment **20** is designed to receive two ice trays and is formed to provide flat bottom surfaces **28** to receive such trays which preferably also have flat bottoms for adequate heat transfer. The bottom of the compartment is double-walled, having a seamed wall **29** spaced below the walls **28**, to provide an intervening space **30** for the circulating refrigerant entering through conduit **19**. The compartment also has double-walled sides **31** and **32** affording similar spaces, and a double-walled longitudinal partition **33** defining the areas for two ice cube trays, although it is apparent that the compartment may be designed to contain more or less than two trays.

The spaced bottom walls **28** and **29** are preferably braced by rivets **34** or other spacing elements to prevent expansion thereof under pressure of the circulating refrigerant in the space **30**.

The compressor **11** may be automatically activated and deactivated, while the power source continues to run, by providing a temperature control box **35** connected by a line **36** to a temperature sensor **37** located in the "brine"

tank **23**, and wired to the electro-magnetic clutch **13** by line **38**, to provide a thermostatic control. Thus, when the brine tank solution is frozen, the clutch will disengage to deactivate the compressor, and will re-engage to activate the compressor when the temperature in the brine tank rises.

A manual switch **38** may also be provided for controlling the engagement of the clutch **13**.

The refrigerating system above described may be installed in connection with the marine engine and ice box of most cruising sailboats and admirably achieves the objects of this invention for marine use, avoiding the necessity of frequently purchasing block ice for the conventional ice box, and also avoiding the necessity of providing high powered generators for operation of an electric refrigerator. Moreover, the storage compartment will be maintained at a lower temperature than would be afforded by a comparable block of ice; and the hold-over time will be substantially as long as that afforded by an equivalent block of ice; the absolute hold-over period depending on the efficiency of the insulation of the ice box or refrigerator, and the frequency of openings of the ice box latch.

The spaced double walls of the freezer compartment accommodate a heavy volume of rapidly circulating refrigerant to ensure quick freezing of ice cubes. The spacing between the bottom and vertical walls may vary from ½ inch to ⅜ inch, but the distance is not critical so long as the space area is adequate to contain a large volume of the refrigerant.

For use in cruising or camping motor vehicles, an air cooled condenser is used in place of the water cooled condenser in marine use; and the condenser **14** is preferably substituted by a dryer and receiver-condenser of conventional type when the improved system is installed in an automobile.

I claim:

Mechanical refrigerating apparatus for boats and automobiles having an engine and a box to be refrigerated, comprising a compressor mechanically coupled to and driven by the engine, a condenser, an expansion valve, and a freezing compartment for ice cube trays, a brine tank, a conduit for refrigerant interconnecting the compressor, the condenser, the valve and said compartment and said brine tank, said brine tank and compartment being located in the box and the box providing a food storage compartment, a conduit for refrigerant leading from said compartment into said brine tank and back to said compressor, and clutch means intermediate the engine and the compressor; thermostatic control means for regulating the operation of the clutch and for regulating the operation of the expansion valve in accordance with the temperature in the brine tank; said freezing compartment having a double-walled bottom and double-walled sides providing communicating spaces between said walls for the circulation of liquid refrigerant through said spaces and thence to the brine tank conduit, and means for circulating refrigerant through said spaces; and spacing means between the respective walls of said bottom for holding said walls in substantially parallel, spaced relation against pressures created in the space between them.

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