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REFRIGERATING APPARATUS

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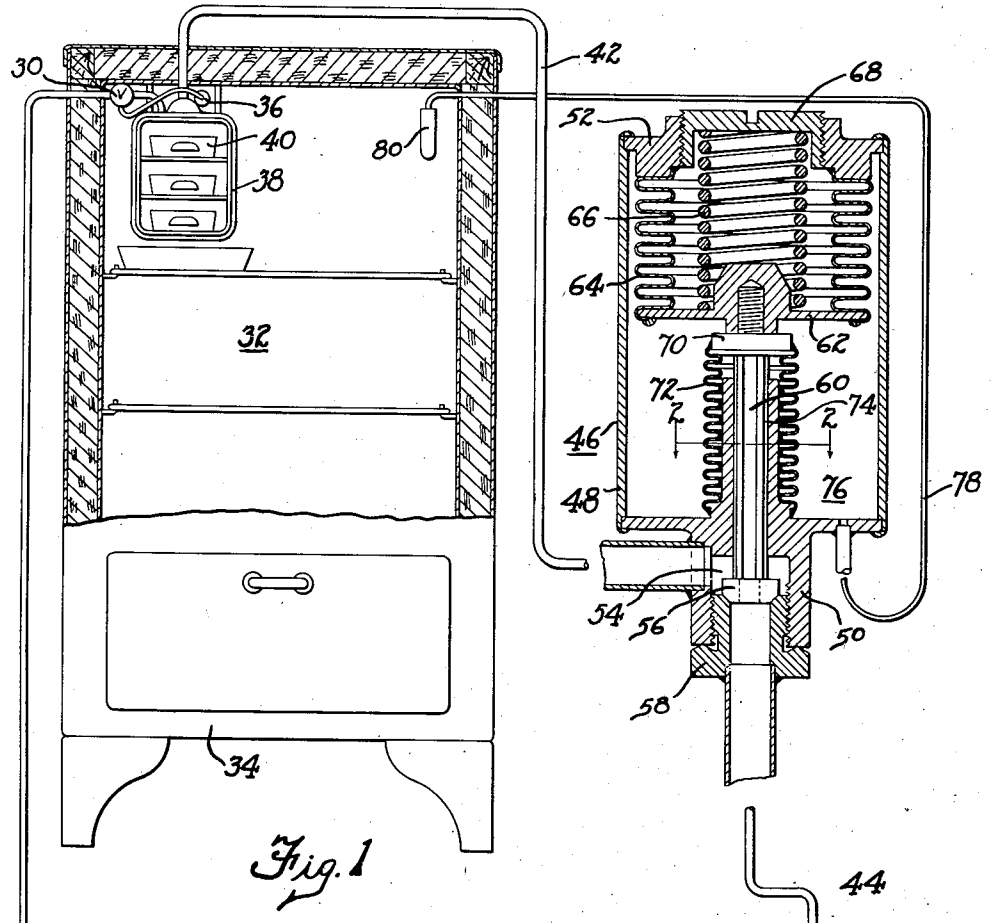

Fig. 1

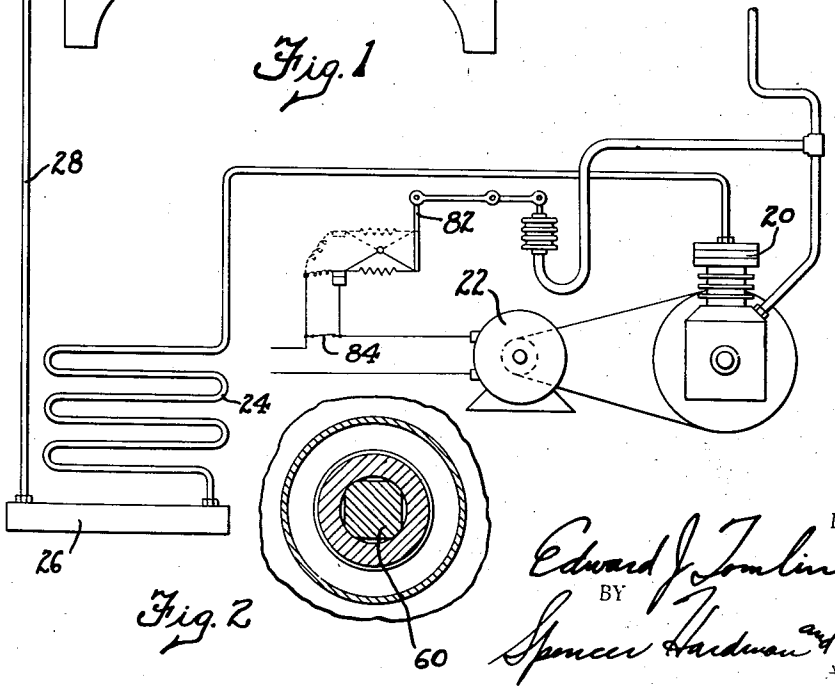

Fig. 2

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REFRIGERATING APPARATUS

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7 Claims. (Cl. 62—4)

This invention relates to refrigerating apparatus and more particularly to control means therefor.

