Dec. 31, 1940. M. WEXLER 2,227,168

REFRIGERATION

Filed Jan. 11, 1933 3 Sheets-Sheet 1

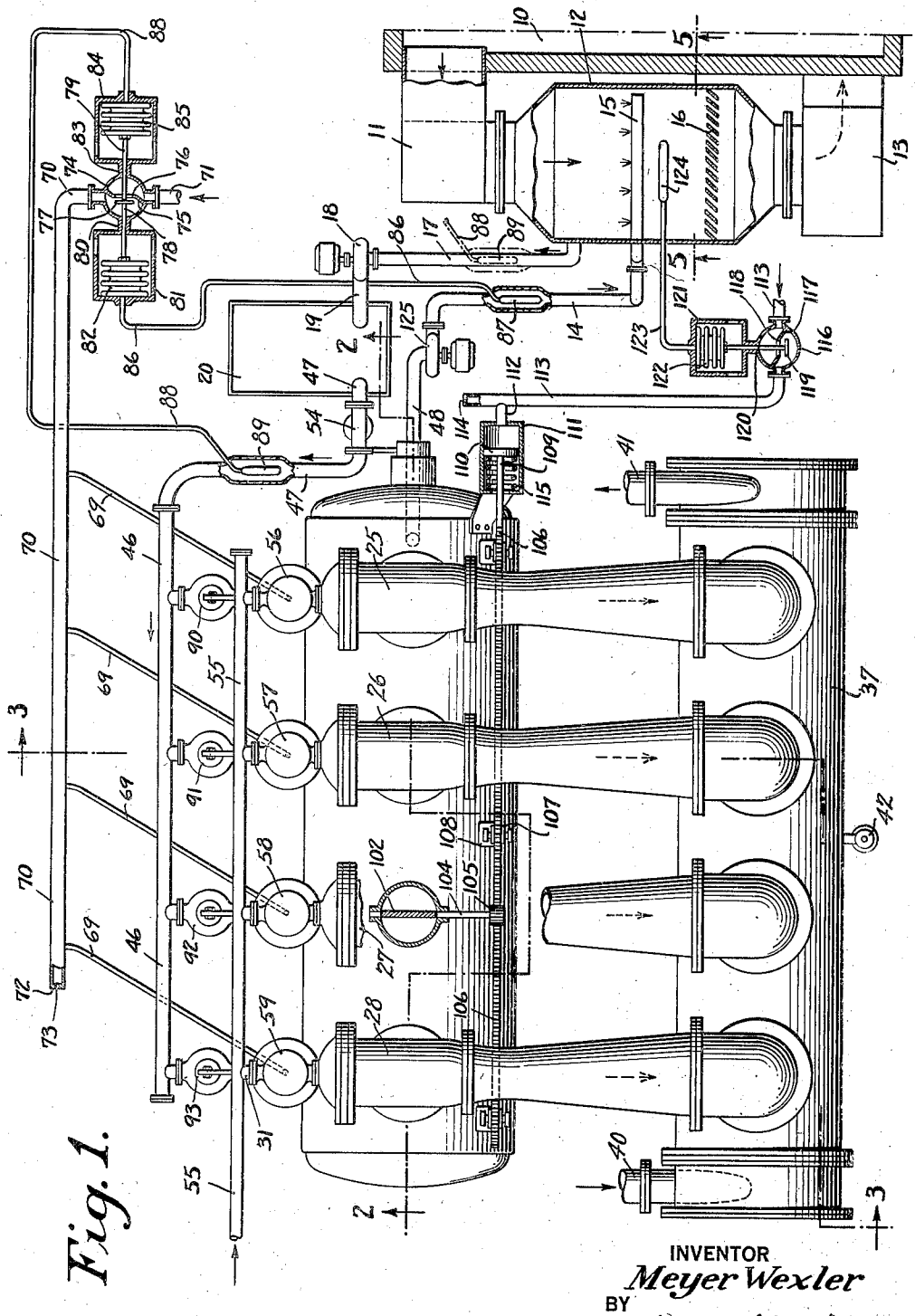

Fig. 1.

