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Falk et al.

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[54] MOBILE REFRIGERATION SYSTEM

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[51] **Int. Cl.** **F25b 13/00**

[58] **Field of Search** 62/236, 323, 4, 324, 160

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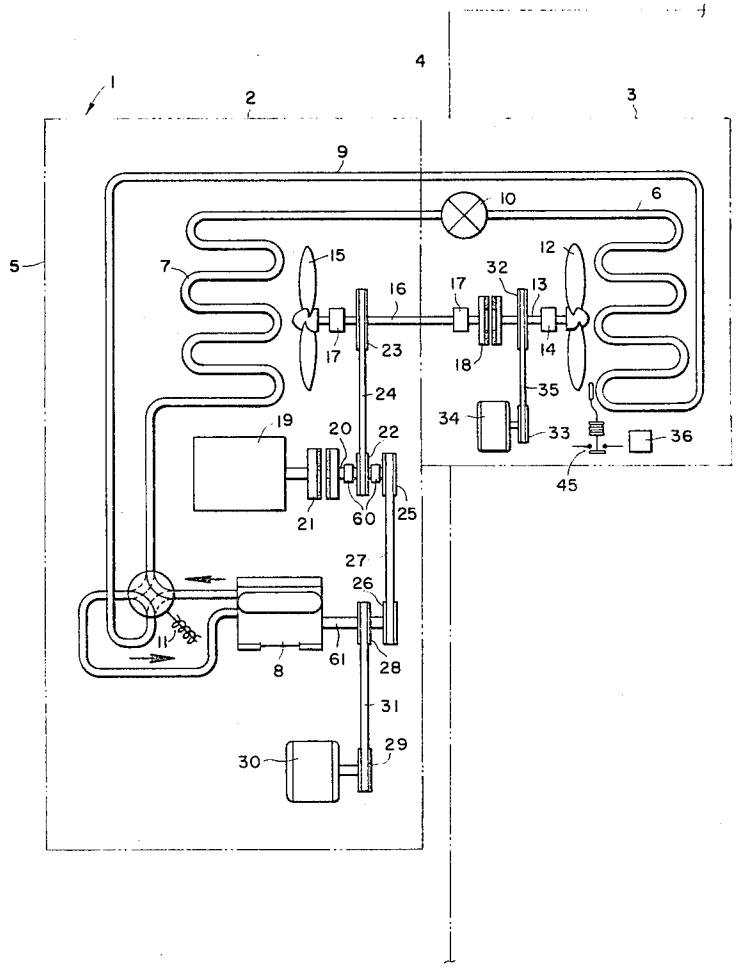
[57] **ABSTRACT**

The compressor and evaporator and condenser fans of a mobile refrigeration system are driven by a continuously operating internal combustion engine. Temperature control of the refrigeration system when powered by the internal combustion engine is obtained by cycling the refrigeration system between heating and cooling cycles. A defrost cycle clutch is provided for disengaging the evaporator fan when the evaporator coil is defrosting. When an alternating current power source is available, the condenser fan and compressor may be driven by a standby electric motor, which is cycled off and on to obtain temperature control. A separate electric motor is provided to continuously drive the evaporator fan during this cycling of the standby electric motor. Means is provided to disengage the defrost clutch during operating of this separate electric motor. When the system is connected for standby motor operation, this separate electric motor is deenergized during the defrost cycle.

