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NONRECIPROCATING REFRIGERATION UNIT

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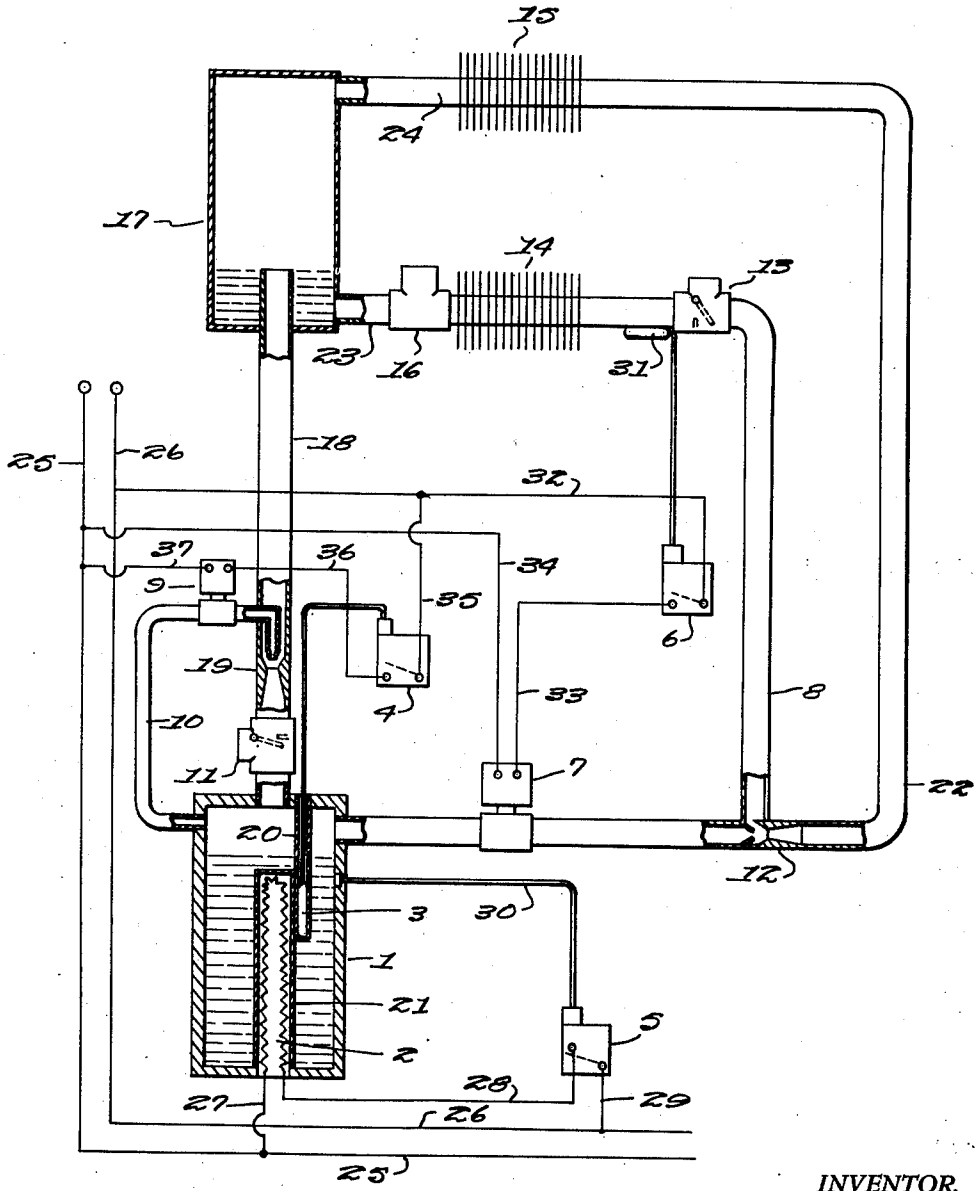

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NONRECIPROCATING REFRIGERATION UNIT

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2 Claims. (Cl. 62—3)

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This invention relates to a refrigeration system, and more particularly to a refrigeration system which has no moving parts for conveying the refrigerant from a low-pressure region to a high-pressure region.

The object of the invention is to provide a refrigeration system in which a gaseous refrigerant at high pressure is passed or delivered through an ejector or nozzle in order to draw evaporated refrigerant from the evaporator.

