Sept. 10, 1940. E. DICKEY 2,214,103

REFRIGERATING APPARATUS

Filed May 31, 1935 2 Sheets-Sheet 1

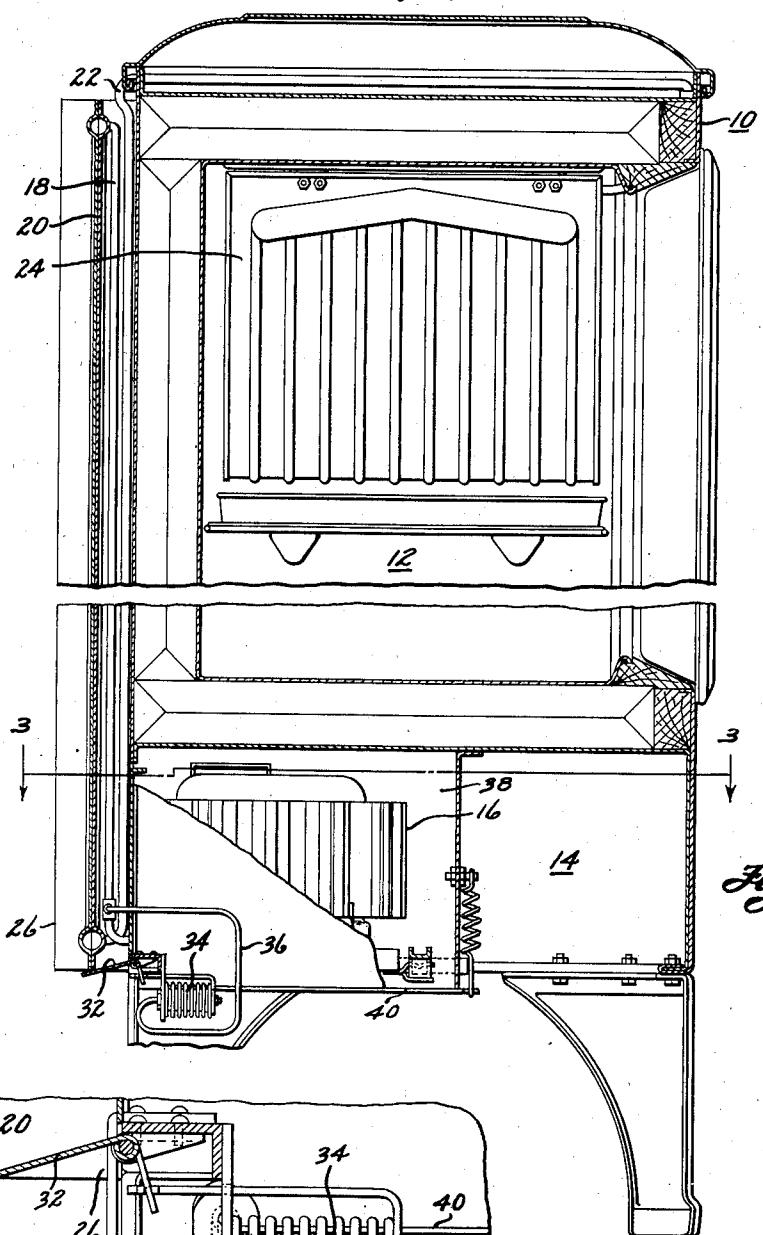


Fig. 1

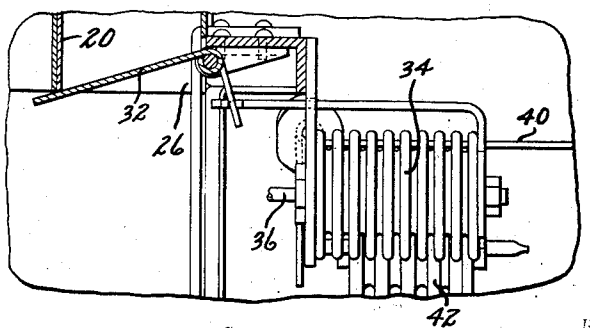


Fig. 2