Attempts have been made to operate refrigerating apparatus continuously so as to eliminate the usual starting and stopping and thereby permit the use of a smaller apparatus to supply refrigeration. The operation of a system in such a manner has disclosed certain difficulties in maintaining the proper evaporator and refrigerator temperatures thereby. In such systems in warm weather the evaporator and refrigerator temperatures would be too high while in cool weather the temperatures would be too cool. Also, there was little or no reserve capacity to take care of ice freezing demands.

It is an object of my invention to provide an improved refrigerating system which is capable of operating continuously and capable of maintaining proper evaporator and refrigerator temperatures when operating continuously under varying conditions.

It is another object of my invention to regulate the operation of the refrigerating system according to the refrigerator temperature and to provide an additional form of regulation to provide additional refrigeration when ice freezing is being accomplished.

It is a further object of my invention to provide a refrigerating system in which the evaporating pressure and temperature within the evaporating means is controlled mainly by the box temperature but in which means are provided for adequately taking care of ice freezing demands.

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

In the drawing:

Fig. 1 is a view partly in section and partly diagrammatic embodying my invention; and

Fig. 2 is a section along the line 2—2 of Fig. 1.

In the embodiment disclosed herein a compression type of refrigerating system is disclosed in which the liquid refrigerant flows to the evaporating means under the control of a thermostatic valve responsive to the temperature of the evaporating means and the flow of evaporated refrigerant out of the evaporating means is controlled mainly by the temperature within the refrigerated cabinet but also according to the pressure of the refrigerant within the evaporating means. The motor driven compressor may be operated continuously, if desired, or may be operated intermittently under low pressure or other form of control.

Referring now more particularly to the drawing, there is shown a compressor 20 driven by an electric motor 22 for compressing the refrigerant and for forwarding the compressed refrigerant to a condenser 24 where the compressed refrigerant is liquefied and collected in a receiver 26. From the receiver 26 the liquid refrigerant is forwarded through a supply conduit 28 to a thermostatic valve 30 located within the food compartment 32 of a domestic electric refrigerator 34. The opening and closing of the thermostatic valve 30 is controlled by a thermostatic bulb 36 located in heat exchange relation with the upper portion of an evaporating means 38 also located within the food compartment 32 and containing a plurality of ice trays 40 for freezing ice cubes.

The liquid refrigerant evaporates within the evaporating means 38 under reduced pressure to cool the air within the food compartment 32 and for freezing any water in the ice trays 40. This evaporated refrigerant returns to the compressor through the return conduits 42 and 44 which are connected by an improved control valve 46 which controls the withdrawal of evaporated refrigerant from the evaporating means 38.

This control valve 46 has a cylindrical outer casing 48 provided with a valve housing 50 at one end and a bellows support 52 for closing the other end. The valve housing 50 has the conduit 42 entering at one side and opening into a valve chamber 54 which contains a valve 56 resting upon a valve seat formed in the upper end of the threaded bushing 58. This valve is connected to the lower end of a square valve stem 60 which is threaded into the end plate 62 of a metal bellows 64. This metal bellows 64 is sealed at its upper end to the bellows support 52 and contains a compression type coil spring 66 which bears at its upper end against a threaded adjusting cap 68 and at its lower end against the end plate 62 of the bellows 64 for urging the valve 56 to closed position. Immediately beneath the end plate 62 is a smaller end plate 70 which is sealed to the upper end of a flexible metal bellows 72 which extends downwardly surrounding the valve stem guide 74 and is connected to and sealed to the valve housing 50 at the lower portion of the valve stem guide 74.

By this construction, a fluid chamber 76 is formed within the control valve which is connected by tubing 78 to a thermostatic bulb 80 located within the food or refrigerated compart-

ment 32. This thermostatic bulb 80, the tube 78 and chamber 76 are preferably filled with a volatile liquid having suitable characteristics to open and close the valve 56 in order to maintain the evaporating means 38 at a proper temperature to properly cool the refrigerator chamber 32. A second chamber is formed within the bellows 72 and this is acted upon by the pressure within the evaporating means which communicates with the bellows 72 and its end plate through the return conduit 42, the valve chamber 54 and the passages surrounding the square valve stem 60. The system may be provided with a low pressure control switch mechanism 82 which may be connected to the return conduit 44 and in series with the electric motor 22. However, preferably the motor-compressor unit operates continuously by closing a manual switch 84 which is connected in parallel with the low pressure switch 82.

