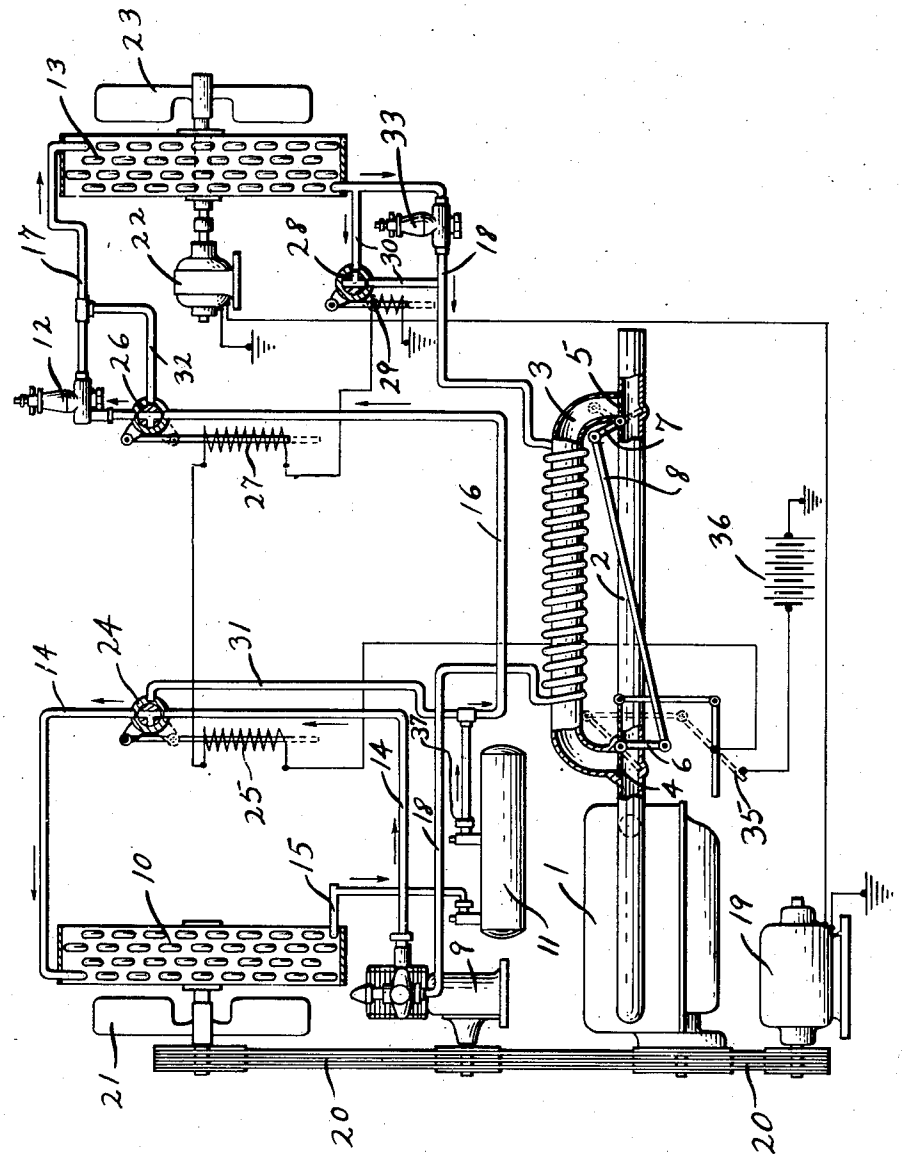
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REFRIGERATION UNIT

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REFRIGERATION UNIT

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2 Claims. (Cl. 62—115)

This invention relates to a refrigeration unit and more particularly to a portable refrigeration unit driven by an internal combustion engine which is particularly useful for refrigerating the storage compartments of moving vehicles, such as motor trucks, trailers and railway cars. In this type of refrigeration unit it is desirable that the evaporator should be defrosted quickly with substantially no rise in the temperature within the refrigerated compartment.

It is the object of this invention to produce a refrigeration unit driven by an internal combustion engine which can be quickly defrosted and returned to the refrigerating cycle with no substantial change in the temperature within the refrigerated compartment.

The drawing shows a diagrammatic lay-out of the refrigerating unit.

Referring more particularly to the drawing there is shown an internal combustion engine 1 with an exhaust line 2 and an exhaust by-pass line 3 controlled by valves 4 and 5 which are connected together by levers 6 and 7 and link 8 so that valves 4 and 5 open and close simultaneously.

The refrigerating unit comprises a compressor 9, condenser 10, receiver tank 11, expansion valve 12 and evaporator 13. A pipe line 14 connects the compressor with the condenser. Pipe line 15 connects the condenser with the receiver 11. Line 16 connects the receiver 11 with the expansion valve 12. Line 17 connects the expansion valve 12 with the evaporator 13 and line 18 connects the evaporator with the intake port of the compressor 9.

The engine 1 drives a generator 19, the compressor 9 and the condenser fan 21 by means of a belt and pulley arrangement generally designated 20. The generator drives an electric motor 22 which drives the evaporator fan 23. Line 14 is the pressure line whereas line 18 is the suction line.