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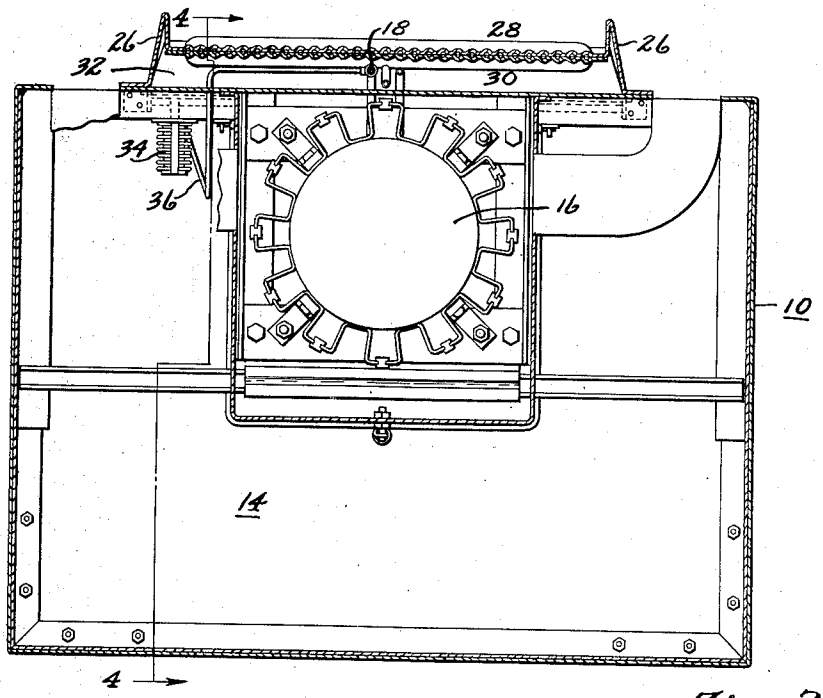


Fig. 3

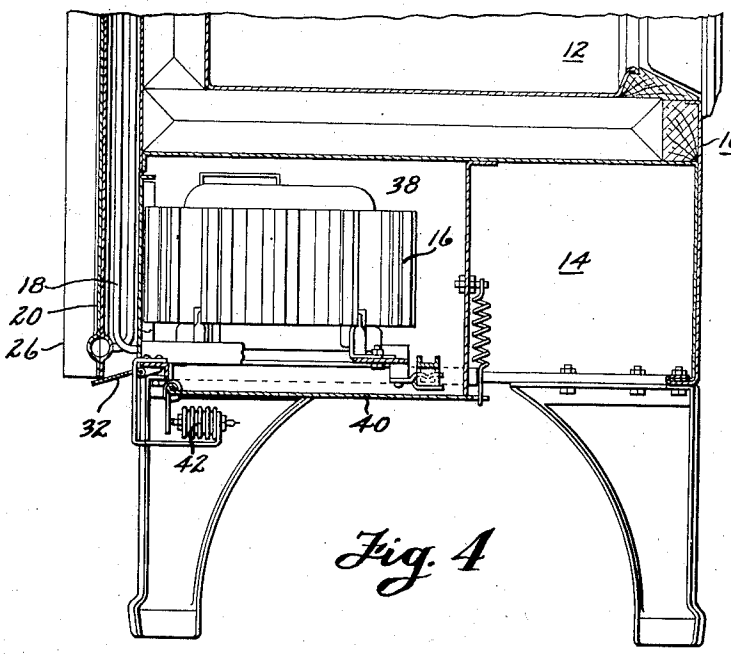


Fig. 4

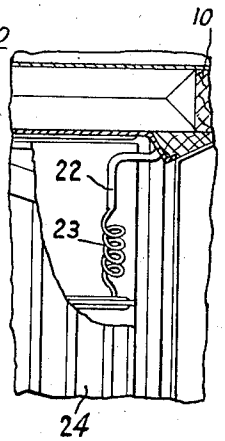


Fig. 5.