14 Claims, 2 Drawing Figures



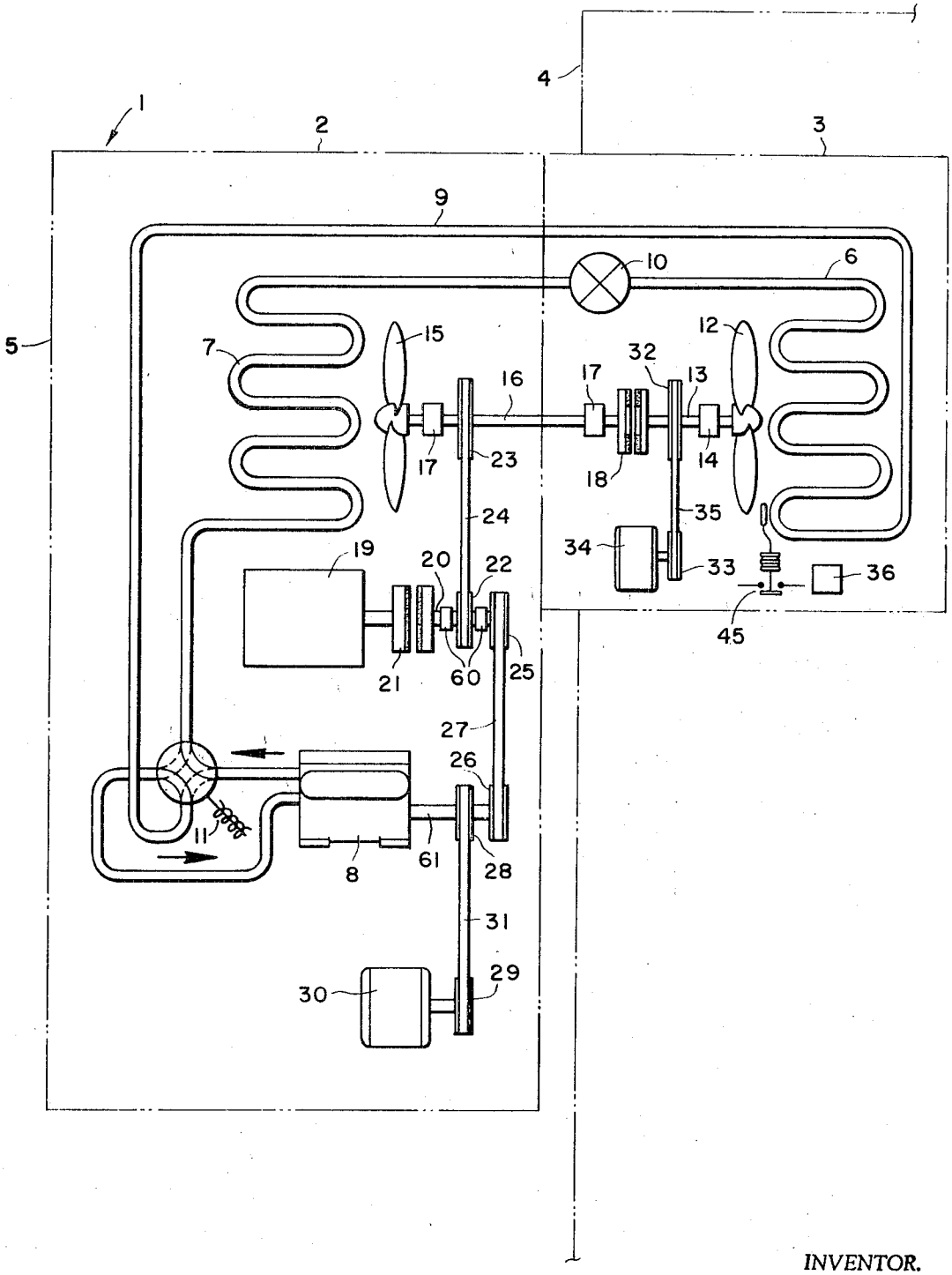


FIG. 1

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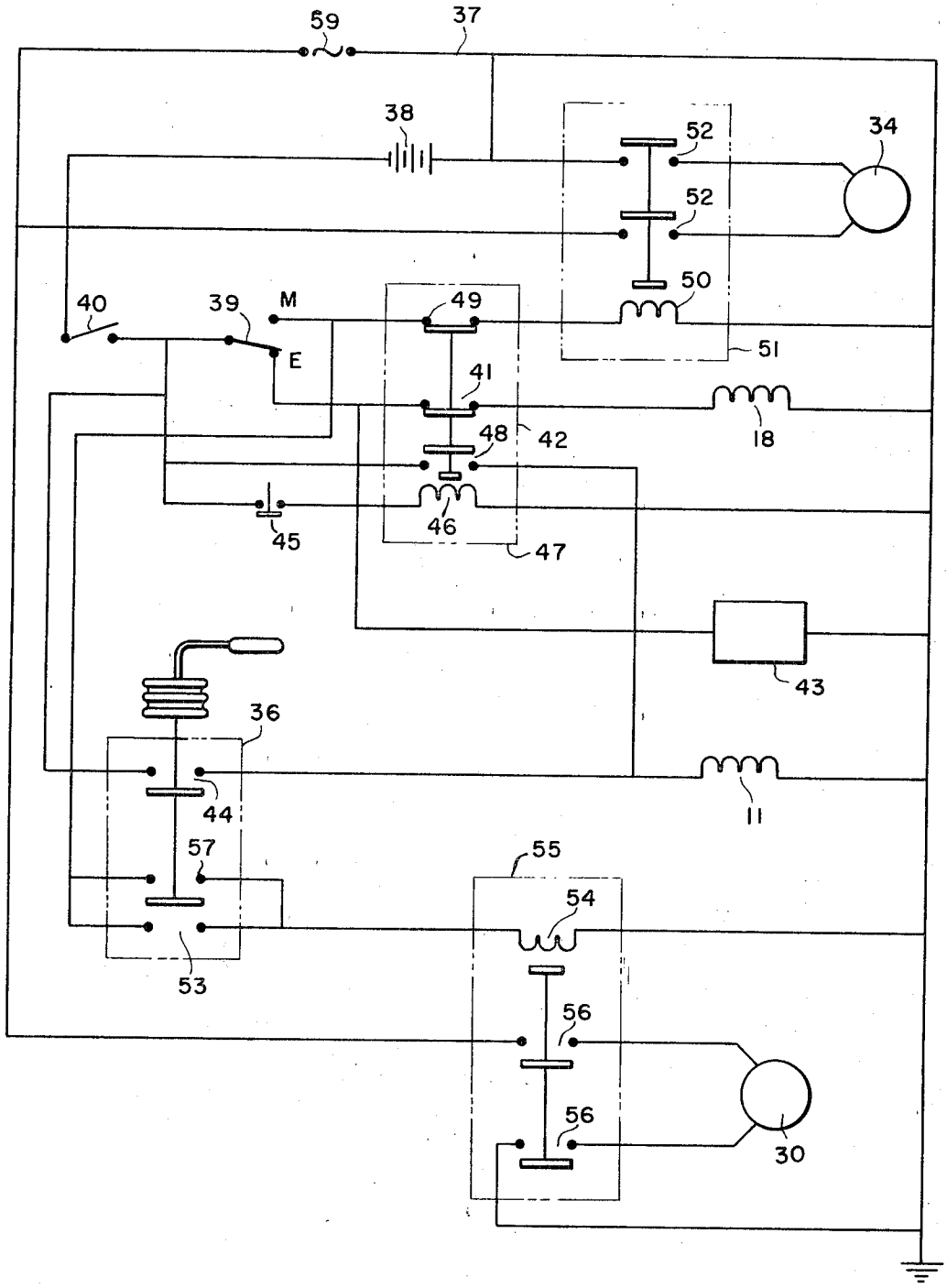