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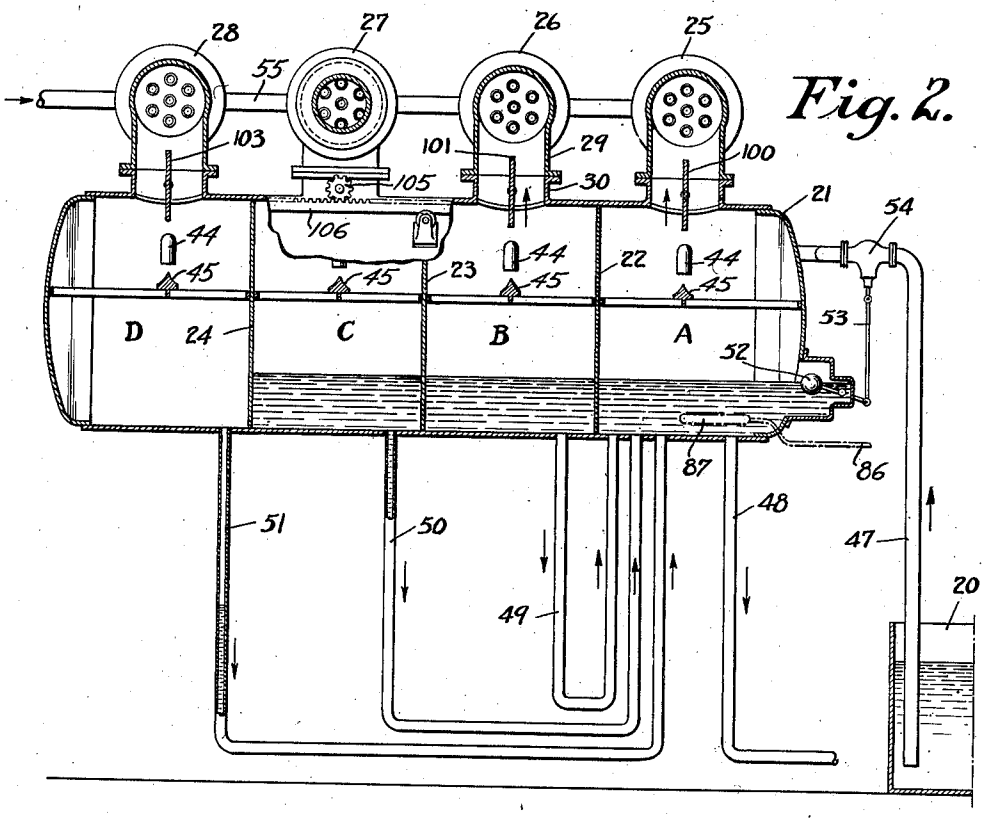

Fig. 2.

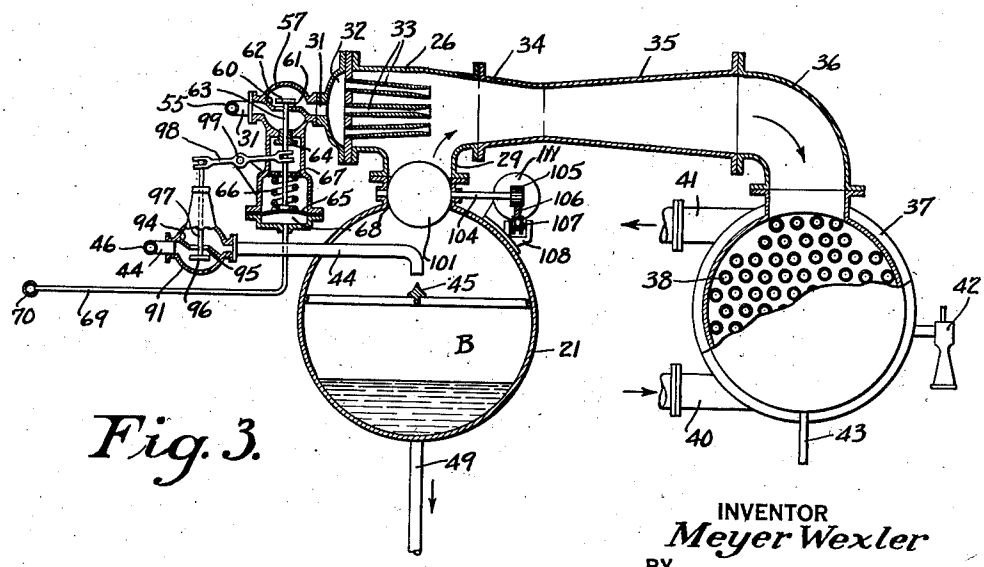

Fig. 3.

