

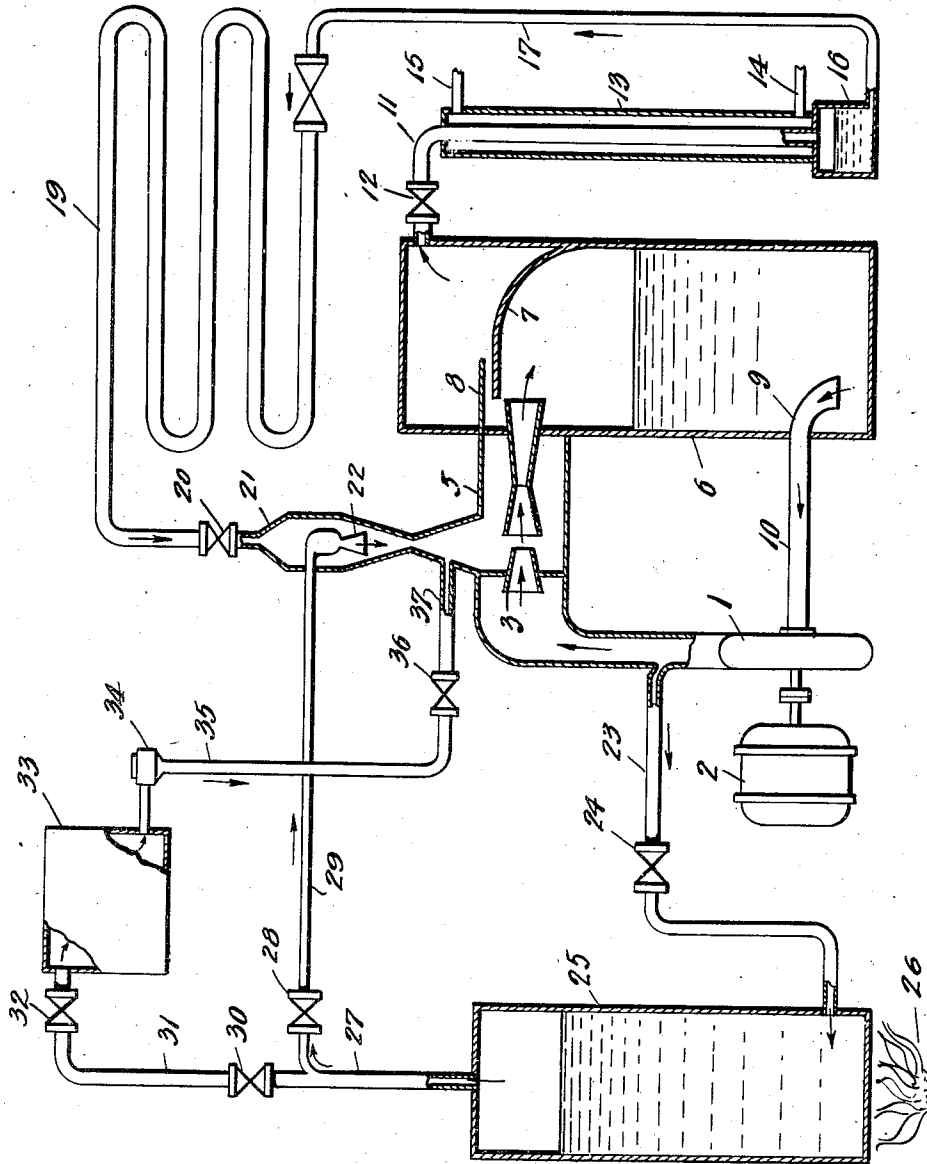
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MEANS AND METHOD OF REFRIGERATION AND HEATING

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MEANS AND METHOD OF REFRIGERATION
AND HEATING

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20 Claims. (Cl. 62-169)

My invention relates to cooling and heating methods and apparatus. It is based upon a method and an apparatus as disclosed in my co-pending application Ser. No. 477,038, filed August 22, 1930, and is an improvement of same.

In the apparatus as covered by my application No. 477,038 I utilize the energy in a jet of liquid refrigerant to exhaust a space vaporizing another portion of said refrigerant, then compress said vapor by the jet in a compression space and liquefy said vapor in a condensing space.

In my present invention I increase the flow and assist in creating a low pressure in the refrigerating space by adding a vapor ejector between the refrigerating space and the space through which the liquid jet is projected, thus utilizing two means in series to exhaust the refrigerating space. The vapor used in the vapor ejector is generated from a portion of the liquid refrigerant in a boiler which is supplied with liquid refrigerant by the same pump producing the liquid jet. I have also made the arrangement so that during a heating season and by the manipulation of valves, the refrigerating space may be cut off and the boiler used to supply heating medium to a heating element, as a radiator, unit heater or any other suitable device. The liquid jet exhauster will now operate as a conventional vacuum return pump, transferring condensate from the heating system to the boiler.

