

[54] MARINE REFRIGERATION, FREEZING AND COOL STORAGE SYSTEMS

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[51] Int. Cl.**F25b 27/00**

[58] Field of Search.....62/236, 237, 240, 243, 323, 62/439, 513

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[57] ABSTRACT

A refrigeration, freezing and/or storage system for use on marine vessels having insulated enclosures or cabinets comprises a plurality of components which may be flexibly located depending upon the size and available space in any particular boat or ship, the system comprising a compressor, a container, a eutectic solution disposed in said container and means for operating the compressor, a container, a eutectic solution disposed in said container and means for freezing the eutectic solution.

18 Claims, 17 Drawing Figures

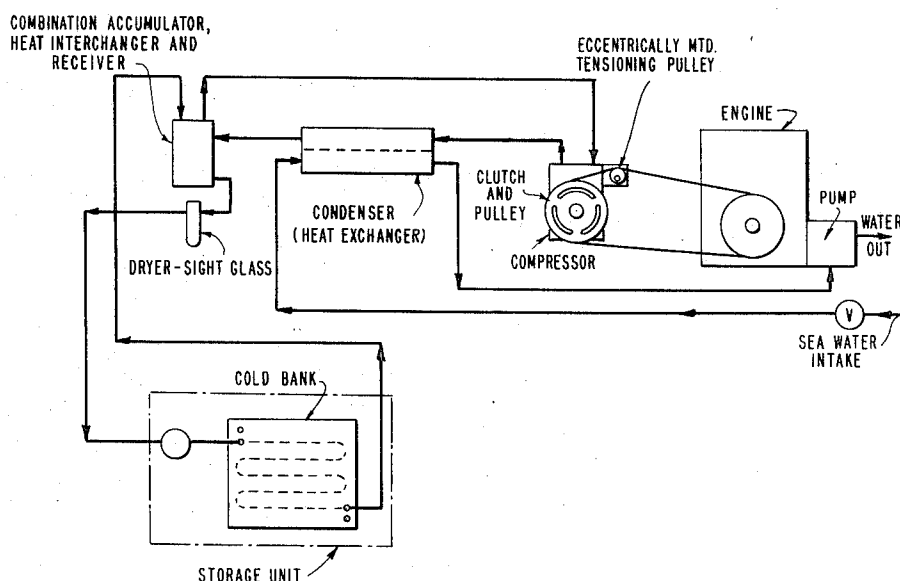
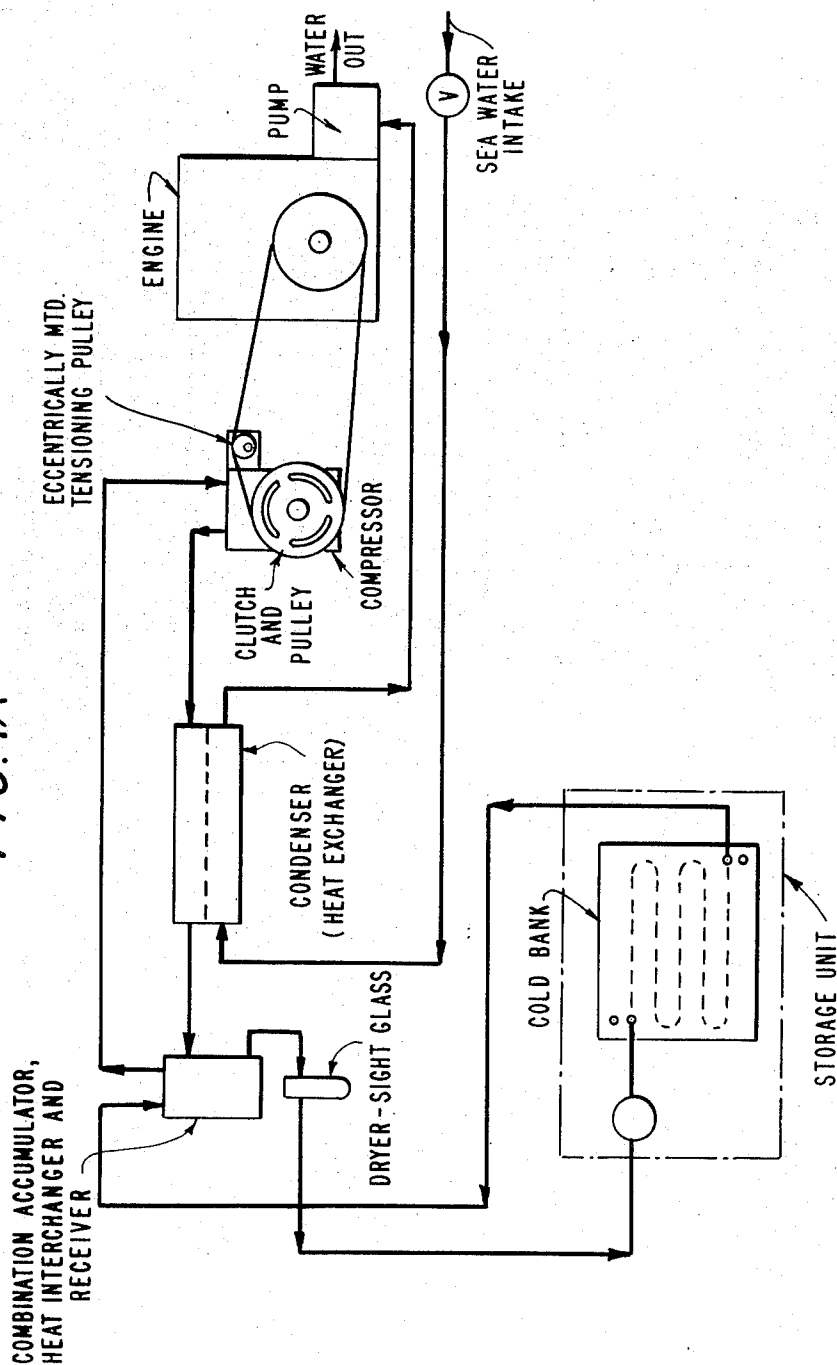