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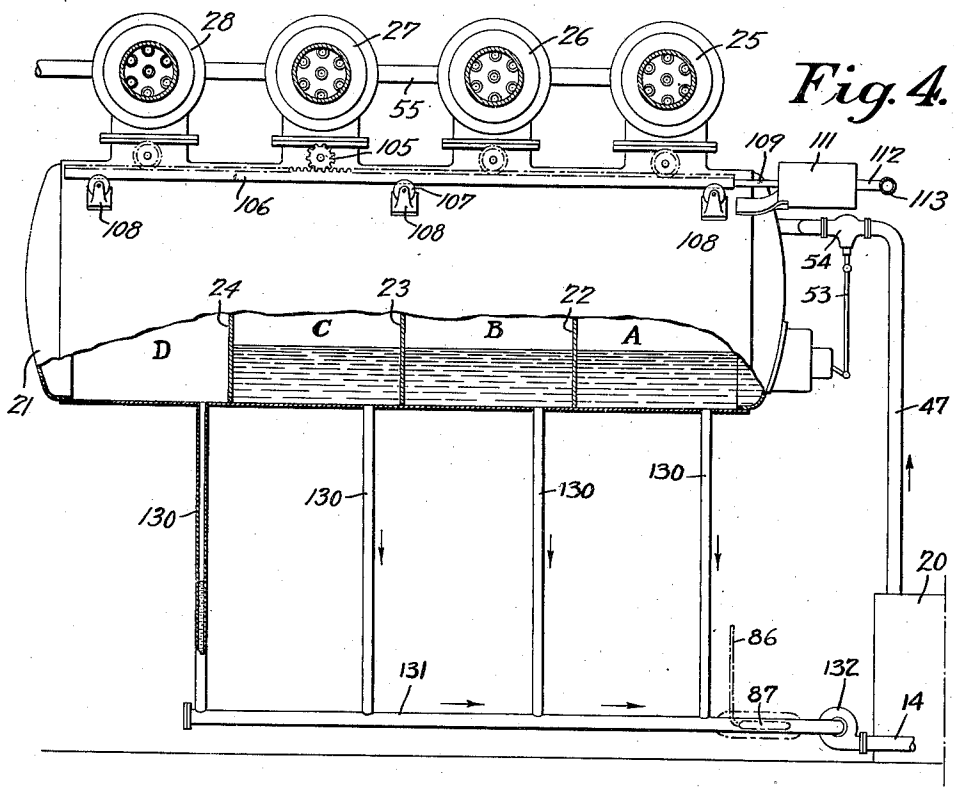
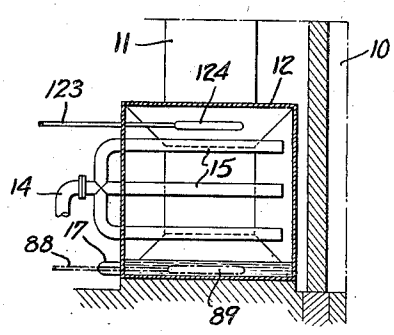


Fig. 4.

Fig. 5.



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UNITED STATES PATENT OFFICE

2,227,168

REFRIGERATION

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12 Claims. (Cl. 62—2)

This invention relates to refrigeration, more particularly to vacuum refrigeration, and especially to vacuum refrigeration systems utilizing flash evaporation as the operating principle.

The primary object of the invention is to provide a flash evaporation refrigeration system in which the refrigeration load and the temperature of the refrigerant may be accurately controlled to thereby obtain the desired degree of refrigeration.

This object is attained, in general, by utilizing one or more refrigerating or evaporating zones and controlling the rate of evaporation of the refrigerant in each of the several zones so that the ultimate desired load and refrigerant temperature may be obtained. The control is preferably automatic and is made responsive to the temperature or variations thereof, at any convenient point in the refrigeration system or the equipment associated therewith, or to differentials in temperature at suitable points in the system, but the control may be entirely manual or partly automatic and partly manual.

The nature and principle of the invention will be better understood from the following description considered in connection with the accompanying drawings forming a part of the specification and in which:

Fig. 1 is a top plan view, partly in section, of vacuum refrigeration apparatus arranged in accordance with the present invention and applied specifically to the conditioning of air;

Fig. 2 is a vertical sectional view taken substantially on line 2—2 of Fig. 1, showing three compartments in operation;

Fig. 3 is a transverse sectional view taken substantially on line 3—3 of Fig. 1;

Fig. 4 is a longitudinal sectional view similar to Fig. 2 but showing another form of apparatus; and

Fig. 5 is a sectional view taken substantially on line 5—5 of Fig. 1.

Like characters of reference refer to like parts throughout the several views.

While the embodiment of the invention illustrated in the drawings is shown as applied specifically to the conditioning of air, it will be understood that the invention is not limited to this particular application but may be applied generally to the cooling of various liquids, gases and solids.

Referring to the drawings, particularly Figs. 1 to 3 inclusive, reference character 10 indicates an enclosure such as a building, autitorium or the like which contains air to be conditioned. The air in the enclosure is withdrawn through a conduit 11 and is caused to flow through an air conditioning chamber 12 from which it is returned to the enclosure 10, after being properly conditioned. The air conditioning chamber may be of any convenient form. As shown, it comprises an elongated rectangular enclosure connected at its opposite ends to the conduits 11 and 13 respectively. In the system illustrated, water is used as the refrigerant and the water is introduced into the chamber 12 through a line 14 and is sprayed into the chamber through one or more sprays 15 in direct contact with the air flowing through the chamber. Baffles 16 may be provided to assist in the deentrainment of the water from the air, and heating means, not shown, may also be utilized, if desired, to heat the air to the desired temperature. The water from sprays 15 collects in the bottom of the air conditioning chamber 12 and is withdrawn therefrom through a line 17 and delivered by a pump 18 through line 19 into the surge tank 20, from which the water is conducted to the refrigerating apparatus.