Valves may of course be arranged to automatically furnish heating or cooling or both as will be required.

The figure illustrates in diagrammatic form my invention. The individual parts are conventional and well known in the arts and no detail description is therefore necessary. They may be constructed in many different ways to accomplish the desired result. My invention covers all different forms of design of the several parts in the combination. Such parts as the boiler, vapor ejector, jet exhauster, condenser, refrigerating element, etc. may be constructed as shown or any other conventional design may be used. In the liquid jet exhauster I include any other design embracing all apparatus in which the kinetic energy of a moving liquid is utilized to exhaust a space and to compress vapors exhausted from this space. Such conventional arrangements and designs where the liquid circulates in a closed casing alternately exhausting and compressing a vapor due to its motion are included in this invention if used in the combination covered and claimed.

In the figure, 1 is a pump driven by a motor 2. The pump discharges through a nozzle 3 and the jet produced passes through another nozzle 4 enclosed in a suction chamber 5. The liquid then discharges into a compression chamber 6, the stream being deflected downwardly by baffle 7, vapors passing upwards by baffle 8 into upper

part of compression chamber 6. The pump is supplied with liquid from this compression chamber 6 through suction inlet 9 and pipe 10.

It is now seen that the liquid, which is the refrigerant in liquid state will pass from a compression space through a suction space and then back to this compression space. In passing through a lowering of the pressure in this space will occur which will also cause a lowering of the pressure in the refrigerating coil 19. This coil may of course be replaced by any suitable element. Vapors in this element will be drawn through auxiliary suction chamber 22 into suction chamber 5 to be delivered into compression chamber 6. The compressed vapor will thence pass through valve 12 and pipe 11 into a condenser 13 to be liquefied there by any suitable cooling medium. The liquefied refrigerant collecting in receiver 16 will then pass through liquid line 17, expansion valve 18 to be vaporized under the reduced pressure in refrigerating element or coil 19.

Thus I have described the elements, the apparatus and the method of causing refrigeration as disclosed in my pending application 477,038.

I now introduce an auxiliary device to assist in and augment the circulation of the refrigerant, and which will increase the pressure difference, by adding another means to work in series with the liquid jet exhauster, thus giving in effect a multiple stage exhausting and compressing. These stages may be multiplied in any amount by adding other similar devices in series.

Part of the liquid refrigerant discharged by the pump is caused to flow under the higher discharge pressure through pipe 23 and valve 24 to a boiler or refrigerant generator 25, heated by heating means 26 to produce refrigerant vapor under this higher pressure. This vapor then passes through valve 28, pipe 29 to vapor ejector 22 enclosed in auxiliary suction chamber 21. By the action in this vapor exhauster, the flow of vapor from the refrigerating element 19 will be augmented and will thus assist the liquid jet in suction chamber 5 to maintain a lower pressure on refrigerant in element 19.

Now the arrangement, besides permitting a multistage method of exhausting and compressing, will also furnish a method to produce ordinary heating. The vapor will then pass through a valve 30, pipe 31, valve 32 into a radiator or heating element 33; the condensate through a trap 34, return pipe 35, valve 37 into suction chamber 5. It is seen that this circuit contains all the essential elements of a conventional vapor heating system, with boiler, radiator, return pump and return to boiler. By manipulation of valves the system may now operate either as a cooling apparatus or a heating apparatus or a combination of both. Auto-

matic devices as thermostatic valves, float control, etc. may be added to the system so as to fit the entire apparatus into so called air conditioning installations, maintaining a desired room temperature under all conditions of outside temperature. The heated water in boiler may also be used for heating.

I claim:

1. The method of refrigeration consisting in circulating a body of refrigerant from a compression and storage space through a condensing space and a refrigerating space, mechanically imparting motion to a body of the liquid refrigerant and utilizing the energy of this moving liquid to lower the pressure in the refrigerating space whereby the liquid refrigerant in this space is vaporized, returning the vaporized refrigerant along with the moving liquid to the compression space, condensing the compressed refrigerant in said condensing space, returning the resulting liquid to the refrigerating space and vaporizing a portion of said refrigerant by heat application and utilizing said vapor to assist in the circulation of the vaporized refrigerant from the refrigerating space to the compression space.