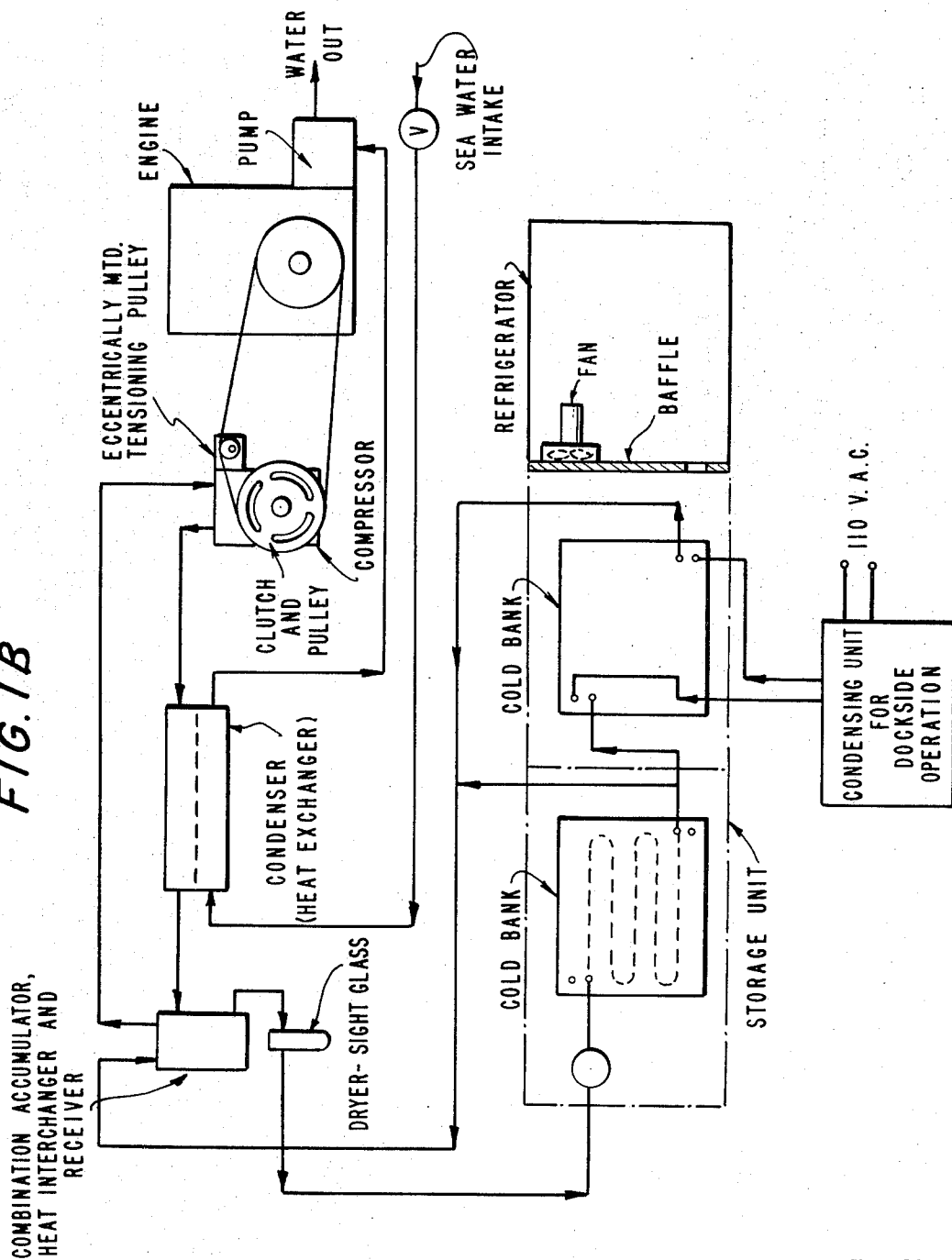
FIG. 1A



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FIG. 1B



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FIG. 2

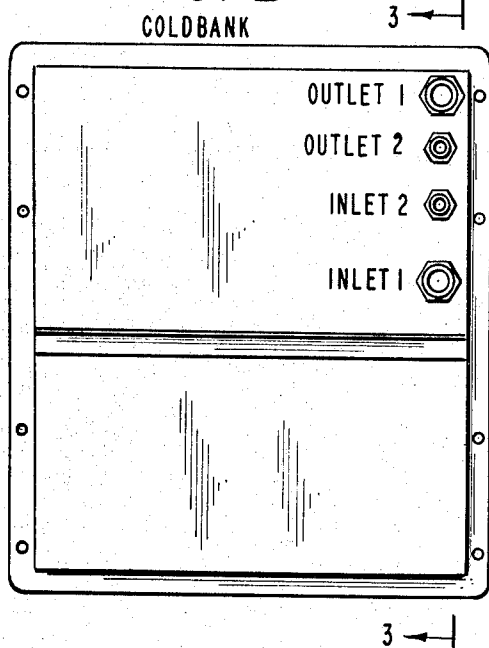


FIG. 3

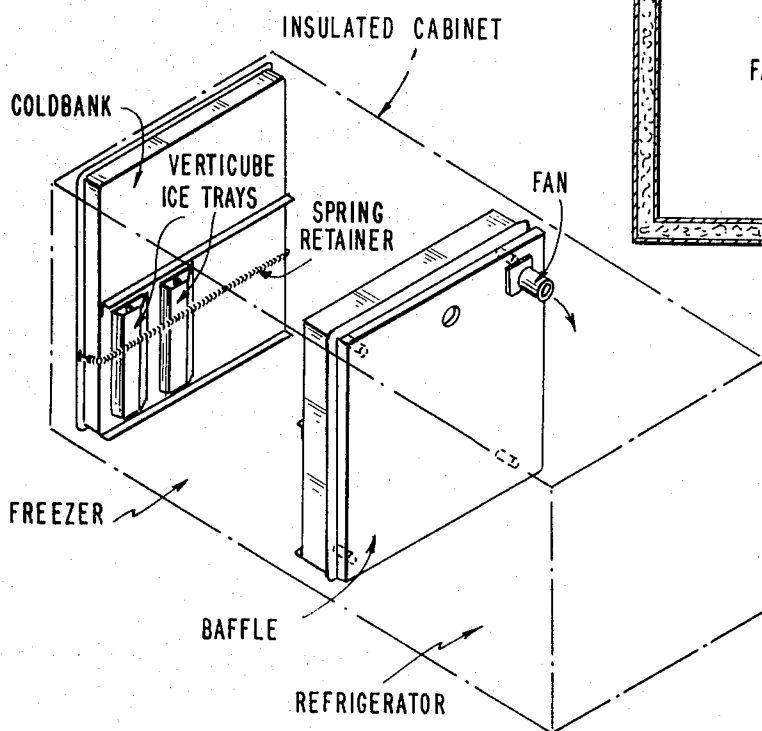
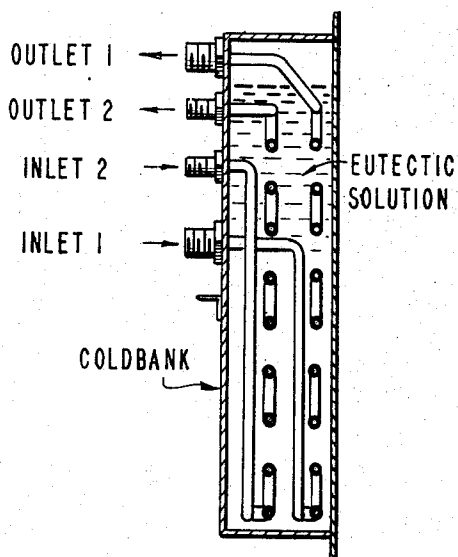