With this system liquid refrigerant is forced into the evaporator whenever the evaporator falls below the temperature for which the valve 30 is set. This liquid refrigerant evaporates within the evaporating means 38 and creates a pressure within. When the temperature within the food compartment 32 is high, the volatile liquid within the thermostat 80 will expand and increase the pressure upon the end plate 62 of the bellows 64 to move the valve 56 to open position to permit the evaporated refrigerant to be withdrawn from the evaporator by the compressor 20. When the temperature within the food compartment 32 becomes low, the volatile liquid within the thermostat 80 will contract, thus reducing the pressure within the chamber 76 and permitting the spring 66 to move the valve 56 to closed position. This will cause the refrigerant pressure within the evaporator to build up and thus to slow down the evaporation therein. If the valve 56 is closed for a sufficient length of time the evaporation will finally approach a point where it will cease altogether. However, the normal position of the valve 56 will be partially open which will ordinarily maintain at all times the proper evaporator and box temperature within the evaporating means 38 and the food compartment 32.

When warm ice trays such as the ice tray 40 are placed into the evaporating means 38, an increase in evaporation takes place within the evaporating means 38 because of the higher temperature imposed on the evaporator. This also creates an increased pressure within the return conduit 42 and the valve chamber 54 which will cause an increased pressure upon the end plate 70 of the bellows 72 to tend to place a greater pressure on the valve structure tending to open the valve 56 to a wider open position. This will permit evaporation of the liquid refrigerant at a more rapid rate so as to cause the freezing of the water within the ice trays to progress rapidly without reducing the amount of refrigeration provided for the food compartment 32 to a dangerous extent.

Thus, I have provided a refrigerating system which provides for both box cooling and ice freezing demands and which will permit the continuous operation of the refrigerant compressor, if desired.

While the form of embodiment of the present 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. Refrigerating apparatus including a refrigerant evaporating means for cooling a medium and a refrigerant compressing and condensing means for supplying liquid refrigerant to and for withdrawing evaporated refrigerant from the evaporating means, and means responsive to the arithmetical sum of the influences of the temperature of the medium to be cooled and the pressure of the refrigerant within the evaporating means for controlling the withdrawal of refrigerant from the evaporating means.

2. Refrigerating apparatus including a refrigerant evaporating means for cooling a medium and a refrigerant compressing and condensing means for supplying liquid refrigerant to and for withdrawing evaporated refrigerant from the evaporating means, and valve means responsive to the temperature of the medium to be cooled and to the pressure of the refrigerant within the evaporating means for controlling the withdrawal of refrigerant from the evaporating means.

3. Refrigerating apparatus including a refrigerant evaporating means for cooling a medium and a refrigerant compressing and condensing means for supplying liquid refrigerant to and for withdrawing evaporated refrigerant from the evaporating means, and valve means located at the outlet of the evaporating means and responsive to the temperature of the medium to be cooled and to the pressure of the refrigerant within the evaporating means for controlling the withdrawal of refrigerant from the evaporating means.

4. Refrigerating apparatus including a cabinet, a refrigerant evaporating means for cooling the interior of the cabinet and provided with means for freezing ice, a refrigerant compressing and condensing means for supplying liquid refrigerant to and for withdrawing evaporated refrigerant from the evaporating means, and valve means directly responsive to the temperature within the cabinet and to the temperature of the ice freezing means for controlling withdrawal of evaporated refrigerant from the evaporating means, said valve means being located at the outlet of said evaporating means.

5. Refrigerating apparatus including a refrigerant evaporating means for cooling a medium and a refrigerant compressing and condensing means for supplying liquid refrigerant to and for withdrawing evaporated refrigerant from the evaporating means, a control means including valve means for controlling the circulation of refrigerant through the evaporating means, temperature responsive means responsive to an increase in temperature of the medium to be cooled to operate the valve means to provide increased circulation of refrigerant through the evaporating means, and a second temperature responsive means responsive to an increased temperature of the evaporating means for operating the valve means to provide increased circulation of refrigerant through the evaporating means.

6. Refrigerating apparatus including a refrigerant evaporating means for cooling a medium and a refrigerant compressing and condensing means for supplying liquid refrigerant to and for withdrawing evaporated refrigerant from the evaporating means, a control means including valve means for controlling the circulation of refrigerant through the evaporating means, temperature responsive means responsive to an increase in temperature of the medium to be cooled to operate the valve means to promote circulation of the refrigerant through the evaporating means, and a second temperature responsive means re-

sponsive to an increased temperature of the evaporating means for operating the valve means to promote circulation of the refrigerant through the evaporating means, one of said first and second temperature responsive means being effective to operate the control means to stop the refrigerant compressing means upon a fall in temperature.

7. Refrigerating apparatus including a refrigerant evaporating means for cooling a medium and a refrigerant compressing and condensing means for supplying liquid refrigerant to and for withdrawing evaporated refrigerant from the evaporating means, and means responsive to the arithmetical sum of the influences of the temperature of the medium and the temperature of the evaporating means for controlling circulation of refrigerant through the evaporating means.

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