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UNITED STATES PATENT OFFICE

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REFRIGERATING APPARATUS

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Application May 31, 1935, Serial No. 24,282

7 Claims. (Cl. 62—3)

This invention relates to refrigerating apparatus and more particularly to controlling means for the refrigerant circuit of a compression refrigerating machine. In refrigerating apparatus of the compression type designed for low cost, it is essential, if satisfactory operation is to be secured, that the refrigerating cycle take place with maximum efficiency at all times since with a low powered motor, which cost limitations impose, the unit must be operated as near as possible to its theoretical maximum efficiency if satisfactory box temperature and ice freezing characteristics are to be maintained.

It has been possible heretofore to construct low cost refrigerating apparatus which will operate with satisfactory efficiency at full load by proper design of the system and proper correlation of the relative capacities of its various elements. Many such low cost systems employ a fixed restrictor to regulate expansion of the refrigerant in order to take advantage of the low cost and freedom from service difficulties inherent in that type of expansion device. However, the natural characteristics of a fixed restrictor are such that the changes in rate of flow therethrough produced with changes in pressure differential across the same do not produce the optimum flow rates for all possible load conditions. It has been necessary in designing a system of this character, therefore, to choose some one load condition usually the maximum, under which the system is designed to operate at maximum efficiency and to accept operation at considerably less efficiency under all other load conditions.

If a refrigerating apparatus of the character described is designed to operate at maximum efficiency under maximum load conditions, such, for example, as a high room temperature, together with a large freezing load of water to be cooled and frozen, the considerably reduced efficiency under less than full load conditions causes unnecessarily large current consumption at times when the apparatus is not operating under maximum load.

Heretofore, it has been possible to reduce the high current consumption at partial loads only by sacrificing efficiency at full load, and it is an object of the present invention to provide a mechanical refrigerating apparatus which is designed to operate at maximum efficiency under full load, and in which the loss of efficiency and consequent current consumption are materially reduced when operating under partial load conditions.

The present invention is directed to the provision of a means for artificially inducing, under low load conditions, those conditions which are necessary to maintain high efficiency at full load. Thus, for example, under full load conditions, the head pressure is high due to the high room temperature to which the condenser is exposed. The present invention is directed to providing means for artificially maintaining the temperature of the condenser at a point such that the high head pressure will be maintained during low load conditions. Also, under high load conditions, the temperature of the compressor is high and the lubricant therein is maintained in a high state of concentration, due to the high temperature. The present invention is also directed to providing means for artificially maintaining the high temperature of the compressor during low room temperatures.

It is a further object of the present invention to provide a refrigerating apparatus of the character described having means for varying the circulation of air over the refrigerant liquefying unit.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a vertical cross section of a refrigerating apparatus embodying the present invention;

Fig. 2 is a fragmentary view corresponding to Fig. 1 showing a portion of the apparatus on a larger scale;

Fig. 3 is a cross section on line 3—3 of Fig. 1;

Fig. 4 is a cross section on line 4—4 of Fig. 3; and

Fig. 5 is a fragmentary view with parts of the evaporator broken away to show the fixed restrictor.

The refrigerating apparatus comprises a cabinet 10 having a food compartment 12 and a machinery compartment 14 below the food compartment. Within the machinery compartment, there is mounted a motor-compressor unit 16 which delivers compressed refrigerant through a conduit 18 to a plate condenser 20 mounted on the back wall of the cabinet 10. Refrigerant liquefied in the condenser 20 is delivered through a conduit 22 to an evaporator 24 mounted in the food compartment 12, a heat interchanger (not shown) and a fixed restrictor 23 of conventional design being interposed in the line 22. A suction line (not shown) delivers expanded refrigerant from the evaporator to the compressor 16. The