FIG. 4

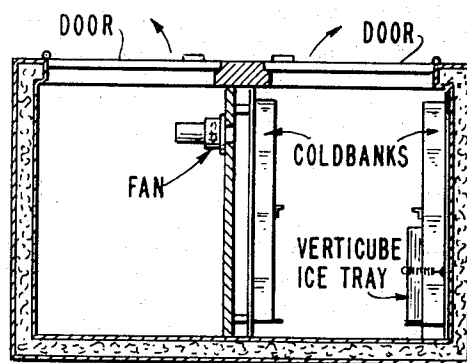


FIG. 5

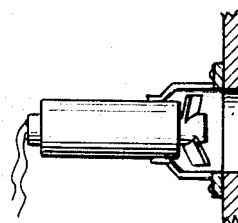
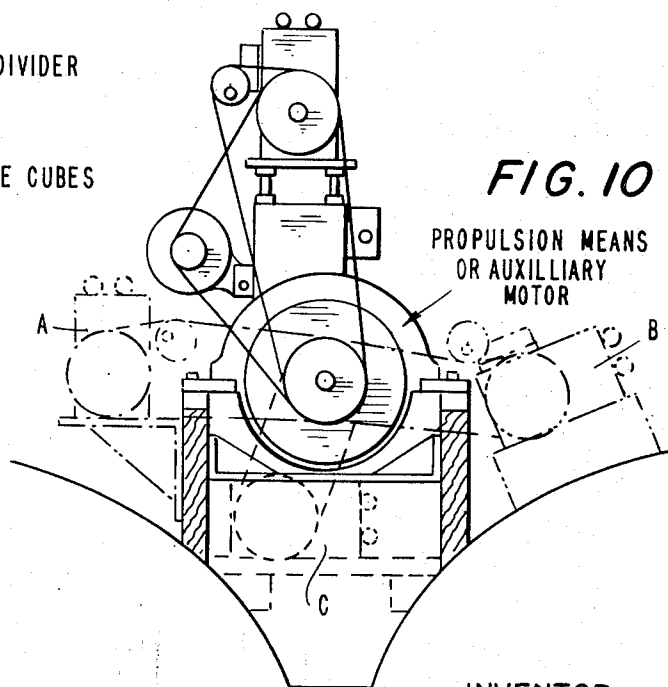
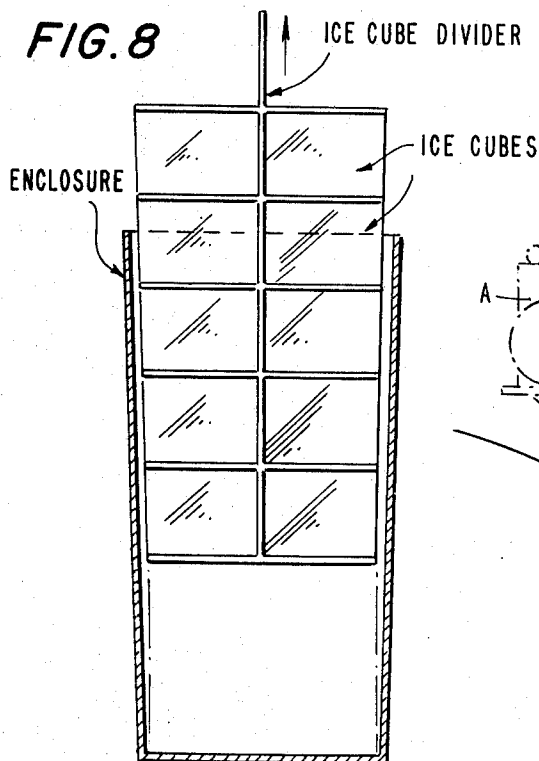
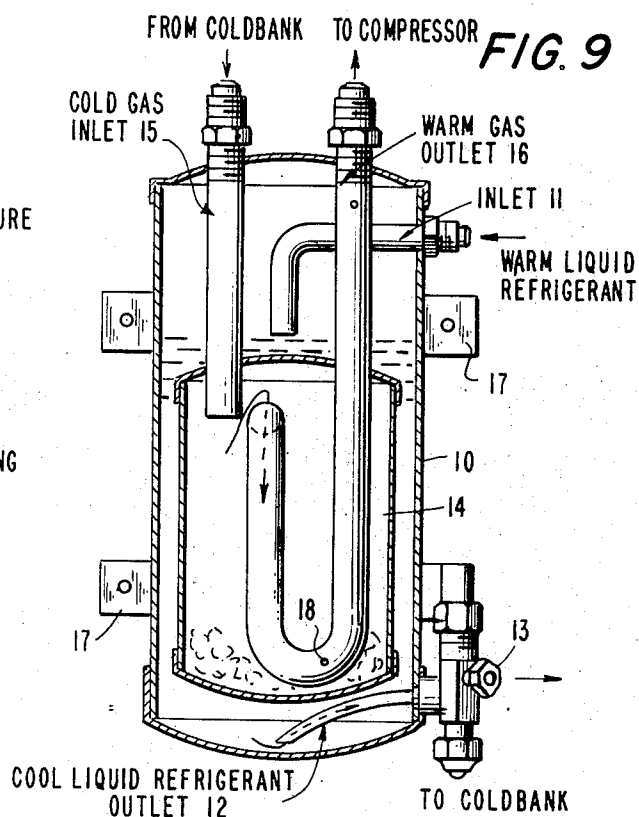
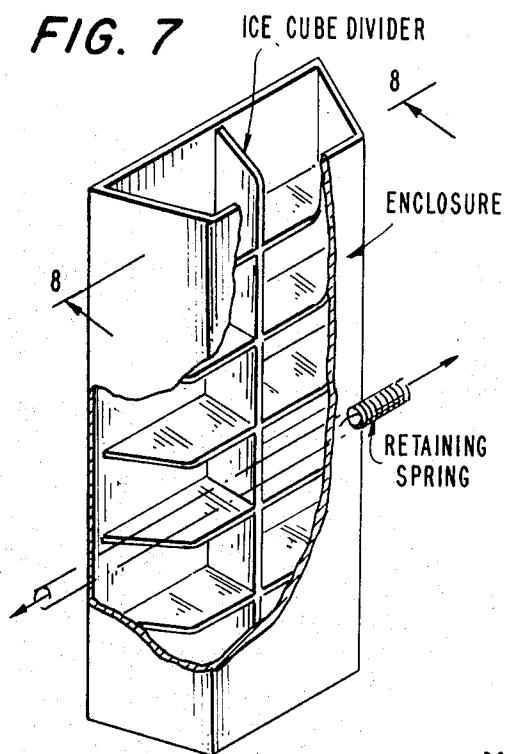