FIG. 2

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MOBILE REFRIGERATION SYSTEM

BACKGROUND OF THE INVENTION

Mobile refrigeration systems have now been in use for a number of years for cooling and sometimes heating railroad refrigerator cars, trucks, and containers. In some systems, particularly those in use on refrigerator cars, it is common practice to provide an engine generator set, the power from which is used to drive separate electric motors for driving the refrigerant compressor as well as the individual condenser and evaporator fans.

Another, lower cost, power transmission system for mobile refrigeration units employs only a mechanical drive between the internal combustion engine and the refrigerant compressor, condenser fan, and evaporator fan. It is now common to provide a clutch to disengage the evaporator fan in such mechanical drive systems to permit the evaporator to be defrosted without unduly warming the contents of the truck, container, etc. It is also common practice to provide such mechanical drive systems with a standby electric motor for operation from an alternating current power source in lieu of the engine power source.

In the aforementioned mechanical drive system, it would be normal to operate the engine continuously and obtain temperature control by cycling the refrigeration system from heating to cooling and vice versa. Also variable speed control might be employed. However, when such a system is operated from the standby electric motor temperature control is normally obtained, at least in part, by cycling the electric motor between an energized and a deenergized condition.

Thus, when such a refrigeration system is made ready for standby electric motor operation and the load on the refrigeration system is insufficient for energization of the standby electric motor, the evaporator fan, i.e., the fan circulating the air within the conditioned space over the indoor heat exchanger, is not in operation. Without substantially continuous operation of the evaporator fan relatively uniform temperature distribution within the conditioned space cannot be maintained.

SUMMARY OF THE INVENTION

It is thus a principle object of this invention to provide means for maintaining a relatively uniform temperature distribution within the space air conditioned by the mobile refrigeration system unit.

More specifically, it is an object of this invention to provide means for substantially continuously operating the indoor heat exchanger fan of a mechanical drive mobile refrigeration system unit for maintaining a relatively uniform temperature distribution within the conditioned space where the refrigeration unit is provided with a standby electric motor.

It is still another object of this invention to provide a mobile refrigeration system having an indoor heat exchanger fan, an engine power source, and an electric standby motor power source, with means for drivingly connecting said indoor heat exchanger fan to said engine during operation of said engine and means for disengaging said indoor heat exchanger fan from said engine and driving said indoor heat exchanger fan from a second electric motor when said system is made ready for being driven by said standby electric motor.

More specifically, this invention involves: a refrigeration unit for cooling a mobile container comprising a housing having a first portion adapted to extend into an opening in a mobile container and a second portion adapted to remain external of the container; a refrigerant evaporator disposed within said first portion of said housing; a refrigerant compressor and condenser disposed in said second portion of said housing; a refrigerant loop serially connecting said evaporator, compressor and condenser; an evaporator fan disposed in said first portion of said housing positioned to circulate air in said container over said evaporator; a condenser fan disposed in said second portion of said housing positioned to pass cooling air over said condenser; a clutch; a first rotary drive means

drivingly connecting one side of said clutch with said evaporator fan; a second rotary drive means drivingly connecting the other side of said clutch to said condenser fan; a prime mover and standby electric motor disposed within said second portion of said housing; power transmitting means for drivingly connecting said engine and standby electric motor to said compressor and said second rotary drive means; a second electric motor drivingly connected to said first rotary drive means and evaporator fan independently of said second rotary drive means whereby said evaporator fan may be driven by said second electric motor to maintain relatively uniform temperature distribution within said container when said prime mover is not operating to drive said evaporator fan via said clutch.

Other objects and advantages will become apparent as this specification proceeds to describe the invention with reference to the accompanying drawings in which like reference numerals designate like parts wherein:

FIG. 1 is a schematic of a mobile refrigeration system employing the invention and;

FIG. 2 is an exemplary electric control circuit for operating the refrigeration system shown in FIG. 1.

