

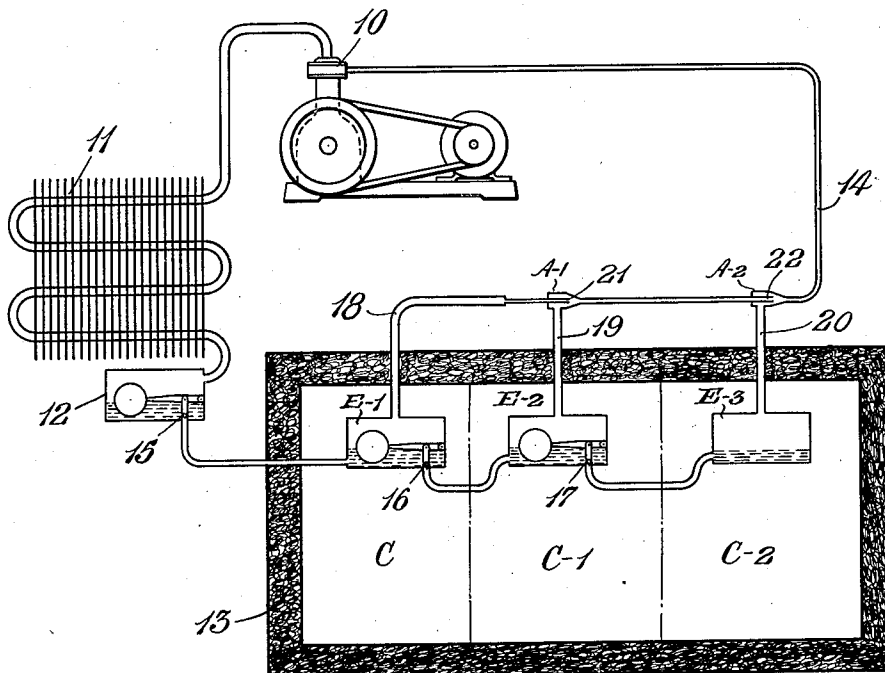
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REFRIGERATION

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REFRIGERATION

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3 Claims. (Cl. 62—115)

This invention relates to the art of refrigeration and more particularly to a refrigeration process and a refrigeration system wherein liquid refrigerant is delivered directly from the condenser to the evaporator.

With the evaporator operating at a low temperature and pressure and the condenser at a high temperature and pressure, there is an appreciable entropy loss in cooling the liquid refrigerant to the evaporating temperature.

It is an object of the present invention to lessen the entropy loss in a refrigeration system or to obtain greater efficiency of operation by utilizing heat energy in the liquid refrigerant which would otherwise be unexpended or lost.

A further object of the invention is to provide a new and improved process of and apparatus for refrigeration capable of more efficiently maintaining separate compartments refrigerated at different temperature levels.

Other objects and advantages will become apparent upon an analysis of the system in view of the following description and the exemplary embodiment of the invention shown in the drawing, wherein the single figure diagrammatically illustrates one application of the invention.

Referring to the drawing a compressor 10 supplies compressed refrigerant to a condenser 11, from which it passes to a receiver 12. A cabinet 13 is divided into compartments C, C-1 and C-2 containing, respectively, evaporating units E-1, E-2 and E-3 from which gaseous refrigerant is returned to the compressor 10 through suction line 14. The evaporating units are supplied with refrigerant successively, the supply to the first evaporating unit E-1, being controlled by a float valve 15 in receiver 12 which maintains the liquid refrigerant in said receiver at a predetermined constant level; the supply to the second unit E-2 by a similarly operating float valve 16 in unit E-1, and the supply to unit E-3 by float valve 17 in E-2. Vaporized refrigerant passes off from the respective evaporating units through conduits or pipes 18, 19 and 20 into the suction line 14, which is common to said pipes. Aspirators A-1 and A-2 having suitable expanding or ejector nozzles 21 and 22 are provided for stepping up the velocity of the gases passing into the suction line from the respective evaporating units.

The system operates as follows:

Liquid refrigerant from the condenser 11 accumulates in receiver 12, float control valve 15 maintaining the liquid in the receiver at a predetermined constant level. From the receiver

12, the liquid refrigerant is delivered into the first evaporating unit E-1 wherein it is maintained at a relatively low pressure by the action of the compressor 10. In E-1 the liquid heat content of the refrigerant vaporizes some of the liquid, and this vapor flows out through expanding nozzle 21 in aspirator A-1. The float control valve 16 in the evaporator E-1 is adjusted to maintain the liquid in said evaporator at a predetermined level, and as the supply of liquid is greater than can be vaporized at this stage, the excess liquid is pre-cooled by evaporation and the pre-cooled liquid delivered into the second evaporator stage or unit E-2. The compartment C-1 in which the unit E-2 is located may be, for example, the food compartment of a refrigerator, and the liquid refrigerant in evaporator E-2 absorbs heat from the medium or article to be cooled and the vaporized refrigerant is delivered to the suction side of aspirator A-1, where additional energy is imparted to the refrigerant vapor by the high velocity vapor leaving the expanding nozzle 21. Thus the pressure of the vapor leaving the aspirator A-1 is higher than the pressure of the vapor in the evaporator E-2.

Similarly, surplus liquid may be delivered from evaporator E-2 to E-3, where additional heat is absorbed by the liquid refrigerant and the vapor therefrom delivered to the suction side of aspirator A-2, where additional energy is imparted to the vapor in the suction line 14 by expanding nozzle 22, so that the pressure in the latter line is higher than the pressure in evaporator E-3. The compartment C-2 in which evaporator E-3 is located may be a further separate refrigerating compartment wherein the temperature is maintained at a lower or different temperature level than that in compartment C-1.

With a system of this type heat energy which would otherwise be unexpended is rendered available to perform work on the vapor flowing in the suction line or low pressure side of the system and deliver it to the compressor at a higher pressure than would otherwise be possible. Coincident with this advantage, is that of maintaining separate compartments to be refrigerated at different temperature levels.

It will be obvious to those skilled in the art that certain changes may be made in the system without departing from the spirit of the invention and therefore the invention is not limited to the illustrative embodiment shown in the draw-

ing and described in the specification but only as indicated in the appended claims.

I claim:

1. A refrigeration system including a condensing unit and a plurality of evaporators, said evaporators being connected to said condensing unit so that liquid refrigerant flows from one evaporator to another, liquid level responsive means in one evaporator for controlling flow of liquid therefrom to the next evaporator, and aspirating means for utilizing flow of vapor from one of said evaporators to said condensing unit to withdraw vapor at a lower pressure from a succeeding evaporator.
2. A refrigeration system including a plurality of evaporators, means for supplying liquid refrigerant to a first evaporator, means for removing refrigerant vapor from said first evaporator to precool the said liquid refrigerant, means for

passing said precooled liquid refrigerant to a second evaporator, and means for utilizing the vapor evolved in said first evaporator for doing work and for aiding in the production of a temperature in said second evaporator lower than in said first evaporator.

3. A method of refrigeration which includes vaporizing refrigerant fluid in a plurality of places, withdrawing vaporous refrigerant fluid from one of said places and utilizing flow of withdrawn vapor to withdraw vapor from a succeeding place at lower pressure, and conducting liquid refrigerant to said first place and then from said first place to said second place so that the liquid refrigerant is precooled in said first place before entering the lower temperature second place and the vapor formed by the precooling utilized to do work.

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