Another object of the invention is to provide a refrigeration system which includes a mechanism for automatically and accurately controlling the flow of refrigerant through the system so as to insure that the system is at all times operating under the most efficient conditions.

Another object of the invention is to provide a refrigeration system which is extremely simple and inexpensive to manufacture.

Other objects and advantages will be apparent during the course of the following description.

In the accompanying drawing, forming a part of this application, and in which like numerals are used to designate like parts throughout the same:

The single figure is a schematic or diagrammatic view illustrating the refrigeration system of the present invention.

Referring in detail to the drawing, the numeral 1 designates a generator which may be fabricated of any suitable material, and the generator 1 is preferably insulated. The generator is adapted to receive liquid refrigerant, such as Freon 12 therein, and an electric heating element 2 projects into the generator 1 in order to vaporize or volatilize the liquid refrigerant in the generator. Arranged contiguous to the heating element 2 and positioned in the generator 1 is a thermostat control bulb 3. Operatively connected to the thermostat control bulb 3 is a thermostat switch 4. A pressure switch 5 is actuated by the pressure of the refrigerant in the generator 1, and a thermostat switch 6 is actuated by the temperature in the evaporator, as later described in this application. The thermostat switch 6 serves to operate a solenoid valve 7, whereby automatic control of the evaporator is effected.

The numeral 8 designates a suction line or conduit, while the numeral 9 designates a solenoid valve which is arranged in a high-pressure gas line or tube 10. A pipe 18 has one end projecting into a receiver tank 17, while the other end of the pipe 18 communicates with the top of the generator 1. A check valve 11 is arranged in the pipe 18 adjacent the lower end thereof, the check valve 11 serving to insure that refrigerant can only flow from the receiver tank 17 into the generator 1 and not in the opposite direction.

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The refrigeration system of the present invention further includes an ejector or nozzle 12 which is arranged in a high-pressure gas line or conduit 22. Arranged in the conduit or suction line 8 is a check valve 13 which serves to prevent refrigerant from accidentally flowing back into the evaporator 14. The evaporator or cooling unit 14 is connected to the bottom of the receiver tank 17 by a conduit 23. In the evaporator 14, the refrigerant boils and the effective cooling takes place.

A condenser 15 is provided and is connected to the upper end of the receiver tank 17 by a conduit 24. Arranged in the conduit 23 is an expansion valve 16 which may be of any conventional design. Arranged in the lower portion of the gas transfer line or pipe 18 is an ejector 19. The thermostat control bulb 3 is arranged or positioned within a well 20 which may be secured to a well 21 that surrounds the heater element 2.

The numerals 25 and 26 designate a pair of electrical conductor wires which are adapted to convey electrical energy from a suitable source of supply. An electric wire 27 connects one end of the heating element 2 to the line 25, and an electric wire 28 connects the heating element 2 to the pressure switch 5, there being a wire 29 electrically connecting the pressure switch 5 to the wire or line 26. A tube 30 has one end communicating with the interior of the generator 1, and the other end of the tube 30 is connected to the pressure switch 5, so that the switch 5 which controls the heating element 2 is actuated by pressure in the generator 1. A thermostat control bulb 31 is operatively connected to the thermostat switch 6, whereby the solenoid valve 7 will regulate the flow of refrigerant through the conduit 22 to thereby control the temperature of the cooling unit or evaporator 14. A wire 32 electrically connects the line 26 to the thermostat switch 6, and an electricity-carrying wire 33 electrically connects the thermostat switch 6 to the solenoid valve 7, there being an electric wire 34 electrically connecting the solenoid valve 7 to the power line 25.

The thermostat control bulb 3 is operatively connected to the thermostat switch 4, and a wire 33 electrically connects the thermostat switch 4 to the wire 32, there being a wire 36 electrically connecting the thermostat switch 4 to the solenoid valve 9. A wire 37 electrically connects the solenoid valve 9 to the electric line 25.