As shown, the refrigerating apparatus includes a closed cylindrical vessel indicated 21, which is divided into four compartments designated A, B, C and D by suitable partitions 22, 23 and 24, which are spaced from each other and extend transversely of the axis of the vessel. The compartments A, B, C and D will hereinafter be referred to as flash chambers, and it will be understood that in lieu of the flash chambers constituting compartments of a single vessel they may each be entirely separate and independent of the others, if desired.

Each of the flash chambers is provided with suitable vacuum producing means, such as the thermo-compressors shown, to withdraw vapors of the water from the flash chambers, and to thereby maintain the desired degree of vacuum in each chamber. The thermo-compressors for the several flash chambers A, B, C and D are indicated 25, 26, 27 and 28 respectively. Each thermo-compressor has a vapor inlet 29 connected to a vapor outlet 30 of each of the flash chambers. Steam from a suitable source is introduced into each thermo-compressor for operating the same through an inlet 31, which delivers the steam to a steam chest 32 from which it flows through a plurality of steam nozzles 33 into the converging part 34 and thence into the diverging part 35, from which it is conducted by

a suitable connection 36 into a surface condenser 37. As shown, all of the thermo-compressors discharge into a single condenser having but one compartment, but it will be apparent that a number of separate condensers, one for each of the flash chambers and thermo-compressors, may be utilized if desired. The condenser 37 comprises a cylindrical shell having a plurality of spaced tubes 38 extending longitudinally thereof and through which cooling water flows through the condenser, the water being introduced into the condenser through an inlet 40 and after passing through the tubes 38 is withdrawn from the condenser through outlet 41. Suitable means, such as the steam jet pump 42, is employed to remove the non-condensables from the condenser. Condensate is withdrawn from the condenser through tail pipe 43.

Water is introduced into each of the flash chambers through a pipe 44 which discharges the water onto a distributing cone 45 or other convenient means for breaking up the stream of water. Each of the water inlet pipes 44 is connected to a water manifold 46 which has its inlet end connected to a line 47 having its inlet end at the lower part of the surge tank 20. As indicated in Fig. 2, water is withdrawn from flash chamber A through line 48 which is connected to line 14 through which water is conducted to sprays 15 in the air conditioning chamber 12. The bottom of flash chamber B is connected to the bottom of flash chamber A through a loop seal 49; flash chamber C with flash chamber A through a loop seal 50, and flash chamber D with flash chamber A through a loop seal 51. The water in flash chamber A and in the other flash chambers is maintained at a predetermined level by a float 52 which is connected by a suitable connection 53 to a valve 54 in line 47 through which water is conducted from the surge tank 20 into the manifold 46 for distribution through the inlets 44 into the several flash chambers.

Steam for the thermo-compressors is introduced from a suitable source of supply to steam manifold 55, to which are connected the steam inlets 31 for each of the thermo-compressors. The quantity of steam supplied to each of the thermo-compressors is controlled by means which preferably is responsive to variations in temperature at one or more suitable points in the refrigerating system or associated equipment. As shown in Figs. 1 to 3 inclusive, differentials in the temperatures of the water supplied to and withdrawn from the flash chambers are utilized to control the quantity of steam admitted to the thermo-compressors. The flow of steam from the manifold 55 to the thermo-compressors 25, 26, 27 and 28 is controlled by steam valves 56, 57, 58 and 59 respectively which are disposed in the steam inlets 31 for each thermo-compressor. Each of these steam valves is provided with a partition 60 which separates the inlet and outlet parts of each valve, and each partition 60 has a valve seat 61 upon which poppet valve 62 is adapted to seat to close the valve. Valve 62 has a stem 63 which is guided by guide 64, and is connected at its lower end to a flexible diaphragm 65 which is spring pressed downwardly as shown in Fig. 3, or in a direction tending to close valve 62, by a coil spring 66 which bears at its upper end against a partition 67. The chamber 68 below the diaphragm 65 is connected by an air line 69 to an air manifold 70. The inlet end of the manifold 70 is connected by an air line 71 to a suitable source of air under pressure, and the outlet end 72 of the air manifold 70 is provided with an orifice 73 of suitable proportions to maintain the desired air pressure in the manifold 70. The pressure of the air in manifold 70 is controlled by a differential thermostatic valve indicated generally 74, which is operated by the temperature differential between the water in line 14, which conducts the cooled water from the flash chambers to the air conditioning chamber, and the temperature of the water in line 47, through which water flows from the air conditioning chamber and surge tank 20 into the flash chambers. Valve 74 is provided with a suitable partition 75 having a valve seat 76 therein, upon which a poppet valve 77 is adapted to seat to close the valve. Valve 77 is provided with a stem 78 which extends from one side thereof and a stem 79 extending from the other. Stem 78 passes through a guide 80 into a chamber 81 and is connected at its outer end to a flexible bellows 82. Stem 79 extends through a guide 83 into a chamber 84 and is connected at its outer end to a flexible bellows 85. Bellows 82 is connected by a tube 86 to a thermostatic bulb 87 which, in the specific arrangement shown in Figs. 1 to 3 inclusive, is disposed in the line 14 through which water is conducted from the flash chambers to the sprays 15 in the air conditioning chamber. The bulb 87, tube 86 and bellows 82 are filled with a suitable fluid which expands when heated and contracts when cooled. Bellows 85 is likewise connected by a tube 88 to a thermostatic bulb 89 disposed in the water line 47 through which cooled water is delivered from surge tank 20 to the water manifold 46 for distribution to the several flash chambers. The bellows 85, tube 88 and thermostatic bulb 89 are filled with a suitable fluid which expands when heated and contracts when cooled.