FIG. 6

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FIG. 11

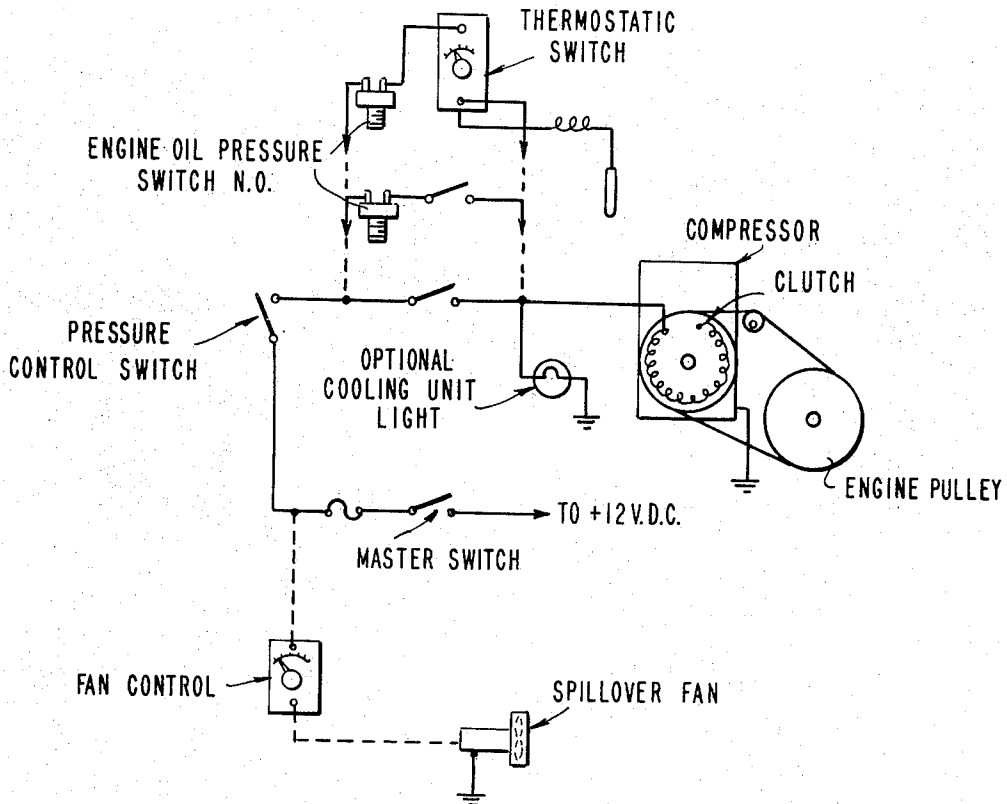
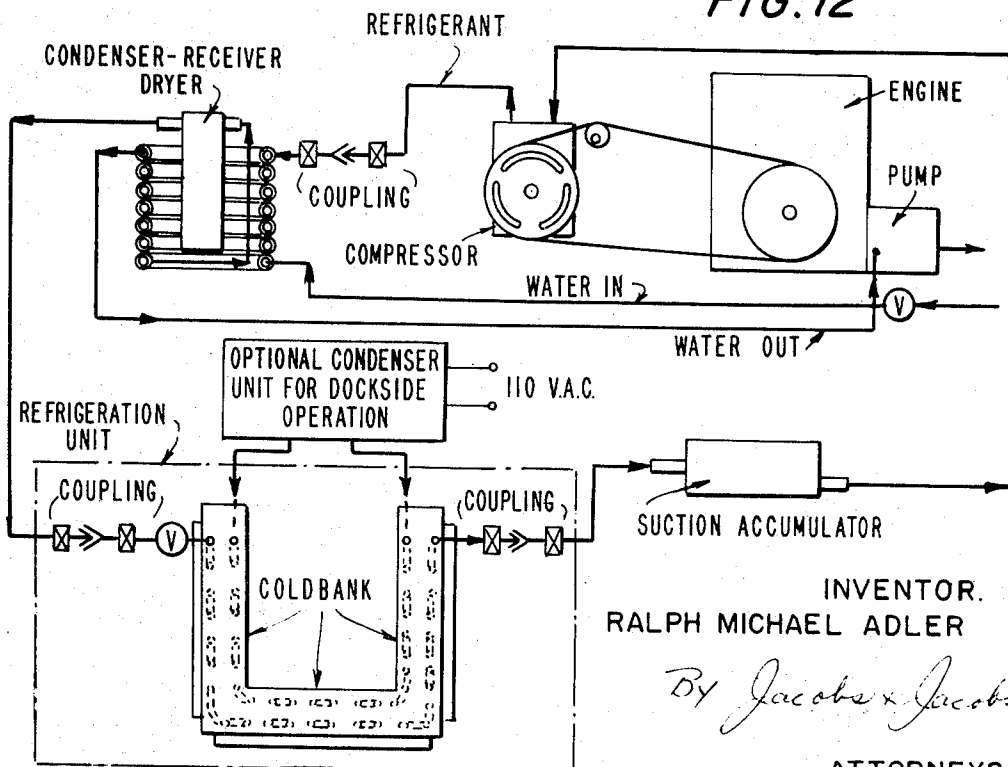


FIG. 12



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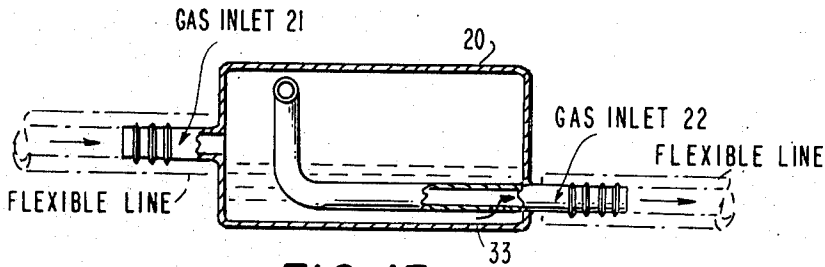


FIG. 13

FIG. 14

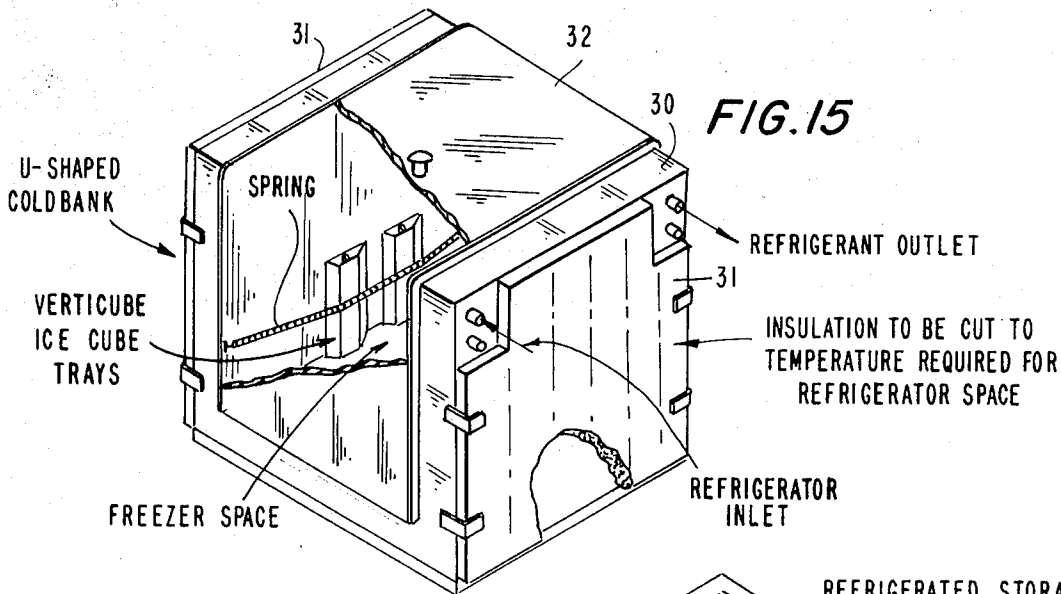
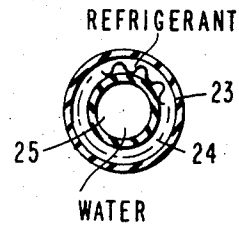
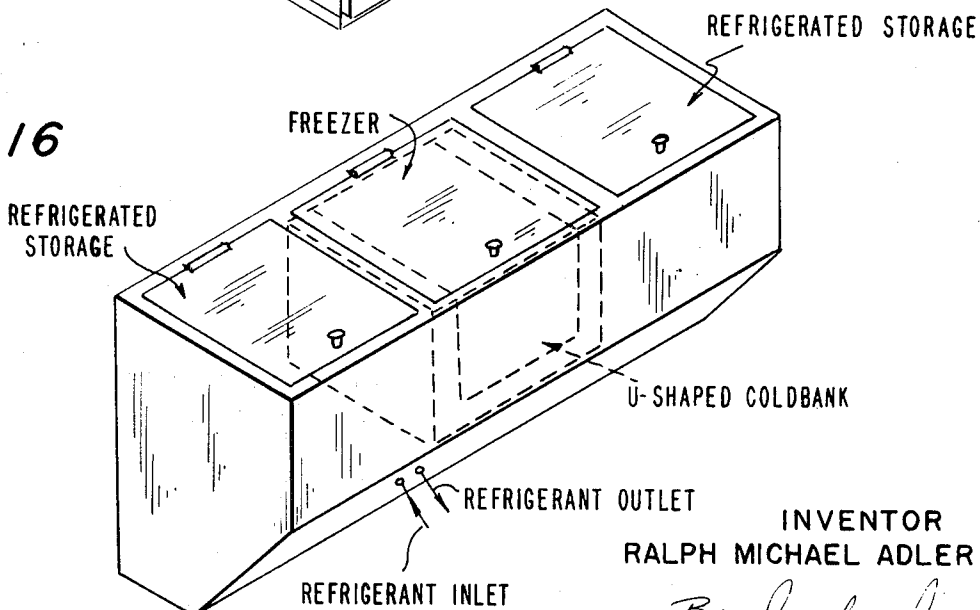