In use, the operation of the refrigeration system

is as follows: The refrigerant in the generator 1 is heated to a predetermined temperature and pressure by means of the heating element 2, so that gas or vapor under high pressure is generated or produced. This high-pressure vapor passes through the solenoid valve 7, thence through the ejector 12, and the ejector 12 creates a vacuum or draws vapor through the suction line or conduit 8. The conduit 8 is connected to the cooling unit or evaporator 14. The high and low-pressure gases or vapors are mixed in the ejector 12 and carried through the remaining portion of the conduit 22, these vapors then passing through the condenser 15. In the condenser 15, the vapors are cooled and liquefied, and the liquid refrigerant enters the receiver tank 17. When the receiver tank 17 is about one-half full of liquid refrigerant, the liquid level in the generator 1 will have been lowered below the thermostat control bulb 3, and this causes the bulb 3 to become hot and thereby close the thermostat switch 4. This closing of the thermostat switch 4 causes the solenoid valve 9 to open, and this results in or causes the ejector 19 to refill the generator 1 with refrigerant. When the liquid level in the generator is raised above the thermostat control bulb 3, the bulb 3 will be cooled to thereby open the thermostat switch 4 so that this results in or causes the solenoid valve 9 to close. This cycle is repeated continuously as the level of refrigerant in the generator 1 is lowered.

The electric heating unit well 21 extends to the top of the thermostat control bulb 3, so that an efficient heat transfer will be effected between the bulb well 20 and the heating unit well 21. The wells 20 and 21 are preferably welded together. The thermostat switch 6 controls the temperature of the evaporator 14, since the thermostat switch 6 controls the solenoid valve 7. Also, the thermostat switch 4 serves to control the liquid level in the generator 1, because the thermostat switch 4 operates or actuates the solenoid valve 9. Further, the pressure switch 5 controls or regulates the gas pressure in the generator 1, because the pressure switch 5 controls the actuation of the heating element 2. Pressure is maintained in the generator 1 at all times. The check valve 13 prevents the high-pressure gas from entering the evaporator 14 on the off-cycle. The check valve 11 opens only when refrigerant is being transferred from the receiver tank 17 to the generator 1.

If desired, the heating element 2 may be a canned heating unit or may be heat supplied from an engine exhaust, and if such a heating system were used, the controls would be different. The refrigeration system of the present invention can be used in domestic refrigerators, air-conditioning units, as well as being adapted for use by campers, picnickers and the like. The refrigeration system requires no moving parts to transfer the refrigerant, and the system is simple and inexpensive to manufacture. Any suitable refrigerant, such as Freon, can be used in the system.

I claim:

1. In a refrigeration system, a receiver tank, a generator adapted to receive refrigerant from said receiver tank, a heating element arranged in said generator, a tubular well in said generator enclosing said heating element, a second well in said generator secured to said first well, a thermostat control built in said second well, a thermostatic switch connected to said control bulb, a condenser, an evaporator, a first conduit connecting said generator to said condenser, a second conduit connecting said condenser to said receiver tank, an ejector arranged in said first conduit, a third conduit connecting said receiver tank to said evaporator, an expansion valve in said third conduit, a fourth conduit connecting said evaporator to said ejector, a pipe connecting said receiver tank to said generator, a pressure operated switch for controlling the actuation of said heating element, a check valve in the pipe connecting said generator to said receiver tank, a high pressure tube connected to said generator and to said pipe above said check valve, a solenoid arranged in said high pressure tube, a solenoid valve in said first conduit, a thermostatic control bulb connected to said last said solenoid valve and a circuit for said pressure switch, said solenoid, said solenoid valve, and said first and second thermostatic switches for the actuation thereof.

2. In a refrigeration system, a receiver tank, a generator adapted to receive refrigerant from said receiver tank, a heating element arranged in said generator, a condenser, an evaporator, a first conduit connecting said generator to said condenser, a second conduit connecting said condenser to said receiver tank, an ejector arranged in said first conduit, a third conduit connecting said receiver tank to said evaporator, a fourth conduit connecting said evaporator to said ejector, a pipe connecting said receiver tank to said generator, a pressure-operated switch for controlling actuation of said heating element, a high pressure tube connecting said generator to said pipe, a solenoid valve arranged in said tube, a thermostat switch for actuating said solenoid valve for controlling the level of liquid refrigerant in said generator, a solenoid valve arranged in said first conduit, and a thermostat switch for actuating said last-named solenoid valve to control the temperature of said evaporator.

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