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REFRIGERANT CONDENSER FOR MECHANICAL REFRIGERATING MACHINES

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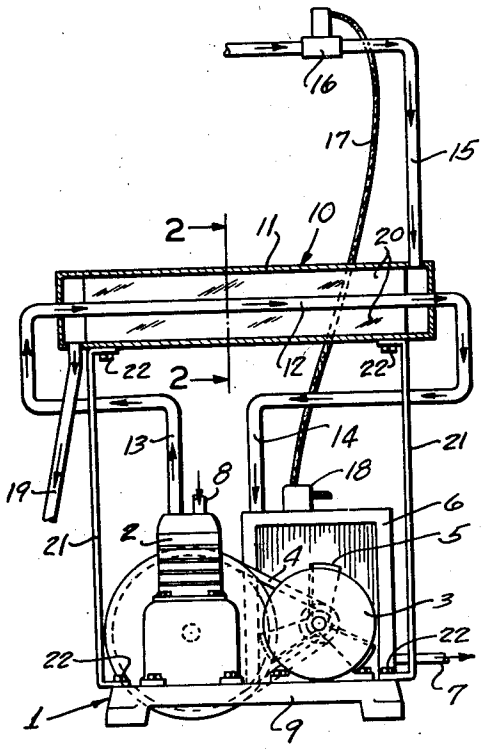


FIG. 1.

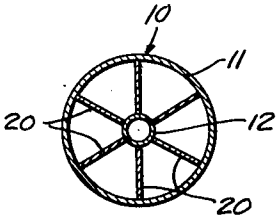


FIG. 2.

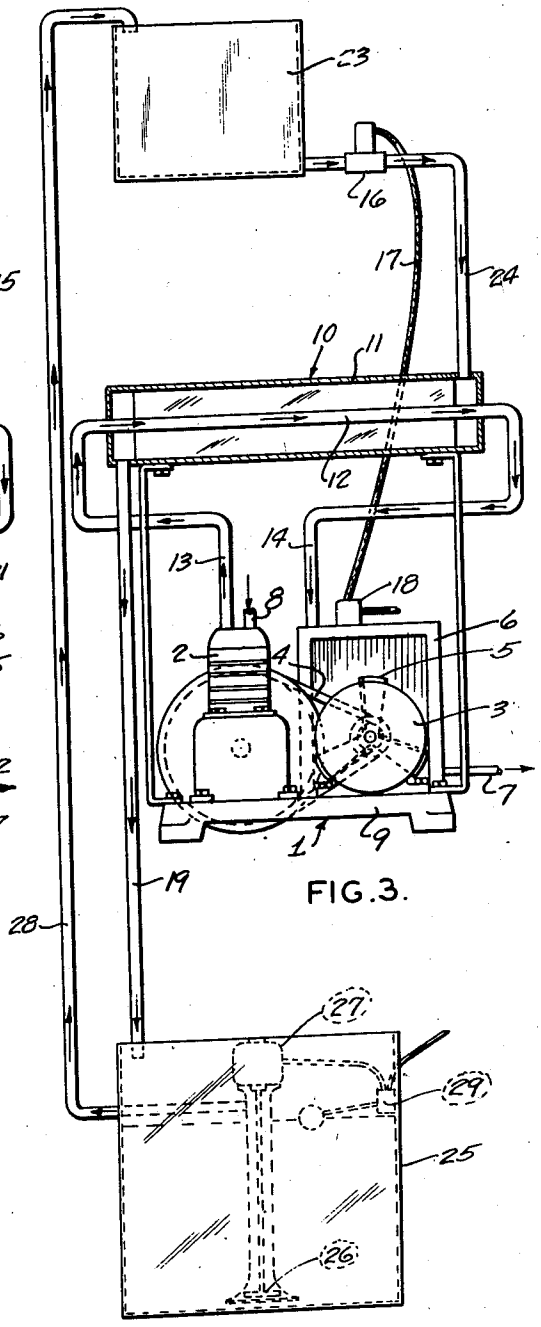


FIG. 3.

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REFRIGERANT CONDENSER FOR MECHANICAL REFRIGERATING MACHINES

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7 Claims. (Cl. 62—3)

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This invention relates to refrigerating machines generally and specifically to improvements in refrigerant condensing means therefor.

An important object of the invention is to provide an improved mechanical refrigerating unit which will have a large refrigerating capacity in proportion to the size of the unit, and which will be selectively operable to care for increases in required cooling due to seasonal conditions and changes in the demand for cooling.

More specifically the present invention is directed to a refrigerating unit, having an auxiliary or secondary refrigerant condenser arranged to increase the cooling capacity of the unit upon a demand therefor, and to means rendering the introduction of the secondary condenser into the refrigerant system automatically responsive to demand for increased cooling.