condenser 20 is formed as illustrated in Fig. 3 with sheet metal wings 26 on either side thereof to provide vertical flues 28 and 30 adjacent both surfaces of the condenser plate for the passage of air for cooling the condenser. At the bottom of the flue 30, there is mounted a damper 32 for controlling the entrance of air to the flue. The damper 32 is controlled by means of an expansible bellows 34 which is connected by means of a conduit 36 to the conduit 18. The bellows 34 thus is responsive to the head pressure within the condenser 20 and operates to open the damper 32 upon increased head pressure and vice versa. The compressor 16 is mounted within an air duct 38, the entrance to which is at the bottom and controlled by means of a pivoted damper 40. The damper 40 is actuated by an expansible bellows 42 which is filled with a volatile fluid to expand and contract in response to temperature of the air surrounding the bellows. The bellows 42 operates to open the damper 40 upon an increase in temperature.

In operation under peak load conditions, the head pressure in the condenser 20 will be high and the bellows 34 will maintain the damper 32 open, thus providing for maximum flow of cooling air to the condenser 20 which is necessary at the peak room temperature. Likewise, the damper 40 will be maintained open by the bellows 42 to provide for maximum flow of air to the compressor 16. Under low load conditions, the head pressure is artificially maintained at a point near the peak due to the action of the damper 32 which tends to close whenever the head pressure tends to decrease. Likewise, the temperature of the compressor is artificially maintained due to the action of the damper 40 which tends to close whenever the room temperature falls below the peak value.

It will thus be seen that the present invention provides a refrigerating apparatus in which the conditions which occur at peak loads and contribute to the efficiency of the machine are maintained during operation at maximum peak load.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A refrigerating apparatus comprising in combination, an enclosure to be refrigerated, an evaporator in thermal exchange with said enclosure, a refrigerant liquefying means supplying refrigerant to said evaporator, a fixed restrictor between said liquefying means and said evaporator, and means for varying the air flow over said liquefying means in response to head pressure variations.

2. In combination, an enclosure to be refrigerated, an evaporator in thermal exchange with said enclosure, a refrigerant compressor, a fixed restrictor, a refrigerant condenser insulated from said enclosure, fluid flow connections between said evaporator, compressor, restrictor and condenser, and means for varying the air flow over said condenser upon variations in temperature outside said enclosure.

3. A refrigerating apparatus comprising, in combination, an enclosure to be refrigerated, a refrigerant compressor, a refrigerant condenser insulated from said enclosure, an evaporator in thermal exchange with said enclosure, fluid flow connections between said compressor, condenser and evaporator, means for inducing natural flow of air over said condenser, and means for decreasing the air flow over said condenser upon a decrease in the temperature outside said enclosure.

4. A refrigerating apparatus comprising, in combination, an enclosure to be refrigerated, an evaporator in thermal exchange with said enclosure, a motor-compressor unit, a refrigerant condenser insulated from said enclosure, means for varying the air flow over said condenser, and means for independently varying the air flow over said motor-compressor unit.

5. A refrigerating apparatus comprising, in combination, an enclosure to be refrigerated, an evaporator in thermal exchange with said enclosure, a refrigerant compressor, a refrigerant condenser, fluid flow connections between said evaporator, compressor and condenser, means forming a flue for the circulation of air over said condenser, independent means forming a flue for the circulation of air over said compressor, and temperature responsive means for varying the circulation of air through one of said flues.

6. A refrigerating apparatus comprising, in combination, an enclosure to be refrigerated, an evaporator in thermal exchange with said enclosure, a motor-compressor unit, a refrigerant condenser insulated from said enclosure, fluid flow connections between said evaporator, unit and condenser, means for inducing natural flow of air over said motor-compressor unit, and means for varying the natural flow of air over said motor-compressor unit.

7. In combination, an enclosure to be refrigerated, an evaporator in thermal exchange with said enclosure, a compressor and a condenser in refrigerant flow relationship with said evaporator, means for directing air over said condenser, a fixed restrictor between said condenser and said evaporator, and means responsive to the pressure within said condenser for controlling the flow of air over said condenser.

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