DETAILED DESCRIPTION

Now referring to FIG. 1, it will be seen that a mobile refrigeration unit 1 is provided with a housing 2 having a first portion 3 which extends inwardly of an aperture in a container wall 4 and a second portion 5 which extends externally of said container wall. Wall 4 may be that of a truck, refrigerator car or container. Disposed within the first portion 3 of housing 2 is an indoor heat exchanger 6. Disposed within the second portion 5 of housing 2 is an outdoor heat exchanger 7 and a refrigerant compressor 8. Heat exchangers 6 and 7 and compressor 8 are serially connected by closed refrigerant circuit or loop 9. A conventional refrigerant throttling means 10 is disposed within refrigerant loop between heat exchangers 6 and 7. Furthermore, the refrigerant loop in the particular embodiment shown is provided with a four-way reversing valve 11 between the compressor and the heat exchangers 6 and 7 for reverse operation of the refrigeration circuit. Throughout this specification the term evaporator is used in reference to the indoor heat exchanger 6 and the term condenser is used in reference to the outdoor heat exchanger 7 as the refrigeration unit 1 is primarily used for cooling the conditioned space of a truck or container. However, it should be noted that during reverse cycle, i.e., heating cycle operation, that indoor heat exchanger 6 in fact becomes a condenser and outdoor heat exchanger 7 becomes an evaporator.

An indoor heat exchanger or evaporator fan 12 is mounted for rotation with evaporator fan shaft 13 which is mounted for rotation in a suitable bearing 14. An outdoor heat exchanger or condenser fan 15 is mounted for rotation with condenser fan shaft 16 which is rotatably mounted in suitable bearings 17. Condenser fan shaft 16 and evaporator fan shaft 13 are drivingly engaged upon energization of electromagnetic fan clutch 18.

An internal combustion engine 19 is drivingly connected to a jack shaft 20 by way of a centrifugal clutch 21 which is responsive to engine shaft speed. Shafts 20 and 16 respectively are provided with sheaves 22 and 23 which are drivingly interconnected by way of V-belt 24. Shaft 20 which is rotatably mounted in bearings 60 has a second sheave 25 which is drivingly connected to a sheave 26 on the input drive shaft 61 to compressor 8 by a second V-belt 27. A second sheave 28 on the input shaft 61 to compressor 8 is drivingly interconnected with a sheave 29 on standby electric motor 30 via V-belt 31.

Thus, it will be seen that by way of the belts and sheaves heretofore described compressor 8, standby electric motor 30, jack shaft 20, and condenser fan shaft 16 are all drivingly interconnected. Engine 19 becomes drivingly interconnected to these elements only when operated above a predetermined speed by way of centrifugal clutch 21.

Evaporator fan shaft 13 is provided with a sheave 32 which is drivingly interconnected to sheave 33 on second electric or fan motor 34 via V-belt 35. It should be understood that when evaporator fan shaft 13 is driven by engine 19, second electric or fan motor 34 is freely rotated as the motor is not energized.

Outdoor heat exchanger or condenser fan 15 is positioned to circulate outdoor ambient air over heat exchanger 7 while indoor heat exchanger fan 12 is positioned to circulate the air within the container inward of wall 4 and to pass such air over the indoor heat exchanger or evaporator 6. Suitable apertures in portions 3 and 5 (not indicated) are provided for this air circulation. A thermostat or temperature controller 36 is positioned to sense the temperature within the conditioned or container space inward of wall 4 for purposes of controlling the refrigeration system as hereinafter described.

OPERATION

The operation of the mobile refrigeration unit 1 is best understood by specific reference to FIG. 2 showing an exemplary schematic electrical diagram. Let it be assumed that the control system 37 is connected to a 12-volt DC power source 38 and a high voltage AC power source 59 and that the engine-standby motor selector switch 39 is in the position making contact with terminal E rendering the system ready for engine drive operation. Closure of the control circuit main switch 40 establishes a circuit including power source 38, switch 40, selector switch 39, contacts 41 of defrost relay 42, and fan clutch 18 thereby energizing clutch 18 and drivingly engaging shafts 16 and 13. Also upon closure of control circuit main switch 40 a circuit is established including power source 38, switch 40, selector switch 39, and engine ignition system 43. Energization of engine ignition system 43 permits engine 19 to be started and run. The details of this starting system have not been herein shown as they may be entirely conventional. As the engine is started and brought to speed, clutch 21 engages thereby placing engine 19 in driving relation with jack shaft 20 which in turn is drivingly connected to compressor 8 and fan shaft 16, and fan shaft 13 by way of clutch 18. Thus compressor 8 and both fans 12 and 15 are in operation.

During the cooling cycle hot compressed refrigerant is discharged from compressor 8 and passed through four-way reversing valve 11 to be cooled by heat exchanger 7 with outdoor ambient air whereupon the condensed high-pressure refrigerant is throttled to a lower pressure by throttling means 10 and delivered to indoor heat exchanger 6. The liquid refrigerant within heat exchanger 6 is evaporated by heat from air within the container which is passed over the heat exchanger 6 by fan 12 thereby cooling the space within the container. The evaporated refrigerant is returned to the suction side of compressor 8 via four-way reversing valve 11.