Each of the water lines 44 through which water is introduced into the flash chambers is controlled by suitable means, which are operated in response to the temperature existing at any point in the refrigerating system or associated equipment, but which are preferably operated in response to the same temperature or temperature differential to which the operation of the valves 56, 57, 58 and 59, controlling the thermo-compressors, are responsive. As shown, a water valve is connected in each of the water lines 44 for the several flash chambers, these valves being designated 90, 91, 92 and 93 for the flash chambers A, B, C and D respectively. As illustrated particularly in Fig. 3, each of the valves 90, 91, 92 and 93 comprises a valve body having a partition 94 provided with a valve seat 95, upon which a poppet valve 96 is adapted to seat to close the valve. Valve 96 is provided with a stem 97 which is connected at its upper end to a lever 98. This lever is pivoted intermediate its ends at 99 and has its end opposite the end which is connected to valve stem 97, connected to valve stem 63, the arrangement and connections being such that when the valves 56, 57, 58 and 59 or either of them closes, the corresponding and connected valves 90, 91, 92 and 93 respectively will also be closed.

The rate at which vapor is withdrawn from each of the several flash chambers A, B, C and D and consequently the temperature of the water in each of the said flash chambers, is controlled by suitable means which are responsive to the temperature in any desired part of the system. As shown, such means comprise dampers 100, 101, 102 and 103, one of which is disposed in each of the vapor outlets 30 of the flash cham-

bers A, B, C and D respectively. As illustrated, each of these dampers is a circular disk and is supported in the vapor outlets 30 so as to rotate about a horizontally disposed diametrical axis. Each damper has a shaft 104 connected to its axis and the outer end of each of these shafts 104 is provided with a pinion 105 which meshes with a suitable rack 106. The rack 106 is supported in brackets 108 mounted on the vessel 21 and one end of the rack 106 is connected to the piston rod 109 of a piston 110 in pneumatic cylinder 111, which is connected at one end through pipe 112 to an air line 113 supplied by air under pressure from a suitable source. The line 113 has at its outlet end a suitable orifice 114 so proportioned as to maintain a predetermined air pressure in the line. A coil spring 115 surrounds the piston rod 109 and urges the piston 110 toward the end of cylinder 111 to which pipe 112 is connected. The air pressure in the line 113 is controlled by a valve 116 which is operated in response to the temperature at some desired point in the system, such as the temperature of the air in the air conditioning chamber 12 as shown. Valve 116 is provided with a partition 117 having a seat 118 upon which is adapted to seat a poppet valve 119 having a stem 120 which extends into a cylinder 121 and is connected to a flexible bellows 122. Bellows 122 is connected by a tube 123 to a thermostatic bulb 124 which is disposed in the air space of the air conditioning chamber 12 preferably at a point between the sprays 15 and baffles 16 as shown. The bellows 122, tube 123 and bulb 124 are filled with a suitable fluid which expands when heated and contracts when cooled.