FIG. 15

FIG. 16



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MARINE REFRIGERATION, FREEZING AND COOL STORAGE SYSTEMS

The present invention is concerned with a system which provides refrigeration and/or freezing and/or cold storage for marine vessels without the necessity of having a sufficient quantity of on-board electrical generating and/or storage capacity available to provide constant electrical operation. More particularly, the present invention provides a system as above described which may be operated from the propulsion means or auxiliary engine of a marine vessel and is capable of providing refrigeration and/or freezing and/or cold storage on board of the vessel for periods of up to 60 hours without the requirement of continuous engine operation.

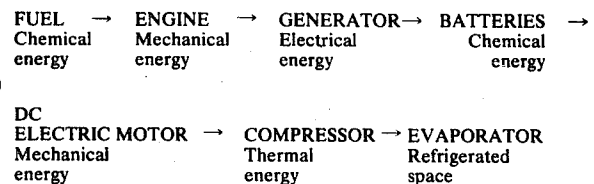
According to a modification of the present invention, a supplemental adapter system may be provided which enables the system to be activated by the use of conventional electrical current at a dock or other electrical source area.

Thus, the present invention is particularly suitable for use on small pleasure vessels, sailing vessels or yachts which have auxiliary engine power, but are not of such a size that they have large electrical generating and/or storage systems.

Various types of devices have heretofore been used to provide refrigeration and ice cube production on small vessels and yachts. These include electrically driven compressor systems, absorption devices and thermo-electric apparatus. However, at the present time only approximately 9 percent of the some 700,000 powered yachts have any type of refrigeration system aboard. Over 90 percent of such vessels are fitted with simple insulated ice boxes and employ blocks of ice to provide refrigeration. Such ice blocks have become increasingly difficult to obtain in recent years and it is equally important to bear in mind that such "ice boxes" cannot provide adequate refrigeration for cruises or long passages and it is thus constantly necessary to be near an ice source since the ice used melts rapidly. Thus frozen food cannot be stored over any substantial or prolonged period of time, and food is subject to spoilage. The high cost for the ice cubes as well as the attendant logistical problems are further disadvantages for "ice boxes". In view of the cost involved for available marine refrigeration equipment, it is believed that this is not a significant factor and it appears that a consideration of the basic principles equally shows the present problems in the art. All refrigeration systems are basically heat pumps. Thus, they remove heat which has entered or been absorbed by the refrigerated space which heat is given up by the material which is to be cooled or stored within the refrigerated space. Three basic types of systems are presently in use which accomplish heat removal: Firstly, thermoelectric devices which transfer heat energy through a semi-conducting material by the continuous application of an electric current. This type of system is characterized by low efficiency, low capacity and is thus feasible for marine application in very small, approximately 1 cubic foot, capacity units. Secondly, there are the absorption devices such as "Servel" Gas Home Refrigerator. This device circulates ammonia or similar liquids through the refrigerated space to remove heat by vaporization and such devices require a large continuous heat source as the input power supply to operate the system.

The heat source is generally an open flame which may be alcohol, kerosene or bottled gas fed and such a system is particularly objectionable aboard a yacht and has a serious disadvantage which is reflected in the insurance rates on vessels so equipped. As an alternative, an electrical resistance heating element may be used and while this may be practicable on shore because of readily available current, it is not usable aboard most small vessels for anything much larger than a 1 cubic foot unit because it would completely discharge a large 12 volt storage battery in a few hours. Moreover, since these systems transfer heat from the refrigerated space into the boat's interior, they are not desirable for marine use and such systems tend not to operate efficiently at any appreciable angle of heel or under conditions of normal motion aboard small vessels. Thirdly is the mechanical refrigeration system. This system has proved most efficient for use on large vessels. A typical unit circulates "Freon" or other liquid with a very low boiling point through a heat exchanger coil inside the refrigerated space. The heat entering the refrigerated space or given up by the item to be cooled within the refrigerated space is absorbed by the Freon causing it to boil or vaporize. The vapor is then removed and recompressed into a more dense gas by an electrically-operated mechanical compressor and the gas is then passed through a condenser where the excess heat is given up to the air within the boat or to the outside water if a pump and water cooled condenser is provided and thereby condenses back into the liquid state again and is continuously recirculated in such fashion through the system.

In the use of such systems the critical factor is the electrical consumption of the DC motor which drives the compressor since it must operate from the boat's batteries when no generator is running or when the boat is not alongside the dock. The current requirements for anything larger than a 2 or 3 cu ft. box is quite large and would generally require 5 or 6 hours of engine operation per day to generate and store sufficient electric power in the battery to operate the system. By virtue of the plurality of stages of energy conversion, the cycle is inefficient and may be represented by the following scheme.



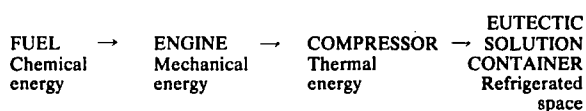
There are unavoidably large power losses at each conversion. These units generally run 20 minutes out of every hour in order to stay ahead of the heat which is continuously entering the refrigerated space. Their operation is noisy and often disturbs persons sleeping aboard such vessels. Such systems are not practical for small and medium sized yachts primarily because their high electrical requirements.

Auxiliary sailing yachts under about 60 feet in length generally use a 12 volt DC electrical system. Space is limited and the weight allowance available for large batteries is also limited and the charging alternator or generator is generally driven by the propulsion engine

which is generally the only mechanical energy source on board.

On some power yachts on which an engine is operating when underway and which are seldom anchored away from marinas or dockside 110 volt AC shore power for more than a few hours, some types of available electrically-driven compressor refrigeration is fairly satisfactory. However, on auxiliary motored sailing yachts the engine is ordinarily not running when the vessel is underway and such engine operation is considered objectionable. The owners of such vessels operate their vessel engines less than one hour daily. In addition, such vessels are anchored away from shore power normally and cruise and race off-shore for prolonged periods of time. To provide refrigeration in the typical "ice box" used aboard such vessels using battery power would require approximately 15 ampere per hour at 12 volt DC continuously. The charging equipment on board has usually less than a 60 ampere hour capacity and the battery capacity averages 200 ampere hours which must provide power for all of the onboard electrical requirements in addition to that required for refrigeration. Thus, approximately 4 to 6 hours of engine operation per every 24 hour day would be required for refrigeration needs, probably in two sessions of three hours each. Such is a completely unacceptable system for most auxiliary sailing yachts owners and consequently most owners have chosen to do without refrigeration which they have taken for granted at home or on shore and continue to use the "ice box" and to obtain blocks of ice where possible.