Should the temperature in the conditioned space fall below a predetermined value, contacts 44 of thermostat 36 are closed to establish a circuit including 12-volt power source 38, control circuit main switch 40, contacts 44 of temperature controller 36 and reversing valve 11 whereby reversing valve 11 is energized to the reverse position shown in dotted line in FIG. 1. Thus, hot compressed refrigerant is discharged from compressor 8 and passed via reversing valve 11 to indoor heat exchanger 6. The air within the container space circulating over heat exchanger 6 is thereby heated causing the refrigerant within heat exchanger 6 to condense. The condensed refrigerant then passes through throttling means 10 to outdoor heat exchanger 7. Heat removed from air passing over outdoor heat exchanger 7 causes the refrigerant within heat exchanger 7 to evaporate so that it may return as a vapor to compressor 8 via four-way reversing valve 11.

Should the container or conditioned space rise to a predetermined temperature, contacts 44 of temperature controller 36 will again open returning the system to the cooling cycle.

During cooling cycle operation ice may accumulate on the indoor heat exchanger which must periodically be removed. For this purpose we have provided a defrost switch 45 which is closed in response to excessive ice accumulation on heat exchanger 6, i.e., in response to a demand for defrost. Closure of defrost switch 45 establishes a circuit including power source 38, control circuit main switch 40, defrost switch 45 and coil 46 of defrost relay 47 thereby energizing defrost relay 47. When defrost relay 47 is energized contacts 41 are opened thereby deenergizing clutch 18 so that fan 12 will not circulate warm air from heat exchanger 6 within the conditioned space during the defrost cycle. Energization of defrost relay establishes a circuit including power source 38, control circuit main switch 40, contacts 48 of defrost relay 47, and reversing valve 11. Energization of reversing valve 11 thus places the refrigeration system in a heating cycle whereby the indoor heat exchanger is warmed to render the heat exchanger free of ice. Switch 45 is opened upon completion of defrost to return the system to normal control.

Now assume that selector switch 39 is in the position bridging contact M for standby motor operation and that control circuit main switch 40 is closed after engine 19 has stopped rotating. It will be apparent that in this position of selector switch 39, no circuit is established energizing either evaporator fan clutch 18 or engine ignition system 43. Fan 12 thus is free wheeling with respect to fan 15. When the selector switch is in the position for standby motor operation, a circuit is completed including power source 38, switch 40, switch 39, contact 49 of defrost relay 47 and the coil 50 of indoor heat exchanger fan relay 51. The energization of indoor heat exchanger fan relay 51 closes contacts 52 thereby connecting the second electric or fan motor 34 to alternating current power source 59 thus causing fan 12 to be driven by motor 34. Motor 34 does not drive shaft 16 as clutch 18 remains disengaged.

Should the temperature in the conditioned space remain at the desired value, standby motor 30 remains deenergized. However, should the temperature rise above a predetermined value, temperature controller 36 closes contacts 53 thereof, thereby establishing a circuit including power source 38, control circuit main switch 40, selector switch 39, contacts 53 of temperature controller 36, and coil 54 of standby motor relay 55. The energization of standby motor relay 55 closes contacts 56 connecting standby motor 30 to power source 59 thereby energizing motor 30.

Motor 30 thus drives compressor 8 and through jack shaft 20 drives shaft 16 and thus fan 15. In this cycle of operation the reversing value is not energized and the system is on the cooling cycle aforementioned. Jack shaft 20 does not drive engine 19 because engine 19 is not running to engage centrifugal clutch 21. The cooling cycle is similar to that aforedescribed in connection with operation of engine 19, except that fan 12 is driven by motor 34 rather than by shaft 16.

Should the temperature of the conditioned space fall below a predetermined set point, the contacts 53 of controller 36 will open thereby deenergizing standby motor relay coil 54 thus opening relay contacts 56 and deenergizing standby motor 30. However, it will be noted that fan motor 34 continues to operate despite the deenergization of standby motor 30.

Should the temperature in the conditioned space fall further, contacts 44 and 57 of temperature controller 36 will be closed whereby a first circuit is established including power source 38, control circuit main switch 40, contacts 44 of temperature controller 36, and the coil of reversing valve 11 thereby energizing reversing valve 11 to the heating cycle position. A second circuit is established including power source 38, control circuit main switch 40, switch 57 of temperature controller 36, and coil 54 of standby motor relay 55 whereby standby motor relay 55 is energized to complete a circuit between power source 59 and standby motor 30. The system thus operates on the heating cycle as hereinbefore described.

Should the temperature within the conditioned space rise above a set point, temperature controller 36 will return to the position shown thereby opening contacts 44 and 57 and

deenergizing the reversing valve 11 and coil 54 of standby motor relay 55 thereby deenergizing standby motor 30. Again, it will be noted that motor 34 continues to operate despite the deenergization of motor 30.

Thus it will be seen that despite the off-and-on cycling of standby motor 30, the indoor heat exchanger fan 12 driven by motor 34 continues to operate and circulate air within the conditioned space thereby maintaining substantially uniform temperature throughout the conditioned space.

Should the system while on the standby motor cooling cycle require defrostings, switch 45 is closed thereby energizing coil 46 of defrost relay 47 as hereinbefore described. Energization of coil 46 closes contacts 48 thereby establishing a circuit including power source 38, control circuit main switch 40, contacts 48, and reversing valve 11 thereby placing the system in the heating cycle. Energization of coil 46 also opens contacts 49 thereby disrupting the circuit including coil 50 of indoor heat exchanger fan relay 51. Deenergization of coil 50 causes contacts 52 to open thereby deenergizing indoor heat exchanger fan motor 34 so that heat exchanger 6 may be defrosted without undue heating of the conditioned space.