Other objects are to be found in the form, construction and arrangement of the various items of equipment which will fully carry out the foregoing objects to best advantage.

The invention has been disclosed in a preferred form and in an alternate form thereof, as may be seen in the accompanying drawing, in which:

Figure 1 is the preferred form of the invention illustrated in a schematic or diagrammatic view, certain parts of the complete system having been omitted for the reason of brevity;

Figure 2 is a sectional detail view of my auxiliary condenser unit as taken at line 2—2 in Figure 1, and

Figure 3 is an alternate or modified disclosure of the invention illustrated in Figure 1.

Referring now to the preferred form of my invention, I may employ the usual type of mechanical compressor unit 1 which includes a compressor 2 driven by electrical motor 3 through a drive belt 4. A fan 5, mounted on the extended end of the shaft for motor 3, serves to force cooling air flow over the usual condenser or radiator 6. In the usual refrigerant system a refrigerant liquid feed line 7 leads from the condenser 6 to a refrigerant storage tank (not shown) and from there through an expansion valve to the evaporator or space cooling unit, the latter units not being shown here as they are well known in the art. The refrigerant leaving such evaporator is again returned to the compressor through the suction line 8. This unit is suitably mounted on a base frame 9, as shown.

In many cases the selection of a cooling unit is dependent upon the heat load to be expected under the most adverse conditions, and in the case of a space or room cooling unit the highest heat

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load occurs during the summer period when the ambient temperature is highest. Therefore, the selected unit must have a cooling capacity rated to care for such conditions, and may be exceedingly oversize for the normal or average cooling conditions encountered. According to my invention, it is now possible to select a cooling unit of more nearly the size to handle average heat loads, and yet increase its cooling capacity automatically and efficiently as the demand for cooling increases above the average heat load. I accomplish this improved and desirable feature by providing a secondary or auxiliary refrigerant condensing unit positioned generally in series with the normal or usual refrigerant condenser 6 of the unit 1.

This secondary condensing unit is shown generally at 10 and comprises a jacket type closed tank 11 having a centrally positioned pipe section extending therethrough for flow connection at one end with the refrigerant discharge line 13 from the compressor, and for connection at its opposite end with the inlet line 14 for the normal condenser 6. A tank 11 is sufficiently larger than the pipe section 12 therein (Figure 2) to provide a suitable jacket space therebetween for the flow of a cooling medium, such as water. In the first form of my invention, I prefer to utilize the city water system as a source of supply and consequently conduct the water through line 15 and under the control of a flow valve 16 to the inlet of the auxiliary condenser. Such cooling medium flows through the condenser 10 counter to the direction of refrigerant flow in pipe section 12 to the discharge line 19 for discharge and suitable disposal. Moreover, I have desirably increased the refrigerant cooling effect of the condenser 10 by affixing a plurality of radially directed and circumferentially spaced fins 20 to the pipe section 12 so that a number of flow passages are formed to assure an even distribution of flow from end to end of the condenser. An additional aid in uniformity of cooling medium flow is achieved by terminating the fins 20 at a suitable distance from the opposite ends of tank 11 to form respectively inlet and discharge spaces therein. This auxiliary condenser 10 may be mounted on the base frame 9 of the unit 1 by legs 21 attached by bolts 22 to the tank 11 and to the base.

The control of the flow of cooling water to the auxiliary condenser 10 is automatically obtained through the use of a solenoid type of control valve, as at 16, in combination with an actuating unit 18 located at the radiator 6 and connected by

electric cable 17. The unit 18 may be a thermostatically actuated electric switch such that the electrical circuit to the valve 16 is completed when the temperature rise in the radiator 6 exceeds its desired capacity for cooling the refrigerant. Thus the auxiliary condenser is rendered automatically available to handle any predetermined temperature rise and hence over load in the heat dissipating capacity of the radiator 6. It will be seen from the above that, during the summer periods of high ambient temperature, the condenser or radiator 6 will not be called upon to operate inefficiently and with an excess cooling load as a slight temperature rise above its desired range will cause the thermostatic switch 18 to respond by opening the control valve 16 for the flow of a cooling medium, such as city water, to and through the auxiliary condenser unit 10.

I also have shown a modified cooling system in Figure 3 in which I have embodied all the elements of my previous system and have added the additional feature of a closed system for the cooling medium to be circulated through the auxiliary condenser 10. Without repeating a description of the entire system, my modified system includes a cooling medium storage tank 23 connected to the condenser inlet by a gravity supply line 24 in which the flow control valve 16 is placed. The condenser discharge line 19 now, instead of leading to a zone of disposal, is connected to a sump tank 25 into which the medium flows by gravity.