According to my invention the propulsion means or auxiliary engine is used as a direct source of mechanical energy and this energy is stored in a container or enclosure which contains a eutectic solution in the form of latent heat of fusion rather than as an electro-chemical form in a battery. Thus, the cycle of energy conversion according to this system looks as follows:



The inefficient energy conversions from mechanical to electrical to chemical and back are thereby eliminated and the overall system efficiency is high. Typical engine operation may be reduced to approximately 30 minutes per every 36 to 60 hours and no electricity is required. The eutectic solution container hereinafter referred to as COLDBANK (trademark of Adler & Barbour Yacht Services, Inc.) is a closed container having tubing in preferably serpentine form therein, through which a suitable refrigerant such as Freon passes. The eutectic solution occupies the space surrounding said tubing. Evaporation of the refrigerant within the tubing removes sufficient heat in a short period of time to completely solidify or freeze the eutectic solution. The coldbanks are disposed within the space to be used as a freezer or refrigerator. Suitable insulated cabinets or enclosures are produced by a number of manufacturers. The frozen eutectic solution provides continuous refrigeration or freezing by virtue of its latent heat of fusion. This effect is of prolonged duration without the requirement of continuous or

frequently intermittent operation of the mechanical compressor refrigeration system.

An optional feature of the system according to the present invention is the addition of a 110 volt AC power operated compressor which can be connected to a shore or dockside power source to freeze the eutectic solution without the necessity of engine operation.

It is a particular advantage of the present invention that the various components making up my system can be flexibly located on board a marine vessel, that is according to the available space the individual components can be located where space permits and connected by suitable flexible tubing or hoses to one another to form the completed device and operative system. Weight distribution which is an important factor both in the operation of the boat and in the disposition of components is thus simplified according to the present invention.

According to my invention a compressor is provided which is operated from the propulsion or auxiliary engine which compressor is connected into a condensor or heat exchanger which in turn is connected into a combination suction accumulator, heat interchanger and receiver which in turn is connected to one end of the tubing within one or more coldbanks which coldbanks are disposed in the area which is to be used as a refrigerator or freezer. The other end of the tubing is connected to the compressor through the combination suction accumulator, heat interchanger and receiver. Any conventional refrigerant such as any of the Freons is circulated through the system. Freon 12 is one typical refrigerant. Sea water is used to extract the heat from the refrigerant which passes through my system and the eutectic solution is thus frozen in the coldbanks within a short period of time. The compressor then is shut off. As the coldbanks absorb the heat, the eutectic solution slowly melts. When the eutectic solution is substantially completely melted, the compressor is started up to refreeze the solution. The sea water which is used to absorb the heat from the refrigerant is drawn on board in a conventional manner and such sea water is often used for cooling the engine and is pumped out and disposed back into the sea. The existing engine's sea-water pump may be easily adapted to perform this additional function.

According to a second embodiment of my invention, a simplified system can be used which is capable of being precharged with refrigerant and which in place of the combined suction accumulator, heat interchanger and receiver utilizes a small separate suction accumulator through which the refrigerant passes as it vaporizes from the coldbank before it passes back into the compressor and condensor. An important feature of the second embodiment are the push-fit couplings which allow the system to be pre-charged and to be easily connected whereas my first embodiment which is intended for larger installations and/or multiple coldbanks generally requires charging the system with refrigerant once the system has been installed and connected.

The combined suction accumulator, heat interchanger and receiver utilized in my invention is also novel and may be used in other refrigerator-type systems. In addition, my VertiCube (trademark of Adler & Barbour Yacht Services, Inc.) ice cube tray

can be used in conjunction with my freezing unit to make ice cubes and has been found to make substantially perfect ice cubes despite the constant movement of the marine vessel when it is underway.

My invention may be more fully understood by reference to the accompanying drawings wherein:

FIG. 1A is a schematic view of my system according to the first embodiment;

FIG. 1B is a schematic view of my system according to an alternate embodiment;

FIG. 2 shows an enlarged section of a coldbank having inlets and outlets suitable for connection to the optional 110 volt AC dockside power operated on board refrigerating device;

FIG. 3 is a section taken along lines 3—3 of FIG. 2 and shows the serpentine configuration and arrangement of the refrigerant containing tubing within the coldbank;

FIG. 4 shows a typical combination insulated enclosure divided into refrigerator and freezer and having my VertiCube ice cube trays held in place against a coldbank by a spring retainer. A fan extends from the freezer portion into the refrigerator portion to supply cool air from the freezer portion to the refrigerator portion and a return air flow hole;

FIG. 5 is a further view of the cabinet of FIG. 4 which shows the refrigerator and freezer sections to have top-opening doors;

FIG. 6 is an enlarged detail of one type of fan which may be utilized in the freezer/refrigerator compartments shown in FIGS. 4 and 5;

FIG. 7 is a break-away view of my VertiCube ice cube tray;

FIG. 8 is a further view which shows the tapered container which facilitates removal of the ice cubes;

FIG. 9 is an enlarged view of my combination suction accumulator, heat interchanger and receiver;

FIG. 10 shows three alternate positions for the compressor which is operated from an engine;

FIG. 11 is a diagrammatic electrical circuit according to my first embodiment;

FIG. 12 shows the second embodiment of my invention;

FIG. 13 is an enlarged view of the suction accumulator used in the embodiment of FIG. 12;

FIG. 14 is an enlarged cross-section of the condenser tubing of FIG. 12;

FIG. 15 shows a typical U-shaped coldbank having insulation on the outer portion which is easily removed or cut-away;

FIG. 16 is a typical refrigerator/freezer unit having a center disposed freezing unit and refrigerator storage units on either side.

Referring now to the drawings, FIGS. 1A and 2 through 11 show the first embodiment of my invention. FIG. 1B shows an alternative embodiment. FIG. 1 shows a compressor which can be operated by a propulsion or an auxiliary engine aboard a marine vessel, which compressor is connected to a heat exchanger, which heat exchanger is, in turn, connected to a combination suction accumulator heat interchanger and receiver. The combination suction accumulator heat interchanger and receiver is connected to a dryer-sight glass which is, in turn, connected to one or more coldbanks which are disposed in a suitably in-