Thus it will be seen that I have provided a mobile refrigeration system which permits both engine and standby electric motor operation wherein the indoor heat exchanger fan is operated continuously with either standby motor or engine power source except during those periods when defrosting of the indoor heat exchanger coil is being conducted.

I claim:

1. A refrigeration system for air conditioning a space comprising: a refrigerant compressor, a first heat exchanger, a refrigerant throttling means, and a second heat exchanger serially connected in a closed refrigerant loop; a first fan positioned to pass outdoor air over said first heat exchanger; a second fan positioned to circulate air from said conditioned space over said second heat exchanger; a power transmitting means for driving said compressor, said first fan and said second fan; a first electric motor drivingly connected to said power transmitting means; means for energizing said first electric motor in response to a first condition demanding air conditioning of said space; a second electric motor drivingly connected to said second fan; and means for energizing said second electric motor in the absence of said first condition whereby air circulation within said conditioned space is normally maintained for relatively uniform temperature distribution when said second heat exchanger is not conditioning said space.

2. A refrigeration system for air conditioning a space comprising: a refrigerant compressor, a first heat exchanger, a refrigerant throttling means, and a second heat exchanger serially connected in a closed refrigerant loop; a first fan positioned to pass outdoor air over said first heat exchanger; a second fan positioned to circulate air from said conditioned space over said second heat exchanger; a power transmitting means for driving said compressor, said first fan and said second fan; a prime mover; a first electric motor, selector means having alternative positions selecting said prime mover and said first electric motor for driving said power transmitting means; means for energizing said first electric motor in response to a first condition demanding air conditioning of said space while said selector means is positioned for operation of said first electric motor, a second electric motor drivingly connected to said second fan; means for energizing said second electric motor in the absence of said first condition while said selector means is positioned for operation of said first electric motor; whereby air circulation within said conditioned space is normally maintained for relatively uniform temperature distribution when said second heat exchanger is not conditioning said space; and means for drivingly disengaging said second fan from said power transmitting means when said second electric motor is energized whereby said second electric motor is not required to drive said refrigerant compressor or said first fan.

3. A refrigeration system for cooling a conditioned space comprising: a refrigerant compressor, a refrigerant condenser, a refrigerant throttling means and a refrigerant evaporator serially connected in a closed refrigerant loop; a condenser fan positioned to pass cooling air over said condenser; an evaporator fan positioned to circulate air from said conditioned space over said evaporator; defrost means for warming and thus defrosting said evaporator in response to a first condition demanding defrost of said evaporator; a power transmitting means for driving said compressor, said condenser fan, and said evaporator fan; a first electric motor drivingly connected to said power transmitting means; means for energizing said first electric motor in response to a second condition demanding cooling of said conditioned space; a second electric motor drivingly connected to said evaporator fan and means for energizing said second electric motor in the absence of said first and second conditions whereby air circulation within said condition space is normally maintained for relatively uniform temperature distribution when said evaporator is not cooling or being defrosted.

4. A refrigeration system for cooling a conditioned space comprising: a refrigerant compressor, a refrigerant condenser a refrigerant throttling means and a refrigerant evaporator serially connected in a closed refrigerant loop; a condenser fan position to pass cooling air over said condenser; an evaporator fan positioned to circulate air from said conditioned space over said evaporator; defrost means for warming and thus defrosting said evaporator in response to a first condition demanding defrost of said evaporator; a power transmitting means for driving said compressor, said condenser fan, and said evaporator fan; a prime mover; a first electric motor; selector means having alternative positions selecting said prime mover and said first electric motor for driving said power transmitting means; means for energizing said first electric motor in response to a second condition demanding cooling of said conditioned space while said selector means is positioned for operation of said first electric motor; a second electric motor drivingly connected to said evaporator fan; means for energizing said second electric motor in the absence of said first and second conditions while said selector means is positioned for operation of said first electric motor whereby air circulation within said conditioned space is normally maintained for relatively uniform temperature distribution when said evaporator is not cooling or being defrosted; and means for drivingly disengaging said evaporator fan from said power transmitting means when said second electric motor is energized whereby said second electric motor is not required to drive said refrigerant compressor or said condenser fan.

5. A refrigeration unit for cooling a mobile container comprising a housing having a first portion adapted to extend into an opening in a mobile container and a second portion adapted to remain external of the container; a refrigerant evaporator disposed within said first portion of said housing; a refrigerant compressor and condenser disposed in said second portion of said housing; a refrigerant loop serially connecting said evaporator, compressor and condenser; an evaporator fan disposed in said first portion of said housing positioned to circulate air in said container over said evaporator; a condenser fan disposed in said second portion of said housing positioned to pass cooling air over said condenser; a clutch; a first rotary drive means drivingly connecting one side of said clutch with said evaporator fan; a second rotary drive means drivingly connecting the other side of said clutch to said condenser fan; a prime mover and standby electric motor disposed within said second portion of said housing; power transmitting means for drivingly connecting said prime mover and standby electric motor to said compressor and said second rotary drive means; a second electric motor drivingly connected to said first rotary drive means and evaporator fan independently of said second rotary drive means whereby said evaporator fan may be driven by said second electric motor to maintain relatively uniform temperature distribution within said container when said prime mover is not operating to drive said evaporator fan via said clutch.