A by-pass valve 24 controlled by solenoid 25 is placed in line 14. A by-pass valve 26 controlled by solenoid 27 is placed in line 16 and a by-pass valve 28 controlled by solenoid 29 is inserted in by-pass line 30. By-pass valve 24 controls by-pass line 31 which runs between line 16 and line 14. By-pass valve 26 controls by-pass line 32 which runs from line 16 to line 17 to by-pass expansion valve 12. By-pass valve 28 is positioned in line 30 so that the suction line 18 can by-pass expansion valve 33. Line 18 is coiled around the exhaust by-pass line 3 to effect heat exchange between the gases in line 18 and the exhaust gases of the engine 1 at the proper time, as outlined below.

In the full line showing of the drawing the unit is operating in the refrigeration cycle, that is, the compressed refrigerant passes through line 14, solenoid valve 24 into the condenser 10, through line 15 into receiver 11, thence through line 16, by-pass valve 26, expansion valve 12 into the evaporator 13 and then through line 30, by-pass valve 28 and line 18 back into the compressor. During the refrigeration cycle exhaust valves 4 and 5 are closed so that the exhaust gases are not passing through by-pass line 3 but are passing through line 2 direct to atmosphere.

When it is desired to defrost the unit, exhaust valves 4 and 5 are manually thrown to open position, as shown in the dotted lines, whereupon the exhaust gases are now directed through by-pass line 3. As exhaust valves 4 and 5 are simultaneously opened, switch 35 interconnected therewith is closed thus placing battery 36 in circuit with the solenoids 25, 27 and 29, thereby energizing these solenoids. Energization of the solenoids 25, 27 and 29 produces the following result: By-pass valve 24 connects line 14 with line 31 so that the compressed gases by-pass, that is, do not flow through the condenser 10 and receiver 11 but pass through lines 31 and 16 to by-pass valve 26. By-pass valve 26 is now turned to the dotted line position so that the gases by-pass expansion valve 12 and pass directly through lines 32 and 17 into the evaporator 13. By-pass valve 28 has now shut off line 30 so that the gases pass from the low side of the evaporator through expansion valve 33 where they are further expanded to absorb heat and then pass through line 18 and the coil about the hot exhaust by-pass line 3 where they are heated and expanded preparatory to passing into the compressor 9. It is evident that the heated gases upon being compressed pick up further heat preparatory to being passed through the evaporator 13 and thus speedily defrost the evaporator. Check valve 37 permits the gases to flow only in the direction of the arrow and thus prevents the gases from flowing from line 31 back into the receiver 11 and condenser 10.

As soon as the unit is defrosted, valves 4 and 5 are again operated to shut off the by-pass line 3 and open switch 35 which breaks the circuit between the battery 36 and the solenoids 25, 27 and 29 whereupon the by-pass valves 24, 26 and 28 return to the full line position shown in the drawing and the refrigeration cycle begins.

I claim:

1. In a refrigerating system comprising a compressor 9, a condenser 10, an evaporator 13, a line 14 connecting the high side of the compressor with the condenser, a line 15, 16, 17 connecting the condenser with the evaporator, a suction line 18 connecting the evaporator with the low side of the compressor, a first solenoid operated by-pass valve 24 connected into the line 14 between the high side of the compressor and the condenser, a by-pass line 31 forming a connection between the above said by-pass valve 24 and the said line 15, 16, 17 between the condenser and the evaporator, an expansion valve 12 in the second mentioned line 15, 16, 17 positioned between the evaporator and the point at which the above said by-pass line 31 connects into the line 15, 16, 17 between the condenser and evaporator, a second solenoid operated by-pass valve 26 in the line 15, 16, 17 running between the condenser and evaporator and positioned between said expansion valve 12 and the point at which said by-pass line 31 connects into the line 15, 16, 17 running between the condenser and the evaporator, a by-pass line 32 about said expansion valve 12, the second mentioned by-pass line 32 connecting the second mentioned solenoid operated valve 26 with the part of the second mentioned line 15, 16, 17 extending from said expansion valve 12 to the evaporator 13, an internal combustion engine for operating said compressor, an exhaust line 3 for said engine constituting a source of heat, said exhaust line being in heat exchange relation with said line 18 connecting the evaporator with the low side of the compressor, a valve 4 for said exhaust line, said exhaust line valve 4 when closed preventing the exhaust gases from flowing through said exhaust line and when open permitting the exhaust gases to flow through said exhaust line 3, and means for coincidentally operating said solenoid by-pass valves 24, 26 to open them into their respective by-pass lines 31, 32 and for opening said exhaust line valve 4, whereby the refrigerant may bypass the condenser 10 and the said expansion valve 12 in the line 15, 16, 17 running between the condenser and evaporator and whereby the exhaust gases may flow through the exhaust line 3 and the refrigeration system may be quickly defrosted.

2. The combination as claimed in claim 1 including a second expansion valve 33 positioned in said suction line 18 between the evaporator 13 and the exhaust line 3 of said engine, and a third solenoid operated by-pass valve 28 in a line 30 connected into said line 18 between the evaporator and the low side of the compressor for bypassing said second expansion valve 33, said third solenoid operated valve 28 being coincidentally operated with the other solenoid valves 24, 26 for by-passing the refrigerant about said second expansion valve 33 during the refrigeration cycle when said first and second by-pass valves 24, 26 close their respective by-pass lines, said third solenoid valve 28 being closed during the defrosting cycle to shut off its respective by-pass line 30 while first and second solenoid by-pass valves 24, 26 open their respective by-pass lines 31, 32.

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