The sump tank 25 contains a submerged pump 26 driven by a motor 27 such that the cooling medium is forcibly delivered therefrom through return line 28 to the storage tank 23 for reuse. A suitable period of cooling is allowed for the cooling medium by permitting it to remain in the sump tank 25 at a constant level as will be measured by a float actuated switch 29 inserted in the electrical line to the pump motor 27. Thus, when the float rises above this level the switch 29 will close, energizing the motor 27 and causing pump operation to take in the cooler medium at the bottom of the sump tank 26 for delivery to storage tank 23. Additional cooling of this medium may be obtained by extending the length of line 28, as desired.

Having now described my invention in connection with alternate embodiment thereof, it will be appreciated that additional variants and modifications will come to mind, but it is my desire to cover all such variants and modifications within the scope of the claims annexed hereto.

I claim:

1. In a refrigerant cooling system, the combination of a compressor having refrigerant suction and discharge connections, a refrigerant condensing and cooling radiator, a refrigerant flow line connecting said compressor discharge and said radiator, an auxiliary refrigerant condensing means cooperative with said flow line and positioned for activity intermediate the compressor and radiator, means for supplying a cooling medium to said auxiliary condensing means including a cooling medium supply control valve, and means operatively connected with said control valve and subject to the temperature of said radiator for opening said control valve to supply cooling medium to said auxiliary refrigerant condensing means in presence of a temperature rise at said radiator exceeding a predetermined temperature value.

2. In a refrigerant cooling system, the combination of a compressor, a refrigerant cooling and condensing radiator connected in refrigerant flow

receiving relation with said compressor and from which cooled and condensed refrigerant is discharged for use in the cooling system, secondary refrigerant condensing means cooperative with said flow line and positioned for activity intermediate said radiator and compressor, means for supplying a cooling medium to said secondary condensing means including a cooling medium supply control valve, and thermally actuated means operatively connected with said control valve and subject to the temperature of said radiator for opening said control valve to supply cooling medium to said secondary condensing means in presence of a temperature rise at said radiator exceeding a predetermined temperature value.

3. In a refrigerant cooling system, the combination of a compressor having refrigerant suction and discharge lines, a refrigerant condensing and cooling radiator, a refrigerant flow line connecting said radiator and compressor discharge line, tank means enclosing a section of said refrigerant flow line, means positioned in said tank for contact with the enclosed flow line section to increase the effective heat radiating surface thereof, means for supplying a cooling medium to the tank for flow therethrough and in heat absorbing relation with said flow line section and surface increasing means, a flow control valve for said cooling medium supply means, and control means of a thermally responsive character operatively connected with said control valve means and being positioned in thermal responsive relation with said radiator for effecting opening operation of said control valve to supply cooling medium in presence of a temperature rise at said radiator exceeding a predetermined temperature value.

4. In a refrigerant cooling system, the combination of a compressor, a refrigerant cooling and condensing radiator, a refrigerant flow line connecting said radiator and compressor, jacket means enclosing a section of said flow line, spaced fins disposed in contacting relation between said flow line section and said jacket means, said jacket means having inlet and outlet means, a closed cooling medium flow system connected with the jacket inlet and outlet means, said closed system including a storage tank in gravitational flow feeding relation with the jacket inlet means, a sump tank in gravitational flow receiving relation with the jacket outlet means, means for forcibly circulating the cooling medium from said sump tank to said storage tank to maintain a predetermined level of cooling medium in said sump tank, and means for automatically regulating the feeding of the cooling medium to said jacket in presence of a rise of temperature at said radiator exceeding a predetermined temperature value.

5. In refrigerant cooling systems, wherein a compressor and a refrigerant condensing and cooling radiator are operatively connected by a refrigerant flow line of constant length extending from the compressor discharge to the radiator, a system of such type characterized in that the radiator is dimensioned to handle average heat loads, and further characterized in that the flow line is provided with an auxiliary refrigerant condensing means positioned for activity on said flow line in advance of the radiator, said auxiliary means being controllable as to cooling agent supply to permit activity and inactivity with the control responsive to radiator temperature conditions, to thereby cause auxiliary means inactivity during periods when the flow line and radiator temperatures are within a predetermined tem-

perature range, and to render the auxiliary means active when such flow line content temperatures exceed the maximum of such range, activity of the auxiliary means being operative to reduce the temperature of the flow line content prior to delivery to the radiator with the reduction sufficient to deliver the content to the radiator with temperature values substantially within the rated range of the radiator.

6. A system as in claim 5 characterized in that the cooling agent for auxiliary means operation is liquid with the means comprising a tank enclosing a length section of the flow line.

7. A system as in claim 6 characterized in that the tank forms an element of a cooling-agent circulating system and with the circulating system also including the valve for controlling the activity and inactivity of the auxiliary means.

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