ulated storage unit. When more than one coldbank is disposed in such storage unit, the coldbanks are connected in series. FIG. 1A shows a first coldbank and FIG. 1B shows an optional second coldbank divided from a further storage unit which can be used as a refrigerator by insulation. Suitable means for transmitting cool air from the space containing the coldbanks to the refrigerator portion is provided such as by a fan and as shown in FIG. 4, a return air flow hole is provided through the insulation so that the warm air from the refrigerated space will move back into the area containing the coldbanks. The coldbanks are connected, in turn, back to a combination suction accumulator heat interchanger and receiver and that combination unit is connected, in turn, to the compressor. As shown in the electrical diagram in FIG. 11, a thermostatic switch or other suitable control is provided so that when the system is filled with a refrigerant such as, for example, Freon 12, it is pumped through the system and cooled until the eutectic solution in the coldbank or coldbanks is frozen, at which point the compressor would stop. The system thereby would shutdown and the engine might then be stopped or not, as desired. The frozen coldbanks will generally maintain their frozen state for a period ranging from 36 hours to 60 hours, at the end of which period the eutectic solution in the coldbank would be substantially melted and in the form of a liquid. At this point, the thermostat would cause the clutch to engage, which, in turn, would cause the compressor to operate, assuming the engine was again operated, and the refrigerant would be pumped through the coldbanks into the combination suction accumulator heat interchanger and receiver coming in the gas inlet pipe 15 shown most clearly in FIG. 9. As shown in FIG. 9, the combination suction accumulator heat interchanger and receiver comprises an outer casing 10 having an inner container or casing 14 disposed near the bottom portion thereof. Gas inlet pipe 15 extends into the inner container and a warm gas outlet pipe 16 also extends into the inner container and is generally of a J type configuration. Gas outlet pipe 16 is connected, such as, by flexible tubing to the compressor and the cold gas which comes in gas inlet pipe 15 is warmed and any liquids, such as oil or liquid "slugs" of refrigerant, drop to the bottom of the inner container 14 where, if they are liquid refrigerant slugs, they would vaporize and go into warm gas outlet pipe 16, or if they are oil, they would pass out the hole 18 disposed in the warm gas outlet pipe 16. The warmed refrigerant, in gas form, would then be passed into the compressor and from the compressor to a heat exchanger, where it is changed into liquid form, by cooling by suitable means, such as, by passing sea water through the heat exchanger, which sea water absorbs heat from the refrigerant and may be optionally used to cool the engine as well, after which the sea water is passed out overboard back into the sea. From the heat exchanger, the cooled refrigerant, now in warm liquid form, passes into the combination suction accumulator heat interchanger and receiver through an inlet pipe 11 and passes out at the bottom of the combination suction accumulator heat interchanger and receiver as cool liquid through outlet 12 having valve 13 to facilitate system servicing. From there, the liquid refrigerant passes through a dryer-sight glass and into

the coldbank or coldbanks. The coldbanks comprise a container or enclosure having pipes or tubes in a generally serpentine form therein, together with inlet and outlet means as shown in FIGS. 1 and 3. The container is filled with a eutectic solution. The system, as shown in FIGS. 1A and 2 through 11, can also be used with an optional on-board condensing unit connectable to a dockside 110 Volt AC power source and in such a case (see FIG. 1B), there is a second set of inlet and outlet means and a second set of serpentine tubes or pipes disposed in each coldbank as shown in FIGS. 2 and 3. For dockside operation, the compressor and engine are not used and a refrigerant is circulated by the on-board 110 Volt AC dockside operated condensing unit until the coldbanks are frozen. The dockside unit can optionally be cycled automatically by a thermostat control located in the refrigerated space and to provide automatic refrigeration as well as to maintain the coldbank or coldbanks frozen.

FIG. 2 shows inlet and outlet pipes 1 and inlet and outlet pipes 2 which are used for the engine-driven system in the case of the former and the on-board disposed dockside powered unit in the case of the latter. The disposition of the tubing is most clearly illustrated in FIG. 3.

FIG. 4 shows a typical insulated cabinet arrangement which represents a modification of that shown in FIG. 1, wherein the left portion is a freezer compartment and the right portion is a refrigerator compartment separated by insulation from the freezer portion. The freezer compartment contains at least one coldbank. Means for transmitting the cold air from the freezer compartment into the refrigerator compartment is illustrated schematically by the fan which is shown also in FIG. 1 and the return air flow hole which permits warm air flow back from the refrigerator portion into the freezer portion is also illustrated. FIG. 4 shows my verticube ice cube trays disposed against a coldbank and held in place by suitable means, such as a spring retainer. FIG. 5 shows a further view of FIG. 4 showing two coldbanks and illustrating the insulated cabinet as being a top opening type having separate doors for the refrigerator and freezer portions. FIG. 6 shows a typical fan which is suitable for use to transmit cold air from the freezer to the refrigerator portion.

FIGS. 7 and 8 illustrate my verticube ice cube trays which comprise an enclosure of a generally trapezoidal shape having an open top portion, the bottom portion representing the narrower portion of the trapezoid. FIG. 8 most clearly shows the fact that the bottom portion is smaller, that is, of a lesser diameter, than the top portion. Suitable dividing means, such as an ice cube divider, is inserted in the enclosure and the ice cube tray is then filled with water and placed in a vertical position such as that shown in FIGS. 4, 5 and 7. In this position, substantially evenly sized ice cubes are formed, despite the rocking and pitching of the vessel on which they are used. Because of the tapered end portion, the ice cubes may be easily removed from the enclosure as shown in FIG. 8, since a small amount of heat either by warm water, friction or by placing the tray for a few moments in the sun or ambient temperature will loosen the cubes sufficiently to allow them to be slid out of the enclosure fairly easily.

All of the connections in my system are done by flexible tubing, since it can be appreciated, the requirements of particular boats are such that the components making up my system must be capable of flexible disposition as space and requirements of the individual vessel warrant. In addition, the compressor can be mounted in various positions adjacent to the propulsion means or auxiliary motor of the marine vessel involved and FIG. 7 shows three possible positions for compressor A, B and C, in relation to the motor.

FIG. 11 shows, in detail, a typical electrical system according to my first embodiment.

FIGS. 12 through 14 show a second embodiment of my present invention which is particularly advantageous because the system may be pre-charged with refrigerant prior to delivery, the open connections of the system merely packaged sealed for the delivery and then the system can be simply installed and connected together by the use of self-sealing couplings as shown in FIG. 12.

According to the modification most clearly shown in FIG. 12, a compressor which is operated in a similar manner to my first embodiment, such as through the propulsion means or an auxiliary engine, is connected to a condenser - receiver - dryer which, in turn, is connected to a coldbank which in FIG. 12 is shown in U-shaped form. The coldbank is disposed in a refrigerator or freezer compartment which is a suitably insulated, as shown in FIGS. 15 and 16. The coldbank has the same preferably serpentine pipes or tubes as my first embodiment and an inlet and outlet means to connect the coldbank into the main system, as well as a second inlet and outlet connection with serpentine pipes or tubes which are available for optional dockside operation as discussed in connection with my first embodiment. The coldbank outlet is connected to a suction accumulator which, in turn, is connected through flexible tubing to the compressor. Suitable cooling means is connected into the condenser - receiver - dryer, such as, for example, sea water, which is passed countercurrently through the condenser portion of the condenser - receiver - dryer for the purpose of heat absorption and it operates in the same manner as that discussed with regard to my first embodiment.

The suction accumulator comprises an enclosure 20 having a gas inlet pipe 21 and a gas outlet pipe 22. Gas inlet pipe 21 enters the enclosure 20 about the middle of the end portion and outlet 22 extends out from near the bottom portion of the other end of the enclosure and is generally an L-shaped form with the long portion of the L extending to the outlet and the short portion of the L extending upward, terminating near the top of the enclosure. The gas passing through inlet 21 fills the enclosure 20 and any entering liquid slugs of refrigerant would fall to the bottom of the enclosure and only gas would pass through outlet 22. Entering slugs of oil would similarly collect at the bottom and be slowly returned to the compressor through small oil return hole 33. The suction accumulator, as shown, will also perform these functions with equal efficiency when oriented with axis vertical or in any intermediate position within an arc. The device thus serves to protect the compressor from returning incompressible liquid slugs and performs this function in various orientations as shown.