From the foregoing description the operation of the system will be apparent. Air to be conditioned is withdrawn from enclosure 10 through conduit 11 and is caused to flow through air conditioning chamber 12, and after being suitably conditioned is returned to the enclosure 10 through conduit 13. Water cooled to the desired temperature is supplied from one or more of the flash chambers A, B, C and D through line 48 and line 14 to the water sprays 15 in the air conditioning chamber, and the water which is ordinarily warmed by contact with the air in the conditioning chamber 12, is returned through lines 17 and 19 by pump 18 to surge tank 20 from which it is caused to flow into one or more of the flash chambers through line 47 and manifold 46, due to the low pressure maintained in the flash chambers. Water is conducted from the flash chambers B, C and D when the chambers are in operation and/or supplied with water, through loop seals 49, 50 and 51 respectively to flash chamber A, from which it is withdrawn through line 48 by pump 125 and forced into the water line 14, which conducts it to the sprays 15 in the air conditioning chamber 12. Water vapors are withdrawn from those flash chambers which are in operation by the thermo-compressors connected thereto and the vapors are introduced into the condenser 37, where they are condensed and the condensate withdrawn through tail pipe 43 while the non-condensable gases are withdrawn by steam jet pump 42. Air under pressure is supplied from air line 71 to the manifold 70 at some predetermined maximum pressure, say for example 15 pounds, but the precise pressure of the air in the manifold 70 is at any time determined by the extent to which the valve 77 is removed from its seat 76. Each of the valves 56, 57, 58 and 59 is supplied with a spring 66 which is adjusted to close the valve at a pressure which is different from the pressure at which any other valve is closed. For example, the tension of the spring in valve 56 would be adjusted so that the valve will be closed when the air pressure in manifold 70 falls below 3 pounds gauge and will be fully opened when the pressure exceeds that value; valve 57 may be supplied with a spring adjusted so that the valve will be fully closed when the air pressure is below 6 pounds gauge and will be fully opened when the pressure exceeds that value; the spring in valve 58 may be adjusted so that the valve will be fully closed when the pressure is below 9 pounds gauge and will be fully opened when the pressure is above that figure, and the spring in valve 59 may be adjusted so that the valve will be closed when the air pressure in manifold 70 is below 12 pounds gauge and will be fully opened when the pressure exceeds that figure. The valves 90, 91, 92 and 93, which control the supply of water to each of the flash chambers A, B, C and D from the water manifold 46, being connected in the manner shown to the valves 56, 57, 58 and 59 respectively, will be fully opened when the steam valve to which it is connected is opened, and will be closed fully when the steam valve is closed. A rise in temperature of the water in line 47 will cause the fluid in bulb 89, line 88 and bellows 85 to expand, and will tend to move valve 77 off its seat 76, and the lowering of the temperature of the water in line 47 will cause the fluid to contract and tend to move the valve toward its seat. An increase in the temperature of the water in line 14 will cause the fluid in bulb 87, pipe 86 and bellows 82 to expand and to tend to move valve 77 toward its seat 76, while a cooling of the water in line 14 will cause the fluid to contract and will tend to move the valve 77 off or away from its seat 76. In this manner, it will be clear that the differential in temperature between the water in line 47 and the water in line 14 is utilized to control the pressure of the air in manifold 70 which in turn controls the operation of the several thermo-compressors and thereby controls the ultimate temperature of the water delivered to the sprays 15.

Dampers 100, 101, 102 and 103 are all operated at the same time in the embodiment shown and are adapted to be opened to any degree from fully closed to fully opened position depending upon the temperature of the air in the air conditioning chamber 12. Assuming that the dampers are in fully opened position, a lowering of the temperature of the air in the air conditioning chamber 12 will cause the fluid in the thermostatic bulb 124, pipe 123 and bellows 122 to contract, and will cause valve 119 to be moved toward its seat 118, and will thereby diminish the air pressure in line 113 and cylinder 111 and will permit spring 115 to move the piston 110 toward the right as shown in Fig. 1, thereby moving rack 106 to the right and rotating the pinions 105 which are connected to the damper shafts 104, thereby moving the dampers toward closed position to an extent which corresponds to the decrease in temperature of the air flowing through the air conditioning chamber. An increase in the temperature of the air in chamber 12 will cause the dampers to open to an extent which corresponds to the extent of the rise in temperature of the air in chamber 12. The damper control is such that all the dampers for the several flash chambers may advantageously be operated simultaneously, but it will of course be

understood that operating means such as that disclosed may be employed for each of the flash chambers so that the dampers for the several flash chambers may be separately operated.

The differential valve 74 controls the number of thermo-compressors and flash chambers which are in operation at any given time and accordingly controls the refrigerating load, while the valve 116 controls the rate at which vapors are removed from the several flash chambers which are in operation, and thereby provides an accurate control of the temperature to which the refrigerant, or the water in the flash chambers and the water delivered to the sprays 15 is cooled. For example, assuming that it is desired to cool the air entering the air conditioning chamber 12 to a predetermined temperature and that at a particular time the operation of two flash chambers only, chambers A and B, are necessary to cool the air to this temperature. Under these circumstances, the temperature differential between the water in line 14 and the water in line 47 will be such that valve 76 in the differential control valve 74 will be off its seat to such an extent that the air pressure in air manifold 70 will be sufficient to open valves 56 and 57 and the corresponding water valves 90 and 91. With the springs 66 adjusted as heretofore indicated, the pressure in the manifold 70 will be over 6 pounds and under 9 pounds. Also let it be assumed that the air in air conditioning chamber is, at the particular time mentioned, being cooled to the predetermined temperature, so that valve 119 of the control valve 116 is fully opened and the air pressure in line 113 and cylinder 111 is sufficient to maintain the dampers 100, 101, 102 and 103 in fully opened position. In the event the air entering the air conditioning chamber rises in temperature, additional heat will be removed from the air by the water discharged through sprays 15 and the water withdrawn from the air chamber 12 will be somewhat higher in temperature and will cause the expansion of the fluid in thermostatic bulb 89 in line 47, while the temperature of the water in line 14 momentarily remains the same. This greater temperature differential will cause valve 77 to move further off its seat 76 and will increase the pressure of the air in manifold 70 to such an extent that one or more additional thermo-compressors and flash chambers will be brought into operation. The additional cooling thus provided will cause the water introduced into flash chamber 21 to be further cooled and will cause the contraction of the liquid in bulb 87 in line 14 and also result in a drop in temperature of the water in line 47 and a contraction of the liquid in bulb 89. This lowering of the temperature differential may cause one or more of the thermo-compressors to be shut down to obtain the proper temperature of the cooling water for the sprays 15. In this manner, the air in the air conditioning chamber will be brought to the desired temperature or to the approximate desired temperature. If the temperature of the spray water is somewhat too low for the desired temperature of the air, the liquid in thermostatic bulb 124 will contract and cause a lowering of the air pressure in line 113 and cylinder 111 and permit spring 115 to move piston 110 and rack 106 so that the dampers 100, 101, 102 and 103 are closed to an extent which depends upon the extent to which fluid in the bulb 124 contracts. The partial closing of the dampers will throttle the thermo-compressors and cause less vapor to be withdrawn from the flash chambers in operation and will result in an increase in the temperature of the water delivered to the sprays 15. In the event the air entering the chamber 12 should be reduced in temperature, the operations just described will be reversed to cause the desired increase in the temperature of the water delivered to the sprays 15 and the thermostatic bulb 124 will control the dampers 100, 101, 102 and 103 so that the precise or substantially the precise temperature of the air leaving the chamber 12 is maintained.