2. The method of refrigeration consisting in circulating a body of refrigerant from a compression and storage space through a condensing space and a refrigerating space, mechanically imparting motion to a body of the liquid refrigerant and utilizing this liquid as a jet projected through a suction space to lower the pressure in the refrigerating space whereby the liquid refrigerant in this space is vaporized and also to return the vaporized refrigerant along with the moving liquid to the compression space, condensing the compressed refrigerant in said condensing space, returning the resulting liquid to the refrigerating space, vaporizing a portion of said refrigerant by heat application and utilizing said vapor to assist in the circulation of the vaporized refrigerant from the refrigerating space to the compression space.

3. The method of refrigeration consisting in vaporizing refrigerant in a refrigerating space, causing a stream of liquid refrigerant to circulate from and back into a compression space, utilizing the energy of this moving liquid stream to lower the pressure in the refrigerating space, return vaporized refrigerant along with the liquid stream to the compression space, compress the fluids in this compression space, withdrawing compressed vapors from this compression space, condensing same in a condensing space, returning the condensed refrigerant to the refrigerating space, vaporizing a portion of said refrigerant by heat application and utilizing said vapor to assist in the circulation of the vaporized refrigerant from the refrigerating space to the compression space.

4. The method of refrigeration consisting in vaporizing refrigerant in a refrigerating space, causing a stream of liquid refrigerant to circulate from and directly back into a compression space, utilizing this liquid stream as a jet projected through a suction space to lower the pressure in the refrigerating space, return vaporized refrigerant along with the liquid stream to the compression space, compress the fluids in this compression space, withdrawing compressed vapors from the compression space, condensing same in a condensing space, returning condensed refrigerant to the refrigerating space, vaporizing a portion of refrigerant by heat application and

utilizing said vapor to assist in the circulation of the vaporized refrigerant from the refrigerating space to the compression space.

5. The method of refrigeration consisting in vaporizing the refrigerant in a refrigerating space, causing a stream of the liquefied refrigerant to circulate from and directly back into a compression space, utilizing the energy of this moving liquid stream to lower the pressure in the refrigerating space, returning vaporized refrigerant along with the liquid stream to the compression space, compressing the fluids in this compression space, condensing the compressed vapors in a condensing space, returning liquid refrigerant to the refrigerating space, vaporizing a portion of refrigerant by heat application and utilizing said vapor to assist in the circulation of the vaporized refrigerant from the refrigerating space to the compression space.

6. A refrigerating apparatus comprising a compression tank, a body of liquid refrigerant, a condenser, an expansion valve, an evaporating and refrigerating space, a jet exhauster adapted to withdraw vaporized refrigerant from the refrigerating space and lower the pressure therein, means for causing a stream of liquid refrigerant from the tank to flow through the jet exhauster and back together with the vaporized refrigerant into the tank, a refrigerant generator and means to supply same with liquid refrigerant from the compression tank, heating means in connection with the refrigerant generator to vaporize the refrigerant and a vapor ejector between the refrigerating space and the jet exhauster to enable the refrigerant vapor generated in the generator to assist in the circulation of the vaporized refrigerant from the refrigerating space to the jet exhauster.

7. In a refrigerating apparatus, a compression tank adapted to be partially filled with liquid refrigerant, a jet exhauster comprising a suction chamber, a nozzle opening into said suction chamber and a delivery tube in position to receive the jet and connected to the compression tank, a pump and means for driving same, inlet and outlet conduits for the pump communicating with the tank and nozzle respectively, a boiler communicating with the discharge of said pump, a vapor ejector communicating with said boiler and said suction chamber, an evaporator and communication means between said evaporator and said vapor ejector.

8. In a refrigerating apparatus a circuit comprising a compression tank for liquefied and vaporized refrigerant, a pump with means for driving same and means to receive liquid refrigerant from said compression tank, a jet exhauster comprising a nozzle to receive liquid refrigerant from said pump, a suction chamber through which the said jet will pass, a delivery tube in position to receive said jet and connected with said tank to deliver liquid and vapor to said tank; a second interconnected and parallel circuit comprising said compression tank, a condenser to receive refrigerant vapor from said tank, an expansion valve and a refrigerating space with communication means from said condenser to said expansion valve, a vapor ejector and communication means from said refrigerating space and said ejector, and communication means from said ejector to said suction chamber; and a third interconnected and parallel circuit comprising said pump, a boiler and communication means from said pump to said boiler and communication means from said boiler to said vapor ejector.

9. A refrigerating apparatus, a first circuit comprising a closed compression tank adapted to be partially filled with liquid refrigerant, a jet exhauster comprising a suction chamber, a nozzle opening into the suction chamber and a delivery tube positioned to receive the jet and opening into the upper portion of the said tank, a pump, inlet and outlet conduits for the pump communicating with the tank and the nozzle respectively, means for driving the pump, a condenser connected with the tank, and evaporator connected in series with the condenser, an outlet pipe from the evaporator leading to a vapor ejector and a conduit from said vapor ejector to suction chamber of the jet exhauster; and a second circuit comprising a conduit from the discharge of said pump to a boiler, said boiler and a conduit from the vapor space of said boiler to the said vapor ejector.