FIG. 14 shows a section of condenser - receiver - dryer shown in FIG. 12, wherein the condenser - receiver - dryer 23 comprises concurrent tubes, the outer one being the portion through which the refrigerant, such as Freon 12, passes, and the inner portion being the one through which the water or other cooling liquid passes.

As most clearly shown in FIG. 15, a U-shaped coldbank is provided which may include insulation on the sides thereof and this insulation can be cut away as required in order to provide the proper temperature in the exterior refrigerated cabinet in which the coldbank is to be placed. The coldbank 30 has insulation 31 around all the sides, including the top having a door portion 32. The inlet and outlet pipes are shown, as well as the ice cube trays which may be disposed against one or both of the sides of the coldbank.

The U-shaped coldbank is installed in a typical vessel's food storage cabinet having a center freezer portion which is flanked by refrigerator storage units on either side. With this type of an arrangement, the means for regulating the refrigerated section temperatures while maintaining sub-freezing temperatures in the interior portion of the U-shaped coldbank is the progressively removable insulation material, which is suitably adjusted to expose sufficient coldbank surface to attain the correct temperature.

The combination suction accumulator heat interchanger and receiver is capable of use in any type of refrigeration system, in view of its ability to prevent incompressible liquid refrigerant or oil from passing into the compressor, thereby damaging this component. A similar purpose is filled by a suction accumulator used in the second embodiment of my invention and the disposition of the L shaped outlet pipe with hole 33 prevents such liquids from passing into the compressor.

My ice cube trays may be used in conjunction with any refrigeration or freezing system and are particularly valuable for use on board marine vessels.

My system in both embodiments represents a flexible system in the sense it is capable of being installed on virtually any sized marine vessel and coldbanks can be added as desired to provide sufficient freezing and refrigeration. The components can be located in whatever space is available and can be connected to the flexible tubing so that large amounts of space in any one area are not required.

My marine refrigeration system furthermore provides the first system which is capable of providing refrigeration and freezing for periods of up to 60 hours without the use of electrical current and without the necessity for operating an auxiliary motor for more than a short period of time in any 36-60 hour time period.

It is to be appreciated that the components of my two embodiments are interchangeable between the systems.

Other and further uses and modifications of my invention will be appreciated by those skilled in the art with reference to the above description, the drawings and the appended claims.

What is claimed is:

1. A marine system for providing refrigeration, freezing and cold storage aboard marine vessels having an insulated enclosure within which consumable items can

be placed, which system comprises a compressor, non-electrical means for operating said compressor, a heat exchanger connected to said compressor, a combination suction accumulator, heat interchanger and receiver connected to said heat exchanger, at least one coldbank disposed within said insulated enclosure, a refrigerant, which at least one coldbank comprises a closed container, a eutectic solution disposed within said container, and means for passing the refrigerant through said eutectic solution, said means being connected to said combination suction accumulator, heat exchanger and receiver, and means for stopping and starting said system when said at least one coldbank is frozen and unfrozen.

2. A system according to claim 1 wherein said non-electrical means is a propulsion means disposed aboard a marine vessel.

3. A system according to claim 2 wherein said container and refrigerant passing means comprises tubing in a generally serpentine form disposed within said container and inlet and outlet means connected to said tubing through said container.

4. A system according to claim 3 wherein said insulated enclosure is divided into a refrigerator space and a freezer space, and wherein at least two coldbanks are disposed in the freezer space which coldbanks are connected in series to one another and further comprising means for transmitting cold air from the freezer space to the refrigerator space and warm air from the refrigerator space to the freezer space.

5. A system according to claim 3 which comprises means for drawing sea water from the sea, passing it through the heat exchanger to absorb heat from the refrigerant flowing therethrough and passing said heated sea water back into the sea.

6. A system according to claim 5 wherein said combination suction accumulator, heat interchanger and receiver comprises an outer casing, an inner casing disposed within the lower portion of said outer casing, inlet means for receiving cold refrigerant gas from the at least one coldbank, said inlet means extending into said inner casing, outlet means for passing warmed refrigerant gas disposed in the inner casing to said compressor, said means having a hole disposed at a bottom most point, a second inlet means for receiving warm liquid refrigerant from the heat exchanger into the interior of the outer casing, and second outlet means for passing said cooled liquid refrigerant from the interior of the outer casing to said at least one coldbank.

7. A system according to claim 6 further comprising a dryer disposed between said combination suction accumulator, heat interchanger and receiver and said at least one coldbank and connected to said second outlet and said coldbank inlet.

8. A system according to claim 7 further comprising at least one ice cube tray disposed against said at least one coldbank, said ice tray comprising a trapezoidal shaped enclosure having an open top, the bottom portion of which is of lesser diameter than the top and removable means for dividing the space within said trapezoidal enclosure into ice cube sized divisions.

9. A system according to claim 8 wherein said coldbank has a second inlet and outlet means, tubing in a generally serpentine form connected thereto and an electrically operable refrigeration system connected to said second inlet and outlet means.

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10. A marine system for providing refrigeration, freezing and cold storage aboard marine vessels having an insulated enclosure within which consumable items can be placed, which system comprises a compressor, non-electrical means for operating said compressor, a combination condenser - receiver - dryer connected to said compressor, at least one coldbank disposed within said insulated enclosure, a refrigerant, which coldbank comprises a closed container, a eutectic solution disposed within said container and means for passing the refrigerant through said eutectic solution, said means being connected to said combination condenser - receiver - dryer, a suction accumulator connected at one end to said means and at the other end to said compressor and means for stopping and starting said system when said at least one coldbank is frozen and unfrozen.

11. A system according to claim 10 wherein said non-electrical means is a propulsion means disposed aboard a marine vessel.

12. A system according to claim 11 wherein said suction accumulator comprises a closed casing having an inlet at one end disposed at about the center and an outlet at the other end disposed near the bottom and a substantially L-shaped pipe disposed within said casing the long portion of which is connected to said outlet and has a hole therethrough and the short portion of which extends upward terminating just short of the top of said casing.

13. A system according to claim 12 wherein said container and refrigerant passing means comprise inlet and

outlet means and tubing in a generally serpentine form connected to said inlet and outlet means.

14. A system according to claim 13 wherein said at least one coldbank comprises a U-shaped coldbank.

15. A system according to claim 13 wherein said insulated unit is divided into a refrigerator space and a freezer space, and wherein the U-shaped coldbank is disposed in the freezer space and further comprising means for adjusting the temperature in the refrigerator space.

16. A system according to claim 13 which comprises means for drawing sea water from the sea, passing it through the condensor portion of the condensor - receiver - dryer to absorb heat from the refrigerant flowing therethrough and passing said heated sea water back into the sea.

17. A system according to claim 16 further comprising at least one ice tray disposed against said at least one coldbank, said ice tray comprising a trapezoidal shaped enclosure having an open top, the bottom portion of which is of lesser diameter than the top and removable means for dividing the space within said trapezoidal enclosure into ice cube sized subdivisions.

18. A system according to claim 17 wherein said coldbank has a second inlet and outlet means, tubing in a generally serpentine form connected thereto and an electrically operable refrigeration system connected to said second inlet and outlet means.

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