It will be understood that the operation of the dampers will provide water for the sprays 15 at temperatures which are intermediate the temperatures ordinarily obtained by the operation of the flash chambers without the use of the dampers.

In this manner it will be seen that differential control valve 74 automatically regulates the refrigerating load to take care of fluctuations in load, while the control valve 117 automatically, and independently of the valve 74, accurately regulates the temperature of the water delivered to the sprays 15 to maintain the temperature of the air leaving the air conditioning chamber at the desired temperature.

In lieu of using loop seals to conduct water from the flash chambers B, C and D to flash chamber A, as shown in Fig. 2, the arrangement shown in Fig. 4 may be employed, wherein each of the flash chambers is connected by a pipe 130 to a manifold 131 which discharges into a pump 132 having its discharge end connected to line 14. With this arrangement the water from flash chambers B, C and D or either of them, is conducted directly to manifold 131 and to line 14 without first being introduced into the flash chamber A. So far as pressure differentials between the several flash chambers are concerned, the operation of the arrangement shown in Fig. 4 is identical with that shown in Fig. 2.

As indicated in dotted lines in Fig. 1, thermostatic bulb 89 may be disposed in line 17 if desired, rather than in line 47, or may be located in the pool of water at the bottom of air conditioning chamber 12, as indicated in dotted lines in Fig. 5. And thermostatic bulb 87 may be disposed in flash chamber A so as to be submerged in the water therein as shown in dotted lines in Fig. 2, or may be located in manifold 131, as indicated in dotted lines in Fig. 4. Where the invention is utilized for the cooling of liquids or solids or gases other than air, the thermostatic bulb 124 is preferably placed so as to be in contact with the subject of refrigeration, that is to say, the liquid, gas or solid being cooled.

It will be understood, of course, that the specific location of the various thermostatic bulbs for controlling the operation of the system may be at any suitable or desired points in the system or associated equipment, the specific points at which the bulbs are located being determined by convenience and the temperatures to be controlled.

Any desired number of flash chambers such as those disclosed may be used. A single flash chamber arranged as disclosed will not, of course, provide the flexibility or range of load control provided by two or more chambers, but it is contemplated that a single chamber may be employed advantageously under some circumstances. Moreover, means other than the pneumatic means disclosed may be utilized for controlling the operation of the system.

It will be evident to those skilled in the art

that changes in the construction, arrangement, disposition and operation of the various parts of the system disclosed may be made without departing from the spirit of the invention. No intention is entertained to limit the breadth of the invention except by the scope of the appended claims.

What is claimed is:

1. Refrigeration apparatus comprising a plurality of closed vessels, means for introducing a refrigerant into each of the vessels, means for withdrawing liquid refrigerant from each of the vessels and commingling the refrigerant so withdrawn, means for withdrawing vapors from each of the vessels to maintain a vacuum in each vessel, means responsive to the differential in temperature between the refrigerant introduced into the vessels and liquid refrigerant withdrawn therefrom for controlling the means for withdrawing vapors from the vessels, and means responsive to the temperature of the subject of refrigeration for controlling the rate at which vapors are withdrawn from the vessels.

2. Refrigeration apparatus comprising a closed vessel, means for introducing a refrigerant thereinto, means for withdrawing liquid refrigerant therefrom, means for withdrawing vapors from the vessel to maintain a vacuum therein, means responsive to the differential in temperature of the refrigerant introduced into the vessel and the liquid refrigerant withdrawn from the vessel for controlling the means for withdrawing vapors from the vessel, and means responsive to the temperature of the subject of refrigeration for controlling the rate at which vapors are withdrawn from the vessel.