10. The method of refrigeration consisting in mechanically imparting motion to a portion of a body of liquid refrigerant, utilizing the energy of this moving liquid to lower the pressure on another portion of the refrigerant whereby this refrigerant will vaporize and cause refrigeration, vaporizing another portion of said refrigerant by heat application and utilizing said vapor to assist in said lowering of the pressure.

11. The method of refrigeration consisting in mechanically imparting motion to a portion of a body of liquid refrigerant, utilizing the energy of this moving liquid to compress vaporized refrigerant, vaporizing another portion of said refrigerant by heat application and utilizing said vapor to assist in said compression and to exhaust a space containing liquid refrigerant, causing vaporization with heat absorption.

12. The method of refrigeration consisting in mechanically imparting motion to a portion of a body of liquid refrigerant, utilizing the energy of this moving liquid to lower the pressure on another portion of the refrigerant whereby this refrigerant will vaporize and cause refrigeration, and also to compress the vaporized refrigerant, vaporizing another portion of said refrigerant by heat application and utilizing said vapor to assist in the said lowering of the pressure and the said compression.

13. The method of refrigeration consisting in successively vaporizing, compressing and condensing a circulating body of refrigerant, imparting motion to a stream of the liquid refrigerant, utilizing the energy of this moving stream to respectively raise and lower the pressure on different portions of the main body of the circulating refrigerant, also vaporizing another portion of said refrigerant by heat application and utilizing said vapor to assist in said circulating.

14. The method of refrigeration consisting in successively vaporizing, compressing and condensing a circulating body of refrigerant, imparting motion to a stream of liquid refrigerant, utilizing the energy in this moving stream to lower the pressure on the body of refrigerant to be vaporized and to compress the vaporized refrigerant, whereby it is condensed, and vaporizing another portion of refrigerant by heat application to assist in the circulation of said body of refrigerant.

15. The method of refrigeration consisting in vaporizing a refrigerant in a refrigerating space, causing a stream of liquid to circulate from and back into a compression space, utilizing the energy

in this moving stream to lower the pressure in the refrigerating space, vaporizing a liquid and utilizing said vapor to assist in the said lowering of the pressure.

16. A combined method of cooling and heating comprising imparting motion to a portion of a liquid, utilizing the energy in said moving liquid to exhaust a refrigerating space containing another portion of said liquid and to compress vapors of said liquid in a compression space, vaporizing another portion of said liquid by heat application utilizing a portion of said vapors for purpose of heating and another portion in a vapor ejector to assist in the circulation of the vapor from the refrigerating space to the compression space.

17. A refrigerating apparatus, a closed circuit comprising a pump to cause a general circulation of a refrigerant, a boiler with heating means where portions of said refrigerant is vaporized, a refrigerating space where another portion of said refrigerant is vaporized with absorption of heat and refrigerating effect, a first suction space where an ejector for vapor generated in said boiler produces a lowered pressure on said refrigerating space, a second suction space where an ejector for liquid discharged by said pump produces a transfer of vapors from said first suction space and compresses same into a condensing space, said condensing space and communication means from same to said refrigerating space and with expansion means in said communication means and other communication means between different parts of the apparatus to enable refrigerant to circulate as described.

18. A refrigerating apparatus comprising two interconnected and closed circuits as follows: a first circuit consisting of a pump, a boiler with heating means, an ejector for vapor enclosed in a first suction space, an ejector for liquid enclosed in a second suction space and a compression and condensing space; a second circuit consisting of said compression and condensing space, an expansion means, a refrigerating space, said first suction space and said second suction space and communication means between said parts to complete said described circuits.

19. A method of refrigeration comprising the circulation of a refrigerant through interconnected and closed circuits as follows: by the application of heat vaporizing a portion of refrigerant liquid, utilizing the energy of said vapor in motion to lower the pressure on another portion of said refrigerant liquid causing vaporization of same with refrigerating effect, imparting motion to another portion of said refrigerant liquid and utilizing the energy of said liquid in motion to compress said vapors, condensing said vapors by the withdrawal of heat and returning portions of said condensate to point of heat application and other portions to point of refrigeration.

20. A method of refrigeration comprising completely vaporizing a liquid refrigerant with refrigerating effect and under a lowered pressure and causing a flow of the vapor produced from a lower to a higher pressure by first utilizing the energy in a moving body of refrigerant vapor produced by heat application and second in series with this utilizing the energy in a moving body of liquid refrigerant.

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