6. The apparatus as defined by claim 5 wherein said second electric motor is disposed within said first portion of said housing.

7. A refrigeration system for conditioning a space comprising: a refrigerant compressor, an outdoor heat exchanger, a refrigerant throttling means, and an indoor heat exchanger serially connected in a closed refrigerant loop; a first fan positioned to pass outdoor air over said outdoor heat exchanger; a second fan positioned to circulate air from the conditioned space over said indoor heat exchanger; a prime mover; a standby electric motor; a second electric motor; a mechanical drive train extending from said prime mover to said compressor, said first fan and said second fan for mobile operation; and means for mechanically drivingly connecting said compressor and said first fan to said standby electric motor and simultaneously mechanically drivingly connecting said second fan to said electric motor.

8. The apparatus as defined by claim 7 including means for defrosting said indoor heat exchanger and means for deenergizing said second electric motor when said indoor heat exchanger is defrosting.

9. The apparatus as defined by claim 7 wherein said means for mechanically drivingly connecting said compressor, said first fan and said second fan to said prime mover includes a clutch positioned to disengage said second fan without disengaging said compressor and first fan.

10. In a refrigeration system for conditioning a space and having a refrigerant compressor, an outdoor heat exchanger, a throttling means and an indoor heat exchanger serially connected in a closed refrigerant loop, a first fan positioned to pass outdoor air over said outdoor heat exchanger, a second fan positioned to circulate air from the conditioned space over said indoor heat exchanger, a prime mover, and a standby electric motor, the improvement comprising: a second electric motor; first means for drivingly connecting said compressor and said first and second fans to said prime mover when said second electric motor is not energized; second means for drivingly connecting said compressor and first fan to said standby electric motor and for drivingly connecting said second fan to said second electric motor when said second electric motor is energized; and means for selecting one of said first and second means for driving said compressor, first fan and second fan.

11. In a refrigeration system for conditioning a space and having a refrigerant compressor, an outdoor heat exchanger, a throttling means and an indoor heat exchanger serially connected in a closed refrigerant loop, a first fan positioned to pass outdoor air over said outdoor heat exchanger, a second fan positioned to circulate air from the conditioned space over said indoor heat exchanger, a prime mover, a standby electric motor, means for drivingly connecting said prime mover to said compressor and first and second fans, and means for drivingly connecting said standby electric motor to said compressor and first fan, the improvement comprising: a second electric motor; means drivingly connecting said second electric motor to said second fan; a source of electric power; a first electric circuit extending from said second electric motor to said source of electric power; and a second electric circuit extending from said standby motor to said source of electric power.

12. In a refrigerant system for conditioning a space and having a refrigerant compressor, an outdoor heat exchanger, a throttling means and an indoor heat exchanger serially connected in a closed refrigerant loop, a first fan positioned to pass outdoor air over said outdoor heat exchanger, a second fan positioned to circulate air from the conditioned space over said indoor heat exchanger, a prime mover, and a standby electric motor, the improvement comprising: means for driving said first fan alternatively by said prime mover and by said standby electric motor; a second electric motor; and means for driving said second fan alternatively by said prime mover and by said second electric motor.

13. A refrigeration system for air conditioning a space comprising: a refrigerant compressor, a first heat exchanger, a refrigerant throttling means, and a second heat exchanger serially connected in a closed refrigerant loop; a first fan positioned to pass outdoor air over said first heat exchanger; a second fan positioned to circulate air from said conditioned space over said second heat exchanger; a power transmitting means for driving said compressor, said first fan and said second fan; a first electric motor drivingly connected to said power transmitting means; means for activating said first electric motor in response to a first condition demanding air conditioning of said space and deactivating said first electric motor in the absence of said first condition; a second electric motor drivingly connected to said second fan; and means for energizing said second electric motor in the absence of said first condition whereby air circulation within said conditioned space is normally maintained for relatively uniform temperature distribution when said second heat exchanger is not conditioning said space.

14. A refrigeration system for cooling a conditioned space comprising: a refrigerant compressor, a refrigerant condenser, a refrigerant throttling means and a refrigerant evaporator serially connected in a closed refrigerant loop; a condenser fan positioned to pass cooling air over said condenser; an evaporator fan positioned to circulate air from said conditioned space over said evaporator; defrost means for warming and thus defrosting said evaporator in response to a first condition demanding defrost of said evaporator; a power transmitting means for driving said compressor, said condenser fan, and said evaporator fan; a first electric motor drivingly connected to said power transmitting means; means for activating said first electric motor in response to a second condition demanding cooling of said conditioned space and deactivating said first electric motor in the absence of both of said first and second conditions; a second electric motor drivingly connected to said evaporator fan and means for energizing said second electric motor in the absence of said first and second conditions whereby air circulation within said condition space is normally maintained for relatively uniform temperature distribution when said evaporator is not cooling or being defrosted.