3. Refrigeration apparatus comprising a closed vessel, means for introducing a refrigerant into the vessel, means for withdrawing liquid refrigerant from the vessel, a thermo-compressor connected with the vessel for withdrawing vapors therefrom and maintaining a vacuum therein, and means responsive to the differential in temperature between the refrigerant introduced into the vessel and the liquid refrigerant withdrawn therefrom for controlling the operation of the thermo-compressor.

4. Refrigeration apparatus comprising a plurality of closed vessels, means for introducing a refrigerant into each of the vessels, means for withdrawing liquid refrigerant from each of the vessels and commingling the refrigerant so withdrawn, a thermo-compressor connected with each of the vessels for withdrawing vapors of the refrigerant from the vessels and maintaining a vacuum in each of the vessels, means responsive to the differential in temperature between the refrigerant introduced into each of the vessels and the commingled liquid refrigerant withdrawn therefrom for controlling each of the thermo-compressors to thereby control the refrigeration load and a baffle in the path of flow of the vapors being withdrawn from each of the vessels, and means responsive to the temperature of the subject of refrigeration for controlling the rate at which vapors are withdrawn from each of the vessels whereby the temperature of the refrigerant is controlled.

5. The method of refrigeration which comprises introducing a refrigerant into a plurality of closed vessels operating in parallel, withdrawing and commingling liquid refrigerant from the several vessels, withdrawing vapors of the refrigerant from each of the vessels to maintain a vacuum in each vessel, controlling the number of vessels in operation by the temperature differential between the refrigerant introduced into the vessels and the liquid refrigerant withdrawn therefrom, and controlling the rate at which the vapors are withdrawn from each of the vessels by the temperature of the subject of refrigeration.

6. The method of refrigeration which comprises introducing a refrigerant into a closed vessel, withdrawing liquid refrigerant therefrom, withdrawing vapors of the refrigerant from the vessel to maintain a vacuum therein, and controlling the withdrawal of the vapors from the vessel by the differential in temperature between the refrigerant introduced into the vessel and the liquid refrigerant withdrawn therefrom.

7. In refrigerating apparatus, a plurality of evaporating chambers, a condenser, ejectors for connecting the respective chambers to the condenser for evacuating the chambers, each ejector embodying a diffuser conduit affording communication between its associated chamber and the condenser and including a motivating jet, valves for interrupting or permitting the flow of motive fluid to the respective jets, means for admitting liquid to be cooled to one or more of said chambers, means for controlling said admission means and said valves so that one valve is open while another is closed or all valves are open or closed and said admission means is rendered effective to restrict the admission of liquid to one or more of said chambers dependent upon activity of the ejectors, and means providing a sealing connection between the chambers so that a pressure corresponding to condenser pressure may obtain in a chamber whose ejector is inactive and lower pressure may obtain in the other chamber or chambers due to the activity of the ejectors thereof.

8. Apparatus for supplying a refrigerating demand comprising a plurality of evaporating chambers operating at substantially the same pressure, means associated with each chamber for withdrawing vapor therefrom and compressing the same, means for condensing the vapor discharged from the several withdrawing means, and means operable automatically in response to the refrigerating demand for successively rendering said withdrawing means operative.

9. Apparatus for supplying a refrigerating demand comprising a plurality of evaporating chambers in which cooling is effected by evaporation of liquid, each chamber having means for withdrawing vapor therefrom to effect evaporation, means operable automatically in response to a relatively heavy load condition for effecting operation of a plurality of said vapor withdrawing means and in response to a lighter load condition for effecting operation of a smaller number thereof, means for conveying liquid to be cooled through said chambers including conduit means communicating with said chambers, and means providing a seal between said chambers when one of said vapor withdrawing means is in operation and another is not.

10. Apparatus for supplying a refrigerating demand comprising evaporator means adapted to contain liquid to be evaporated, a plurality of ejectors for withdrawing vapor from said means to effect cooling by evaporation of liquid therein, and means for controlling the operation of a plurality of said ejectors, said means being operable to vary the total ejector capacity in response only to changes in temperature of the liquid in said apparatus prior to cooling by said evaporator

means and to changes in the final temperature effected in the liquid by said evaporator means.

11. Apparatus for supplying a refrigerating demand comprising evaporator means adapted to contain liquid to be evaporated, a plurality of ejectors for withdrawing vapor from said means to effect cooling by evaporation of liquid therein, the evaporator means being so constructed and so related to said plurality of ejectors that each ejector withdraws vapor from an individual part only of the evaporator means, and means for controlling a plurality of said ejectors and automatically operative to vary the total ejector capacity in operation in response to end temperature conditions of the liquid.

12. In cooling apparatus, the combination of evaporator means, a plurality of compressor elements for removing vapor from said evaporator means to effect cooling by evaporation of liquid therein, said evaporator means and said compressors supplying a common cooling demand, a thermostatic element responsive to a temperature maintained at a low value by the cooling apparatus, and means controlled by said thermostatic element and operating automatically to initiate operation of said compressors successively as said temperature changes in one direction and to terminate operation of said compressors successively as said temperature changes in the opposite direction.

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