* * * * *

6. The apparatus as defined by claim 5 wherein said second electric motor is disposed within said first portion of said housing.

7. A refrigeration system for conditioning a space comprising: a refrigerant compressor, an outdoor heat exchanger, a refrigerant throttling means, and an indoor heat exchanger serially connected in a closed refrigerant loop; a first fan positioned to pass outdoor air over said outdoor heat exchanger; a second fan positioned to circulate air from the conditioned space over said indoor heat exchanger; a prime mover; a standby electric motor; a second electric motor; a mechanical drive train extending from said prime mover to said compressor, said first fan and said second fan for mobile operation; and means for mechanically drivingly connecting said compressor and said first fan to said standby electric motor and simultaneously mechanically drivingly connecting said second fan to said electric motor.

8. The apparatus as defined by claim 7 including means for defrosting said indoor heat exchanger and means for deenergizing said second electric motor when said indoor heat exchanger is defrosting.

9. The apparatus as defined by claim 7 wherein said means for mechanically drivingly connecting said compressor, said first fan and said second fan to said prime mover includes a clutch positioned to disengage said second fan without disengaging said compressor and first fan.

10. In a refrigeration system for conditioning a space and having a refrigerant compressor, an outdoor heat exchanger, a throttling means and an indoor heat exchanger serially connected in a closed refrigerant loop, a first fan positioned to pass outdoor air over said outdoor heat exchanger, a second fan positioned to circulate air from the conditioned space over said indoor heat exchanger, a prime mover, and a standby electric motor, the improvement comprising: a second electric motor; first means for drivingly connecting said compressor and said first and second fans to said prime mover when said second electric motor is not energized; second means for drivingly connecting said compressor and first fan to said standby electric motor and for drivingly connecting said second fan to said second electric motor when said second electric motor is energized; and means for selecting one of said first and second means for driving said compressor, first fan and second fan.

11. In a refrigeration system for conditioning a space and having a refrigerant compressor, an outdoor heat exchanger, a throttling means and an indoor heat exchanger serially connected in a closed refrigerant loop, a first fan positioned to pass outdoor air over said outdoor heat exchanger, a second fan positioned to circulate air from the conditioned space over said indoor heat exchanger, a prime mover, a standby electric motor, means for drivingly connecting said prime mover to said compressor and first and second fans, and means for drivingly connecting said standby electric motor to said compressor and first fan, the improvement comprising: a second electric motor; means drivingly connecting said second electric motor to said second fan; a source of electric power; a first electric circuit extending from said second electric motor to said source of electric power; and a second electric circuit extending from said standby motor to said source of electric power.

12. In a refrigerant system for conditioning a space and having a refrigerant compressor, an outdoor heat exchanger, a throttling means and an indoor heat exchanger serially connected in a closed refrigerant loop, a first fan positioned to pass outdoor air over said outdoor heat exchanger, a second fan positioned to circulate air from the conditioned space over said indoor heat exchanger, a prime mover, and a standby electric motor, the improvement comprising: means for driving said first fan alternatively by said prime mover and by said standby electric motor; a second electric motor; and means for driving said second fan alternatively by said prime mover and by said second electric motor.

13. A refrigeration system for air conditioning a space comprising: a refrigerant compressor, a first heat exchanger, a refrigerant throttling means, and a second heat exchanger serially connected in a closed refrigerant loop; a first fan positioned to pass outdoor air over said first heat exchanger; a second fan positioned to circulate air from said conditioned space over said second heat exchanger; a power transmitting means for driving said compressor, said first fan and said second fan; a first electric motor drivingly connected to said power transmitting means; means for activating said first electric motor in response to a first condition demanding air conditioning of said space and deactivating said first electric motor in the absence of said first condition; a second electric motor drivingly connected to said second fan; and means for energizing said second electric motor in the absence of said first condition whereby air circulation within said conditioned space is normally maintained for relatively uniform temperature distribution when said second heat exchanger is not conditioning said space.

14. A refrigeration system for cooling a conditioned space comprising: a refrigerant compressor, a refrigerant condenser, a refrigerant throttling means and a refrigerant evaporator serially connected in a closed refrigerant loop; a condenser fan positioned to pass cooling air over said condenser; an evaporator fan positioned to circulate air from said conditioned space over said evaporator; defrost means for warming and thus defrosting said evaporator in response to a first condition demanding defrost of said evaporator; a power transmitting means for driving said compressor, said condenser fan, and said evaporator fan; a first electric motor drivingly connected to said power transmitting means; means for activating said first electric motor in response to a second condition demanding cooling of said conditioned space and deactivating said first electric motor in the absence of both of said first and second conditions; a second electric motor drivingly connected to said evaporator fan and means for energizing said second electric motor in the absence of said first and second conditions whereby air circulation within said condition space is normally maintained for relatively uniform temperature distribution when said evaporator is not cooling or being defrosted.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,646,773 Dated March 7, 1972

Inventor(s) George L. Falk, et. al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 7, line 17 should read as follows: -- fan to said second electric motor. -- . Cancel columns 9 and 10.

Signed and sealed this 12th day of December 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

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